

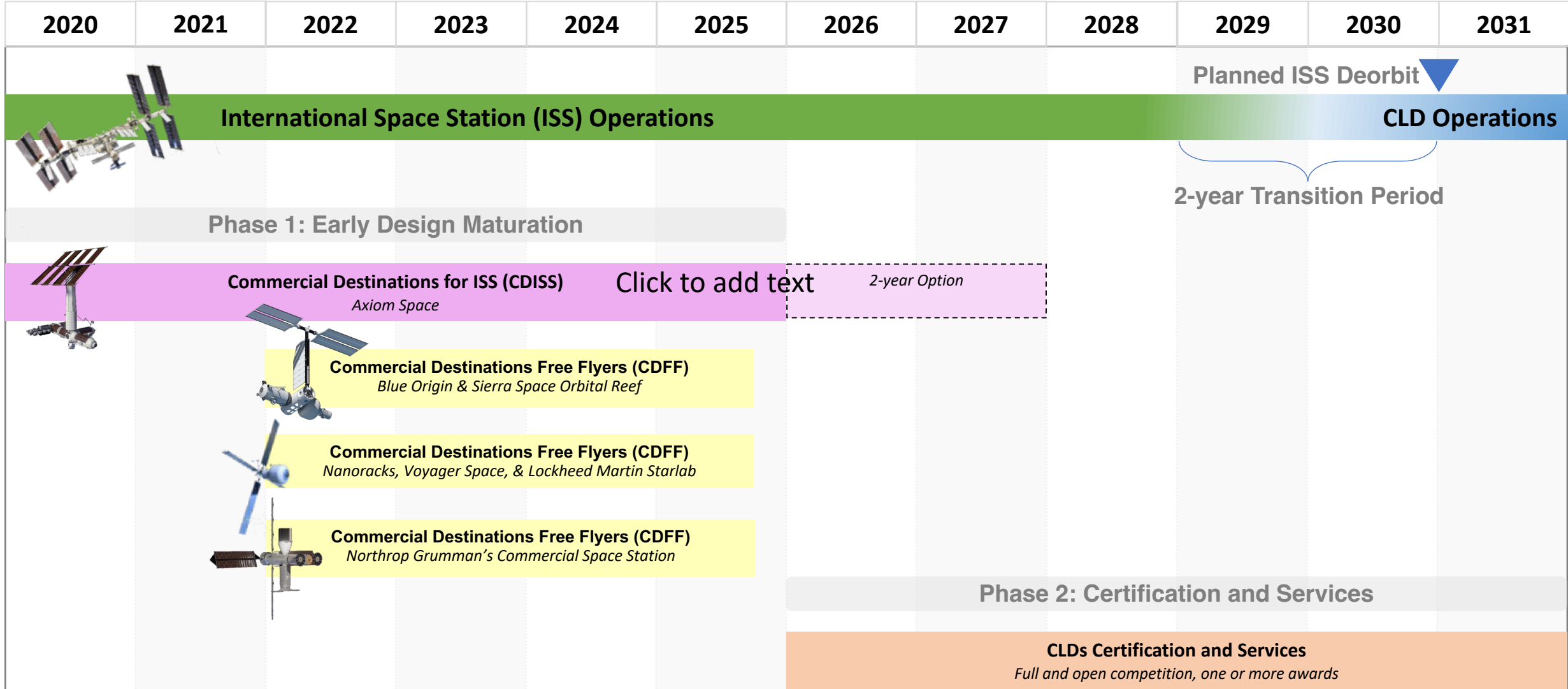
Commercial LEO Development Program

Agenda



- Commercial LEO Acquisition Strategy Schedule
- Commercial LEO Destinations (CLD) Status
 - Requirements Development
 - Commercial Destinations Free Flyers (CDFF) Status
 - Axiom Commercial Destination on International Space Station (CDISS)
- Private Astronaut Missions (PAM)
 - AX-2 Status
 - Future PAM solicitations
- Commercial Activities on ISS
- Commercial Space Capabilities (CSC)

NASA Acquisition Strategy Schedule



Commercial LEO Destinations Requirements Development



Draft requirements documents planned for release to industry during Phase 1 utilizing NASA Request for Information (RFI) process combined with industry 1-1s and workshops

- RFI-1 – Draft human rating requirements and whitepaper on key conops/open questions to industry
 - Released on May 4th
 - 292 Comments received – completing 1-1s with industry
- RFI-2 planned for end of 1Q FY23 – Concept of Operations document
- RFI-3 planned for end of 1Q FY23 – Updated Utilization Whitepaper/service requirements
- RFI-4 planned 2Q FY23 – Draft CLD-REQ-1 130 Level 2 Requirements Document/ Updated Standards
- Workshops being developed:
 - Overall Safety Approach and Requirements (Follow up from RFI1 White paper)
 - CLD Certification Strategy and Approach
- Additional documents planned via RFI:
 - Operations Standards and Processes/Plans requirements.

Commercial Destination Free Flyer - Nanoracks



Project Status:

- Nanoracks and Lockheed Martin held an Engineering Review Board to review their major design trades in June 2022.
 - Milestone #2 System Readiness Review (SRR)/June 2022 and Milestone #3 System Design Review (SDR)/September 2022 are delayed due to overall replan coming out major design trade decisions
- Nanoracks completed first in a series of Starlab Research Workshops for their George Washington Carver Science Lab, in September 2022.



Near Term Forward Work:

- NASA/Nanoracks to amend the current SAA at Quarterly end of Oct 2022. Update will include schedule changes coming from trade studies.
- Nanoracks is working towards SRR for their terrestrial lab, George Washington Carver planned for December 2022

Commercial Destination Free Flyer - Northrop Grumman

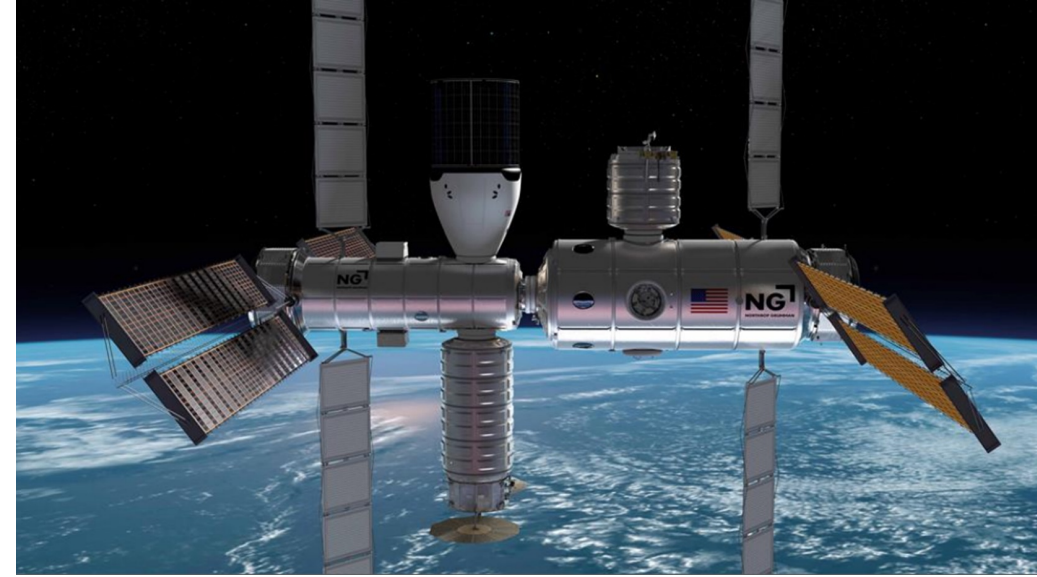


Project Status:

- Northrop Grumman successfully completed 3rd milestone CDFF ConOps Review in July 2022, RID Closures planned by SRR in Nov 22.
- Northrop Grumman has greatly increased its Marketing presence to solicit future customers
 - Strong presence at ISS R&D Conference
 - Public website and video [Commercial Space Station - Northrop Grumman](#)

Near Term Forward Work:

- CDFF Level System Requirements Review and Quarterly planned for Nov 2022
 - Documents delivered and in review



Commercial Destination Free Flyer – Blue Origin

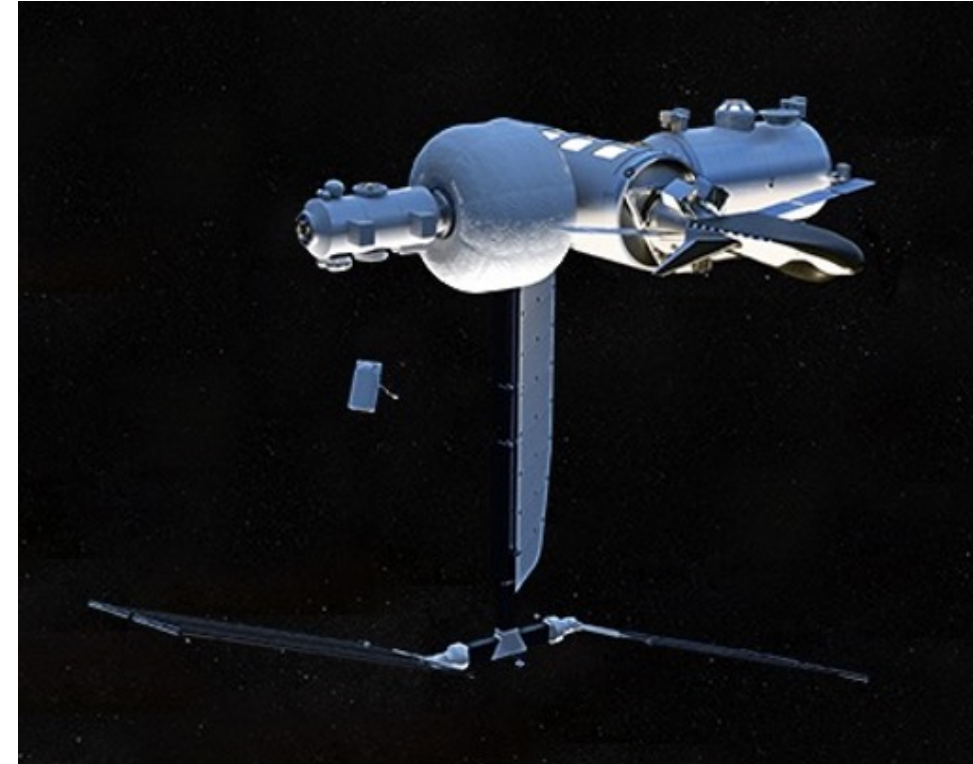


Project Status:

- Three major reviews have been completed:
 - SRR was completed in March 2022
 - SDR was completed in July 2022
 - Delta SRR was completed in September 2022
- Delta SRR included insight into DAC-1 outbriefs

Near Term Forward Work:

- Plan to provide NASA with additional insight



Axiom Commercial Destination on ISS Status

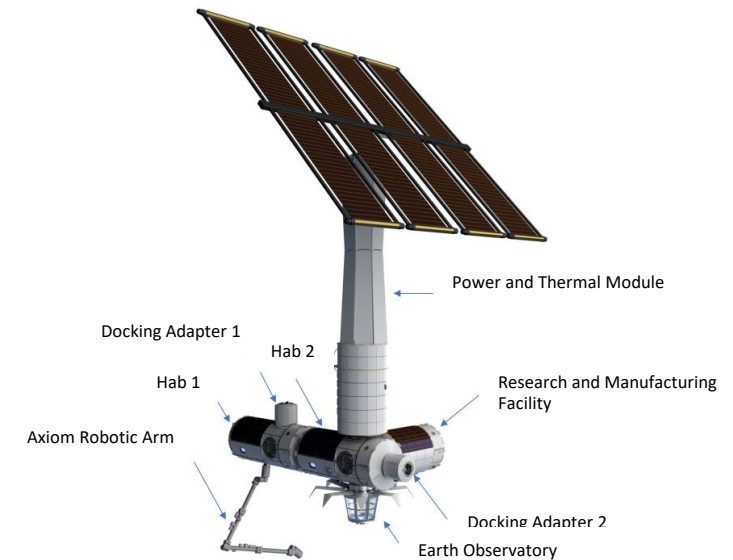
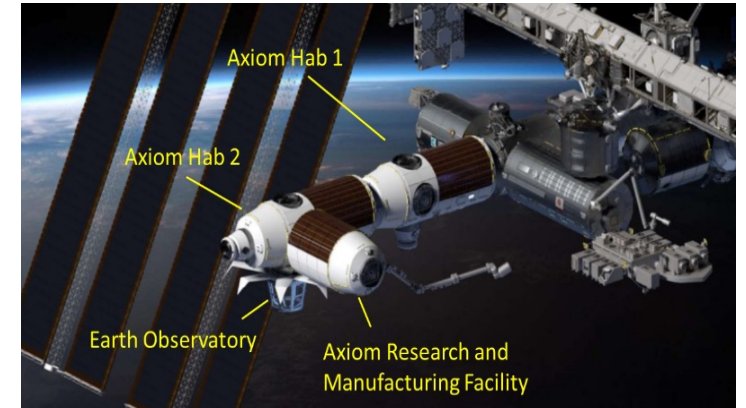


Project Status:

- Task Order 5 in place to support Axiom Hab 1 and Hab 2 CDR Activities
- Completed Axiom Post-PDR Design Progress Reviews, Verification Planning Milestone
- Subsystem CDR for Avionics, Structures, Docking Adapter, ECLSS and Payloads kickoffs occurred in August 2022 and related data packages are in review by NASA. Review completion of Phase 1 targeted for November 2. Replan underway of Phase 2 CDR (remaining subsystems such as RPOC/GNC, Prop, etc) and Phase 3 (Element/Segment)
- Axiom continues development testing to mature design/requirements using Agile design approach. Fabrication for primary structure for first two modules underway at TASI and long lead system procurements for flight and development hardware underway
- ISSP integration effort authorized. Working to authorize long lead parts buys for ISS reconfiguration.
- Teams are mutually developing hazard reports and controls/mitigations as per the standard design/ISS processes.

Near Term Forward Work:

- ISSP to continue to work with SOMD about Axiom progress and authorizing required ISS reconfiguration additional development and ISS visiting vehicle integration efforts
- ISSP to work with Axiom to replan Phase 2 CDR (continued review of subsystems) and Phase 3 CDR (Element/Segment review).



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Private Astronaut Mission-2 (Ax-2)

PAM/Launch Provider: Axiom Space on SpaceX Falcon 9 /Crew Dragon

Mission Duration: 10 days

Launch Date: NET May 1, 2023;

Mission Overview & Status:

Crew: PAM CDR (Peggy Whitson), Pilot (John Shoffner), Mission Specialists (Kingdom of Saudi Arabia to be named post MCOP approval)

Mission Objectives: Media, science, research, non-profit, and commercial activities similar to AX-1

Project Status:

- NASA negotiated the following purchase of services as part of the AX-2 contract (*any costs associated with these requirement changes post Ax-2 will be levied on the PAM provider, not NASA):
 - Polar (2) return
 - NORS tank return
 - Contingency late return of CTBEs (2)
 - Ax-2 CDR support*
 - Ax-2 requirement and contract changes*
- Added additional milestones and requirements associated with cargo planning, payload processing, data deliverables and mission timeline updates as a part of AX-1 LL
- Crew training began on 10/17

Near Term Forward Work:

- PAM Integration and Vehicle Integration Reviews – 12/1

PAM 3/4 Solicitation Status



- RFP was released on September 14th for the PAM-3 and PAM-4 flight opportunities
 - Proposals due: Oct 27th
 - Tentative award: Late 2022/Early 2023
- RFP incorporated Ax-1 lesson's learned into PAM requirements documents (e.g. PACE Annex 1). Key Items updated from last solicitation include:
 - Stricter workday requirements for Private Astronauts and PAM CDR
 - Required adaptation and setup/tear down time for all Private Astronauts
 - Requirement that former flown NASA government astronaut serve as PAM CDR
 - Added additional milestones and requirements associated with cargo planning, payload processing, data deliverables, and mission timeline updates
 - Modifying PA training including tailoring courses to address PAM specific activities

Commercial Activities on ISS



- Axiom has submitted twelve (12) commercial activity requests for Ax-2
 - Six (6) are new items and 6 are re-flight items from AX-1
- Only one (1) new commercial activity request outside of PAMs submitted since last DPMC – in process with Commercial LEO panel
- CLDP evaluating potential updates required to current policies (NID 8600-121) and programs in place to enable commercial activities on ISS.
 - Working with stakeholders on lessons learned from past two years of FA3 program
 - Working with agency stakeholders to develop and clarify policy guidance and recommend appropriate documentation for industry
 - Working with FOD and other stakeholders to re-assess current policies and documentation associated with use of NASA crew in conducting commercial activities on ISS

Commercial Space Capabilities (CSC) Status



- **CCSC1 SAAs will expire this year and will not be extended.**
 - NGIS: 12/21/22, SpaceX: 12/31/22, ULA: 12/31/22. Final Frontier Design expired 9/30/22.
 - Major ongoing activities are: SubkW Electric thruster collaboration (NASA GRC/NGIS), LOFTID flight demonstrator (NASA LaRC/ULA), Smart Propulsion testing (NASA MSFC/ULA), Starship 1st Orbital flight TDRSS/Imagery.
 - Preparing follow-on CCSC2 competition. Announcement release planned for 10/2022.
- **CCSC2 SAA**
 - Completed PSB on 10/12. Plan to release RFP by end of October.
 - Similar scope to CCSC1 except activities must have a connection or contribution to LEO economy.
- **Continue to support SpaceX commercial flights under a Umbrella RSAA**
 - Annex 1: Polaris Dawn limited flight operations support (Detonator support moved to standalone RSAA)
 - Annex 2: Technical expertise and assessments of EVA and crew system designs, MMOD assessments, human health / science advice, and limited flight operation support to 3rd commercial mission
- **Continue to support commercial space research activities**
 - Received 3 new EPSCoR Grants and monitoring 7 ongoing (OSTEM sponsored)
 - Received and evaluating Ignite SBIR proposals – 1 recommended for award (STMD sponsored)

How Can NAC Help?

Commercial Human Spaceflight – cont.



- Continue to advocate for the importance of the Commercial LEO Development Program within the National Space Policy Community.
 - Advocacy for future regulatory framework is needed to support future success.
- In order to avoid a gap in LEO the program will need sustained budgetary support as CLD Partners begin to fully develop their designs.





QUESTIONS