

**Swarm Technologies, Inc.** is a private company building a low Earth orbit satellite constellation for communications with Internet of things (IoT) devices using a store and forward design. Social Capital incubated Swarm, Craft Ventures was an early investor. On 16 July 2021 Swarm entered into an agreement to become a direct wholly-owned subsidiary of SpaceX.<sup>[2]</sup>

In-Q-Tel, the venture capital arm of the CIA, lists Swarm Technologies as one of their startups.<sup>[3]</sup>

They have a Federal Communications Commission (FCC) licence for low bandwidth communications satellites in low Earth orbit.<sup>[4]</sup>

In 2018 Swarm became the first U.S. company found to have deployed satellites without regulatory approval after an FCC investigation into the startup's launch of its first four picosatellites on an Indian PSLV rocket in January that year.<sup>[5]</sup>

By December 2020 Swarm had launched 9 test satellites and 36 of a planned 150 low Earth orbit satellites to provide communication with IOT devices.<sup>[6]</sup>

In February 2021 Swarm announced that its commercial services were now live using 72 commercial satellites providing its global low cost data service to customers.<sup>[7]</sup>

The Swarm Tile is its dedicated two-way satellite data modem designed to be low energy and embedded on the PCB of third-party products. Other products include a data plan and a development kit.<sup>[8]</sup>

## History

Swarm Technologies was founded in 2016 by Sara Spangelo and Benjamin Longmier, former employees of Google and Apple respectively.<sup>[9]</sup>

The company became widely known in industry circles after illegally launching its first four test satellites in 2018. The responsible US regulatory authority FCC had refused the license for the start-up because they feared that the satellites could be too small to be recognized by the space surveillance systems. They could then become particularly dangerous, turning into "invisible" space debris. Despite this, the satellites, along with around 30 other payloads, were launched on an Indian PSLV rocket.<sup>[9]</sup> The FCC imposed a \$900,000 fine for this.<sup>[10]</sup> The housing of the next test satellites was then enlarged. Together with correspondingly enlarged radar reflectors and a GPS-based position transmitter, the increased traceability permitted for licensing to be achieved.<sup>[11][12][13]</sup>

The construction of the actual constellation began with the launch of twelve third-generation SpaceBEEs on September 3, 2020 on a European Vega rocket. After additional 48 SpaceBEE satellites were launched by the end of January 2021, commercial operations of the constellation began.<sup>[14]</sup>

In July 2021 SpaceX acquired Swarm for \$524 million.<sup>[2][15]</sup>

## Technology and use

The third-generation SpaceBEE satellites weigh around 400 grams and, like the first generation, have a 0.25U CubeSat format; according to the manufacturer, they are about 11 × 11 × 2.8 centimeters in size.<sup>[16]</sup> The second generation are 1U cubesats. Solar cells for the power supply are located on the top and the bottom. The antenna for communication with the ground stations is wrapped around the satellite when it is launched and unfolds after the

Swarm Technologies, Inc.	
Type	Private
Industry	Telecommunications
Founded	2016
Founders	Sara Spangelo (CEO) <div>Ben Longmier<sup>[1]</sup></div>
Headquarters	Palo Alto, California, U.S.
Number of employees	30 (2021) <sup>[2]</sup>
Parent	SpaceX
Website	<div>www.swarm.space</div> <div>(http://www.swarm.space/)</div>

release into space. The data exchange is performed in a relatively small bandwidth, on the one hand with the end devices and on the other hand with ground stations that are connected to the Internet. After completion of the constellation, at least three satellites should always be reachable from any point on earth.

Swarm Technologies offers data transfer plans starting at \$60 per year per connected device. At this price, 750 data packets of 192 bytes each can be transmitted monthly.<sup>[17]</sup>

## 2018 controversy and fine

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As a US corporation, Swarm has to follow US space regulatory procedures. In April 2017 Swarm applied for FCC permission for an experimental radio service license for its initial picosatellites. The FCC rejected the application in December 2017 due to concerns on tracking because of the very small size of the satellites (measuring at 0.25U CubeSat size) but they were launched from India the following month.<sup>[18][19]</sup>

After the launch was reported, an authorized April 2018 launch of more satellites was immediately delayed when FCC permission was withdrawn. An FCC investigation found that not only had Swarm launched the four unauthorized satellites, it had also unlawfully transmitted signals between them and earth stations in Georgia. The investigation also discovered that Swarm had performed various other equipment tests before the launch without required FCC authorizations, including between weather balloons and ground stations.<sup>[20]</sup>

Industry reaction was also highly negative, fearing not only disruption from uncoordinated activity but also enhanced future regulation.<sup>[21]</sup> Spaceflight Inc., which had arranged the Indian launch as a rideshare, changed its processes to check that customers have the proper licenses.<sup>[22]</sup>

The settlement required Swarm to pay a penalty of \$900,000 and to follow a strict compliance plan to prevent future violations. This included submitting additional details to the FCC at least 45 days before a planned launch for the next three years.

While it was noted that the fine was relatively small, it had been increased from an initial amount agreed between the company and the FCC Enforcement Bureau. An FCC Commissioner observed that the negative publicity would probably prevent repetitions by Swarm or other.<sup>[23]</sup>

## Satellite constellation

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- **SpaceBEE** are a constellation of picosatellites, predominantly in the CubeSat 0.25U form factor, intended to reach a quantity of 150.<sup>[24]</sup> SpaceBEE test models 5 to 9 were larger to assuage concerns about radar tracking. Swarm's website lists satellites' mass at 400 g and size at 110 × 110 × 28 mm.

## SpaceBee launches

Flight No.	Mission	COSPAR ID	Date and time (UTC)	Launch site	Launch vehicle	Orbit altitude	Inclination	Number deployed	Deorbited	Outcome
1	SpaceBEE 1–4	2018-004	12 January 2018, 03:59:00 <sup>[25]</sup>	Satish Dhawan Space Centre, <u>FLP</u>	PSLV-XL	520 km (320 mi)	97.6°	4	3	Success
			Four experimental satellites SpaceBEE, built to the 0.25U CubeSat are to demonstrate two-way satellite communications and data relay for Swarm Technologies Inc. <sup>[25]</sup>							
2	SpaceBEE 5–7	2018-099	3 December 2018, 18:34:05 <sup>[26]</sup>	Vandenberg, <u>SLC-4E</u>	Falcon 9 B5	580 km (360 mi)	97.8°	3	0	Success
			Three experimental satellites SpaceBEE. <sup>[25]</sup>							
3	SpaceBEE 8–9	2019-037	29 June 2019, 04:30:00 <sup>[27]</sup>	Mahia, LC-1A	Electron	460 km (290 mi)	45.0°	2	0	Success
			Two experimental satellites SpaceBEE. <sup>[25]</sup>							
4	SpaceBEE 10–21	2020-061	3 September 2020, 01:51:10 <sup>[28]</sup>	Kourou, <u>ELV</u>	Vega	535 km (332 mi)	97.5°	12	0	Success
			Twelve commercial satellites SpaceBEE. <sup>[25]</sup>							
5	SpaceBEE 22–39 SpaceBEE NZ-1 to -6	2020-085	20 November 2020, 02:20:01 <sup>[29]</sup>	Mahia, LC-1A	Electron	520 km (320 mi)	97.4°	24	6	Success
			Eighteen commercial satellites SpaceBEE and 6 commercial satellites SpaceBEE NZ-1 to NZ-6. <sup>[25]</sup>							
6	SpaceBEE 40–75	2021-006	24 January 2021, 15:00:00	CCSFS, <u>SLC-40</u>	Falcon 9 B5			36	0	Success
			Thirty-six commercial satellites SpaceBEE. <sup>[25]</sup>							
7	SpaceBEE 76–87	2021-015	28 February 2021, 04:53:00	SDSC, <u>FLP</u>	PSLV-DL			12	12	Success
			Twelve commercial satellites SpaceBEE. <sup>[30]</sup>							
8	SpaceBEE 88–111 SpaceBEE NZ 7-10	2021-059	30 June 2021, 19:31:00	CCSFS, <u>SLC-40</u>	Falcon 9 B5	523 km (325 mi)	97.5°	28	0	Success
			Twenty-four commercial satellites SpaceBEE and four commercial satellites SpaceBEE NZ. <sup>[31]</sup>							
9	SpaceBEE 112-127 SpaceBEE NZ 11-14	2022-026	15 March 2022, 16:22:00	Kodiak, LP-3B	Rocket 3.3	525 km (326 mi)	97.5°	20	0	Success
			16 commercial satellites SpaceBEE and 4 commercial satellites SpaceBEE NZ. <sup>[32][33]</sup>							
10	SpaceBEE 128-139	2022-033	1 April 2022, 16:24:16	CCSFS, <u>SLC-40</u>	Falcon 9 B5	480 km (300 mi)	97.4°	12	0	Success
			12 commercial satellites SpaceBEE. <sup>[34]</sup>							
11	SpaceBEE 140-155	2022-047	2 May 2022, 22:49:52	Mahia, LC-1A	Electron	510 km (320 mi)	97.4°	24	0	Success

	<b>SpaceBEE NZ 15-22</b>		16 commercial satellites SpaceBEE and 8 commercial satellites SpaceBEE NZ. <sup>[35]</sup>							
12	<b>SpaceBEE 156-167</b>	2023-001	3 January 2023, 14:56:00	CCSFS, SLC-40	Falcon 9 B5	520 km (320 mi)	97.5°	12	0	Success
			12 commercial satellites SpaceBEE. <sup>[36]</sup>							

## References



- "Our story" (<https://swarm.space/our-story/>). *Swarm Technologies*. Retrieved 18 July 2021.
- Foust, Jeff (9 August 2021). "SpaceX to acquire Swarm Technologies" (<https://spacenews.com/spacex-to-acquire-swarm-technologies/>). *SpaceNews*. Retrieved 9 August 2021.
- In-Q-Tel website. *In-Q-Tel — Portfolio*. (<https://www.iqt.org/portfolio/>)
- Coldewey, Devin (17 October 2019). "Swarm gets green light from FCC for its 150-satellite constellation" (<https://techcrunch.com/2019/10/17/swarm-gets-green-light-from-fcc-for-its-150-satellite-constellation/>). *TechCrunch*. Retrieved 9 August 2021.
- Grush, Loren (4 October 2018). "Company that launched satellites without permission gets new license to launch more probes" (<https://www.theverge.com/2018/10/4/17928452/swarm-technologies-spacebees-satellites-spacex-falcon-9-fcc-license>). *The Verge*. Retrieved 8 August 2021.
- Spangelo, Sara (10 September 2020). "Swarm launches first 12 commercial satellites" (<https://swarm.space/swarm-launches-first-12-commercial-satellites/>). *Swarm Technologies*. Retrieved 22 January 2021.
- Spangelo, Sara (9 February 2021). "Swarm is commercially live!" (<https://swarm.space/swarm-is-commercially-live/>). *Swarm Technologies*. Retrieved 8 August 2021.
- "Products" (<https://swarm.space/products/>). *Swarm Technologies*. Retrieved 9 August 2021.
- Michael Sheetz: *Former Google engineer's start-up slammed by FCC for unauthorized satellite launch* (<https://www.cnbc.com/2018/03/09/swarm-technologies-slammed-by-fcc-for-unauthorized-satellite-launch.html>). CNBC, 9 March 2018.
- 900.000 Dollar Strafe für nicht genehmigte Satelliten* (<https://www.heise.de/newsticker/meldung/900-000-Dollar-Strafe-fuer-nicht-genehmigte-Satelliten-4257856.html>). Heise Online, 21 December 2018.
- Swarm gets green light from FCC for its 150-satellite constellation* (<https://techcrunch.com/2019/10/17/swarm-gets-green-light-from-fcc-for-its-150-satellite-constellation/>). Techcrunch, 2 October 2018.
- SpaceBEE 5, 6, 7, 8, 9* ([https://space.skyrocket.de/doc\\_sdat/spacebee-5.htm](https://space.skyrocket.de/doc_sdat/spacebee-5.htm)) auf Gunter's Space Page, retrieved 2 December 2020.
- Trackability and Detectability of the SpaceBEE Satellites* ([https://licensing.fcc.gov/myibfs/download.do?attachment\\_key=1592878](https://licensing.fcc.gov/myibfs/download.do?attachment_key=1592878)). LeoLabs, 26 October 2018. (PDF)
- Satellite startup Swarm kicks off space-based Internet service* (<https://fortune.com/2021/02/09/satellite-startup-swarm-space-based-internet-service/amp/>). Fortune, 9 February 2021.
- Maidenberg, Micah; Driebusch, Corrie; Jin, Berber (17 August 2023). "A Rare Look Into the Finances of Elon Musk's Secretive SpaceX" (<https://www.wsj.com/tech/behind-the-curtain-of-elon-musks-secretive-spacex-revenue-growth-and-rising-costs-2c828e2b>). *The Wall Street Journal*. Archived (<http://archive.today/2023.08.17-224420/https://www.wsj.com/tech/behind-the-curtain-of-elon-musks-secretive-spacex-revenue-growth-and-rising-costs-2c828e2b>) from the original on 17 August 2023. Retrieved 17 August 2023.
- Our Technology* (<https://www.swarm.space/our-technology/>), retrieved 2 December 2020.
- Products* (<https://www.swarm.space/products/>) auf der Herstellerwebsite, retrieved 2 November 2020.
- Harris, Mark (9 March 2018). "FCC Accuses Stealthy Startup of Launching Rogue Satellites" (<https://spectrum.ieee.org/fcc-accuses-stealthy-startup-of-launching-rogue-satellites>). *IEEE Spectrum*. Retrieved 8 August 2021.
- "DISMISSED-WITHOUT PREJUDICE" (<https://apps.fcc.gov/els/GetAtt.html?id=203152>). *Federal Communications Commission*. 12 December 2017. Retrieved 8 August 2021.
- "FCC Reaches \$900,000 Settlement for Unauthorized Satellite Launch" (<https://www.fcc.gov/document/fcc-reaches-900000-settlement-unauthorized-satellite-launch>). *Federal Communications Commission*. 20 December 2018. Retrieved 8 August 2021.

21. Foust, Jeff (13 March 2018). "Industry worried about regulatory backlash after unauthorized cubesat launch" (<https://spacenews.com/industry-worried-about-regulatory-backlash-after-unauthorized-cubesat-launch/>). *SpaceNews*. Retrieved 8 August 2021.
22. Grush, Loren (6 August 2018). "Later this year, a SpaceX Falcon 9 rocket will launch its biggest batch of satellites yet" (<https://www.theverge.com/2018/8/6/17654372/spacex-falcon-9-spaceflight-industries-small-satellite-rideshare>). *The Verge*. Retrieved 8 August 2021.
23. "Statement of Commissioner Michael O'Rielly" (<https://docs.fcc.gov/public/attachments/FCC-18-184A3.pdf>) (PDF). *Federal Communications Commission*. 20 December 2018. Retrieved 8 August 2021.
24. Krebs, Gunter (21 July 2021). "SpaceBEE 10, ..., 180" ([https://space.skyrocket.de/doc\\_sdat/spacebee-10.htm](https://space.skyrocket.de/doc_sdat/spacebee-10.htm)). *Gunter's Space Page*. Retrieved 9 August 2021.
25. "Display: SpaceBEE-1 NSSDCA ID: SPACEBEE1 COSPAR ID: 2018-004AH" (<https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=SPACEBEE1>). NASA. 14 May 2020. Retrieved 23 January 2021. ⓘ This article incorporates text from this source, which is in the public domain.
26. "Display: SpaceBEE-5 COSPAR ID: 2018-099BM" (<https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=2018099BM>). NASA. 14 May 2020. Retrieved 23 January 2021. ⓘ This article incorporates text from this source, which is in the public domain.
27. "Display: SpaceBEE-8" (<https://nssdc.gsfc.nasa.gov/nmc/spacecraft/displayTrajectory.action?id=2019-037C>). NASA. 14 May 2020. Retrieved 25 January 2021. ⓘ This article incorporates text from this source, which is in the public domain.
28. McDowell, Jonathan. "SpaceBEE-10 2020-061AK 46305" (<https://planet4589.org/space/log/launchlog.txt>). Jonathan's Launch Log. Retrieved 25 January 2021.
29. McDowell, Jonathan. "SpaceBEE-22 2020-085AA 46953" (<https://planet4589.org/space/log/launchlog.txt>). Jonathan's Launch Log. Retrieved 25 January 2021.
30. Chaturvedi, Amit (28 February 2021). "PSLV lifts off with Amazonia-1, 18 other satellites; ISRO says launch successful" (<https://www.hindustantimes.com/india-news/isros-pslv-lifts-off-with-brazil-s-amazonia-1-from-space-centre-in-sriharikota-101614487314347.html>). *Hindustan Times*. Retrieved 28 February 2021.
31. Lentz, Danny (29 June 2021). "SpaceX successfully launches Transporter 2 mission with 88 satellites" (<https://www.nasaspaceflight.com/2021/06/spacex-f9-transporter-2-rideshare/>). *NASASpaceFlight*. Retrieved 30 June 2021.
32. Foust, Jeff (22 March 2022). "Swarm launched satellites on Astra mission" (<https://spacenews.com/swarm-launched-satellites-on-astra-mission/>). *SpaceNews*. Retrieved 23 March 2022.
33. McDowell, Jonathan [@planet4589] (11 April 2022). "It's now clear that the Astra LV0009 mission launched 20 SpaceBEEs, namely SpaceBEE 112 to 127 and New Zealand flagged SpaceBEE NZ-11 to NZ-14. All but two are now ID'd by 18SPCS; no IDs yet for the SpaceBEEs launched on Transporter-4" (<https://twitter.com/planet4589/status/1513365524889100292>) (Tweet). Retrieved 11 April 2022 – via Twitter.
34. Clark, Stephen (1 April 2022). "Forty payloads ride into orbit on SpaceX Falcon 9 rocket" (<https://spaceflightnow.com/2022/04/01/forty-payloads-ride-into-orbit-on-spacex-falcon-9-rocket/>). *Spaceflight Now*. Retrieved 1 April 2022.
35. Iemole, Anthony (2 May 2022). "Rocket Lab makes first booster catch attempt during successful There And Back Again mission" (<https://www.nasaspaceflight.com/2022/05/rocket-lab-booster-catch-attempt/>). *NASASpaceFlight*. Retrieved 7 May 2022.
36. Lentz, Danny (3 January 2023). "SpaceX rings in 2023 with Transporter-6 rideshare mission" (<https://www.nasaspaceflight.com/2023/01/spacex-transporter-6/>). *NASASpaceFlight*. Retrieved 4 January 2023.

## External links

- [Official website \(https://www.swarm.space/\)](https://www.swarm.space/)

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