Agenda

- Commercial Crew Program (CCP)
- Commercial LEO Development Program (Comm LEO)

Commercial Crew Program (CCP) Status

CCP Flight Accomplishments

CCP is proud to be leading a new chapter in human spaceflight

SPACEX
Demo-1
Launched 03/02/19
Landed 03/08/19

BOEING
OFT
Launched 12/20/19
Landed 12/22/19

SPACEX
Demo-2
Launched 05/30/20
Landed 08/02/20

SPACEX
Crew 1
Launched 11/15/20
Landed 05/02/21

SPACEX
Crew 2
Launched 04/23/21
Landed 11/09/21

SPACEX
Crew 3
Launched 11/10/21
Landed 05/06/22

SPACEX
Crew 4
Launched 04/27/22
Landed 10/14/22

BOEING
OFT-2
Launched 05/19/22
Landed 05/25/22

SPACEX
Crew 5
Launched 10/5/22
Landed 3/12/23

SPACEX
Crew 6
Launched 3/2/23
Landed 9/4/24

SPACEX
Crew 7
Launched 8/25/23
Landed 3/12/2024

SPACEX
Crew 8
Launched 3/4/2024
On Orbit

Up Next…

BOEING
CFT
Launch NET 5/6/2024

SPACEX
Crew 9
Launch NET Mid-Aug 2024

Crew Flight Test (CFT) Status

- **Schedule**
  - Readiness for CFT launch is on track for May 6.
- **Certification Process**
  - Remaining certification products are expected to close ahead of the Agency Flight Test Readiness Review, with standard open work remaining.
- **Flight Readiness**
  - Starliner rolled to the launch site on April 16, where the spacecraft was hoisted and mated atop the Atlas V rocket.
  - Recent hardware and flight test readiness milestones ahead of stacking of the integrated vehicle include:
    - Spacecraft fueling in early April
    - Completion of the Commercial Crew Program CFT Flight Test Readiness Review
    - Completion of the ISS Stage Operations Readiness Review
    - Completion of the Flight Operations Directorate Flight Test Readiness Review
    - Completion of the delta Software Readiness Review. Starliner Flight and Ground Software is on track for May launch.
    - Completion of the ISS Vehicle Assessment Review (VAR) to present issue closure and flight readiness status to the International Partners and extended ISS community
  - Upcoming readiness milestones
    - CFT Agency Flight Test Readiness Review
    - Prelaunch Mission Dress Rehearsal and Crew Training Activity at the launch site
    - United Launch Alliance Launch Readiness Review

Crew-8 Status

Crew-8 Status:

- **Launched March 3, 2023, docked to ISS March 5, 2023**
  - The March 2 launch attempt was scrubbed due to weather.
- **Crew:** Matthew Dominick (NASA), Michael Barratt (NASA), Jeanette Epps (NASA), Alexander Grebenkin (Roscosmos)

- **Launch Vehicle:** Falcon 9, Kennedy Space Center, Pad 39A
  - First-flight Booster
  - Successful booster return to Landing Zone-1 following stage separation.

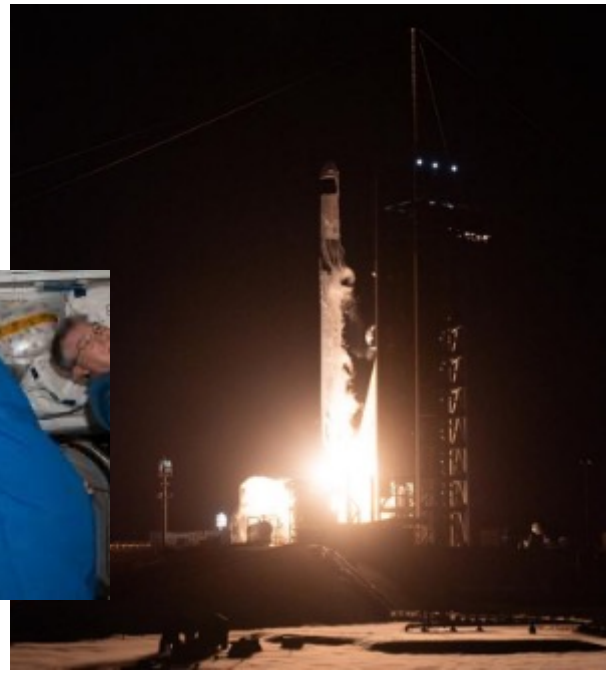
- **Expected docked duration: Up to 180 days**
  - Dragon Endeavour – fifth flight (certified for five flights)
  - Previously flew Demo-2, Crew-2, Axiom Mission-1, Crew-6
    - As part of the refurbishment process, teams installed new components such as the heatshield, parachutes, pod panels, Draco engines, and nosecone.
    - Teams also worked to swap out numerous prop system valves ahead of the flight to further mitigate the risk of corrosion on the fifth-flight capsule.

- **Endeavour is healthy docked to station and operating within the flight rules**
  - Upon ascent, all Dragon rendezvous and docking burns were executed nominally
    - Dragon's prop system remains in great shape.
  - To date, Dragon's weekly checkouts confirm all systems nominal

Crew-7 Status

Crew-7 Mission:

- **Launched Aug. 26, 2023, docked to ISS Aug. 27, 2023**
- **Crew:** Jasmin Moghbeli (NASA), Andreas Mogensen (European Space Agency), Satoshi Furukawa (Japanese Aerospace Exploration Agency), Konstantin Borisov (Roscosmos)



- **Launch Vehicle:** Falcon 9, Kennedy Space Center, Pad 39A
  - First-flight Booster
  - First crewed launch utilizing the Hanger X Launch Control Center
  - Successful booster return to Landing Zone-1 following stage separation.

- **Docked duration:** 199 days in space, 197 docked to ISS
  - Dragon Endurance – third flight
  - Previously flew Crew-3 and Crew-5

- **Landed off the coast of Pensacola, FL on March 12, 2024, at 5:47 a.m. ET.**
  - Winds at splashdown 2 knots with less than 1ft wave heights
  - Dragon's prop system performed extremely well throughout the return executing all nominal departure and landing system burns.
  - Claw separation and trunk jettison were completed nominally.
  - Upon re-entry, Dragon deployed two good drogues and four healthy mains
  - Post-splashdown, SpaceX recovered all parachute system hardware including drogues, energy modulators, and all four main parachutes.
  - NASA and SpaceX are currently performing data reviews.

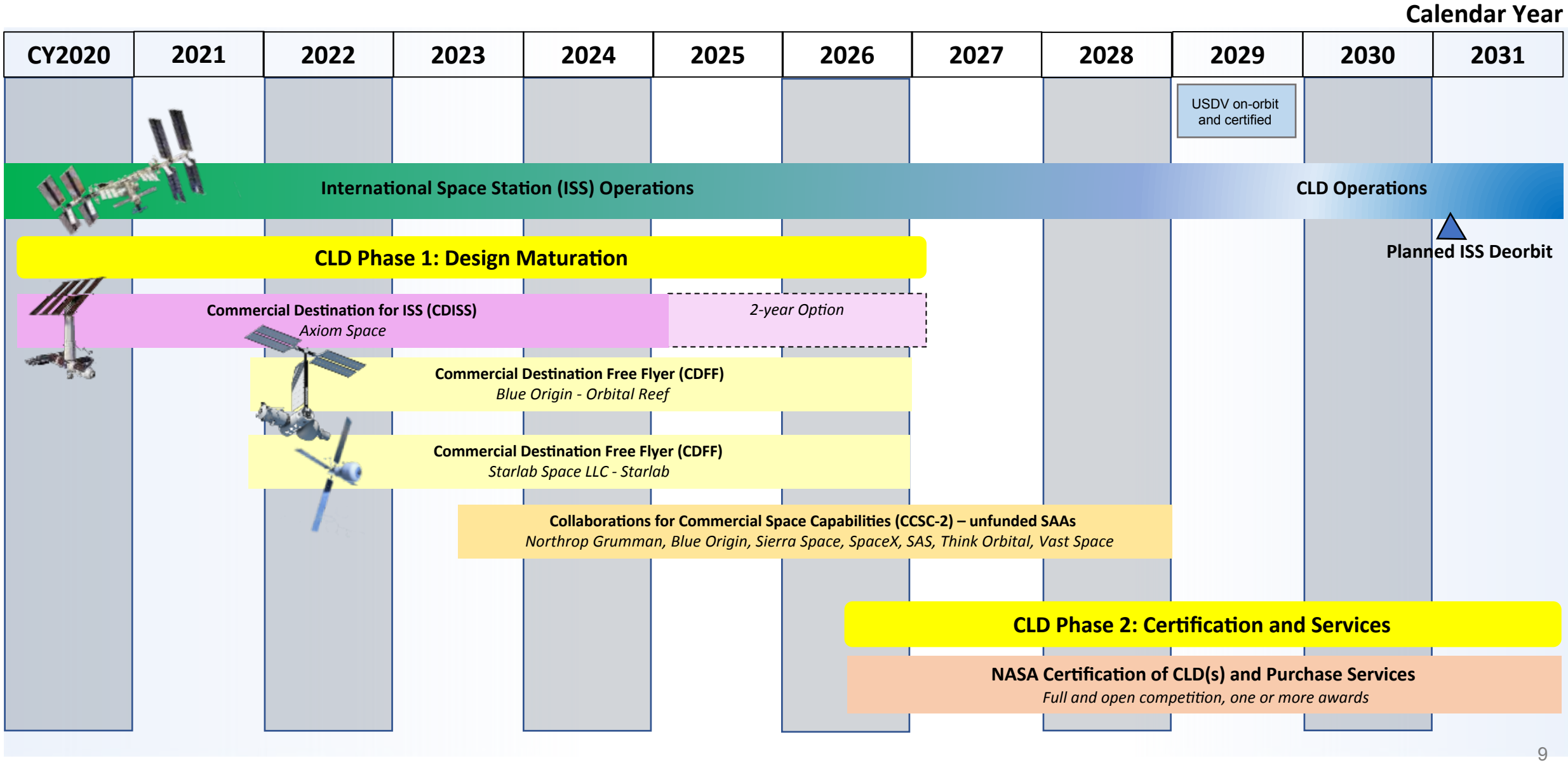
Summary

- **CCP continues to facilitate the development and certification of U.S. industry-based crew transportation systems**
- **SpaceX continuing to provide routine crewed missions to the International Space Station**
- **Boeing is making progress toward final readiness for crewed flight**
- **CCP is beginning a more robust engagement with the Comm LEO Program, including integrating the crew transportation requirements into the overall CLD requirements.**
  - Announced seven U.S companies the agency will partner through its second Collaborations for Commercial Space Capabilities (CCSC-2)

Go Boeing CFT!

Commercial LEO Development Program Status

ISS-to-CLD Transition



Commercial LEO Destinations
Funded Partners

Latest Axiom Developments

Axiom:

- Axiom is modifying the Axiom Station Assembly Sequence to enable a commercially viable free flyer after two modules.
- The Axiom Habitation Module #1 (AxHab 1) will launch in late 2026 with a Minimum Viable Product (MVP) approach.
- Resuming Critical Design Review incorporating updated MVP approach.

Upcoming Milestones:

- Q2 2024 - TASI structural testing
- Q3 2024 – TASI pressure testing
- Q3 2024 - Mission Concept Review for the AxStation Payload, Power, Thermal Module (PPTM)
- Q4 2024 – TASI primary structure delivery
- Q4 2024 – PPTM System Requirements Review.
- Q1 2025 – CDR completion

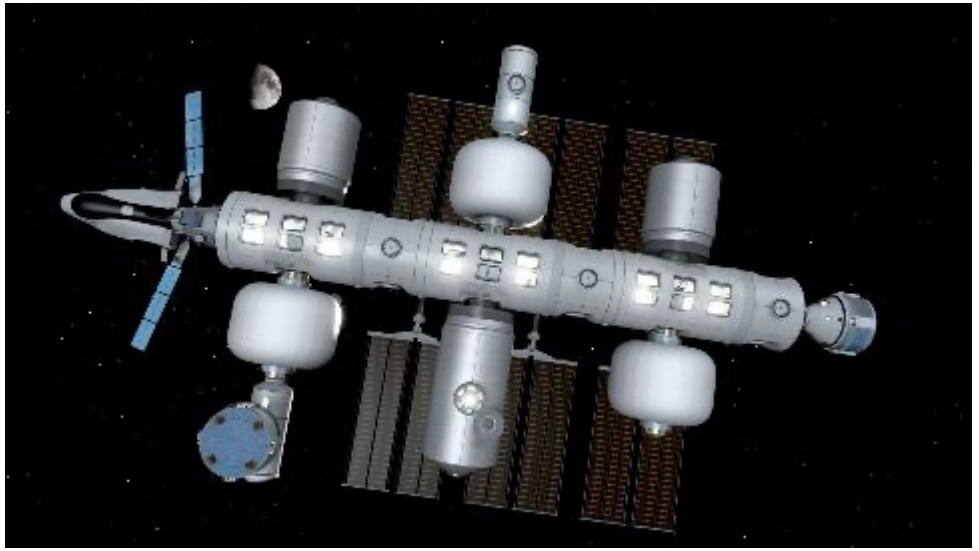
Axiom AI&T facility at the Houston Spaceport

Axiom Station attached to ISS

Latest Blue Origin Developments

Blue Origin Funded SAA:

- Completed Water Multi-filtration and CO2 Reactor Testing Milestones in March 2024.
- Developing medium fidelity HITL test plans for a milestone planned later in 2024.



Orbital Reef

Upcoming Milestones:

- May 2024 - Destination Service Requirements and Standards Assessment
- June 2024 – Payloads Interim Design Review
- June 2024 – Space Vehicle (SV) Architecture Concept Review
- June 2024 – Life Module Full-Scale Burst Test

New Glenn

Latest Starlab Developments

Starlab:

- Voyager Space/Nanoracks and Airbus finalized Starlab Space LLC.
  - The Nanoracks SAA has been reassigned to Starlab LLC via SAA Amendment 4.
- Completed the Alternative Urine Processor Final Design Review in February 2024.
- Completed the Payload Research Facility Design and Groundbreaking and Starlab Station Design Update in March 2024.

Upcoming Milestones:

- July 2024 - Cygnus Upgrades PDR
- July 2024 - Habitat Structural Test Article Preliminary Design
- October 2024 - Integrated Operations Review

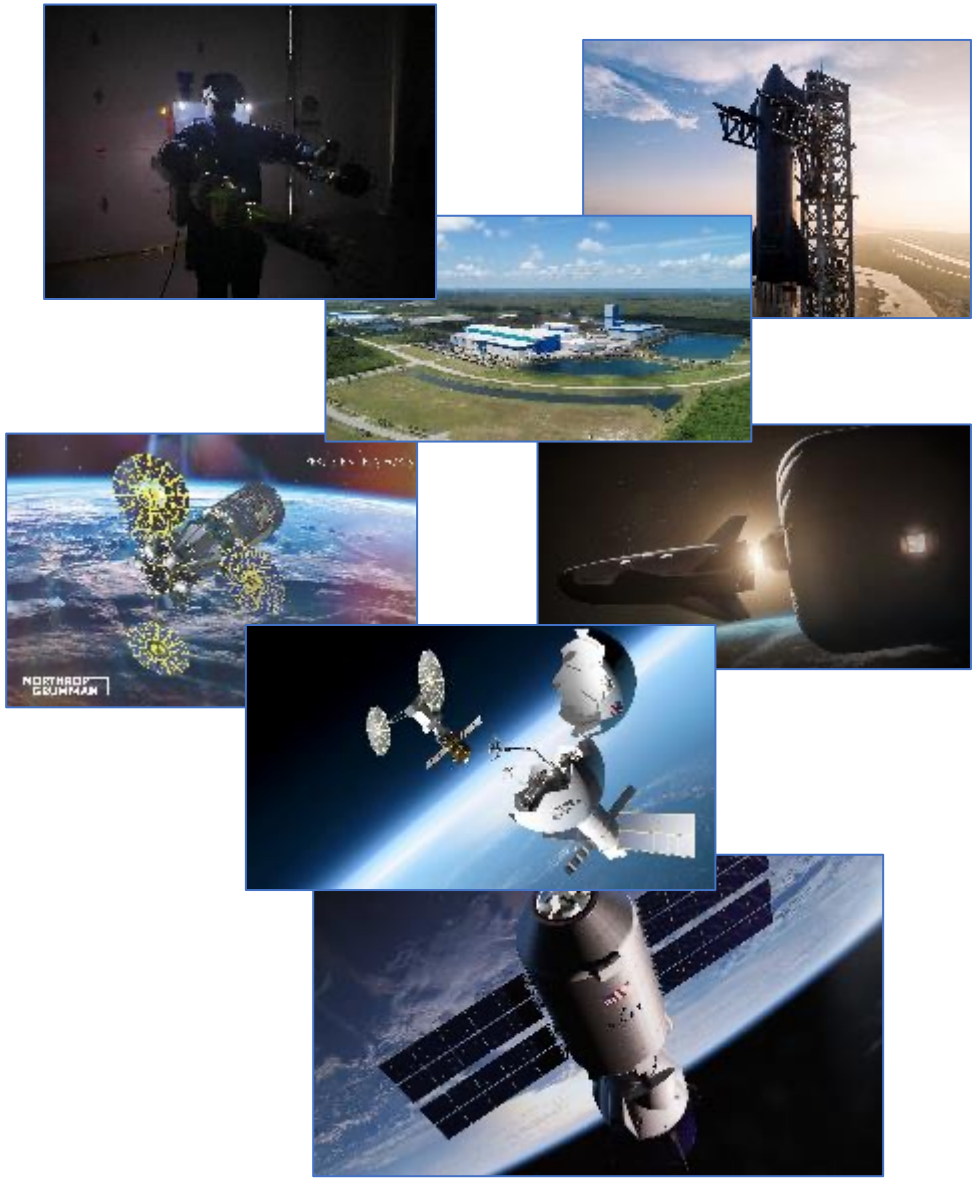
Starlab

Commercial LEO Destination Unfunded Partners

Collaborations for Commercial Space Capabilities (CCSC)

- **Unfunded SAAs with US industry to support the development of new space capabilities relevant to NASA's exploration strategy**
- **Partners receive access to unique NASA know-how, data, and technical resources where available**

  - **Blue Origin, Kent, Washington**
  - **Northrop Grumman Systems Corporation, Dulles, Virginia**
  - **Sierra Space Corporation, Broomfield, Colorado**
  - **Space Exploration Technologies Corporation, Hawthorne, California**
  - **Special Aerospace Services, Boulder, Colorado**
  - **ThinkOrbital Inc., Lafayette, Colorado**
  - **Vast Space LLC, Long Beach, California**



COMMERCIAL LEO DEVELOPMENT PROGRAM

Latest Blue Origin, Northrop Grumman, SpaceX, and Sierra Space Developments

Blue Origin:

- Next Program Status Update expected June 2024.

Northrop Grumman:

- Planning for Project Management Review with NASA in April during which revisions to Partner development plan will be presented.

SpaceX:

- NASA providing consultation on considerations for in-space medical research and exercise for SpaceX's private passenger missions.
- Performed its 3rd Starship Integrated Flight Test on March 14.

Sierra Space:

- Completed Pathfinder Soft Goods Test and Payload Review Feb 2024.
- Upcoming Pathfinder Safety Status and Interim Design Review Q3 FY24.

Northrop Grumman – Uncrewed Persistent Platform that works with crewed CLDs

SpaceX – SpaceX's proposed integrated LEO transportation architecture encompasses both near term Dragon and longer term Starship-bases capabilities

Sierra Space - Pathfinder CLD with LIFE inflatable habitat/Service Module and Dream Chaser for crew and cargo

COMMERCIAL LEO DEVELOPMENT PROGRAM

Latest Vast, SAS and Think Orbital Developments

Vast:

- Partner completed Solar Array Development Test (originally scheduled for November 2024).
- NASA providing consultation on environmental control and life support, payloads operations, spacecraft materials and environments, and micrometeoroid protection.
- Haven-1 aluminum primary structure manufacturing is underway.
- Announced the use of SpaceX' Starlink as their space station broadband communications.

Special Aerospace Services (SAS):

- NASA is providing technical expertise and data for small spacecraft to SAS for its Autonomous Maneuvering Unit development.
- Partner plans to complete a SAS Systems Requirements Review by the end of April.

ThinkOrbital:

- Partner has been performing ground tests of its E-beam welding demonstrator intended for suborbital flight testing scheduled in May and the orbital test in July.

Special Aerospace Services – A robotic MMU-like system for external CLD ops instead of EVAs. Later versions can support suited crew.

ThinkOrbital Ground test of its E-beam flight demonstrator

Vast – Proposing an evolution multi-module/launch CLD. Haven-1 is the first demonstration module and crewed mission, due to launch no earlier than August 2025

Ax-4 Mission Summary

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

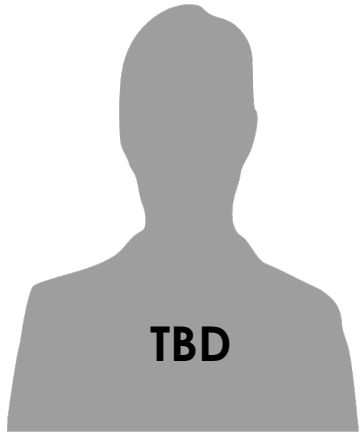
Mission Duration: 16 Days, 14 Docked Days

Launch Date: NET October 2024

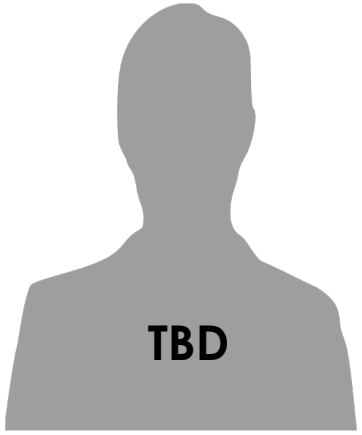
- **Objectives:** Human Research, Technology Demonstrations, Outreach, Media, and Commercial Activities

- **Status**
  - Crew Identification – One crew member has been identified. Three additional crew members are in-work.
  - The start date for crew training and final launch date will be determined following crew selection.
  - Contract deliverables not impacted by launch date are in review.

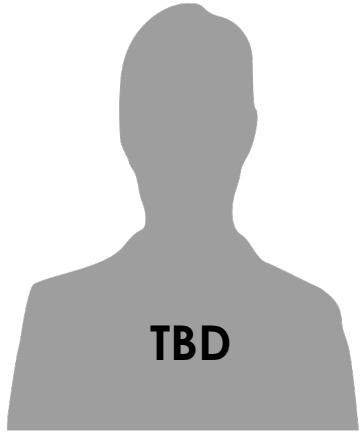
Peggy Whitson
Commander



Pilot



Mission Specialist #1



Mission Specialist #2

COMMERCIAL LEO DEVELOPMENT PROGRAM

Key Program Milestones

2023

Program


RFI #2 Released CLD Requirements

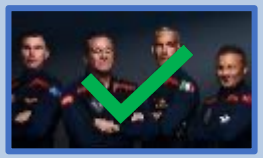

Industry Day #2 CLD Requirements

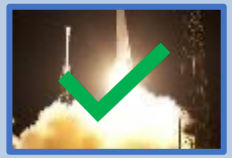

RFI #3 Released CLD Requirements


Industry Day #3 CLD Requirements

PAM


Ax-2 Mission


PAM #3 Mission Order Signed


PAM #4 Mission Order Signed

Destinations Office


SBIR Phase 2 Award


CCSC-2 Solicitation & Awards


Axiom Station Hatches Fabricated


Starlab System Design Review


Northrop Grumman & Starlab Teaming Agreement


LIFE Habitat Pressure Test


Additional Milestones & Funding for CLDs


Orbital Reef Core Module Structural Test


Starship 2nd Flight Test

2024

Program


Medical Operations TIM

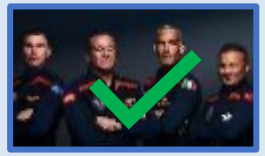

Human Systems Integration TIM


Mission Concept Review


Utilization and Safety Workshops


CLD Requirements Baseline

PAM


Ax-3 Mission


Ax-4 Mission

Destinations Office


Orbital Reef ECLSS Milestones


Orbital Reef Window Test

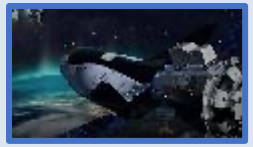

Vast Large Window Pressure Test


Northrop Tech Gap Analysis Milestone


Axiom Station Modules 1 & 2 Fabrication


Starlab Test Article Design Complete


Orbital Reef Tug Concept Review


Sierra Space Pathfinder Softgoods Test


Starlab Optical Link Demo Milestone


Cygnus Upgrades PDR for Starlab


Vast Solar Array Deployment Test


Starlab PDR


Axiom Station Critical Design Review

Summary

- CCP is delivering on its goal of safe, reliable and cost-effective transportation to and from ISS from the United States through a partnership with American private industry
- The Comm LEO Program continues to make good progress on development milestones, program requirements, and certification strategy.