November 2021

IAF SPACE COMMUNICATION AND NAVIGATION COMMITTEE (SCAN)

1. Introduction

The IAF Space Communications and Navigation Committee (SCAN) 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. Summary

Space-based communication and space-based navigation continue to be significant drivers for new applications and new technology.

The satellite communications market was estimated to be worth $62.19 billion in 2019 and is predicted to grow by about 9.2 % in the period from 2020 to 2027. There is still a high need of very high throughput satellites (VHTS) and a growing capacity need for Internet of Things (IoT) services.

The international Global Navigation Satellite Systems (GNSS) infrastructure continues to expand, with global [Beidou (China), Galileo (EU), GLONASS (Russia), GPS (USA)] as well as the regional [EGNOS (EU), IRNSS (India), QZSS (Japan), WAAS (USA)] systems. The economic benefit of GPS alone has been estimated at $1.4 Trillion (2017$) since it went operational in 1995. The impact of the loss of GPS is estimated at $1 billion per day.

3. Highlights

In 2020 about 22 commercial communication satellites were ordered to be manufactured: six by Space Systems Loral (US), four by Northrop Grumman (US), two by Boeing Satellite Systems (US), six by Airbus Defense and Space (F), three by Thales Alenia Space (F), and one by China Great Wall Industries (CGWIC).

As of 5 Nov 2021, six commercial communication satellite manufacturing orders have been placed: two for Maxar (US), two for Airbus Defense and Space (F), one for Thales Alenia Space (F) and one micro-GEO for Astranis (US).

SpaceLink, a US company formed by Australia's Electro Optic Systems (EOS) in 2020, awarded a contract to OHB System AG (Germany) to manufacture four satellites for its commercial space data relay constellation. SpaceLink plans to establish a relay network in medium Earth orbit to connect commercial and government satellites with customer mission operations centers. This is a remarkable move. Until now, all data relay networks have been established in geostationary orbits.

SpaceLink won a contract to demonstrate a 10 Gbit/s optical communication service for the ISS. SpaceLink plans to provide data-relay services in Ka-band at about 600 Mbit/s (as currently provided by TDRSS), and in the optical domain for 1 to 10 Gbit/s data rate with its now contracted MEO data relay constellation.

In the area of mega-constellations, 2021 saw a substantial increase of the constellation sizes of OneWeb and Starlink. From July 2021 until October 2021 OneWeb has launched 240 satellites using four launchers. Starlink launched 51 spacecrafts in September 2021.

On 20 January 2021, the European Commission signed a contract with Airbus and Thales for the second generation of Galileo satellites. These new satellites, due to be launched in 2024, will have the latest in highly innovative technologies (e.g., digitally configurable antennas, inter-satellite links, new atomic clock technologies, use of fully electric propulsion systems), that will allow these satellites to improve the accuracy of Galileo as well as the robustness and resilience of its signal.

In March 2021, EGNOS, the European Geostationary Navigation Overlay Service, celebrated 10 years of operation. This European regional navigation system provides services primarily to airlines, and provides an accuracy and integrity improvement to all GNSS service providers. EGNOS, like the US-based Wide Area Augmentation System (WAAS), can pinpoint positions to within 1.5 m! Such accuracy facilitates automated landing of aircraft thus allowing operations in the worst visibility conditions.

RUAG Space signed an agreement in October 2021 with the UAE's Mohammed Bin Rashid Space Centre (MBRSC) to deliver their LEORIX space-based GNSS receivers. These latest receivers allow satellite operators to locate their satellites with unprecedented accuracy. RUAG's LEORIX, GEORIX, and PODRIX line of products leverage the latest in technology development from the European Space Agency and with 80 receivers already on order, space operations will be getting increasingly more reliable – something that is of the utmost importance as the issue of space debris continues to haunt those that are on the operational front lines.

The US Global Positioning System launched the fifth GPS III satellite, nicknamed Neil Armstrong, on 17 June 2021, and it is now operational. The five operational GPS III satellites, manufactured by Lockheed Martin, are an integral part of the GPS constellation, and continue to advance the capabilities of GPS, with a 15-year design life, 3X better accuracy, and a new internationally coordinated signal, L1C.

The Japanese Quasi-Zenith Satellite System (QZSS) launched its first successor satellite, QZS-1R, on 26 October 2021. It has a 15-year design life, and replaces QZS-1 (Michibiki-1). QZSS began service in 2018 with four satellites. The Japan Aerospace Exploration Agency (JAXA) plans to have seven satellites launched by 2023.

4. Future outlook

The first ViaSat-3 VHTS satellite launch, originally foreseen for 2021, has been moved to 2022 at the earliest, due to the effects of COVID-19. ViaSart-3 is the highest capacity geostationary satellite system under development in the world, providing a capacity of more than one Terrabit/s (=1012 bit/s) with one satellite. The ViaSat-3 Americas satellite must be brought into use (BIU) by 31 December 2021 OR it must receive a waiver from the FCC's deployment milestone. The originally planned launch date was 29 March 2021 and operational service was expected by 31 December 2021. The launch date has now shifted to 2022.

The success of EGNOS and WAAS to airlines has attracted the attention of those wishing to operate unmanned drones in the same commercial airspace. As the number of remotely piloted vehicles quickly outpace the number of commercial aircraft, safety-of-life services is seen as essential to safely managing the skies.

5. Committee activities

The SCAN committee had a very active year. The IAC 2021 symposium was organized, abstracts evaluated and selected, and sessions conducted in Dubai. This was the first use of a restructure of the symposium session descriptions, which now has several sessions with the same name but shown as Part 1, Part 2, etc. The new structure required more coordination between session chairs, but also allowed grouping of specific topics into each session, for more cohesive discussion. The committee will continue with this approach for a few more years, to further evaluate the benefits versus effort. As a result of pandemic-related absents in Dubai, substitute session chairs were arranged to support all nine sessions that the committee sponsors.

In addition to organizing and running the B2 symposium, the SCAN committee Terms of Reference was updated. The previous version from 2005 did not include space-based navigation. This has been added, the overall ToR updated, and it now conforms to the new IAF template.

Virtual meetings were held in March 2021 and October 2021. Elections were conducted for Chair and Vice-Chair. All affiliations and contact information were updated in the SCAN committee roster. Reviewing the roster for inactivity (no committee participation for more than 3 years), several "members" and one "friend" were removed. Four new members and one expert were added. All other members were re-elected. After two years of successful virtual meetings, the committee is exploring the opportunity to conduct more frequent virtual meetings to improve cohesion of all activities. The goal is to conduct meetings quarterly, adding virtual meetings in winter and summer, with in-person meetings at the IAF Spring Meetings and the annual IAC.