TEAM ALPHA CUBESAT

GROUND TOURNAMENT 2 PRELIMINARY DESIGN REVIEW REPORT

Required Data for Competitor Teams with Non-NASA Launch

Team Alpha CubeSat
c/o XISP-Inc
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Required Data for Competitor Teams with Non-NASA Launch

1. Launch Service Provider RFP
2. Deep Space Industries, Inc. Letter of Intent
3. Alpha CubeSat Technology Readiness Level
4. Original Alpha CubeSat SLS Payload Questionaire (reference data)

2016

Request for Proposals to Supply Alpha CubeSat Launch Provider Services

ACS-02-01-2016

GARY PEARCE BARNHARD, DESIGNATED POINT OF CONTACT
XTRAORDINARY INNOVATIVE SPACE PARTNERSHIPS, INC.
8012 MacArthur Boulevard, Cabin John, MD 20818
www.xisp-inc.com
www.alphacubesat.com

1.1 Request for Proposal

This is a Request for Proposal (ACS-02-01-2016) from Xtraordinary Innovative Space Partnerships, Inc. (XISP-Inc), a for-profit entity located at 8012 MacArthur Boulevard, Cabin John, MD 20818, for Launch Provider Services as defined below hereafter called the "RFP".

1.2 Introduction

Alpha Cubesat, a registered NASA CubeQuest Challenge participating team is seeking a contractor to provide Launch Services for the Alpha CubeSat spacecraft according to the requirements in the Statement of Work in Appendix A.

1.2 Period of Performance

The period of performance of this contract is from the date of execution of a contract resulting from this RFP process until ACS launch is achieved as follows:

- ACS launch shall be no later than December 2018, subject to completion of the ACS Final Flight Readiness/Safety Review and the timing of available launch service components.

1.3 Place of Performance

The contractor's facility and other locations as determined by the proposed solution and implemented in the resultant contract.

1.4 Letter of Intent

Proposers shall submit a letter of intent to compete along with any modifications they require in the Statement of Work delivered electronically to Team Alpha CubeSat c/o Xtraordinary Innovative Space Partnerships, Inc. (gary.barnhard@xisp-inc.com & barnhard@barnhard.com) no later than 5PM EST February 29, 2016.

Proposers are encouraged to respond at the earliest possible opportunity iterating their submission as necessary so that their final letter of Intent can reflect the resolution of any issues they have identified with the Statement of Work.

1.5 Proposal Submittal

A compliant response to this Request for Proposal shall be considered a timely delivered Letter of Intent (as defined in paragraph 1.4) which includes the following:

(1) Confirmation that the responding entity is in receipt of the most recent version of the Team Alpha CubeSat (c/o XISP-Inc) Request for Proposal.

(2) Statement that the responding entity provides the letter of intent as a compliant response to the Request for Proposal to deliver Launch Provider Services to ACS.

(3) Confirmation that the responding entity either has the capability to deliver Launch Provider Services which support beyond Earth Orbit trajectories or is moving forward with the development of a capability to deliver Launch Provider Services which support beyond Earth Orbit trajectories that is intended to be available for technology demonstration if not operational use during the cited time frame of interest.

(4) Confirmation, if applicable, that the responding entity recognizes the value of having Team Alpha CubeSat as a participant in the Launch Provider Services technology demonstration mission.

(5) The responding entity letter of intent must explicitly state an offer to negotiate in good faith with Team Alpha CubeSat a Launch Provider Services agreement which can meet or exceed the minimum requirements articulated in the Request for Proposal, subject to mutually agreeable technical clarifications/amendments, terms, and conditions.

1.5 Point of Contact

The XISP-Inc point of contact for this RFP is Gary Pearce Barnhard, gary.barnhard@xisp-inc.com & barnhard@barnhard.com, +1 301 229 8012 (Office), +1 301 509 0848 (Mobile).

Appendix A - Statement of Work

1.0 Scope and Requirements

Scope
Team Alpha CubeSat is seeking a contractor to provide launch services for its Alpha Cubesat satellite from the surface of the Earth to the defined deep space trajectory insertion point.

Single Spacecraft
This contract will include the launch of a single ACS spacecraft.

Spacecraft Mass Properties
The ACS shall not exceed 14.0 kg maximum payload mass.

Spacecraft Volume
The ACS spacecraft volumetric properties are shown in Table 1-1 Payload Maximum Dimensions and Figure 1-1 Payload Envelope Dimensional Depiction.

The ACS Center of Gravity constraints are defined in Table 1-2 Payload Center of Gravity Envelope.

Required Compliance Document
The ACS spacecraft is required to be compliant with the volume and mass constraints contained in the following reference documents:

- Space Launch System (SLS) Spacecraft & Payload Integration Office (SPIO), Revision: Baseline, Document No: SLS-SPIE-HDBK-005, Effective Date: TBD, Title: SLS Secondary Payload User's Guide (SPUG)
- Launch Service Provider, Revision: Baseline, Document No: TBD, Effective Date: TBD, Title: Trajectory Insertion Bus Payload User's Guide (TIBPUG) or equivalent vendor's Payload User's Guide.

The launch mechanisms employed shall leverage the available resources of the International Space Station where cost effective and practical.

The Contractor shall provide a launch vehicle system for ACS that shall be capable of delivering the spacecraft (exclusive of contractor supplied beyond Earth orbit injection systems and the 6U deployment mechanism) to an

ACS at the point of deployment must meet Earth escape velocity for the baselined deep space trajectory (Characteristic Energy C3=0, nominally V_e = 11.2 (km/s).

[reference Trajectory section AlphaCubeSat Preliminary CubeSat Design Package]

The combination of the launch services imparted velocity and the ACS propulsion system imparted velocity must enable the total mission delta V for the selected weak stability boundary trajectory requirements to be met. These include:

- Maintain suitable weak stability boundary trajectory into deep space for a minimum of 4 million km.
- Transition to a return orbital trajectory passing through the Earth Moon L_2 point.
- Transition to an accessible lunar orbit which is stable for at least one year mission elapsed time.

It is anticipated that the ACS Propulsion system (low thrust long duration + high thrust short duration) will be able to contribute up to 1.5 km/s to the meet the delta V requirement. Achieving this goal with acceptable margin necessitates an evolution in the integrated propulsion system design. Additional margin will require optimized trajectory calculations to meet the total delta V requirements with acceptable margins.

ACS altitude at the point of deployment must exceed 45,000 km (defined by minimum altitude required to clear the Van Allen radiation belts).

The Contractor shall perform all launch vehicle planning, analysis, design, development, production, integration, and testing required to provide the launch service appropriate to transport the payload to the desired orbit.

Table 1-1 Payload Maximum Dimensions

Deployer	A		B		C		Volume		Mass	
	in	mm	in	mm	in	mm	in^3	mm^3	lbs	kg
6U	9.41	239.00	14.41	366.00	4.45	113.00	603.41	9,884,562	30.86	14.00

Figure 1-1 Payload Envelope Dimensional Depiction

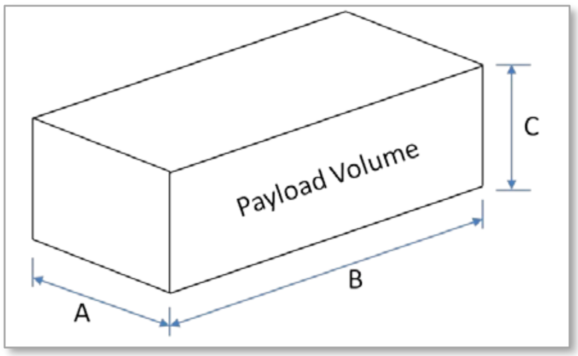

Table 1-2 Payload Center of Gravity Envelope

Parameters	Units	6U	
		Min.	Max.
Center of Mass, X	in. (mm)	-1.57 (-40)	+1.57 (+40)
Center of Mass Y	in. (mm)	+0.39 (+10)	+2.76 (+70)
Center of Mass Z	in. (mm)	+5.24 (+133)	+9.17 (+233)

2.0 Planning

The Contractor shall furnish all services to meet ACS launch services requirements including, but not limited to: program management, mission integration, launch site support, ground and flight system safety, and performance assurance.

3.0 Launch Vehicle Analysis, Design

The Contractor shall provide the design of the launch vehicle, including but not limited to the following subsystems: structures, mechanisms, fluids/propulsion, electrical/electronics, guidance/navigation/control, flight termination, and software. The Contractor shall provide the expected launch vehicle environments that the payload will be exposed to during launch.

3.1 Launch Service Provider Payload Requirements

3.1.1 Deployment Envelope

The combined ACS spacecraft and the Trajectory Insertion Bus must be circumscribed by the JEM External Airlock CYCLOPS IVA/EVR transition interface system.

3.1.2 Payload Mass

The ACS spacecraft mass will not exceed 14.0 kilograms.

3.1.3 Undeployed Dimensions and Volume

The ACS spacecraft undeployed dimensions and volume will not exceed the values shown in Table 1-1 Payload Maximum Dimensions.

3.1.4 Deployed Total Mass of TIB and ACS

The deployed total mass of the TIB and ACS will not exceed 300 Kilograms.

3.1.5 Payload Power Pass Through to TIB

The ACS shall capable of providing a minimum of 50 Watts pass through power to the TIB after deployment of the ACS solar arrays.

3.1.6 Power Transfer Interface

The Launch Services Provider in conjunction with Team Alpha CubeSat shall define and implement a power transfer interface with quick disconnect.

3.1.7 Deployment Interface

The Launch Services Provider will provide an ACS deployment interface which is functionally equivalent with the Planetary Services 6U CubeSat deployment mechanism except as otherwise noted.

3.1.8 Safety Requirements

3.1.8.1 The Alpha CubeSat (ACS) spacecraft must meet or exceed the International Space Station (ISS) safety requirements for pressurized or unpressurized cargo from the delivery to the applicable ground cargo processing facility (Kennedy Space Center or the Mid-Atlantic Regional Spaceport) until the Launch Service Provider (LSP) Trajectory Insertion Bus (TIB) passes outside the ISS Keep Out Sphere (KOS) with the ACS attached.

3.1.8.2 The ACS must meet or exceed the LSP TIB safety and interface requirements from the point of integration (TBD: ground or ISS depending on cargo vehicle accommodations) until the TIB executes the equivalent of a Planetary Services Deployment Mechanism release of the ACS spacecraft.

3.1.8.3 The following ISS Safety Requirements Documents are applicable to ACS unless superseded by equivalent LSP documents:

- **SSP 50021 – ISS Safety Requirements Document**
- **SSP 50021 DCN 001**
- **SSP 50021 DCN 002**
- **SSP 30599 Revision E – Safety Review Process**
- **SSP 30559 Revision D – ISS Structural Design and Verification Requirements**
- **SSP 52005 Revision D – Payload Flight Equipment Requirements and Guidelines for Safety-Critical Structures**
- **SSP 41172 Revision U – Qualification and Acceptance Environmental Test Requirements**
- **SSP 30558 Revision C – Fracture Control Requirements for Space Station**

3.1.8.4 The ISS SSP 30599 Revision E – Safety Review Process Document begins with a Phase I Safety Review which typically occurs after the preliminary design is complete. In anticipation of the need to meet the requirements of the Phase I Safety Review after CubeQuest Challenge GT-2 the ACS Team shall developed an annotated abstract of the Phase I Safety Review process to documenting readiness to comply with the applicable requirements.

3.1.9 Protective Fairing

The Launch Services Provider shall supply a protective fairing for the ACS spacecraft to protect it from inadvertent damage prior to spacecraft deployment.

4.0 Development and Production

The Contractor shall manufacture, assemble, test and transport the launch vehicle and all mission hardware required to provide the launch service and shall provide all materials and equipment necessary for these tasks.

The Contractor shall provide the following with the launch service:

a. A 6U-Class satellite deployment mechanism that will allow for the integration and release of the proposed Alpha CubeSat satellite configuration.
b. The Contractor's solution shall:

   i. Initiate the deployment of the Alpha CubeSat satellite.

   ii. Establish and hold the nominal separation attitude prior to the separation event.

   iii. Launch the Cubesat

5.0 Integration

The Contractor shall provide the necessary services and hardware to integrate the satellite with the 6U-Class satellite deployment mechanism provided.

6.0 Launch Operations

The Contractor shall perform the following:

a. Assemble, transport, maintain, checkout, launch, and deliver the satellite into the desired orbit.
b. Provide and make arrangements for all facilities, supplies, and services required for preparation and launch of the vehicle.
c. Identify launch vehicle ground and space flight safety launch constraints.
d. Integrate the ACS spacecraft, encapsulate, transport, and perform spacecraft to launch vehicle integrated checkout activities necessary to assure launch readiness.
e. Provide and schedule the necessary support services at the launch site that are required for launch preparation of the launch vehicle, integrated testing with the payload, and launch.

7.0 Payload Processing Support

The Contractor shall provide notification at the Launch Vehicle Readiness Review to coordinate the payload delivery and integration in to the deployment mechanism. The Contractor shall provide an office-like environment for payload storage.

8.0 Safety and Quality

The Contractor shall establish, implement, and maintain risk management, safety, reliability, and quality assurance programs in accordance with AS9100, Aerospace Quality Management System, or equivalent.

(end of Appendix A)

Gary Pearce Barnhard
Xtraordinary Innovative Space Partnerships, Inc.
8012 MacArthur Boulevard
Cabin John, MD 20818

Dear Mr. Barnhard:

Deep Space Industries, Inc. (DSI) is in receipt of the most recent version of the Team Alpha CubeSat (c/o XISP-Inc) Request for Proposal ACS-02-01-2016 Version 1.2 dated February 3, 2016.

DSI hereby provides this non-binding Letter of Intent as a compliant response to the Request for Proposal to deliver Launch Provider Services to ACS.

DSI is moving forward with the development of a capability to deliver Launch Provider Services which support beyond Earth Orbit trajectories that is intended to be available for technology demonstration if not operational use during the cited time frame of interest.

DSI recognizes the value of having Team Alpha CubeSat as a participant in the Launch Provider Services technology demonstration mission.

DSI hereby offers to negotiate in good faith with Team Alpha CubeSat a Launch Provider Services agreement which can meet or exceed the minimum requirements articulated in the Request for Proposal, subject to mutually agreeable technical clarifications/amendments, terms, and conditions.

The DSI point of contact for this Letter of Intent is Daniel Faber, daniel.faber@deepspaceindustries.com, +1 855 855 7755 xt 507 (Office), +1 650 691 3130 (Mobile).

Sincerely,

Daniel Faber

Chief Executive Officer

	Alpha CubeSat Technology Readiness Level (TRL)*				
	System/Subsystem Name	**TRL@GT-2**	TRL@GT-3	TRL@GT-4	**Rational for Stated TRL**
		PDR	CDR	FRR	
0	**Alpha CubeSat Spacecraft**	**5**	6	7	**Alpha CubeSat is a technology demonstration satellite**
1	**Communications System (COMM)**				
	Tethers Unlimited SWIFT-KTX Programmable K Band Transceiver (Avionics+ Software Defined Radio)	5	6	7	COTS K band product being upgraded by vendor to Ka
	Clyde Space, Pumpkin, or equivalent 6U CubeSat Integrated Reflectarray Antenna	7	8	9	Reflectarray antennas are now a COTS product from multiple vendors
	NASA DSN 34m BWG Ka Band 32 GHz Downlink Standard Service Baseline	9	9	9	Available DSN Standard Service
	Alternate Ground Station Ka Band 32 GHz Uplink is baselined	7	8	9	Alternate Ka Band Ground Stations are currently operational
	NASA DSN 34m BWG S or X Band Uplink	9	9	9	Available DSN Standard Service
	Corresponding alternate S or X Band Uplink ground station services (option)	9	9	9	Alternate S or X Band Ground Stations are currently operational
2	**Electrical Power System (EPS)**				
	Blue Canyon technologies XB1 Module Battery	7	8	9	COTS product
	Clyde Space 6U CubeSat SIDE Solar Panels	7	8	9	COTS product
	Power Management And Distribution BCT XB1 Module	7	8	9	COTS product
3	**Data Management System (DMS)**				
	Bus Control Subsystem - Blue Canyon Technologies XB1 Module	7	8	9	COTS product
4	**Guidance, Navigation & Control (GN&C)**				
	Blue Canyon Technologies XACT Module	7	8	9	COTS product
	Blue Canyon Technologies XB1 Module	7	8	9	COTS product
5	**Structures & Mechanisms System (S&Mech)**				
	Solar Reflectarray Panel Hinge (Qty=4)	7	7	7	COTS products are now available from multiple vendors
	Solar Reflectarray Single Axis Articulation Servo (Qty=2)	7	7	7	COTS products are now available from multiple vendors
	Solar Reflectarray Deployment Mechanism (Qty=2)	7	7	7	COTS products are now available from multiple vendors
	Solar Reflectarray Mount (Qty=2)	7	7	7	COTS products are now available from multiple vendors
	TIB Spacecraft Deployment Mechanism Attach Point	7	7	7	COTS products are now available from multiple vendors
	Passive Power Source Inhibit Mechanism (EPS)	7	7	7	COTS products are now available from multiple vendors
	1U x 3U Ram/Forward Plate Structure	7	7	7	COTS products are now available from multiple vendors
	Mechanical Oxidizer Tank Seal	7	7	7	COTS products are now available from multiple vendors
	2U x 3U Core Structural Spars, Rails & Plate	7	7	7	COTS products are now available from multiple vendors
	Scar for Partial Aft Plate + Hybrid Rocket Ejection	2	TBD	TBD	Potential option to recover margin
6	**Propulsion System (PROP)**				
	Hybrid Motor Oxidizer Tank Subsystem	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Hybrid Motor Core Subsystem	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Busek BIT-1 Ion Thrusters (Qty=4)	5	6	7	Multiple vendors have tested prototypes, integration challenge
7	**Thermal Control System (TCS)**				
	EPS Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	PROP Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	GN&C Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	COMM Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	S&Mech Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	DMS Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	PS Passive Dissipation	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Tools to Move Heat	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Tools for Mitigating and/or Rejecting Heat	5	6	7	Multiple vendors have tested prototypes, integration challenge

8	**Payload Systems (PS)**				
	CubeQuest Challenge Encoded BIT Stream Generator	5	6	7	Multiple vendors have tested prototypes, integration challenge
	System Performance Data Capture & Return	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Deep Space & Lunar Data Capture & Return	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Memorial Spaceflight Canisters	5	6	7	Multiple vendors have tested prototypes, integration challenge
9	**Ground Systems**				
	Spacecraft Control Center	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Spacecraft Near Real Time State Model Generator	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Capture & Store required navigation bits	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Payload(s) Operations Center	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Payload(S) Near Real Time State Model Generator	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Capture and Store Cube Quest Challenge Encoded BIT Stream	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Internet VLAN	5	6	7	Multiple vendors have tested prototypes, integration challenge
	Automated Command Sequence Generation and Verification Tool	5	6	7	Multiple vendors have tested prototypes, integration challenge
10	**Launch Service Provider (LSP) Systems**				
	Earth-to-LEO Launch Vehicle	9	9	9	COTS service is available from multiple vendors
	Upper Stage/Trajectory Insertion Bus (TIB)	5	6	7	COTS service is available or planned by multiple vendos
	TIB Fairing (if applicable)	5	6	7	COTS service is available or planned by multiple vendos
	ACS Transportation Packaging	9	9	9	Commerical Cargo is a COTS service
	NOTES:				
	*As defined in NASA/SP-2007-6105 Rev 1 pg 296. Include rational for stated TRL.				

System/Subsystem Name TRL@GT-2 TRL@GT-3 TRL@GT-4 **Rational for Stated TRL**
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Alpha CubeSat Technology Readiness Level (TRL)*

8 **Payload Systems (PS)** 6
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10 **Launch Service Provider (LSP) Systems**

Earth-to-LEO Launch Vehicle	9	9	9	COTS service is available from multiple vendors
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TIB Fairing (if applicable)	5	6	7	COTS service is available or planned by multiple vendos
ACS Transportation Packaging	9	9	9	Commerical Cargo is a COTS service

NOTES:

*As defined in NASA/SP-2007-6105 Rev 1 pg 296. Include rational for stated TRL.

APPENDIX C
ALPHA CUBESAT SLS PAYLOAD QUESTIONNAIRE <FWD-003>

PAYLOAD INFORMATION	
General Information Explanation	**Payload Customer Input:**
Use payload full name & acronym in parentheses.	Alpha CubeSat (ACS)
Name of the organization sponsoring the payload. This may be an international partner or a NASA research integration office or other.	NASA Cube Quest Challenge
Need contact name for future payload resource questions.	Principal Investigator (PI): Gary P. Barnhard Project Manager (PM): Ethan Chew Interface Engineer (IE): Michael Doty
Contact e-mail address and phone number, including area code.	E-mail Address: gary.barnhard@xisp-inc.com Phone Number: +1 301 229 8012
Contact address to include street, city, state, & zip code.	Team Alpha CubeSat c/o XISP-Inc 8012 MacArthur Boulevard Cabin John, MD 20818-1608
Can be Astronomy, Astrophysics, Exploration, or other. Please denote as manned or unmanned.	Other, unmanned
Briefly describe the payload in its deployed and stowed formation. Include brief listing of key subsystems.	**Stowed configuration:** *1Ux2Ux3U (6U total volume)* CubeSat accommodated by NASA furnished Planetary Services 6U launcher. Systems/subsystems include: Ka Band radio, Nitrous Oxide & Infused Paraffin hybrid orbital injection motor, ion thrusters (four) with solid iodine propellant, body mounted conformal integrated solar array & receive/transmit antenna, integrated Electrical Power System with batteries, power management and distribution, Data Management System, Attitude Determination & Control System,

	Guidance Navigation & Control System, Thermal System, Primary Payload, Structures & Mechanisms, and Scar for Secondary Payload (future). **Deployed Configuration:** *1Ux2Ux3U (6U total body volume)* with 36 U deployed surface area of integrated solar array & receive/transmit antenna. . Systems/subsystems include: Ka Band radio, Nitrous Oxide & Infused Paraffin hybrid orbital injection motor, ion thrusters (four) with solid iodine propellant, body mounted conformal integrated solar array & receive/transmit antenna, integrated Electrical Power System with batteries, power management and distribution, Data Management System, Attitude Determination & Control System, Guidance Navigation & Control System, Thermal System, Primary Payload, Structures & Mechanisms, and Scar for Secondary Payload (future).
Briefly describe the objective/operation of the payload.	Successfully navigate from EM-1 translunar trajectory deployment using alternate minimum energy trajectory to deep space target past 4 million kilometers completing various communications challenges (deep space derby), transition to translunar trajectory passing through Earth/Moon L2 and into Lunar orbit, complete various other communications challenges, and finally impact the surface of moon.
List any foreign partnership/participation.	None.
Is any part of the payload or data proprietary? Explain.	Fully optimized orbital trajectories may be patentable. Various System/Subsystem elements may be covered by one or more non-disclosure agreements.
Name of person who completes the questionnaire, if different from PI.	Principal Investigator
Date questionnaire is completed.	July 3, 2015

PAYLOAD PHYSICAL PARAMETERS (STOWED)			
Resource	**Definition**	**Units**	**Payload Needs**
L x W x H	Length and Width (or diameter) and over all Height, in its stowed configuration. (to one decimal place)	in. x in. x in.	9.4 in x 14.4 in x 4.5 in
Weight	Weight of stowed configuration including any propellants and expendables. (to one decimal place)	lbm	30.9 lbm
Center of Gravity	Estimate the stowed payload center of gravity with the reference plane starting at the base of the payload. Coordinates of X, Y, & Z with X being along the centerline of the vehicle. (to on decimal place)	X = in. Y = in. Z = in.	X= 0 in. Y = 2.3 in. Z = 7.2 in.
Cube Class	3U, 6U, 12U, larger, or different class	xU	6U
Unit Count	Number of deployable objects within payload (cluster or swarm)	1, 2, …., x	One (1), Alpha Cubesat spacecraft
Transmission Frequency	Identify what frequency your payload will use to communicate with ground or other. Stipulate difference between receiving and transmitting frequencies.	MHz & Watts	Spacecraft: Alpha CubeSat Ka Band, TX, 32 GHz, 7 Watts Ground Station: DSS-25 Ka Band, RX, 28 GHz, 25 Watts

PAYLOAD GROUND TRANSPORT TO KSC			
Resource	**Definition**	**Units**	**Payload Needs**
Power	No power in transport, acceptable?	Yes or No	Yes
Temperature	Ambient Environment (45° to 100°F), acceptable?	Yes or No	Yes
Vibration	Define, if any, shipping "g" limits?	g	None specified, no requirement
Shock	Define, if any, drop shock limits?	g	None specified, no requirement
Environment Monitoring	Does the payload need thermal /vibration limit/shock limit / humidity monitoring during ground transport?	Yes or No: If Yes, List Environments to be Monitored	None specified, no requirement
Other	List any other needs or resources to the payload.	Optional	None specified, no requirement

PRE/POST PAYLOAD INTEGRATION IN MSA (AT MPCV FACILITY OR AT VAB)			
Resource	**Definition**	**Units**	**Payload Needs**
Power	Is 28Vdc trickle charge [TBR] needed?	Yes or No	Yes
	If yes, what amperage?	Amps	1.0 Amp would be acceptable [TBR]
	If yes, how long is trickle power needed?	hours, days, or weeks	Until umbilical is disconnected from payload ring prior to launch, objective is to launch fully charged
	List type & power size of battery in payload.	NiCad, Li ion, etc. Volts & watts	Li-Ion 2.6 Ahr + up 5.2 Ahr addon if volume and mass budget permit 12 +/- 2Vdc
Environment Restrictions	Are there any environment restrictions (temp., humidity, etc.)?	Show Appropriate Unit	None specified, no requirement
Facility Support	Will you perform any test & check-out before payload/deployer installed in MSA?	Yes or No If Yes, brief description of activities.	Yes. The battery state of charge will be verified and a check for any damages incurred during transportation will be conducted. If not required to do previously, the installation of the Nitrous Oxide gas bottle (open the deployer, insert bottle, and screw in to stop) and verification that there are no leaks will be performed at this point. The status of any remaining remove-before-flight inhibits will be verified and their removal coordinated with the MSA installation team.
	List needed services.	Power, N2, etc.	Power
	List needed equipment.	Table,	Table, lighting, Nitrous Oxide

		lighting, etc.	sniffer, camera, electrical pig tail, laptop, test & status verification software.
Other	List any other needs or resources to the payload.	Optional	None have been identified at this time.

PAYLOAD ON THE PAD (PRELAUNCH)			
Resource	**Definition**	**Units**	**Payload Needs**
Pad Dwell Time	Can payload handle 2 months on pad without services (i.e. trickle charge)?	Yes or No If No, what is maximum dwell time?	Yes.
Dry N2 Purge	Can payload handle a 6 to 12 hour dry nitrogen purge during vehicle tanking, prior to lift-off?	Yes or No	Yes.
	Can payload handle a temperature range of (-100°F to 80°F)?	Yes or No	No. There are issues with respect to the cold side of the temperature range. This can be mitigated by the use of the trickle charge and/or turning on some portion of the equipment.
Other	List any other needs or resources to the payload.	Optional	None have been defined at this time.

PAYLOAD DURING ASCENT (LAUNCH THROUGH MPCV DEPARTURE & DISPOSAL BURN (~4 TO 5 HOURS)			
Resource	**Definition**	**Units**	**Payload Needs**
Ascent	Can payload handle maximum vibration level of [**TBD-002**]?	Yes or No	Yes [Payload track as a requirement and will be tested to value when specified]
	Can payload vent air during ascent at the rate of x.x psi/sec?	Yes or No	Yes [Payload track as a requirement and will be tested to value when specified]

	Does the payload contain any pressure vessels or trapped gas enclosures?	Yes or No If Yes, then describe volumes & pressures.	Yes. Nitrous Oxide cylinder. Current place holder is Department of Transportation (DOT) approved Nitrous Oxide bottle. The bottle includes an NOS/CGA-approved high-flow valve and built-in siphon tube. For extra safety, an NOS exclusive blow-off venting system is included. If the bottle is overfilled or if pressure increases beyond the maximum safety level, the vent opens and discharges the nitrous in a [TBR] safe direction.
	List any other needs or resources to the payload.	Optional	None have been defined at this time.

PAYLOAD DEPLOYMENT (POST ICPS DISPOSAL BURN, PRE SECONDARY PAYLOAD SYSTEM SHUTDOWN) FIRST DEPLOYMENT OPPORTUNITY IS L+ 4 TO 5 HOURS. MOON WILL BE 3.5 TO 8.5 DAYS AWAY DEPENDING ON LAUNCH WINDOW. LAST CHANCE FOR PAYLOAD DEPLOYMENT WILL BE 8 TO 9 DAYS [TBR] DAYS AFTER ICPS DISPOSAL BURN.			
Resource	**Definition**	**Units**	**Payload Needs**
Deployment	Describe point when payload is to be deployed. Link to time after MPCV departure.	hours or days	Nominally
	Can payload accommodate a 4.6 ft/sec. min. deployment rate?	Yes or No	Yes.
	If other rate desired, specify.	ft./sec.	[TBR]
	Does payload deployment coincide with another payload?	Yes or No	No.
	If yes, identify other payload & state order of deployment.	Brief Description	Not applicable.
	Does payload deploy or expand beyond its stowed configuration?	Yes or No If Yes, give final dimensions ft x ft x ft	Yes. 0.78417 ft x 1.20083 ft x 2.7725 ft
	Can payload delay expansion process by 5 to 10 seconds from deployment?	Yes or No	Yes.
Pointing	Does payload need to be deployed in a particular direction?	Yes or No	No.

	If yes, describe target direction (moon, Earth, other, etc.)	Optional	Not applicable at this time.
Trigger Signal	Does payload need a trigger signal prior to deployment?	Yes or No	No
	If yes, how much time before deployment?	minutes	Not applicable at this time.
Communication	State method for communicating w/ground or other points.	Brief Description	Ka Band radio is the baseline means of transmission and reception. Alternate UHF system may be incorporated subject to mass and volume constraints.
	How long after deployment will payload start transmitting data?	sec., min., hours	30 minutes or less is current baseline. [TBR]
Other	List any other needs or resources to the payload.	Optional	The NASA Deep Space Network will provide support for orbit determination pursuant to the documented Cube Quest Challenge government provided services description in the . "Required Navigation Artifacts for Authenticating Claimed Communications Distances, and Verifying Achievement and Maintenance of Lunar Orbit for Compliance with Cube Quest Challenge Rules – Draft 1.4 January 6, 2015" and subsequent versions.

Disposal	What is method of payload disposal?	Earth reentry, crash on Moon, deep space, other	Crash on the Moon.

OTHER INFORMATION: OPTIONAL
(1) Reference complete Conceptual Design data package