SSL Payload Orbital Delivery System (PODS)
"FedEx to GTO/GEO"

May 27th, 2015

For more information, contact:

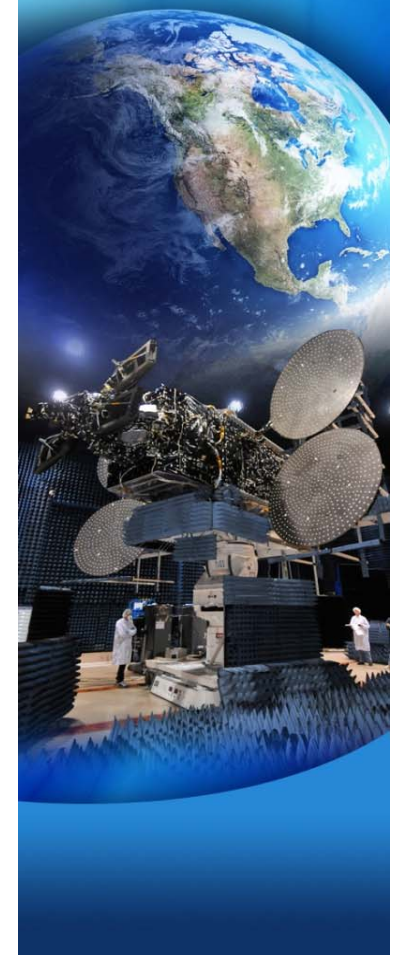**Al Tadros, SSL**
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Cost-Effective, Frequent, Quick Access to GTO/GEO for Small Payloads

◆ **The Payload Orbital Delivery System (PODS) enables cost-effective, high-tempo access to GTO or GEO for small payloads – "FedEx to GEO"**

   ➢ ≤ 90 kg for standard form factor, ≤ 150 kg for extended form factor

   ➢ ~6-8 satellite launch opportunities per year with SSL

   ➢ Standardization of interfaces and form factor enables quick turnaround

   ➢ Commercial primary ensures on-time launch – no one-year or two-year launch slips as can happen with other types of rideshare

   ➢ Launch vehicle independent – payload interface does not change if the launch vehicle changes

◆ **PODS launches are available now**

   ➢ First launch March 2017

      • 60kg available for your payload

   ➢ Frequent opportunities follow
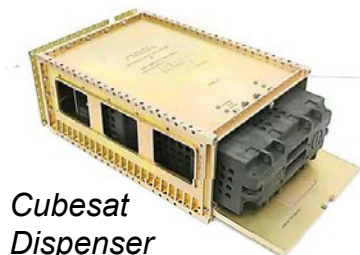
   ➢ Contact us with your mission needs

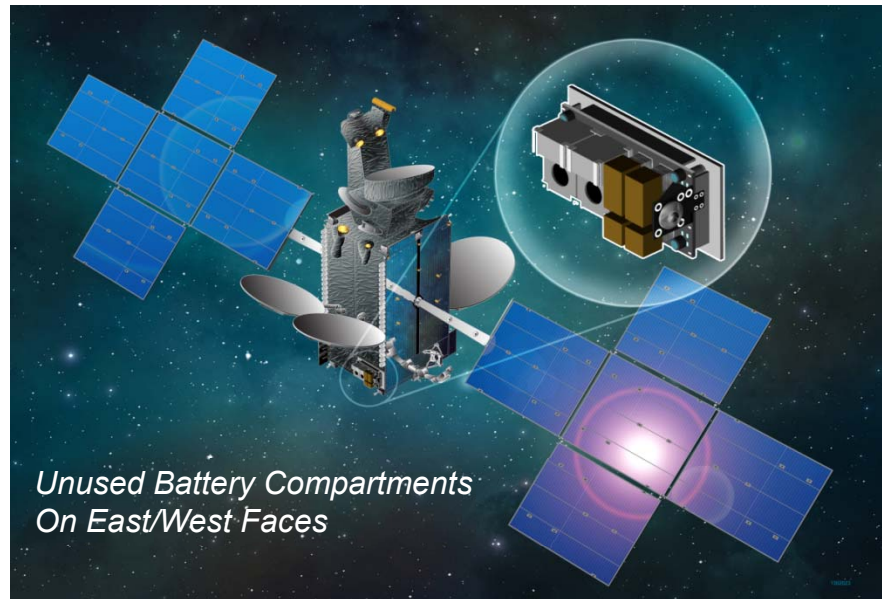# PODS are Hosted Payloads that are Dispensed from the ComSat

◆ Typical pre-release views for different integration locations on the GEO ComSat are shown

◆ Launch location depends on microsatellite volume and ComSat configuration

◆ Payload sizing can go as small as CubeSat

◆ No need for SmallSat provider to interact with the launch vehicle

◆ MicroSatellites are dispensed using the MDA separation system

◆ CubeSats can select a dispenser of their choice

Mid East/West Faces If No E/W OMUX

Anti-Nadir Side of North/South Panels
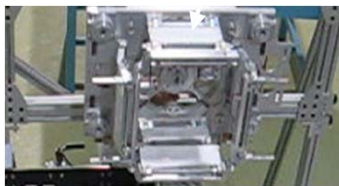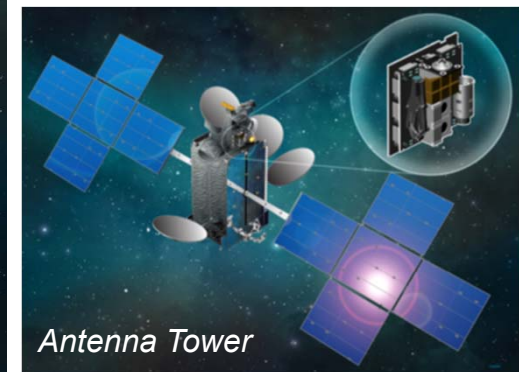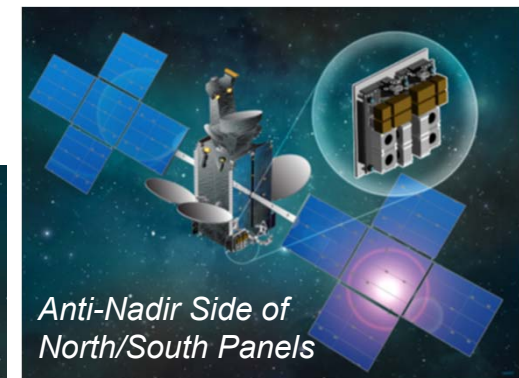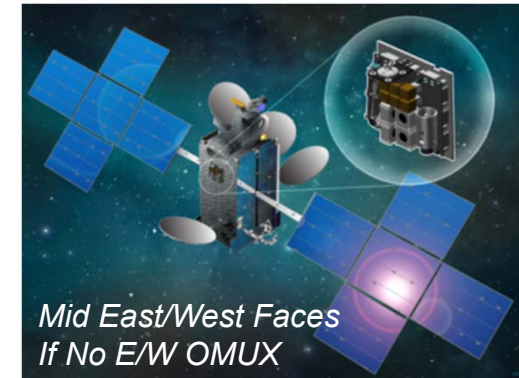
MDA Separation System (*Patent Pending*)

Cubesat Dispenser

*Unused Battery Compartments On East/West Faces*

Antenna Tower

MDA SSL

Mission Concepts

◆ SSL launches on a variety of launch vehicles:

➤ Ariane 5, Falcon 9, Proton, Atlas

◆ SSL works with the SmallSat provider to select a drop-off location that meets the SmallSat mission needs. Popular options include:

➤ Sub-GEO, Super-GEO
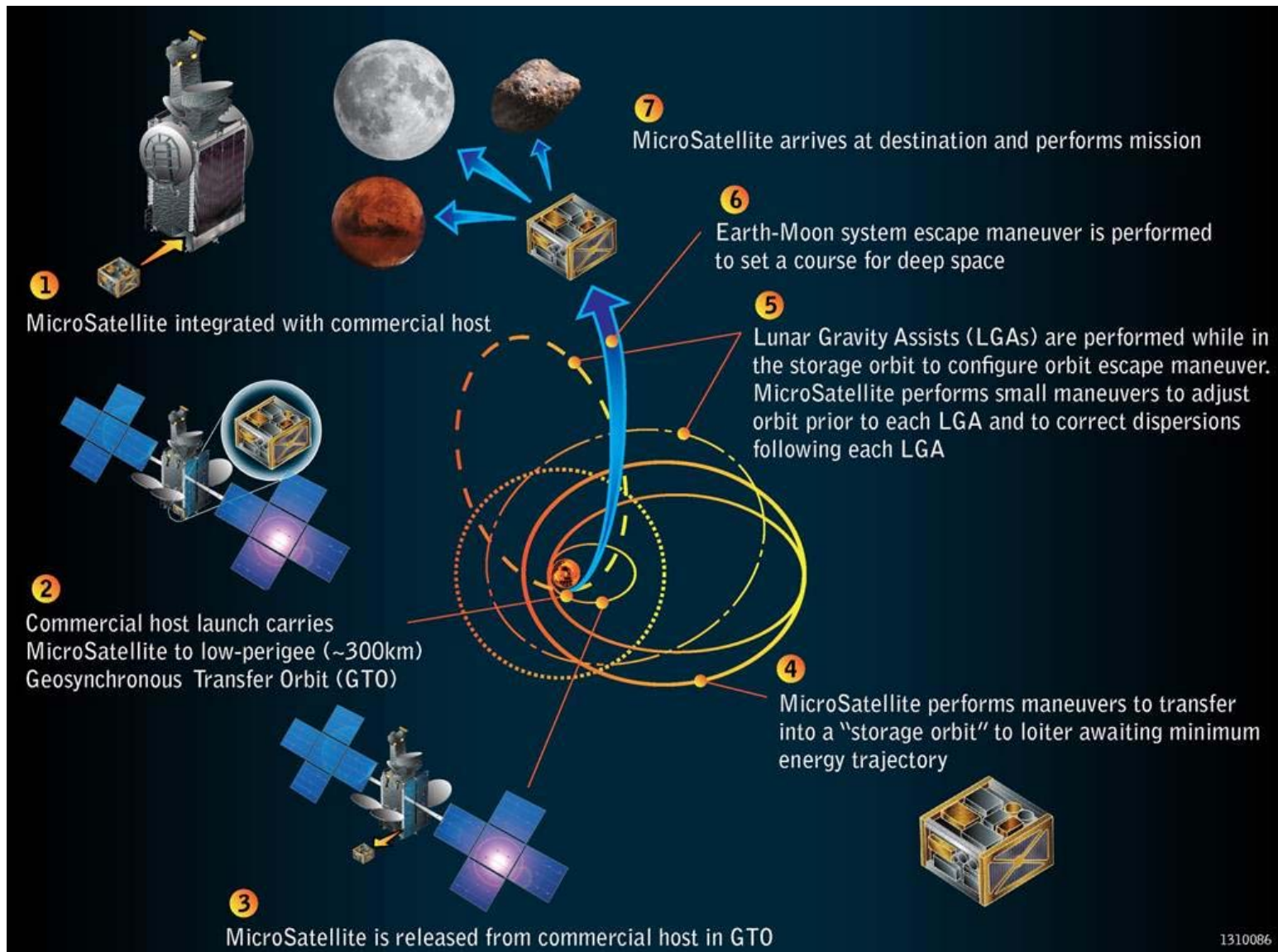
➤ GTO

➤ In-between GTO and GEO

◆ Potential SmallSat missions:

➤ Space Situational Awareness

➤ Satellite Servicing

➤ GEO Infrastructure Resupply

➤ Deep Space Exploration (Moon, Asteroids)

➤ Technology Demo

➤ Many others!

◆ If desirable, the SmallSat can use the GEO ComSat as a data relay if data volumes are large
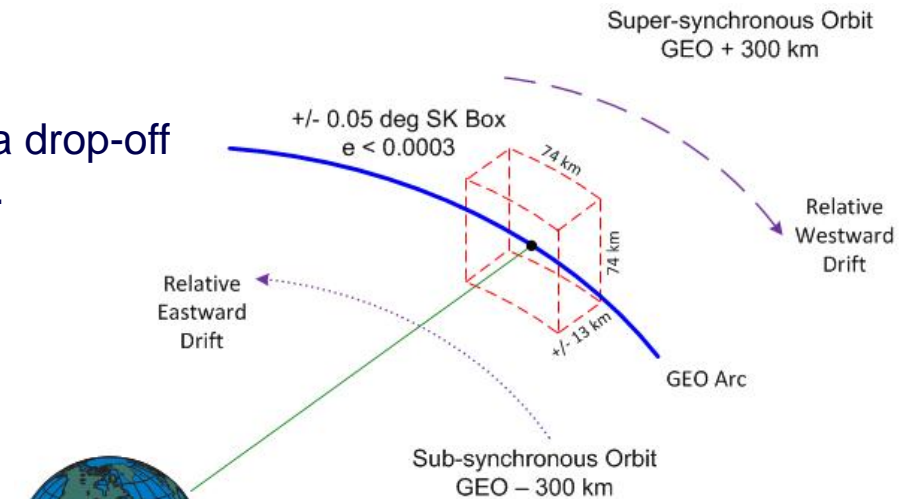
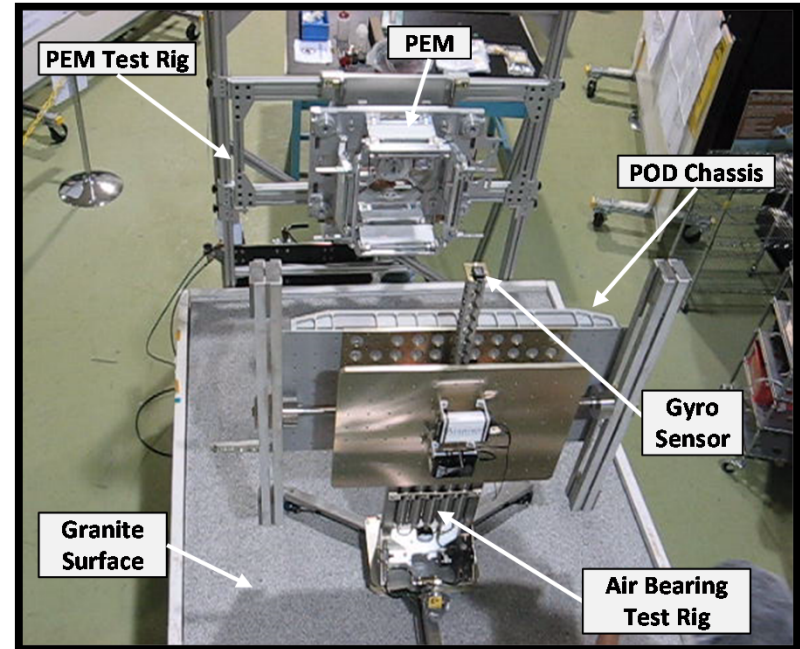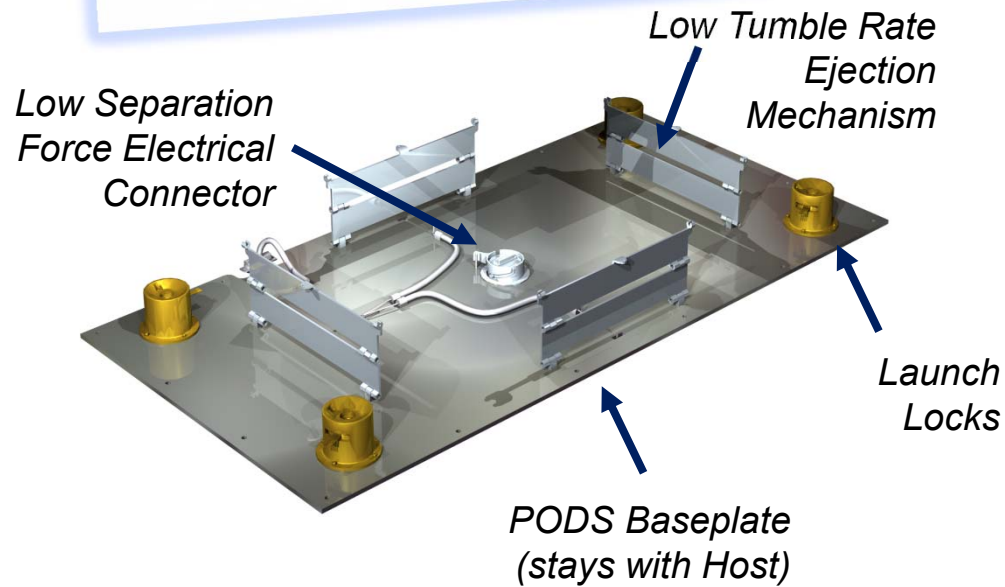| EVENT	RP (KM)	RA (KM)
TRANSFER ORBIT	6628.1	42164.6
POST AMF 1 ORBIT	11695.8	42160.7
POST AMF 2 ORBIT	22546.7	42158.6
POST AMF 3 ORBIT	39463.7	42157.6
POST AMF 4 ORBIT	42100	42157.5
POST TRIM 1 ORBIT	42145.8	42157.4
POST TRIM 2 ORBIT	42157.3	42173.3
GEOSYNCHRONOUS	42155	42173.3

Deep Space Microsatellite Missions - GTO Drop-Off

May 2015   5

PODS Concept – MicroSatellite with MDA Dispenser

Standard PODS
(1m x 0.5m x 0.4m) (L x W x H)

Low Separation Force Electrical Connector

Low Tumble Rate Ejection Mechanism

Launch Locks

PODS Baseplate (stays with Host)

PEM Test Rig

PEM

POD Chassis

Gyro Sensor

Granite Surface

Air Bearing Test Rig
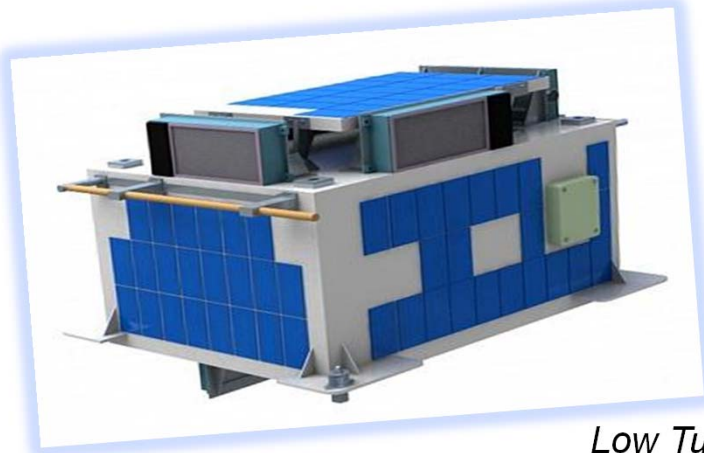
MDA Dispenser
(Patent Pending)

PODS Concept - CubeSats

◆ **CubeSats deployed using PODS can choose from commercially available CubeSat dispensers**
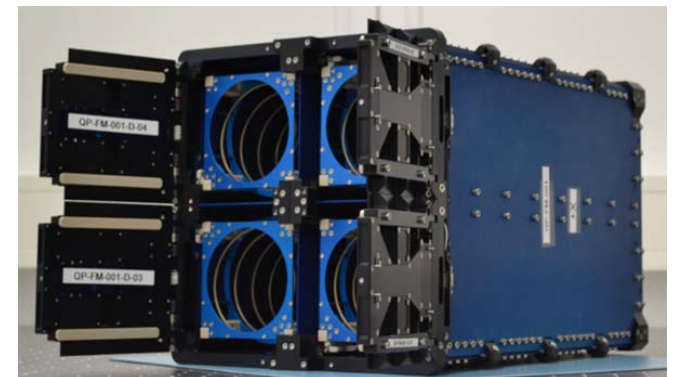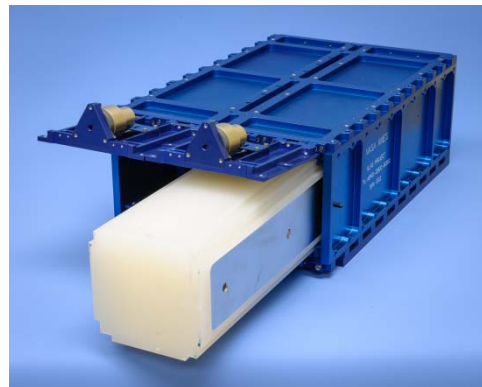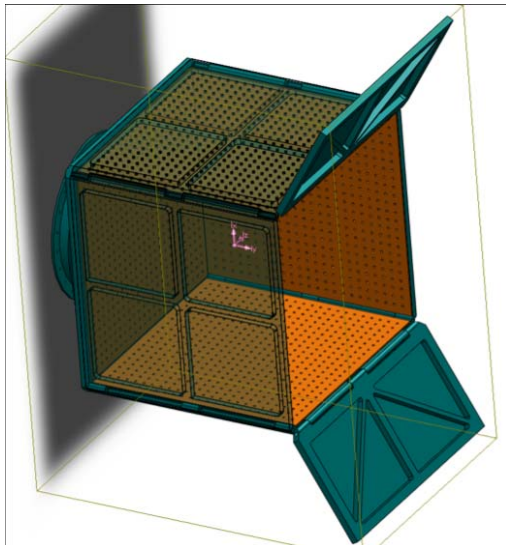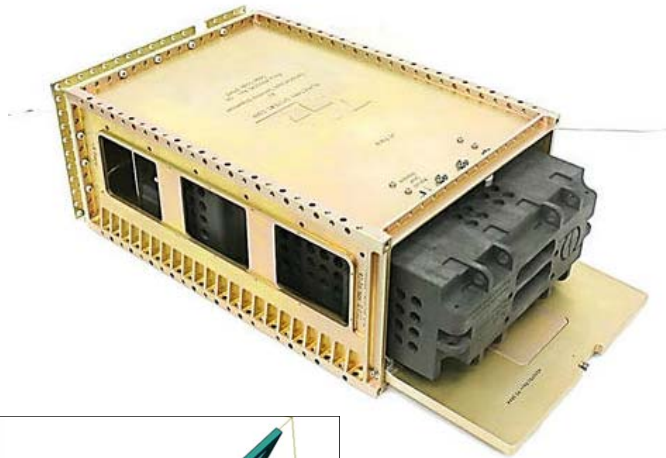
Turn-Key Solutions for Small Satellite Missions

◆ SSL offers a PODS-compatible microsatellite bus specifically designed to be launched using the PODS service

  ➢ User can integrate their payload of choice to meet specific mission needs

  ➢ First PODSBus launch targeted for 2017

◆ PODSBus Parameters:

  ➢ Microsatellite wet mass: 75kg

  ➢ Payload mass: up to 15kg

  ➢ Design life: 5 years

  ➢ Propulsion: Electric Propulsion

  ➢ Propellant: Xenon

  ➢ Dimensions: 1m x 0.5m x 0.5m

SSL PODS Service Takes the MicroSatellite from I&T to Launch

Items Typically Included in Firm Fixed Price Contract:

◆ Program Management

◆ Product Assurance

◆ Systems Engineering Support

◆ Host to POD ICD

◆ Host to POD Adaptor

◆ Analysis (e.g. Coupled Loads, Orbit Raising and Separation, Thermal)

◆ Integration of MicroSatellite to SSL Satellite

◆ Integrated testing

◆ SSL I&T security

◆ Launch Vehicle Contract

◆ ITAR / Export Control Paperwork

◆ Delivery of MicroSatellite to Launch Base

◆ Joint Launch Base Operations including Bi-Prop Loading if necessary

◆ Launch of MicroSatellite to GTO or Near-GEO Orbit

PODS User's Guide Summary Table

MicroSatellite Parameter	Typical Value	User Value
Launch Frequency	6-8 SSL Launch Opportunities per year	
Maximum Volume	1m x 0.5m x 0.4m (Standard Sizing) 1m x 1m x 0.6m (Extended Sizing) Other volumes: ask for specific needs	
Maximum Mass	90 kg (Standard Sizing) 150 kg (Extended Sizing) Other masses: ask for specific needs	
Available power	150W average, 300W peak; 28-31 V	
State During Launch	Off	
Data Connection	MIL-STD-1553 (optional); other interfaces possible	
Thermal Environment	-35°C to + 60°C non-operating + aero-thermal heating during launch	
Launch Dynamics	Acoustic, static, vibration, shock envelope of common launch vehicles (Ariane 5, Proton, Falcon 9, Atlas)	
Ejection Speed	0.25 m/s minimum	
Maximum Tumble Rate	0.5 deg/sec/ axis	
Dispensing Orbits Available	GTO (at apogee), near GEO (300 km sub or super)	
Range Accuracy of Drop-Off	100 m	
In-track accuracy	2 km	
Release pointing accuracy	5 degrees per axis	
Deployment Video Available	Yes	

Summary

◆ **The Payload Orbital Delivery System (PODS) enables cost-effective, high-tempo access to GTO or GEO for MicroSatellites or CubeSats**

➢ **6-8 launch opportunities per year with SSL**

➢ **We are now booking launches for Q1 2017 and beyond**

◆ **Cost-effective access to GTO & GEO combined with recent advances in smallsat technology enables many potential future missions**

➢ **SSL can provide a standard PODS-compatible microsatellite bus in combination with launch for a "turn-key" mission solution**

◆ **SSL welcomes input from Users:**

➢ **In developing and co-proposing mission concepts that can take advantage of this unique platform**

➢ **Working with smallsat providers to address mission-specific needs**