READY TO GO: POLAR FAMILY AIRSHIPS FOR SURVEYING AND CARGO

Innovative Airship Solutions from Guardian Flight Systems

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Presentation Preview

- About Guardian Flight Systems
- Polar 400 – Proof-of-concept for the Polar family of airships
- Polar 600 – Near-term deliverable airship for aerial surveying
- Polar 3000 – Low-risk 10-ton cargo airship
- Ready to do business!

Innovation begins with experience…

GUARDIAN FLIGHT SYSTEMS

Guardian Flight Systems: *Who are we?*

- Established in 2006 to build persistent aerial platforms.
- A division of Aviation Worldwide Services
  - Global provider of logistics and aviation services with $300 million in annual revenue
  - Part 125 and 135 carrier for the US DoD
  - Operating in over two dozen countries with over 70 aircraft
  - Completion center for Sikorsky's Blackhawk
  - Part 145 Modification and Repair Station
- Established relationships with TCOM, AMS, etc.

Guardian Flight Systems: *Engineering Heritage*

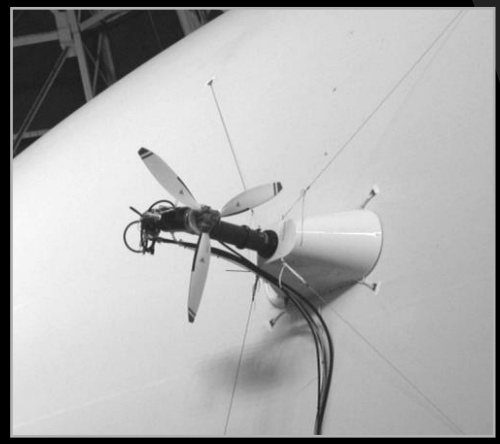
- 120 years combined airship experience within our engineering group
  - Skyship 500HL, 600
  - Westinghouse Sentinel 1000, 5000
  - Cargolifter
  - ATG SkyKitten, SkyCat, AT-10
- Developed Polar Family Airship architecture:
  - Fully maneuverable to zero airspeed
  - VTOL/STOVL capable
  - Can “taxi” in a manner similar to an airplane
  - Demonstrated and validated reduced ground crew requirements
  - Deliberate use of low-risk COTS technologies

The first member of Guardian's Airship family.

POLAR 400

Polar 400:
Reflects Polar-Family architecture

- Primary powerplant located in gondola for ease of maintenance
- The four hull-mounted propellers driven hydraulically for simplicity
- Two side-mounted vectorable propellers provide vertical thrust for VTOL and horizontal thrust for cruise
- Two stern-mounted propellers provide low-speed yaw and fore/aft control
- Non-rigid design for simplicity, ease of repair, and low cost
- Represents a “scalable” design



Polar 400:
General Specifications

Take-off power	**270 hp**
Maximum continuous power	**230 hp**
Speed – max	**45 kts**
Speed – cruise	**30 kts**
Operating altitude	**5,000 ft**
Endurance – max	**12 hrs**
Volume	**4,000 m^3**
Length	**49.7 m**
Diameter	**12.27 m**
Height overall	**14.86 m**
Ballonet total capacity	**25%**

Polar 400:
Test and Evaluation Success

US OSD-sponsored and contracted launch/recovery/refueling exercise and technical evaluation of Polar 400 prototype vehicle results:

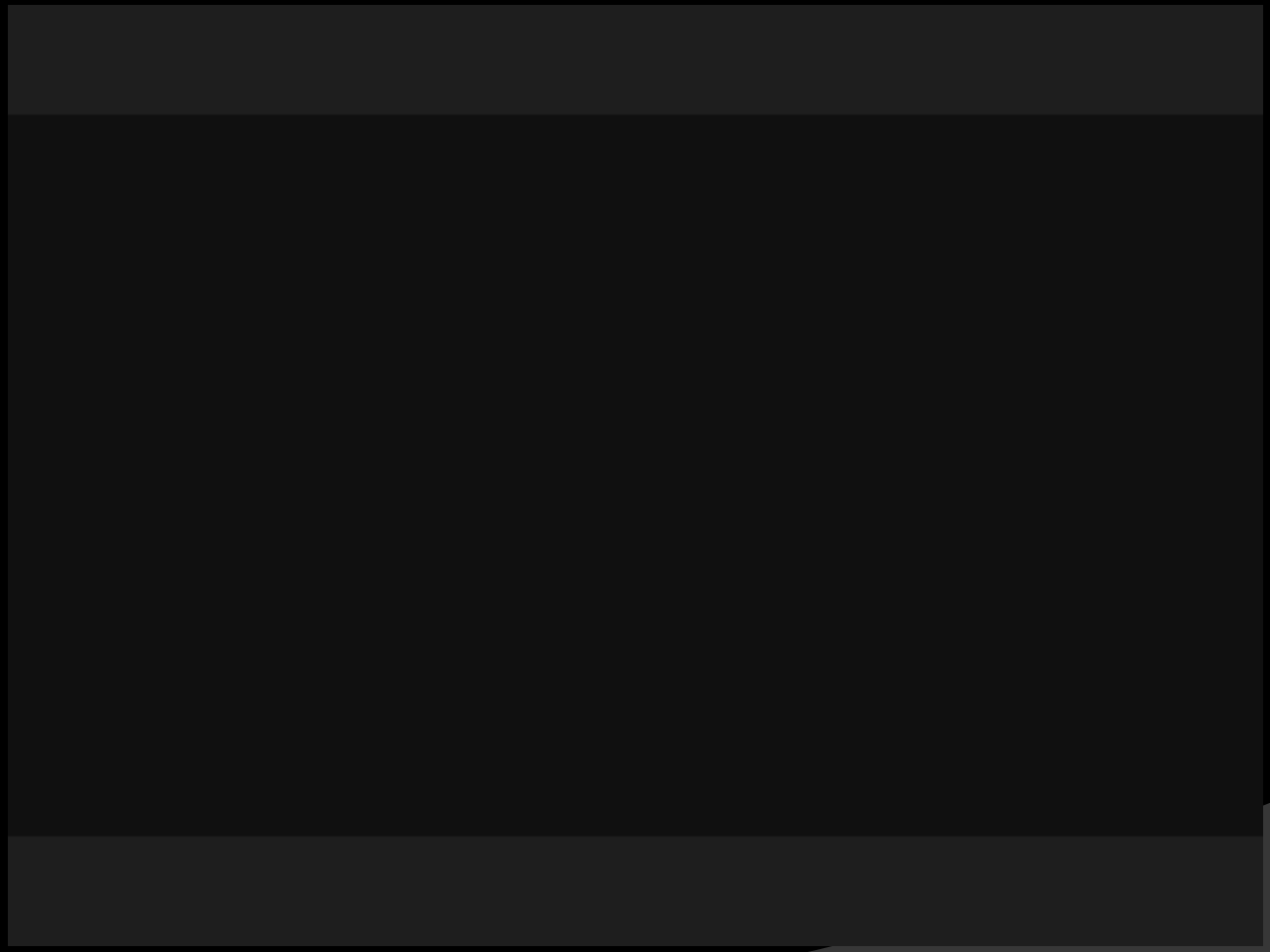
- OSD: “Due to quick turn time (6 to 7 minutes including refueling) it’s clear a single crew could operate at least 2 or 3 different airships…”
- OSD: “The manpower is 5 personnel (including the remote pilot) to attach and release the airship from the mast and 6 personnel… to fuel the vehicle.”
- NAVAIR: “The 4 propellers permit vertical takeoff with pitch and lateral control at zero speeds. The impact is:
  - No runway needed
  - Lower operational costs
  - Less people on the ground”

Polar 400:
Testing and Evaluation Success

- Participated in Army RDECOM C4-ISR On-the-move, Fort Dix/Lakehurst, July-Sept 09 as central aerial node – multi-payload installation (see below)
- Over 300 total flight test hours and >10 communication/surveillance payloads integrated by end of C4ISR-OTM

"…I get to see a lot of stuff in this class of airship…the [Guardian] engineers have assembled and tested the most mature UAV system of this class." – Senior NAVAIR engineer

Polar 400:
VTOL Video



Polar 400: *Summary*

- Demonstrated improvements in low-speed control over conventional ships
- Demonstrated reduction in necessary ground crew
- Demonstrated a sound approach and robust system architecture
- ½ linear scale prototype for Polar 3000

*Providing a **near-term** solution for aerial surveying.*

POLAR 600

Polar 600:
General Characteristics

- 950 kg surveying payload capacity in addition to 2-pilot crew and fuel (3 kW available for payload)
- Survey >20 hours at 20 knots, 100 nm from base (radius/speed/payload/endurance tradeoffs possible)
- Type-certified design (derived from the proven Skyship 600: US Type Certificate AS1EU)
- Powered by twin 300 hp vectorable direct-drive Lycoming IO-540 engines (STC SS05290AT)
- Low-speed maneuverability enhanced by Polar-family hydraulic lateral thruster system which increases loiter stability and reduces ground crew requirements.
- First flight in 6 months, deliverable in 12 months
- We offer “parallel” payload integration using Polar 400 test-bed vehicle to shorten time into the field

Polar 600: *Specifications*

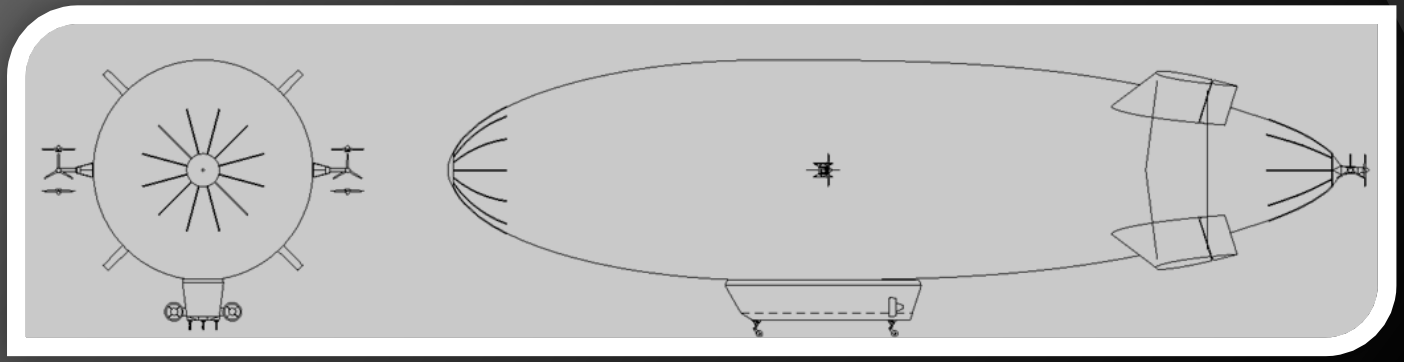
Volume	6,666 m^3
Length	61 m
Diameter	15.2 m
Max operating altitude	5,000 ft msl
Fuel capacity	490 kg
Maximum heaviness	350 kg
Maximum lightness	250 kg
V_{mc}	10 knots
V_{mo}	50 knots
AUEW	4,930 kg
MTOW	7,100 kg

Polar 600:
Performance Trade Space Estimates

On-station Loiter Endurance in Hours vs. Operating Radius*

Radius	20 KTAS	30 KTAS	40 KTAS
0 nm	51	21	9.5
50 nm	35	14	6.6
100 nm	21	8	3.9

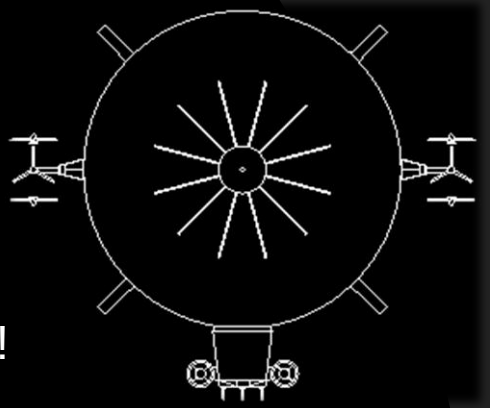
**ISA conditions, 3,500 msl pressure height, 950 kg Payload, 200 kg crew, 40 KTAS cruise, 75 kg fuel reserve*



A low-risk approach to delivering a 10-ton cargo ship.

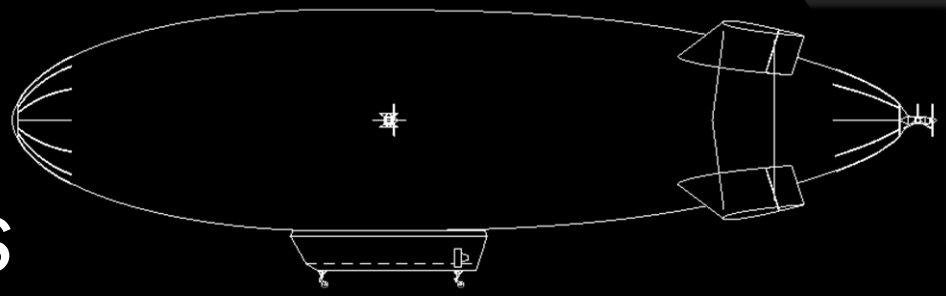
POLAR 3000

Polar 3000:
General Characteristics



- Low-risk design
  - No fundamentally new technology or design work!
  - Based on Polar 400 hull form, fins etc.
  - Uses COTS powerplants and propellers
  - Proven Polar-family architecture and low-speed maneuverability
  - Derived from persistent surveillance platform variant being designed for US military
- Powered by 3 x 300 hp Ford Diesels and 2 x 1,000 hp vectorable PT6 turboprops
- 10 metric ton cargo capacity, 100 nautical mile radius, VTOL
- 12 metric ton cargo capacity, 100 nautical mile radius, STOVL
- 1.6 metric ton VTOL drop-off capacity (no re-ballasting)
- 3.4 metric ton STOVL drop-off capacity
- 16 months to first flight, 36 months to certify, ~$20 million
- Drop-off capacity can be significantly expanded if desired

Polar 3000: *Specifications*



Volume	30,000 m^3
Max pressure Height (25% ballonet)	~10,000 ft msl
Length	98 m
Width	35 m
Fuel Capacity	5,000 kg
AUEW	16,000 kg
MTOW	29,500 kg
Crew allowance	300 kg
Maximum Structural Cargo Payload	12,000 kg
Maximum VTOL heaviness	2,000 kg
Maximum STOVL heaviness	4,000 kg
Maximum lightness	2,500 kg

Polar 3000:
Performance Trade Space Estimates

Cargo Capacity (metric tons) vs. Operating Radius*

Radius	VTOL w/ re-ballast	VTOL drop off	STOVL w/ re-ballast	STOVL drop off
100 nm	10.4	1.6	12.0	3.4
200 nm	10.0	1.4	11.8	3.4
500 nm	8.8	1.0	10.3	2.9

**ISA conditions, 4,500 ft msl pressure height, 45 KTAS cruise @ 4,000 ft, no refueling, two hour cruise reserve, 300 kg crew.*

Next steps to learn more about Guardian Flight Systems

READY FOR BUSINESS

Guardian Flight Systems: *Next Steps…*

- Visit our display and tell us what *you* need
  - Alan Ram, Vice President
  - Brandon Buerge, Lead Scientist
- Visit our facility in Elizabeth City, NC
- Schedule a demonstration of the Polar 400
- Ready to build a ship to your requirements!