

SpaceX Falcon-9 Rideshare SmallSat Missions

By Don Hillger and
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Introduction

Large numbers of small satellites are increasingly being placed into orbit in single launches. Part of the impetus is the reduced launch cost per spacecraft when so many are launched simultaneously. In addition, small satellites are becoming more and more popular. SmallSats (also referred to as CubeSats or MicroSats) are often used to test new spacecraft capabilities or for training in the development and operation of satellites at low cost. They are also a relatively affordable means of filling the skies with large numbers of satellites for various purposes. They can form an operational constellation to widely and frequently monitor Earth, or blanket Earth with Internet and/or telephone communications.



Transporter mission patch.

This article will cover mainly the SpaceX Rideshare missions (<https://www.spacex.com/rideshare/>) and their different types. The commonality is the SpaceX Falcon-9 launch rocket. These group launches have become a frequent occurrence in recent years, with 15 of them to date. Other multiple-satellite launches have also taken place, but most of them usually involve fewer spacecraft on different launch rockets. The focus here is on the named systems utilized by SpaceX and others, as well as some of the spacecraft that that were part of the group launches.

The table summarizes the SmallSat group launches that are covered in this article. All were launched by the SpaceX Falcon-9 rocket, and all but the first one were largely managed by SpaceX with help from SmallSat mission managers. The first one, **SmallSat Express**, was organized by Spaceflight Industries, who contracted with SpaceX for a Falcon-9 launch in

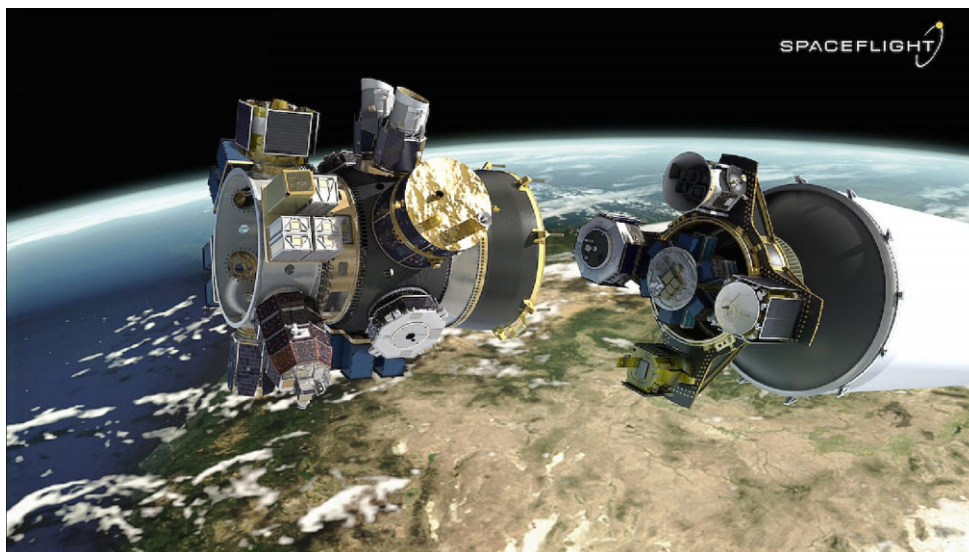
2018. Subsequently, Spaceflight Industries has organized the launch of other spacecraft in smaller numbers on other rockets.

Table: SmallSat Falcon-9 group launches

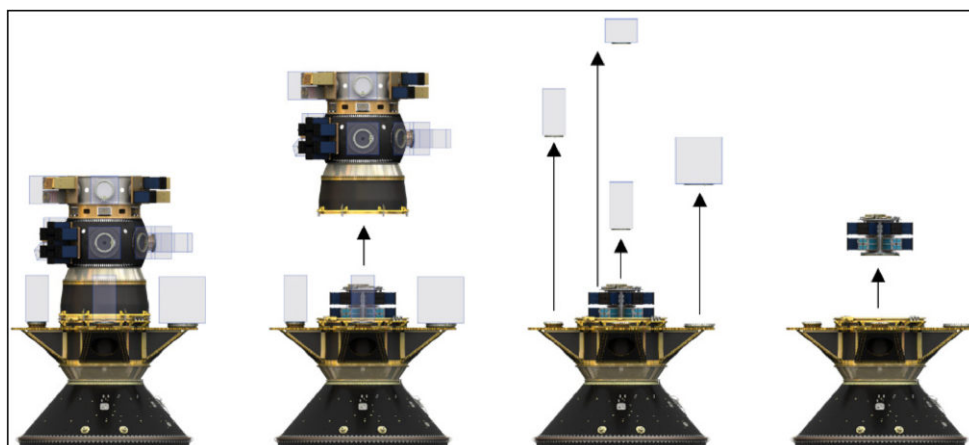
SmallSat group	Launch date (dd-mm-yyyy)	Number of SmallSats (approx. number of different spacecraft names)
(Spaceflight Industries) SSO-A: SmallSat Express group [sun-synchronous orbit]		
SSO-A: SmallSat Express	03-12-2018	71 (52)

(SpaceX) Transporter groups [sun-synchronous orbits]		
Transporter-1	24-01-2021	143 (24)
Transporter-2	30-06-2021	88 (39)
Transporter-3	13-01-2022	105 (38)
Transporter-4	01-04-2022	40 (18)
Transporter-5	25-05-2022	59 (30)
Transporter-6	03-01-2023	115 (44)
Transporter-7	15-04-2023	51 (38)
Transporter-8	12-06-2023	72 (40)
Transporter-9	11-11-2023	90 (50)
Transporter-10	04-03-2024	53 (37)
Transporter-11	16-08-2024	116 (48)
Transporter-12	14-01-2025	131 (62)
(SpaceX) Bandwagon groups [mid-inclination orbits]		
Bandwagon-1	07-04-2024	11 (7)
Bandwagon-2	21-12-2024	30 (15)

The powerful Falcon-9 rocket allows a large number of SmallSats to be launched together. The spacecraft are then separated from the launch vehicle attached to one or more “hubs” in groups known as “free-flyers”. The individual spacecraft are then adequately separated in orbit by releasing them over time. An artist’s depiction of two such free-flyers with the SmallSats still attached to their hubs for the SSO-A launch is provided below. In it, one of the hubs is still attached to the launch rocket’s second stage. A second depiction shows how SmallSats are released from the hubs. The free-flyers then deploy drag sails to de-orbit and burn up in Earth’s atmosphere.



Spaceflight-Industries free-flyers.



SSO - A deployment Sequence from Falcon 9.

SmallSat groups called **Transporter** started in 2021, using a multi-satellite deployment system similar to that of the 2018 SSO-A mission. A Transporter-4 launch cover with a Denis Ranski cachet is provided, depicting the SpaceX Transporter deployment system with multiple SmallSats attached to a hub attached to the second stage. This appears to be a single hub launch, compared to the two-hub SmallSat Express design discussed above.



Transporter-4 with 40 smallsats cover.

The launch rocket used in these SpaceX Transporter missions provides the lift to high-inclination sun-synchronous orbits, a common orbit which generally allows complete coverage of Earth every 12 hours, with two overhead passes every day.



Bandwagon mission patch.

In 2024, SpaceX started offering a second type of SmallSat launch opportunity called **Bandwagon**, of which only two have been launched as this is being written. The difference is that Bandwagon offers launch to mid-inclination orbits, for example 45°, which do not reach higher latitudes, but spend more time orbiting over the more populated regions of Earth.

One of the Bandwagon-1 covers is provided, as an example of this type of mission. This cover contains a logo for the South “Korea 425” Project reconnaissance satellites. KorSat-1, as the first of the KorSat radar component of that project, was launched on 7 April 2024 in the Bandwagon-1 group. Similarly, KorSat-2 was launched in the Bandwagon-2 group on 21 December 2024.



Bandwagon-1 with 11 smallsats cover

Some of the spacecraft involved in these launches

Spaceflight Industries acted as a broker for collecting the spacecraft for the SSO-A SmallSat Express. The launch carried spacecraft from 18 different countries and more than 35 customers from different entities such as governments, commercial interests, universities, and even a high school! Only a few of the over 1000 Rideshare SmallSats to date will be mentioned here as examples of the types of missions that utilize these group launches.

The US Air Force (USAF) Academy launched two satellites (**FalconSat-6** on SmallSat Express in 2018 and **FalconSat-10** on Transporter-9 in 2023) that were built by Academy students. FalconSat-6 was designed to test various thrusters and measure the local plasma. FalconSat-10 is a test-bed to demonstrate new technologies including some related to propulsion and communications.

Planet [Lab]'s **SkySat-14 and 15** imaging satellites were launched with SmallSat Express, but others in the SkySat series flew with other multi-satellite launch missions. Three of Planet's **Flock** (aka **Dove**) Earth-observation satellites were launched on SmallSat Express, a couple hundred more of the Flock constellation were subsequently launched in five different Transporter groups to date (for details see the authors' website, mentioned at the end of this article).

Other constellations of spacecraft similarly launched by Falcon-9 rockets in more than one Rideshare group include **Capella**, **Centauri**, **Connecta**, **GHGSat**, **ICEYE**, **Kepler**, **Lemur**, **NuSat**, **QPS-SAR**, **SpaceBEE** and a number of **OSCAR** amateur radio satellites, as well as a few of SpaceX's own **Starlink** satellites. Those various spacecraft fall under the general categories of environmental-observing, communications, navigation, or scientific disciplines.

Details about these spacecraft series are beyond the scope of this article and are left to the reader to research. These spacecraft series are mentioned only in passing, as few if any postal items have depictions of any of them. Rather, only the launch covers for the full Rideshare missions are readily available, but only a few include details of the many satellites that were launched. One such cover is a Transporter-1 launch cover with a Lollini cachet, which lists most of the 24 unique names of the SmallSats that were lofted in this Rideshare mission.



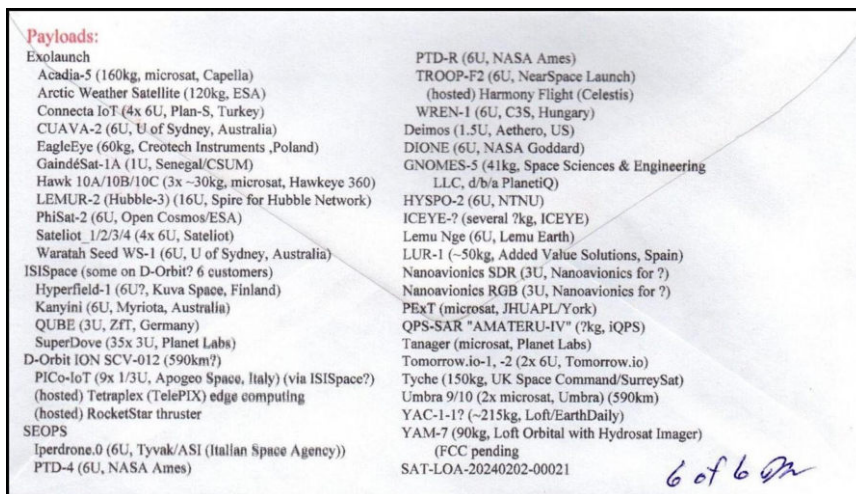
Transporter-1 with 143 smallsats cover.

Images of the launch covers that the authors have found are available for viewing at <https://rammb.cira.colostate.edu/dev/hillger/transporter.htm>. One example is a Transporter-11 launch cover with a JM cachet which has logos of some of the space-related companies that arrange mission management services for SmallSats, such as integration and deployment: companies such as Exolaunch, SEOPS, and AVS. Again, details about these services are beyond the scope of this article and are up to the reader to research if interested. Plenty of information is available online. Unusually, this cover also depicts one of the SmallSats: "Planet's first hyperspectral satellite". Though unnamed on the cover, it is Tanager-1.



Transporter-11 with 116 smallsats cover.

The back of this cover has a list of the SmallSats deployed on this Transporter-11 mission, including the Planet Labs Tanager-1 microsat which is depicted on the cover front. This is much more mission information than is typically found on most Rideshare covers, which is understandable given the large numbers and unusual names of the various satellites launched in these missions.



Back of Transporter-11 with 116 smallsats cover.

Similarly, the insert from a Galactic Space Covers launch cover for Transporter-4 has a somewhat detailed list of the SmallSats for that Rideshare mission. The authors frequently use Gunter's Space Page (<https://space.skyrocket.de/>) to help with spacecraft identification, which is becoming an increasing challenge, as the number of orbited Earth satellites continues to rise. (For example, in 2023 over 2600 objects were launched into space, with the USA alone accounting for more than 2100 of those spacecraft in just over 100 launches, an average of about 20 spacecraft per launch.)



Transporter-4 with 40 smallsats cover.

Summary

This article has discussed the multi-spacecraft launches of SmallSats by the SpaceX Falcon-9 rocket and mentioned a few of the SmallSats that were deployed in those missions.

An unsettling side effect of launching so many spacecraft is that the US Air Force (USAF) Space Surveillance Network (SSN) is not always able to distinguish among SmallSats that are deployed close to each other because many of them are similar in design with few distinguishing features. The SSN attempts to track each spacecraft individually for collision avoidance purposes, but they are not necessarily specifically identified by the spacecraft owner or operator. This has prompted a call for a better way to identify in-orbit spacecraft. The identification problem will only increase, as already many more than 25,000 space objects are being tracked, a number that has greatly increased in the last few years and will continue to increase over time.

Biographical notes

The authors have researched and written extensively on the subjects of weather, climate, and un-manned spacecraft on stamps and covers, as well as other topics. Their Un-manned Satellite Philately website can be found at <http://rammb.cira.colostate.edu/dev/hillger/satellites.htm>. Email correspondence with the authors is welcome, using the addresses below.

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