Narrative Statement

A. Requested Extension

ArduSat Inc. (ArduSat), a non-profit corporation based in San Francisco, California, requests a conventional experimental radio license to extend its Special Temporary Authorization (STA) under Call Sign WG9XFC (File No. 0917-EX-ST-2012) pursuant to 47 C.F.R. §§ 5.3(a), 5.54(a)(1), and 5.61(c).[1] Under this STA, ArduSat is authorized to operate two nanosatellites – the ArduSat-1 and the ArduSat-X. Although the STA was originally granted starting July 1st, 2013, the two satellites did not commence transmissions until November 20th, 2013.[2] This delay was due in part to a delay in the launch of Japan Aerospace Exploration Agency's (JAXA's) HTV 4, which was anticipated to launch July 15, 2013,[3] but actually launched August 3, 2013.[4] Additionally, ArduSat anticipated that the satellites would be released from the International Space Station within approximately one month of entering space, but the satellites were actually released after approximately three and a half months, on November 20, 2013 because JAXA desired a Japanese astronaut on hand for the ISS deployment.[5]

Based on this substantial and unanticipated delay, ArduSat is seeking an extension of its authority to operate the ArduSat-1 and ArduSat-X under Call Sign WG9XFC, which expires

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[1] ArduSat is related to but separate from the for-profit NanoSatisfi, Inc. (NanoSatisfi). NanoSatisfi recently received authority to operate the ArduSat-2. *See* Call Sign WG2XXW, File No. 0532-EX-PL-2013 (granted Dec. 6, 2013).

[2] *See* Letter from Trey Hanbury to FCC, File No. 0917-EX-ST-2012 (Dec. 6, 2013), https://apps.fcc.gov/els/GetAtt.html?id=143743&x=.

[3] *See, e.g.*, ArduSat-1 Orbital Debris Assessment Report (Exhibit to this Application and Exhibit to File No. 0917-EX-ST-2012) ("ArduSat-1 ODAR").

[4] *See, e.g., ArduSat Heads to Space!* KickStarter (Aug. 3, 2013), http://www.kickstarter.com/projects/575960623/ardusat-your-arduino-experiment-in-space/posts/558926.

[5] *See, e.g., ArduSat-1 and ArduSat-X Deployed from ISS*, KickStarter (Nov. 20, 2013), http://www.kickstarter.com/projects/575960623/ardusat-your-arduino-experiment-in-space/posts/669200.

January 1, 2014. Although the two satellites are expected to remain in orbit at longest until approximately September 2014 (roughly 9 to 10 months after release), ArduSat is respectfully requesting an extension of its authority to operate until January 1, 2015, to avoid any possibility of having to revisit the Commission to request a further extension if the satellites remain in orbit slightly longer than predicted. Of course, as required by the authority to operate, ArduSat will notify the Commission when transmissions terminate and if they terminate earlier than expected. Additionally, as part of this extension request and in an effort to streamline the Commission's review, ArduSat is requesting authority for the ArduSat-1 and ArduSat-X to communicate with earth stations in Chelmsford, Massachusetts and Sandy Shores, Texas in addition to the otherwise identical earth station it is currently using in San Francisco, California. In granting this extension, the Commission can allow ArduSat to continue allowing students, teachers, hobbyists, and researchers to affordably create and run their own custom-built experiments and applications in space.

B. Background of ArduSat

ArduSat has created tools that make it simple for anyone to interact with space by offering convenient, affordable, and on-demand access to satellites.[6] The enterprise grew out of a volunteer effort by four graduate students at the International Space University who began building a prototype nanosatellite as a platform for making space accessible and affordable to students. Early funding for the concept came from the crowd-funding website Kickstarter, where the ArduSat Arduino-based satellite concept raised more than $100,000 from nearly 700 private space enthusiasts.[7]

[6] NanoSatisfi, *Homepage* (last accessed Oct. 30, 2013), http://www.nanosatisfi.com/.

[7] *ArduSat – Your Arduino Experiment in Space*, Kickstarter (last accessed July 9, 2013), http://www.kickstarter.com/projects/575960623/ardusat-your-arduino-experiment-in-space

Since the ArduSat-1 and the ArduSat-X commenced operations (after being released into orbit by the International Space Station) on November 20th, 2013, Kickstarter funders and others have been able to use these satellites to test experiments, play games, take pictures, and run applications in a manner that truly allows anyone to access space.[8] For this pioneering work so far, which is helping to democratize access to space, the Obama Administration has recognized ArduSat co-founder and CEO Peter Platzer as a Champion of Change.[9]

C. Description of Equipment and Theory of Operation

The ArduSat-1 and the ArduSat-X are nanosatellites built in the CubeSat form factor,[10] a standard that helps reduce the cost of launching small satellites into space by allowing for a common deployment system. The basic unit for the CubeSat form factor is a single 10-centimeter cube, weighing no more than 1.33 kilograms,[11] and both of the satellites are constructed according to the so-called "1U" base form factor.

These two ArduSats carry a suite of sensors and a payload computer that can be reprogrammed while in space. The user-programmable payload computer is comprised of an array of Arduino processors (AVR processors) and can run code developed on the ubiquitous, open-source Arduino software development platform. ArduSats were invented with the purpose of creating an inexpensive, accessible development platform in space on which students,

[8] *Official ISS Deployment Date / New Videos & Quizzes*, Kickstarter (last accessed Oct. 30, 2013), http://www.kickstarter.com/projects/575960623/ardusat-your-arduino-experiment-in-space/posts/591684.

[9] *Creating Next Generation Innovators Through Space Education*, The White House (June 6, 2013), http://www.whitehouse.gov/blog/2013/06/06/creating-next-generation-innovators-through-space-education.

[10] *See* California Polytechnic State University, *CubeSat Design Specification* (last visited July 10, 2013), http://www.cubesat.org/images/developers/cds_rev12.pdf.

[11] The CubeSat standard is scalable along one axis, allowing up to three of these 10-centimeter cubes to be joined together (so-called "1U," "2U," and "3U" CubeSats).

teachers, hobbyists, and researchers could affordably create and run their own custom-built experiments and applications.

Users can design their own space-based applications, experiments, and even space games using the Arduino open-source prototyping platform. Once a user-designed application has passed testing on an ArduSat clone located on Earth, users can upload their applications to the payload computer of an ArduSat that is orbiting in space, where it is monitored and maintained by the satellite's main computer. From there, the applications are free to sample data from the payload sensors and bus, take pictures, and return data to the user's web browser whenever the satellite is in range of a participating ground station. At the end of the user's experiment period, which can be up to a week in length, any remaining data is downlinked and returned to the user.

An ArduSat's payload consists of a suite of sensors, including an optical spectrometer, a Geiger counter, an atmospheric sensor, an infrared sensor, an accelerometer, a gyroscope, a magnetometer, a sun sensor, an electromagnetic wave sensor, a dual-frequency GPS receiver (for ionospheric studies), a megapixel camera,[12] and more. The sensors (and other telemetry values) are sampled by the user-generated programs running on the payload computer.

D. Orbital Debris Mitigation Statement

Consistent with 47 C.F.R. § 5.64, ArduSat has included Orbital Debris Assessment Reports (ODARs) for both the ArduSat-1 and the ArduSat-X as exhibits to this application (these are the same ODARs from ArduSat's STA application).

E. Conclusion

[12] ArduSat has received a license from the National Oceanic and Atmospheric Administration to operate the cameras on board the ArduSat-1 and the ArduSat-X. *See* NOAA Private Remote Sensing Space System License, attached to this application (also available at http://www.nesdis.noaa.gov/CRSRA/licenseHome.html).

By granting this application, the Commission can help ArduSat continue to make space accessible to anyone.

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The “stop buzzer” point of contact for the market trial is Joel Spark, Lead Engineer Satellite Bus (415-947-9865; joel@nanosatisfi.com).