Deutsche Gesellschaft für Luft- und Raumfahrt Lilienthal-Oberth e.V. Bezirksgruppe Hamburg

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Hamburg Aerospace Lecture Series
Hamburger Luft- und Raumfahrtvorträge

RAeS Hamburg in cooperation with the DGLR, VDI, ZAL & HAW invites you to a lecture

Hybrid Air Vehicles – The Airlander Project

Chris Daniels, Head of Partnerships and Communications, Hybrid Air Vehicles Ltd

Date: **Thursday 12 October 2017, 19:00**
Location: **HAW Hamburg**
Berliner Tor 5, (Neubau), Hörsaal 01.10

HAW HAMBURG

Lecture followed by discussion

No registration required !
Entry free !

Chris Daniels will describe the development and design of the Airlander, the largest, and one of the most innovative and greenest aircraft in the world today. He will explain how Airlander combines aerostatics, aerodynamics and vectored thrust to provide great flexibility, capability, fuel economy and safety. Chris will also discuss the market opportunities and potential market size of Airlander; and complete his lecture by describing Hybrid Air Vehicles' commitment to projects that aim to help inspire younger generations.

Chris Daniels studied mathematics at Oxford University and has an MBA from IESE Business School in Barcelona. He was awarded a Flying Scholarship by the Royal Air Force to obtain a Private Pilots Licence and has kept a lifelong interest in aviation. Chris has worked in diverse areas such as on the Trading Floor in investment banking and professional expedition leading. Most recently Chris was Head of the London 2012 Olympic and Paralympic Games B2B Activation at Lloyds Banking Group. Chris joined Hybrid Air Vehicles Ltd 3 years ago where his role covers funding, media, communications and Government relations, and also encompasses partnership opportunities with major brands and within Airlander's supply chain.

DGLR / HAW	Prof. Dr.-Ing. Dieter Scholz	Tel.: (040) 42875 8825	info@ProfScholz.de
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DGLR Bezirksgruppe Hamburg http://hamburg.dglr.de
RAeS Hamburg Branch http://www.raes-hamburg.de
VDI, Arbeitskreis L&R Hamburg http://www.vdi.de/2082.0.html
ZAL TechCenter http://www.zal.aero/veranstaltungen

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http://hav-connect.aero/Group/Lectures

NEXT GENERATION
LIGHTER-THAN-AIR
HYBRID AIR VEHICLES
THE FUTURE IS
AIRLANDER

HYBRID Air Vehicles

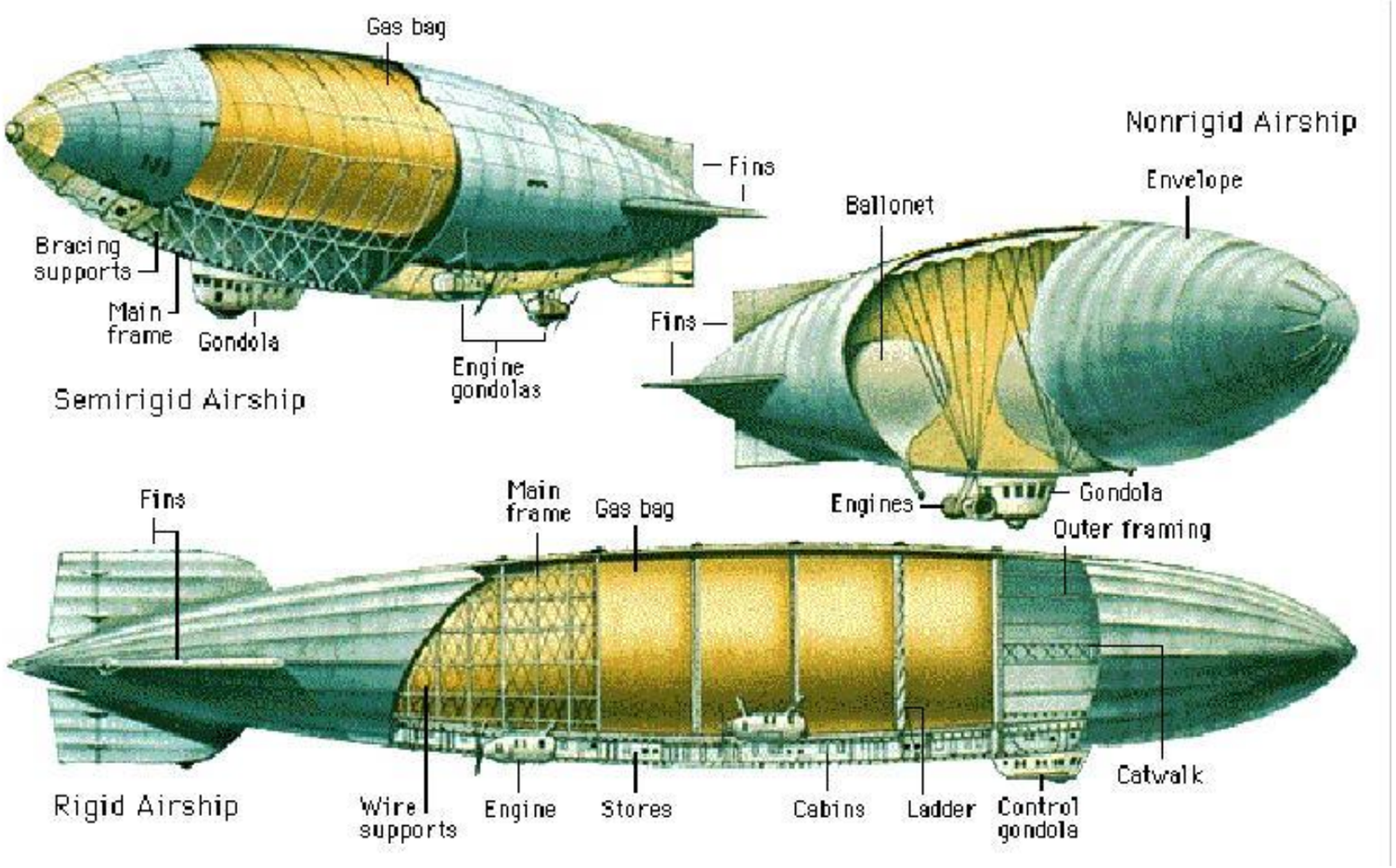
AIRLANDER™

Chris Daniels
Head of Partnerships & Communications

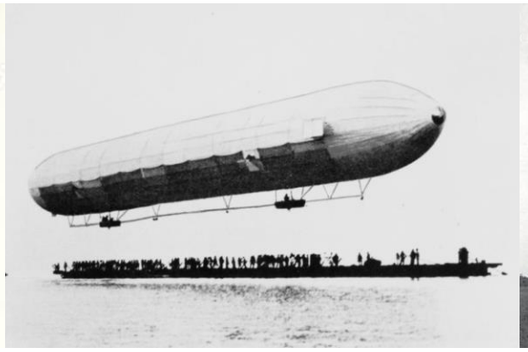
Dawn of a new era?

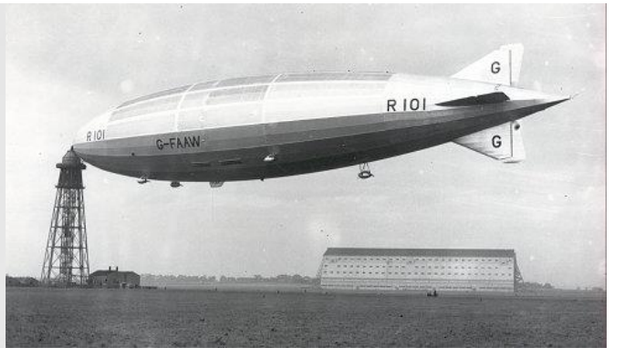
Airship Types

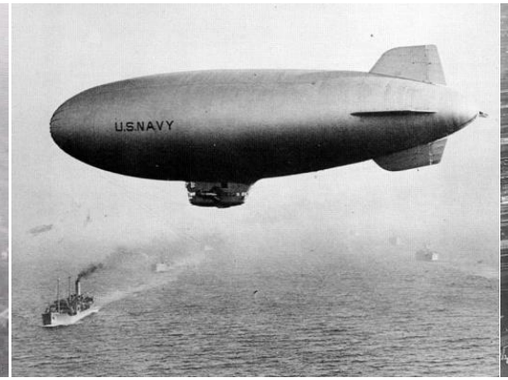
Airships can be rigid, semi-rigid, or non-rigid



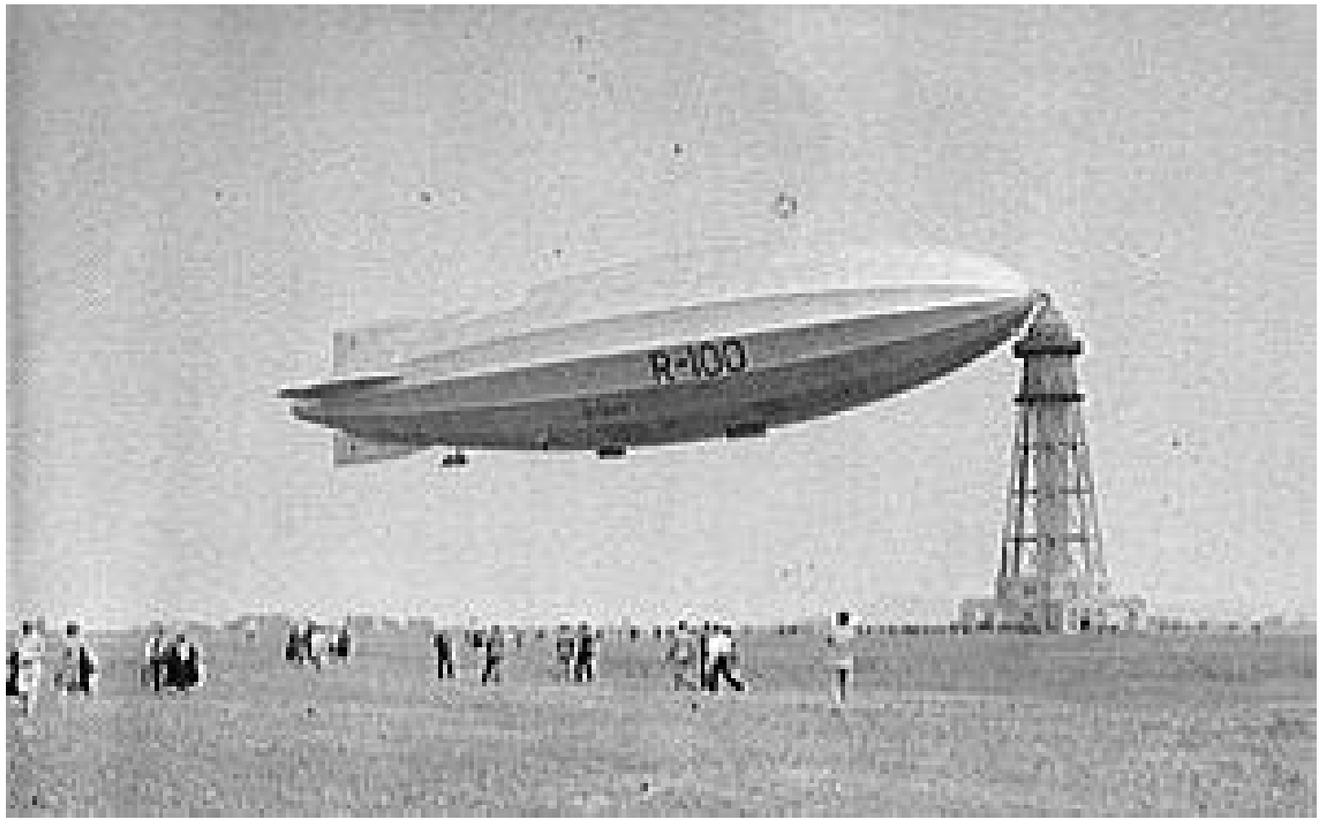
150 years of airship innovation







Looking back at airships….



https://en.wikipedia.org/

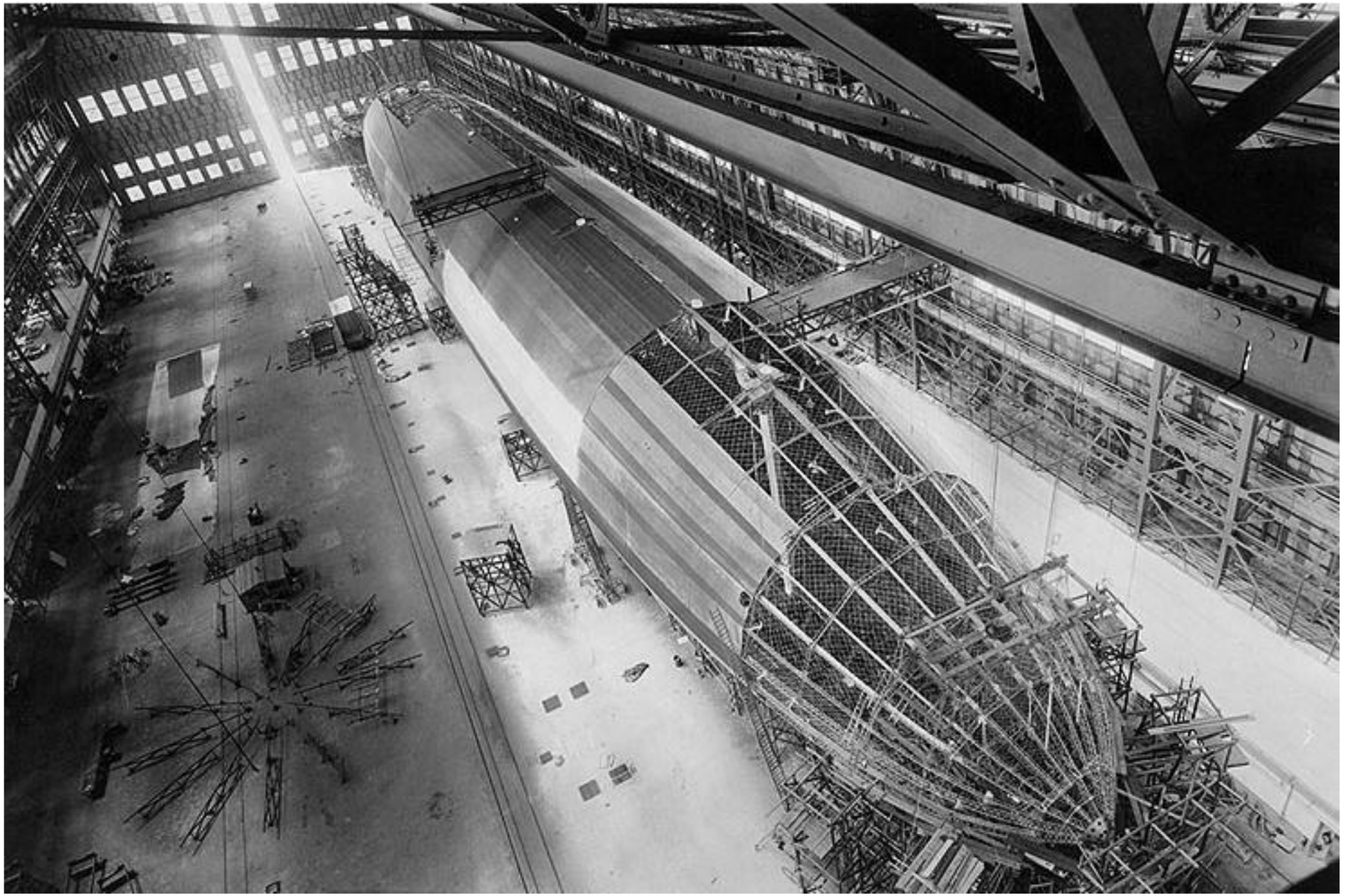
Traditional Airships - Wind Shifts Could Be A Problem

Photo # NH 84569 USS Los Angeles stands on end, 25 August 1927

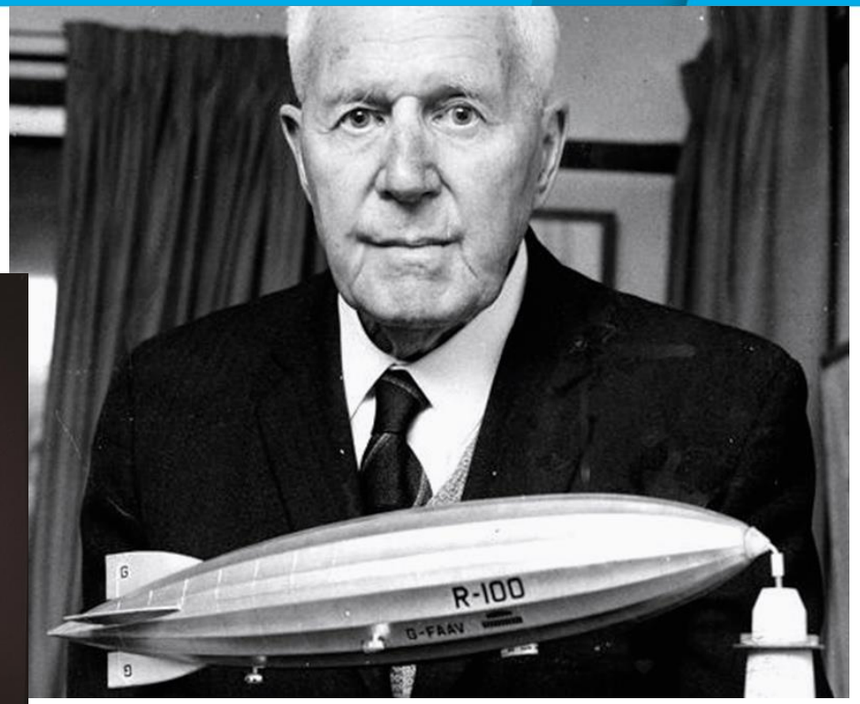
Ground handling needs lots of people

Traditional Airships - Ground Handling Issues

Structure and gas retention were always problematic



Barnes Wallis and Roger Munk

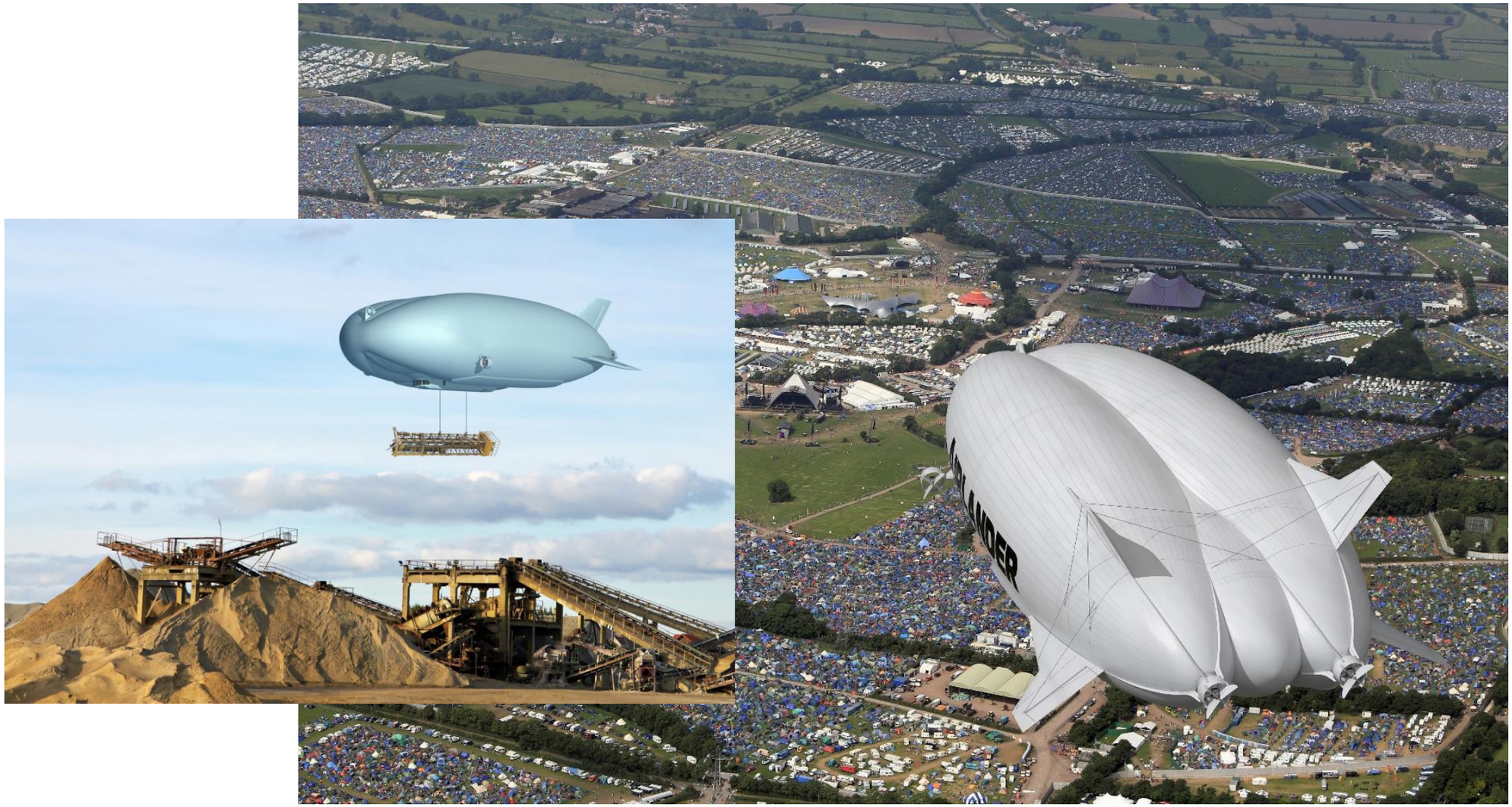


The Problem with Traditional Airships

Barnes Wallis comments:

- Better retention of the lifting gas (which he said should be helium not hydrogen)
- Improved fabric properties to allow larger non-rigid airships
- Utilisation of composites and plastics to reduce weight and hence improve the payload capacity
- Develop vectored thrust to aid in low speed flight and ground handling
- Improve the flight control system to give the pilot better control of the vehicle

Airlander’s vision is to make LTA flight viable



Now for some engineering

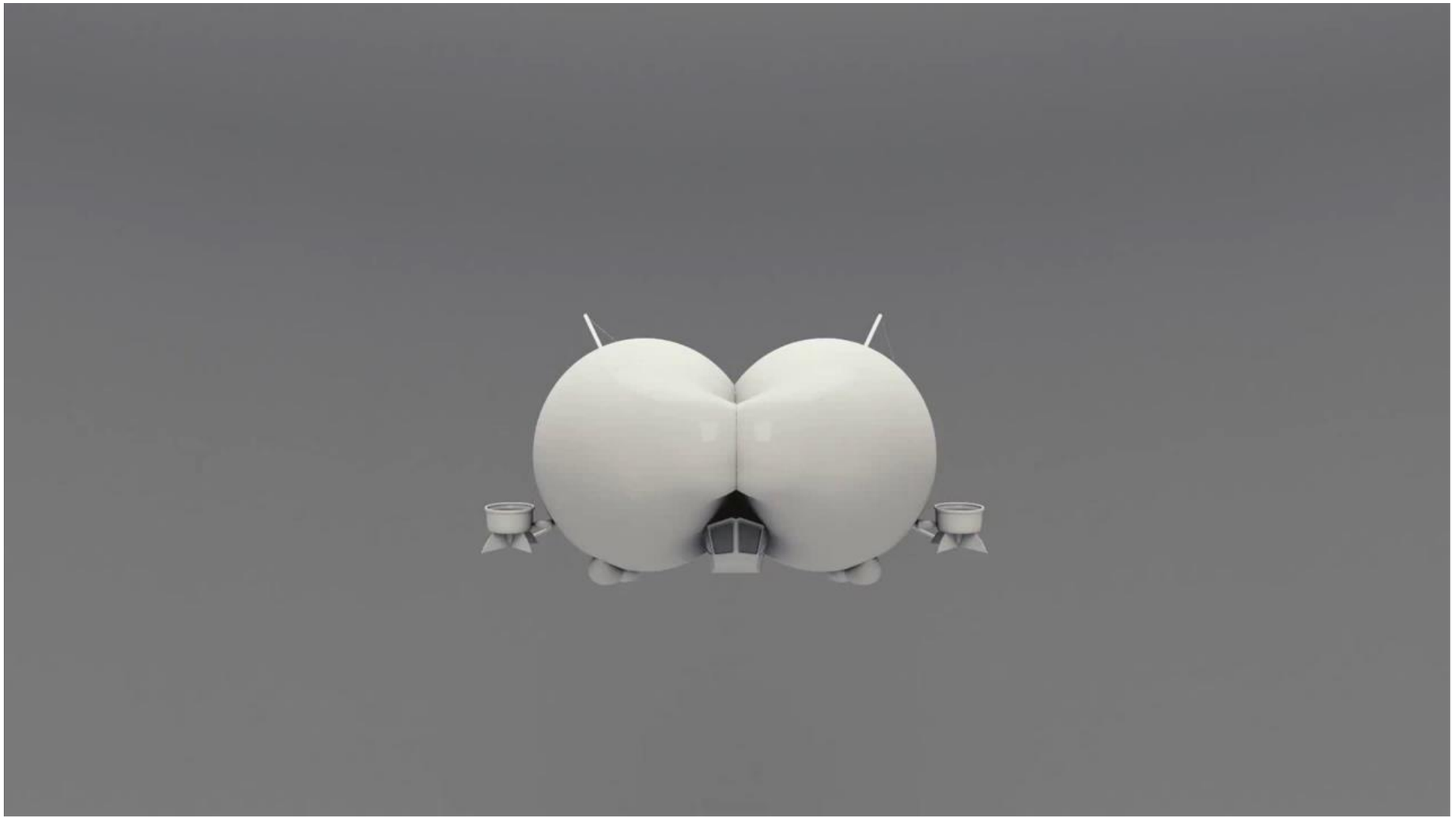
Aerostatic lift

Aerodynamic lift

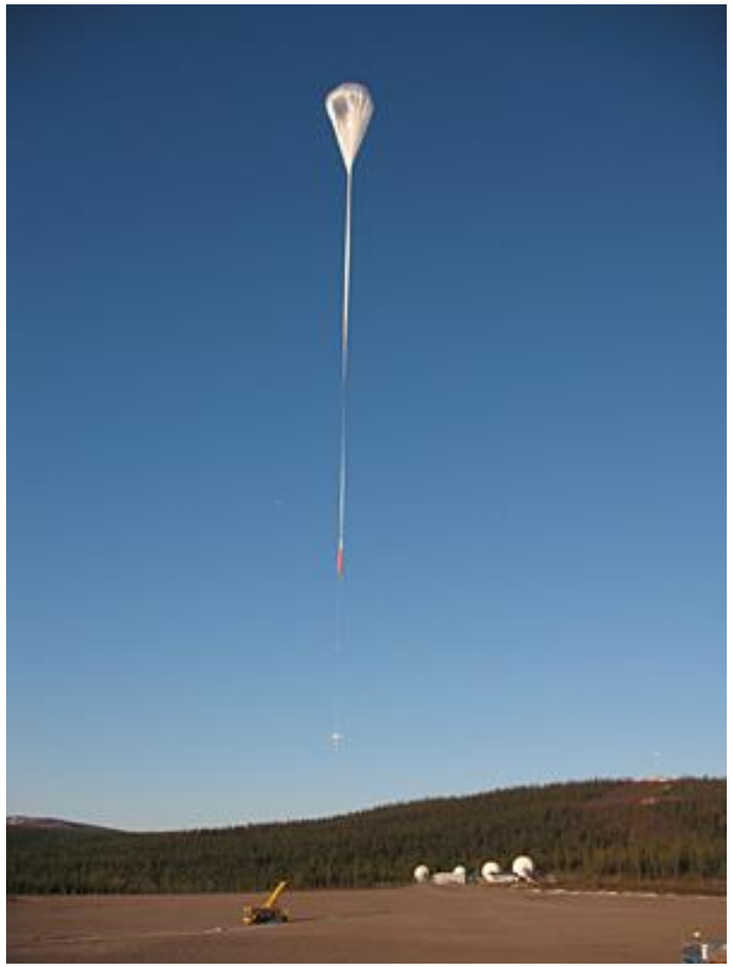
Vectored thrust from propulsors can be directed upwards or downwards

Weight

Airlander – 3 forms of lift



Pressure and altitude

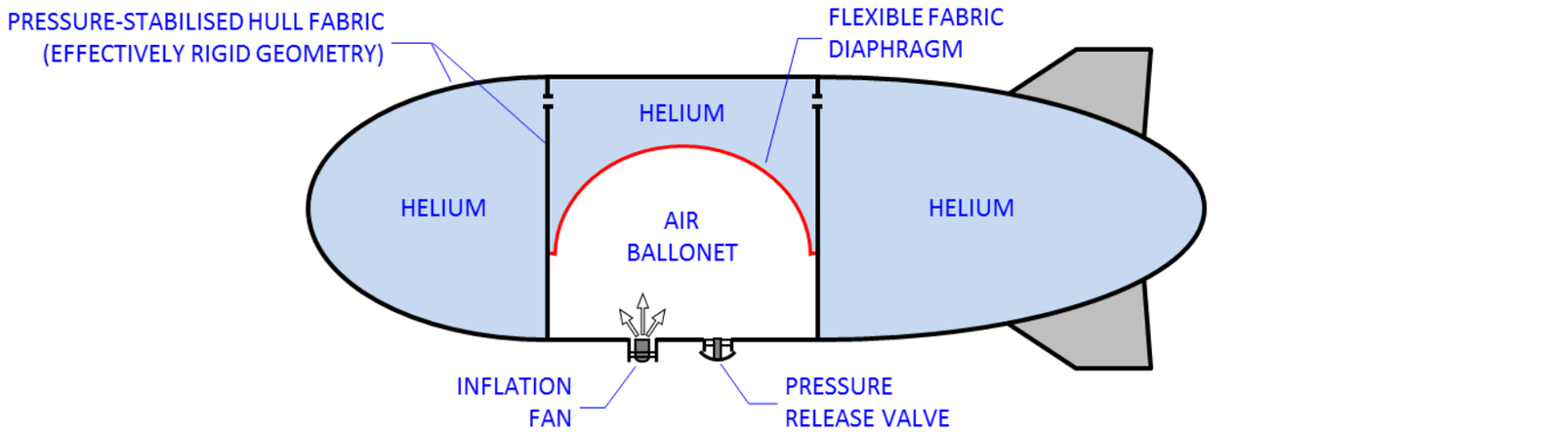


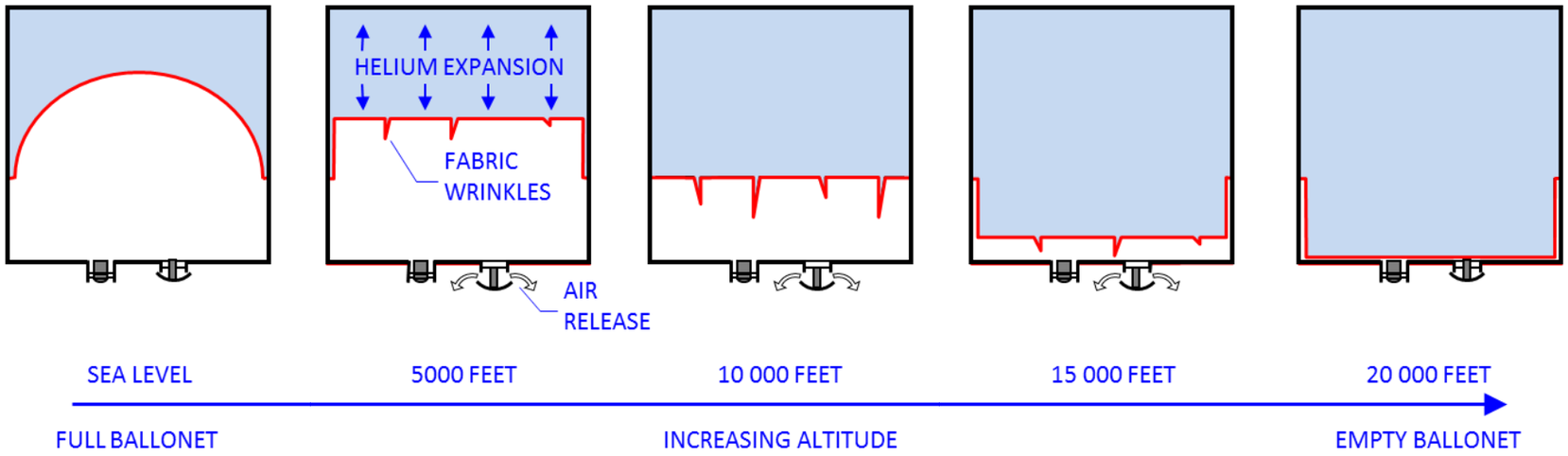
150 meter diameter!

http://www1.udel.edu/udaily/2009/may/balloon052109.html

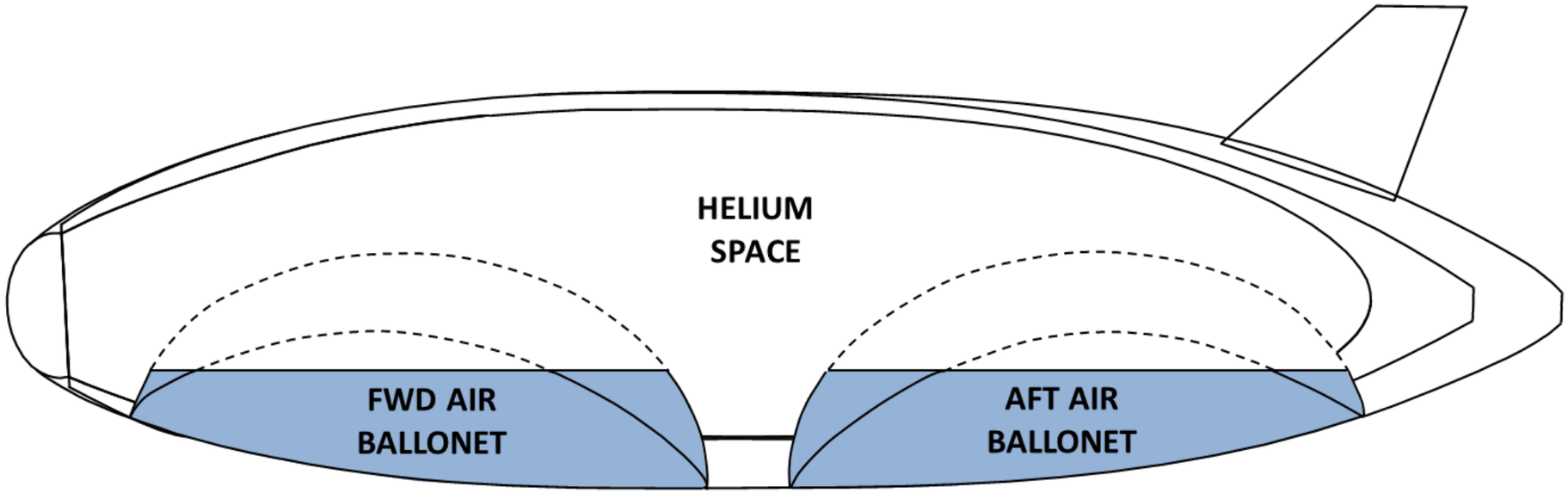
How do we stop the same expansion of Airlander?

Non-Rigid, Pressure Stabilised Structure

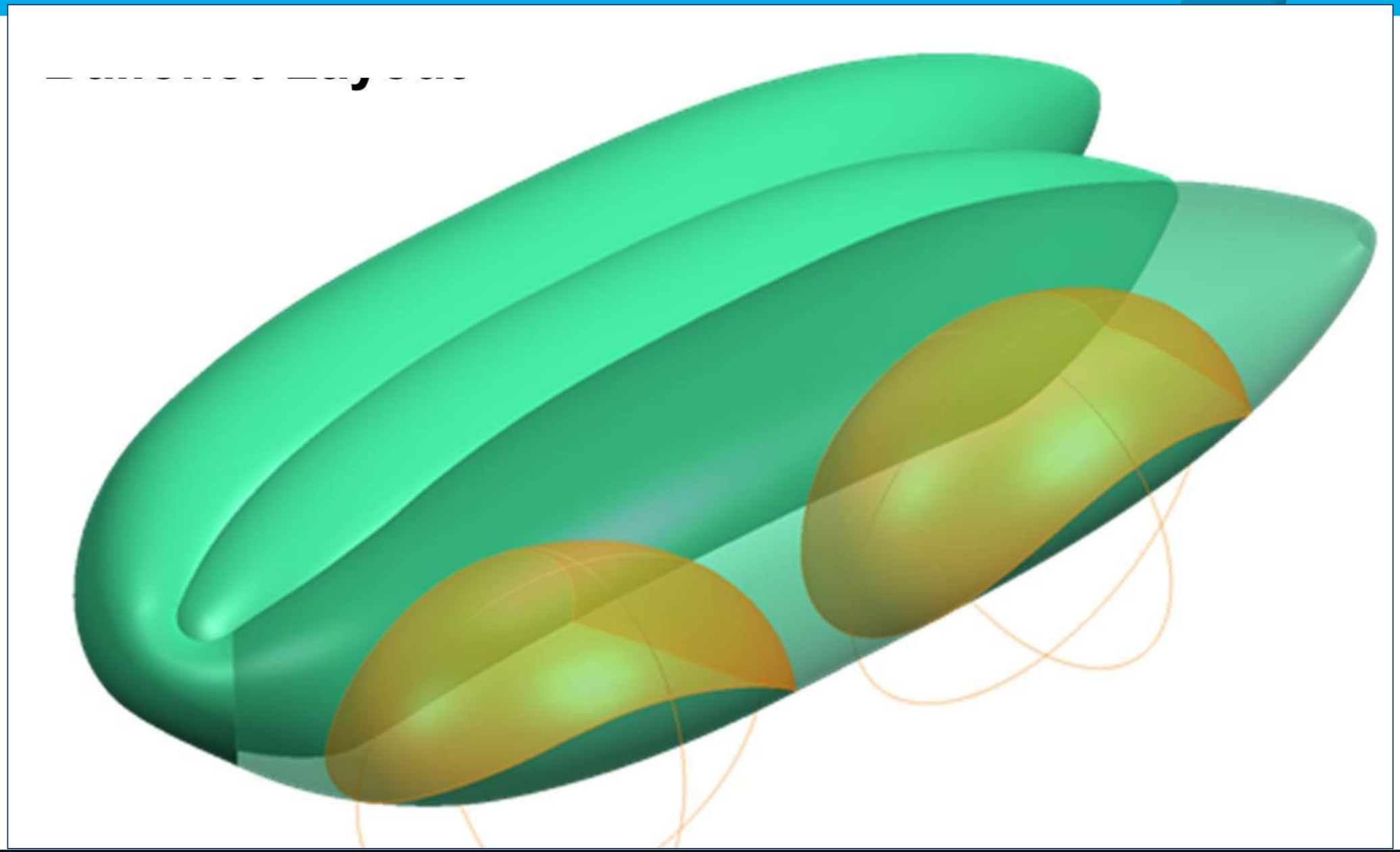




Non-Rigid Trim Capability



Ballonet layout – 3D



The Airlander story so far…

2007

Hybrid Air Vehicles formed and test scale demonstrators

2010

Won US Army $500m development contract to provide Afghanistan Persistent Surveillance with Northrop-Grumman

2012

First flight of the Airlander for the US Army

2013

US budget sequestration and Afghan drawdown led to cancellation. HAV buyback the Airlander to develop in UK

2014

Civil classification & huge media launch

THE TIMES

itv NEWS

Discovery CHANNEL

Bloomberg NEWS

2015

Fully financed the return to flight programme and countdown to first UK flight

2016

Aircraft upgraded, reassembled and undertaking civil test flight programme

The pre-HAV era

Testing the SkyKitten

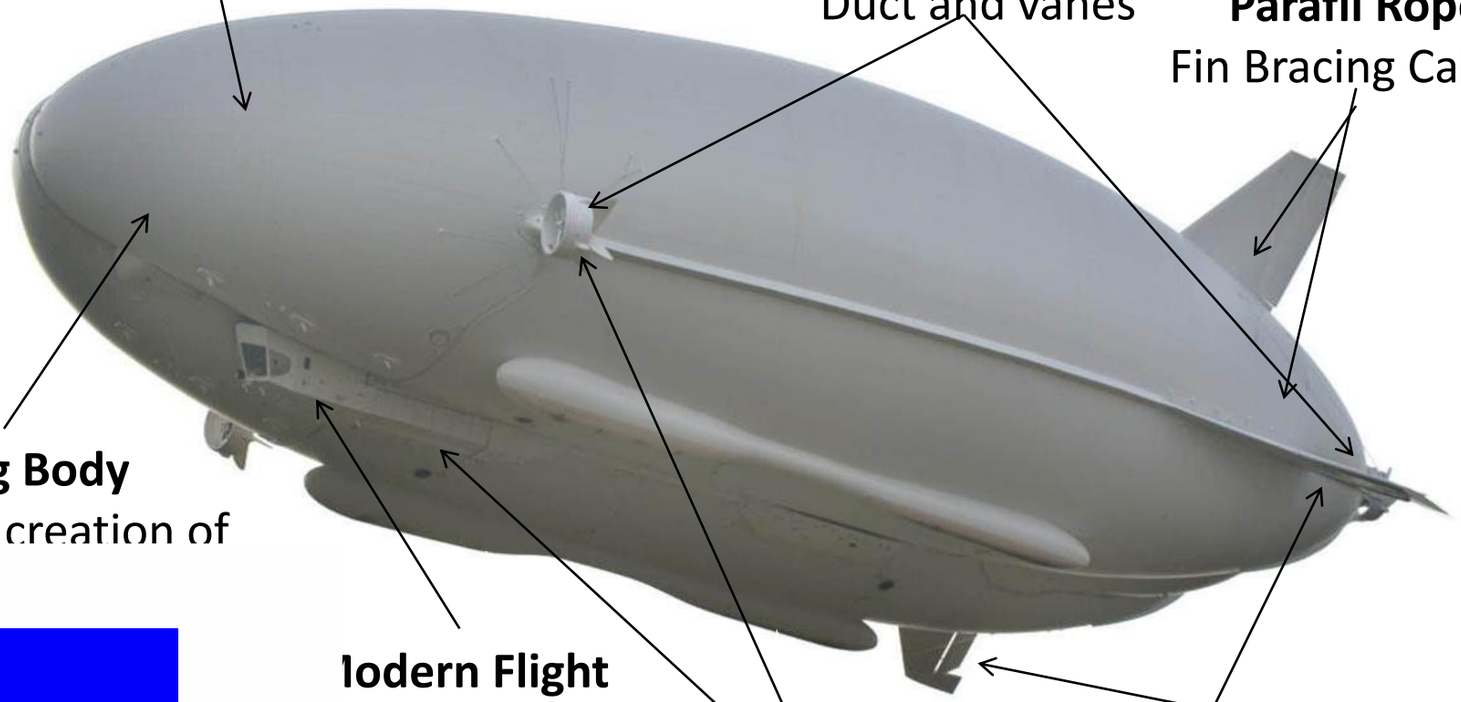
ACLS and water landing tests on scale demonstrator

Airlander - The Solution

Vectran, Tedlar & Mylar Fabric
Gas tight and very strong

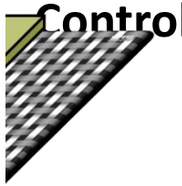
Vectored Thrust
Duct and vanes

Parafil Rope
Fin Bracing Cables



Lifting Body
Significant creation of

lodern Flight
Controls



Carbon Fibre Structure
Significant weight savings

Fibre Glass Composite Sandwich & Fabric Covering
Tail Fins

Airlander Advantages-

Airlanders land like a conventional aircraft

Can power themselves on to the ground

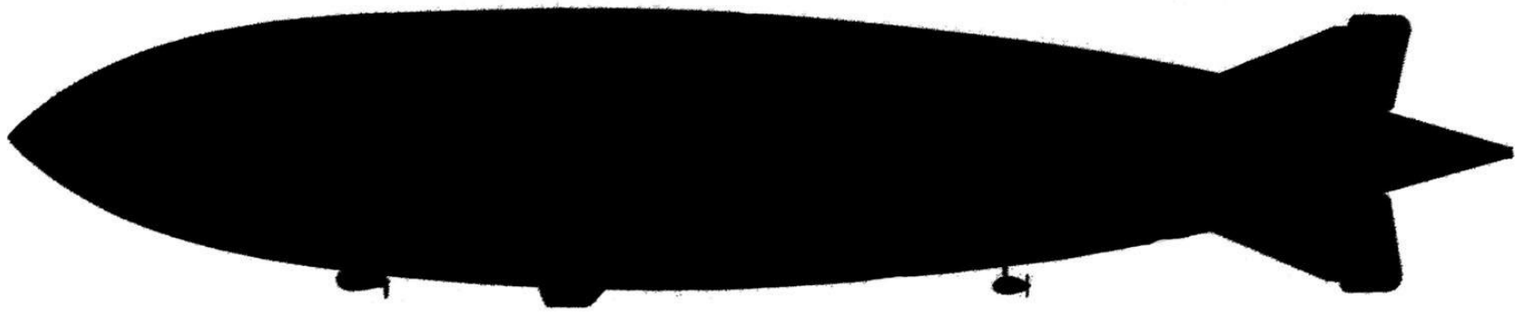
Airlanders require far less ground crew

Less affected by weather

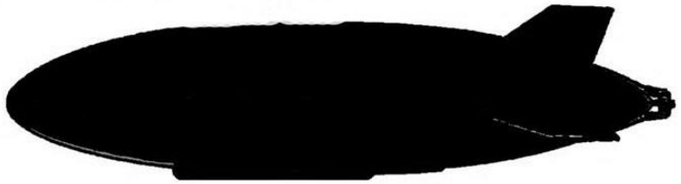
To the real thing – roll-out of US Army LEMV

Long Endurance Multi Intelligence Vehicle LEMV

Size comparisons



H.M.A R101c - 777ft

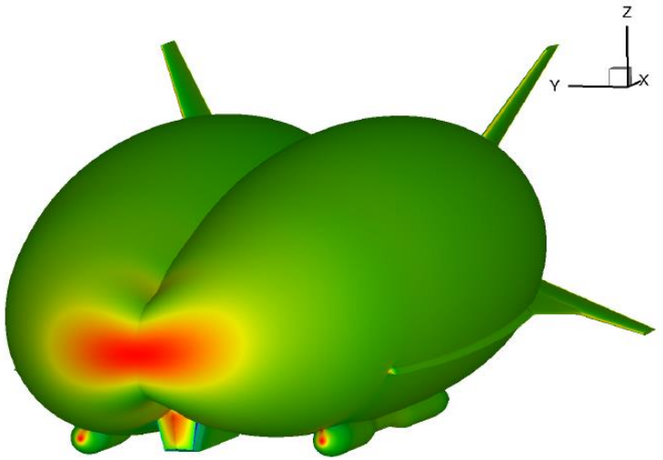


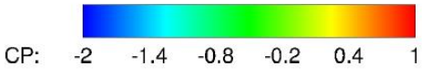
HAV Airlander - 300ft

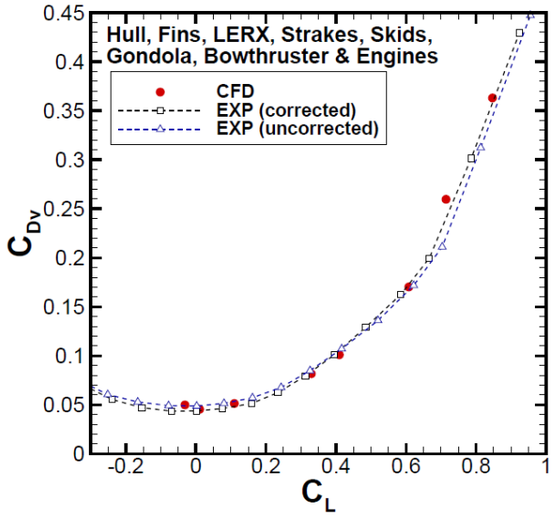
Boeing 747 - 231.3ft

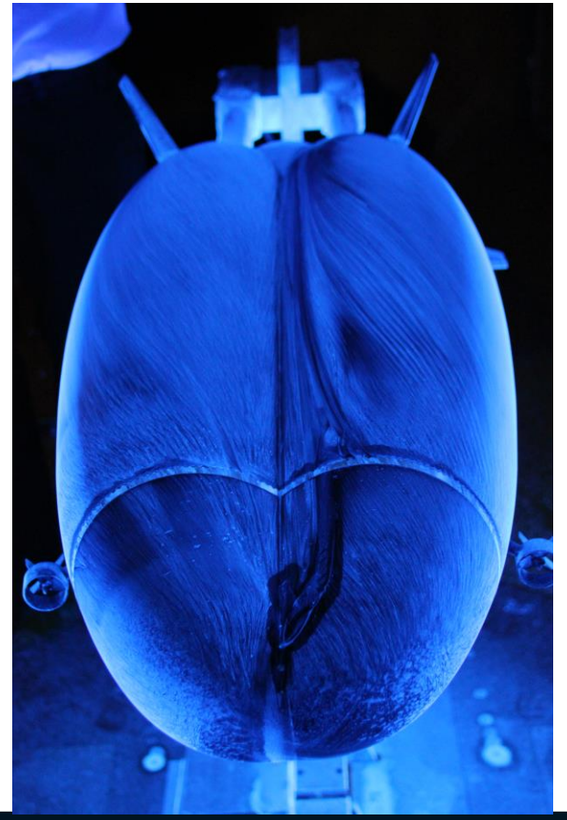
What’s in the boxes?

InnovateUK grant has permitted plenty of innovation









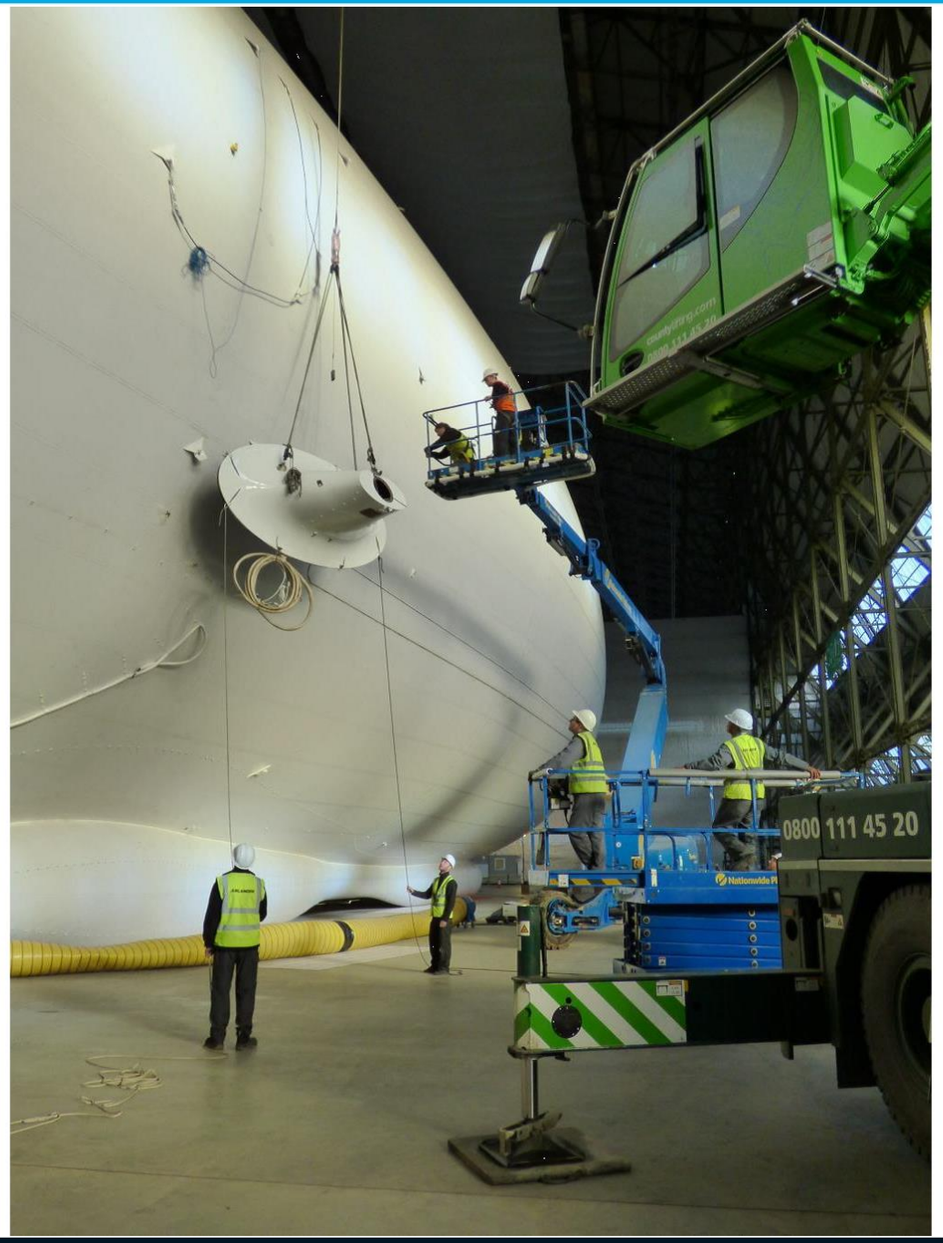
Wind tunnel testing at Cranfield

Return to Flight – Dec 2013 onwards

Careful inflation then attach everything

First add one Cabin and Flight Deck

Then the engine housing



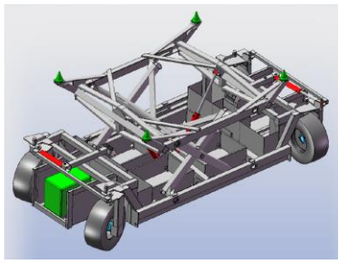
Some engines

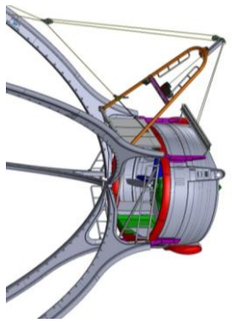
Then the fins

This gives one newly assembled Airlander

Ground equipment

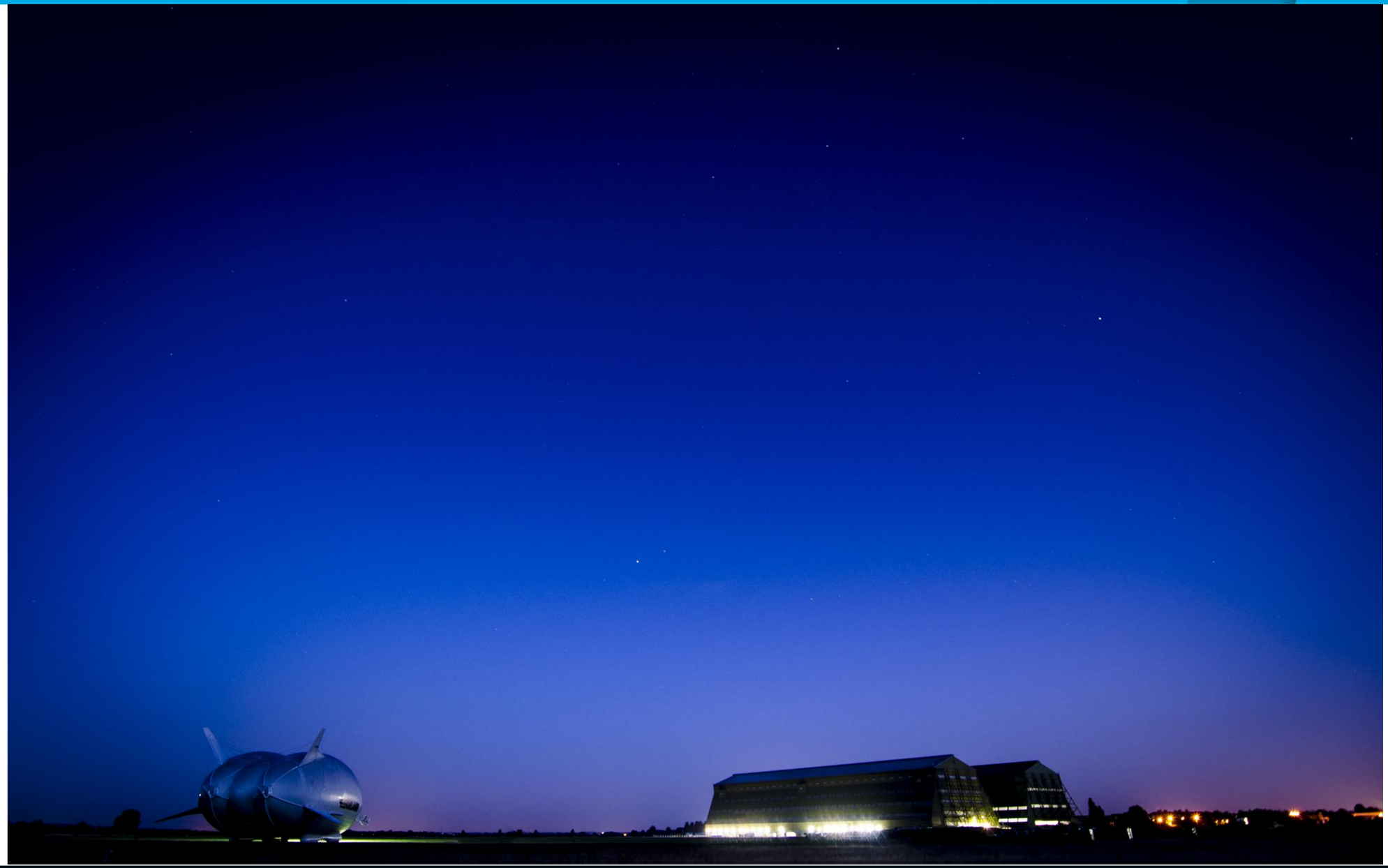
Airlander – Undercarriage and Maintenance



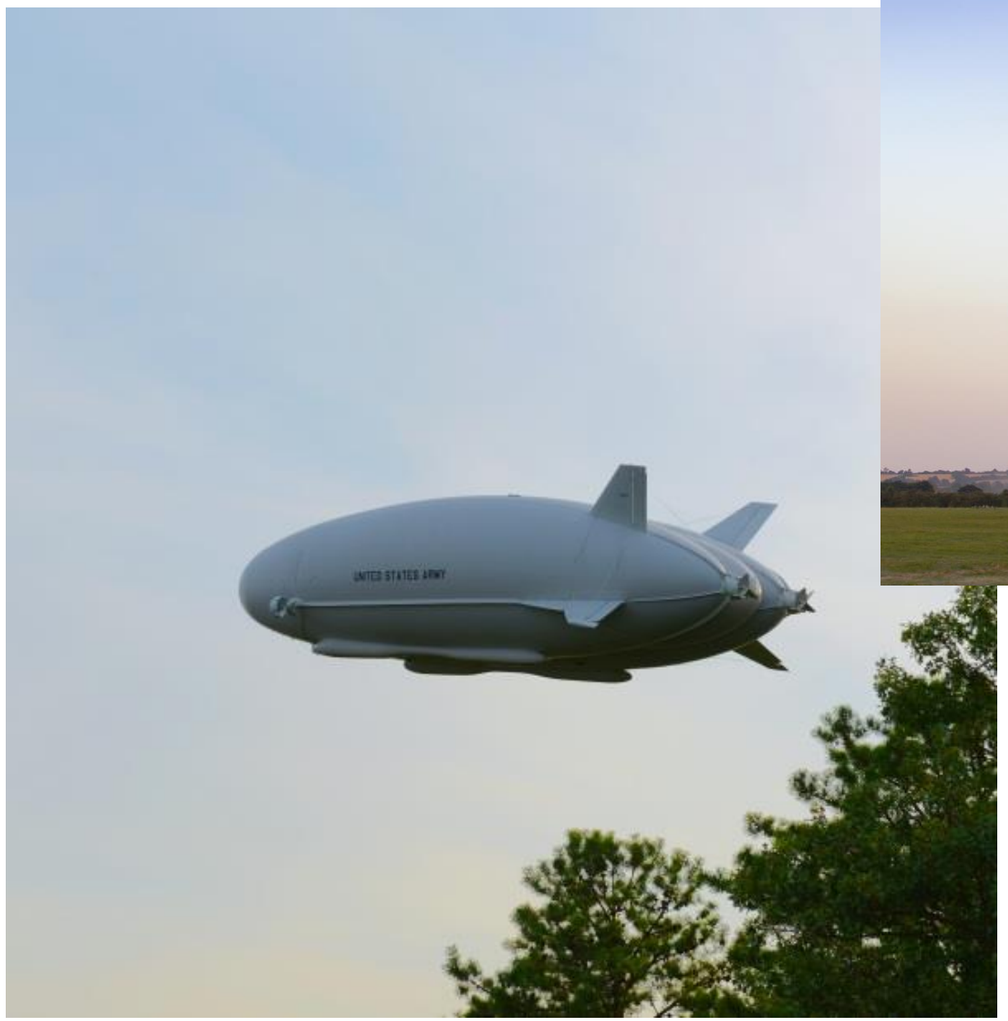


String……

Hangar roll-out



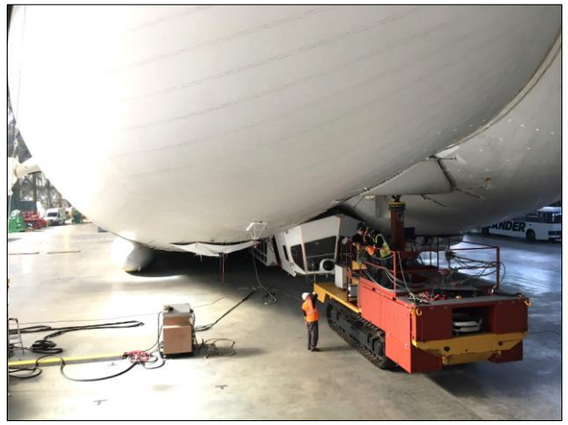
LEMV (HAV-304) versus Airlander

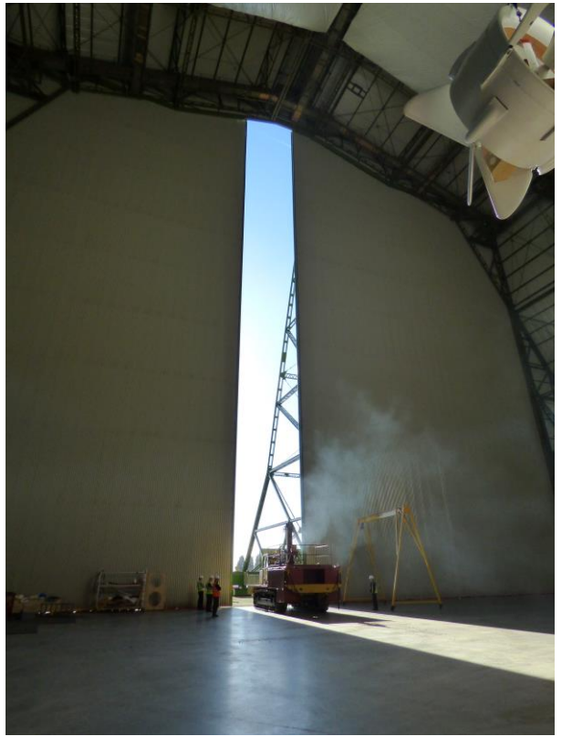


Actions Taken – post-summer 2016

- Aircraft Modifications (in addition to repair activity)
  - Auxiliary Landing System
  - Mooring line retrieval
  - Acceleration of other planned changes – flight test instrumentation, pressure system management
  - Improved presentation of heaviness and CG to flight crew and test management team
  - Improved airspeed data

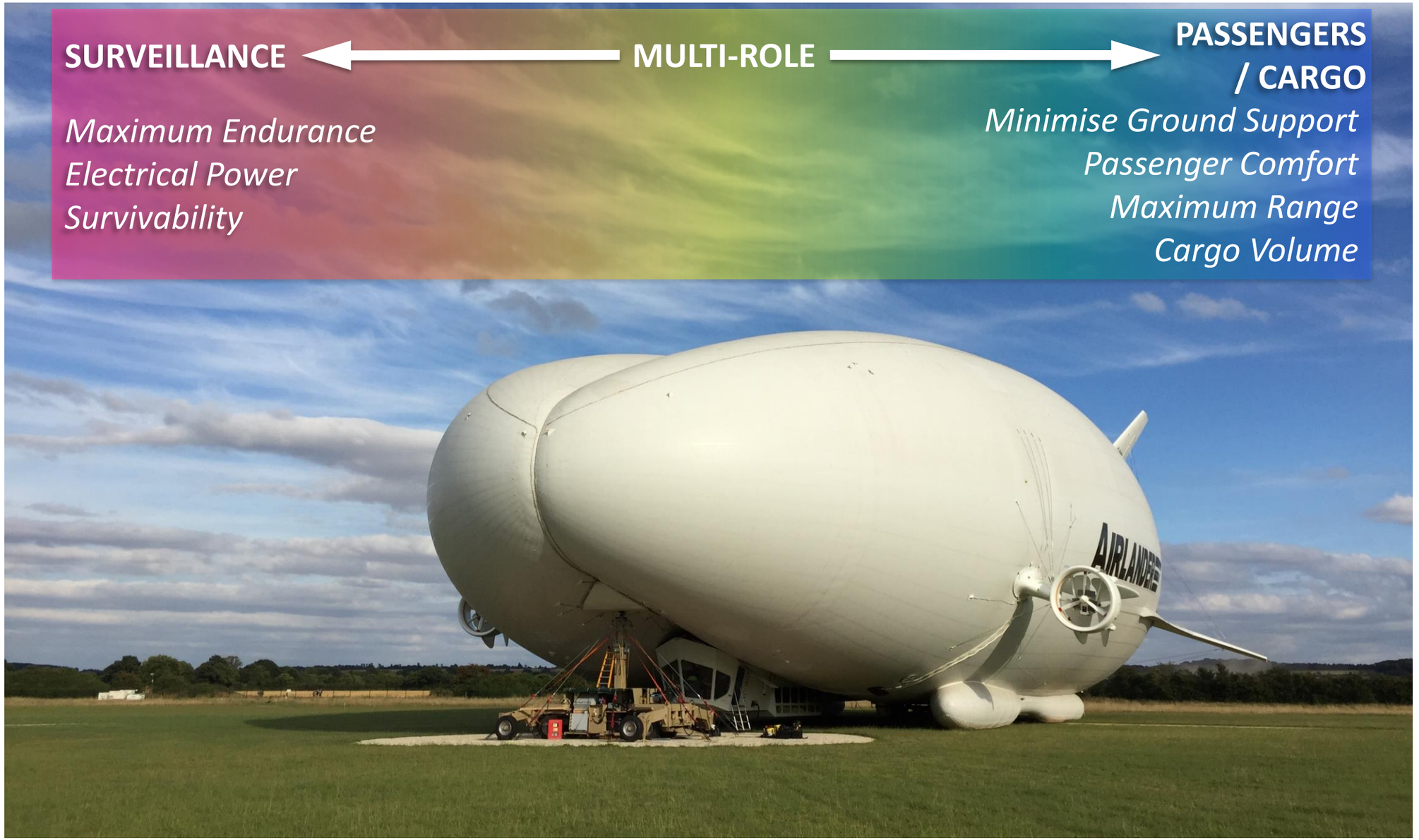
- Ground Support Equipment Modifications
  - New Mobile Mooring Mast
  - Improvements to existing ground equipment



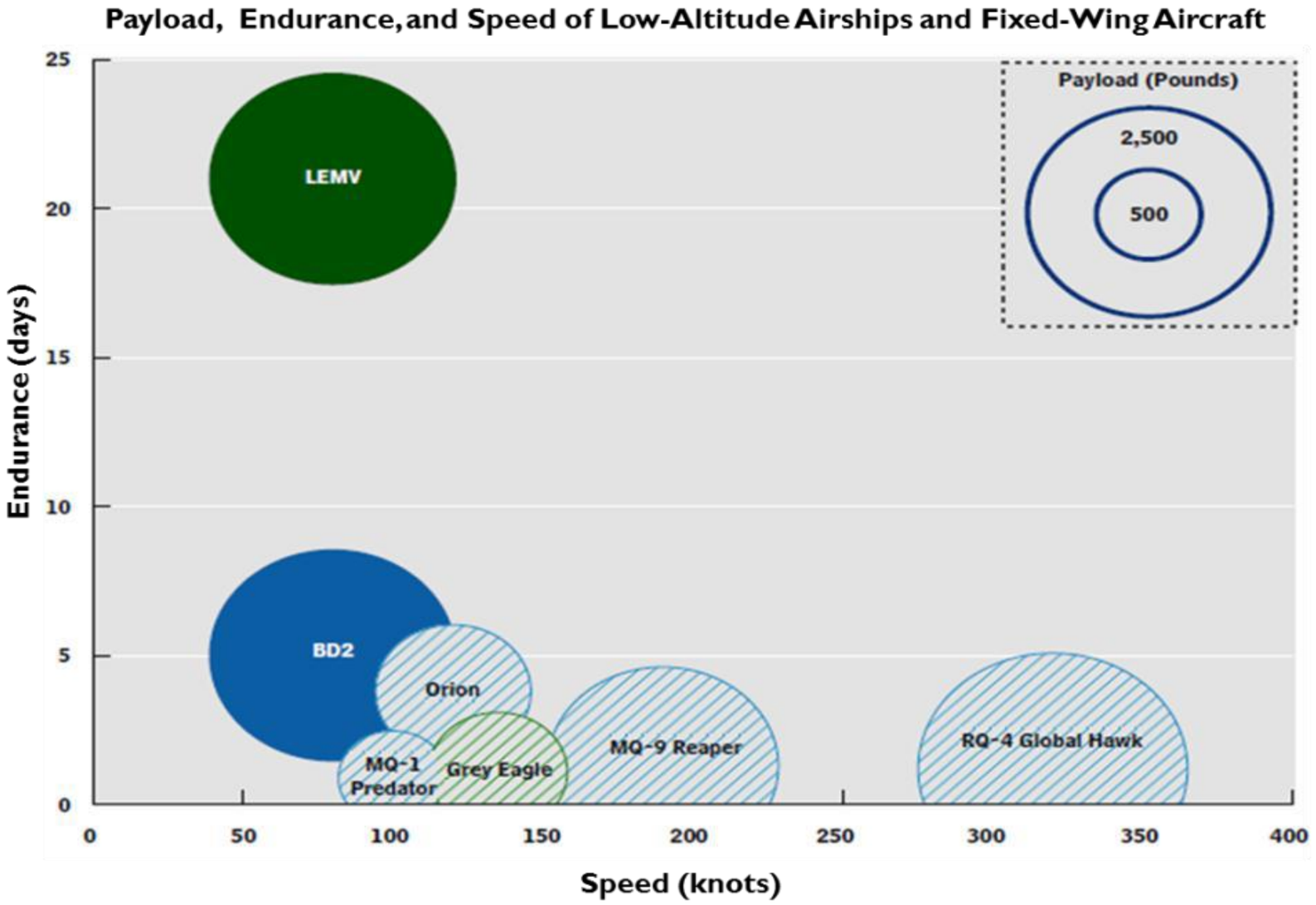


Interlude – so what?

Support Operations



80x more effective at surveillance

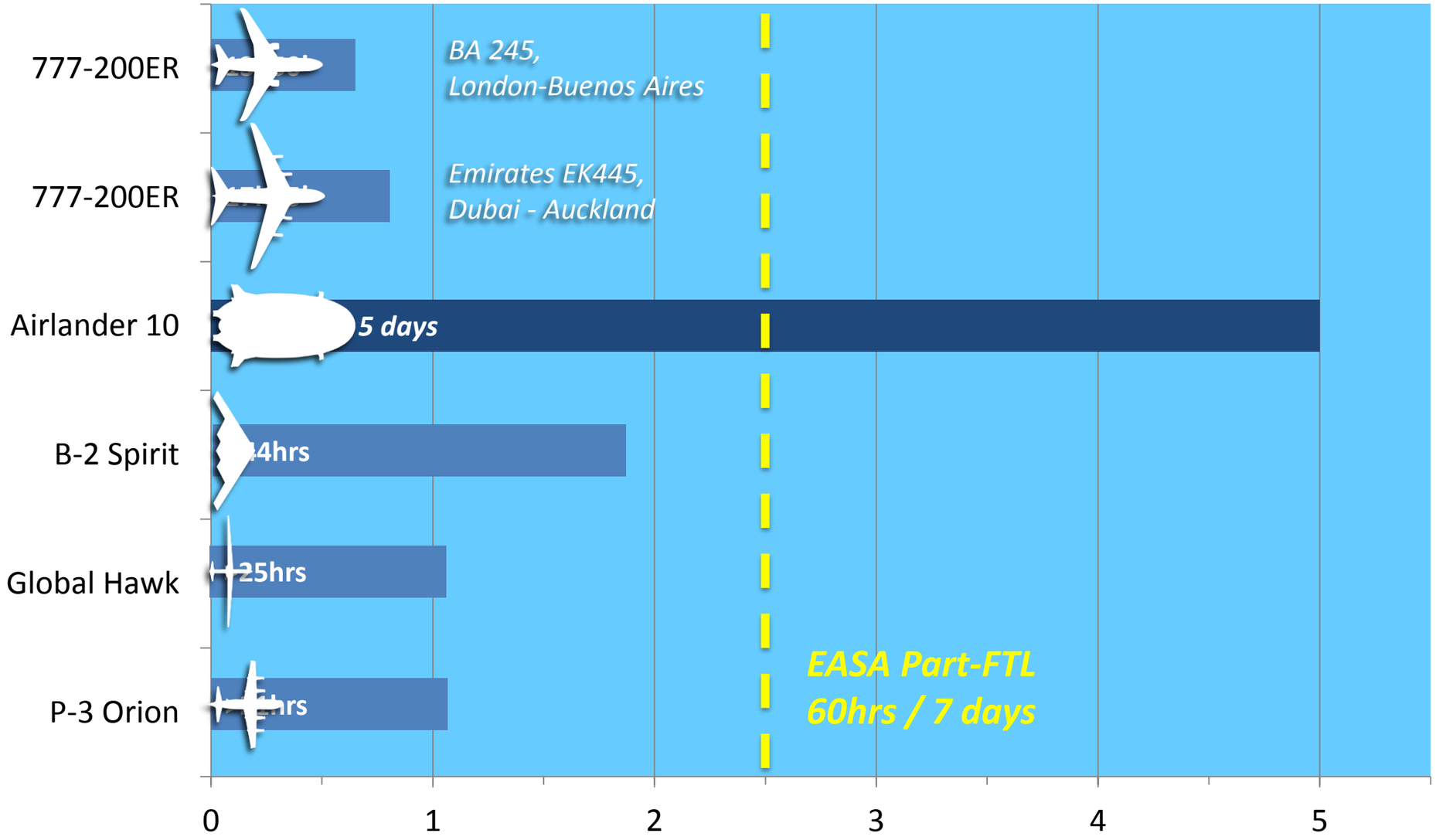


Notes:

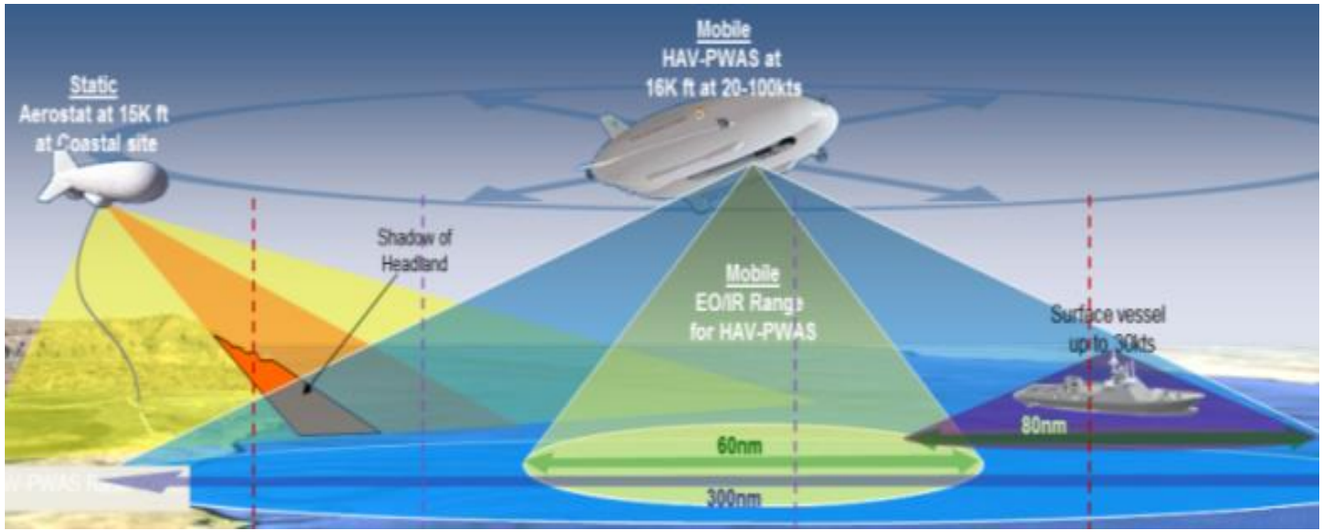
1. Solid circles denote airships, hatched circles denote fixed wing-aircraft. Circle area is proportional to payload.
2. BD2 is a conventional air ship and has now been mothballed.

Source:
US Congressional Budget Office report, November 2011

Crew Duty – Extended Operations



Persistent Wide Area Surveillance Capability



Likely Missions

Air

- Persistent Wide Area Surveillance
- Airborne Early Warning

Maritime

- Persistent EEZ surveillance
- Organic task force support
- Counter Terrorism, anti-piracy
- Search and Rescue
- ASW/MCM
- Anti Mine Warfare
- Anti Missile Warning
- Pattern of Life Assessment
- Humanitarian Relief
- Identification of swarm attacks, mother ships, illegal immigrants

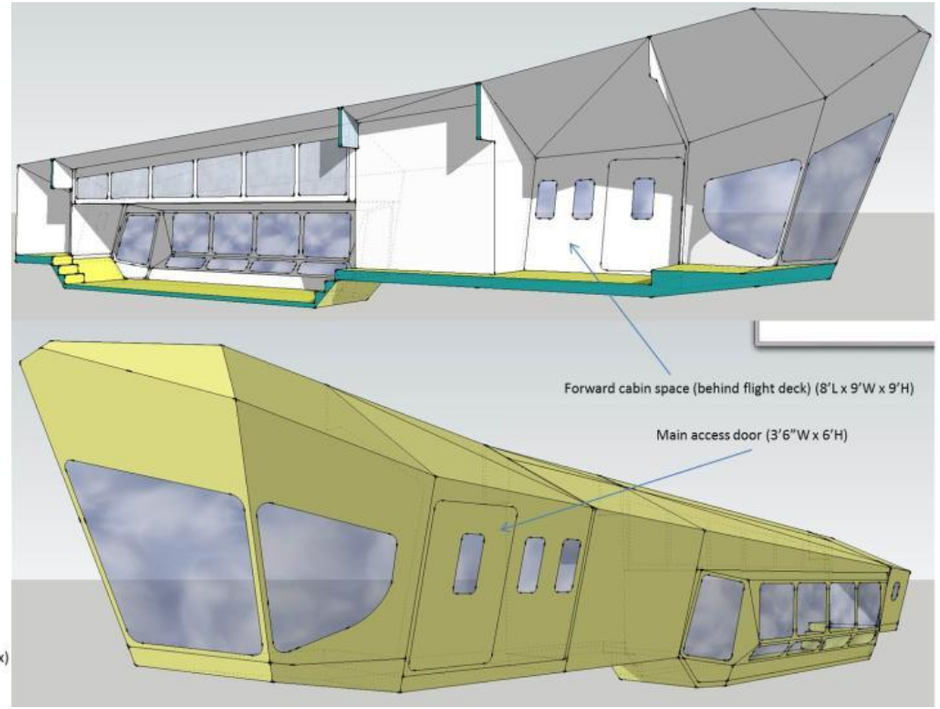
Land

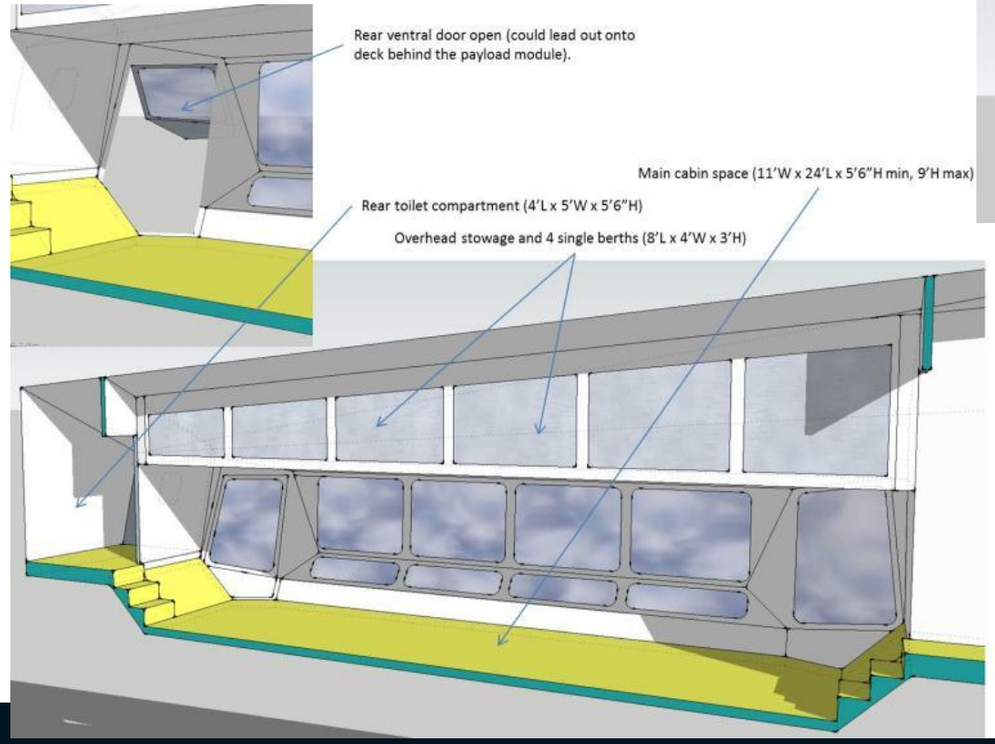
- Homeland Security/Border Surveillance
- Internal Security/Ground Interdiction
- Pipeline/asset security
- C4ISR for integrated security forces
- Humanitarian Relief

Accommodation / configuration – Airlander 10

Mission module layout – for Trials and Demonstrations

Multiple options available for Vehicle 002 and subsequent vehicles





Airlander 10 will be rebuilt with a large multi-use payload module

Additional space is available behind the flight deck for mission and payload systems.

Crew accommodation and services are provided for a 4-5 day mission

Market Opportunities for Hybrid Airships/Aircraft

What are the capabilities of hybrid aircraft?

- Long endurance due to low fuel burn
- Long range due to low fuel burn
- Ability to operate in areas with little or no infrastructure
- Can operate at a range of different speeds
- Stable

What markets would benefit?

- Search and Rescue
- Coastal Patrol
- ISR (Intelligence, Surveillance and Reconnaissance)
- Advertising and Filming
- Geo surveying
- Remote Logistics
- Mining support
- Oil and gas support
- Humanitarian aid
- Sightseeing
- Very short haul or “fast ferry” for passengers

3 phases – with pre-agreed gateways

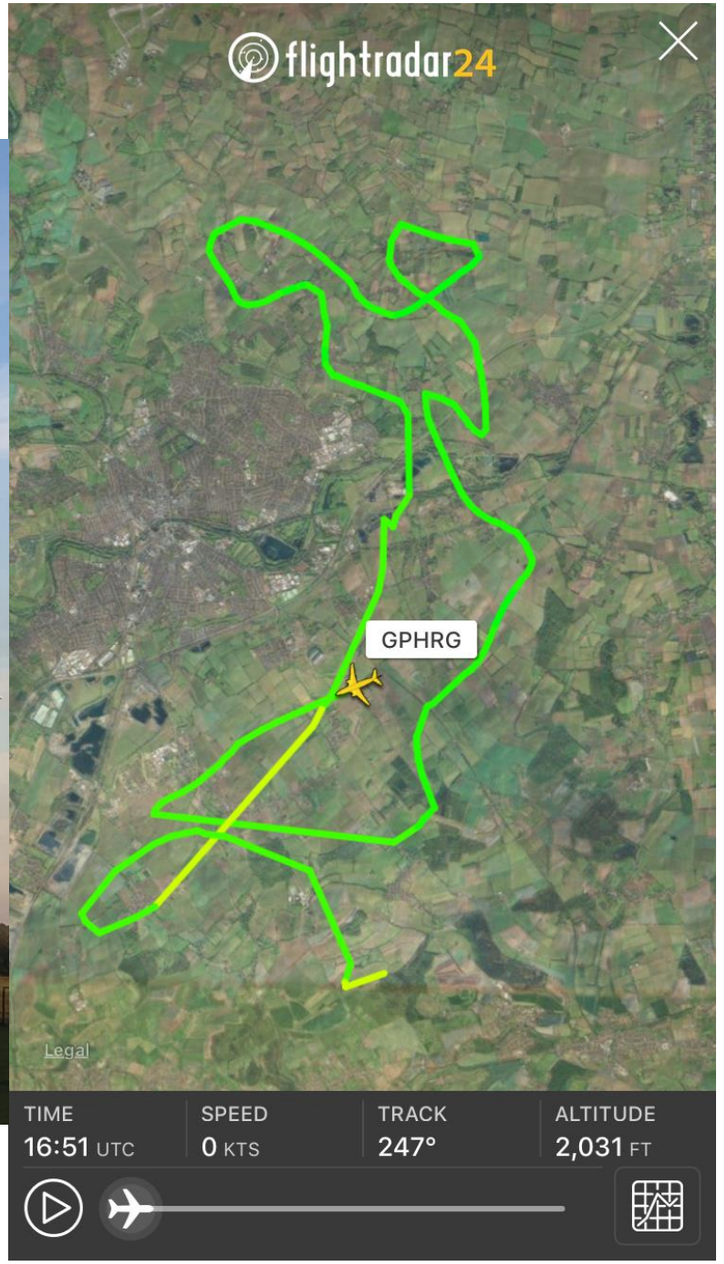
GATE	AWR1	AWR2	AWR3
Purpose	Development	Authority Acceptance	Record breaking etc
	Showing Compliance	Customer trials	
	Own Crew Training	Air Displays	
Max Speed (IAS)	40 kts	60	V_O
Max Altitude	4,000 feet	10,000	16,000
Distance from airfield	15	75	No limit
Max Flight Time	3	8	48
Wind Limit (Take-off)	15	25	35
Visibility and weather	Day, VMC	Day or Night, VMC	Day or Night, VMC or IMC
2 engine flight	No	No	Yes
Occupancy	4	4	9
Outside Temp	-5 to 30°C	-20 to 40	-40 to 54
Heaviness	200-1000 kg	200-2500	0-4000

Key points – it is huge in every respect

We literally stopped traffic

It flies and lands well

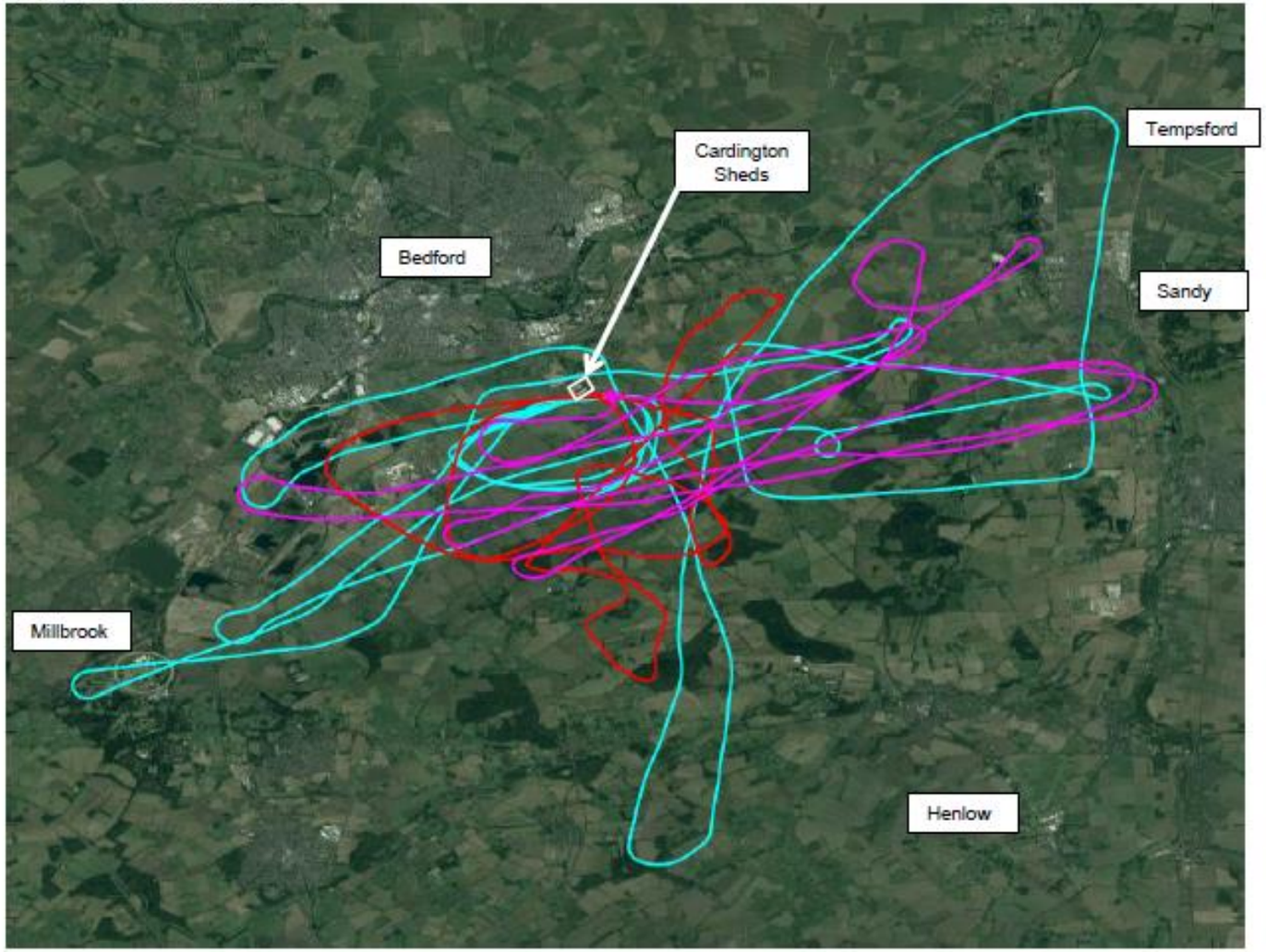

G-PHRG
AIRLANDER


flightradar24
GPHRG
Legal
TIME
16:51 UTC
SPEED
0 KTS
TRACK
247°
ALTITUDE
2,031 FT

We’re flying over rural Bedfordshire

On-board GPS Traces

Red: Flight 003. Blue: Flight 004. Pink: Flight 005



This is just the beginning

HYBRID Air Vehicles

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Sir Barnes Wallis
Award

2014
Best of What's New
Award in Aerospace

Co-funded by the Horizon 2020 programme of the European Union

ecoconnect's
CleantechInnovate
Finalist 2016

EEF FUTURE MANUFACTURING AWARDS 2014 Regional Winner

EEF FUTURE MANUFACTURING AWARDS 2014 National Winner

EEF FUTURE MANUFACTURING AWARDS 2014 National Winner

Airlander Videos& Downloads

www.youtube.com/channel/UCnvPhACVf7t4Ykgx1OxgRiQ

www.hybridairvehicles.com/news-and-media/press