


COMMERCIAL CREW PROGRAM

# Briefing to NAC

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Director, NASA HQ

October 31, 2022

# AGENDA

CCP Vision for 2022/23

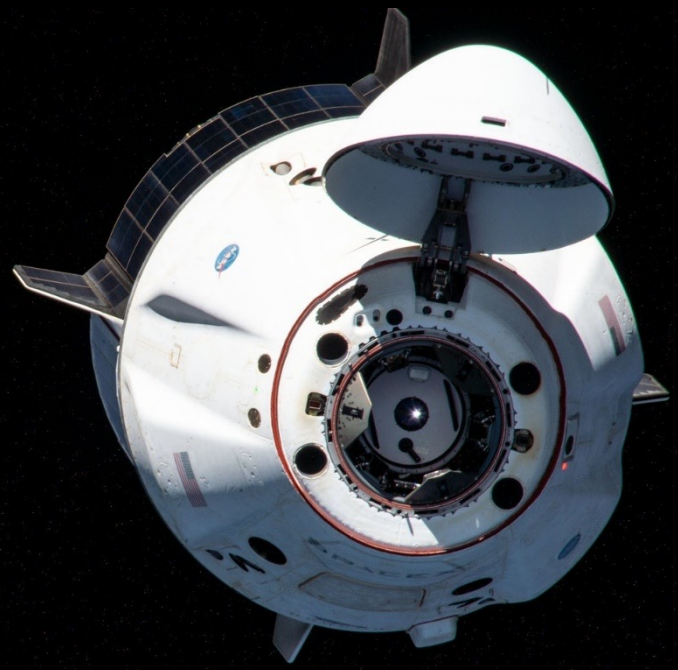
SpaceX Status

- Crew-4
- Crew-5
- Crew-6

Boeing Status

- OFT-2
- CFT

Conclusion



# CCP-ENABLED SPACE TRAVELERS

Bob and Doug
Demo-2

Jared Isaacman, Hayley Arceneaux,
Sian Proctor, Christopher Sembroski
Inspiration4

Michael L-A, Larry Connor
Mark Pathy, Eytan Stibbe
Axiom-1

Nicole, Josh,
Anna, Koichi
Crew-5

Mike, Victor,
Soichi, Shannon
Crew-1

Shane, Megan,
Akihiko, Thomas
Crew-2

Raja, Thomas,
Matthias, Kayla
Crew-3

Robert, Jessica
Kjell, Samantha
Crew-4

May 2020 | Jul 2020 | Sep 2020 | Nov 2020 | Jan 2021 | Mar 2021 | May 2020 | Jul 2021 | Sep 2021 | Nov 2021 | Jan 2022 | Mar 2022 | May 2022 | Jul 2022 | Sep 2022

# CCP VISION FOR 2022/2023

Safely execute the 2022/23 mission manifest:

- Ensure direct crew rotational missions on SpaceX Crew Dragon to ISS
  - ✓ Conduct Falcon 9 multi-Re-use cert for Crew-4
  - ✓ Execute critical direct handover mission Crew-3/Crew-4 – Spring
  - ✓ Execute critical direct handover mission Crew-4/Crew-5 – Fall
  - Complete Dragon Re-use 5x
- Complete the Boeing Starliner development phase
  - ✓ Execute Orbital Flight Test-2 – Spring
  - Resolve key Crew Flight Test Technical Issues
  - Complete Crew Flight Test DCR
  - Execute critical Crew Flight Test when ready

Sustain a productive, healthy, safety-focused programmatic culture

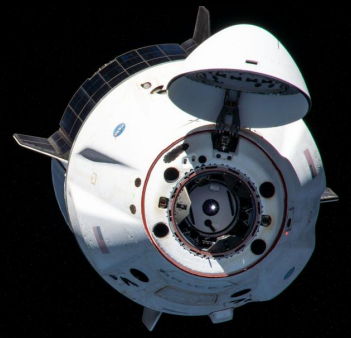
Ensure crewed access to space for the long-term:

Purchase additional missions to meet crew rotation needs through ISS's expected lifetime

- ✓ Awarded 3 additional missions to SpaceX on February 28, 2022
- ✓ Awarded 5 additional missions to SpaceX on August 31, 2022

Perform activities to enable commercial crew spaceflight and low Earth orbit economy

- ✓ Conducting fleet following of Atlas V, Falcon 9 and Crew Dragon missions to include Inspiration-4, Axiom-1, and future missions
- ✓ Evaluating designs and proposed modifications to LC-39A to protect assured access to ISS
- ✓ PartneringPad-40Back-UpCargoandCrewCapability
- ✓ PlanningforfuturesupporttotheCommercialLEOProgramforcertificationofcrewtransportationservices
- ✓ to/from Commercial LEO Destinations

# SPACEX STATUS

Crew-4
Crew-5
Crew-6

# CREW-4

Mission Duration: April 27, 2022 – October 14, 2022

- Overcame dynamic weather challenges during return
- Shortest return duration to date, ~5 hours

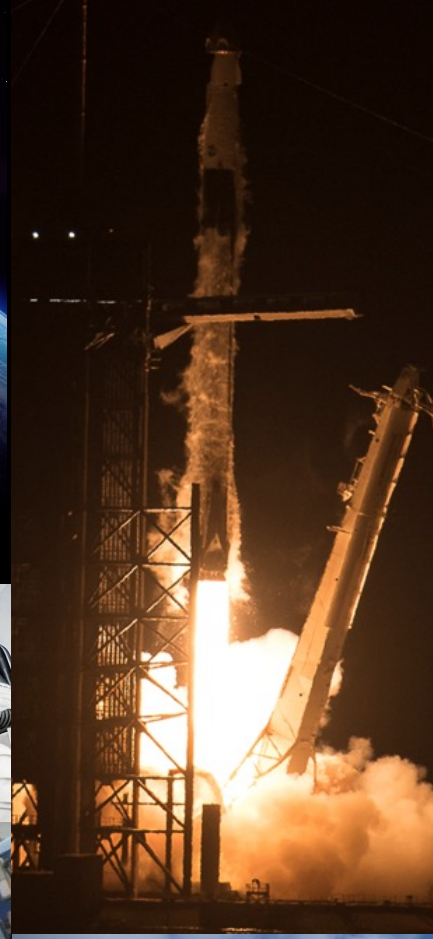
Crew: Kjell Lindgren, Robert "Bob" Hines, Jessica Watkins, Samantha Cristoforetti

Launch Vehicle: Falcon 9

- First four flight Falcon 9 first stage booster used on a Commercial Crew Program mission
- Booster previously launched the Crew-3 mission

Crew Dragon: *Freedom* New capsule, but utilizing more reused Dragon composite components: heat shield compositee structure, four Draco thrusters

Performance: Crew-4 *Freedom* performed very well, operated within flight rules. All monthly vehicle checkouts were nominal.

Crew-4 was the fourth rotational mission with SpaceX, launching four crew members, in the fourth month of the year, on a fourth flight booster – a first for Commercial Crew and a huge accomplishment for the team and industry!

# CREW-5

Mission Duration: Crew-5 successfully launched on October 5, 2022 and docked to ISS on October 6, 2022.

- Latest ISS planning has Crew-5 return NET late February 2023
- Crew-5 Endurance vehicle and crew continue nominal on-orbit operations

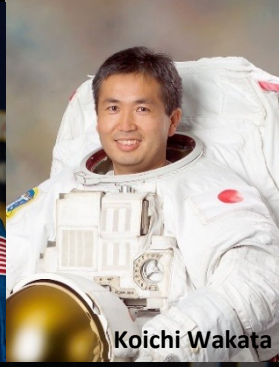
Crew: Nicole Mann, Josh Cassada, Koichi Wakata, Anna Kikina

- First female commander of a Commercial Crew Program mission

Launch Vehicle: Falcon 9, first flight booster

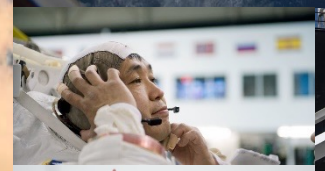
Crew Dragon: *Endurance*, second flight (previously flew Crew-3 mission)











# CREW-6

Mission Duration: Targeted for NET February 2023

Crew: Mission Specialist Andrey Fedyaev, Pilot William Hoburg, Mission Specialist Sultan Al Nedayi, and Commander Stephen Bowen

Crew Dragon: *Endeavor*

# BOEING STATUS

## Orbital Flight Test-2
## Crew Flight Test

# ORBITAL FLIGHT TEST-2

Mission Duration: 6 days. May 19, 2022 – May 25, 2022

- First time both CCP crew transportation systems, Starliner and Crew Dragon, were docked to ISS at the same time

Crew: Uncrewed, utilizing instrumented anthropometric test device “Rosie”

Launch Vehicle: Atlas V

- Emergency Detection System armed and active

Starliner: Spacecraft 2, first flight

Performance: OFT-2 met all orbital flight test objectives and allowed vehicle performance to be assessed. Completed flight test objectives:

- Launch of a normal trajectory to establish Starliner orbital insertion
- Validation of the Atlas V rocket and dual engine Centaur second stage
- Validation of the ascent abort emergency detection system
- Separation of Starliner from the Atlas V rocket
- Approach, rendezvous, and docking with International Space Station
- Performing of hatch operations, astronaut ingress into Starliner and configure it for quiescent mode at station
- Evaluation of the spacecraft’s habitable environment and crew internal interfaces
- Undocking and departure from the space station
- Deorbit to include separation of crew module from service module
- Entry and descent to include demonstration of aero-deceleration system
- Target landing and recovery

Vehicle recovery by ground teams at White Sands Space Harbor, NM

Post flight data reviews ongoing


# CREW FLIGHT TEST

Mission Duration: Approximately two weeks. Launch date under review.

- NASA has the capability to extend CFT for up to a six-month mission and add a mission specialist to the manifest in the event of a fleet contingency.

Crew: Barry “Butch” Wilmore, Suni Williams

Launch Vehicle: Atlas V

Starliner: Spacecraft 3 *Calypso*, previously flew OFT-1

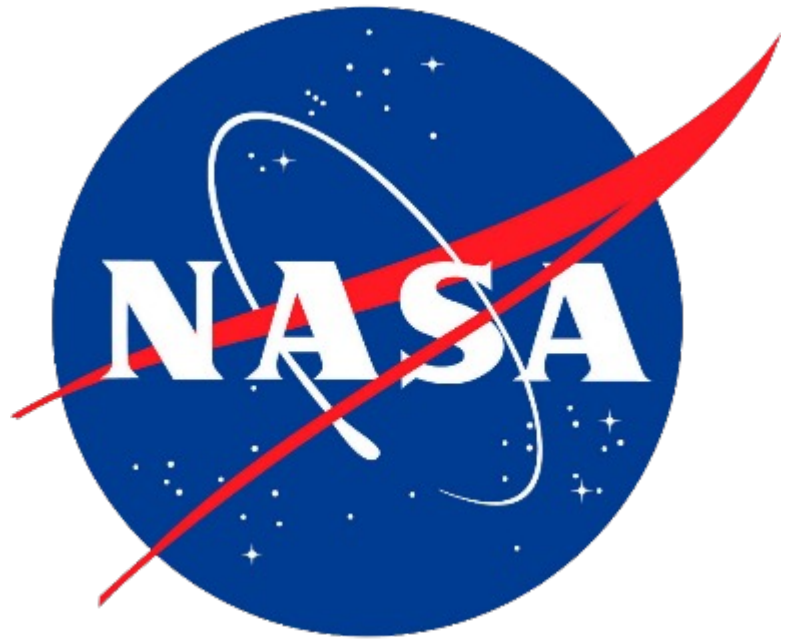
- New, expendable service module

Path to Flight:

- Crew module refurbishment and acceptance testing underway
- Service module production on going
- Centaur, booster, and launch vehicle adapter in storage at Cape Canaveral awaiting final integration
- Mission reviews continue to evaluate critical hardware
- Crew recovery planned by ground teams at one of five land landing zones in the Western United States

# CONCLUSION

- CCP is safely executing its 2022 operational manifest
- CCP continues to facilitate the development and certification of U.S. industry-based crew transportation systems
- Boeing and SpaceX are meeting contractual milestones and maturing their designs
  - Risks are being identified and important design challenges are being addressed
  - NASA is engaged in meaningful insight
- Both providers have operated safe flights to the ISS in 2022, with SpaceX continuing to transport crew and cargo and Boeing making tangible progress toward crewed missions and certification
- CCP has robust and efficient processes for certification including addressing waivers and deviations
  - Progress is being made in the burn down of key certification products with the providers
- In preparation for flight, there is significant and critical work ahead


NASA