Setting the Standard: Recommendations on "Launch Unit" Standard SmallSat Sizes between CubeSats and ESPA-Class

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Configured Payload per Launch Vehicle

Launch Unit Standard

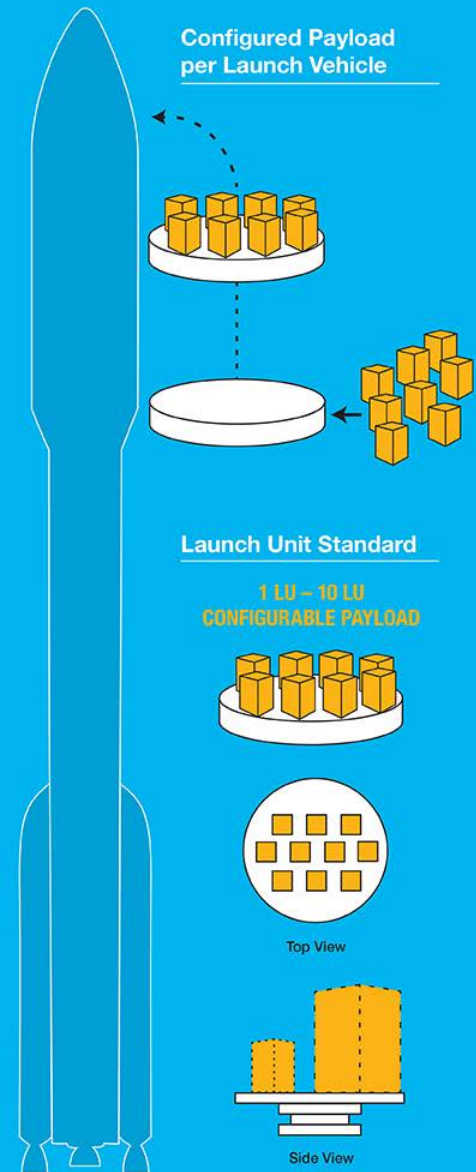**1 LU – 10 LU CONFIGURABLE PAYLOAD**

Top View

Side View

Small Satellites are Abundant
How do they all get to space?

Fewer than 700 small satellites were launched between 2006 and 2015

Over the next 10 years, estimates are an additional 3,500 to 10,000 satellites will be launched[1]

0.25 kg

3.5 kg

164 kg

Small satellites have a mass less than 500 kg
- *CubeSats are a special subset of small satellites which conform to the "CubeSat Standard"*
- *The "ESPA class" is an informal standard for a satellite with a mass of approximately 180 kg*

Small satellites are on the rise!

1. Euroconsult, "Prospects for the Small Satellite Market," (Jul. 2017)

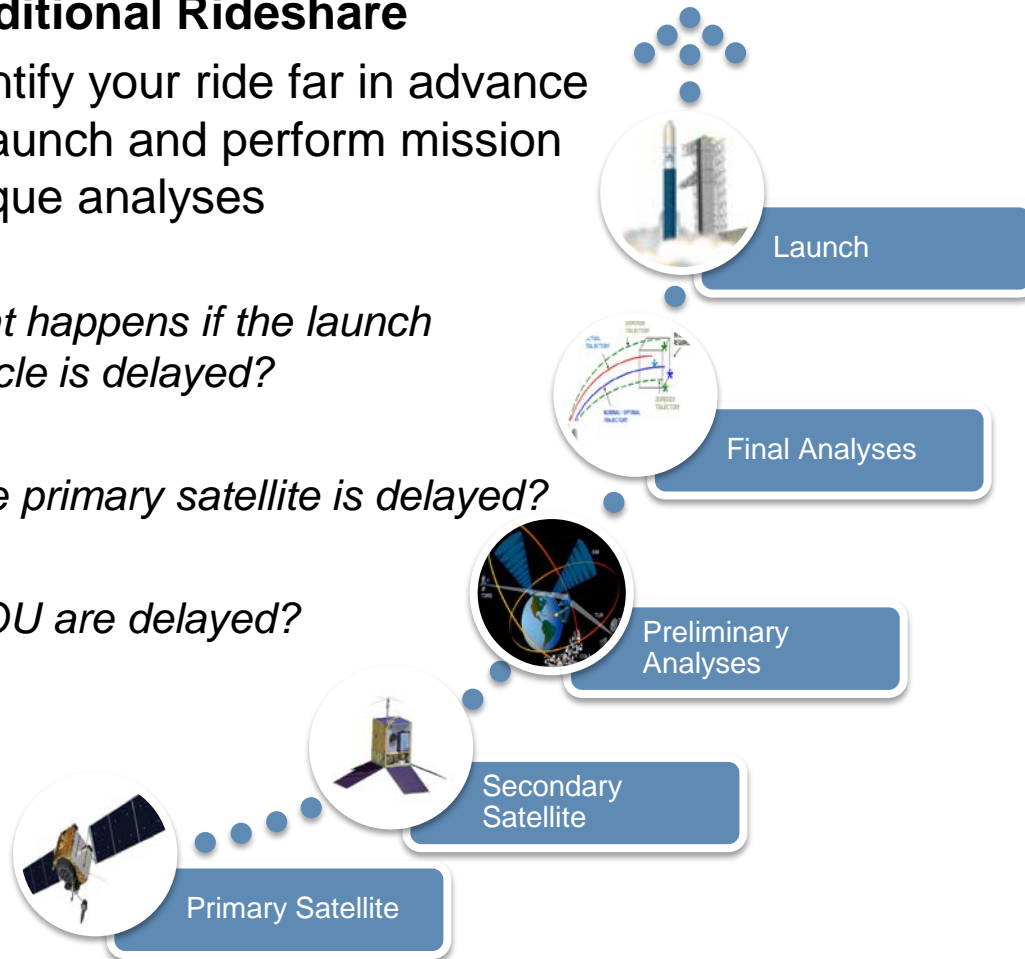# Traditional Rideshare vs Rideshare with LaunchU

Traditional Rideshare

Identify your ride far in advance of launch and perform mission unique analyses

What happens if the launch vehicle is delayed?

If the primary satellite is delayed?

If YOU are delayed?

Launch

Final Analyses

Preliminary Analyses

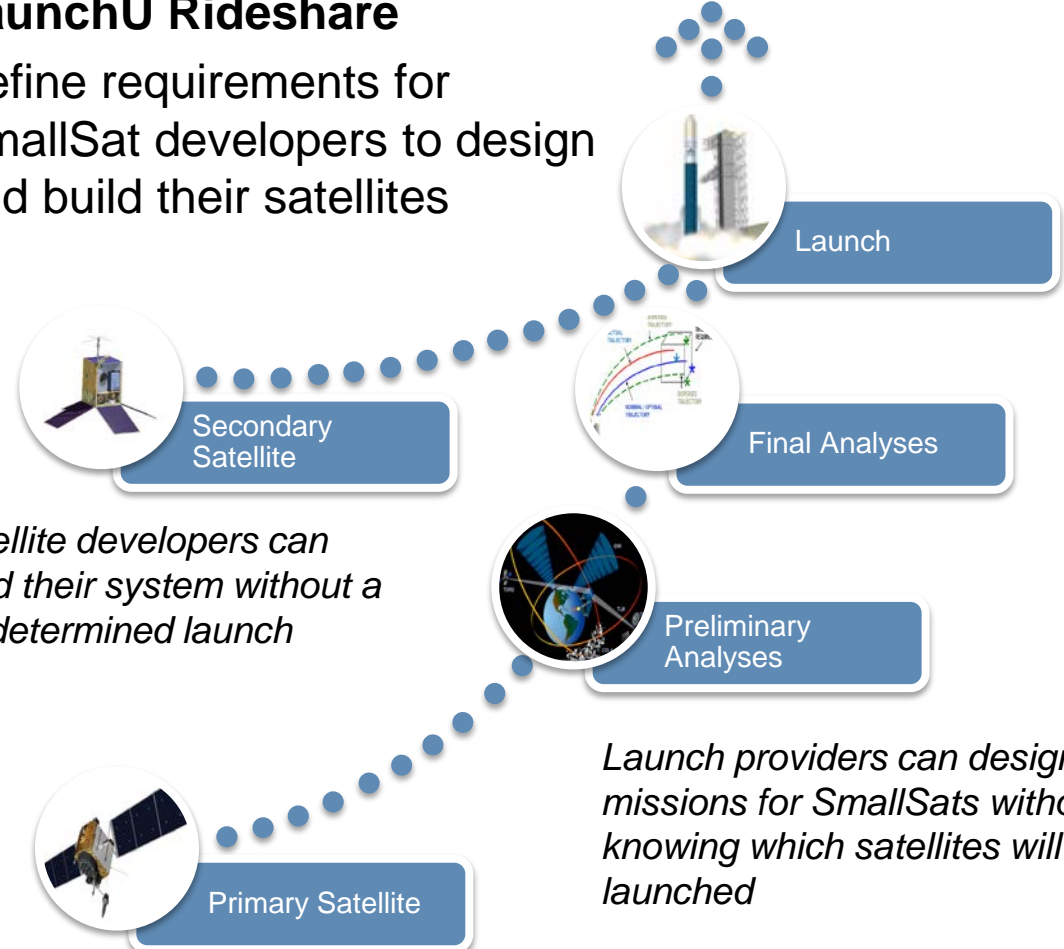Secondary Satellite

Primary Satellite

LaunchU Rideshare

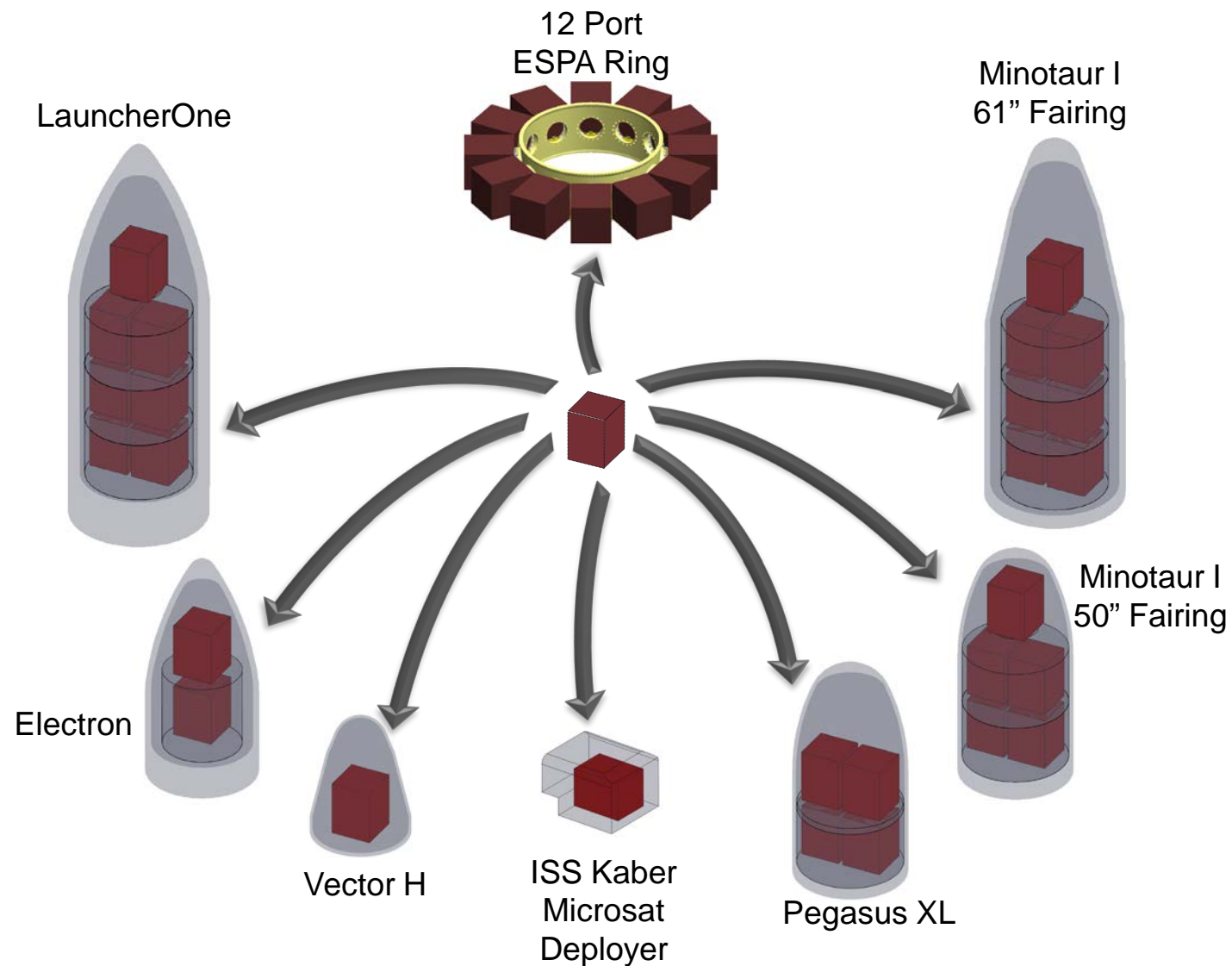Define requirements for SmallSat developers to design and build their satellites

Satellite developers can build their system without a predetermined launch

Launch providers can design missions for SmallSats without knowing which satellites will be launched
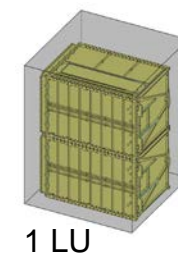
Launch

Final Analyses

Preliminary Analyses

Secondary Satellite

Primary Satellite

LaunchU enables flexible assured access to space for the small satellite market

Volume Efficiency

12 Port
ESPA Ring

LauncherOne

Minotaur I
61" Fairing

Minotaur I
50" Fairing

Electron

Vector H

ISS Kaber
Microsat
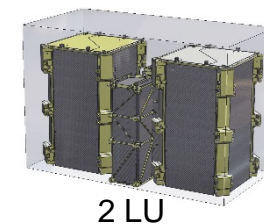Deployer

Pegasus XL

Alternate Uses of LaunchU Volume

2 Planetary Systems
Corporation (PSC) 12U
Dispensers

1 LU

2 12U and 2 3U
Tyvak Dispensers

2 LU

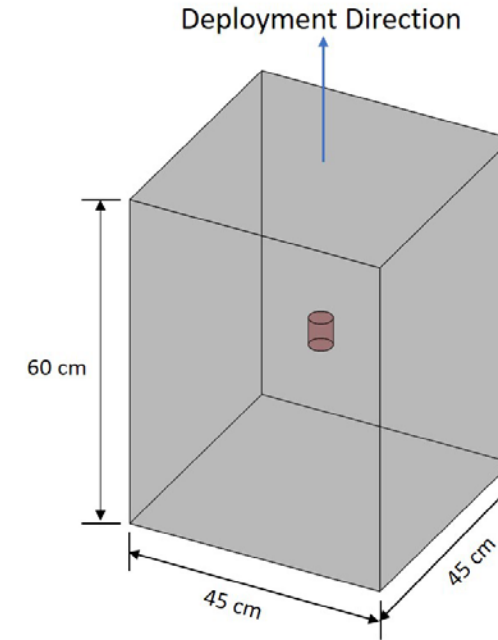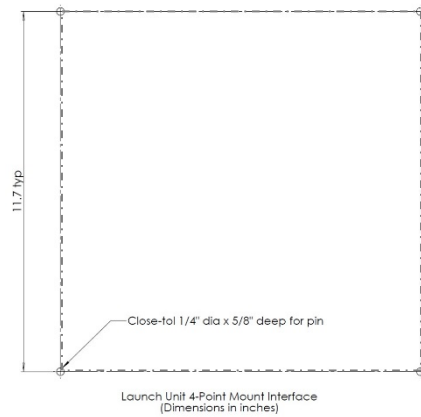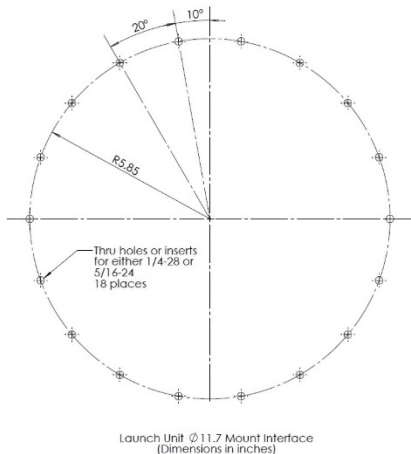*LaunchU provides a more efficient use of launch vehicle fairing volume for small satellites*

LaunchU Recommendations

Volume, Mass, and Dynamics

INCLUDES SEPARATION SYSTEM

- *Volume: 45 x 45 x 60 cm*
- *Mass: 60-80 kg*
- *CG: 30 ± 5 cm along height, within 2 cm of centerline*
- *First fundamental frequency: above 50 Hz in both axial and lateral directions*
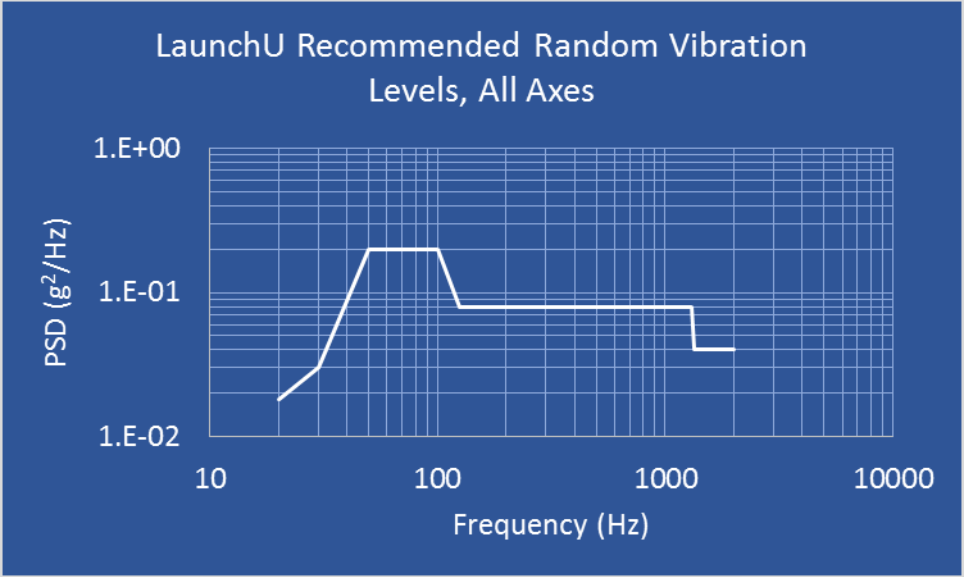

Deployment Direction

60 cm

45 cm

45 cm

- Mechanical Interfaces

20° 10°

R5.85

Thru holes or inserts for either 1/4-28 or 5/16-24 18 places

Launch Unit Ø11.7 Mount Interface (Dimensions in inches)

11.7 typ

Close-tol 1/4" dia x 5/8" deep for pin

Launch Unit 4-Point Mount Interface (Dimensions in inches)
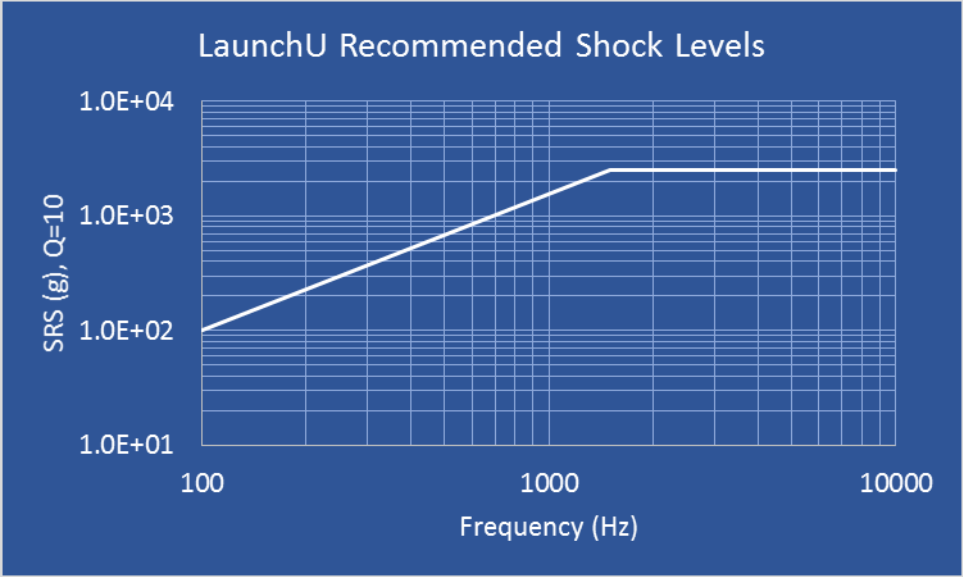
Electrical Interfaces

- Limited to
  - *Signals required to initiate separation system (sent by launch vehicle)*
  - *Loopback circuits for separation indication*
- No LaunchU satellite telemetry data transmitted via the launch vehicle telemetry units
- LaunchU satellite telemetry transmitters will not radiate prior to separation

Load Recommendations

LaunchU Recommended Random Vibration Levels, All Axes

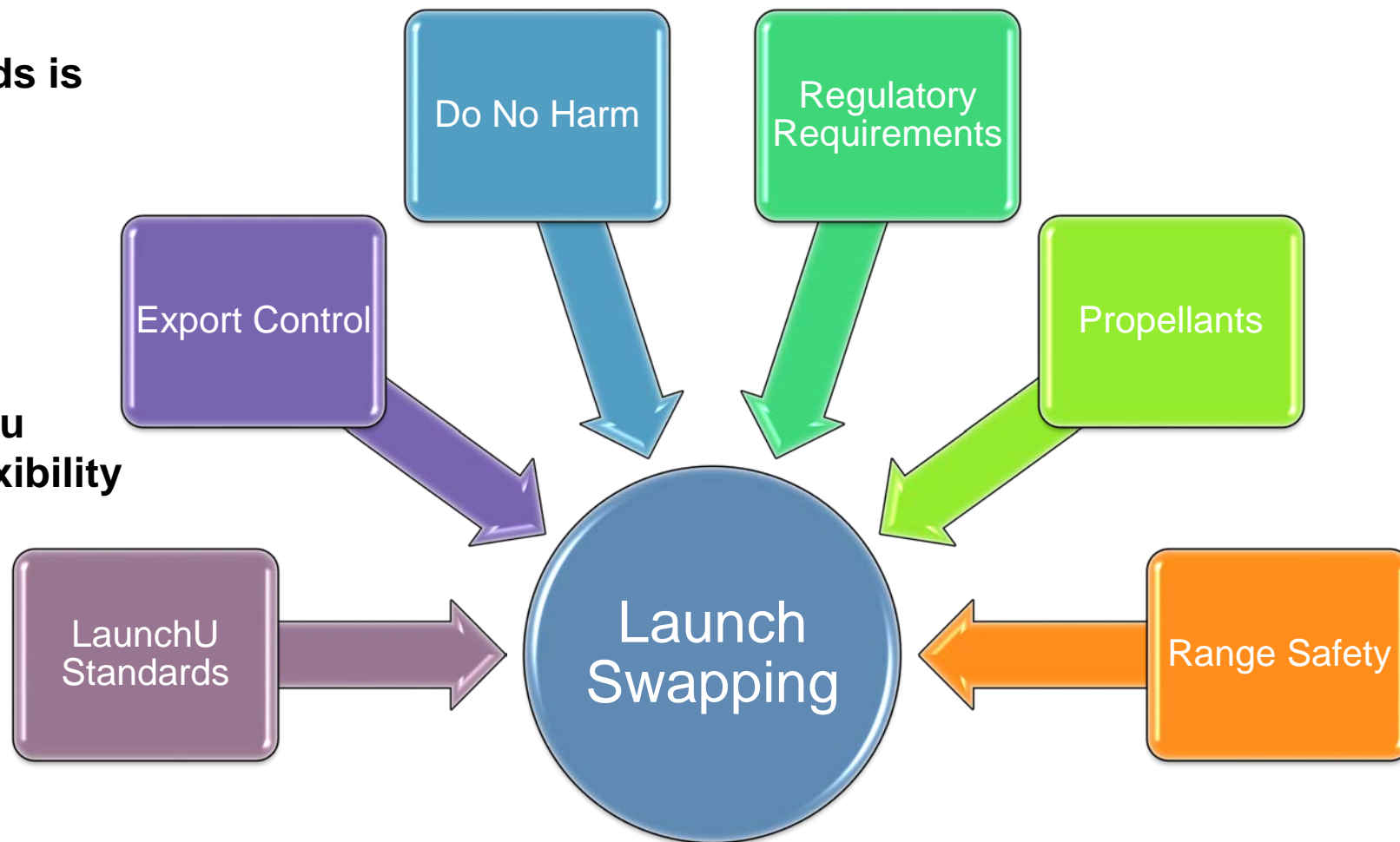| Frequency (Hz)	Acceptance Level PSD (g²/Hz)
20	0.018
30	0.03
50	0.2
100	0.2
125	0.08
1300	0.08
1350	0.04
2000	0.04
gRMS	11.76

LaunchU Recommended Shock Levels

Frequency (Hz)	Shock Response Spectrum (g)
100	100
1500	2500
10000	2500
	Q=10

Static Loads: 8.5 Gs applied at the center of gravity in each direction

Additional Considerations

Meeting the LaunchU standards is only part of the story

By addressing other areas, you dramatically increase your flexibility in launch opportunities

Export Control

Do No Harm

Regulatory Requirements

Propellants

LaunchU Standards

Launch Swapping

Range Safety

Next Steps

Engage SmallSat community on recommendations

Feedback Needed!

- Details provided in SSC-IX-07
- Come see me and ask questions today in the Aerospace booth (#166) from 4-5 pm
- Visit www.aerospace.org/launch-u and provide feedback

Pursue formal LaunchU standard

Launch Unit Consortium Members