# AMSAT

# Emergency Communications

# Wide-Field-of-View Payload Accommodations Study

Request for Proposal

August 21, 2015

# Project Summary

AMSAT wishes to participate in a ride-share opportunity as a hosted amateur radio payload on the Wide Field of View (WFOV) geosynchronous satellite currently being designed by Millennium Space Systems for the USAF Remote Sensing Program Office (USAF SMC/RS). A study shall be conducted by Millennium Space Systems to determine feasibility of the ride-share to determine the effects on the existing design.

# Study Statement of Work

The accommodations study will include the following elements:

### Payload Accommodations

#### Accommodations: mechanical, location on spacecraft

#### Electrical Accommodations: harnessing, wiring, payload interface electronics, data, software, commanding, grounding, relays, dead-facing, keep-out zones – ensuring no failure of the AMSAT payload can propagate back to the spacecraft

### Accommodations

#### Develop a Preliminary Interface Control Document (ICD)

#### Develop a Preliminary Payload Integration Plan with Milestones, Dependencies and any work-around if payload delivery is late

### Cost Estimate for Secondary Payload Integration onto WFOV

#### Establish a Giver/Receiver List for both the study and for the follow-on integration & test program

#### Develop a Technical Risk Assessment in terms of any impacts to the baseline spacecraft design

# AMSAT Payload and CONOPS Description

The AMSAT payload would consist of a software-defined radio, manufactured by RINCON Research Corporation, and additional electronic components needed to make it functional will come from Virginia Tech and AMSAT and shall be placed into operation in the amateur satellite service. It would be an FCC licensed, internationally coordinated digital transponder and bent pipe transponder.

### Frequency Bands:

5660 MHz (center frequency) uplink, ~10 MHz wide

10460 MHz (center frequency) downlink ~ 10 MHz wide

### Modes of Operation

The payload would implement a digital transponder and a bent pipe transponder using a channelized uplink (frequency division multiplexed) and would divide these channels between digital uplinks and bent pipe uplinks based on demand and as coordinated but will be settable by the operators to best fit the available channel capacity as USAF WFOV changes position around the earth. The downlink will consist of a single carrier digital signal and a single frequency band producing an FDM linear transponder (bent pipe).

### Power

Initial discussions indicated an available 100+ W. We need maximum possible transmit power so we proposed to consume every available watt but stay beneath the power cap. We propose that the operators of USAF WFOV simply turn our transponder off when there is insufficient power to operate our payload as opposed to our increase in complexity of making multiple power settings at this time. This can be reconsidered in cooperation with MSS.

### Mass

Initial discussions indicated a maximum payload allowance of up to 20 Kg of mass. We propose to build a total payload that is significantly less than 20 Kg total mass, inclusive of antennas, electronics, and cables.

### Size

Mass volume allowed or actual envelope size is currently unknown. We foresee a very small footprint on the cold plate for thermal control, and small footprint external to the body of the USAF WFOV bus for our antennas.

### Antennas

The current CONOP utilizes short horns operating in the 10 GHz amateur satellite service allocation and will have a half power beam width that will subtend the visible earth. The receive antenna concept is a phased array consisted to two separate flat panels mounted on the available space adjacent to the nadir pointing face but consisting of one each panel, mounted on the +X and –X face. The 10 GHz band will need at least two horns, one for the digital transponder and one for the bent pipe transponder.

### Payload Operation

We propose the only control needed by AMSAT is power on/power off which shall be independent and downstream of any USAF WFOV operator control of the payload as mentioned in section 3.3 Power. We plan to command and control the payload in-band using the digital uplink with our payload doing decryption, verification, and identification. We will downlink telemetry from our payload on the digital downlink. This can and will include any digital data needed by the primary mission which are consistent with FCC Part 97 Amateur Radio Service rules. We propose no need for any data from our payload to be transmitted for our payload to any system already on USAF WFOV. There will be zero contact between our digital system and our data and the USAF WFOV payloads. We will provide, in coordination with MSS, analog signals consisting of telemetry points from our payload that MSS wishes us to incorporate and which are consistent with FCC Part 97 Amateur Radio Service rules.

# Key Points of Contact

|  |  |  |  |
| --- | --- | --- | --- |
| Organization | Name | E-mail | Phone |
| AMSAT | Jerry Buxton | [vpe@amsat.org](mailto:vpe@amsat.org) | 817-573-2465 |
| MSS | Stan Dubyn | [stan.dubyn@millennium-space.com](mailto:stan.dubyn@millennium-space.com) | 310-683-5850 |
| Virginia Tech | Bob McGwier | [rwmcgwi@vt.edu](mailto:rwmcgwi@vt.edu) | 540-231-2041 |
| Virginia Tech | Sonya Rowe | [sarowe@vt.edu](mailto:sarowe@vt.edu) | 540-231-7053 |

# Period of Performance

The accommodations study shall be delivered to AMSAT eight weeks after proposal acceptance.

# Deliverables

The following shall be included in the final delivery of the accommodations study to AMSAT:

### Preliminary ICD

### Preliminary Payload Integration Plan

### Integration Risk Assessment

Including Technical and schedule Risk

### Operational Risk Assessment

Including Likelihood vs. Consequence of any on-orbit secondary payload flip-outs

### Payload Integration Cost Estimate

### Out-brief and Recommendation to Col. Kennedy and the USAF SMC/RSFT Program Office

Including a “Go/No-Go” Recommendation

# Funding Commitment

Shall be provided by AMSAT