APPENDIX A

RESPONSE TO QUESTION 7 OF FCC FORM 442 (PURPOSE OF EXPERIMENT)

Narrative Summary

Capella Space Corp. ("Capella") is a satellite imaging company, headquartered in Palo Alto, California, that has developed technology to allow its satellites to "see" what other satellites cannot.

Capella satellites will be able to see through clouds and at night, permitting imaging during bad weather and/or low-light conditions, by utilizing Synthetic Aperture Radar ("SAR") images. Optical imaging, which is the current standard for Earth imaging, is limited to cloud-free locations with ideal light conditions. These limitations mean that 75% of the Earth surface remains undetected regardless of the number of optical satellites in space. In contrast, SAR imaging is an active imaging technique that utilizes radar antennae that emit pulses of microwave radiation at a pulse repetition frequency of thousands of pulses per second. The radar receiver measures the time, strength, and phase characteristics of the pulse echoes and uses this data to generate two-dimensional images.

Capella plans to deploy a constellation of SAR satellites (the "Planned SAR Constellation") that will be placed in polar orbit in the near future. In furtherance of this plan, Capella is seeking a conventional experimental radio license (the "Conventional License") for two demonstration Capella SAR satellites (the "Capella Satellites"). The Conventional License will enable Capella to conduct in-space performance assessments and evaluate proposed Capella satellite technology and software prior to the deployment of the Planned SAR Constellation.

The Capella Satellites that are the subject of this application will operate in a sun-synchronous orbit. The first satellite launch will be on Spaceflight's Sun Sync Express launch vehicle, also known as Sun Synchronous Orbit-A (SSO-A), with a nominal altitude of 575 km and a Local Time of Descending Node ("LTDN") of 10:30 a.m. There is a possibility the first launch will be switched to the Indian Space Research Organisation's Polar Satellite Launch Vehicle ("PSLV"), with a sun-synchronous orbit at a 550-600 km altitude and a LTDN of 12:00 p.m. Should Capella decide to switch the first satellite launch from the SSO-A to the PSLV, then Capella will notify the Federal Communications Commission of its decision. The second satellite launch will be on the PSLV9, with a nominal altitude of 630 km and a LTDN of 10:00 a.m. Capella anticipates launching the first of the Capella Satellites by mid-2018. The designed operating lifetime of the first of the Capella Satellites is approximately three years.

The Capella Satellites will utilize 500 MHz of the 9300-10000 MHz frequency band for SAR imaging. Downlink communication between the Capella Satellites and gateway Earth stations will be dual circular polarization RHCP and LHCP and will utilize 375 MHz of the 8025-8400 MHz frequency band. Uplink communication will utilize 1.4 MHz of the 2025-2110 MHz frequency band. Capella will also monitor AIS transmissions in the 161.9625 MHz, 161.025 MHz, 156.775 MHz, and 156.825 MHz frequency bands.

The primary purpose of this experiment is to test and validate the performance of the Capella Satellites' new technologies. These technologies will be contained in certain components of the Capella Satellites, including a high-gain SAR antenna, a high-performance SAR radio, a high-power RF amplifier, a large-capacity power generation and storage subsystem, an innovative heat dissipation subsystem, propulsion system, and a high-performance SAR processing capability. The objective of combining these new technologies is to achieve the performance of large SAR satellites in a compact, scalable form factor.

The high-gain SAR antenna is being designed and manufactured in-house by Capella. The SAR antenna's innovative design results in a high peak gain while remaining compact enough to fit within a small satellite structure.

The high-performance Hawk radio was designed and developed in-house by Capella. The Hawk radio utilizes an innovative software-defined radio design that allows it to function as both a radar and communications radio. The radio offers large transmit and receive bandwidths and can operate in both the radar frequency band as well as the downlink frequency band. This inherent flexibility allows the radio to optimize its form factor and volume.

The propulsion system is water based. 1.3-1.5 kg of water is contained in a bladder that is surrounded by 40-50g of FE36 pressurant in a pressurized 750mL titanium tank. The water is vaporized in the thruster head and expelled by opening the thruster head valve. The FE-36 will evaporate if released into space.

These technologies will ensure that the Planned SAR Constellation will provide high-quality SAR imagery and data to Capella's commercial and government customers and for non-commercial, scientific, educational, or other public benefit purposes.

Overview of Operations

Capella seeks to use the following frequency bands:

1) 2025-2110 MHz for uplink;[1]
2) 8025-8400 MHz for downlink;[2]
3) 9300-10000 MHz for SAR imaging;[3] and

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[1] *See* U.S. Table of Frequency Allocations, FN US347, *available at* https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf (allocating the 2025-2110 MHz band for non-Federal Earth-to-space transmissions on a case-by-case, non-interference basis).

[2] *Id.* at FN US258 (allocating the 8025-8400 MHz band on a primary basis for non-Federal EESS use).

[3] *Id.* (allocated on a secondary basis for non-Federal EESS).

4) 161.9625 MHz, 161.025 MHz, 156.775 MHz, and 156.825 MHz for automatic identification system ("AIS") monitoring.[4]

Mission control for the Capella Satellites will be physically located at Capella's headquarters in Palo Alto, with backup command authority at Capella's facility in Denver, Colorado. The ground system for the Capella Satellites will be implemented utilizing Amazon Web Services – GovCloud ("AWS") to facilitate remote/decentralized management by authorized personnel.

Capella has selected Kongsberg Satellite Services (KSAT) to provide the ground-based telemetry, tracking, and command ("TT&C") and payload downlink for the Capella Satellites. These ground antennas will be located in Svalbard Norway, TrollSat Antarctica, and Punta Arenas Chile. Capella expects that KSAT will obtain any and all required licenses to operate its antennas.

Command packets for the Capella Satellites will be generated on Capella's local production network. Each packet will be sent to Capella's AWS instance for encryption. A plaintext version of the packet will be stored in a database in the AWS instance. The packet then travels from the AWS production instance to a remote ground station from which it is subsequently radiated to the Capella Satellites. The Capella Satellites then receive the packet and forwards it to the main flight computer, which will then decrypt and authenticate the packet before forwarding it to the relevant processing module. The schedule for downlink and SAR imaging is generated on the ground and commanded to the Capella Satellites.

Telemetry, payload, and beacon packet generation will occur on the main flight computer of the Capella Satellites. Each packet will be encrypted, forwarded to the downlink radio, and radiated to a ground station. The packet will then be forwarded to Capella's production AWS instance, which will decrypt the packet, allowing the packet to travel to the local machine running the command/telemetry application on Capella's production network. A plaintext version of the packet will be stored in a database in Capella's AWS instance. Data will be accessed through an Application Programming Interface used by customers and Capella's online servers.

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[4] *See* U.S. Table of Frequency Allocations, FN 5.228, 5.228C, 5.228D, US52 *available at* https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf (allocating the 2025-2110 MHz band for non-Federal Earth-to-space transmissions on a case-by-case, non-interference basis).