



November 3rd, 2017

1424 K St Northwest
Lower Level
Washington, D.C. 20005

Darren Rowen
The Aerospace Corporation
2310 E. El Segundo Blvd.
El Segundo, CA 90245-4609
Mail: P.O. Box 92957
Los Angeles, CA 90009-2957

Re: OA-8 above International Space Station Satellite Deployment Approval

Dear Darren,

NanoRacks would like to you (as demonstrated in the attached Jettison Authorization Form (JA-037b) and the June 28th ISS Program Multilateral System Engineering & Integration Control Board) that the International Space Station Program and NASA are committed to proceeding forward with the intent to deploy the two AeroCube 7 (B/C) satellites from the Orbital ATK 8 Cygnus Cargo Resupply Vehicle after unberthing from the ISS. The post deploy altitude of these two satellites should be no less than 45 kilometers above the ISS orbit. The final payload orbit should be as close to co-elliptic with the ISS as possible.

The ability to accomplish this is dependent upon availability of sufficient propulsion capability of the Cygnus. The actual availability of the remaining propulsion budget will not be known until after launch and berthing of the OA-8 vehicle; however, if the launch and rendezvous profile are executed as planned, there should be sufficient margin to accomplish the deployment at higher altitude – this is the baseline plan.

Should you or other parties you deliver this memo to have any questions, then please do not hesitate to contact me at the information below. We are looking forward to a successful mission.

Kind Regards,

A handwritten signature in black ink, appearing to read "H. Martin", written over a light blue horizontal line.

Henry Martin
Senior Mission Manager
NanoRacks, LLC
(859) 559-7322
hbmartin@nanoracks.com

Multilateral Systems Engineering & Integration Control Board (MSEICB)

7:30 am Central

Summary Minutes

June 28, 2017

Building 4 South, Room 4419

Board Chair: Jeffrey J. Arend

Topic

Introduction/Opening Comments

Presenter

OM/Jeff Arend

MSEICB - Special Topics

OA8 eNRCSD Candidates


OM/Charles Gray

Summary: Mr. Gray presented the jettison analysis results and recommendation for the External NRCSD Satellites that are to be deployed above the ISS from OA8 while the vehicle is in free flight. It was noted that the revised jettison policy now includes criteria for these types of deployments. External deployments have been previously discussed at the MSEICB; however, this is the first one for formal approval. Background for each of the satellites can be found in the presentation. It was also noted that this request is for more satellites in one deployment than we have done in the past. All candidates have mass below 5 kg. The impact to ISS operations has a 1% likelihood of a debris avoidance per satellite deployed above the ISS; however, there is no immediate risk after deployment as they are so high up and remain in their orbit for several years. None of the satellites deployed above the ISS thus far have decayed to our altitude yet. The BNs with these satellites should not present any risk at 480/460 km; however, we will have a better understanding where they will go once we receive the real-time analysis and are 45 km above the ISS. All the candidates meet the jettison criteria with the exception of AeroCube as it has a warm water propulsive system. Usually prop systems have a higher risk; however, the PD indicated that the AeroCube has a max dV of 0.03 m/s for one thruster firing which cannot present a risk of conjunction with ISS within the six month prox ops timeframe. The SRP is to review these satellites later this week. If any issues are identified, then Mr. Gray will bring the topic back to the Board. Orbital lifetime predictions were provided. The recommendation is to approve the 10 satellites presented from OA-8 external NRCSD.

Disposition: The Board provided approval with the recommendation.

2. Board: <input type="checkbox"/> Space Station Control Board (SSCB) <input type="checkbox"/> ISS Mission Management Team (IMMT) <input checked="" type="checkbox"/> Multilateral Systems Engineering and Integration Control Board (MSEICB)		3. Date: Oct 18, 2017						
4. Title: OA8 external NRCSD Cubesats								
5. The following items have been approved for jettison by the general partnership of the International Space Station Program, as agreed to by the International Partner Program Managers or their MSEICB designees.								
<ul style="list-style-type: none"> a) Lemur-2 (8 Satellites) b) CHEFSat c) AeroCube 7 B/C (2 Satellites) d) PropCube e) ISARA f) Asgardia 								
6. Initiator Name:	Organization/Company:	Phone:						
Charles Gray	OM	281-244-8525						
7. NASA Responsible POC:	Organization:	Phone:						
Charles Gray	OM	281-244-8525						
8. Flight Effectivity: OA8		EVA (if applicable): N/A						
9. Requirements from PPD 1011, Multilateral ISS and ISS Visiting Vehicle Jettison Policy (see PPD 1011 Rev B for complete list of criterion)								
<input checked="" type="checkbox"/> 3.1-1 – The jettison candidate(s) shall be trackable by the Space Surveillance Network (SSN). <input checked="" type="checkbox"/> Expedited Approval Criteria: Candidate has metallic cross sectional area $\geq 100 \text{ cm}^2$ on three orthogonal sides. <input checked="" type="checkbox"/> 3.1-2 – Jettison candidate has demonstrated that risk of on-orbit fragmentation has been controlled. <input checked="" type="checkbox"/> 3.2-1 – Analysis has demonstrated that jettison candidate will not contact any ISS structure during jettison. <input checked="" type="checkbox"/> Expedited Approval Criteria: Jettison is planned to occur from a location and in a direction which has been previously approved for jettison, utilizing a jettison/deployment method that has been previously analyzed and approved. <input checked="" type="checkbox"/> 3.2-2 – Jettisoned object demonstrates safe relative motion with the ISS. <input checked="" type="checkbox"/> Expedited Approval Criteria: Candidate pre-activation and operational Ballistic Number (BN) meet the following criteria:								
<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Deploy dV (m/s)</th> <th style="padding: 5px;">BN (kg/m²)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">< 0.5</td> <td style="text-align: center; padding: 5px;">≤ 100</td> </tr> <tr> <td style="text-align: center; padding: 5px;">≥ 0.5</td> <td style="text-align: center; padding: 5px;">≤ 120</td> </tr> </tbody> </table>			Deploy dV (m/s)	BN (kg/m ²)	< 0.5	≤ 100	≥ 0.5	≤ 120
Deploy dV (m/s)	BN (kg/m ²)							
< 0.5	≤ 100							
≥ 0.5	≤ 120							
<input checked="" type="checkbox"/> 3.2-3 – Candidates with systems capable of modifying or adding energy into the candidate's orbit have demonstrated that they do not pose a collision hazard with ISS or visiting vehicles. <input type="checkbox"/> Expedited Approval Criteria: Jettison candidate does not have systems capable of modifying or adding energy into the candidate's orbit. <input checked="" type="checkbox"/> 3.3-1 – Jettison shall be scheduled such that there is sufficient time to determine the jettisoned object's orbital parameters and assess effects on any visiting vehicle operations. <input type="checkbox"/> If the above criteria cannot be met, see blocks 11 and 12 for exception to the policy.								
10. Jettison Rationale (must fall into one or more of the following categories)								
<input type="checkbox"/> Items that pose a safety issue for the ISS or for return onboard a visiting vehicle (contamination, materials, degradation, etc.) <input type="checkbox"/> Items that negatively impact ISS utilization, return or on-orbit stowage manifests <input type="checkbox"/> Items that represent an EVA timeline savings <input checked="" type="checkbox"/> Items that are designed for jettison								
11. An exception is granted to the following requirement(s):								
3.2-3 Expedited Approval Criteria: All Cubesats meet the Expedited Approval Criteria with the exception of the 2 AeroCube 7 B/C satellites, which have a warm water propulsion system.								
12. Rationale for the exception:								
Analysis provided by the AeroCube 7 Payload Developer and NanoRacks validates that the satellite still meets the 3.2-3 Requirement: the dV capability of the satellite is so low as to not pose a collision hazard with ISS or visiting vehicles. AeroCube conservative maximum dV is 0.033 m/s. Taking this value into account, TOPO analysis demonstrates that the risk posed by this propellant system is not appreciably greater than the risk posed by a non-propulsive satellite.								


13. Submitting Signatures

13a. Initiator			
Print Name:	Charles Gray	Phone:	281-244-8525
Signature:		Date:	10/25/17
13b. NASA Responsible POC			
Print Name:	Adam Baker	Phone:	281-483-2747
Signature:		Date:	10/25/17

14. Concurrence Signatures

14a. ISS Safety Review Panel:			
Print Name:		Phone:	
Signature:		Date:	
14b. Multilateral Systems Engineering & Integration Office:			
Print Name:	Jeff Arend	Phone:	281-244-7038
Signature:		Date:	

15. International Partner	Approve of Decision		Dissenting Opinion
Roscosmos	Y <input type="checkbox"/>	N <input type="checkbox"/>	<input type="checkbox"/>
Canadian Space Agency	Y <input type="checkbox"/>	N <input type="checkbox"/>	<input type="checkbox"/>
European Space Agency	Y <input type="checkbox"/>	N <input type="checkbox"/>	<input type="checkbox"/>
Japan Aerospace Exploration Agency	Y <input type="checkbox"/>	N <input type="checkbox"/>	<input type="checkbox"/>
Agenicia Spatiale Italiano	Y <input type="checkbox"/>	N <input type="checkbox"/>	<input type="checkbox"/>

Official Poll Taken By: 	Date: 10/25/17
<input type="checkbox"/> Program Manager ISS Program, <input type="checkbox"/> Operations Integration Manager or <input checked="" type="checkbox"/> MSEICB Chair	