

GNSS / NSS / ENSS StarShadow

Peter Lobner, 24 August 2021

1. Introduction

After the NAVAIR StarLight contract ended in 2011, Global Near Space Services (GNSS) dropped its “doing business as” (dba) trade name and reverted to the corporate name Near Space Systems, Inc. (NSS), which later was acquired by Enerbay to form Enerbay – Near Space Systems (ENSS), all without ever leaving Colorado Springs, CO. The new firm continued to offer the three platforms in its “Star” portfolio of “affordable, persistent, wide-area communications and sensing” airships, which originally were developed by GNSS:

- **StarTower** was a tethered, hybrid, large aerostat designed to operate up to 2,000 ft (609 m) AGL, up to 10,500 ASL.
- **StarShadow** was a free flying, hybrid, optionally manned airship, similar in shape to the StarTower and designed to operate between 5,000 and 15,000 ft (1,524 – 4,572 m).
- **StarLight** was their unmanned stratospheric platform with the same design and altitude performance originally specified by NAVAIR: up to 85,000 ft (25,908 m).

All of these platforms could be configured to support a wide variety of missions. The StarTower, shown below, had a length of 63 feet (19.2 m), width of 56 feet (17 m) and height of 19 feet (5.8 m), with a gas envelope volume of 40,000 ft³ (1,133 m³). With a streamlined 2:1 lift-over-drag (L/D) ratio, it could operate in 70-knot winds.



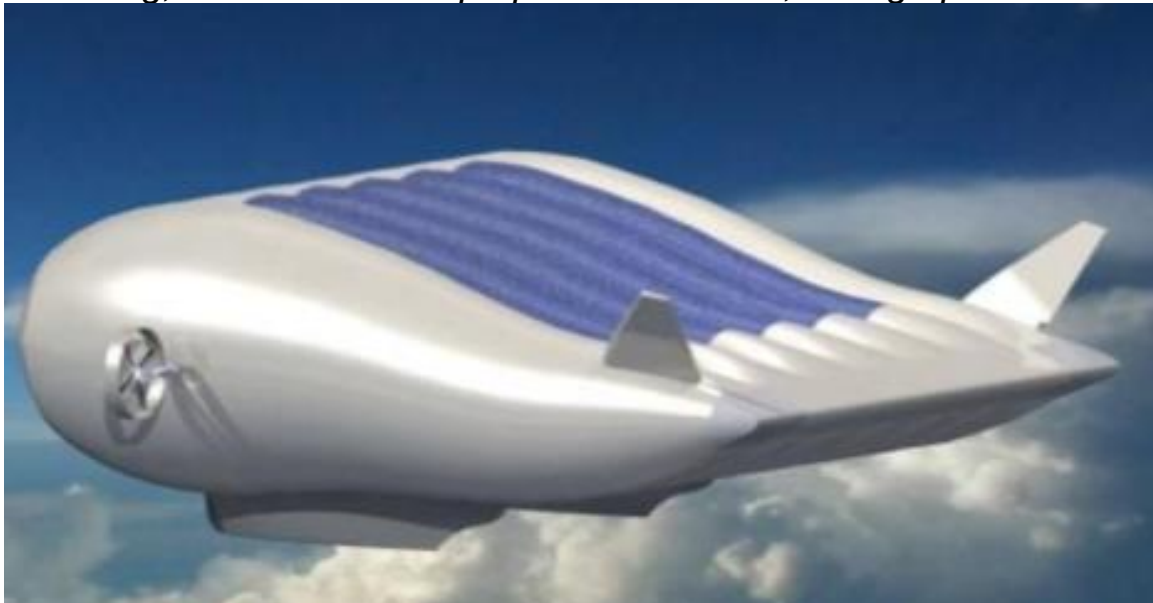
StarTower aerostat. Source: ENSS

2. StarShadow design

The StarShadow is as an optionally manned, hybrid, solar powered, advanced, medium altitude, wide-area communications and surveillance airship. Its aerodynamic hull shape is based on the StarTower high-performance, airfoil-shaped gas envelope, and has a similar lift-over-drag ratio of about $L/D = 2$.

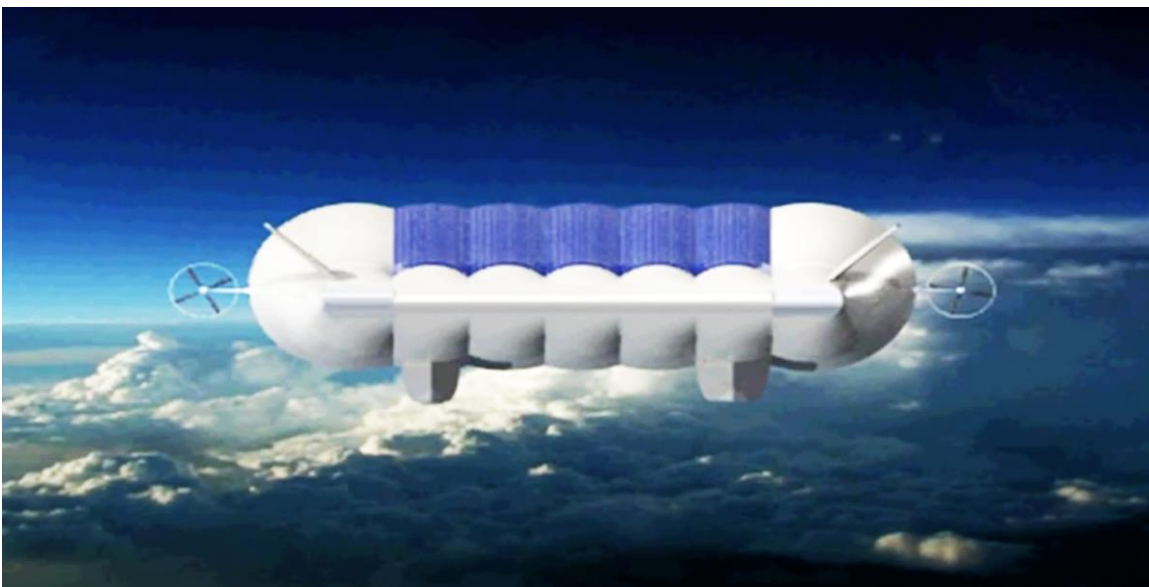


Renderings of the StarShadow hybrid airship in flight. Note the two widely spaced gondolas (above), the flexible, thin-film photovoltaic array on the top of the hull (below), and the flank-mounted, thrust vectoring, ducted fan main propulsors. Source, both graphics: ENSS





*Renderings of the StarShadow hybrid airship in flight.
Note the pilot-optional cockpit in the port gondola (above).
Also note the seven lobes in the broad lifting body envelope (below)
and the flexible, thin-film photovoltaic array on the five central lobes.
Source, both graphics: Screenshots from GNSS 2010 video.*





Renderings of StarShadow on the ground. Source: ENSS

General Characteristics

Parameter	StarShadow
Airship type	Hybrid, semi-rigid, heavier-than-air
Lift gas	Helium or hydrogen
Propulsion system	2 x flank-mounted, electrically powered, variable pitch, thrust vectoring ducted fans.
Electric power system	Hybrid solar electric with battery for night operations, augmented by a hydrocarbon-fueled auxiliary power unit (APU).
Flight controls	Electro-mechanical elevon on the “beaver-tail” trailing edge and twin rudders. Multi-chamber ballonnet controls center of gravity.
Accommodations	1 x optional pilot
Payload	Up to 1,102 lb (500 kg)
Payload power	Up to 8 kW
STOL takeoff run	About 100 ft (30.5 m)
Rate of climb	700 fpm (3.6 m/s) thru 10,000 m (3,048 m) MSL
Speed, cruise	42 kts (48.3 mph, 77.8 kph)
Speed, maximum	60 kts (69 mph, 111 kph)
Altitude, operating	5,000 and 15,000 ft (1,524 – 4,572 m) MSL
Altitude, maximum	20,000 ft (6,096 m) MSL
Mission endurance	Up to 3 weeks

StarShadow was funded by private capital and was developed as a scalable, configurable surveillance and communications platform intended for the following types of applications:

- Advanced LTE broadband aerial networks
- Wide area surveillance and communications relay
- Border, port and coastal security
- Protection of critical infrastructure
- Support of military and police actions
- Remote sensing and resource mapping

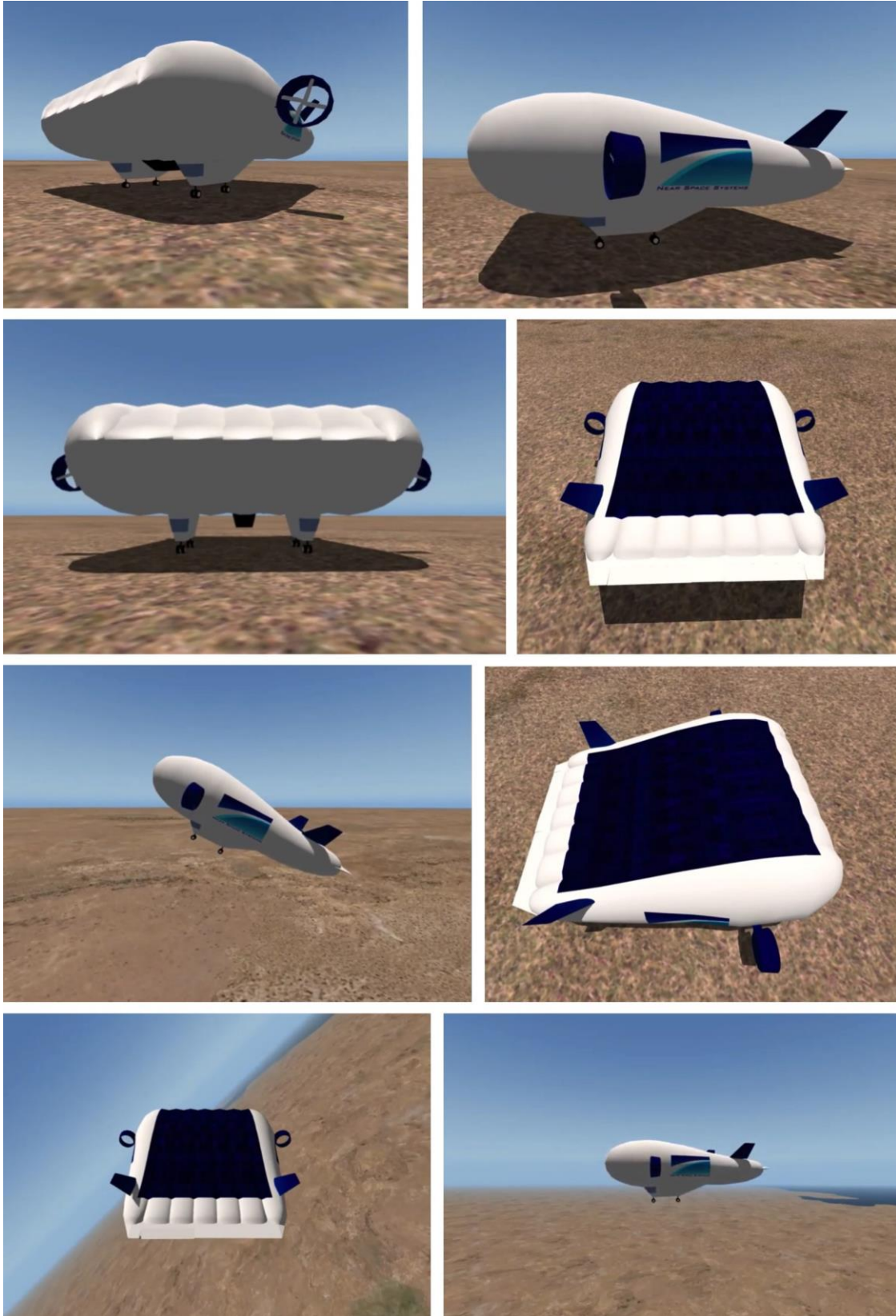
On surveillance and communications missions, the StarShadow's radio frequency coverage range depends on its operating altitude. At 15,000 ft (4,572 m) altitude, StarShadow's sensor coverage range is 110 km (70 miles).

StarShadow could fly its missions autonomously, including the STOL takeoff and landing. A command and control uplink enables the users to update the autonomous flight plan, which can be based on GPS waypoints. Alternatively, it can be flown remote-manually or by an on-board pilot.

The StarShadow is much larger than the SkyTower aerostat. With large flight control surfaces and vectorable thrusters, the StarShadow is very maneuverable.

StarShadow has a modular, open architecture payload system to accommodate a wide range of sensors. The payload is housed in the two gondola pods and in belly-mounted racks, which provide easy access in the field for maintaining or changing sensors or other equipment when needed.

Turnaround time after a mission is expected to be about 90 minutes, based on refueling the APU, topping off the lift gas if needed and performing any scheduled airship or payload maintenance. Onboard self-diagnostics reports any detected issues in real time, via the command and control data link.



StarShadow montage. Source: Screenshots, NSS 2013 video

GNSS / NSS / ENSS originally planned to deliver the StarShadow in 2015. However, no StarShadow was ever built.

3. For additional information:

- GNSS video, “StarTower, StarShadow, and StarLight by NSS - Near Space Systems, Inc.” (8:48 minutes), 12 October 2010: <https://www.youtube.com/watch?v=GKTgpSPVKd8&t=525s>
- NSS video, “StarShadow by Near Space Systems, Inc.” (9:58 minutes) 14 November 2013: https://www.youtube.com/watch?v=bLaXMXUi1yl&feature=emb_title
- “Enerbay – Near Space Systems (ENSS) – Providing Affordable, Persistent, Wide-Area Communications and Sensing,” presentation circa 2015: <http://www.enerbay.ca/wp-content/uploads/2015/09/Near-Earth-Systems.pdf>