IAF Committee Briefs



2024

IAF SPACE TRANSPORTATION COMMITTEE

Introduction

The objective of the Space Transportation Committee is to address worldwide space transportation solutions and innovations. In particular, the goals are:

- To foster understanding and cooperation amongst space business academicians and practitioners, through the creation, diffusion, and adoption of new knowledge (i.e., research exploration, from academics to practitioners) and lessons learned (i.e., experience exploitation, from practitioners to academics)
- To build a worldwide network of communication and relationships between space business amateurs and professionals, by providing a forum of discussion, disclosure, creative thinking (i.e. brain-storming), and information sharing.
- To encourage, promote, and assist the development of newer members of the space community through IAC participation The corresponding activities are devoted to different types of space transportation missions, systems (launch vehicle system and/or the propulsion stages, expendable or reusable, manned or unmanned) and to their safety and support operations.

The activities of the IAF STC include the following:

- Proposal and organization of IAC symposium and sessions, including identification of relevant space-related topics to be included in the Call for Papers
- Participation in the paper selection as IPC members
- Participation as IPC members (Chairs, Rapporteurs and Symposium Coordinators) - Organization of dedicated conferences, publications
- Participation in the IAF Committee Briefs and the annual IAF Highlights

Summary

The major development in the space transportation field is the increase in the size of launch vehicles like Starship, New Glenn, SLS that allow new missions in Low Earth Orbit but also to the Moon and to Mars. Another major trend is the consideration of the re-useability of launch vehicles.

Highlights

<u>SpaceX</u>

SpaceX completed Starship launches 2, 3, and 4 on November 18 2023, March 14 2024, and June 6 2024 respectively. Each successive launch demonstrated substantial steps forward in the development of the Super Heavy Booster and Starship upper stage. Flight 2 demonstrated the first stage separation using a hot staging technique but suffered a loss of the ship during its ascent burn. Flight 3 resulted in a successful completion of ascent objectives, with the Booster completing a boost-back burn and attempting a landing burn before the loss of the vehicle and Starship being lost on reentry. Flight 4 demonstrated both a successful ascent and successful entry for both the Booster and Ship, with both the Booster and the Ship completing soft water landings on the ocean (as planned). Notably for both flights 3 and 4, SpaceX was able to collect data during the reentry portion of the flight via direct connection of the Starship vehicle to SpaceX's Starlink constellation, enabling data rates that are unprecedented for space vehicle reentries.

SpaceX is underway in building a new factory for fullscale Starship production as well as a second launch pad at its privately owned and operated launch facility in South Texas in the USA.

While likely more relevant to human spaceflight committees, SpaceX also completed the Polaris Dawn



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mission which made history by accomplishing the first ever all civilian, private spacewalk and transiting higher than anyone since the Apollo missions in a private Dragon capsule.

Starship high-resolution video during reentry, data collected via Starlink.



Starship flight 3 launch:



Status of Andøya Spaceport

The construction of the spaceport for micro launchers in Andøya, Norway started in early 2022. The first construction stage is completed, the spaceport was officially opened in Nov 2023 and is now operational. The Initial Operating Capability includes the first launch pad, a launcher integration hall, and a temporary launch and mission control center. Andøya Spaceport received its Spaceport Operator License from the Norwegian Ministry of Trade and Fisheries in August 2024, paving the way for the imminent first test launch of the Spectrum launcher by our customer and partner ISAR Aerospace. Other launch operators are in talks with Andøya Spaceport which aims to host several launch operators at once.

CHANG'E-6 / Sample return from far side of the moon

From May 3rd to June 25th, China conducted the world's first sample return mission from the far side of the Moon. Chang'e-6, the twin sister of Chang'e-5 lunar probe, with a mass of about 8.35 metric tons, was launched by Long March 5 launcher to TransLunar

orbit on May 3rd. It consisted of Lander, Ascender, Returner and Orbiter. After lunar orbit insertion, which was conducted by the Orbiter, the Ascender-Lander combination was separated from Returner-Orbiter combination. With the help of MagpieBridge-2 Data Relay Satellite, Ascender-Lander Combination successfully landed in Apollo Basin, which is located on the far side of the Moon. After collecting 1935.3 grams of lunar samples, the Ascender returned to Lunar Orbit. Then China conducted the world's second unmanned automatic rendezvous and docking on Lunar Orbit. Samples were transferred from Ascender to Returner, and then Ascender was separated and deorbited. The Orbiter brought the returner to TransEarth Orbit. On June 25th, after separation from the orbiter, the Returner conducted a skip reentry and landed in China.



YANG Yuguang, vice chair of IAF STC, introducing Chang'e-6 mission on China Central Television's CGTN Channel

Future Outlook

In 2024, a state-owned company and a private of China completed their VTVL (Vertical TakeOff and Vertical Landing) test at Jiuquan Satellite Launch Center, respectively. Both test vehicles use the propellant combination of methane and liquid oxygen. LandSpace, the private company, adopted stainless steel on the fuselage of it's Zhuque-3 test launch vehicle. Both tests reached the altitude of 10km and landed vertically on concrete pads. Grid Fins, cold gas RCS were also adopted for attitude control during descending. LandSpace announced that an orbital launch attempt will be conducted in 2025 and a recovery attempt will also be conducted at the same flight test.

Committee Activities

The committee is currently made of more than 70 members from all over the world including South America, Australia, North America, Europe and Asia. Only no member from Africa is currently given. A good distribution is given with a high number of female members and young professionals + students and also a good distribution among categories (industry, Academia, agencies).

The committee is not only active in the organization of the International Astronautical Congress, but also fosters synergies with other relevant space transportation conferences, and also tries to improve the exchange between the committee members through regular, committee internal webinar sessions, the last one in September 2024 on SpaceX results. The next webinar is planned for Spring 2025.

It is also planned by the committee to improve its visibility in social media in the near future.

In 2024, the IAF Space Transportation Committee invited multiple colleagues from the IAF Community to attend programs on China Central Television's CGTN Channel. The topics covered but not limited to Earth-Moon Transportation System, new launch vehicles, Space Policies and space conferences.









Giuseppe Rebaldi, Martin Sweeting, Remco Timmermans, Bernard Foing on CGTN

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