

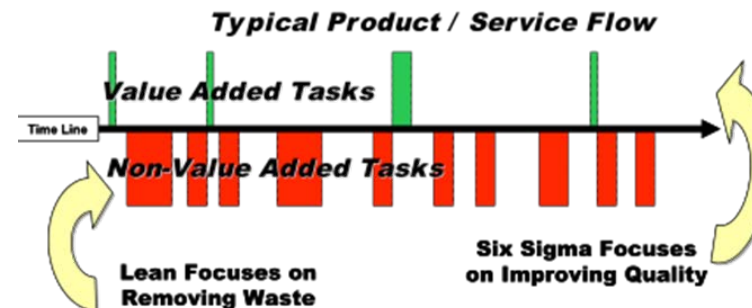
United Nations/Brazil Symposium on Basic Space Technology
"Creating Novel Opportunities with Small Satellite Space Missions"
Natal, Brazil, 11 - 14 September 2018

"Lean Small Satellite Missions Require Lean Access to
Space"

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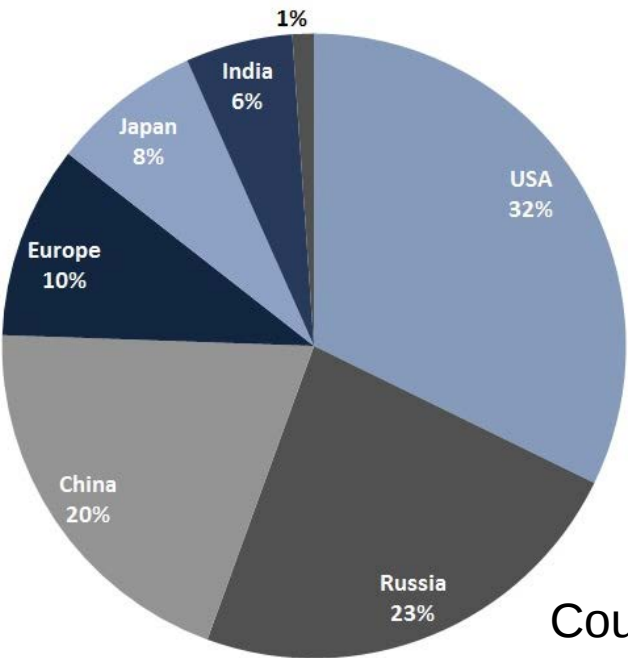
"Lean" Small Satellite Missions Concept

- The concept of “lean satellite missions” was born from the creation and evolution of the practices of lean manufacturing, lean engineering, lean satellites , lean launch and lean operations
- “Lean” is a both technical and management approaches to the “risk and reward” considerations, it is not a standard by itself
- Lean and Six Sigma are widely used in industry as continuous improvement best practices
 - They can also be very **complementary** in nature and, if performed properly, can produce unprecedented results
 - Lean focuses on eliminating non-value added activities in a process and Six Sigma focuses on reducing variation from the remaining value-added steps
 - Lean provides speed ensuring products and services flow without interruption while Six Sigma ensures that critical product / service characteristics are completed correctly the very first time we do them.



Status of Access to Space

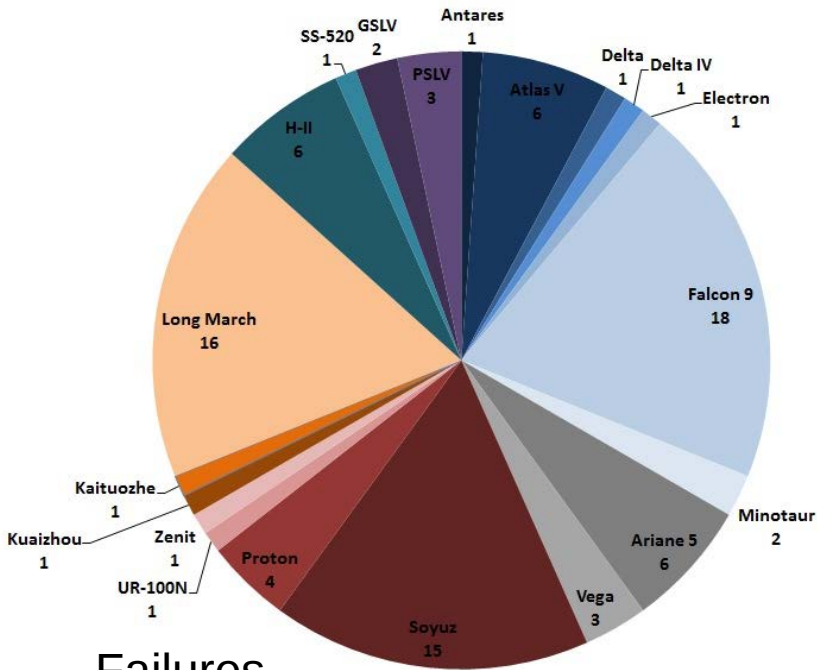
Orbital Launch Attempts by Country



Country

Launches

Launch Attempts by Launcher Family



Failures

Lean Access to Space

- Improved CubeSat manifesting via NASA's CubeSat Launch Initiative (CSLI)
- As reliability is demonstrated, some providers may be appropriate for future less risk-tolerant NASA missions
- Milestones-based payment structure; **limited** LSP insight through milestone reviews
- A **single demonstration** flight was awarded to Firefly, Rocket Lab, and Virgin Galactic
- Statement of Work: Minimum 60kg to LEO (425km), orbit inclination 33 to 98 degrees, launch date no later than April 15, 2018
- Companies are responsible for LV development costs



Comparison Only

For Comparison Only	
	Pegasus XL (Orbital)
	16.9 m
	Up to 443 kg to LEO
	1.18 m
	Multiple
	Certified; Low risk-tolerant spacecraft

VECTOR (new)



Specification *	Alpha 1.0 (Firefly)	Electron (Rocket Lab)	LauncherOne (Virgin Galactic)
Length	23 m	17 m	20 m
Payload Mass	200 kg	150 kg	300 kg
Payload Diameter	1.45 m	1.1 m	1.3 m
Orbit	500 km (Sun Synchronous)	500 km (Sun Synchronous)	500 km (Sun Synchronous)
LV Certification	No certification High risk-tolerant spacecraft		

* LSP recommends a 25% reduction from published specifications for vehicles of this size and maturity until successfully demonstrated

SPORT Space Weather Operational U Class Observatory Constellation

