



Chapter Contents

Chapter Glossary	ii
2.0 Complete Spacecraft Platforms	7
2.1 Introduction	7
2.2 State-of-the-Art – Spacecraft Platforms.....	7
2.2.1 Hosted Orbital Services	7
2.2.2 Spacecraft Bus	11
2.3 Programmatic and Systems Engineering Considerations.....	27
2.4 Summary	27
2.5 References	28



Chapter Glossary

(COTS)	Commercial-off-the-Shelf
(EELV)	Evolved Expendable Launch Vehicle
(ESPA)	EELV Secondary Payload Adapter
(GEO)	Geostationary Equatorial Orbit
(I&T)	Integration and Test
(kg)	Kilogram
(LEO)	Low Earth Orbit
(MEO)	Medium Earth Orbit
(MTBF)	Mean Time Between Failures
(NASA)	National Aeronautics and Space Administration
(SHF)	Super High Frequency
(SmallSat)	Small Satellite
(SPA)	Secondary Payload Adapter
(STMD)	Space Technology Mission Directorate
(TRL)	Technology Readiness Level
(UHF)	Ultra High Frequency
(UK)	United Kingdom
(Unk)	Unknown
(USA)	United States of America
(VLEO)	Very Low Earth Orbit
(VHF)	Very High Frequency
(W)	Watts
(xGEO)	Beyond Geostationary Equatorial Orbit



2 Complete Spacecraft Platforms

2.1 Introduction

The Small Spacecraft market enables a wide range of market utilization for mission implementations, from ground-up developments of a spacecraft to entire hosted orbital solutions. This chapter assesses the state of the art for complete spacecraft platforms in two distinct SmallSat markets.

- 1) **Hosted orbital services:** an emerging business model in the space industry that offers customers access to satellite capabilities to host their payloads (also known as **hosted orbital payloads**) without the need to build, launch, or operate their own spacecraft. With hosted orbital missions, a payload is typically delivered to the provider to be integrated onto an existing spacecraft.
- 2) **Spacecraft bus:** also known as a *satellite bus* or *spacecraft platform*, is the section of the flight segment that provides essential services to the payload and enables the mission objectives such as thermal management, power, communication, guidance, navigation and control, data processing, and propulsion. This option allows the user to purchase a spacecraft bus with optional system-level integration and test (I&T) services, but vendors may not offer hosted orbital services (spacecraft bus + system-level I&T + operations).

Neither option is superior, and selection may depend on the needs and constraints of each individual mission. The list of organizations/companies in this chapter is not complete and does not constitute an endorsement from NASA. The information is for awareness and guidance only. The performance advertised may differ from actual performance since the information has not been independently verified by NASA subject matter experts and relies on information provided directly from the manufacturers or available public information. Table 2-9 includes a list of providers with contact information and the source used to complete the tables. It is recommended to contact the organizations/companies directly for further clarification and applications for your specific mission needs.

This chapter organizes the state-of-the-art small spacecraft platforms into these two main categories: Hosted Orbital Services and Spacecraft Bus. The dedicated small spacecraft bus section is further divided by PocketQube, CubeSat, and ESPA-Class offerings. Each subsection contains a summary table with a non-exhaustive list of commercially available small spacecraft platforms.

2.2.1 Hosted Orbital Services

2.2.2 Spacecraft Bus

PocketQubes

CubeSats

ESPA-Class

Section 2.3 provides a brief explanation on systems engineering considerations that introduces newcomers to the design selection process and highlights specific resources for mission development.

2.2 State-of-the-Art – Spacecraft Platforms

2.2.1 Hosted Orbital Services

Hosted orbital service providers receive science instruments and/or technology payloads and perform system-level integration and test, and operations. The vendor implementation varies widely across the industry, depending on providers' vehicle type and business model. Examples of vendor implementations include the following:



- Host customer payload on vendor's dedicated spacecraft with the entire spacecraft bus available to a single customer and/or mission
- Host customer payload on vendor's unused capability aboard their own, internally developed mission
- Host customer payload along with other payloads from different customers on a single spacecraft
- Host customer 'software-only' payload, also known as a 'virtual' payload on an existing spacecraft that supports virtual payloads

It should be noted that not all hosted orbital service providers sell their spacecraft bus to customers. Spacecraft bus providers are listed in Section 2.2.2. It is the user's responsibility to conduct their own research to determine which solution best meets their mission requirements and constraints.

Benefits of hosted orbital solutions include cost effectiveness, reliability, flexibility, faster access to space, and the ability for users to focus on the spacecraft payload. Customers can access space capabilities without the high upfront costs of building and launching their own spacecraft and can concentrate their efforts and resources on their specific instruments or technologies, leaving the spacecraft bus build, system-level integration and test, and operations to an experienced developer. Hosting multiple payloads offers efficiencies through resource sharing, which can make this option more affordable than manifesting a payload on its own dedicated spacecraft. Common interfaces allow for rapid integration and test, decreasing the overall time to flight. Mission success can be improved by leveraging a commercial provider's proven infrastructure, processes and expertise. Services can be scaled up or down based on mission needs, allowing for adjustments in bandwidth, coverage, or mission duration. Additional space-based hosting of small spacecraft payloads is also available on several vehicles that are not covered in this report, including payloads that are hosted in or on the ISS, attached to rocket bodies, or hosted in or on capsules (crewed or uncrewed) that return to earth.

Procurement of hosted orbital services is relatively new and can be challenging if the user does not have experience procuring such services. In 2023, NASA's Flight Opportunities program released a solicitation for Suborbital/Hosted Orbital Flight and Payload Integration Services that, for the first time, included commercial orbital platforms capable of hosting payloads. Fifteen companies were selected to provide flight and payload integration services for technology payloads to be demonstrated in high-altitude, reduced gravity, and other relevant testing environments on suborbital rocket-powered vehicles, high-altitude balloons, and hosted orbital platforms via Indefinite Delivery/Indefinite Quantity (IDIQ) contracts. These IDIQ contracts can be used by NASA centers and other government agencies to procure hosted orbital services. The Flight Opportunities competitions and solicitations (e.g., TechLeap, TechFlights) offer options for hosted orbital platforms, aiming to advance the maturity of a technology via flight tests. Additional information on NASA's Flight Opportunities program and the IDIQ contract for hosted orbital services can be found here: <https://www.nasa.gov/stmd-flight-opportunities/nasa-contracted-flight-providers/>.

**Table 2-1: Hosted Orbital Service Providers**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the Hosted Payloads category)

Organization <small>Headquarters</small>	Max Volume	Max Mass (kg)	Peak Power (W)	3-σ Pointing Control/ Knowledge	Destination	US Office
AerospaceLab <small>Belgium</small>	0.125 m ³	50	300	<0.005°/ <0.005°	LEO, GEO	Yes
Artemis Space Technologies <small>UK</small>	0.58 m ³	500	1,500	0.01°/0.01°	LEO, MEO, GEO, Lunar and Deep Space	No
Astranis Space Technologies Corp. <small>USA</small>	0.02 m ³	10	300	<0.1°/ <0.09°	GEO	Yes
Astro Digital <small>USA</small>	Unk	Unk	Unk	Unk	Unk	Yes
Axelspace <small>Japan</small>	0.2 m ³	30	184	<0.05°/ <0.04°	LEO	No
Berlin Space Technologies <small>Germany</small>	1 m ³	250	2,500	<0.017°/ <0.017°	LEO	Yes
C3S Electronics Development <small>Hungary</small>	16.5U	18.5	155	0.2°/ 0.2°	LEO, MEO	No
CREOTECH <small>Poland</small>	>50U	100	175	<0.015°/ <0.015°	LEO, MEO, GEO, Lunar	No
EnduroSat <small>Bulgaria</small>	150U	70	300	0.1°/ 0.008°	LEO	Yes
General Atomics EMS <small>USA</small>	0.46 m ³	200	450	0.03°/ 0.02°	LEO	Yes
German Orbital Systems <small>Germany</small>	4U	8	50	<1°/ <1°	LEO	No
Gran Systems <small>Taiwan</small>	6U	12	50	2°/ 2°	LEO, Lunar	Yes
Harpy Aerospace <small>India</small>	6U	28	72	<0.1°/ <0.01°	LEO, GEO, Lunar, ISS	Yes
Hemeria <small>France</small>	0.1 m ³	35	250	<0.03°/ <0.01°	LEO, GTO, GEO	No
Innova Space <small>Argentina</small>	0.5U	0.5	4	<15°/ <15°	LEO	Yes
Loft Orbital <small>USA</small>	0.44 m ³	85	>1,000	<0.035°/ <0.03°	LEO	Yes
Momentum Space <small>USA</small>	1 m ³	800	3,000	0.008°/ 0.008°	LEO, MEO, GEO, Lunar, Deep Space	Yes
NanoAvionics <small>Lithuania</small>	0.7 m ³	150	378	0.15°/ 0.03°	LEO	Yes
Nara Space <small>South Korea</small>	16U	19	120	0.05°/ 0.03°	LEO	No
NearSpace Launch <small>USA</small>	8U	16	160	0.5°/ 0.2°	LEO	Yes
Northrop Grumman <small>USA</small>	0.37 m ³	50	420	<4°/ <1°	LEO	Yes
NovaWurks <small>USA</small>	1 m ³	300	2000	0.002°/0.0004°	LEO, GEO, xGEO	Yes
NPC SPACEMIND <small>Italy</small>	12U	24	100	<0.1°/ <0.1°	LEO, MEO	No

**Table 2-1: Hosted Orbital Service Providers**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the Hosted Payloads category)

Organization <small>Headquarters</small>	Max Volume	Max Mass (kg)	Peak Power (W)	3-σ Pointing Control/ Knowledge	Destination	US Office
OHB LuxSpace <small>Luxembourg</small>	0.3 m ³	90	600	<0.022°/ 0.01°	LEO	No
OHB Sweden <small>Sweden</small>	1 m ³	300	1,500	0.008°/ 0.008°	LEO, MEO	No
Open Cosmos <small>UK</small>	12U	18	160	0.03°/0.02°	LEO	No
Orbital Astronautics <small>UK</small>	0.163 m ³	100	5,000	<0.05°/ <0.01°	LEO, MEO, GEO, Deep Space	No
Orion Space Solutions <small>USA</small>	14U	45	400	<1°/ <1°	LEO, GEO, Lunar	Yes
Quantum Space <small>USA</small>	0.5 m ³	100	400	0.006°/0.006°	LEO, GEO, Cislunar, Lunar, Deep Space	Yes
Redwire Space <small>USA</small>	0.94 m ³	104	500	0.005°/0.0017°	LEO, MEO, GEO and Deep Space	Yes
Rocket Lab <small>USA</small>	Unk	Unk	Unk	Unk	LEO	Yes
SatRev <small>Poland</small>	3U	3	25	1°/0.6°	LEO	No
Sierra Space <small>USA</small>	0.48 m ³	250	500	0.001°/ <0.001°	LEO, MEO, GEO	Yes
SITAEL <small>Italy</small>	0.90 m ³	120	2,000	0.0017°/ 0.001°	LEO	No
SpaceX <small>USA</small>	Unk	Unk	Unk	Unk	LEO	Yes
Space Inventor <small>Denmark</small>	24U	50	400	<0.008°/ <0.008°	LEO, GEO, MEO	No
Spacemanic <small>Czech Republic</small>	12U	18	500	0.1°/ 0.05°	LEO, MEO, GEO, Lunar	No
Spire Global <small>USA</small>	12U	32	300	0.1°/ 0.05°	LEO	Yes
Surrey Satellite Technology Ltd. <small>UK</small>	0.4m ³	200	2,000	<0.01°/ <0.01°	LEO, MEO, GEO, Lunar	No
Terran Orbital <small>USA</small>	12U	100	500	0.014°/ 0.002°	LEO, GEO, Deep Space	Yes
Varda Space Industries <small>USA</small>	Unk	Unk	Unk	Unk	Unk	Yes
Xplore <small>USA</small>	0.125 m ³	55	210	0.17°/ 0.018°	VLEO, LEO, Cislunar	Yes
York Space Systems <small>USA</small>	-	300	1,500	0.008°/ 0.004°	LEO, GEO, Lunar	Yes

2.2.2 Spacecraft Bus

The SmallSat market offers complete spacecraft bus solutions including system-level I&T and operations options. Spacecraft bus providers in this section may only offer the spacecraft bus as a product or may also provide I&T and operations services. Contact the provider using the data in Table 2-8 to better understand the services offered if a provider seem to meet your basic requirements advertised in the tables.

PocketQubes

PocketQubes refer to small satellites that conform to a form factor of 5 cm cubes. PocketQubes use a standard deployer and follow a unit nomenclature of P. In this case 1P refers to a single 5 cm cube (see Figure 2.1). Consequently, 2P refers to two of these single units. A typical PocketQube deployer can deploy up to a 3P satellite but larger deployers may allow additional capability. PocketQube providers have developed spacecraft buses to simplify mission implementation; a list of providers is included in this section. Table 2-2 lists known available commercial PocketQube products. Figure 2.2 is an example of a PocketQube deployer at Alba Orbital.

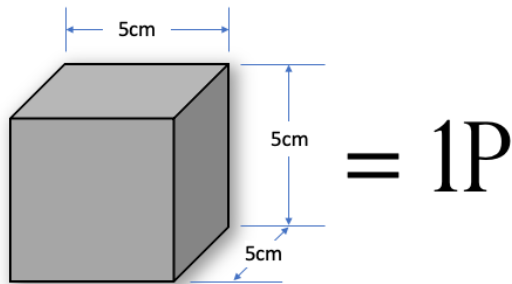


Figure 2.1: PocketQube dimensions.



Figure 2.2: Alba Orbital Integration of PocketQubes into the deployers. Credit: Alba Orbital.

Table 2-2: PocketQubes Market Solutions						
(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the PocketQube category)						
Organization Headquarters	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
Alba Orbital ^{UK}	15	5°/2°	UHF, S	LEO	Flown LEO	Yes
DIYSATELLITE ^{Argentina}	9	<5°/<5°	VHF, UHF, SHF	LEO, GEO, Lunar	Flown LEO	No
FOSSA Systems ^{Spain}	10	<5°/<5°	UHF, S	LEO	Flown LEO	No
Hydra Space Systems ^{Spain}	8	5°/5°	VHF, UHF	LEO	Flown LEO	No
Innova Space ^{Argentina}	3.9	N/A -Magnetic Passive	UHF	LEO	Flown LEO	Yes
Quub, Inc. ^{USA}	26	5°/2°	UHF, S	LEO, Lunar	Flown LEO	Yes

CubeSats

CubeSats refer to small satellites that conform to a form factor of 10 cm cubes. The CubeSat standard was created by California Polytechnic State University, San Luis Obispo, and Stanford University's Space Systems Development Lab in 1999 to facilitate access to space for university students. Low-cost access to space increased due to the adoption of the standard by launch providers. Many organizations are currently using the standard including academia, private industry, and government. More information on the history of CubeSats can be found in the introduction of this report. CubeSat providers have developed spacecraft buses to accommodate missions from <1U to 27U satellites. This section provides a list of providers arranged by satellite size: 0.25U-3U (Table 2-3), 6U (Table 2-4), 12U (Table 2-5) and 16U+ (Table 2-6).

Multiple companies have developed deployers for CubeSats with different dimensions and external volume allocations. Contact your sponsoring organization and/or launch provider for specifics on which deployer to use in your mission. The primary two interfaces follow the classic corner rails or the tabs (clamped and unclamped). Most spacecraft bus providers in this chapter can adapt to different interfaces. Refer to the Launch, Integration, and Deployment chapter for further information on SmallSat deployers. Figure 2.3 includes images of CubeSat missions that have been successfully flown in space, Figure 2.4 provides examples of CubeSat deployers' locations on a rocket, and Figure 2.5 provides examples for 6U and 16U satellites from Spire Global.

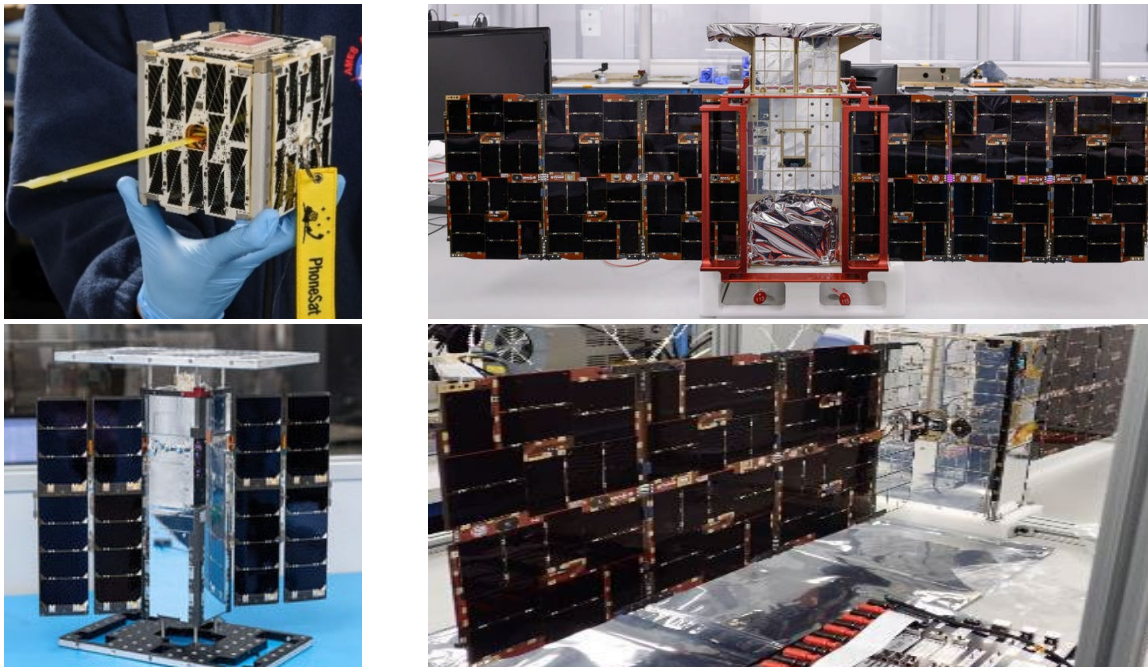


Figure 2.3: Examples of flown CubeSats. (Top left) 1U PhoneSat spacecraft, (top right) 12U CAPSTONE spacecraft, (lower left) 3U CLICK spacecraft, (lower right) 6U PTD-3 spacecraft. Credits: NASA and Terrain Orbital.

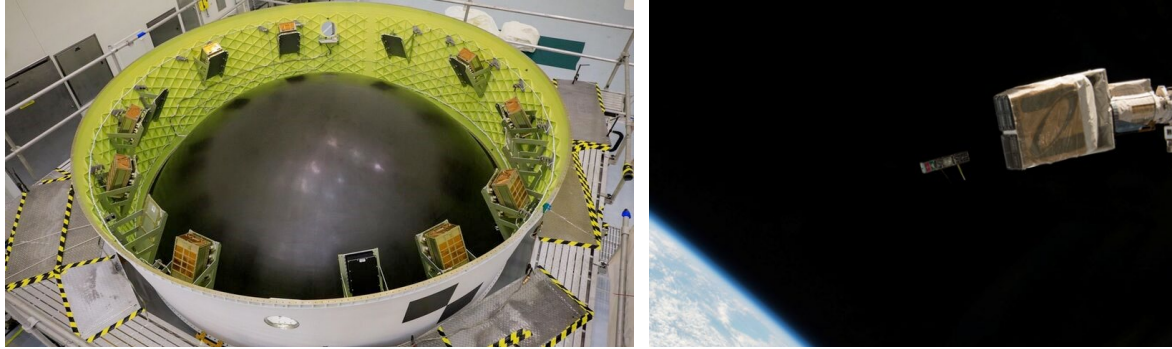


Figure 2.4: (left) Location of Artemis CubeSat deployers in between the Orion Crew Vehicle and the Interim Cryogenic Propulsion Stage (ICPS); (right) NASA Nodes mission deployment from ISS. Credit: NASA.

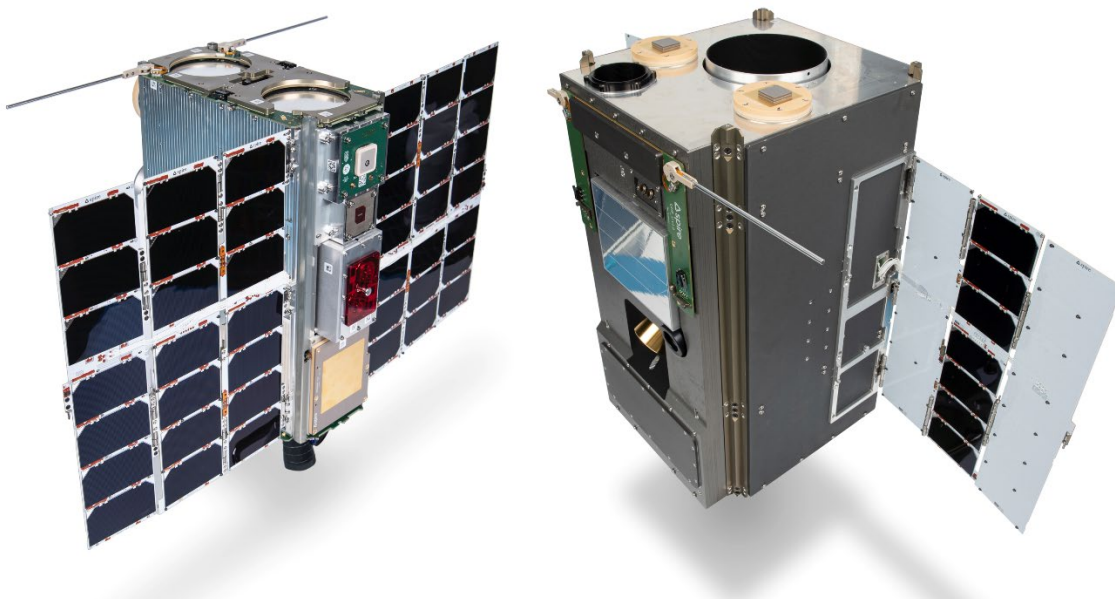


Figure 2.5: Examples of a 6U and 16U CubeSat. Credit: Spire Global.

**Table 2-3: 0.25U-3U Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 0.25U-3U category)

Organization <small>Headquarters</small>	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
AAC Clyde Space <small>Sweden</small>	90	<0.1°/ <0.01°	VHF, UHF, S, X	LEO	Flown LEO	Yes
Alén Space <small>Spain</small>	180	0.2°/0.1°	VHF, UHF, S	LEO	Flown LEO	No
Artemis Space Technologies <small>UK</small>	50	0.01°/0.01°	UHF, S, X, Ka, Ku	LEO	Flown LEO	No
Blue Canyon Technologies <small>USA</small>	27	0.003°/0.003°	L, S, X	LEO, GEO, Deep Space	Flown LEO Qualified GEO and Deep Space	Yes
C3S Electronics Development <small>Hungary</small>	35	0.2°/0.2°	UHF, S	LEO, MEO	Flown LEO	No
Deimos Space <small>Spain</small>	35	0.2°/0.2°	UHF, X	LEO	Flown LEO	No
EnduroSat <small>Bulgaria</small>	84	<1°/ <0.6°	UHF, S, X	LEO	Flown LEO	Yes
FOSSA Systems <small>Spain</small>	30	1°/1°	UHF, S	LEO	Flown LEO	No
General Atomics EMS <small>USA</small>	10	0.28°/0.08°	UHF	LEO, MEO, GEO, xGEO	Under Development	Yes
German Orbital Systems <small>Germany</small>	24	<1°/ <1°	UHF, S	LEO	Flown LEO	No
GomSpace <small>Denmark</small>	35	2.5°/2°	S	LEO	Flown LEO	Yes
Gran Systems <small>Taiwan</small>	50	2°/ 2°	VHF, UHF	LEO	Flown LEO	Yes
GUMUSH AeroSpace <small>Turkey</small>	80	<1°/ <0.1°	VHF, UHF, S, X	LEO	Flown LEO	No
Harpy Aerospace <small>India</small>	72	<0.1°/ <0.01°	VHF, UHF, S, X	LEO, GEO, Lunar	Qualified LEO and Lunar	Yes
Hex20 <small>Australia</small>	25	0.003°/ 0.003°	UHF, S	LEO, MEO, GEO, Lunar	Flown LEO	No
IMT <small>Italy</small>	>5	10°/5°	VHF, UHF	LEO	Under Development	No
Innova Space <small>Argentina</small>	7.5	<15°/ <15°	UHF	LEO	Flown LEO	Yes
ISISPACE <small>The Netherlands</small>	50	<15°/ <15°	VHF, UHF, S	LEO	Flown LEO	No
NanoAvionics <small>Lithuania</small>	175	13.20°/12.93°	UHF, S, X	LEO	Flown LEO	Yes
NearSpace Launch <small>USA</small>	100	0.5°/0.2°	L, UHF, S, X	VLEO, LEO	Flown LEO	Yes
NPC SPACEMIND <small>Italy</small>	51.6	<0.1°/ <0.1°	UHF, S, X, Ka	LEO, MEO, GEO, Lunar	Flown LEO and MEO	No
Open Cosmos <small>UK</small>	160	2.4°/0.67°	UHF, S	LEO	Flown LEO	No

**Table 2-3: 0.25U-3U Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 0.25U-3U category)

Organization <small>Headquarters</small>	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
Orbital Astronautics <small>UK</small>	400	0.1°/ 0.01°	S, X, K, Ka, Optical	LEO, MEO	Flown LEO	No
Orion Space Solutions <small>USA</small>	8	1°/1°	L, S, X	LEO	Qualified LEO	Yes
Pumpkin Space Systems <small>USA</small>	200	0.05°/<0.05°	UHF, S, X, Ka	LEO	Flown LEO	Yes
Quub, Inc. <small>USA</small>	44	5°/2°	UHF, S	LEO, Lunar	Flown LEO	Yes
SatRev <small>Poland</small>	36	1°/0.6°	UHF, S	LEO	Flown LEO	No
SkyLabs <small>Slovenia</small>	100	0.3°/0.06°	VHF, UHF, S	LEO, MEO	Flown LEO and MEO	No
Space Flight Laboratory <small>Canada</small>	93	0.009°/0.004°	UHF, S, X, Ka	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	No
Space Inventor <small>Denmark</small>	100	0.01° / 0.01°	VHF, UHF, S, X, L	LEO	Flown LEO	No
Spacemanic <small>Czech Republic</small>	30	0.1°/0.05°	VHF, UHF, S	LEO, GEO, Lunar	Flown LEO Qualified GEO	No
Spire Global <small>USA</small>	35	0.1°/0.05°	UHF, L, S, X, Ka, Ku	LEO	Flown LEO	Yes

**Table 2-4: 6U Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 6U category)

Organization ^{Headquarters}	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
AAC Clyde Space ^{Sweden}	150	<0.1°/ <0.01°	VHF, UHF, S, X	LEO	Flown LEO	Yes
Alén Space ^{Spain}	180	0.2°/0.1°	VHF, UHF, S	LEO	Flown LEO	No
Argotec ^{Italy}	80	<0.02°/ <0.01°	UHF, S, X	LEO, GEO, Deep Space	Flown Deep Space Flown Lunar	Yes
Artemis Space Technologies ^{UK}	100	0.01°/0.01°	UHF, S, X, Ka, Ku, Optical	LEO, MEO, GEO, Lunar, Deep Space	Flown LEO Qualified MEO, GEO, Lunar, and Deep Space	No
Astro Digital ^{USA}	240	<0.1°/ <0.05°	UHF, S, X, Ka	LEO	Flown LEO	Yes
Blue Canyon Technologies ^{USA}	108	0.003°/0.003°	L, S, X	LEO, GEO, Deep Space	Flown LEO and Lunar Qualified GEO and Deep Space	Yes
C3S Electronics Development ^{Hungary}	165	<0.2°/ <0.2°	UHF, S	LEO, MEO	Under Development	No
Deimos Space ^{Spain}	40	0.05°/0.05°	UHF, S, X	LEO	Under Development	No
EnduroSat ^{Bulgaria}	112	0.08°/0.04°	UHF, S, X	LEO	Flown LEO	Yes
General Atomics EMS ^{USA}	10	0.28°/0.08°	UHF, S	LEO	Flown LEO	Yes
German Orbital Systems ^{Germany}	72	<1°/ <1°	UHF, S, X	LEO	Flown LEO	No
GomSpace ^{Denmark}	102	0.07°/0.056°	S, X	LEO, Deep Space	Flown LEO Qualified Deep Space	Yes
GUMUSH AeroSpace ^{Turkey}	160	<0.1°/ <0.05°	VHF, UHF, S, X	LEO	Under Development	No
Harpy Aerospace ^{India}	160	<0.1°/ <0.01°	VHF, UHF, S, X	LEO	Qualified LEO	Yes
Hex20 ^{Australia}	45	0.003°/0.003°	UHF, S, X	LEO, MEO, GEO, Lunar	Flown LEO	No
IMT ^{Italy}	115	0.1°/0.1°	VHF, UHF, S, C, X	LEO	Under Development	No
ISISPACE ^{The Netherlands}	100	<0.3°/ <0.3°	UHF, S, X	LEO, Lunar	Flown LEO Qualified for Lunar	No
NanoAvionics ^{Lithuania}	175	0.18°/0.12°	UHF, S, X	LEO	Flown LEO	Yes

**Table 2-4: 6U Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 6U category)

Organization ^{Headquarters}	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
NearSpace Launch ^{USA}	160	0.5°/0.2°	L, UHF, S, X	LEO	Flown LEO	Yes
NPC SPACEMIND ^{Italy}	85.2	<0.1°/0.1°	UHF, S, X, Ka	LEO, MEO, GEO, Lunar	Flown LEO	No
Open Cosmos ^{UK}	160	0.02°/0.01°	UHF, S, X	LEO	Flown LEO	No
Orbital Astronautics ^{UK}	1,000	0.1°/0.01°	S, X, K, Ka, Optical	LEO, MEO	Flown LEO	No
Orion Space Solutions ^{USA}	15	1°/1°	L, S, X	LEO	Flown LEO	Yes
Pumpkin Space ^{USA}	200	0.05°/0.05°	UHF, S, X, Ka	LEO, Lunar	Flown LEO Qualified Lunar	Yes
Quub, Inc. ^{USA}	50	5°/2°	UHF, S, Ku	LEO, Lunar	Under Development	Yes
SatRev ^{Poland}	36	1°/0.6°	UHF, S	LEO	Qualified LEO	No
SkyLabs ^{Slovenia}	200	0.3°/0.06°	VHF, UHF, S	LEO, MEO	Flown LEO and MEO	No
Space Dynamics Laboratory ^{USA}	400	0.021°/0.021°	UHF, S, X, Ka	LEO, GEO, GTO, Cislunar, Deep Space	Flown LEO Qualified GEO, GTO, Lunar and Deep Space	Yes
Space Flight Laboratory ^{Canada}	240	0.009°/0.004°	UHF, S, X, Ka	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	No
Space Inventor ^{Denmark}	200	<0.008°/0.008°	VHF, UHF, S, X	LEO	Flown LEO	No
Spacemanic ^{Czech Republic}	500	0.1°/0.05°	VHF, UHF, S	LEO, GEO, Lunar	Flown LEO Qualified GEO	No
Spire Global ^{USA}	200	0.1°/0.05°	UHF, L, S, X, Ka, Ku	LEO	Flown LEO	Yes
Terran Orbital ^{USA}	180	0.021°/0.007°	UHF, S, X	LEO, GEO, Lunar	Flown LEO and Lunar	Yes

**Table 2-5: 12U Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 12U category)

Organization ^{Headquarters}	Peak Power (W)	3- σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
AAC Clyde Space ^{Sweden}	400	<0.01°/ <0.0075°	VHF, UHF, S, X, K, Ka, Ku, Optical	LEO	Qualified LEO	Yes
Alén Space ^{Spain}	180	0.2°/0.1°	UHF, S	LEO	Under Development	No
Argotec ^{Italy}	100	<0.02°/ <0.01°	UHF, S, X	LEO	Under Development	Yes
Artemis Space Technologies ^{UK}	150	0.01°/0.01°	UHF, S, X, Ka, Ku, Optical	LEO, MEO, GEO, Lunar, Deep Space	Flown LEO Qualified GEO, MEO, Lunar, and Deep Space	No
Blue Canyon Technologies ^{USA}	108	0.0025°/0.0025°	L, S, X	LEO, GEO, Deep Space	Flown LEO and GEO Qualified Deep Space	Yes
C3S Electronics Development ^{Hungary}	165	<0.2°/ <0.2°	UHF, S	LEO, MEO	Under Development	No
EnduroSat ^{Bulgaria}	250	0.08°/0.04°	UHF, S, X, K/Ka	LEO	Flown LEO	Yes
General Atomics EMS ^{USA}	115	0.3°/0.024°	UHF, S	LEO	Qualified LEO	Yes
GomSpace ^{Denmark}	102	0.07°/0.056°	S, X	LEO	Qualified LEO	Yes
GUMUSH AeroSpace ^{Turkey}	240	<0.05°/ <0.05°	VHF, UHF, S, X	LEO	Under Development	No
Harpy Aerospace ^{India}	420	<0.1°/ <0.01°	VHF, UHF, S, X, K, Ka, Ku, Optical	LEO	Qualified LEO	Yes
Hex20 ^{Australia}	110	0.003°/0.003°	UHF, X	LEO, MEO, GEO, Lunar	Flown LEO	No
ISISPACE ^{The Netherlands}	190	<0.03°/ <0.03°	UHF, S, X, Ka	LEO	Under Development	No
NanoAvionics ^{Lithuania}	175	0.18°/0.09°	UHF, S, X	LEO	Flown LEO	Yes
Nara Space ^{South Korea}	120	0.05°/0.03°	S, X	LEO	Qualified LEO	No
NearSpace Launch ^{USA}	500	0.5°/0.2°	L, UHF, S, X	LEO, MEO	Under Development	Yes
NPC SPACEMIND ^{Italy}	96	<0.1°/ <0.1°	UHF, S, X, Ka	LEO, MEO, GEO, Lunar	Flown LEO	No
Open Cosmos ^{UK}	160	0.031°/0.027°	UHF, S, X	LEO	Flown LEO	No
Orbital Astronautics ^{UK}	1,000	0.05°/0.01°	S, X, K, Ka, Optical	LEO, MEO, GEO	Flown LEO	No
Orion Space Solutions ^{USA}	40	<1°/ <1°	L, S, X, Ka	LEO, GEO	Qualified LEO and GEO	Yes
Pumpkin Space ^{USA}	400	0.05°/ <0.05°	UHF, S, X, Ka	LEO, Lunar	Qualified LEO	Yes

**Table 2-5: 12U Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 12U category)

Organization <small>Headquarters</small>	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
SkyLabs <small>Slovenia</small>	500	0.3°/0.06°	VHF, UHF, S	LEO, MEO	Flown LEO and MEO	No
Space Dynamics Laboratory <small>USA</small>	400	0.021°/0.021°	UHF, S, X, Ka	LEO, GEO, GTO, Cislunar, Deep Space	Flown LEO Qualified GEO, GTO, Lunar and Deep Space	Yes
Space Flight Laboratory <small>Canada</small>	322	0.009°/0.004°	UHF, S, X, Ka	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	No
Space Information Laboratories <small>USA</small>	180	0.008°/0.008°	S, X, Ka	LEO, GEO, Lunar	Under Development	Yes
Space Inventor <small>Denmark</small>	200	<0.008°/<0.008°	VHF, UHF, S, X	LEO	Flown LEO	No
Spacemanic <small>Czech Republic</small>	500	0.1°/0.05°	VHF, UHF, S, X	LEO, GEO, Lunar	Flown LEO Qualified GEO	No
Spire Global <small>USA</small>	300	0.1°/0.05°	UHF, L, S, X, Ka, Ku	LEO	Qualified LEO	Yes
Terran Orbital <small>USA</small>	100	0.021°/0.007°	UHF, S, X	LEO, GEO, Lunar	Flown LEO and Lunar	Yes

**Table 2-6: 16U+ Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 16U+ category)

Organization ^{Headquarters}	Format	Peak Power (W)	3- σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
AAC Clyde Space ^{Sweden}	16U	400	<0.01°/ <0.0075°	VHF, UHF, S, X, K, Ka, Ku, Optical	LEO	Qualified LEO	Yes
Argotec ^{Italy}	16U+	220	<0.02°/ <0.01°	UHF, S, X, K, Ka	GEO, Deep Space	Under Development	Yes
Artemis Space Technologies ^{UK}	16U	200	0.01°/0.01°	UHF, S, X, Ka, Ku, Optical	LEO, MEO, GEO, Lunar, Deep Space	Flown LEO Qualified GEO, MEO, Lunar, and Deep Space	No
Astro Digital ^{USA}	16U+	500	<0.05°/ <0.01°	UHF, S, X, Ku, Ka, V, W, Optical	LEO	Flown LEO	Yes
Blue Canyon Technologies ^{USA}	16U	108	0.0025°/0.0025°	L, S, X	LEO, GEO, Deep Space	Qualified LEO, GEO and Deep Space	Yes
C3S Electronics Development ^{Hungary}	16U+	165	<0.2°/ <0.2°	UHF, S	LEO, MEO	Under Development	No
Deimos Space ^{Spain}	16U+	100	0.025°/0.025°	UHF, S, X	LEO, Lunar, Deep Space	Under Development	No
EnduroSat ^{Bulgaria}	16U	250	0.08°/0.04°	UHF, S, X, K/Ka	LEO	Qualified LEO	Yes
German Orbital Systems ^{Germany}	16U	164	<1°/ <1°	UHF, S, X	LEO	Qualified LEO	No
GomSpace ^{Denmark}	16U	150	0.07°/0.056°	S, X	LEO	Qualified LEO	Yes
GUMUSH AeroSpace ^{Turkey}	16U	240	<0.05°/ <0.05°	VHF, UHF, S, X	LEO	Under Development	No
Harpy Aerospace ^{India}	16U, 27U	420	<0.1°/ <0.01°	VHF, UHF, S, X, K, Ka, Ku, Optical	LEO	Qualified LEO	Yes
Hex20 ^{Australia}	27U	150	0.003°/0.003°	UHF, S, X	LEO, MEO, GEO, Lunar	Flown LEO	No
ISISPACE ^{The Netherlands}	16U	190	<0.03°/ <0.03°	UHF, S, X, Ka	LEO	Under Development	No
NanoAvionics ^{Lithuania}	16U	175	0.18°/0.09°	UHF, S, X	LEO	Flown LEO	Yes
Nara Space ^{South Korea}	16U	120	0.05°/0.03°	S, X	LEO	Flown LEO	No
NPC SPACEMIND ^{Italy}	16U	120	<0.1°/ <0.1°	UHF, S, X, Ka	LEO, MEO, GEO, Lunar	Under Development	No
Open Cosmos ^{UK}	16U	160	0.031°/0.027°	UHF, S, X	LEO	Flown LEO	No
Orbital Astronautics ^{UK}	16U, 27U	1,000	0.05°/0.01°	S, X, K, Ka, Optical	LEO, GEO, Lunar	Qualified LEO	No
Orion Space Solutions ^{USA}	16U+	400	<1°/ <1°	L, S, X, Ka, Optical	LEO, GEO, Lunar	Qualified LEO, GEO and Lunar	Yes

**Table 2-6: 16U+ Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the 16U+ category)

Organization <small>Headquarters</small>	Format	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
Pumpkin Space <small>USA</small>	16U, 27U	400	0.05°/0.05°	UHF, S, X, Ka	LEO, Lunar	Qualified LEO	Yes
SkyLabs <small>Slovenia</small>	20U+	500	<0.005°/0.003°	VHF, UHF, S	LEO, MEO	Flown LEO and MEO	No
Space Dynamics Laboratory <small>USA</small>	16U+	1,600	0.021°/0.021°	UHF, S, X, Ka, Optical	LEO, GEO, GTO, Cislunar, Deep Space	Flown LEO Qualified GEO, GTO, Lunar and Deep Space	Yes
Space Flight Laboratory <small>Canada</small>	16U	322	0.009°/0.004°	UHF, S, X, Ka	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	No
Space Information Laboratories <small>USA</small>	27U	180	0.008°/0.008°	S, X, Ka	LEO, GEO, Lunar	Under Development	Yes
Space Inventor <small>Denmark</small>	16U	200	<0.008°/0.008°	VHF, UHF, S, X, L, Ka, Ku, QV	LEO, GEO, MEO	Flown LEO and GEO	No
Spacemanic <small>Czech Republic</small>	16U, 27U	1,000	0.1°/0.05°	VHF, UHF, S, X	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	No
Spire Global <small>USA</small>	16U	300	0.1°/0.05°	UHF, L, S, X, Ka, Ku	LEO	Flown LEO	Yes
Terran Orbital <small>USA</small>	16U	100	0.021°/0.007°	UHF, S, X	LEO, GEO, Lunar	Flown LEO and Lunar	Yes

ESPA-Class

The term ESPA-class refers spacecraft using the Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (SPA) or similar configurations. The ESPA ring typically separates the primary payload from the upper stage of the launch vehicle and permits additional mounting locations for secondary payloads. Multiple rings can be stacked to increase the number of secondary payloads.

Table 2-7 includes ESPA-class options that may not be designed for the ESPA ring but have the mass and volume to permit adaptability to rideshare opportunities. The information in this chapter is limited to offerings with mass under 500 kg even though some variants of the ESPA ring can support higher mass. Variants of the ESPA ring include, but are not limited to, ESPA-Heavy and ESPA-Grande. Examples of ESPA rideshares are provided in Figures 2.5, 2.6, and 2.7, while Figure 2.9 shows an example of an ESPA satellite from Muon Space.



Figure 2.6: Example mission configuration using rideshare plates. Credit: SpaceX.

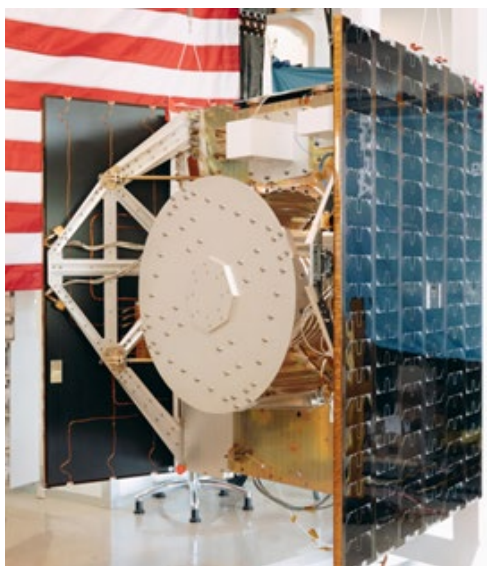


Figure 2.7: Apex Aries bus with payloads. Credit: Apex Space.

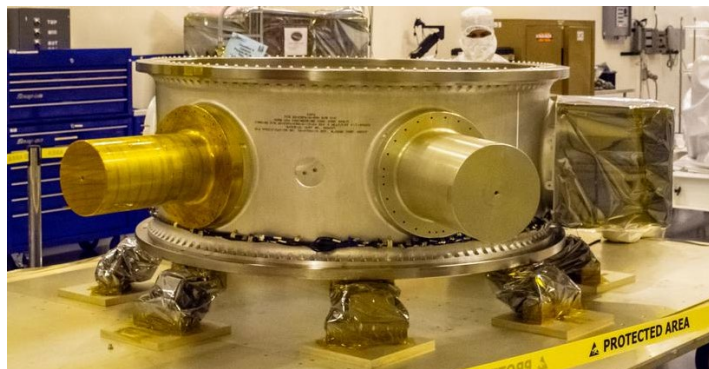


Figure 2.8: LandSat-9 ESPA ring populated with payloads and mass ballasts. Credit: NASA/Randy Beaudoin.

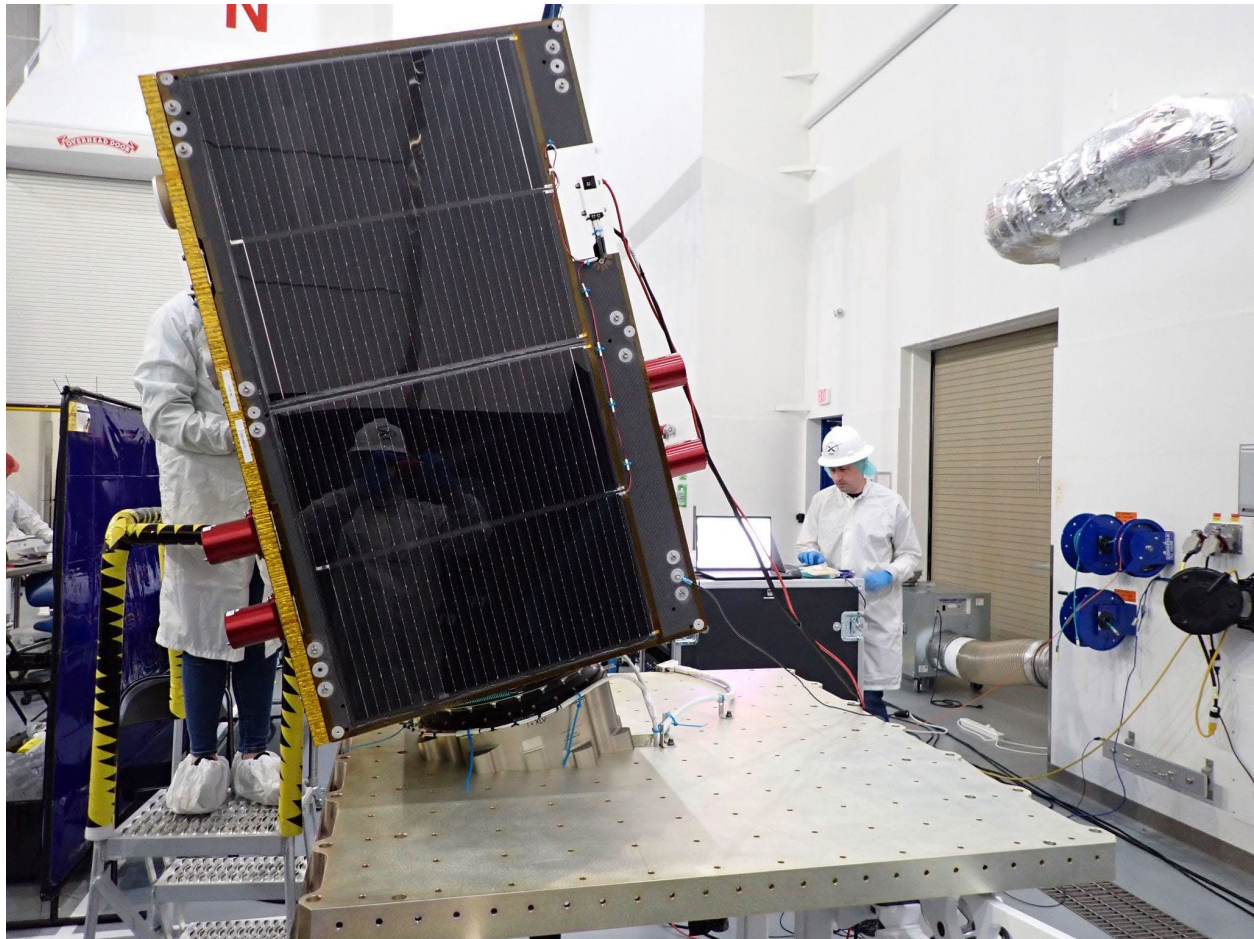


Figure 2.9: ESPA-Class satellite bus from Muon Space during integration at SpaceX facility for Transporter 8 rideshare mission. Credit: Muon Space via ExoLaunch and SpaceX.

**Table 2-7: ESPA-Class Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the ESPA-Class category)

Organization ^{Headquarters}	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
Aerospacelab ^{Belgium}	1,000	<0.003°/<0.003°	S, X, Ka, Optical	LEO, GEO	Flown LEO Under Development GEO	Yes
Airbus US Space & Defense ^{USA}	2,200	0.3°/0.3°	S, Ka, Optical	LEO	Flown LEO	Yes
Apex Space ^{USA}	4,000	0.005°/0.0025°	UHF, S, X	LEO, GEO	Flown LEO	Yes
Argotec ^{Italy}	400	<0.01°/<0.008°	UHF, S, X, K, Ka	LEO, MEO, GEO, Deep Space	Qualified LEO Under Development MEO, GEO, Deep Space	Yes
Artemis Space Technologies ^{UK}	1,250	0.01°/0.01°	UHF, S, X, Ka, Ku, Optical	LEO, MEO, GEO, Lunar, Deep Space	Qualified LEO, MEO, GEO, Lunar and Deep Space	No
Astranis Space Technologies Corp. ^{USA}	2,500	<0.1°/<0.01°	MIL-Ka, Ka, Ku, Q, V, X	MEO, GEO, Cislunar, Deep Space, Polar, High Inclination	Flown GEO	Yes
Astro Digital ^{USA}	2,000	<0.05°/<0.01°	UHF, S, X, Ku, Ka, V, W, Optical	LEO, GEO, Deep Space	Flown LEO	Yes
Astroscale ^{USA}	3,530	0.05°/0.025°	S, X, C	LEO, GEO	Under Development	Yes
BAES ^{USA}	2,500	<0.007°/<0.006°	L, S, X, Ka	LEO, MEO, GEO, Deep Space	Flown LEO, Qualified Deep Space	Yes
Berlin Space Technologies ^{Germany}	2,500	<0.017°/<0.017°	S, X	LEO	Flown LEO	Yes
Blue Canyon Technologies ^{USA}	1,082	0.0025°/0.0025°	L, S, X	LEO, GEO, Deep Space	Flown LEO and GEO Qualified Deep Space	Yes
CesiumAstro ^{USA}	4,500	<0.1°/<0.01°	S, L, Ka, Optical	LEO	Under Development	Yes
CREOTECH ^{Poland}	150	<0.015°/<0.015°	S, X, Optical	LEO, MEO, GEO, Lunar, Deep Space	Flown LEO	No
Deimos Space ^{Spain}	300	<0.005°/<0.005°	S, X, iDRS	LEO	Under Development	No
EnduroSat ^{Bulgaria}	300/3500	0.1°/<0.008°	UHF, S, X, K/Ka	LEO	Qualified LEO (300W) Under Development (3500W)	Yes
General Atomics EMS ^{USA}	450	0.03°/0.02°	S, X	LEO	Qualified LEO	Yes
Harpy Aerospace ^{India}	2,100	0.35°/0.35°	S, Ka, Optical	LEO	Qualified LEO	Yes

**Table 2-7: ESPA-Class Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the ESPA-Class category)

Organization ^{Headquarters}	Peak Power (W)	3- σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
Hemeria ^{France}	>1,000	<0.03°/ <0.01°	S, X	LEO, GEO, GTO	Flown LEO Qualified GEO and GTO	No
LeoStella ^{USA}	2,000	0.013°/0.009°	UHF, S, X	LEO	Flown LEO	Yes
Lockheed Martin ^{USA}	500+	<0.1°/ <0.1°	S, X, Ka	LEO, GEO, Lunar, Deep Space	Flown LEO Qualified GEO, Lunar and Deep Space	Yes
Loft Orbital ^{USA}	>1,000	<0.035°/ <0.03°	S, X, L	LEO	Flown LEO	Yes
Magellan Aerospace ^{Canada}	200	0.01°/0.01°	S, X	LEO	Flown LEO	No
Malin Science Space Systems ^{USA}	918	<0.015°/ <0.015°	UHF, X, Ka	Mars	Under Development	Yes
Moog ^{USA}	2,000	<0.050°/ <0.033°	S, X, Ka, Optical	LEO, GEO	Flown LEO Under development GEO	Yes
Momentum Space ^{USA}	3,000	0.008°/0.008°	S, X, Ka, Optical	LEO, MEO, GEO, Lunar, Deep Space	Flown LEO	Yes
Muon Space ^{USA}	3,000	0.012°/0.03°	S, X, Ka	LEO	Flown LEO	Yes
NanoAvionics ^{Lithuania}	660	0.24°/0.09°	UHF, S, X	LEO	Flown LEO	Yes
Northrop Grumman ^{USA}	400	<0.01°/ <0.008°	S, X, Ka	LEO, GEO, HEO	Flown LEO, GEO, and HEO	Yes
NovaWurks ^{USA}	>5,000	0.002°/0.0004°	UHF, S, L, X, Ka, Ku and Optical	LEO, MEO, GEO, GTO, HEO, Lunar and Deep Space	Flown LEO and GTO	Yes
OHB LuxSpace ^{Luxembourg}	834	<0.022°/ 0.01°	S, X	LEO	Qualified LEO	No
OHB Sweden ^{Sweden}	1,500	0.008°/0.008°	S, X, L	LEO, MEO	Flown LEO	No
Open Cosmos ^{UK}	2,200	<0.033°/0.03°	S, X	LEO	Under Development	No
Orbital Astronautics ^{UK}	5,000	0.05°/0.01°	S, X, K, Ka, Optical	LEO, MEO, GEO, Deep Space	Qualified LEO	No
Quantum Space ^{USA}	1,000	0.006°/0.006°	S, X, Ka	LEO, GEO, Cislunar, Lunar, Deep Space	Under Development	Yes
Reflex Aerospace ^{Germany}	>300	<0.01°/ <0.01°	S, X, Ka, Ku, Optical	LEO	Under Development	No
Redwire Space ^{USA}	600	0.005°/0.0017°	X	LEO	Qualified LEO	Yes

**Table 2-7: ESPA-Class Market Solutions**

(The fields indicate maximum capability; organizations may offer multiple options including smaller capabilities within the ESPA-Class category)

Organization ^{Headquarters}	Peak Power (W)	3-σ Pointing Control/ Knowledge	Comm Options	Intended Destination	Maturity	US Office
Sierra Space ^{USA}	500	0.001°/ <0.001°	UHF, S, X	LEO, MEO, GEO	Flown LEO	Yes
SITAEL ^{Italy}	2,000	0.0017°/0.001°	S, X	LEO	Qualified LEO	No
Southwest Research Institute ^{USA}	1,550	0.015°/0.002°	S, X, Ka	LEO, GEO	Flown LEO Under Development GEO	Yes
Space Dynamics Laboratory ^{USA}	1,600	0.021°/0.021°	UHF, S, X, Ka, Optical	LEO, GEO, GTO, Cislunar, Deep Space	Flown LEO	Yes
Space Flight Laboratory ^{Canada}	1,200	0.009°/0.004°	UHF, S, X, Ka	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	No
Space Inventor ^{Denmark}	400	<0.008°/ <0.008°	VHF, UHF, S, X, L, Ka, Ku, QV	LEO, GEO, MEO	Qualified LEO	No
Surrey Satellite Technology Ltd. ^{UK}	2,000	<0.01°/ <0.01°	S, X, Ka, Ku, ISL	LEO, Lunar	Flown LEO Under Development Lunar	No
Terran Orbital ^{USA}	1,500	0.014°/0.002°	UHF, S, X	LEO, GEO, Lunar	Flown LEO	Yes
XPLORE ^{USA}	950	0.17°/ 0.018°	S, X	VLEO, LEO, Cislunar	Under Development	Yes
York Space Systems ^{USA}	1,500	0.008°/0.004°	UHF, S, X, Ka, Ku, Optical	LEO, GEO, Lunar	Flown LEO Qualified GEO and Lunar	Yes



2.3 Programmatic and Systems Engineering Considerations

When determining the optimal mission design approach, small satellite mission developers should carefully evaluate the programmatic and systems engineering considerations that align most with their specific objectives and constraints. This assessment is crucial for making informed decisions that best serve the mission's goals and requirements. Example of these considerations include:

- Environments the system will endure during development and in flight
- Concept of operations, including desired orbit
- Functional and performance requirements
- Key performance parameters with appropriate margins (e.g., mass, volume, power, data link, data budget, pointing)
- Software considerations such as development environment and re-use
- Technology development considerations such as flight heritage, Technology Readiness Level (TRL), and reliability
- Risk posture for development and performance
- Trades between performance, cost, and schedule
- Procurement considerations such as production/lead time and contractual mechanisms
- Licensing requirements, as applicable (e.g., RF licensing, remote sensing, export control, re-entry)

In addition to the considerations listed above, hosted orbital service missions should also consider:

- Payload priority/mission lifetime for multi-customer/multi-manifest missions
- Balancing costs vs payload use of platform resources (e.g., mass, volume, power, data link, data budget, pointing)

Before finalizing any mission design decisions, it is essential to thoroughly analyze these factors, along with numerous other considerations, for each potential option within the trade space. Given mission system performance requirements for key performance parameters like mass, volume, power, data link, data budget, and pointing, a functional importance rating and risk-based trade study should be used to screen the many options available. In addition to functional performance, relevant flight heritage or TRL, production lead time, and any available reliability data should be included in the trades. These factors, as well as cost, could drive the design to be done via COTS or commercial support.

Mission developers may want to take into consideration the following guides to help them in their selection and design process:

- NASA CubeSat 101 Book <https://www.nasa.gov/content/cubesat-launch-initiative-resources>
- NASA Systems Engineering Handbook <https://www.nasa.gov/connect/ebooks/nasa-systems-engineering-handbook>
- NASA Small Spacecraft Technology program Guidebook for Technology Development Projects https://www.nasa.gov/sites/default/files/atoms/files/smallsattechdevguidebook_rev-508d1.pdf

2.4 Summary

Several vendors have pre-designed fully integrated small spacecraft buses that are space-rated and available for purchase. The market includes companies that are willing to heavily modify their systems to fit the customer's needs and companies attempting to standardize their system with



little to no customization in favor of a better cost proposition. This chapter assembled a long list of providers with key characteristics to facilitate the research and down-selection process for SmallSat practitioners.

For feedback about this chapter, email: arc-sst-soa@mail.nasa.gov. Please include a business email in case of follow up questions.

2.5 References

The references in this section are provided to facilitate the process in which practitioners can obtain information from the providers. The source indicates how the information provided in this chapter was obtained.

Source definition:

2025 = organization provided the information through direct communication with the State-of-the-Art team for the current edition of the document.

2024 = organization provided the information through direct communication with the State-of-the-Art team on the 2024 edition of the document, and the team was unable to communicate with the organization to update the current edition of the document.

Web = information obtained from a provider website or NASA website

Table 2-8: List of Contact Information for Organizations in this Chapter

Organization	Source	Contact Email	Website
AAC Clyde Space	2025	enquiries@aac-clydespace.com	www.aac-clyde.space
Aerospacelab	2025	gerry.jansson@aerospacelab.com	www.aerospacelab.com
Airbus US Space & Defense	2024	deborah.horn@airbusus.com	www.airbusus.com
Alba Orbital	2025	contact@albaorbital.com	www.albaorbital.com
Alén Space	2025	sales@alen.space	www.alen.space
Apex Space	2025	General Inquiries Page	www.apexspace.com
Argotec	2025	info@argotecgroup.com	www.argotecgroup.com
Artemis Space Technologies	2024	info@spaceartemis.com	www.spaceartemis.com
Astranis Space Technologies Corp.	2025	scott@astranis.com	www.astranis.com
Astro Digital	2025	brian@astrodigital.com	www.astrodigital.com
Astroscale-us	2025	k.shahady@astroscale-us.com	www.astroscale-us.com
Axelspace	2024	Contact Page	www.axelspace.com
BAE Systems Inc., Space and Mission Systems (BAES)	2025	Space & Mission Systems Team Contact	www.baesystems.com
Berlin Space Technologies	2025	info@berlin-space-tech.com	www.berlin-space-tech.com
Blue Canyon Technologies	2024	info@bluecanyontech.com	www.bluecanyontech.com
C3S Electronics Development	2025	info@c3s.hu	www.c3s.hu
CesiumAstro	2025	info@cesiumastro.com	www.cesiumastro.com
CREOTECH	2025	kontakt@creotech.pl	www.creotech.pl/space
Deimos Space	2025	cmentrena@deimos-space.com	www.elecnor-deimos.com
DIYSATELLITE	2025	gus@diysatellite.com	www.diysatellite.com
EnduroSat	2025	Contact Page	www.endurosat.com
FOSSA Systems	2025	contact@fossa.systems	www.fossa.systems

**Table 2-8: List of Contact Information for Organizations in this Chapter**

Organization	Source	Contact Email	Website
General Atomics EMS	2024	Chris.white@ga.com	www.ga.com/EMS
German Orbital Systems	2024	info@orbitalsystems.de	www.orbitalsystems.de
GomSpace	2024	info@gomspace.com	gomspace.com
Gran Systems	2025	info@gransystems.com	www.gransystems.com
GUMUSH AeroSpace	2025	gumush@gumush.com.tr	www.gumush.com.tr
Harpy Aerospace	2025	jayakumar@harpyaerospace.in	www.harpyaerospace.in
Hemeria	2025	<u>Contact Form</u>	www.hemeria-group.com/en
Hex20	2025	lloyd@hex20.com.au	www.hex20.com.au
Hydra Space Systems	2025	contacto@hydra-space.com	www.hydra-space.com
IMT	2024	giovanni.cucinella@imtsrl.it	imtsrl.it
Innova Space	2025	info@innova-space.com	innova-space.com/en
ISISPACE	2025	sales@isispace.nl	www.isispace.nl
LeoStella	2025	mike.kaplan@leostella.com	leostella.com
Lockheed Martin	2025	timothy.m.linn@lmco.com	-
Loft Orbital	2025	gautier@loftorbital.com	www.loftorbital.com
Magellan Aerospace	2025	rushi.ghadawala@magellan.aero	www.magellan.aero
Malin Space Science Systems	2025	yee@msss.com	www.msss.com
Moog	2025	<u>Hfreeman2@moog.com</u>	<u>www.moog.com/markets/space</u>
Momentus Space	2025	sales@momentus.space	www.momentus.space
Muon Space	2025	info@muonspace.com	www.muonspace.com
NanoAvionics	2025	info@nanoavionics.com	www.nanoavionics.com
Nara Space	2025	sales@naraspace.com	www.naraspace.com
NearSpace Launch	2025	nsl@nearspacelaunch.com	www.nearspacelaunch.com
Northrop Grumman	2025	John.Dyster@ngc.com	-
NovaWurks	2025	info@NovaWurks.com	www.novawurks.com
NPC SPACEMIND	2025	info@npcspacemind.com	www.npcspacemind.com
OHB LuxSpace	2025	info@luxspace.lu	www.luxspace.lu
OHB Sweden	2025	spacesales@ohb-sweden.se	www.ohb-sweden.se
Open Cosmos	2024	partnerships@open-cosmos.com	open-cosmos.com
Orbital Astronautics	2024	hello@orbastro.com	orbastro.com
Orion Space Solutions	2024	contact@orionspace.com	orionspace.com
Pumpkin Space Systems	2025	sales@pumpkininc.com	www.pumpkinspace.com
Quantum Space	2025	sales@quantumspace.us	www.quantumspace.us
Quub, Inc.	2025	info@quub.space	quub.space
Rocket Lab	Web	spacesystems@rocketlabusa.com	www.rocketlabusa.com
Redwire Space	2024	sales@redwirespace.com	www.redwirespace.com
Reflex Aerospace	2025	sales@reflexaerospace.com	www.reflexaerospace.com
SatRev	2025	engage@satrev.space	www.satrev.space
Sierra Space	2025	spaceapps@sierraspace.com	www.sierraspace.com
SITAEI	2025	sales.space@sitael.com	www.sitael.com
SkyLabs	2025	sales@skylabs.si	www.skylabs.si
Southwest Research Institute	2024	spacecraft-info@swri.org	-
Space Dynamics Laboratory	2025	info@sdl.usu.edu	www.sdl.usu.edu

**Table 2-8: List of Contact Information for Organizations in this Chapter**

Organization	Source	Contact Email	Website
Space Flight Laboratory	2025	info@utias-sfl.net	www.utias-sfl.net
Space Information Laboratories	2024	sales@spaceinformationlabs.com	www.spaceinformationlabs.com
SpaceX	Web	Julianna.Scheiman@spacex.com	www.spacex.com
Space Inventor	2024	sales@space-inventor.com	space-inventor.com
Spacemanic	2025	sales@spacemanic.com	www.spacemanic.com
Spire Global	2024	joe.carroll@spire.com	www.spire.com
Surrey Satellite Technology Ltd.	2025	info@sstl.co.uk	www.sstl.co.uk
Terran Orbital	2025	info@terranorbital.com	terranorbital.com
Varda Space Industries	Web	info@varda.com	www.varda.com
Xplore	2024	inquire@xplore.com	www.xplore.com
York Space Systems	2025	BD@yorkspacesystems.com	www.yorkspacesystems.com