REDACTED FOR PUBLIC INSPECTION

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
PointView Tech LLC	)	File No. 2018-EX-CN-_____
Application for Experimental Authority to Launch and Operate a Low-Earth Orbit, Non-Geostationary Orbit Satellite and Communicate with Certain Earth Stations	)	

APPLICATION NARRATIVE

Pursuant to Sections 308 and 309 of the Communications Act of 1934, as amended,[1] and Part 5 of the Commission's rules,[2] PointView Tech LLC ("PointView") files this application for experimental authorization to launch and operate a single low-earth orbit ("LEO"), non-geostationary orbit ("NGSO") satellite (the "Athena" satellite). The satellite's main communications payload links will operate in the little-used E-band spectrum – 71-76 GHz for the downlinks, 81-86 GHz for the uplinks. [redacted] PointView's request for experimental authority also encompasses two earth stations that will conduct E-band communications with the satellite. The mission will be to determine whether such satellite communications can efficiently provide broadband access to unserved and underserved areas throughout the world. The satellite's narrowband Telemetry, Tracking, and Command ("TT&C") beams will operate in the S-band at 2082 MHz, using less than 1.5 MHz occupied bandwidth, for the uplink, and in the X-band at 8496.25 MHz, using less

[1] 47 U.S.C. §§ 309, 310.

[2] 47 C.F.R. §§ 5.55, 5.63.

than 2.3 MHz occupied bandwidth, for the downlink. PointView's partners, Space Systems Loral ("SSL") and Atlas Space Operations ("Atlas"), will operate three earth stations for TT&C communications subject to authority that has already been received or will soon be requested.

This application provides an overview of the Athena experiment, including its objective and operations; a description of the spacecraft; a summary of the ground operations, including the TT&C functions; a discussion of the power levels, which are all within any and all limits applicable to the frequency bands in question, as well as the steps taken to mitigate any risk of harmful interference; and an explanation of why the experiment serves the public interest. Specifically, the public interest rationale in support of the Athena experiment is strong – PointView will examine the suitability of LEO satellites using millimeter wave frequencies [redacted] to provide broadband Internet access to unserved and underserved areas across the globe. The application shows that the proposed experiment meets all applicable legal and technical requirements. Finally, the application certifies that PointView will meet any applicable international obligations related to the Athena satellite.

Attached to this application are supporting exhibits providing the technical and operational characteristics of the Athena satellite ("Technical Annex"), the orbital debris mitigation plan, and radiation hazard studies for the E-band uplink earth stations.

I. OVERVIEW OF THE ATHENA MISSION AND PROPOSED EXPERIMENT

The Athena experiment will test, demonstrate, and validate new technologies that will allow [redacted] E-band (71-76 GHz downlink and 81-86 GHz uplink) communications between earth stations in the western United States and a non-geostationary orbit ("NGSO") satellite operating in the low-earth orbit.[3] Its main purpose will be to determine

[redacted]

whether such satellite communications can efficiently provide broadband access to unserved and underserved areas throughout the world. The satellite is slated to be launched in early 2019. The tests will run for approximately two years after the start of in-orbit operations, after which point the satellite will be permanently switched off by irreversible ground command and naturally de-orbit within the 25-year requirement.[4]

A. The Athena Spacecraft

The Athena spacecraft is being designed and manufactured by Space Systems Loral, LLC. Space Systems Loral has a contract for launch as a secondary payload on the Arianespace Vega launcher, and is scheduled for launch in early 2019. It will operate in the low-earth orbit, specifically at a sun-synchronous orbit between 500-550 km. Only one spacecraft will be used in the demonstration. Its size will be approximately 0.33 cubic meters, its weight less than 150 kg. [redacted] There will be no on-board propulsion system for orbit change. The operational lifetime of spacecraft is currently planned to be approximately two years.

B. Ground Operations

The [redacted] E-band links will be used for payload communications. The E-band downlink will generally be centered at 72 GHz and 75 GHz; the uplink will generally be centered

[redacted]

[4] *See* NASA, Process for Limiting Orbital Debris, NASA-STS-8719.14A (with Change 1) § 4.3.2, Requirement 4.3-1 at 21 (approved May 25, 2012).

[redacted]

at 82 and 85 GHz.[6] PointView will serve as the E-band [redacted] earth station operator. These stations will be located in California, specifically in Los Angeles and Ventura counties.

Atlas will serve as the TT&C earth station operator and will apply for the TT&C earth station licenses. TT&C will be conducted in the S-band at 2082 MHz, using less than 1.5 MHz occupied bandwidth, for the uplink, and in the X-band at 8496.25 MHz, using less than 2.3 MHz occupied bandwidth, for the downlink. The TT&C earth stations will be located in Mojave, California; Albuquerque, New Mexico; and Brewster, Washington.

C. Power Levels

The power levels for the Athena experiment are within established limits for the proposed bands.[7] The maximum DC power dissipation level of the spacecraft is 1200 W. The X-band TT&C radio consumes less than 50 W DC. The transmit power is 3.64 dBW EIRP with 2.3 MHz bandwidth. The maximum power flux density at the surface of the earth is -148.96 dBW/m²/4 kHz. These operations meet all International Telecommunication Union ("ITU") limits in this band, including those for deep space network ("DSN") protection. The E-band payload downlink consumes less than 300 W DC. The peak transmit power is 44.3 dBW EIRP with 2.1852 GHz bandwidth. The maximum power flux density at the surface of the earth is -138.05 dBW/m²/4 kHz. For the E-band ground uplink, the transmit peak power is 63.4 dBW EIRP (or 78.3 dBW for the high power option) with 2.1852 GHz bandwidth.

[6] There is a possibility that mild tuning may be performed from the planned 72, 75, 82 and 85 GHz centered carriers (*e.g.*, 74.8 and 82.2 GHz may be used to mitigate a potential spectral regrowth issue). In addition, carriers may be run at the band edge (71, 76, 81, and 86 GHz) for atmospheric attenuation characterization. This would be done in compliance with NTIA Redbook requirements.

[7] The power levels were calculated using an altitude of 500 km – the lowest altitude – to assume the highest levels for the altitude range for Athena's orbit.

D. No Harmful Interference – Generally

PointView has taken a number of measures to ensure that no harmful interference will result from its operations. As a threshold matter, the frequency bands and earth station locations were selected to minimize the risk of harmful interference to, or from, other systems. PointView has been in contact with government users operating in the proposed bands and adjacent bands, including NASA. PointView has taken the input it has received in developing its operational plan. It will continue to coordinate with government agencies and other potential spectrum users prior to launch and while the satellite is in operation. PointView intends to conduct an interference analysis and coordination study six months prior to launch so it can finalize coordination with all users in a timely manner.

PointView has established and will maintain a 24/7 point-of-contact for interference issues. That contact is currently George Leris. His contact number is 571-216-3381.

Transmissions will also be limited: E-band transmissions will last for less than 8 minutes per contact (up to four contacts per day); X-band transmissions will last for less than 10 minutes per contact (up to 10 contacts per day); S-band transmissions will last for less than 10 minutes per contact (up to three contacts per day). Command files to alter or mute operations can be uploaded at each available TT&C contact.

E. No Harmful Interference or Unwanted Emissions – Specifically for TT&C

The proposed TT&C frequencies were identified based on careful interference analysis and discussions with government users of the spectrum. PointView initially identified several frequency bands in the 8025-8400 MHz and 8450-8500 MHz ranges before deciding on 8496.25 MHz for its telemetry downlink frequency based on communications with NTIA and NASA. The 8496-8500 MHz band is allocated to the Space Research Service on a primary basis for both

Federal and non-Federal use, and to the Fixed Service for Federal use. PointView believes it can coordinate with systems currently operating in these services, as well as with NASA's EM-1 system, announced for launch in December 2019, and will accept a condition to do so. Moreover, Athena will not cause unwanted out-of-band emissions into NASA's DSN satellites operating at 8400-8450 MHz. PointView's interference analysis shows that it complies with the ITU's SA.1157 out-of-band emissions mask for DSNs operating in the 8400-8450 MHz band. PointView has had several productive discussions with NASA regarding the use of the X-band spectrum, has supplied all requested information, has received positive feedback, and is continuing coordination. Similarly, spacecraft manufacturer SSL and TT&C provider Atlas Space Operations have coordinated with government stakeholders regarding the use of 2082 MHz for the command uplink.

II. GRANT OF THIS APPLICATION WILL SERVE THE PUBLIC INTEREST

Grant of this application will serve the public interest because it will allow PointView to test whether LEO satellites using E-band spectrum [redacted] can be an efficient means for providing fixed and mobile broadband access service. The experiment will help PointView develop new broadband access options for unserved and underserved areas throughout the world.

III. THIS APPLICATION IS LEGALLY AND TECHNICALLY COMPLETE

In this application and its exhibits, PointView is providing all the legal and technical information required by the FCC.

A. Part 5 Narrative Application Requirements

The application complies with all of the requirements of Part 5 of the Commission's rules for experimental applications. In addition to the material provided on FCC Form 442, PointView provides the following narrative information.

1. Question 7a and Section 5.63(c)(1) – The complete program of research and experimentation proposed, including a description of equipment and theory of operation[8]

The equipment and operations that make up the program of research and experimentation are described in the Technical Annex.

2. Question 7b – The specific objectives sought to be accomplished

The Athena experiment will test, demonstrate, and validate new technologies for providing broadband access by experimenting with [redacted] E-band communications between earth stations in up to five locations in the western United States and an NGSO satellite operating in the low-earth orbit. Specifically, PointView is aiming to understand whether an NGSO system using E-band spectrum [redacted] can be used for the provision of fixed and mobile broadband access in unserved and underserved areas. The satellite is slated to be launched in early 2019.

3. Question 7c – How the program of experimentation has a reasonable promise of contributions to the development, extension, expansion or utilization of the radio art, or is along line not already investigated

The experiment has the potential to contribute to the development, extension, expansion, and utilization of the radio art by helping to determine if the E-band spectrum can be used for broadband access. PointView plans to publish many of its experimental findings, including ITU atmospheric attenuation model validation data.

4. Estimated duration of the experiment

PointView anticipates that its testing will require approximately two years from start of in-orbit operations. After that point, the satellite will be permanently switched off by irreversible ground command.

[8] 47 C.F.R. § 5.63(c)(1).

5. Section 5.64(a) – Construction at own risk[9]

PointView has begun construction of the proposed satellite facilities at its own risk. It notified the Commission's Office of Engineering and Technology in writing that it planned to begin construction at its own risk in July 2016.

B. Part 25 Application Requirements

While this application is being filed under Part 5 of the Commission's rules for experimental licensing rather than Part 25 for satellite operations, PointView also provides the information required by Part 25 to allow the Commission to fully evaluate the application. In the narrative below and in the accompanying Technical Annex, Pointview is specifically submitting all of the technical information required by Part 25 of the Commission's Rules, radiation hazard studies, and orbital debris assessment review.

1. Section 25.114(c)(4) – Radio Frequency Plan[10]

PointView's proposed frequency plan is provided in the Technical Annex.

2. Section 25.114(c)(6) – NGSO Orbital Characteristics[11]

The Athena satellite will consist of one NGSO satellite operating in low-earth orbit. The Technical Annex provides: the number of orbital planes and the number of space stations in each plane; the inclination of the orbital planes; the orbital period; the apogee; the perigee; the active service arc; and the local time of the descending node.[12] The right ascension of the ascending node is dependent upon the specific launch date. It will change by 0.9856° per day in order to

[9] 47 C.F.R. § 5.64(a).

[10] 47 C.F.R. § 25.114(c)(4).

[11] 47 C.F.R. § 25.114(c)(6).

[12] Technical Annex § A.3.

keep up with the Earth's rotation around the sun in 365.25 days.[13] Additional orbital parameters, such as the argument of perigee and the initial phase angle of the satellite, are not applicable to a one-satellite non-GSO system in a circular orbit.

3. Section 25.114(c)(7) - Frequency Bands and Coverage Areas[14]

PointView's proposed frequency bands and coverage areas are provided in the Technical Annex.

4. Section 25.114(c)(8) - Calculated Maximum Power Flux Density Levels[15]

The calculated maximum power flux density levels are provided in the Technical Annex.

5. Section 25.114(c)(10) – Estimated Operational Lifetime[16]

The estimated operational lifetime of the Athena satellite is approximately two years from the start of in-orbit operations.

6. Section 25.114(d)(1) – Overall Description of System Facilities and Operations[17]

The overall description of system facilities and operations, including an explanation of the manner in which the uplink frequency bands will be connected to the downlink frequency bands, is provided in the Technical Annex.

7. Section 25.114(d)(6) – Public Interest Rationale[18]

The public interest rationale for the application has been provided in Section II of this narrative.

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[13] *Id.*

[14] 47 C.F.R. § 25.114(c)(7).

[15] 47 C.F.R. § 25.114(c)(10).

[16] 47 C.F.R. § 25.114(d)(1).

[17] 47 C.F.R. § 25.114(d)(6).

[18] 47 C.F.R. § 25.114(d)(6).

8. Sections 5.64(b) and 25.114(d)(14) – Orbital Debris Mitigation[19]

The Orbital Debris Assessment Report ("ODAR") is attached as Exhibit 2 to this narrative.[20] The design of the satellite will limit the amount of debris and the probability of the satellite becoming a source of debris. The satellite has been designed with no separable materials or solar panels. This means that all parts will remain attached during launch, operations, and de-orbiting. The lack of any pressurized vessels on the spacecraft means that there is no risk of accidental explosions during or after completion of mission operations.

The ODAR was prepared using NASA's Debris Assessment Software for orbital debris control and risk mitigation. It shows that the Athena spacecraft is compliant with NASA's standards for orbital debris mitigation and with the objective of limiting the risk for human casualties. Three items are expected to survive re-entry, resulting in a low 1-in-31,800 chance of human casualty, which is well within NASA requirement 4.7-1 in NASA-std-8719.14. In addition, the Athena spacecraft has been manufactured following a "design to demise" approach in choosing materials.

The spacecraft is compliant with de-orbit timeframe requirements. Under worst case conditions of 565 km circular orbit, including the 550 km maximum altitude, plus 15 km orbit insertion range from the launch vehicle provider, the spacecraft will de-orbit within 17 years from launch, or 15 years from the nominal end of mission. This is well within NASA Requirement 4.3-1 to de-orbit within 25 years of end of mission.[21]

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[19] 47 C.F.R. §§ 5.64, 25.114(d)(14).

[20] The calculations for the ODAR assume an orbit of 550 km, the worst-case reentry scenario for the Athena satellite.

[21] *See* NASA, Process for Limiting Orbital Debris, NASA-STS-8719.14A (with Change 1) § 4.3.2, Requirement 4.3-1 at 21(approved May 25, 2012).

9. Section 25.132 – Radiation Hazard Studies[22]

Radiation hazard studies for the payload communications are provided in Exhibit 3. PointView will take the appropriate steps recommended in those studies.

10. Section 25.207 – Cessation of Emissions[23]

Ground TT&C operations will have the power to cease satellite transmissions. The Technical Annex explains how this will be accomplished.

C. TT&C Earth Stations

The three TT&C earth stations will be operated by PointView's partners subject to authority that has already been received or will soon be requested.[24] Nevertheless, the technical information for these earth stations is included in Form 442. The Technical Annex provides a description of the manner in which TT&C will be provided for the experiment.

IV. ITU COST RECOVERY

International registration is not always required for experimental satellite authorizations. Nevertheless, to the extent necessary, PointView will provide all necessary information for filing any Advance Publication Information with the ITU. PointView accepts all international and national frequency coordination obligations for the Athena satellite. PointView will provide the FCC and the State Department any information necessary for filing any required Space Object Registration with the United Nations Office for Outer Space Affairs.

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[22] 47 C.F.R. § 25.132.

[23] 47 C.F.R. § 25.207.

[24] PointView understands that one earth station, in Albuquerque, NM, is already licensed under a Department of Defense authorization, and Atlas is duly authorized to use it. *See* Naval Postgraduate School Application for Equipment Frequency Allocation, DD Form 1494 (July 7, 2015). A new earth station application will be filed by Atlas for a station in Mojave, CA, and a request for modification authority will be filed by Atlas's partner, Denali 20020, LLC ("Denali"), for a station licensed to Denali in Brewster, WA.

PointView is aware that, as a result of the actions taken at the 1998 Plenipotentiary Conference, as modified by the ITU Council in June 2001, processing fees are now charged by the ITU for satellite network filings. As a consequence, Commission applicants are responsible for any and all fees charged by the ITU. PointView affirms it is aware of, and unconditionally accepts, this requirement and its responsibility to pay any ITU cost recovery fees for the ITU filings associated with this application. Invoices for such fees may be sent to the undersigned.

V. CONCLUSION

For the foregoing reasons, PointView respectfully requests that the Commission promptly grant this application for launch and operating authority for the Athena satellite as in the public interest, convenience, and necessity.

Respectfully submitted,

/s/

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