

# Segmento Lançador

Design de estrutura  
e mecanismos

Requisitos e  
Objetivos da Missão

Geometria, Órbita,  
Controle, Serviço e  
Payload

1. Definir o objetivo final da órbita e a precisão da injeção

2. Estimar a massa no lançamento e definir variação

3. Avaliar se é necessário um sistema de prop. na S/C

4. Identificar os requisitos de dimensão/volume

5. Determinar o balanço de custo, cronograma e risco.

6. Avaliar a capacidade, disponibilidade e confiabilidade

7. Contatar o serviço de lançamento.

8. Selecionar o veículo candidato e levantar as condições

9. Proceder o desenvolvimento da S/C (tentando não fixar o lançador)

10. Selecionar o veículo lançador

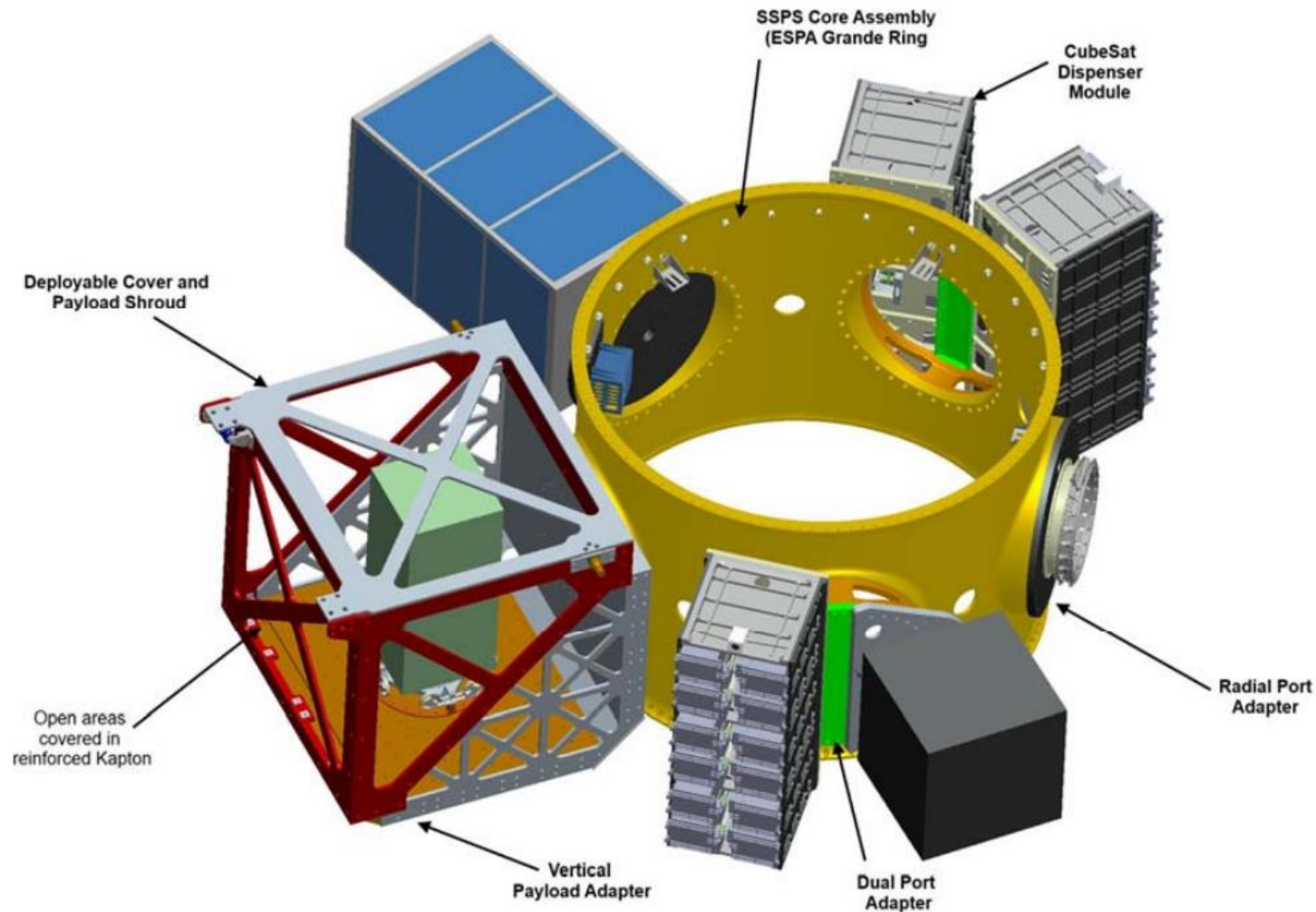
Trade  
A

Trade  
C

Trade  
B

# Space Flight

# SPACEFLIGHT



<http://www.spaceflight.com/wp-content/uploads/2015/05/SPUG-RevF.pdf>

# Flight Share – Noção de Preços

	Containerized			Satellite Class							
Payload Type	3U	6U	12	50 kg	100 kg	150 kg	200 kg	300 kg	450 kg*	750 kg*	1000 kg*
Length (cm)	34.05	34.05	34.05	80	100	100	100	125	200	300	350
Height/Dia(cm)	10.00	10.00	22.63	40	50	60	80	100	150	200	200
Width(cm)	10.00	22.63	22.63	40	50	60	80	100			
Mass(kg)	5	10	20	50	100	150	200	300	450	750	1000
Price – LEO	\$295	\$545	\$995	\$1,750	\$3,950	\$4,950	\$5,950	\$7,950	\$17,500	\$22,000	\$28,000
Price – GTO	\$650	\$995	\$1,950	\$3,250	\$5,950	\$6,950	\$7,950	\$9,950	CALL	CALL	CALL
Price – GSO/LLO	\$995	\$1,990	\$3,250	\$6,500	\$9,950	\$12,950	\$15,950	\$19,900	CALL	CALL	CALL

\$59k/kg

# Falcon 9



**SPACEX**
 FALCON 9
 FALCON HEAVY
 DRAGON
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## FALCON 9 & DRAGON TO RETURN ASTRONAUTS TO SPACE

▶

# FALCON 9

PRICE	FALCON 9
STANDARD PAYMENT PLAN (2018 LAUNCH)	<b>\$62M</b> Up to 5.5 mT to GTO
DESTINATION	PERFORMANCE *
LOW EARTH ORBIT (LEO)	22,800 kg 50,265 lbs
GEOSYNCHRONOUS TRANSFER ORBIT (GTO)	8,300 kg 18,300 lbs
PAYLOAD TO MARS	4,020 kg 8,860 lbs

# Ariane Vega

ELV S.P.A.

INDUSTRIAL PRIME CONTRACTOR

1,500 kg.

PAYLOAD TO CIRCULAR POLAR ORBIT

1-2 / year

AVG. LAUNCH RATE

## VEGA TECHNICAL OVERVIEW



29.9 m  
HEIGHT



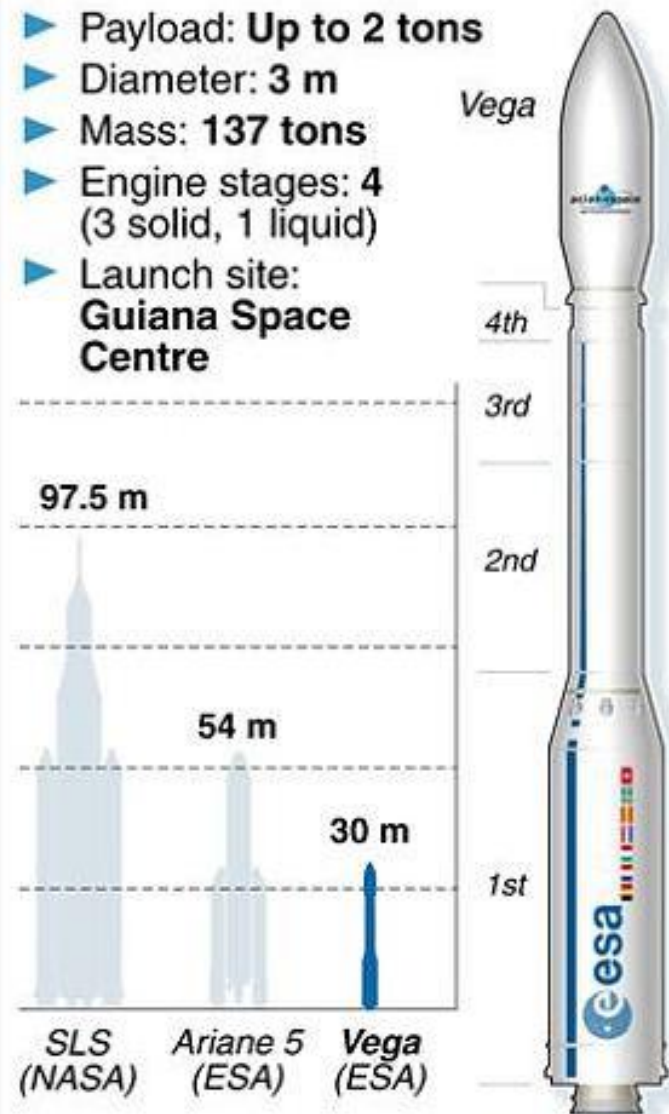
3.025 m  
DIAMETER



137 t  
MASS

## EUROPE'S NEW SMALL LAUNCHER

- ▶ Payload: Up to 2 tons
- ▶ Diameter: 3 m
- ▶ Mass: 137 tons
- ▶ Engine stages: 4 (3 solid, 1 liquid)
- ▶ Launch site: Guiana Space Centre



Source: ESA

21:55 UT 6



# LauncherOne

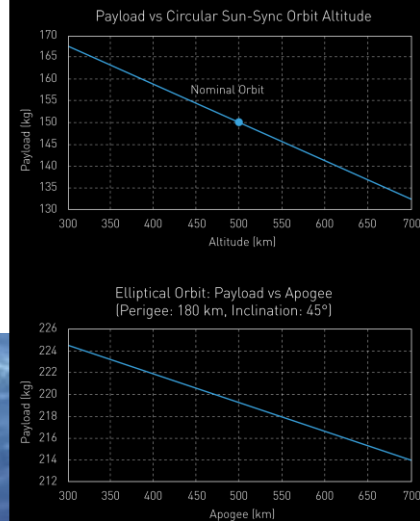


**OUR IDEA OF A HAPPY LIFE: BUILD ROCKETS,  
WORK WITH BRILLIANT PEOPLE, SERVE  
PURPOSEFUL CUSTOMERS, AND OPEN ACCESS TO  
SPACE.**



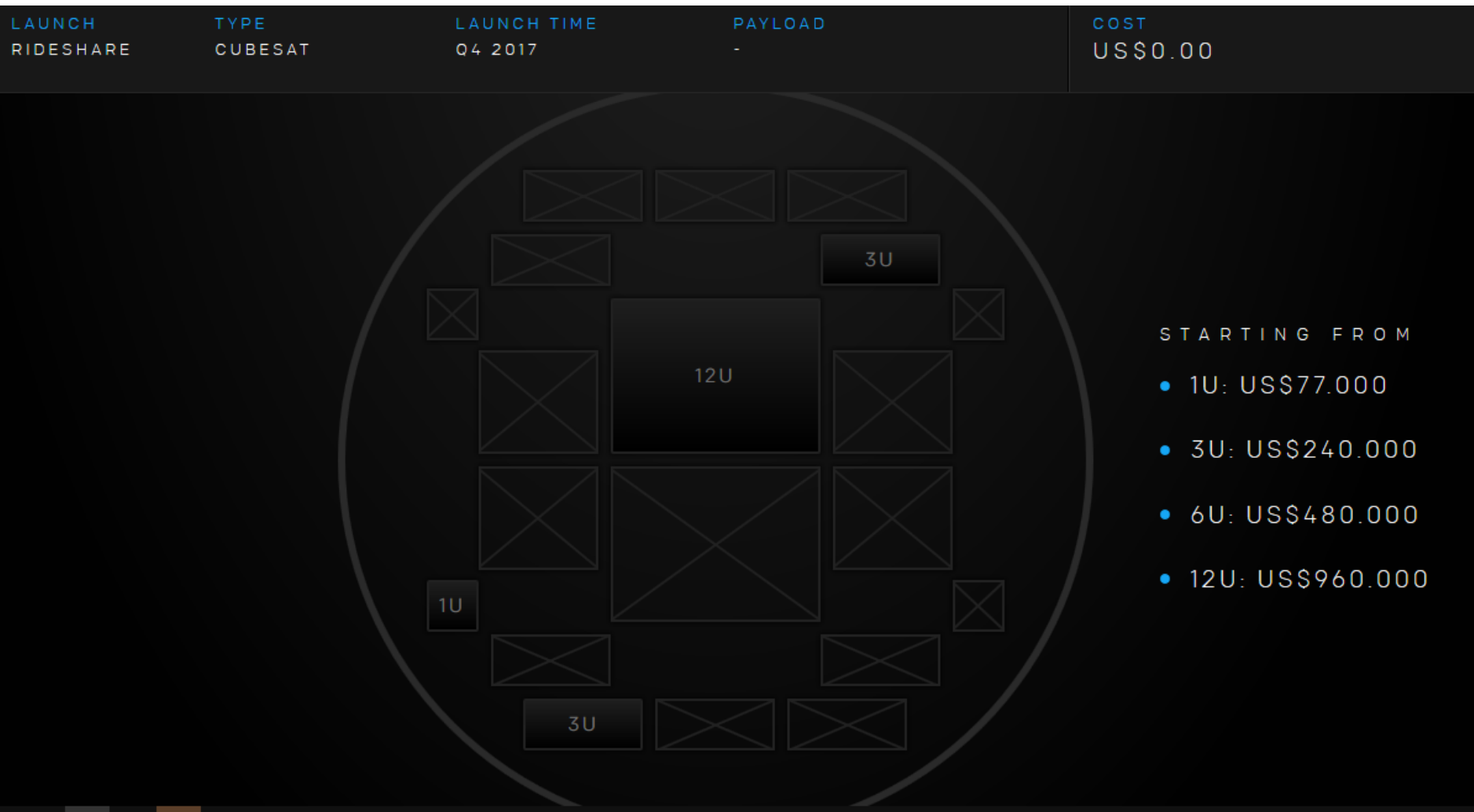
# Rocket-Lab Electron

- Electron is designed for a nominal payload of **150 kg** to a **500 km** sun-synchronous orbit.
- Rocket Lab is able to tailor the vehicle to specific mission requirements including a range of sun-synchronous altitudes in circular or elliptical orbits at inclinations between 39 and 98 degrees.





# Rocket-Lab Rideshare



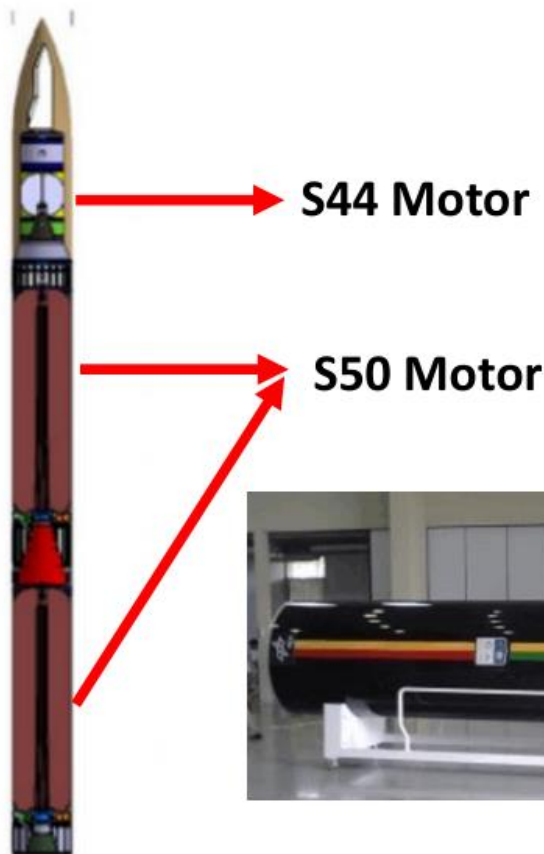
# VLM – Veículo Lançador de Microssatélites

















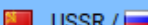
## Planning the Future

### Brazilian Space Launch System – VLM-1

- Standard VLM, 23 kg (600 km to LEO – Sun Synchronous)
- Specific Transportation Cost  $\approx$  U\$ 500,000.00/kg



# Launch Sites

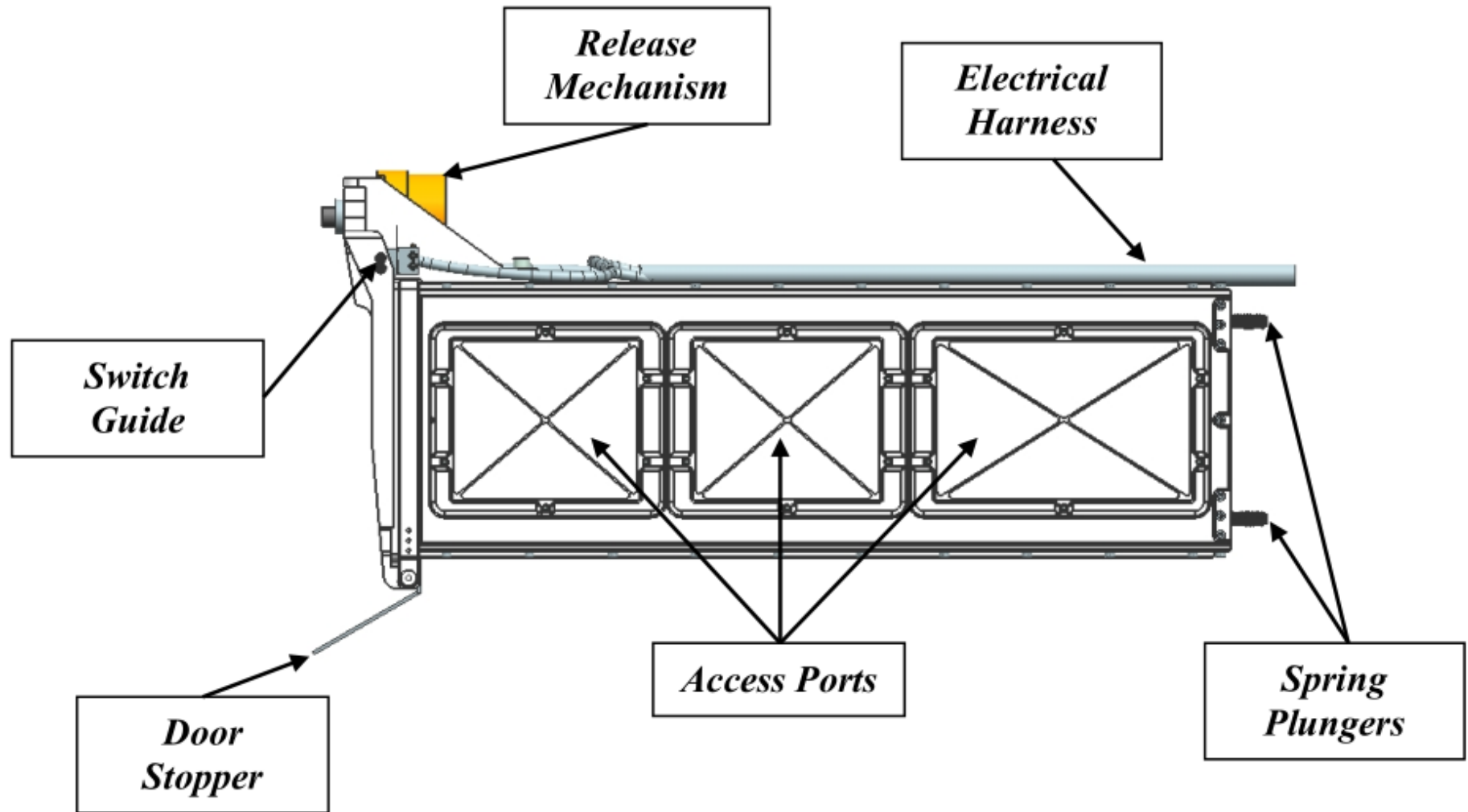
 Australia	<ul style="list-style-type: none"> <li>Wo = Woomera Instrumented Range, Woomera, South Australia</li> </ul>
 Brazil	<ul style="list-style-type: none"> <li>Al = Alcantara Space Center (CLA)</li> </ul>
 China	<ul style="list-style-type: none"> <li>Jq = Jiuquan Space Center, Inner Mongolia</li> <li>TY = Taiyuan Satellite Launch Center (TSLC), Wuzhai, Shanxi</li> <li>We = Wenchang Space Launch Center (WSLC), Hainan</li> <li>Xi = Xichang Space Center (Songlin), Sichuan</li> </ul>
 France	<ul style="list-style-type: none"> <li>Ko = Centre Spatial Guyanais (CSG), Kourou</li> </ul>
 India	<ul style="list-style-type: none"> <li>Sr = Satish Dhawan Space Center (Sriharikota Space Center), Sriharikota, Andhra Pradesh</li> </ul>
• International	<ul style="list-style-type: none"> <li>SL = Sea Launch Platform, Pacific Ocean near Kiritimati (Christmas Island)</li> </ul>
 Iran	<ul style="list-style-type: none"> <li>Sem = Semnan Satellite Launch Center, Semnan province</li> </ul>
 Israel	<ul style="list-style-type: none"> <li>Pa = Israeli Air Force Test Range, Palmachim</li> </ul>
 Italy	<ul style="list-style-type: none"> <li>SM = San Marco Launch Complex, Formosa Bay</li> </ul>
 Japan	<ul style="list-style-type: none"> <li>Ka = Kagoshima Space Center / Uchinoura Space Center, Kagoshima, Kyushu</li> <li>Ta = Tanegashima Space Center, Tanegashima</li> </ul>
 Kazakhstan	<ul style="list-style-type: none"> <li>Ba = Baikonur (Tyuratam, NIIP-5, GIK-5), Tyuratam</li> </ul>
 Marshall Islands	<ul style="list-style-type: none"> <li>Kw = Kwajalein Island, Reagan Test Site (formerly Kwajalein Missile Range), US Army Kwajalein Atoll (USAKA)</li> <li>Om = Omelek Island, Kwajalein</li> </ul>
 North Korea	<ul style="list-style-type: none"> <li>So = Sŏhae Satellite Center, Ch'ŏlsan County, North P'yŏngan Province</li> <li>To = Tonghae (Musudan-ri), Hwadae County, Hamgyong Province</li> </ul>
 South Korea	<ul style="list-style-type: none"> <li>Na = Naro Space Center, Goheung County, South Jeolla</li> </ul>
 USA	<ul style="list-style-type: none"> <li>CC = Cape Canaveral Air Force Station, Eastern Test Range, Cape Canaveral, Florida</li> <li>Ed = Edwards AFB, California</li> <li>Kau = Kauai Test Facility (KTF) (Pacific Missile Range Facility), Barking Sands, Kauai</li> <li>Kd = Pacific Spaceport Complex - Alaska (Kodiak Launch Complex), Kodiak Island, Narrow Cape, Alaska</li> <li>Va = Vandenberg AFB, California</li> <li>WI = Wallops Flight Facility, Wallops Island, Virginia</li> <li>WI = Mid-Atlantic Regional Spaceport (MARS), Wallops Island, Virginia</li> </ul>
 USSR / Russia	<ul style="list-style-type: none"> <li>Ba = Baikonur (Tyuratam, NIIP-5, GIK-5), Tyuratam</li> <li>Do = Yasniy site, Dombrovskiy Air Base, Orenburgskaya Oblast'</li> <li>KY = Kapustin Yar (GTsP-4, GTsMP-4), Volgograd</li> <li>PI = Plesetsk (NIIP-53, GIK-1, GNIIP)</li> <li>Sv = Svobodniy (GIK-2), Amurskaya Oblast'</li> <li>Vo = Vostochniy, Amurskaya Oblast'</li> </ul>

# P-PODs

Poly-Picosatellite Orbital Deployer – P-POD



# Partes



# Exemplos

