

Aprize Satellite Inc.

Exhibit A to FCC Form 442 Application

A. The Proposed Program of Research and Experimentation

1. Aprize Satellite Inc. (“Aprize”), a U.S.-owned Delaware corporation, headquartered in Fairfax, VA, requests FCC experimental authority to construct, launch and operate two non-voice non-geostationary (NVNG) satellites to test the space-to-Earth segment of a two-way data communications system using the downlink frequency band of 400.50- 400.65 MHz and to prove the viability of its innovative system architecture for tracking and monitoring high-value assets using the uplink frequencies granted to SpaceQuest, Ltd (“SpaceQuest”) through Experimental License File No. 0053-EX-ML-2003. SpaceQuest is the technology provider and satellite manufacturer for Aprize and has been conducting a program of experimental research involving the development, testing and demonstration of compact mobile user terminals for use with NVNG satellites. Aprize plans to test its satellite technology and system architecture concept in conjunction with the inexpensive user terminals with omni-directional antennas which have been under development by SpaceQuest. SpaceQuest will seek a modification of its Experimental License to access the Aprize satellites.

2. Aprize will not interfere with the DoD Block 5D-3 Satellite Network that operates on each end of the 400 to 401 MHz band between 400.1 MHz and 400.50 MHz and between 400.65 MHz and 401.00 MHz which are outside the Aprize operating bands.

3. Approval of this experimental program will enable Aprize to complete the necessary experimentation and tests prior to bringing this narrow-band satellite data network into commercial operation. Subject to successful completion of its experimental program, Aprize plans to submit an FCC 312 application to the International Bureau for a commercial space station license as well as an application for blanket authority to operate mobile earth stations in the United States in order to introduce to the public a new class of narrow-band satellite data network services to track and monitor fixed and mobile assets, particularly for the propane and energy industries.

4. The Aprize satellites are designed to receive data signals from user terminals, and poll those from which data is specifically requested. Each satellite stores the data it receives until a satellite ground station is within view, at which time the satellite transmits the collected data to the ground station. The satellites that Aprize proposes to use in this experimentation program are carefully designed and optimized for data relay with very low power consumption. Excluding antennas, each satellite is a 25 cm cube weighing 12kg.

5. Aprize intends to conduct research on the efficacy of operating the satellites’ high power transmitter only during those times when it is actually communicating with user terminals, extracting the needed power for the spacecraft from six nickel cadmium batteries, and to then recharge the batteries during the non-operating portion of the satellites’ orbit. This research will test the ability of the satellites to service multiple user terminals simultaneously.

B. The Specific Objectives Sought To Be Accomplished

1. Investigate the effectiveness and efficiency of various power management techniques for the Aprize low-Earth orbit satellite communications system.
2. Measure the ability of miniature satellite transceivers to send short packet data to the Aprize low-Earth orbiting satellites under actual field operating conditions.
3. Evaluate the reliability of Gaussian Minimum Shift Keying modulation techniques and efficient data transfer protocols when working with a large number of units that transmit very short data packets.
4. Determine the minimum amount of transmitter power required to transfer short data packets reliably to the Aprize satellites using UHF uplink frequencies.
5. Determine the minimum level of satellite transmit power required to close the link with a user transceiver using an omni-directional antenna.
6. Evaluate a new technique for satellite signal capture and Doppler compensation.
7. Conduct limited field trials with prospective customers to determine the operational performance of the radio equipment and identify potential commercial benefits.
8. Demonstrate the use of a satellite tracking and monitoring system to prospective customers.

C. How the program of experimentation has a reasonable promise of contribution to the development, extension, expansion, or utilization of the radio art, or is along line not already investigated.

1. Through its experimental program Aprize will be able to conduct the necessary experimentation and tests that will enable it to apply for a commercial license in order to introduce to the public a whole new class of narrow-band satellite data network services to track and monitor fixed and mobile assets, particularly for the energy industry.
2. There is a great need and growing public recognition and demand for the type of service that is under development at Aprize. The goal of the Aprize experimental program is to develop and test its satellite-based data delivery system that can provide U.S. businesses and government agencies with global visibility of their fixed or mobile assets that will facilitate critical information exchange across the supply chain, providing new levels of executive control, personnel efficiency and customer service.

3. Other systems that are now in operation to address these needs have not yet lived up to their promise. Either they have been too costly to develop, deploy and operate, have had serious technical or financial problems, or have limited coverage.

4. Aprize hopes to resolve these problems in the provision of tracking and monitoring services through its experimental program and to enter the wireless data communications business by providing low-cost, reliable services that will increase the productivity of businesses, minimize asset losses, improve operations, provide fast, efficient information worldwide, enhance customer service and bring down costs, thus benefiting U.S. businesses and consumers alike.

5. Other benefits to the U.S. public will accrue from the ongoing research and development activities by Aprize in the field of satellite-based asset tracking and monitoring systems, which will provide a stimulus to U.S. development, expansion and utilization of wireless data communications networks and contribute to the body of U.S. technological innovation.

D. Technical Information

1. **Design, construction and ownership.** The Aprize spacecraft are designed, built, integrated and tested by SpaceQuest, Ltd., a corporation registered in the Commonwealth of Virginia, United States of America. If an experimental space station license is granted to Aprize, the United States, through the Federal Communications Commission, would be notifying administration to the ITU for the Aprize spacecraft. Aprize is the owner of the satellites and is responsible for the successful launch and functional checkout on orbit.

2. **Space Station Name:** AprizeSat-1 and AprizeSat-2

3. **Construction Completion Date:** February 2004

4. **Estimated Launch Date:** April 2004

5. **Purpose:** Experimental, non-Common Carrier basis

6. **Orbital Type:** NGSO

7. **Orbital Requirements.** The desired orbit for the Aprize satellite is near circular sun-synchronous at 700 km altitude with an inclination of 98 degrees.

Orbital Information

Total Number of Satellites:	2
Total Number of Orbital Planes:	1
Celestial Reference Body:	Earth
Orbit Epoch Date:	TBD
Inclination Angle (degrees):	98
Orbital Period (seconds)	5927
Apogee	700 km
Perigee	700 km
Right Ascension of the Ascending Node (deg.):	0
Argument of Perigee (degrees):	0
Active Service Arc Range (Degrees)	N/A

8. Initial Satellite Phase Angle

Orbital Plane No.1, Satellite No.1, Initial Phase Angle: 0 degrees

Orbital Plane No. 1, Satellite No. 2, Initial Phase Angle: 0 degrees

10. Service Area: CONUS

11. Satellite payloads. The Aprize communications payload consists of four fixed-frequency user receivers, one agile user receiver, one fixed-frequency command & control receiver, and two agile user transmitters.

12. Principle specifications. The Aprize satellite is a cube measuring 25 cm on a side with a total mass of 12 kg. It has body-mounted solar panels on all six sides and a four-element turnstile antenna on each end of the spacecraft that generate approximately 18 watts of power in sunlight. Battery bus voltage is 8.4 Volts and consists of 6 cells with 4.4 Ahr capacity. The satellite has no fuel or deployable mechanisms. It has an estimated lifetime of 15 years.

13. Radio equipment. Aprize is applying for experimental use of the downlink frequency band of 400.50 to 400.65 MHz. The maximum satellite output power is 7 Watts through a right-hand, circularly-polarized, omni-directional antenna, resulting in a power flux density on the ground of $-126.7 \text{ Watts/m}^2/4\text{kHz}$ for a space station altitude of 700 km.

<u>Band</u>	<u>Frequency (MHz)</u>	<u>System</u>	<u>T/R Mode</u>	<u>System Description</u>
UHF	400.50 – 400.65	User Downlink	Half-duplex	FM GMSK Modulation 9.6 Kbps in 15 KHz channel $\pm 15 \text{ kHz}$ Doppler band 7 Watts max output power

The uplink frequency band is from 399.90 to 400.05 MHz.

14. Link Budget. The coverage area diameter from their altitude of 700 km is approximately 5,000 km. Each satellite will pass over the U.S. about six times a day for approximately 12 minutes. The satellite transmitters are only active while communicating with user terminals. Below is the Aprize Satellite Link budget.

Satellite Link Budget

Space-to-Ground	Parameters
Elevation Angle to Satellite (Deg)	90
Orbital Altitude (Km)	700
Slant Range to Satellite (km)	700
Transmitter Frequency (MHz)	400.50
Transmit Power (Watts)	7.0
Transmit Power (dBw)	8.5
Implementation Loss (dB)	1.5
Transmit Antenna Gain (dB)	0.0
EIRP (Watts)	5.0
EIRP (dBw)	7.0
Path Loss (dB)	141.4
Receive Antenna Gain (dB)	0.0
Polarization Loss (dB)	3.0
Implementation Losses (dB)	0.5
Received Signal Strength (dBw)	-134.4
Receiver Noise Figure (K)	575
Front End Gain (G) (Ant Gain-Losses) (dB)	-3.5
G/T (dB/K)	-31.1
BOLTZMAN'S CONSTANT (dB)	-229
C/No (dB-Hz)	63.1
Data Rate (BPS)	9600
Occupied Bandwidth	15000
Eb/No (dB)	23.3
Required Eb/No (dB) for 10-4	11.0
Link Margin (dB)	12.3
Power Flux Density (Watts/m ² /4kHz)	-126.7

15. Antenna Beam Diagrams

Aprize Space Station Antenna
Radiation Pattern
Linear Scale
0 dB = 0.29 dBi
 $Z = 57 + j101$

