



IAF Committee Briefs

Summer 2022

IAF SPACE COMMUNICATIONS AND NAVIGATION COMMITTEE (SCAN)

1. Introduction

The IAF Space Communications and Navigation Committee addresses all aspects of space-based systems, services, applications, and technologies for fixed, broadcast, high-throughput, and mobile communication services as well as position determination, navigation and timing services.

2. Latest Developments

Starlink continues on its path to deploying its full constellation with launches each month from September 2021 to April 2022, bringing the total number of Starlink satellites in orbit up to 2,100. The primary availability of Starlink service is still largely limited to the northern latitudes of North America but the service regions continue to expand. While the popularity of the service is ramping up, there continue to be challenges for Starlink to provide subscribers with the necessary hardware to connect to their service. Astute observers point to shortcomings in Starlink's user terminal supply chain, a situation that is certainly exacerbated by the current electronic components crisis. Starlink has provided the communication service over Ukraine and is keeping Ukraine connected to the World.

In Europe, OneWeb continues to build its constellation. With the 10 February 2022 launch on Soyuz ST-B, it has 428 operational satellites (66% of the planned 648 satellites). Further launches planned with Soyuz need to be rescheduled due to the Ukrainian conflict.

On 22 December 2021, Inmarsat confirmed the launch of their latest satellite, I-6 F1, touted as the "most sophisticated commercial communications satellite ever". Launched by Mitsubishi Heavy Industries, I-6 F1 is intended to deliver enhanced ELERA (L-band) and Global Xpress (Ka-band) to the Indo-Pacific region. The Inmarsat-6s class of satellite is the first-ever hybrid L- and Ka-band satellite and brings increased capacity and new

technological advances to Inmarsat's comprehensive portfolio of mobile satellite services.

During Satellite 2022, a group of panelists consisting of Sulaiman Al Ali, Thuraya Telecommunications CEO, Globalstar CEO David Kagan, Neil McRae, BT Group chief architect, Ignacio Sanchis, Hispasat chief commercial officer, Sara Spangelo, Swarm Technologies CEO and Jay Yass, Omnispace chief commercial development officer discussed the future role of communication satellites in the context of universal connectivity. The group were in agreement that any such universal, global connectivity will require significant collaboration between satellite and terrestrial communications firms as well as equipment manufacturers. Spanish satellite operator Hispasat, for example, envisions "a fully interoperable 5G- based network, melding terrestrial and multi-orbit satellite infrastructure into a single network" within five to 10 years, according to Ignacio Sanchis, Hispasat chief commercial officer.

All four constellations of GNSS and the two RNSS services have continued successfully through an infrastructure modernization process to provide enhanced signal reliability, accuracy and integrity for all user groups. They also have continued to improve provision of new complementary services such as search and rescue, emergency early warning systems and advanced navigation services.

GPS maintained 30 operational satellites, including four operational third-generation satellites, known as Block III. Galileo launched two satellites from French Guiana, as it moves toward the second generation of satellites. The final GLONASS-M satellite was ready to launch in March 2022, with GLONASS-K ready later this year. In RNSS, Japan successfully launched and deployed a replacement QZSS satellite on 26 October.

Given new and emerging conflicts in 2022, there have been increased risks to GNSS from anti-satellite

missions, jamming and spoofing attacks both on ground and in-space, as well as targeted cyberattacks to GNSS operating bases. In the recent Russian-Ukraine conflict, hackers on both sides have targeted both GPS and GLONASS infrastructure. Statements from militaries have raised the need for an alternative GNSS infrastructure.

The past year has seen a rise in AI-driven solutions for GPS-denied or GPS-outage scenarios in terrestrial navigation e.g., in the automotive sector. Spoofing/jamming detection capability for military and civilian applications has continued to progress.

Lunar navigation capabilities and infrastructure have also progressed. NASA and Italy seek to send first GNSS receiver to the Moon in 2023. This will compete with the ESA commissioned project for SpacePNT GPS/Galileo receiver on-board the ESA-SSTL Lunar Pathfinder. Project Moonlight from ESA and LunaNet from NASA has also further cemented plans for a Lunar Communication and Navigation Service (LCNS), to support future's mission to the Moon.

3. Breakthroughs

NTT Corporation and SKY Perfect JSAT Corporation announced on 26 April 2022 that the parties have reached an agreement and signed a contract to establish a joint venture company that will launch a novel integrated space computing network to aid the realization of a sustainable society. The joint venture will take on the challenge of building new infrastructures in space, where business led by the private sector is expected to grow in the future, and contribute to the creation of a sustainable society.

New navigation tests by the US Navy have demonstrated muon quantum particles for navigation in the Arctic region, serving as an alternative to GNSS. Spire has

announced capabilities to detect and geolocate compromised signals in US and Europe in late 2021. Martin UAV has successfully demonstrated GPS-denied navigation in-flight tests.

There has been steady progress in the delivery of navigation from LEO. The UK has commenced a new programme from 2021 in delivering a PNT alternative through the OneWeb communication constellation. New partnerships between Pulsar PNT and Xona Space Systems have emerged to provide resilient PNT solutions for commercial and government end users. Navigation Service (LCNS).

4. Action plan for the year

The committee conducted a successful combined physical/virtual meeting during the 2022 IAF Spring Meetings in Paris. During this meeting, the B2 Symposium content was discussed and finalized prior to the deadline. The need for several session co-chairs and rapporteurs was identified and will be assigned before IAC 2022.

The committee is exploring the opportunity to conduct more frequent virtual meetings to improve the cohesion of all activities, with a goal to conduct meetings quarterly, adding virtual meetings in summer and winter. The committee is also exploring rationale and concepts for activities beyond IAC symposium sponsorship.

The committee continues to address potential technical content overlap with other symposia, with a goal to improve the abstract selection process by helping authors to properly identify the location for their submissions.