

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of	)	
	)	
ICEYE US, Inc.	)	File No. SAT-LOA-2023____ - ____
	)	
Application for Authority to Launch	)	Call Sign: S ____
And Operate a Non-Geostationary Satellite	)	
System in the Earth-Exploration Satellite	)	
Service	)	

APPLICATION OF ICEYE US, INC.

ICEYE US, Inc. (“ICEYE”) hereby requests authority to launch and operate eight (8) small satellites (“Second Tranche”) in low-Earth, non-geostationary orbit (“NGSO”) for the provision of Earth-Exploration Satellite Service (“EESS”). This application is submitted under the Commission’s streamlined licensing procedures governing small satellites.¹ In February 2021, ICEYE applied for authority to launch and operate six (6) small NGSO satellites for EESS (“First Tranche”). File No. SAT-LOA-20210212-00021, Call Sign S3082. Pursuant to Commission authority, ICEYE has launched four of those six satellites, and plans to launch the final two satellites in June 2023.

I. BACKGROUND AND DESCRIPTION OF SERVICES

ICEYE, based in Irvine, California, is a wholly-owned U.S. subsidiary of ICEYE OY, a private company headquartered in Espoo, Finland.² ICEYE OY was founded in 2012 to provide satellite-based remote sensing using synthetic aperture radar (“SAR”) from a constellation of

¹ 47 CFR §25.122. *See Streamlining Licensing Procedures for Small Satellites*, 34 FCC Rcd 13077 (2019) (“Smallsat Order”).

² *See Exhibit A* for Ownership Information.

small satellites in low earth orbit (“LEO”). To date, ICEYE OY has raised \$304 million in private equity funding. ICEYE OY operates a constellation of SAR satellites that provide persistent monitoring capabilities to government and commercial customers. ICEYE OY’s first-of-its-kind system offers global access and rapid dissemination of unclassified, shareable, high resolution imagery.

ICEYE was founded in 2020 to build, own and operate U.S. licensed satellites. ICEYE provides an efficient and dependable complement to the suite of earth observation tools deployed by the U.S. Government. As noted above, ICEYE sought, and was granted authority, to launch and operate six NGSO EESS small satellites. ICEYE will have exhausted that authorization with the launch of its fifth and sixth satellites in June 2023. In order to expand its remote sensing capabilities, ICEYE now seeks authority to launch and operate an additional eight (8) satellites.

Importantly, the satellites in the Second Tranche will be technically identical to the satellites in the First Tranche. ICEYE plans to launch the first satellite of the Second Tranche in October 2023. ICEYE requests that the Commission grant this application prior to August 15, 2023, the date on which ICEYE will ship its first satellite to Cape Canaveral for integration into the SpaceX launch vehicle.

II. DESCRIPTION OF SYSTEM FACILITIES AND OPERATIONS

A. Space Segment, Including Orbital Information

ICEYE seeks authority to launch and operate eight (8) satellites. As noted above, the satellites will be identical to the satellites authorized and launched pursuant to ICEYE’s first

license.

The satellite bus has a total mass of less than 150 kilograms, including propellant. Its smallest dimension is approximately 0.65 meters. The satellite payload is a SAR sensor and data collection system consisting of an active phased array with both transmit and receive modules, transmit and receive radios, and a data converter (A/D and D/A). Once deployed on orbit, the satellites will deploy a modular phased array SAR antenna. Please see **Exhibit B**, Technical Annex, for further technical details.

The satellites will operate in Low Earth Orbit at an altitude up to 600 kilometers. As explained in greater detail in Section IV below, the satellites will use the following frequency bands:

- 2025 - 2110 MHz (S-band): command uplink – operational commands to the satellites
- 2200 - 2290 MHz (S-band): telemetry downlink to the tracking earth stations
- 8025 - 8400 MHz (X-band): mission data downlink – transmission from the satellites to the ground stations of raw SAR data
- 9300 – 9900 MHz (X-band): earth observation/remote sensing

The basic specifications for all communications link channels are summarized in the table below:

Channel Purpose	Center Frequency (MHz)	Channel Bandwidth	Polarization	Tx Power (dBW)
Mission Data Downlink	8025 - 8400	150 - 375 MHz	RHCP	6
Command Uplink	2025-2110	1.2 MHz	RHCP	N/A
Telemetry Downlink	2200-2290	6 MHz	RHCP	3

Each satellite has an expected operational lifetime of 3 years. ICEYE has utilized NASA's Debris Assessment Software version 3.0.1 ("DAS") to determine that all satellites will be compliant with existing orbital debris mitigation requirements. At the end of the satellite's operational life, the satellite will be commanded to de-orbit. All satellites will be de-orbited before expiration of the 6-year license term, with no objects surviving reentry. Post-mission disposal is achieved through the natural effects of atmospheric drag. For the detailed analysis, methodology, and assumptions underpinning this assessment, please see **Exhibit C**, the Orbital Debris Mitigation Plan.

B. Ground Segment

The Mission Operations Center ("MOC") for the satellites is located at ICEYE facilities in Irvine, California. Through its MOC, ICEYE will monitor and control all aspects of satellite operations.

ICEYE will use the same ground stations for its Second Tranche as it uses for its First Tranche.³ For command uplinks in the S-band, ICEYE will use non-federal ground stations in the United States and non-federal ground stations outside the United States.⁴ For command downlinks in the S-band, ICEYE will only use non-federal ground stations

³ A full list of the ground stations is set forth in **Exhibit F**, which matches the list of ground stations listed in Appendix A to the Commission's March 6, 2023 grant of ICEYE's request to launch the fifth and sixth satellites in the First Tranche, File No. SAT-LOA-20210212-00021.

⁴ ICEYE requests flexibility to use additional non-federal earth stations in the United States and outside the United States for command uplinks in the S-band.

outside the United States.⁵ For mission data downlinks in the X-band, ICEYE will use non-federal ground stations in the United States and non-federal stations outside the United States.⁶

ICEYE has already coordinated the use of all non-USG ground stations, whether in the United States or overseas, with federal government ground stations operating in the relevant bands. ICEYE requests authority for such communications subject to appropriate standard conditions requiring coordination with co-frequency Federal Earth station operators.

C. Launch Schedule

The initial satellite in the Second Tranche is expected to be launched in October 2023. ICEYE requests that the Commission grant this application prior to August 15, 2023, the date on which ICEYE will ship its first satellite to Cape Canaveral for integration into the launch vehicle. **Exhibit D** provides a list of the planned launch dates of all eight satellites.

III. REQUIRED CERTIFICATIONS FOR STREAMLINED TREATMENT

ICEYE certifies pursuant to Section 25.122(c) of the Commission's rules that the following requirements for streamlined processing are met for all space stations in the planned network:⁷

Streamlined Requirement

⁵ ICEYE requests flexibility to use additional non-federal earth stations outside the United States for command downlinks in the S-band.

⁶ ICEYE requests flexibility to use additional non-federal earth stations in the United States and outside the United States for mission data downlinks in the X-band.

⁷ See attached Certification of Dee Grover, Vice President of Operations, ICEYE.

(1) The space stations will operate only in non-geostationary orbit
(2) The total in-orbit lifetime for any individual satellite will be six years or less
(3) The space stations will be deployed at an orbital altitude of 600 km or below
(4) Each space station will be identifiable by a unique signal-based telemetry marker distinguishing it from other space stations or space objects
(5) The space stations will release no operational debris
(6) ICEYE has assessed and limited the probability of accidental explosions
(7) The probability of a collision between each space station and any other large object (10 cm or larger) during the orbital lifetime of the space station is 0.001 or less as calculated using current NASA software
(8) The space stations will be disposed of post-mission through atmospheric re-entry. The probability of human casualty from portions of the spacecraft surviving re-entry and reaching the surface of the Earth is zero as calculated using current NASA software
(9) Operation of the space stations will be compatible with existing operations in the authorized frequency bands. Operations will not materially constrain future space station entrants from using the authorized frequency bands
(10) The space stations can be commanded from the ground to immediately cease transmissions and the licensee will have the capability to eliminate harmful interference when required under the terms of the license or other applicable regulations

(11) Each space station is 10 cm or larger in its smallest dimension

(12) Each space station will have a mass of 180 kg or less, including any propellant

IV. SPECTRUM USE AND SHARING ANALYSIS

ICEYE is committed to ensuring the protection from harmful interference of all licensed co-frequency spectrum users. The ICEYE satellites will operate in the authorized frequency bands in a manner that will avoid harmful interference. Successful spectrum sharing is ensured in three principal ways: constant communication and transparency; short transmission time; and a small area of effect.

The ICEYE MOC in Irvine, California will be reachable 24 hours/day and will have the ability to adjust or shut down any satellite transmissions promptly upon request. During satellite operations the MOC will be able to share up-to-date orbital characteristics (including ephemeris data), transmitting windows, and any other information required to ensure successful sharing of spectrum with other RF services. As necessary, the MOC will also be capable of defining “dark zones” in which the satellites will not transmit. Further, as set forth in Section II.B. above, ICEYE will coordinate with Federal and non-federal operators in each band, as required, to ensure compliance.

ICEYE summarizes below the specific spectrum sharing environment for each of the frequency bands in which it proposes to operate. A more detailed discussion of compliance with all requirements for the avoidance of harmful interference is contained in **Exhibit B**, the

Technical Annex.

A. S-Band Operations

1. 2025 - 2110 MHz

ICEYE plans to utilize the 2025 – 2110 MHz band for command uplinks pursuant to the EESS (Earth-to-space) allocation. Non-Federal Earth-to-space transmissions may be authorized in the EESS subject to such conditions as may be applied on a case-by-case basis. Uplink transmissions shall not cause harmful interference to Federal and non-Federal stations operating in accordance with the Table of Frequency Allocations.

2. 2200 - 2290 MHz

ICEYE plans to utilize the 2200 – 2290 MHz band for TT&C downlinks under the EESS (Space-to-Earth) allocation. Non-Federal Earth-to-space transmissions may be authorized in the EESS subject to such conditions as may be applied on a case-by-case basis. Such transmissions shall not cause harmful interference to Federal and non-Federal stations operating in accordance with the Table of Frequency Allocations. Across all potential orbits, the PFD on the ground during TT&C downlink operations will remain under the limit, as detailed in **Exhibit B**, the Technical Annex, ensuring that no harmful interference occurs.

B. X-Band Operations

1. 8025 - 8400 MHz

ICEYE plans to utilize the 8025 – 8400 MHz band for payload data downlink under the EESS (Space-to-Earth) allocation. Harmful interference is avoided through two critical operating characteristics. First, the satellites operate in a non-broadcast mode, only radiating when transmitting data to one of the ground earth stations. Second, the satellites operate below the power flux density requirements established in Table 21-4 of the ITU Radio Regulations.

As detailed in **Exhibit B**, the Technical Annex, across all potential orbits, the PFD on the ground during payload data downlink operations will remain under the limit, ensuring that no harmful interference occurs.

2. 9300 – 9900 MHz

ICEYE plans to utilize the 9300 - 9900 MHz band for SAR imaging under the Earth Exploration-satellite service (active) allocation. A critical means of interference avoidance in this band is the short transmit duration during operations. A nominal SAR image collection lasts for ten to fifteen seconds, and each satellite will be limited to 180 images per day. This means that the maximum imaging time for each satellite will be 2700 seconds per day, corresponding to 3.125% of the day. Further, the area of effect is under 100 square km, because the 3dB beamwidth of the SAR antenna is very tight (0.4 x 1.0 deg).

VI. GRANT OF THE APPLICATION IS IN THE PUBLIC INTEREST

Grant of this application will promote the public interest by facilitating the expeditious deployment of newly developed SAR technology for the provision of low-cost, high-value remote imaging services. The proposed constellation will take advantage of recent advances in small satellite technology as well as the Commission's new streamlined small satellite rules to bring new competition in the marketplace for Intelligence, Surveillance, and Reconnaissance solutions.

There is significant U.S. Government demand for the imaging capabilities that ICEYE will offer, particularly within the U.S. military services and other agencies with a national security mission. USG customers will be able to leverage ICEYE's significant commercial investments in this innovative satellite technology while maintaining the highest security protocols.

VII. OTHER MATTERS

A. NOAA Authorization

ICEYE will shortly file an application with the National Environmental Satellite, Data, and Information Service of the National Oceanic and Atmospheric Administration (“NOAA”) for authority to operate the Second Tranche of satellites. ICEYE will notify the Commission when NOAA grants the authorization.

B. Coordination with Government Agencies

ICEYE has coordinated its First Tranche with NOAA, NASA and the USAF. ICEYE will notify these agencies of its planned Second Tranche, and complete coordination as necessary.

C. ITU Compliance

Pursuant to 47 C.F.R. §§ 25.111 for space systems, it is understood that the commission will submit filings to the ITU on behalf of ICEYE pursuant to international obligations for the coordination and registration of space network systems. ICEYE will provide the commission the appropriate electronic files for submission to the ITU and hereby accepts responsibility to pay any ITU cost recovery fees associated with this application.

D. Operational Strategies to Avoid Collision with the International Space Station during De-Orbiting

Section 25.122(d)(5) requires a description of the design and operational strategies that will be used to avoid in-orbit collision with spacecraft capable of having crew aboard. To comply with Section 25.122(d)(5), ICEYE will coordinate with the 18th Space Control Squadron on both position and planned maneuvers, including de-orbiting. Each spacecraft is equipped with a low

thrust propulsion system comprised of multiple separate thrusters. Sufficient propellant will remain at the planned end-of-life of the spacecraft to use the propulsion system for collision avoidance during re-orbiting through the orbit of the International Space Station.

E. Supplemental Information

ICEYE submits, as **Exhibit E**, the relevant portions of the additional information that it originally provided to the Commission on April 1, 2021 in response to the Commission's follow-up questions to ICEYE's application for authority to launch and operate the First Tranche.

VIII. CONCLUSION

For the foregoing reasons, ICEYE respectfully requests expeditious grant of its application to launch and operate its Second Tranche of EESS satellites as set forth in this application.

Respectfully submitted,

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March 31, 2023

**CERTIFICATION OF COMPLIANCE WITH PART 25 STREAMLINED RULES FOR
SMALL SATELLITE CONSTELLATIONS**

I hereby certify that the satellite system described in the associated application meet the criteria for streamlined processing established under Streamlining Procedures for Small Satellites, Report and Order, 34 FCC Rcd 13077 (2019).

/s/ Deepak Grover

Date: March 31, 2023

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