Douglas Young

From:	Mike Miller <mlmiller@sterksolutions.com>
Sent:	Friday, November 06, 2015 2:17 PM
To:	Douglas Young
Subject:	Fwd: Request for Info - File #0227-EX-PL-2015
Attachments:	Basis and Objectives of eCMASat Secondary Mission Operations.pdf; Beacon Packets R2.pdf

Doug,

Thanks for forwarding these questions from IB. Here are the point by point responses, please let me know if these need to be expanded, or what else may be needed.

Thanks,

Mike
415 385-3842

Questions and Answers

1. Do NASA's spectrum management office and NTIA agree that this mission should be considered non-Federal?

Per request of FCC OET, NTIA has reviewed the Experimental license application, and approved it. In doing so they have accepted the non Federal designation for this spectrum use.

NASA spectrum management office was asked to confirm that the mission should be considered non-Federal for spectrum management, and they have provided that confirmation..

2. Has this expenditure on a space system been through an OMB certification process?

Our project has a life cycle cost of well below $150M. The threshold for reporting to OMB and Congress is $150M, so we do not qualify for OMB certification.

3. IB says that some of the description in the beacon telemetry data table is in shorthand or uses acronyms. It would greatly aid understanding of this if you could provide a short text that describes the information content of the telemetry.

Please see the attached document "Beacon Packets R2.pdf", which has been expanded to include acronym definitions, and discussion of individual data items.

4. Comment: IB can't decipher from the documents they have the point of the "secondary" operations after the primary mission is completed. It seems like this would just involve beacon beeps with telemetry data that isn't relevant to any mission, and not much more. If that's the case, it may make sense to shut down transmissions after the primary mission is completed.

Please see the attached document "Basis and Objectives of eCMASat Secondary Mission Operations.pdf", which describes the purpose and value of continued operations of the spacecraft.

----- Forwarded message from oetech@fccsun27w.fcc.gov -----

Date: Tue, 13 Oct 2015 12:17:12 -0400
From: oetech@fccsun27w.fcc.gov
Reply-To: oetech@fccsun27w.fcc.gov
Subject: Request for Info - File #0227-EX-PL-2015
To: mlmiller@sterksolutions.com

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Office of Engineering and Technology

To: Michael Miller, Santa Clara University

  mlmiller@sterksolutions.com

From: Doug Young

  Douglas.Young@fcc.gov

Applicant: Santa Clara University

File Number: 0227-EX-PL-2015

Correspondence Reference Number: 29776

Date of Original Email: 10/13/2015

Additional questions from International Bureau (IB):
1. Do NASA's spectrum management office and NTIA agree that this mission should be considered non-Federal?
2. Has this expenditure on a space system been through an OMB certification process?
3. IB says that some of the description in the beacon telemetry data table is in shorthand or uses acronyms. It would greatly aid understanding of this if you could provide a short text that describes the information content of the telemetry.

They would also like you to address the following comment:
They can't decipher from the documents they have the point of the "secondary" operations after the primary mission is completed. It seems like this would just involve beacon beeps with telemetry data that isn't relevant to any mission, and not much more. If that's the case, it may make sense to shut down transmissions after the primary mission is completed.

The items indicated above must be submitted before processing can continue on the above referenced application. Failure to provide the requested information within 30 days of 10/13/2015 may result in application dismissal pursuant to Section 5.67 and forfeiture of the filing fee pursuant to Section 1.1108.

DO NOT Reply to this email by using the reply button. In order for your response to be processed expeditiously, you must upload your response via the Internet by visiting The OET Experimental Licensing System, followed by clicking on the "Reply to Correspondence" hyperlink.

----- End forwarded message -----

Basis and Objectives of eCAMSat Secondary Mission Operations by Santa Clara University

The purposes of the "secondary" operations, which SCU will conduct after their conduct of the biology experiment completes, include academic research in anomaly management and system maintenance, along with training students to operate spacecraft prior to a mission. It allows incorporating the operation of spacecraft into a unique course "Satellite Operations", which together with our certification process, allows students to start the path to become certified operator crew members, to conduct mission operations. Other universities send their students to take the class.

This educational effort relies not only on the satellite beacon, but also the Microhard two way channel. Operation of the Microhard link will keep the beacon on, and in this phase SCU will also perform other experiments that will require sending commands to change equipment states, and check telemetry that isn't included in the beacon data. The research includes long term platform trending, as well as publishable research on spacecraft fault diagnosis techniques, using the satellite as a target system. This long term research allows observation of malfunctions as spacecraft parts degrade. These techniques are refined and used in new missions as we continue to operate these spacecraft over the years.

Along with the research, the spacecraft is a critical asset for the maintenance of the ground segment systems that we use to do operations and conduct research. The only way that we can verify that the ground segment system is working, is through communication with an orbiting spacecraft that we operate.

The beacon transmits once every 5 seconds, alternating through 60 variations in packet format,
There are 60 wells or separate experiment vessels, numbered 0 through 59 decimal, aka 3B hex.

eCAMSat Bus Beacon Packet, Data Definition Table

Field Group	Size (Bytes)	Field Description	Field Included for Well Number[1]	Units
Website	11	EcAMSat.org	All	NA
Reserved	3	<space>		
BusTime	6	Bus Time	All	Seconds
Solar Panel Current	4	Solar panel 1 current	0	Analog to Digital Converater (ADC) counts
		Solar panel 2 current	1	ADC counts
		Solar panel 3 current	2	ADC counts
		Solar panel 4 current	3	ADC counts
Solar Panel Temperature	4	Solar panel 1 temp	0	Centidegrees C
		Solar panel 2 temp	1	Centidegrees C
		Solar panel 3 temp	2	Centidegrees C
		Solar panel 4 temp	3	Centidegrees C
Bus Health Group 0	2	Bus' power port status	0	8 Bit field
		Startup counter	1	Integer
		Spacecraft to ground ID	2	Integer
		Experiment phase	3	Bit field
Bus Health Group 1	4	Payload1T	0	Centidegrees C
		Radiation value	1	Events per 30s
		MHX current	2	ADC counts
		MHX Voltage	3	ADC counts
		BatteryV	0	ADC counts

Bus Health Group 2	4	CommV	1	ADC counts
		SensorsV	2	ADC counts
		BusV	3	ADC counts
Bus Health Group 3	4	PayloadHeaterI	0	ADC counts
		PayloadI	1	ADC counts
		Bus Data Page	2	Integer
		Register File Wrap Count	3	Integer
PageNumber	4	Payload Data Page	All	Integer
CardTempM	4	Median card temperature	All	Centidegrees C
Well Number	2	Well Number	All	Integer
TaosR	4	TAOS Reading for Well Number X: Red LED	Well Number	Transmitted Light Intensity
TaosG	4	TAOS Reading for Well Number X: Green LED	Well Number	Transmitted Light Intensity
TaosB	4	TAOS Reading for Well Number X: Blue LED	Well Number	Transmitted Light Intensity
Total Bytes	64			

Note 1: Well Number will increment by one every time a beacon packet is transmitted. When well 59 is reached, it will roll over to well 0. Parameters shown with well number 0, 1, 2 or 3 are shown with every 4th packet, starting with Well Number = 0, 1, 2 or 3. For example, 0 indicates a parameter shown with well number = 0, 4, 8, ... and all well numbers divisible by 4.

Note 2: All Data is in hexidecimal format.

Note 3: Beacon elements that have multiple defintions mean that the data transmitted will rotate between the four different quantities and thus repeat every four transmissions, except

A Packet is 64 8 bit bytes, representing 64 standard (US) ASCII characters, 7 bit, with the 8th bit

the variations are referenced by Well Number.

Discussion
This website provides information about the mission, and data definition
Bus time is initialized to zero during Arming of Experiment
Counts convert to mA by a sensor specific conversion formula.
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Counts convert to mA by a sensor specific conversion formula.
Degrees Centigrade x 100
Degrees Centigrade x 100
Degrees Centigrade x 100
Degrees Centigrade x 100
0b00000000   Each bit represents a subsystem. 1 is powered on. 0 is powered off
Counter initialized to 0 during Arming of Experiment and increments every reboot
Increments by 1 each time a packet is sent
The experiment has 15 phases, starting with phase 1.
Degrees Centigrade x 100
Measures counts on radiation detector, for previous 30 seconds
Counts convert to mA by a sensor specific conversion formula.
Counts convert to mV by a sensor specific conversion formula.
Counts convert to mV by a sensor specific conversion formula.

Counts convert to mV by a sensor specific conversion formula.
Counts convert to mV by a sensor specific conversion formula.
Counts convert to mV by a sensor specific conversion formula.
Counts convert to mA by a sensor specific conversion formula.
Counts convert to mA by a sensor specific conversion formula.
Current page of recorded Bus data
Register file memory space wrap counter
Current page of recorded science data
Degrees Centigrade x 100
X = 0 through 3B hex
Optical Data for a particular well, indicating transmissive level for color Red. 0 = opaque, 4095 decimal = transparent
Optical Data for a particular well, indicating transmissive level for color Green. 0 = opaque, 4095 decimal = transparent
Optical Data for a particular well, indicating transmissive level for color Bue. 0 = opaque, 4095 decimal = transparent

indicating parity.