Suzhou Ark Aviation Technology Co. Ltd. (SAS) (aka Shanghai Aerostat Co., Ltd.)

Peter Lobner, 18 October 2022

1. Introduction

SAS was established in the Wuzhong District, Suzhou, Jiangsu, China in March 2005 as a manufacturer and trading company, producing unmanned free-flying blimps, tethered blimps and tethered balloons that can be used in various civilian and military applications, such as Earth observation, environmental monitoring, pipeline & power line inspection, aerial photography, surveillance, disaster management, communications relay, and advertising.

SAS reports having produced various types of lighter-than-air (LTA) vehicles ranging in size from 4 to 100 meters (13 to 328 ft) and envelope volume from 4 to 35,000 cubic meters (141 to 1,236,000 cubic feet). Their Chinese domestic customers and partners include the Chinese People's Liberation Army, the National Security Bureau, the Ministry of Land and Resources, Ministry of Environmental Protection, other governmental agencies, Shanghai Jiao Tong University, Harbin Institute of Technology and other universities and research institutes. In 2020, SAS reported exporting more than 50 LTA vehicles to international customers in more than 30 countries and delivering more than 150 LTA vehicles to domestic customers.

The SAS website is here: http://www.blimpairship.com

Their current LTA products are shown on the following Made-in-China website (Made-in-China appears to function as a B2B intermediary): https://www.made-in-china.com/showroom/jennerjiang/product-list/catalog-1.html

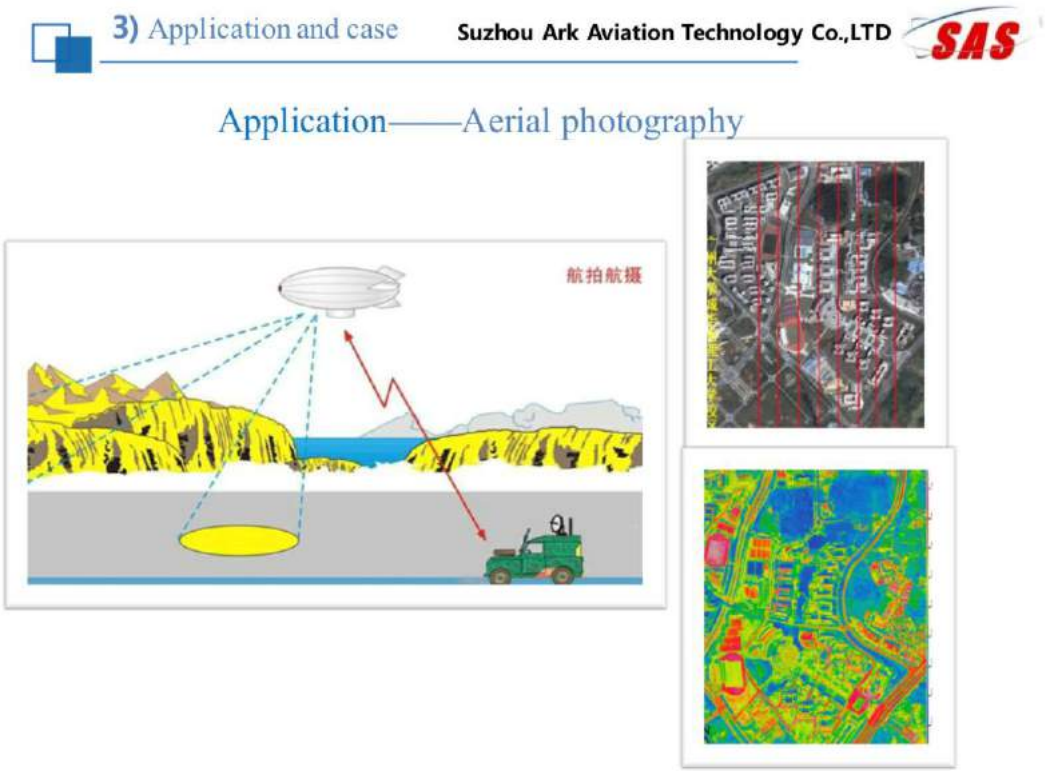
The SAS LinkedIn webpage is here: https://www.linkedin.com/in/美-袁-b00755149/

2. SAS unmanned blimps

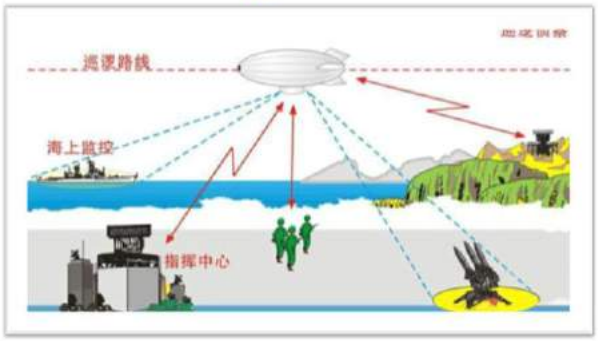
SAS offers a wide range of unmanned blimps in their FZ model line. In addition, SAS also builds custom-made unmanned blimps defined by their customer's specifications. General unmanned blimp characteristics include:

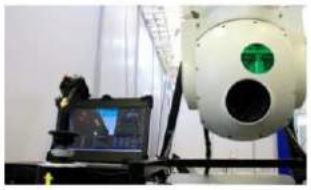
- Envelope: Rip-stop, high-strength, polyester composite fabric with a low leakage polyurethane gas membrane, and coated to protect the fabric from environmental factors, including acid rain, ice and UV-radiation
- Propulsion: Typically, two thrust vectoring engines supported from the gondola
- Control: Remote control via data link from a ground station or on-board navigation module with GPS
- Operating altitude: < 5,000 m (16,404 ft)

The SAS unmanned blimps can be configured for a variety of applications as shown in the following use cases.



Application——aerial surveillance



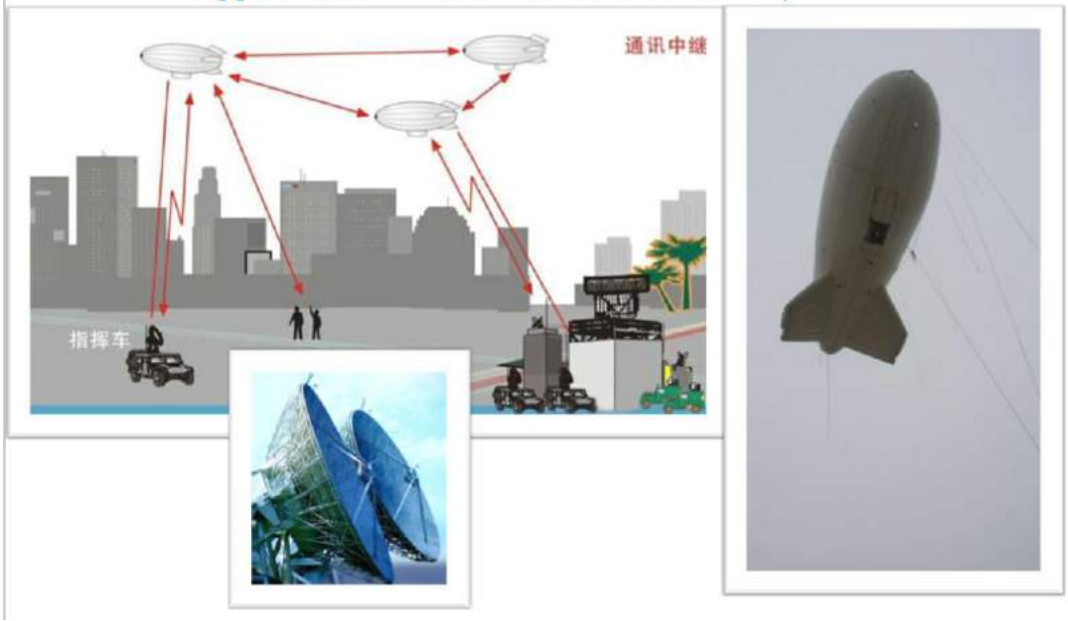


3) Application and case Suzhou Ark Aviation Technology Co.,LTD SAS

Application——Signal reconnaissance and data acquisition

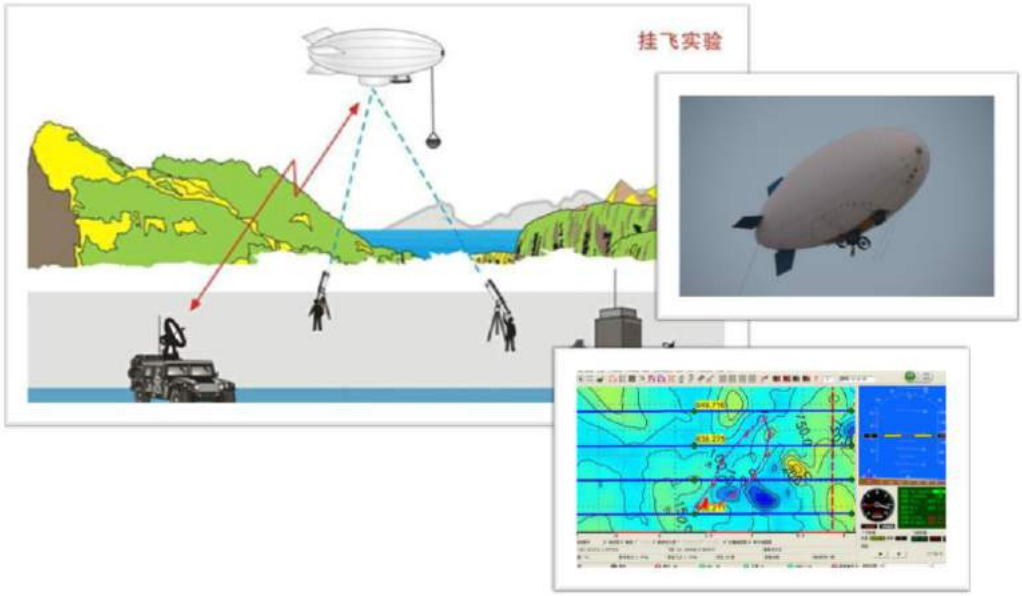
3) Application and case Suzhou Ark Aviation Technology Co.,LTD SAS

Application——communication and relay



3) Application and case Suzhou Ark Aviation Technology Co.,LTD SAS

Application——Carrying and scientific research



3. SAS standard unmanned blimp products

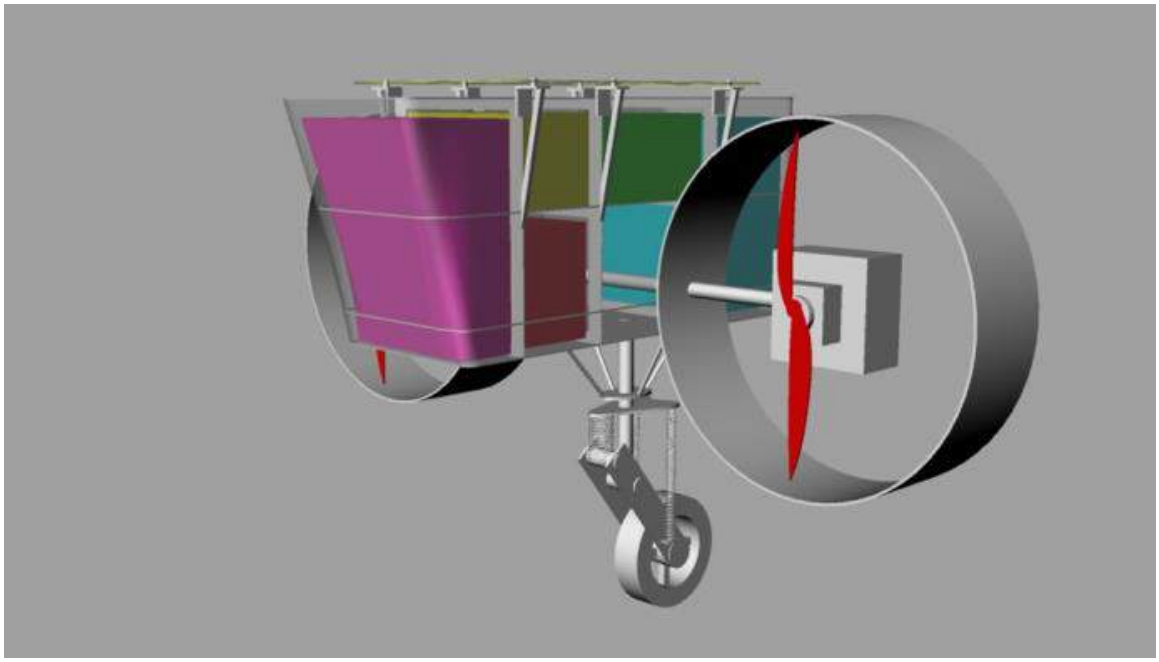
SAS offers a broad range of standard unmanned blimp products that can be scaled to deliver altitude and lift capabilities the meet customer requirements for a variety of applications. Two modest-sized unmanned blimps in their current product line are shown below.

FZ-series, ZH-A500 (Sky One)

This 25 m (82-foot) foot long blimp first flew in 2017. Envelope volume is 550 m3 (19,423 ft3). It is designed for a maximum payload of 150 kg (331 lb), a maximum altitude of 3,000 m (9,843 ft), and 5 hour flight endurance.

FZ-series ZH-A500 (Sky One). Source, both photos: SAS

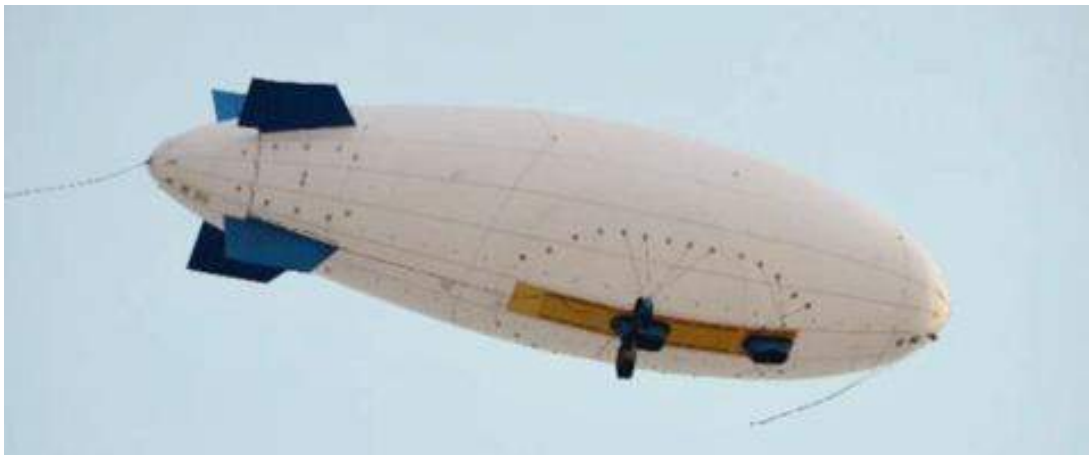
FZ-series ZH-A500 (Sky One). The large circular logo appears to read, "Advanced Air & Space Inter-service Electronic Weapons."
Source, both photos: SAS



General arrangement of the gondola, thrust vectoring propellers, and single landing wheel. Source, both images: SAS

FZ-series, ZH-A300 (Xinjiang “patrol monitoring boat”)

Rendering of an FZ-series ZH-A300 against the Shanghai evening skyline. Gasoline engine or electric motor propulsion is available. Source: SAS



FZ-series ZH-A300. Note the elliptical array of reinforcement points around the bottom of the envelope for attaching the supporting cables for the gondola and separate payload modules. Also note the elliptical array of reinforcements for the tail fin support cables.

Propellers vectored for dynamic lift control. Source: SAS

4. SAS custom unmanned blimps

93-meter, non-rigid, long-range, unmanned airship

The large FZ90 (also identified as FZ30) low-to-medium altitude blimp was developed circa 2014 for the Chinese People's Liberation Army, possibly to demonstrate its use as a long-range search and rescue vehicle or for other military applications. It is comparable in size to the US Navy's ZPG-2W airborne early warning blimps built by Goodyear Aircraft in the 1950s.

FZ90. Source, both photos: SAS

FZ90. Source: SAS via LinkedIn

Parameter	**Model FZ90 (FZ30)**
Type	Unmanned, non-rigid airship (blimp)
Length	93 m (305 ft), scalable to other sizes
Volume	33,000 m^3 (1,165,384 ft^3), scalable to other sizes
Payload, max.	Should be several tons. However, it is listed variously, up to 300 kg (661 lb).
Propulsion	• 6 x flank-mounted, thrust vectoring gasoline-powered engines attached to the envelope with X-framework to distribute loads. • 1 x stern mounted engine
Altitude, max.	>5,000 m (16,404 ft)
Endurance	Listed variously from “above 4 hours” to “72 hours”

30-meter, non-rigid, unmanned lenticular airship

A non-rigid, lenticular airship with a diameter of about 30 meters (98.4 ft) was developed for the School of Aeronautics and Astronautics at Shanghai Jiaotong University. Four thrust vectoring, shrouded propellers were installed at 90º intervals on a circular structural support ring attached around the equator of the airship. SAS was responsible for envelope manufacturing, thruster design, construction and installation and for launch services.

Source, both photos: SAS

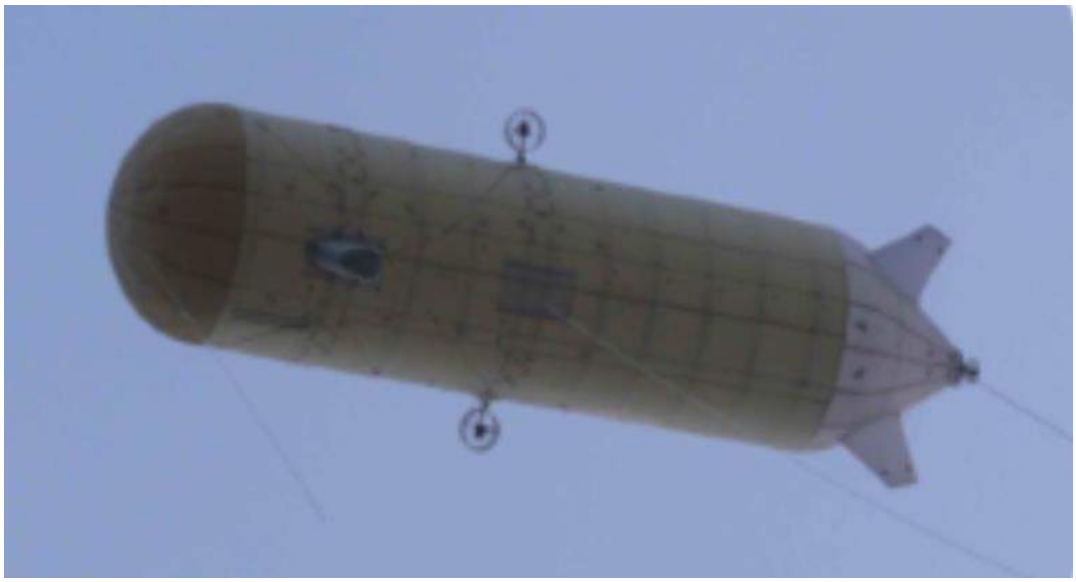
25-meter, non-rigid, 3-engine unmanned airship

SAS developed a 25-meter (82-foot) long, non-rigid, three engine airship for Beijing Sky High Technology Co. Ltd. SAS designed and manufactured the envelope, fins, gondola and propulsion system with two thrust vectoring propulsors mounted on either side of the gondola and one propulsor mounted at the tail.

Source, both photos: SAS

16-meter, non-rigid, 3-engine unmanned airship

SAS developed a 16-meter (52.5-foot) long, non-rigid, three engine airship for Harbin Institute of Technology. SAS designed and manufactured the envelope, fins, gondola and propulsion system with two flank-mounted thrust vectoring propulsors attached to the envelope and one propulsor mounted at the tail.



Source, both photos: SAS

25-meter Zhiyuan-1 (ZY-1) non-rigid, 3-engine unmanned airship

Built for Shanghai Jiao Tong University's (SJTU) Chongqing Nearspace Innovations R&D Center, the 25-meter (82-foot) long, non-rigid, electrically-powered ZY-1 was equipped and flown at low altitude by SJTU from 2007 to 2009 as a flight control system technology demonstrator for a future stratospheric airship.

ZY-1. Source: SAS

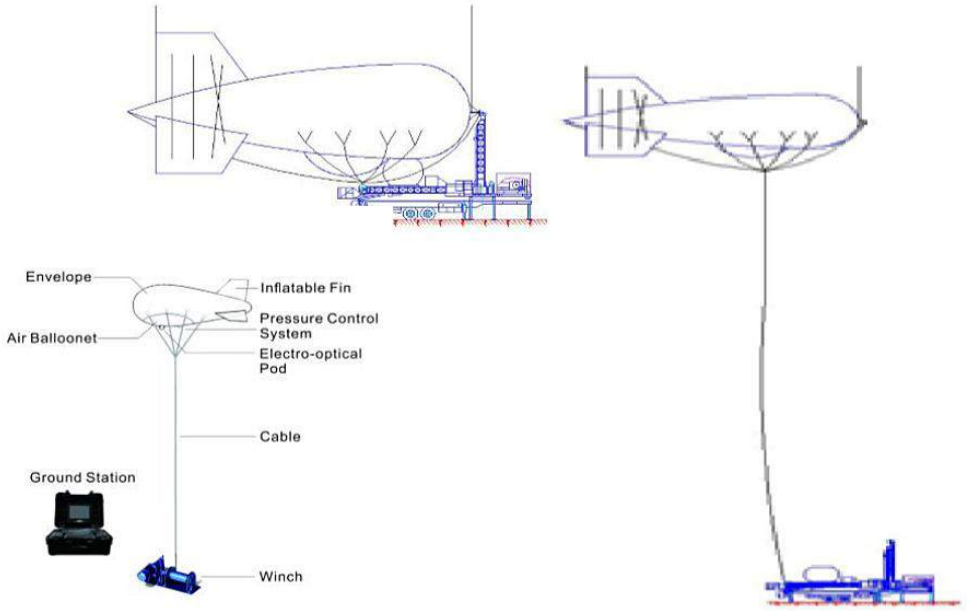
5. SAS tethered blimp systems

The SAS family of tethered blimps has gas envelopes made of rip-stop, high strength, composite cloth, ranging in size from 50 to 10,000 m^3 (1,766 to 353,146 ft^3). The tethered blimps operate from fixed mooring locations and can attain altitudes ranging from 100 to 4,000 m (328 to 13,123 ft) with payloads ranging from 50 to 5,000 kg (110 to 11,023 lb).

SAS reports that their tethered blimp systems have been widely used in advertising, aerial photography, defense and security monitoring, surveillance, natural disaster monitoring, urban planning, atmospheric environment detection, communication and TV relay.

After inflation on a mooring mast or a mooring vehicle with a rotating platform, the tethered blimp is allowed to weathercock on its mooring mast to keep its nose pointed into the wind prior to launch and after

recovery. The tether can be an Ultra-High-Molecular-Weight PolyEthylene (UHMWPE) / Kevlar / Vectran rope or a composite fiber-optic cable. When ready for launch, the blimp is released on its tether and rises to its operating altitude. At the conclusion of a mission, the blimp is winched back down to the ground and secured to its mooring mast.



Components of a SAS tethered blimp system. Source: SAS

SAS developed the FZ30T long-endurance tethered blimp for China Mobile Communications Group/Beijing Satellite Manufacturing Group.

General characteristics of SAS large tethered blimps (based on FZ30T, FZ40T)

Parameter	Model FZ30T / FZ40T
Type	Unmanned, non-rigid, tethered aerostat
Length	Customizable, 10 to 30 m (32.8 to 98.4 ft)
Payload, max	FZ30T: up to 200 kg (441 lb), FZ40T: up to 100 kg (220 lb)
Propulsion	None
Power source	Gasoline-powered generator on mooring truck, power supplied to blimp via tether
Windspeed, max. operating	More than 10 m/s (36 kph, 22 mph)
Altitude, max	1,000 to 2,500 m (3,281 to 8,202 ft)
Endurance	Up to 7 days

Model FZ30T, rated for payloads up to 200 kg (441 lb). Source: SAS via Made-in-China

Model FZ40T, rated for payloads up to 100 kg (220 lb). Source: SAS via Made-in-China

6. SAS tethered balloon systems

The SAS family of tethered balloons has smaller gas envelopes (30 to 200 m^3 / 1,059 to 7,063 ft^3) than tethered blimps, but can be employed in many of the same applications as tethered blimps while operating at lower altitudes of 50 to 1,000 m (164 to 3,281 ft) with smaller payloads of 5 to 100 kg (11 to 220 lb). A typical payload is an electro-optical pod. After inflation, on a trailer-mounted ground station or from a laydown area on the ground, the balloon is released on its tether and rises to its operating altitude. The balloon systems use the same type of tethers as the blimp systems. At the conclusion of a mission, the balloon is winched backdown to its ground station. These portable balloon system can be setup and recovered quickly. A helium recovery system can be included at the ground station to recover helium when the balloon is deflated.

SAS tethered balloon field launch. Source, both photos: SAS

Domestic tethered balloon users have included the China State Grid Group and China State Meteorological Administration.

SAS tethered aerial surveillance balloon.
Source: SAS via Made-in-China

7. For more information

- "Suzhou Ark Aviation Technology Co., LTD," Corporate briefing, December 2020: https://lynceans.org/wp-content/uploads/2022/10/Suzhou-Ark-Aviation-Technology-Co-Ltd_SAS.pdf

Video

- "Chinese 25m UAV Blimp Take off and Fly," (2:07 min), posted by Forest Zhang, 9 Mar 2017: https://www.youtube.com/watch?v=-6IMaBfPnzQ

Other *Modern Airships* articles

- *Modern Airships - Part 1*: https://lynceans.org/all-posts/modern-airships-part-1/
    - Aviation Industry Corporation of China (AVIC) – AS700 blimp
    - Goodyear - N-Class blimps
    - Vantage Airships – hybrid airships, manned & unmanned blimps

- *Modern Airships - Part 2*: https://lynceans.org/all-posts/modern-airships-part-2/
    - China - Cloud One 5G base station aerostat
    - China - Jimu No 1 high altitude aerostat
    - China - Shanghai Jiao Tong University - research airships
- *Modern Airships - Part 3*: https://lynceans.org/all-posts/modern-airships-part-3/