Space Access Technologies, LLC (SpaceAccess)

&

Astronautic Technology (M) Sdn Bhd (ATSB™)

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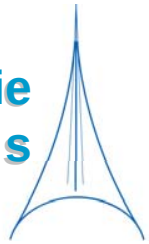
>>Cost Effective access to Space for Research & Education Payloads<<



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Overview

- ***SpaceAccess* was created by the founders of**
  - Design_Net Engineering (DNet)--Gerry Murphy
  - TriSept Corporation (TSC)--Rob Spicer

  ⇒ In response to the space industry's need for more regular and cost effective access to space

- ***SpaceAccess* is devoted to finding rapid response spaceflight opportunities for**
  - Science &Technology Payloads across DOD, NASA, University, and Commercial sectors

SpaceAccess Partners

Founding Partners

- ***DNet* specialize in avionics and provides cost effective, quality solutions in the areas of**
  - Systems, Electronic/Electrical, Mechanical, and Software Engineering services for government, commercial, public and private sector customers
- ***TSC* specialize in integration and operations, with areas of expertise in**
  - Program Management, Systems & Software Engineering, Launch integration & Operations, Mission design & Flight operations, Custom software development, Network communications, and new technology research & development

Major Partner

SpaceAccessTechnologies

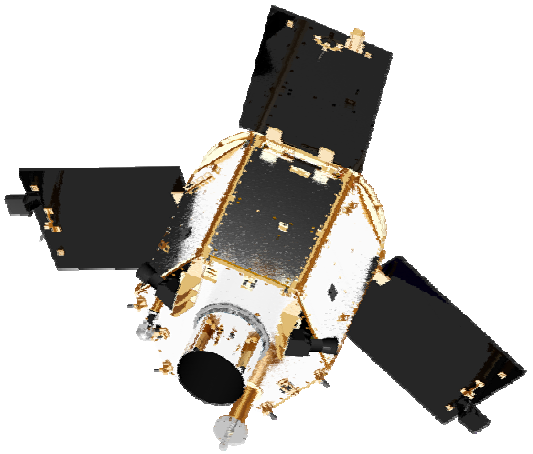
- ***Astronautic Technology (M) Sdn Bhd (ATSB™)***
  - Established in 1997 with the development of TiungSAT-1 to thrust Malaysia into the orbit of nations with space and related technologies

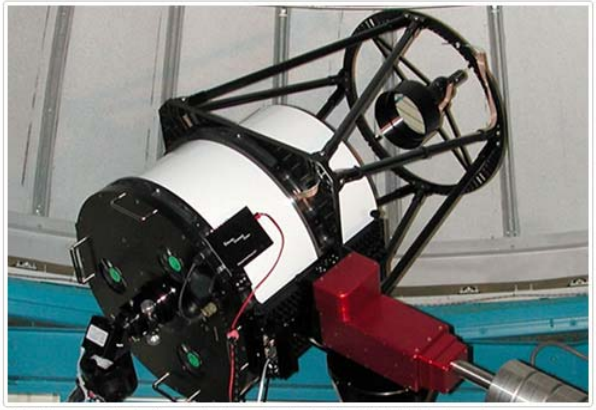
  Mission
  - To develop advanced space systems and related technologies that will provide value-added applications for our customers globally

  Vision
  - To be at the forefront of space and related technologies development and value creation for the advancement of society

The range of products and services include

- **Spacecraft Technologies**
  - Design, Manufacturing & Operations
- **Space and Ground Optical Systems**
  - High Resolution Cameras and Telescopes
- **Satellite Mission Study**
- **Satellite Launch Management**
- **Satellite Imaging and Related Products**
- **Ground Station Systems**
- **Radiation Detectors**
- **Project Management & Consultation**
- **Trainings in Spacecraft Technology**

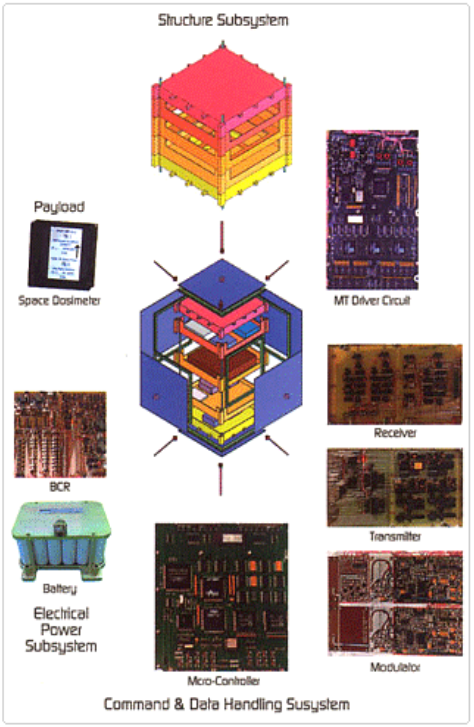


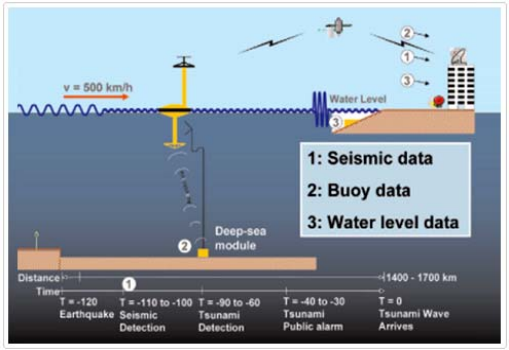


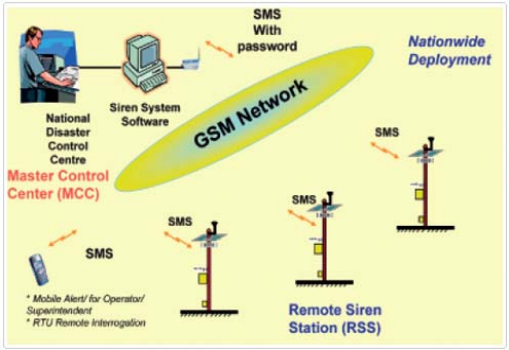
Main telescope with robotic equatorial mounting that will be installed in the observatory. This is a 50 cm Ritchey-Chrétien telescope.

Current Projects

- **RazakSAT™**
  - Completed & ready for launch in 2007
- **D-SAT**
  - Nano-class Satellite
- **CubeSAT & InnoSAT**
  - Pico-class Satellite/CubeSat-class
- **Near-Equatorial Orbit (NEqO) Satellite Constellation**
- **Communication Satellite Feasibility Study**
- **Tsunami Early Warning Systems**
- **Robotic Telescope**
- **Radiation Detector**



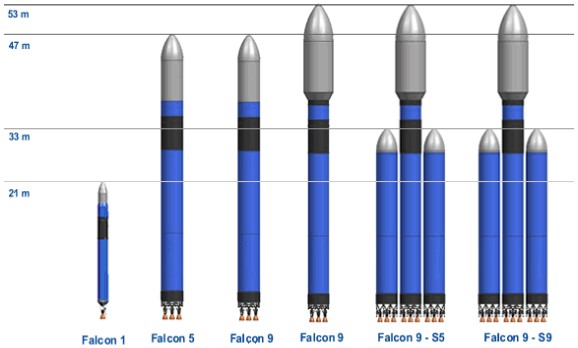




Major Partner

Space Exploration Technologies Corporation (SpaceX)

- SpaceX is developing a family of launch vehicles intended to reduce the cost and increase the reliability of access to space
- SpaceX HQ is located in Southern California
- Falcon 1, Falcon 5 and Falcon 9 LVs offer light, medium and heavy lift capabilities into any inclination and altitude, from low Earth orbit to geosynchronous orbit to planetary missions



	Falcon 1	Falcon 5	Falcon 9	Falcon 9	Falcon 9 - S5	Falcon 9 - S9
LEO	570 kg	4,100 kg	9,300 kg	8,700 kg	16,500 kg	24,750 kg
GTO	--	1,050 kg	3,400 kg	3,100 kg	6,400 kg	9,650 kg
Fairing diameter	1.5 m	3.6 m	3.6 m	5.2 m	5.2 m	5.2 m
Price in millions *	$6.7	$18	$27	$35	$51	$78

* Prices are all inclusive of launch range, third party insurance and standard payload integration costs.

- ***SpaceX provides launch services to SpaceAccess for RideShare opportunities***

Other Partners

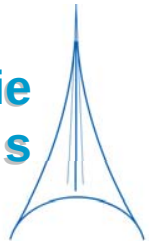
- ***Cal Poly* focuses on facilitating the CubeSat community in finding practical, reliable, and cost-effective launch opportunities. In addition to providing**
  - A CubeSat standard physical layout and design guidelines;
  - A standard flight proven deployment system (P-POD);
  - Coordination of required documents & export licenses;
  - Integration & acceptance testing facilities with formalized schedules;
  - Telemetry information

Other Partners (Cont)

SpaceAccessTechnologies

- **We have MOUs with the following organizations:**
  - USURF/SDL
  - USRA
  - FSRI
  - MIST
  - Others in work (e.g. Garvey, Ecliptic)
- **Each of these organizations bring a specific capability to the table—each share our vision for low cost access for education and a means to help make it happen**

SpaceAccess's Vision



- **Provide Regular, Cost Effective access to space for Research & Education Payloads via various U.S. Launch Vehicles (LV).**
- **The following LV's are either under MOU with Space Access or in some stage of negotiation**

1. SpaceX LV: *Falcon 1*
2. Orbital LV via USAF STP and USURF: *Minotaur*
3. Lockheed Martin LV: *Atlas 5*
4. ATK

Rideshare Enablers

SpaceAccessTechnologies

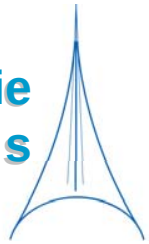
1) The right launch vehicles:

- Small, rapid response, cost effective, rideshare “friendly”
- < $10M for rideshares (dictated by $ available)
- Launch from US ranges

2) Processes that support rideshare:

- Manifest process that encourages rideshare & cost buy-down
- Process for integrating several payloads per flight and completing the mission design in short order and for low cost
- Processes for rapid accommodation of the resulting space vehicle by the LV
- Streamlined range operations

Rideshare Enablers (cont.)



3) Rapidly Configurable "Rideshare Bus" that:

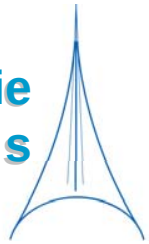
- Uses standardized components and interfaces
- Has well defined *Processes* for rapid configuration / integration
- Supports individual instruments with robust services
- Supports other small S/C classes (e.g., ESPA, Nanosat, FalconSAT, RocketPod, CubeSat)
- Allows ease of integration to the LV
- Provides streamlined on-orbit operations

4) The right business partnerships

5) A political climate that supports commercial launch

SpaceAccess's RSAs

SpaceAccessTechnologies



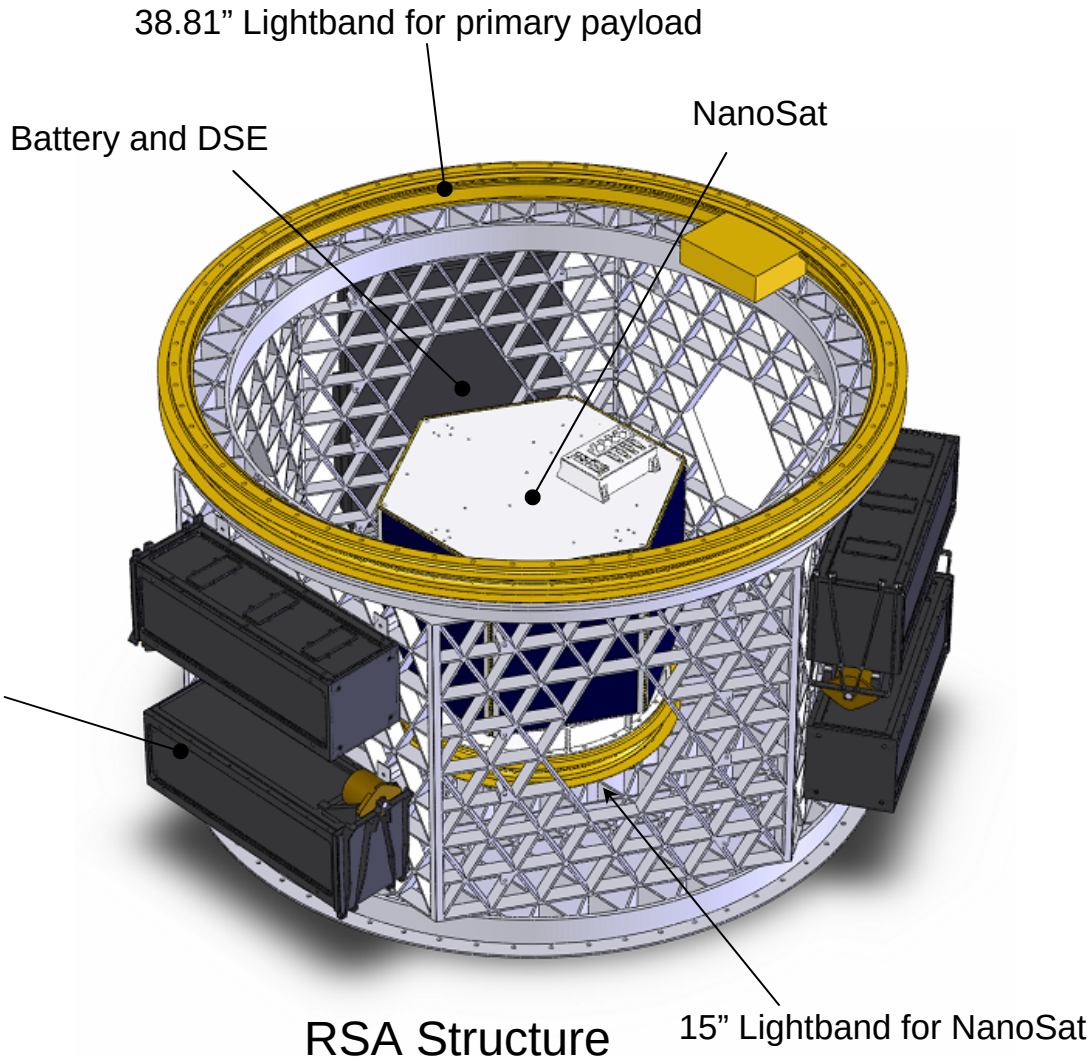
- **Develop standard adapter structures for various LV's (the "RideShare Adapters" (RSAs)), that enable multi-payload manifesting or ridesharing**
- **RSAs are expected to facilitate**
  1) efficient mission specific configuration,
  2) efficient integration of payloads,
  3) effective and rapid integration to launch vehicles
- **RSA for Falcon Class in Qual, others in design**

Promote more responsive and affordable access to space

RSA - SPASS

SpaceAccessTechnologies

- **Secondary Payload Adapter and Separation System**
- **Designed by SpaceAccess**
  - To fully utilize RazakSAT™ excess launch capacity on Falcon 1
  - To support CubeSat and university satellite community
- **ATSB initiated & owns the IP to the RSA-SPASS**

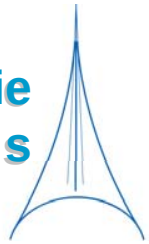


RSA Structure

- **Six classes of payloads (P/Ls) will be served by the Falcon Class RSA:**

Payload Type	Capability	Quantity Per RSA Launch
"Primary"		
Stand-alone spacecraft bus	**Mass:** up to 440lb (200kg) (TBR) **Size:** ≤ 48" (121.92cm) O.D. x 36" (91.44cm) height **Location:** Sits on top of RSA	1
"Secondary"		
"Half ESPA"	**Mass:** up to 198lb (90kg) (TBR) **Size:** ≤ 24" (60.96cm) x 24" x 19" (48.26cm) **Location:** Stowed within the RSA	1
Nanosat-class	**Mass:** <66lb (30kg) **Size:** <18.7" (47.5cm) O.D. x 18.7" (47.5cm) height cylinder to fit CAPE mechanism **Location:** Stowed within the RSA	1
"FalconSAT"-class	**Mass:** < 44lb (20kg) **Size:** <14" (35.56cm) cube **Location:** Stowed within the RSA	2
RocketPod-class	**Mass:** <4.4lb (2kg) **Size:** <3.94" (10cm) "standard CubeSat" <3.94 × 3.94 × 5.51" (~10 × 10× 14 cm) "CubeSat-Plus" **Location:** Stowed within the RSA or Mounted around the RSA	Up to 8
CubeSat-class	**Mass:** 1U: <2.2lb (1kg); 2U: < 4.4lb (2kg); 3U: <6.6lb (3kg); **Size:** Meets normal CubeSat ICD specification **Location:** Mounted around the RSA circumference	Up to 24 1U CubeSats (8 P-PODs)
RSA also designed to be compatible with mechanical interface of the designated LV conical adapter as well as with the 38.8" (985.52mm) Motorized Lightband (MLB) deployment system		

SpaceAccess Services (cont.)



- **Launch goal of <12 months from manifest ATP (assuming P/L will meet schedule)**
- **Equitable cost sharing among all payloads—*you buy your fair share of the ride!***

"Not based on weight alone!!"

Launch Opportunities

SpaceAccessTechnologies

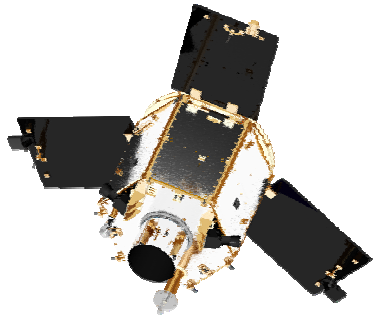
- **Upcoming Rideshare Opportunity**
  - SpaceX: Falcon 1 LV
  - Orbit: h ~ 684.9 km; i ~ 9 deg; e <0.005
  - Current Official Launch Date: July 2007
- **Projected Delivery Date of University CubeSats to Cal Poly for Integration with P-PODs:**
  - Required by April 2007 ⇒ 16 weeks Prior to Launch
    - Cal Poly will be ready to start integrating Academic CubeSats by March 2007
- **CubeSat Integration**
  - Education flow
  - Commercial flow

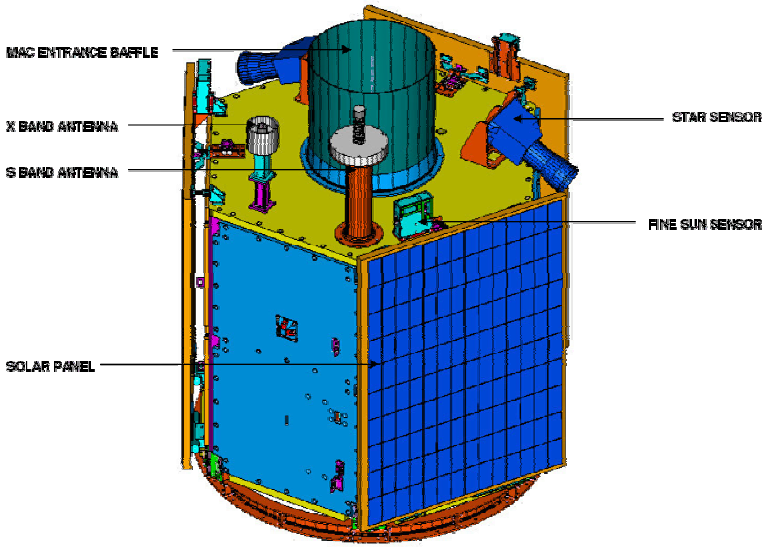
Primary Satellite

RazakSAT™

- A small remote sensing satellite in high resolution space-imaging system
- Payload – Medium-sized Aperture Camera (MAC)

Altitude	685 km
Inclination	9°
Payload (MAC)	GSD: 2.5 m (PAN), 5 m (MS) Swath width: 20 km @ 685 km
ADCS	3-axis stabilized (4 RW) Pointing accuracy: < 0.2° Pointing knowledge: 1 arcmin
EPS	GaAs/Ge solar cells, NiCd batteries
C&DH	TS68EN360 CPU@25MHz
TT&C	Uplink: 9600 bps/1200 bps S-band Downlink: 38.4 kbps/9600 bps/ 1200 bps S-band
Payload Data Management	32 Gbits On-memory 30 Mbps X-band downlink
Structural and Thermal	Ø 1200 X 1200 mm Hexagonal shape Mass: < 200 kg Modular Structure Passive & active thermal control
Mission Lifetime	> 3 years



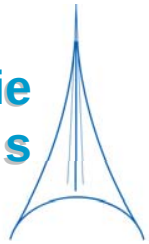


- **Services Provided by ATSB™**
  - Mass to Orbit!!!
  - **Ground Tracking Support**
  - **Telemetry Support**
  - Malaysian Ground stations
    - Longitude: 101.57443 deg; Latitude: 3.09305 deg
    - Antennas: 2m Yagi (~140MHz); 70cm Yagi (~440MHz)
    - Availability: 14 links per day
      - 6 links per day required for Malaysia CubeSats
      - 8 links per day available for other CubeSats
    - Time in view: ~14.35min per pass

• Current Payload Manifest

Payload Type	Available Slots	Status	Customer	
Primary (< 200kg)	**1**	✓ Taken	ATSB™: RazakSAT™	
Secondary Nanosat-class (< 30kg)	**1**	Available	Potential: ATSB™ D-SAT	
Secondary CubeSat-class (< 1kg)	**12 – 18*** More mass may be available → so important to reserve slot to be considered *Total number of available slots dependent on launch margin	**6 slots** Taken	•*ATSB™ Malaysia:* 2 x 3U CubeSats (2 whole P-PODs) •*Bahcesehir University Turkey:* 1U CubeSat--**Aysem** •*Montana State University:* 2U CubeSat--**Electra** •*University of Sydney:* 1U CubeSat--**CASsat** (TBC)	•*Tethers Unlimited:* 1-3 x 1U CubeSats--**SPEECH1**, **SPEECH2**, **SPEECH3** (TBC) •*NCK University Taiwan:* 2U & 1U CubeSats--**PACE, YamSat** (TBC) •*Boeing*: 3U CubeSat

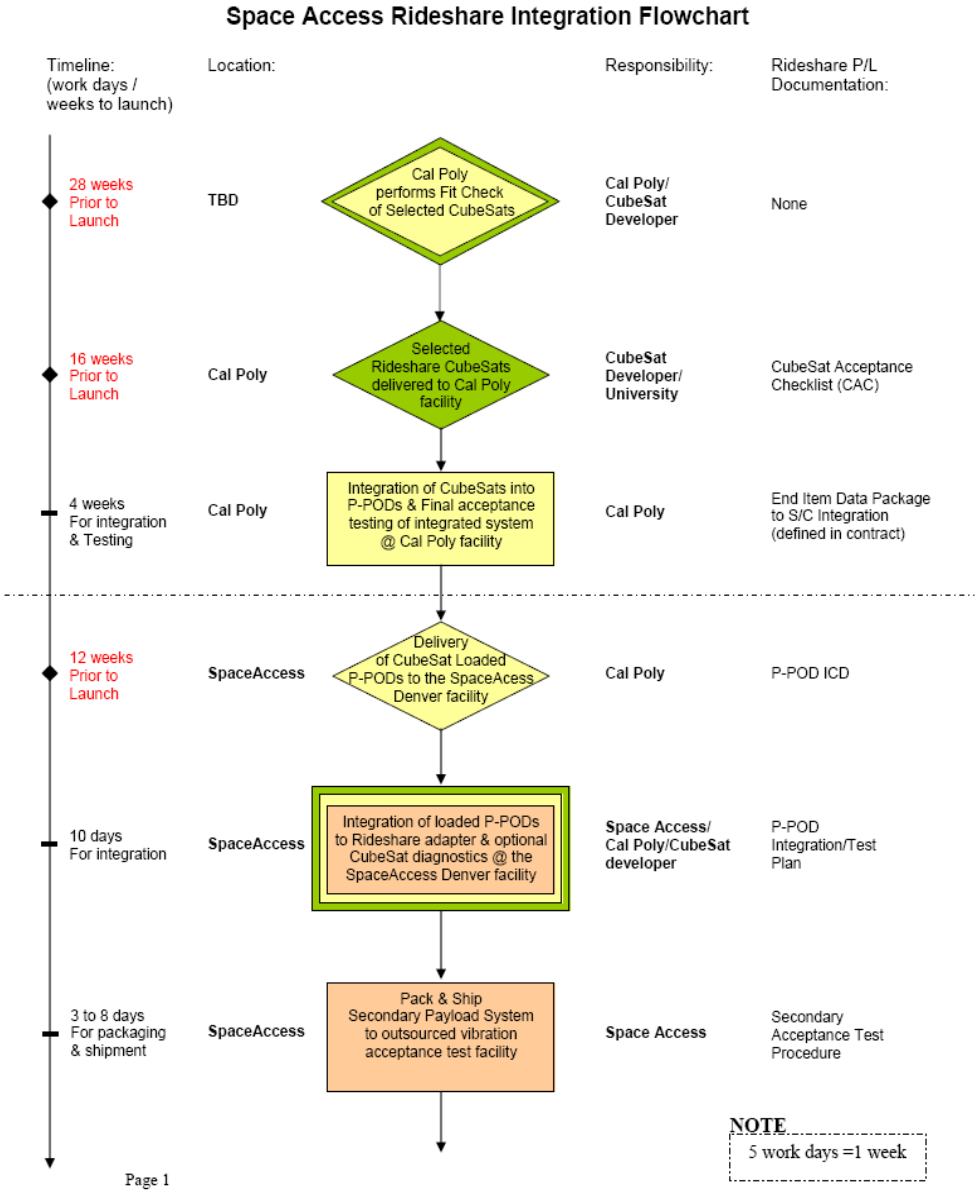
- **Secondary CubeSat-class (< 1kg) Manifest**
  - *ATSB™ Malaysia:* 2 x 3U CubeSats - **CubeSAT, InnoSAT**
  - *UMES/Hawk Institute for Space Science:* 1U CubeSat - **UMES Sat 1**
  - *Boeing*: 3U CubeSat
  - *Tethers Unlimited:* 1-3 x 1U CubeSats – **Structual ED Propulsion Demonstration**
  - *Bahcesehir University Turkey:* 1U CubeSat - **Aysem**
  - *Montana State University:* 2U CubeSat - **Electra**
  - *University of Sydney:* 1U CubeSat - **CASsat** (TBC)
  - *NCK University Taiwan:* 2U & 1U CubeSats - **PACE, YamSat** (TBC)

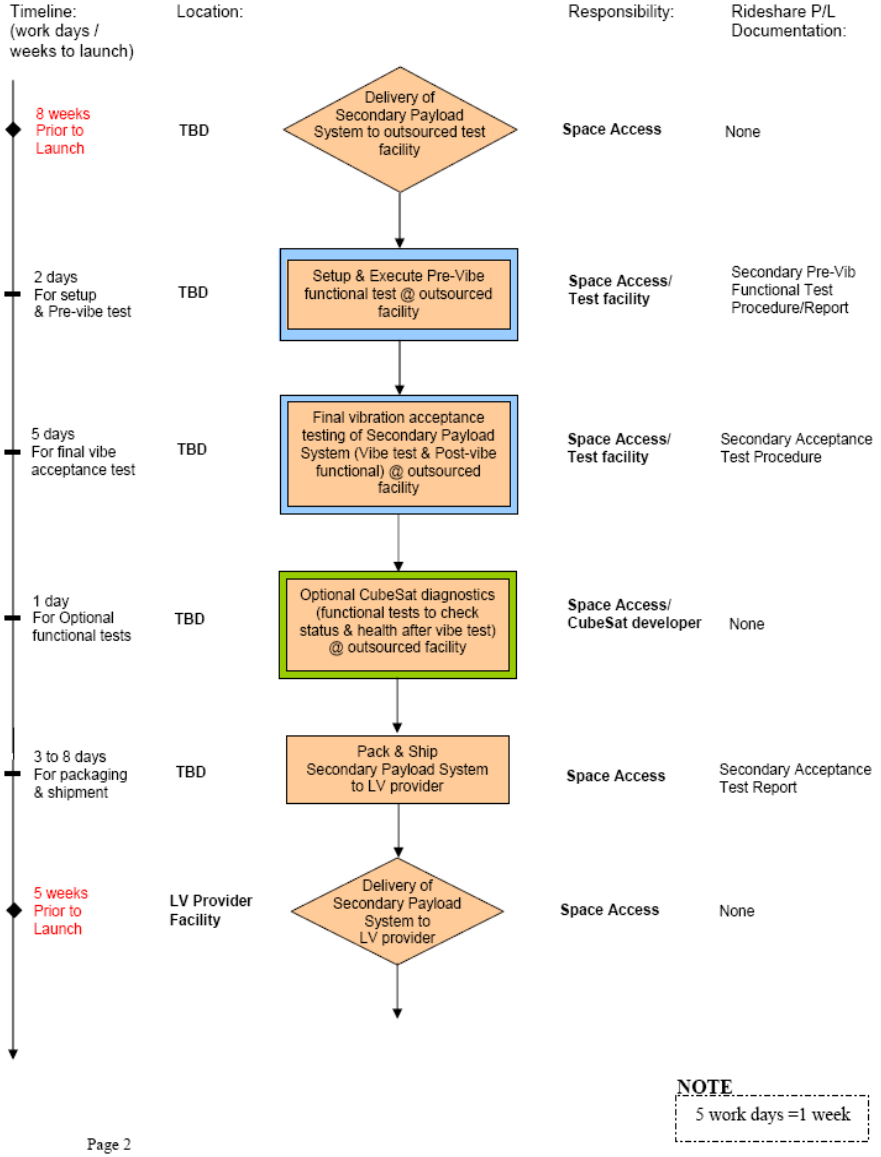


- **Manifest Milestones**
  - **Complete Space Access's "Request for Spaceflight Services" form (http://www.access2space.com)**
    - Space Access checks their rideshare manifest for availability & compatibility
  - **Sign Official Space Access Contract for Desired Rideshare opportunity (manifest study only)**
    - Pay defined down payment to Space Access at time of contract sign-up
  - **After launch opportunities have been identified by SpaceAccess, sign up for Payload Processing and Integration contract**

- **Manifest Milestones**
  - **Projected Delivery Date of CubeSat integrated P-PODs to SpaceAccess for Integration with RSA:**
    - Required by May 2007 ⇒ 12 weeks Prior to Launch
      - RSA adapter will be ready to accommodate & start integrating CubeSat integrated P-PODs by April 2007
      - Alternative delivery date may be negotiated on a case-by-case basis

Space Access Rideshare Integration Flow





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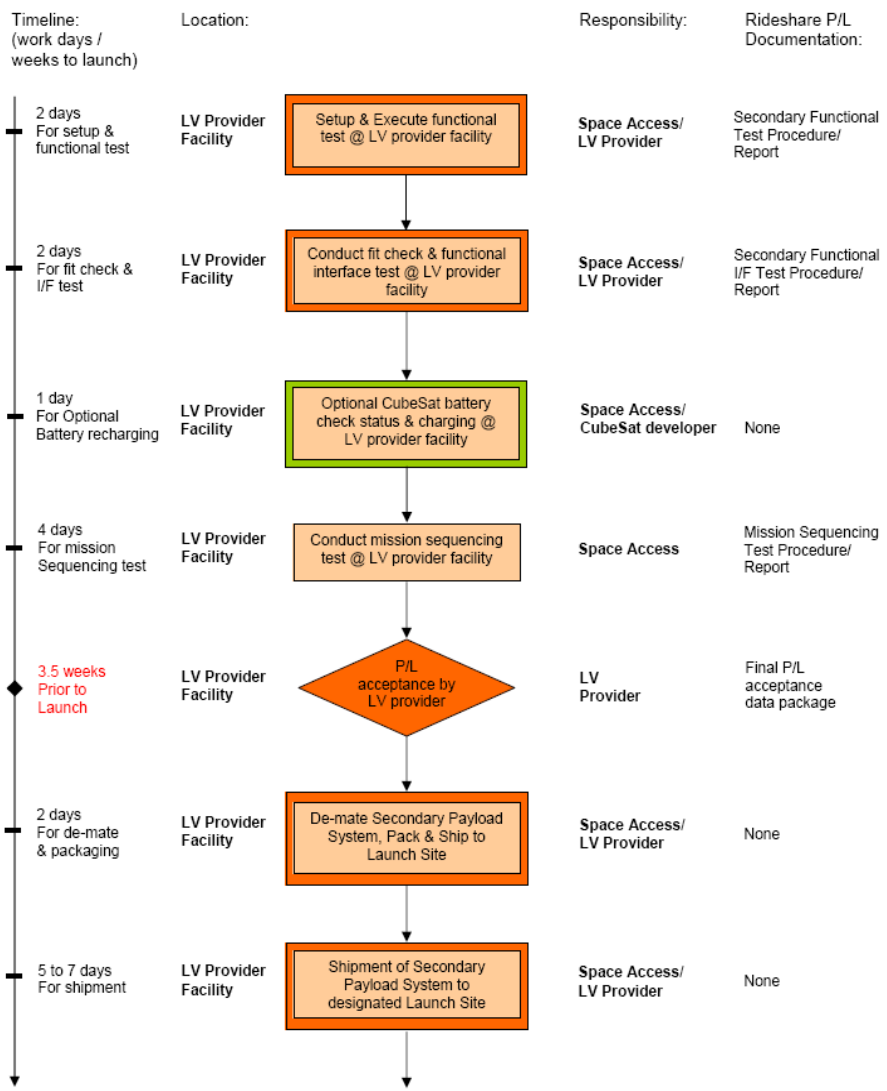

NOTE
5 work days =1 week

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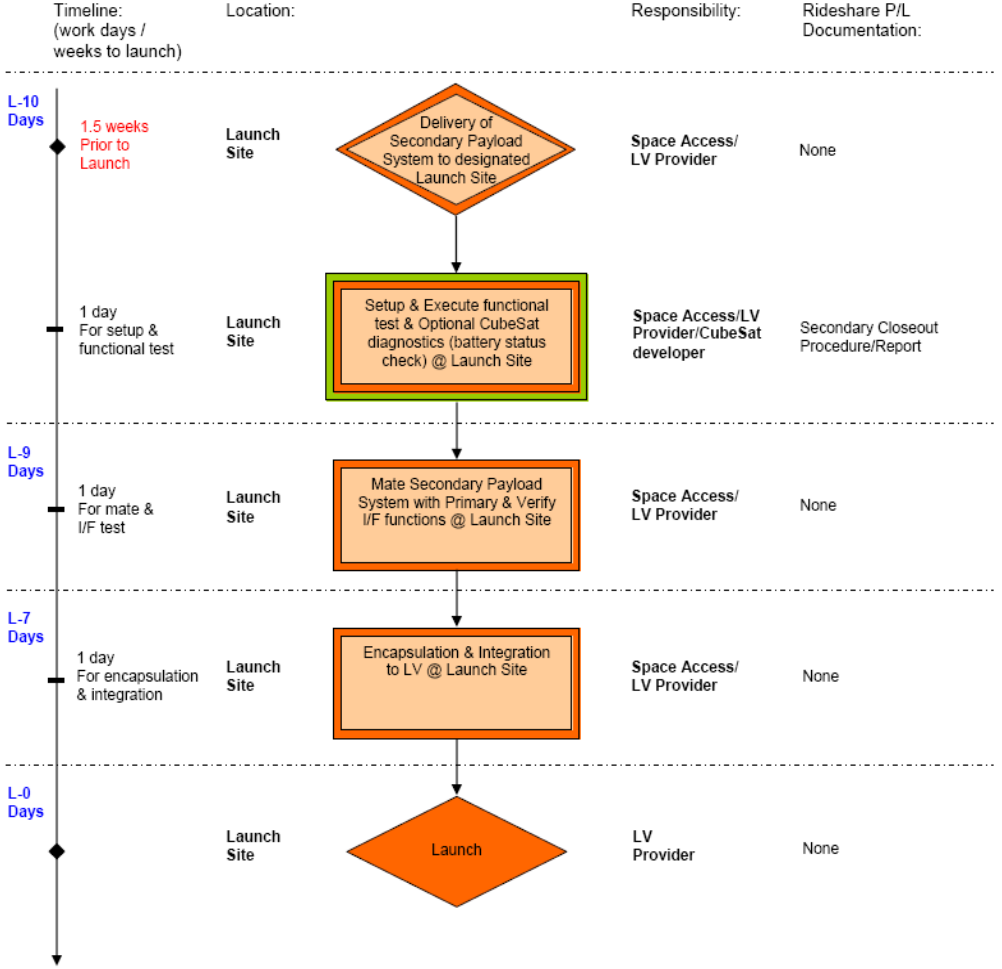

NOTE
5 work days =1 week

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Summary

- **Space Access is working with our partners to combine the needs of the R&D community with those of education**
- **Creating opportunities for small educational payloads is a matter of commitment**
- **We aim to have an educational component on every rideshare mission we help broker**
- **Upcoming Rideshare Opportunity: SpaceX Falcon 1 LV**
  - Current Projected Launch Date: July 2007

Would you like a ride?