



# IAF Committee Briefs

Winter 2024

## IAF SPACE COMMUNICATIONS AND NAVIGATION COMMITTEE (SCAN)

### Introduction

The Space Communications and Navigation Committee (SCAN) deals with all aspects of space-based systems, services, applications, and technologies for communication and navigation. This includes fixed, broadcast, high-throughput, mobile, optical, and quantum communications, as well as position, velocity, time determination and tracking for navigation. The Internet of Things (IoT) and Machine-to-Machine (M2M) topics as they relate to communication and navigation are also in the scope of this committee.

### Summary

The development of mega-constellations continued this year. Starlink's system consists of over 5000 mass-produced small satellites and offers services in an increasing number of countries.

Laser communications experiments in space continue following their roadmap to fulfill new phases of their development. On November 9, as part of NASA's Laser Communications Relay Demonstration (LCRD), the Integrated LCRD LEO User Modem and Amplifier Terminal (ILLUMA-T) was launched aboard a SpaceX Falcon 9 to be hosted in the International Space Station. ILLUMA-T will allow for communications at 1.2 Gbps and showcase how missions in Low Earth Orbit (LEO) can benefit from laser communications.

ESA continues its work on Eagle-1, which will be the first sovereign European end-to-end space-based Quantum Key Distribution (QKD) system, and is a step toward future European quantum communications. Tesat joined SES's team in May and will manufacture the QKD payload comprising its SCOT80 optical communications terminal, which will establish a secure optical link from space to ground. Tesat will also manufacture the QKD

module. An optical communications payload, TELEO, was successfully launched on 27 May and the optical feeder link experiments will start from November.

Major GNSS providers are in the process of stabilizing new services primarily for high accuracy, authentication, and safety-of-life. There is also increasing cooperation for providing signals for space service volume and for providing positioning and communications services in lunar orbit. Space-Based Augmentation Systems (SBAS) are moving towards dual-frequency multi-constellation capability.

### Highlights

2023 marks the 50<sup>th</sup> anniversary of initial approval of the GPS program, and the 30th anniversary of Full Operations. The program continues to launch GPS III satellites to replenish the constellation and add modernized capabilities. Galileo high accuracy service is declared operational, with 225+ registered users. NASA has released a draft version of the LunaNet interoperability specification document for review and feedback. India has launched the NVS-01 satellite under the NavIC programme. This satellite introduces interoperable civilian signals in the L1 frequency band. IEC has released 61108-6 standard for NavIC based maritime receiver equipment. Indian industry has designed and realized multi-GNSS chipsets with NavIC capability for location-based services.

On 13 October, the Deep Space Optical Communications (DSOC) demonstrator was launched onboard the Psyche spacecraft. DSOC is the first demonstration of optical communications beyond the Earth-Moon system by NASA and has the potential of setting the foundation for establishing high data throughput for future missions to Mars and beyond. The first light has been achieved to send data via laser to and from far beyond the Moon for the first time on 16 November.

Another achievement in the laser communications field occurred on 28 April when the mission TeraByte InfraRed Delivery system (TBIRD) achieved a record data transfer speed of 200 Gigabits per second, the highest space-to-ground transmission speed ever achieved with optical communications technology.

The last of Europe's heavy-lift rocket Ariane 5 lifted off July 7 taking onboard a French defense communications satellite, Syracuse 4B, and a German demonstration spacecraft called Heinrich Hertz whose mission is to test new satellite communications technologies for their suitability for space.

On 28 April and on 12 November, four additional SES O3b mPOWER satellites were successfully launched by pairs using SpaceX Falcon 9 rockets, joining the two first satellites of the O3b mPOWER constellation launched in December 2022. With the launches of this year, the system is already operational to offer high-performance network systems.

### **Future Outlook**

We expect to see increasing numbers of launches for constellations as well as different demonstrations for satellite-based Internet-of-Things and other non-terrestrial communication technologies. The convergence of terrestrial systems and satellite-based systems will continue under the framework of 6G.

The focus in space-based navigation will be on high accuracy services, open signal authentication, space service volume, and lunar PNT. Applications like

precision agriculture, GNSS-based tolling, and disaster relief reduction are finding increasing adoption in various countries. It is expected that these applications will mature into operational nature in the near future. Integration of GNSS with terrestrial systems, especially 5G will become more profound. Studies are ongoing for utilizing signals of opportunity from broadband satellites and for having LEO based PNT services. There will be an increasing cooperation among space agencies and commercial industry in this domain. In the civil aviation domain, more airports will have operational procedures for SBAS services, thereby increasing SBAS adoption.

### **Committee activities**

During the IAC 2023 committee meeting in Baku, the committee approved updated session descriptions for IAC 2024 B2 symposium, to improve the abstract selection process by helping authors to properly identify the specific session for their submission. The synergy between laser communication and optical fiber industries was discussed, and a workshop will be proposed in conjunction with IAC. The committee will also propose a Plenary or Special session to bridge the PNT and Space communities, to be sponsored jointly with B4 Small Sats.

The committee is still working on a playlist of SCAN-related YouTube videos, and the creation of individual 5-minute SCAN member introduction videos, both to be posted on the IAF site.