


# Altaeros Energies – SuperTower tethered telecom aerostats

Peter Lobner, 18 December 2024

## 1. Introduction

Ben Glass and Adam Rein co-founded the privately-owned firm Altaeros Energies, Inc. in April 2010, with headquarters in Somerville,  Massachusetts. Originally, their goal was to develop the world's first commercial airborne wind turbine. After five years of development work on the Buoyant Air Turbine (BAT), the firm made a corporate decision in late 2015 to discontinue its work on the BAT, which was partially funded by the U.S. National Science Foundation (NSF), and “pivot” its primary business focus to the development and commercialization of an autonomous tethered aerostat telecom platform called the SuperTower, with continuing NSF funding. The remainder of the BAT story is addressed in a separate article.

After the pivot, Altaeros received significant additional funding in 2017 from SoftBank Group toward the development and commercialization of the SuperTower aerostat.

In 2018, at the conclusion of the NSF-supported Altaeros development project, NSF recorded the following project “outcome report:”

“Altaeros filed a Change of Scope in December, 2015, after which the Phase II project focused on furthering the state of autonomous aerostat technology through demonstration of an automated aerostat platform in real world conditions. Through a Phase IIB supplement, the project scope was extended to support the ongoing development and demonstration of robust, automated control software. Over the course of the project timeframe, Altaeros designed, built and tested three aerostat systems with increasing levels of functionality. The tests culminated with the demonstration of an autonomous SuperTower prototype carrying a functional LTE telecom payload.”



*SuperTower prototype, circa 2017. Source: (L) Altaeros, (R) TechCrunch*

Altaeros announced its first commercial model, the ST-200, in 2019. The firm now offers a range of high capacity, long-endurance tethered SuperTower aerial platforms for commercial and government applications. Their current aerostat product line includes the transportable ST-Flex and the larger fixed-base ST-300 and ST-1000, all of which are equipped with the firm's Aerostat Autopilot™ and can be configured for a wide range of missions. The firm promotes these aerostats as being the world's only fully-autonomous tethered aerostat platforms.



*(L) ST-200, (R) ST-Flex. Source: Altaeros Energies*

Altaeros Energies also offers a range of custom services, including payload integration, turnkey payload development, aerostat field support and service, and custom aerostat development.

Altaeros maintains a research and development center in Fremont, New Hampshire. Altaeros<sub>UK</sub> is a wholly-owned subsidiary with a manufacturing facility in Wrexham, Wales, UK. They produce all Altaeros aerostat envelopes as well as a wide range of inflatable products suitable for a variety of industries.

The Altaeros Energies website is here: <https://www.altaeros.com> and the Altaeros<sub>UK</sub> website is here: <http://altaeros.co.uk>

## 2. Funding review

[National Science Foundation award # 1430989](#) was granted in 2014 to Altaeros Energies and funded as a small business innovative research (SBIR) Phase II project originally directed toward development of the Altaeros BAT airborne wind turbine. This project received \$740,679 in funding in Fiscal Year 2014. At the time of the “pivot” in December 2015, which was mutually agreed with the NSF, Altaeros had spent only a fraction of those funds on the BAT, and the remainder was available to fund initial development of a SuperTower aerostat prototype. The project received \$500,000 in additional NSF funding in Fiscal Year 2017 to continue development and demonstration of SuperTower prototypes.

In August 2017, Altaeros received \$7.5 million in new funding from SoftBank Group toward the commercial launch of the SuperTower telecom aerostat, initially for LTE (4G) cellular service, and later for 5G service. SoftBank is the majority owner of the cell phone service provider Sprint. Previously, in 2014, SoftBank Group had provided \$7 million in Series A funds toward the development and commercialization of Altaeros’ BAT airborne wind turbine technology.

## 3. Patents

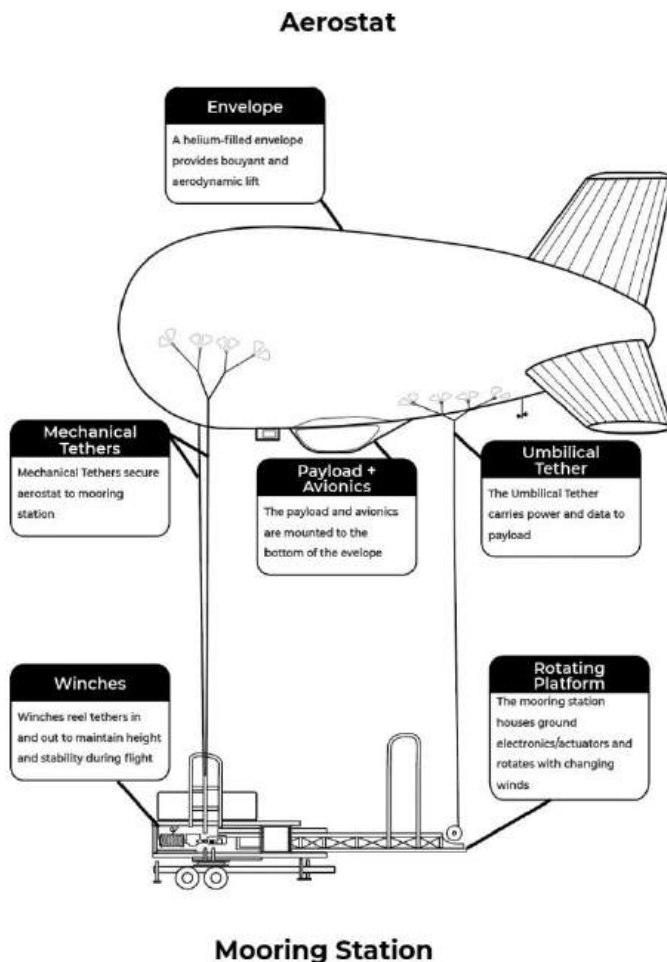
The SuperTower tethered aerostat implements many advanced design and operational features addressed in patents filed by and assigned to Altaeros Energies, as listed at the end of this article. The most recent patent, [US12045066B2](#), “Systems and methods for an automated, lighter-than-air airborne platform,” granted in 2024, provides a comprehensive summary of how semi-autonomous and autonomous aerostat operations are implemented.

“Embodiments disclosed herein enable routine autonomous execution of at least some major phases of aerostat operation in response to commands from human or automated external operators, a built-in decision-making capacity, or both. Various embodiments combine one or more actively controlled tethers, aerodynamic aerostat control surfaces, mechanical assistive devices (e.g., jointed arms attached to a ground station), and/or active propulsors attached to the aerostat to govern aerostat

behavior during launch, flight, and landing phases of operation. Some embodiments enable automatic autonomous performance of all phases of routine post-commissioning aerostat operation, including launch, flight, and landing, without any routine need for availability of a human crew.”

#### 4. Overview of the SuperTower system

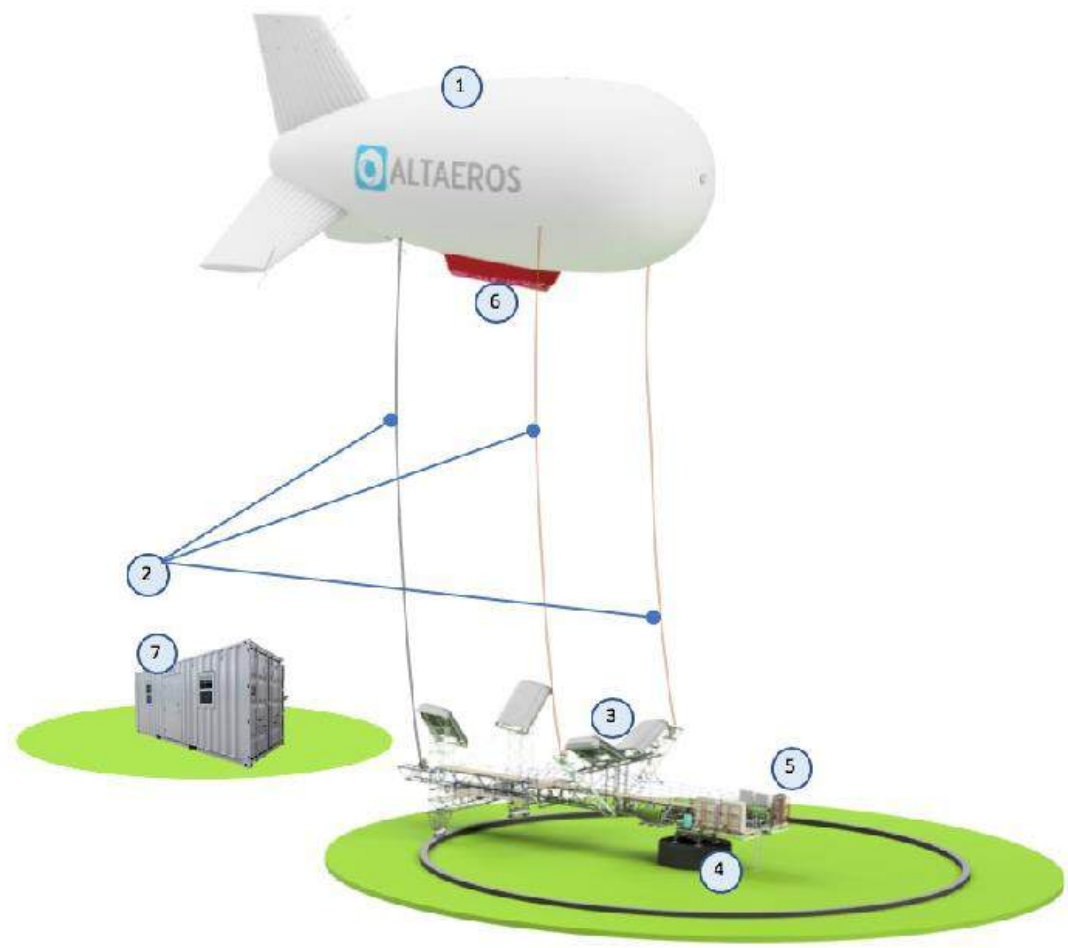
Altaeros Energies’ SuperTower aerostat is a scaleable, conventional, non-rigid helium aerostat with an inverted-Y tail fin configuration. An easily accessible payload bay is attached under the gas envelope and is covered by a fabric fairing in flight. When the aerostat is docked on its rotating ground station, a work platform provides convenient access to the modular payload, which is mounted on a quick-connect rail system that enables a small ground crew to make fast equipment swaps or payload re-configurations in the field.



The basic hardware elements of SuperTower aerostat systems are shown in the following two diagrams.

*Elements of an ST-Flex SuperTower transportable aerostat system. Source: Altaeros Energies*

- 1 **Aerostat System**
  - Helium-filled envelope
  - Stabilizing fins
  - Avionics and power system
- 2 **Tethers**
  - Redundant strength members
  - Embedded power conductors and optical fiber
- 3 **Rotating Ground Station**
  - Winches and slew drive
  - Payload access work platform
- 4 **Concrete Pad/Footings**
  - Low Impact foundation
- 5 **Ground Electronics**
  - Control cabinet
  - Power supply and distribution
- 6 **Airborne Payload**
  - Customer equipment (RRJs, antennas, etc.)
- 7 **Control/Networking Shed**
  - BBU(s)
  - Backhaul interconnect
  - Control interface



*Elements of a SuperTower fixed-base aerostat system.  
Source: Altaeros Energies*

SuperTower aerostats have three operating modes: <sup>TMTM</sup> (fully autonomous), remote control from a control center that can be located some distance away from the aerostat's ground station, and local control at the ground station.

The Aerostat Autopilot<sup>TM</sup>, which is a key feature of every SuperTower aerostat, employs multiple levels of advanced automation and artificial intelligence (AI)-based controls to perform the following functions:

- **Automated Dispatch:** This AI-based decision engine determines operating parameters from mission objectives, system diagnostics, and weather.
- **AI Flight Director:** Manages crewless operations, including launch and recovery, through real-time, closed-loop control of the complete aerostat system.
- **Actuator Control:** Individual, low-level controllers keep all actuators and sub-systems (i.e., winches, slew drive, pressure management) in sync and working at peak performance.

Enhanced stability augmentation systems enabled by Aerostat Autopilot<sup>TM</sup> reduce the need to add heavy payload stabilization equipment for the payload.

Altaeros reports that the Aerostat Autopilot<sup>TM</sup> can maintain aerostat operation with zero on-site crew. In comparison, traditional aerostats require large 24/7 crews, which can account for 80% of the operating cost.

The level of automation enabled by the Aerostat Autopilot<sup>TM</sup> can reduce cost by almost an order of magnitude and real-time automated decision-making maximizes mission availability. Remote monitoring and control features increase mission flexibility and enable re-tasking when required.

All SuperTower aerostats are designed to operate in a temperature range from -20° to +50° C (-4° to +122° F). The aerostats can be deployed from ground elevations up to 2,134 m (7,000 ft). The gas envelope lifetime is 4 to 5 years (depending on model) and system lifetime is expected to be 20 or more years.

## 5. Altaeros' SuperTower product line

First came the ST-200 SuperTower in 2019. The current product line consists of the ST-Flex, ST-300, which superseded the ST-200, and the ST-1000. All of these models incorporate the Aerostat Autopilot™ and are available in government versions (Guardian class), which include GPS (global positioning system) hardening, enhanced encryption and more. The ST-Flex and ST-300 also are available in commercial versions.

### 5.1 ST-200 fixed-base aerostat system

The ST-200 was announced in February 2019 as the world's first aerial cell tower. Its target commercial market was to expand coverage to rural communities. In their press release, Altaeros reported:

“The ST-200 is the culmination of over 8 years of aerostat research and development by Altaeros. Designed to work with many different telecom systems from any number of vendors, the ST-200 is Altaeros' largest and most capable autonomous aerostat platform to date, and the first to be made commercially available. Building upon prior versions, proprietary automation and control software keep the aerial cell tower in place in changing weather and environmental conditions and ensures a stable platform for the telecommunication equipment. Multiple tethers connect the aerostat to the ground and transmit power and data to the airborne equipment, which is key to providing significantly greater capacity than other aerial communication systems.”



*ST-200. Source: Altaeros Energies (circa 2019)*

## General characteristics of an Altaeros ST-200 tethered aerostat

Parameter	ST-200 aerostat
Length	Not available
Volume	Not available
Altitude, max	305 m (1,000 ft) AGL
Tether design	<ul style="list-style-type: none"> <li>• Three structurally redundant tethers minimize the chance of flyaway</li> <li>• One tether includes electric power conductors + a fiber optic line for data</li> </ul>
Wind speed, max operating	100 kph (63 mph)
Wind speed, survival	150 kph (93 mph)
Weight, payload	200 kg (440 lb)
Payload power	7 kW (via powered tether)
Payload types	Modular payload interface supports a wide range of payloads including: multi-sector LTE (4G)/5G, IoT (Internet of Things), EO/IR (electro-optical/infra-red) sensors, and more
Data transmission	Optical fiber in tether provides secure data link to the ground
Operating modes	<ul style="list-style-type: none"> <li>• Aerostat Autopilot™ (fully autonomous), or</li> <li>• Remote control, or</li> <li>• Local control (at the ground station)</li> </ul>
Service interval	30+ days



*ST-200 fixed-base aerostat in flight. Source: Altaeros Energies (circa 2019)*





*ST-200 aerostat docked at its fixed-base ground station.  
Source, both photos: Altaeros Energies (circa 2019)*

## 5.2 ST-Flex transportable aerostat system

Altaeros introduced its second production model, the tactical class ST-Flex, in 2020. This aerostat is a scaled-down version of the ST-200 with a transportable ground station. With a 60 kg (130 pound) payload capacity, ST-Flex can be configured for a wide range of applications, such as:

- Mobile cellular networks: Replace up to 15 ground-based cell towers with a single aerostat.
- Connected industrial sites: Enhance safety and productivity with site-wide coverage from a single aerostat.
- Emergency response: Restore critical cellular phone, WiFi, and/or other wireless coverage quickly with a rapidly deployable aerostat.
- Aerial advertising: Reach a broad audience on the ground with message banners on an aerostat.
- Border security: Deliver 24/7 persistent intelligence, surveillance, reconnaissance (ISR) with an aerostat.
- Military tactical communications: Link rapidly deploying or remote ground forces with over-the-horizon voice and data communications with an aerostat.

All components of an ST-Flex system can be packed on two towable trailers and transported by highway or off-road. The ST-Flex has been military transport certified by ATTLA (Air Transportability Test Loading Activity) and also can be transported in a variety of cargo aircraft, such as the C-130, C-17 and C-5.



*ST-Flex system packaged for transport on two trailers. Source: Altaeros*

Once on site, a small team can deploy the trailer-mounted docking station, inflate the aerostat, and complete commissioning steps to begin operations. All set-up operations are designed to be completed with four people in less than a day. While the ST-Flex is docked, the payload and aerostat systems are readily accessible for maintenance from a work platform on the ground station.

Once commissioned, Aerostat Autopilot™ enables autonomous system operations without local operator intervention. At the conclusion of a mission, pack-up can also be completed in less than a day with a team of four people in less.

### General characteristics of an Altaeros ST-Flex tethered aerostat

Parameter	ST-Flex aerostat
Length	Not available
Volume	About 400 m <sup>3</sup> (14,125 ft <sup>3</sup> )
Altitude, max	305 m (1,000 ft) AGL
Ground elevation, max	2,133 m (7,000 ft) MSL
Tether design	<ul style="list-style-type: none"> <li>• Three structurally redundant tethers minimize the chance of flyaway</li> <li>• One tether includes electric power conductors + a fiber optic line for data</li> </ul>
Wind speed, max operating	100 kph (63 mph)
Wind speed, survival	150 kph (93 mph)
Weight, payload	60 kg (132 lb)
Payload power	1 kW (via power/data tether)
Payload types	<ul style="list-style-type: none"> <li>• <b>Civilian:</b> Modular payload interface supports a wide range of payloads including: multi-sector LTE (4G)/5G, IoT, fixed wireless, and more</li> <li>• <b>Guardian class:</b> Intelligence, surveillance, reconnaissance (ISR), radar, narrow-field electro-optical/infra-red (EO/IR), signal intelligence (SIGINT), counter unmanned aerial systems (cUAS), mobile ad hoc network (MANET) radios, communications relay, multi-sector 4G/5G</li> </ul>
Operating modes	<ul style="list-style-type: none"> <li>• Aerostat Autopilot™ (fully autonomous), or</li> <li>• Remote control, or</li> <li>• Local control (at the ground station)</li> </ul>
Mission duration	1 to 3 weeks typ.
Target availability	>95%



*ST-Flex docked on its mobile ground station. Source: Altaeros*



*ST-Flex ground station includes a work platform that provides easy access to the payload pod attached under the gas envelope. Source: Screenshot from Altaeros video*



*ST-Flex airborne above its ground station. Source: Altaeros*

## 2022 - SoftBank Corp. mobile telcom application

In June 2022, SoftBank Corp., Japan's leading mobile carrier, completed initial operational and telcom testing with an Altaeros' ST-Flex aerostat flying at 249 m (817 ft) above Hokkaido Spaceport, in Taiki Town, Hokkaido, Japan.



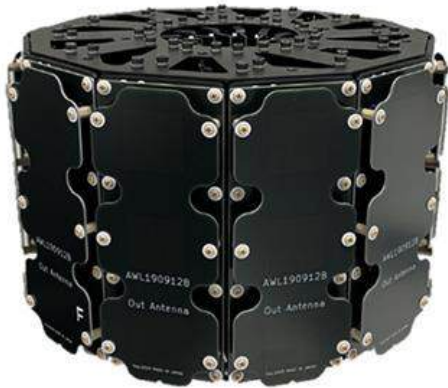
*Softbank / Altaeros ST-Flex test flight.*

*Source, both photos: Screenshot from Altaeros video (2022)*

SoftBank reported: “During the trial, Altaeros' autonomous tethered balloon (aerostat) and SoftBank's base station system were equipped with SoftBank's proprietary cylindrical antenna, a multi-element phased array antenna that realizes communication area “[footprint fixation](#).” ....This is a “technology that fixes a communication area (footprint) for each cell formed on the ground by radio waves emitted from an aircraft equipped with a communications payload. It achieves this by changing the direction of the radio waves as the aircraft rotates.”

This novel antenna technology was developed by SoftBank and its subsidiary HAPSMobile Inc. to enable stable connectivity regardless of airborne motion. Results from the Altaeros' ST-Flex trials will be utilized to refine the technology for use in network disaster

preparedness applications and High Altitude Platform Station (stratospheric HAPS) applications.



*(L) The cylindrical phased-array antenna, and (R) antenna as installed in the payload bay in the Altaeros ST-Flex tethered aerostat. Source: SoftBank (2022)*

## **2022 - World Mobile cellular internet service on Tanzanian islands**

In 2022, Altaeros Energies was a candidate aerostat supplier for a project sponsored by the UK company World Mobile to deploy aerostat-based mobile internet services on the Tanzanian islands of Zanzibar and Pemba, both of which have remote, distributed populations. Altaeros Energies was not selected as the aerostat supplier. However, in 2023 World Mobile placed its plans to deploy an aerostat on the island of Zanzibar on hold.



*Altaeros ST-Flex aerostat in World Mobile livery. Source: World Mobile via CNN (2022)*

## **2023 - Department of Homeland Security (DHS) border protection application**

In October 2023, Altaeros announced that it had been awarded a 5-year, \$99M contract from the DHS, Customs and Border Protection (CBP), for the delivery and support of autonomous ST-Flex Guardian Class autonomous aerostats to be used as persistent ISR platforms for border protection missions.

## **2024 – ST-Flex demonstration during joint Department of Defense (DOD) and Indiana National Guard exercise T-REX 24-2**

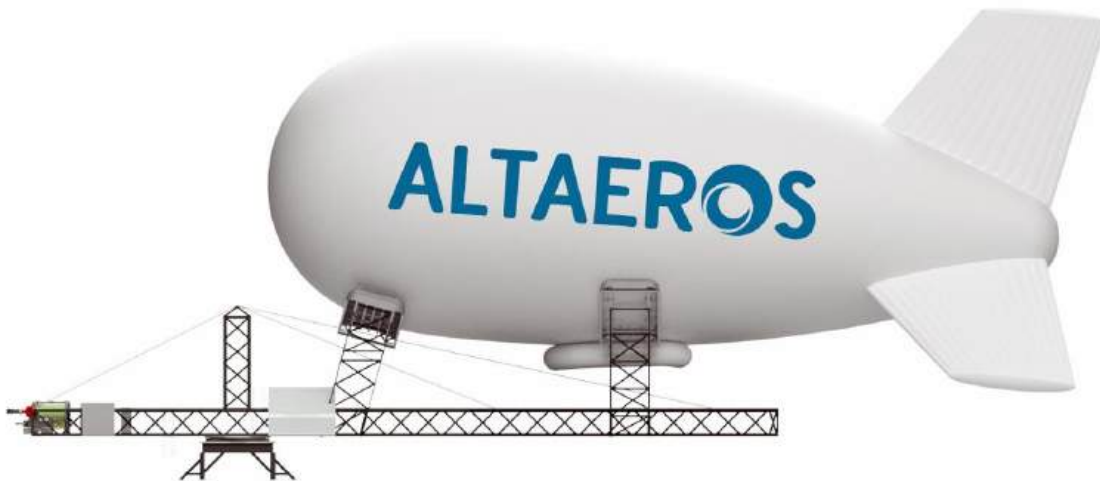
Altaeros provided an ST-Flex aerostat for use during an exercise in August 2024 at Camp Atterbury, Indiana, and demonstrated autonomous features and operational benefits, including launch, recovery, active flight controls and high mission availability. The aerostat carried a multi-functional payload that including IMSAR's NSP-7 Aerostat Radar, Silvus Technologies' Streamcaster SC4400E 4x4 MIMO (Multiple-Input Multiple-Output) radio, and Trillium's HD80 EO/IR sensor.

### **5.2 ST-300 fixed-base aerostat system**

The larger ST-300 is a scale-up of the basic ST-200 configuration, which it replaced in the current Altaeros product line. The ST-300 can carry 1.5 times the payload of the ST-200, up to 300 kg (660 lbs). The high-capacity ST-300 aerostat is intended for long-term deployments at fixed sites. Altaeros promotes the ST-300 as being able to reliably provide LTE (4G)/5G broadband in rural markets at a fraction of the cost of regular cellular towers.



*ST-300 aerostat isometric view.*



*ST-300 aerostat elevation view.  
Source, both graphics: Altaeros Energies*



## General characteristics of an Altaeros ST-300 tethered aerostat

Parameter	ST-300 aerostat
Length	Not available
Volume	About 3,500 m <sup>3</sup> (123,600 ft <sup>3</sup> )
Altitude, max	610 m (2,000 ft) AGL
Ground elevation, max	2,133 m (7,000 ft) MSL
Wind speed, max operating	121 kph (75 mph)
Wind speed, survival	177 kph (110 mph)
Weight, payload	300 kg (660 lb)
Payload types	<ul style="list-style-type: none"> <li>• <b>Civilian:</b> Modular payload interface supports a wide range of payloads including: multi-sector LTE (4G)/5G, electro-optical/infrared (EO/IR) sensors, and more</li> <li>• <b>Guardian class:</b> ISR, radar, narrow-field EO/IR, signal intelligence (SIGINT), counter unmanned aerial systems (cUAS), mobile ad hoc network (MANET) radios, communications relay, multi-sector LTE (4G)/5G</li> </ul>
Payload power	7 kW (via tether)
Service interval	4 to 6 weeks typ.
Target availability	>98%



*ST-300 aerostat docked at its fixed base. Source: Altaeros Energies*

### 5.3 ST-1000 large fixed-base aerostat system

The largest, most capable StarTower aerostat is the ST-1000, which can carry more than three times the payload of an ST-300, up to 1,000 kg (2,200 lb), and operate at a higher altitude. Payload types are similar to the ST-300.

Altaeros lists the ST-1000 as being available only in Guardian class configurations for government customers.

#### General characteristics of an Altaeros ST-1000 tethered aerostat

Parameter	ST-1000 aerostat
Length	Not available
Volume	About 6,500 m <sup>3</sup> ( ft <sup>3</sup> )
Altitude, max	762 m (2,500 ft) AGL
Ground elevation, max	2,133 m (7,000 ft) MSL
Wind speed, max operating	138 kph (85 mph)
Weight, payload	1,000 kg (2,200 lb),
Payload types	<b>Guardian class:</b> ISR, radar, narrow-field EO/IR, signal intelligence (SIGINT), counter unmanned aerial systems (cUAS), mobile ad hoc network (MANET) radios, communications relay, multi-sector LTE (4G)/5G
Payload power	7 kW (via tether)
Service interval	Not available
Target availability	Not available

## 6. For more information on Altaeros telcom aerostats

- “Press release: World’s First Commercial Aerial Cell Tower Launched by Altaeros,” Altaeros Energies, 12 February 2019: <https://www.alt aeros.com/worlds-first-commercial-aerial-cell-tower/>
- Jack M. Wilson, Distinguished Professor of Higher Education, Emerging Technologies, and Innovation “Case- Altaeros Energy,” circa 2019: <https://www.jackmwilson.com/Entrepreneurship/Cases/Case- AltaerosEnergy.pdf>
- “Press release: Altaeros Launches ST-Flex: Portable Rapid Response Aerial Cell Tower,” Altaeros Energies, 13 October 2020: <https://www.alt aeros.com/alt aeros-launches-supertower-st-flex/>
- “Altaeros ST-Flex Receives ATTLA Certification for Shipping Via US Military Air Transport,” Altaeros press release, 21 July 2023: <https://www.alt aeros.com/press-attla-certification/>
- “Altaeros Announces Demonstration in Department of Defense and Indiana National Guard – Sponsored Exercise T-REX 24-2,” Press release, Altaeros Energies, 26 September 2024: <https://www.alt aeros.com/press-release-alt aeros-demo-trex/>

### **Funding**

- National Science Foundation, Award abstract # 1430989, “SBIR Phase II: Ultra-light, Modular Wind Turbine,” Start date 1 October 2014, End date 28 February 2018, Award amount (FY14 & FY17) \$1,240,679: [https://www.nsf.gov/awardsearch/showAward?AWD\\_ID=1430989](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1430989)
- Catherine Shu, “Aerostat startup Altaeros gets \$7.5M from SoftBank to bring broadband wireless to rural areas,” TechCrunch, 8 August 2017: <https://techcrunch.com/2017/08/08/aerostat-startup-alt aeros-gets-7-5m-from-softbank-to-bring-broadband-wireless-to-rural-areas/#!>

## **SoftBank “footprint fixation” technology demonstration**

- “SoftBank Corp. and HAPSMobile Accelerate High Altitude Platform Station (HAPS) R&D to Provide Stable and High-quality Connectivity for Future Commercial Services,” SoftBank press release, 2 September 2021: [https://www.softbank.jp/en/corp/news/info/2021/20210902\\_01/](https://www.softbank.jp/en/corp/news/info/2021/20210902_01/)
- “Softbank and Altaeros Launch World’s First Autonomous Aerostat,” Altaeros press release, 22 June 2022: <https://www.prnewswire.com/news-releases/softbank-and-altaeros-launch-worlds-first-autonomous-aerostat-301573053.html>
- “SoftBank Corp. Successfully Tests High-altitude Tethered Balloon Base Station System that Utilizes Footprint Fixation Technology,” SoftBank press release, 22 June 2022: [https://www.softbank.jp/en/corp/news/press/sbkk/2022/20220622\\_01/](https://www.softbank.jp/en/corp/news/press/sbkk/2022/20220622_01/)

## **World Mobile cellular internet application in Tanzania**

- Dan Swinhoe, “Altaeros partners with World Mobile for balloon-based network in Zanzibar,” DataCenterDynamics, 6 January 2022: <https://www.datacenterdynamics.com/en/news/altaeros-partners-with-world-mobile-for-balloon-based-network-in-zanzibar/>
- Tom Page, “Internet blimps are coming to Zanzibar. But can a UK company succeed where Google failed?” CNN, 12 January 2022: <https://www.cnn.com/2022/01/12/africa/world-mobile-internet-balloon-zanzibar-spc-intl/index.html>

## **U.S. Customs and Border Patrol applications**

- “Altaeros awarded 5-year \$99M contract,” Altaeros news release, 3 October 2023: <https://www.altaeros.com/press-release-altaeros-awarded-5-year-99m-contract/>
- “Altaeros Energies Inc.” Association of the U.S. Army, 2024: <https://www.ausa.org/sponsors/altaeros>

## Videos

- “The Cutting Edge: Altaeros Energies,” (2:28 min), posted by WCVB Channel 5 Boston, 15 September 2017:  
<https://www.youtube.com/watch?v=YZs2WZ9pzcM>
- “The Altaeros SuperTower - Autonomous Aerostat,” (1.13 min), posted by Altaeros, 12 February 2019:  
[https://www.youtube.com/watch?v=j\\_AO42xEEA&t=3s](https://www.youtube.com/watch?v=j_AO42xEEA&t=3s)
- “Altaeros: Bringing Affordable Connectivity to Those Who Need it Most,” (3.20 min), posted by Altaeros, 7 April 2020:  
<https://www.youtube.com/watch?v=F77ZVDjENI4>
- “Autonomous Control for Tethered Aerostats By Altaeros,” (1:32 min), posted by Altaeros, 8 October 2020:  
<https://www.youtube.com/watch?v=ze29ZC9VKFM>
- “Introducing: ST-Flex, Altaeros' Rapidly Deployable Autonomous Aerostat,” (4:55 min), Altaeros, 6 July 2021:  
[https://www.youtube.com/watch?v=cOnr1\\_L7weU&t=5s](https://www.youtube.com/watch?v=cOnr1_L7weU&t=5s)
- “Aerostat Chat and ST-Flex Tour with Director of Flights, Jason Sorinmade,” (6:43 min), Altaeros, 15 September 2021:  
<https://www.youtube.com/watch?v=nuodVRpGeRs&t=4s>
- “Conversation About The Creation of ST-Flex with VP of Engineering, Sheri Palazzo,” (3.01 min) posted by Altaeros, 28 September 2021:  
<https://www.youtube.com/watch?v=6gfFpNDjvGU>
- “A Deep Dive on Aerostat Autopilot with CEO/CTO Ben Glass,” (3:54 min), Altaeros, 12 October 2021:  
<https://www.youtube.com/watch?v=fVBOE3-Bip0>
- “Discussion of SuperTower use cases with Director of Customer Solutions, Peter Mitton,” (2.15 min) posted by Altaeros, 4 November 2021:  
<https://www.youtube.com/watch?v=h1MC5c5h0hg>
- “SoftBank Corp. and Altaeros Test Program - Hokkaido Spaceport, Taiki Town, Hokkaido, Japan,” (1:26 min), Altaeros, 22 June 2022:  
<https://www.youtube.com/watch?v=tENcZXFsfEU&t=14s>
- “[Field Test] High-altitude Tethered Balloon @ Hokkaido Spaceport, Taiki Town, Hokkaido, Japan,” (1 min), posted by HAPSmobile, 21 July 2022:  
<https://www.youtube.com/watch?v=8g7bPMV7Zwg>

- “ST-Flex Guardian Class - Altaeros' Latest Autonomous Aerostat,” (2:49 min), posted by Altaeros, 5 September 2023: <https://www.youtube.com/watch?v=SSCDkY9zleM&t=27s>

### **Telcom aerostat patent applications**

- US2013/0075523A1, “Systems and methods for attitude control of tethered aerostats,” Filed 17 September 2012, Granted 17 November 2015 as patent US9187165B2: <https://patents.google.com/patent/US20130075523A1/en>
- US2015/0048203A1, “Payload suspension for lighter-than-air structures,” Filed 25 February 2013, Published 19 February 2015, later abandoned: <https://patents.google.com/patent/US20150048203A1/en>
- US2015/0083849A1, “Aerostat system with extended flight envelope.” Filed 17 January 2013, Granted 17 October 2017 as US9789947B2: <https://patents.google.com/patent/US20150083849A1/en>
- US2016/0139601A1, “Systems and methods for attitude control of tethered aerostats,” Filed 16 November 2015, Published 19 May 2016, later abandoned: <https://patents.google.com/patent/US20160139601A1/en>
- WO2013/043586A2, “Systems and methods for attitude control of tethered aerostats,” Filed 18 September 2012, Published 28 March 2013: <https://patents.google.com/patent/WO2013043586A2/en>
- US2018/0083726A1, “Wireless communication station,” Filed 15 September 2015, Granted 24 September 2019 as US10425179B2: <https://patents.google.com/patent/US20180083726A1/en>
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