Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of Varda Space Industries, Inc. Application for Authority to Launch and Operate the Winnebago 4 Non-Geostationary Orbit Satellite	)))))))	Call Sign(s): File No. 2189-EX-ST-2024

APPLICATION FOR LICENSE OF VARDA SPACE INDUSTRIES, INC.
AND WINNEBAGO 4 SPACECRAFT

Varda Space Industries, Inc. ("Varda"), in accordance with Part 5 of the Federal Communications Commission's ("Commission") rules, hereby files this application requesting Special Temporary Authority for Varda's VW Series Non-Geostationary Orbit ("NGSO") satellite for its Winnebago 4 mission to manufacture pharmaceuticals in low Earth orbit, scheduled to launch no earlier than June 2025.

Consistent with the information required by the Commission's Rules, Varda has also provided a completed Technical Narrative, Orbital Debris Assessment Report ("ODAR") and ITU supporting documents. Varda specifically seeks authorization for use of the Space Operations Service's 2025 MHz to 2110 MHz and 2200 MHz to 2290 MHz Band, as well as the Mobile-Satellite Service's 1610 to 1626.5 MHz Band on an experimental basis.

I. INTRODUCTION

A. VARDA BACKGROUND

Varda is a California based corporation creating the first free-flying orbital manufacturing facilities with reentry capabilities. Microgravity found in low Earth Orbit ("LEO") has many advantages for manufacturing. For instance, it makes it possible to precisely control the crystallization process of pharmaceutical compounds during manufacturing, thereby

creating valuable products that cannot be created on Earth's surface. To complete the logistics chain needed for orbital manufacturing, Varda plans to build a fleet of economical spacecraft and associated reentry capsules to enable consistent access to microgravity for manufacturing purposes. These capsules are designed for a variety of uses, including both commercial and government missions, and can serve as an ideal testbed for manufacturing products in the microgravity environment of LEO. The capsules also allow for study of hypersonic flows and subjecting test components to hypersonic environments during reentry, as well as other experiments or processes a customer would like to undertake or test in microgravity and then return back to Earth.

Varda's primary commercial business will be manufacturing products that require sustained microgravity. The success of this business hinges on Varda's ability to bring raw resources to orbital manufacturing facilities and then deliver manufactured materials to markets on Earth at low cost and high cadence. To that end, Varda has partnered with Space Exploration Technologies Corp. ("SpaceX") for "rideshare" launches to 510-kilometer, 97.5-degree inclination Low Earth Orbits. In order to support these manufacturing capabilities, Varda has developed a satellite bus that will provide power, handle communication, and station keeping for Varda's manufacturing payload. At the end of that manufacturing process, the satellite bus deorbits with the reentry capsule, the reentry capsule separates from the satellite bus for a controlled terrestrial landing under parachute at one of Varda's partners landing sites, and the satellite bus demises in the atmosphere upon reentry, leaving no orbital debris above the Earth.

As a secondary business, Varda will provide access to low-cost, frequent, flight testing to various U.S. Government partners to accelerate the advancement of hypersonic technologies and capabilities. Ground facilities cannot simultaneously reproduce flight-relevant Mach numbers,

Reynolds numbers, free stream enthalpy, freestream, and shock layer chemistry, and test durations. The Institute for Defense Analysis ("IDA") has stated "no current U.S. facility can provide full-scale, time-dependent, coupled aerodynamic, and thermal-loading environments for flight durations necessary to evaluate these characteristics above Mach 8." To date, flight testing has been prohibitive due to development costs and flight testbed availability.

Varda's reentry capsule provides an on-demand flight test model with maximum flexibility and affordability to accelerate the advancement of technologies by enabling partners to iterate often in real-flight conditions. Thermal protective systems, sensors, optical windows, communications, navigation, and other hypersonic vehicle subsystems can be tested in conditions much closer to those experienced once integrated and flown in the partner's end-system. Varda's reentry capsules must survive these hypersonic flight environments flight environments, maintain low landing dispersions, and make terrestrial landings under parachute in order to minimize landing shock loads for products, thus providing an ideal testbed for customers.

B. VW SERIES DESCRIPTION

1. VW SERIES SPACECRAFT OVERVIEW

Varda is developing a new series of spacecraft, named the VW Series (the "Spacecraft"), to facilitate rapid and cost-effective access to manufacturing in microgravity through its W Series reentry capsule. The Spacecraft is capable of being launched on any SpaceX rideshare mission, enabling low-cost access to microgravity in order to allow manufacturing of a variety of products in space. Built entirely by Varda, this is the first spacecraft specifically designed for the manufacturing and return of materials in microgravity. The Winnebago 4 mission will be the first flight of the VW Series spacecraft.

2. FREQUENCY PLAN

i. S Band Uplink

Varda requests use of the Space Operations Service's 2025 MHz to 2110 MHz Band ("Uplink"). The 2025-2110 MHz frequency band is currently allocated to Space Operations and Earth-Exploration Satellites Services ("EESS"), Fixed, Mobile and Space Research in all ITU regions on a primary basis. For United States applicants however, Space Operations and EESS services are limited to federal operators and use by commercial operators is subject to conditions as may be applied on a case-by-case basis (only Fixed and Mobile are allocated to non-Federal users).[1] Further conditions state that any use may not cause harmful interference to authorized operations. To the extent necessary, Varda requests access to the 2025-2110 MHz band for Earth-to-Space operations, as such use is consistent with previous use of the Band by other services, and will be subject to 47 CFR § 2.106, Footnote US347, specifically complying with the requirement that "[s]uch transmissions shall not cause harmful interference to Federal and non-Federal stations operating in accordance with the Table of Frequency Allocations."

ii. S Band Downlink

Varda also requests use of the Space Operations Service's 2200 MHz to 2290 MHz Band ("Downlink"). The 2200-2290 MHz frequency band is allocated to Space Operations and Earth-Exploration Satellites Services ("EESS"), Fixed, Mobile and Space Research in all ITU regions on a primary basis. For United States applicants however, operations are limited to federal operators and use by commercial operators is not allocated. As Varda is a non-Federal user intending to operate its downlink in a manner similar to other Space Operations users, use of this band is compatible with current and future users. Further, as discussed in the Technical Narrative, Varda's proposed operations in this Application will not preclude any other users in any way, making clear its ability to share spectrum with all other users of the band without

[1] See 47 CFR 2.106, Footnote US347

causing harmful interference, and conforms to all applicable regulations set forth by all stakeholder agencies.

iii. L Band Inter-Satellite Link

Varda requests use of the Mobile-Satellite Service's 1610 to 1626.5 MHz Band, via use of the Iridium network of spacecraft.[2] This link is currently allocated for Space to Earth communications on a secondary basis. Varda requests access to this band, in coordination with Iridium Satellite LLC to support reentry operations of the Winnebago 4 return capsule.

3. LAUNCH SCHEDULE

The Winnebago 4 mission is scheduled to launch on SpaceX's Transporter 14 rideshare mission, launching no earlier than June 1st, 2025.

II. GRANT OF THIS APPLICATION WILL SERVE THE PUBLIC INTEREST

It is in the public interest for the Commission to approve this application for the Winnebago 4 mission. Varda's microgravity platform offers direct access to pharmaceutical processing in the microgravity of low Earth orbit, which will lead to expanding breakthroughs in technology and patient experience that are currently unavailable through terrestrial manufacturing. For example, microgravity offers the ability to crystallize pharmaceutical compounds in an environment free of natural convection and sedimentation, providing a path to formulating small molecules and biologics that traditional terrestrial manufacturing processes simply cannot address. The resulting tunable particle size distributions, more ordered crystals and novel forms can lead to improved bioavailability, extended shelf-life and innovative routes of administration for a variety of pharmaceuticals. These new pharmaceuticals will greatly transform the way the health care providers treat a wide variety of ailments, solely based on the ability to manufacture these forms in microgravity.

[2] Specifically, the HIBLEO-2 system (FCC Callsign S2110)

III. ADDITIONAL LEGAL MATTERS

A. Eligibility and Operational Requirements

1. System Eligibility

Winnebago 4 is eligible for Special Temporary Authority under Part 5 of Title 47 of the Current Federal Regulations. As the Spacecraft is a first of its kind system with the aim of providing a low-cost platform to manufacture pharmaceuticals in space, Special Temporary Authority is the correct license for testing and demonstrating the Spacecraft on-orbit by Varda, with the goal of successful demonstrations leading to follow-on missions that will eventually be licensed under Part 25 once proven.

2. Special provisions for satellite systems (47 CFR § 5.64)

Pursuant to 47 CFR §5.64, the Spacecraft conforms to all provisions set forth for satellite systems certification:

(a) Varda certifies that construction is entirely at the applicant's risk and does not entitle the applicant to any assurances that its proposed experiment will be subsequently approved or regular services subsequently authorized. Varda requests to use this notice, along with all further documentation submitted with this application as formal notice to the Commission of Varda's plans to construct at its own risk.

(b) Varda submits the following information as requested by Section 5.64 (and found in other documents or attachments as referenced):

(1) Varda has assessed and eliminated any amount of debris released in a planned manner during normal operations. By design, the Spacecraft will release no operational debris. More detail can be found in Section 3 of the attached Orbital Debris Assessment Report.

(2) Varda has assessed and limited the probability that the Spacecraft will become a source of debris by collision with small debris or meteoroids that would cause loss of control and prevent disposal. More detail can be found in Section 5 of the attached Orbital Debris Assessment Report.

(3) Varda has assessed and limited the probability during and after completion of mission operations, of accidental explosions or of release of liquids that will persist in droplet form. No debris will be generated in an accidental explosion resulting from the conversion of energy sources on board the Spacecraft into energy that fragments the spacecraft. More detail can be found in Section 4 of the attached Orbital Debris Assessment Report.

(4A) Varda has assessed and limited the probability of the Spacecraft becoming a source of debris by collisions with large debris or other operational space stations. The probability of a collision between the Spacecraft and any other large object (10 centimeters or larger) during the lifetime of the Spacecraft is 5.8715E-07, which is less than the required 0.001 as calculated using current NASA Debris Assessment Software ("DAS") version 3.2.6. More detail can be found in Section 5 of the attached Orbital Debris Assessment Report.

(4B) Varda has assessed and limited the probability of the Spacecraft becoming a collision risk by coordinating with the 18th Space Defense Squadron, the federal organization responsible for space situational awareness. Regular collision avoidance ("COLA") screening is done in conjunction with the Spacecraft to ensure it will not collide with other stations on orbit, and all necessary actions to avoid collisions will be taken by Varda upon notice from the 18th Space Defense Squadron.

(4C) The Spacecraft is designed to operate at 500 km and above (consistent with SpaceX Transporter mission launch profiles) and will stay above all inhabitable spacecraft during all operations. At the end of the mission, a post mission disposal maneuver is done to deorbit both the return capsule as well as the Spacecraft, which will then transit through the orbits that are used by inhabitable spacecraft, including the International Space Station. Coordination is done with the Federal Aviation Administration ("FAA"), NASA Trajectory Operations and Planning

Office (“TOPO”) and the 18th Space Defense Squadron to minimize the risk of collision and avoid posing any operational constraints to the inhabitable spacecraft.

(4D) The Spacecraft will keep to within 50 meters of the intended orbit altitude.

(4E) Varda certifies that upon receipt of a space situational awareness conjunction warning, Varda, as the operator, will review and take all possible steps to assess the collision risk and will mitigate the collision risk if necessary.

(5) The Spacecraft meets all trackability requirements due to having a size much greater than 10 cm in its smallest dimension. The VW Series spacecraft will also be identifiable by a unique signal-based telemetry marker distinguishing it from other space stations or space objects based on frequency and packet formats. Varda plans to share information regarding initial deployment, ephemeris, and/or planned maneuvers with the 18th Space Control Squadron or successor entity, other entities that engage in space situational awareness or space traffic management functions, and/or other operators.

(6) The Spacecraft will not perform any proximity operations, thus no debris generation will result from proximity operations.

(7) The Spacecraft is designed to be disposed of by direct, controlled reentry into the atmosphere. Nominally, the Spacecraft will proceed along an atmospheric demise trajectory upon completion of the last burn that is used to release the return capsule along its return trajectory back to Earth. Calculations have been done to ensure that the probability of success of the chosen disposal method will be 0.9 or greater. More detail can be found in Section 6 of the attached Orbital Debris Assessment Report.

In the off nominal worst case where the Spacecraft is not responsive upon separation from the launch vehicle and is not able to perform any mission or post mission functions, the

spacecraft is predicted to stay in orbit for 11 years, which is less than the 25 year requirement for uncontrolled reentry. Further, the risk to human casualty is calculated as 1:12,900, which is better than the requirement of 1:10,000. More detail can be found in Section 7 of the attached Orbital Debris Assessment Report.

3. License Period (47 CFR § 5.61)

Varda requests a license period of 6 months, starting June 1st, 2025, consistent with the maximum allowable time for a Special Temporary Authority. While the nominal mission duration is ninety (90) days from launch, six months is requested to cover unforeseen launch delays, such as common weather delays and the like from Varda's launch provider, in order to not have to burden the Commission every time the launch is delayed. If requested, Varda will gladly inform the Commission of the end of the mission in order to ensure the license period is as short as is necessary.

4. Non-interference criterion (47 CFR § 5.84)

The VW Series spacecraft can be commanded by command originating from the ground to immediately cease transmissions and Varda will have the capability to eliminate harmful interference when required under the terms of this license or other applicable regulations.

B. **ITU Cost Recovery**

Varda is aware that, per actions taken at the 1998 Plenipotentiary Conference and as modified by the ITU Council in 2005, the ITU charges processing fees for satellite network filings to prevent "warehousing" of spectrum. Therefore, all applicants are responsible for all fees charged by the ITU regarding their application. Varda is aware of this requirement and accepts responsibility to pay all ITU cost recovery fees associated with this application. Such fees and invoices may be sent to the contact representative listed in this.

IV. REQUEST FOR WAIVER

Varda respectfully requests waiver of the frequency allocation regulations along with this application. The Commission may waive any of its rules if there is "good cause" to do so.[3] Waiver is also appropriate where "special circumstances warrant a deviation from the general rule" and "such deviation will serve the public interest" better than strict adherence to the rule.[4] Previously, the Commission has granted a waiver of its rules if the requested relief would not undermine the objective of the rule in question and would otherwise serve the public interest.[5] The Commission may also consider potential hardship, equity, or policy implementation factors as part of its review.[6] It is with this background that Varda is requesting waiver of 47 C.F.R. § 2.106 (Table of Frequency Allocations) for this application to permit the use of Space Operations Service's 2025 MHz to 2110 MHz Band, Space Operations Service's 2200 MHz to 2290 MHz Band and Mobile-Satellite Service's 1610 to 1626.5 MHz Band.

The proposed usage of each of these bands are on a non-conforming, but non-interfering, basis inside the United States. In the Space Operations Service's 2025 MHz to 2110 MHz Band, Space Operations Service's 2200 MHz to 2290 MHz Band, the international frequency allocation tables provide allocations consistent with Varda's use of the bands. Waiver is requested to allow use of the bands as a non-Federal user, whereas currently only Federal users have allocations. Waiver of the Mobile-Satellite Service's 1610 to 1626.5 MHz Band is requested for Space-to-Space operations of the link in order to accurately track the Winnebago return capsule during deorbit operations, consistent with previous waivers and use for Winnebago missions.

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[3] 47 C.F.R. § 1.3.

[4] Northeast Cellular Telephone Co. v. FCC, 897 F.2d 1164, 1166 (D.C. Cir. 1990) (Northeast Cellular).

[5] See WAIT Radio v. FCC, 418 F.2d 1153, 1159 (D.C. Cir. 1969) (WAIT Radio) and See Northeast Cellular, 897 F.2d at 1166.

[6] See WAIT Radio, 418 F.2d at 1159

V. OTHER MATTERS

A. Previous Varda Licenses

Varda has been granted five (5) previous Part 5 Special Temporary Authorities ("STA") for the first two (2) missions of its Winnebago return capsules aboard Rocket Lab's Photon spacecraft. Each mission had an initial STA granted, and then follow up STAs granted to extend operations due to various launch and regulatory delays.

For the Winnebago-1 mission (Call Sign WU9XWE), STA File Number 1751-EX-ST-2022 was granted, but due to unforeseen delays while on orbit (unrelated to operation of the vehicle on orbit), STA File Number 1903-EX-ST-2023 was granted to extend operations until a suitable end of mission date could be coordinated.

For the Winnebago-2 mission (Call Sign WV9XZA), STA File Number 1215-EX-ST-2023 was granted, but due to the Winnebago-1 mission delays referenced above, STA File Number 0229-EX-ST-2024 was granted to support a new Winnebago-2 launch date. Lastly, STA File Number 1266-EX-ST-2024 was granted to support another subsequent launch delay.

The Winnebago-3 mission, STA File Number 1011-EX-ST-2024, was filed by Varda's spacecraft provider for that mission, Rocket Lab USA. That application is currently in review with the status pending.

VI. CONCLUSION

This Application, along with all attached documentation and databases containing appropriate diagrams and details, outlines Varda Space Industries Inc.'s VW Series spacecraft station supporting the Winnebago 4 mission and provides the necessary information to review compatibility of the system with other current (and future) users. Varda specifically seeks authorization for use of the Space Operations Service's 2025 MHz to 2110 MHz and 2200 MHz to 2290 MHz Band, as well as the Mobile-Satellite Service's 1610 to 1626.5 MHz Band on an experimental basis, in accordance with Part 5 of the Commission's rules.

Attachments:
Technical Narrative
Orbital Debris Assessment Report
ITU SpaceCap
ITU GIMS
ITU Cost Recovery Letter

Respectfully submitted,

Peter Dohm
/s/
Varda Space Industries, Inc.