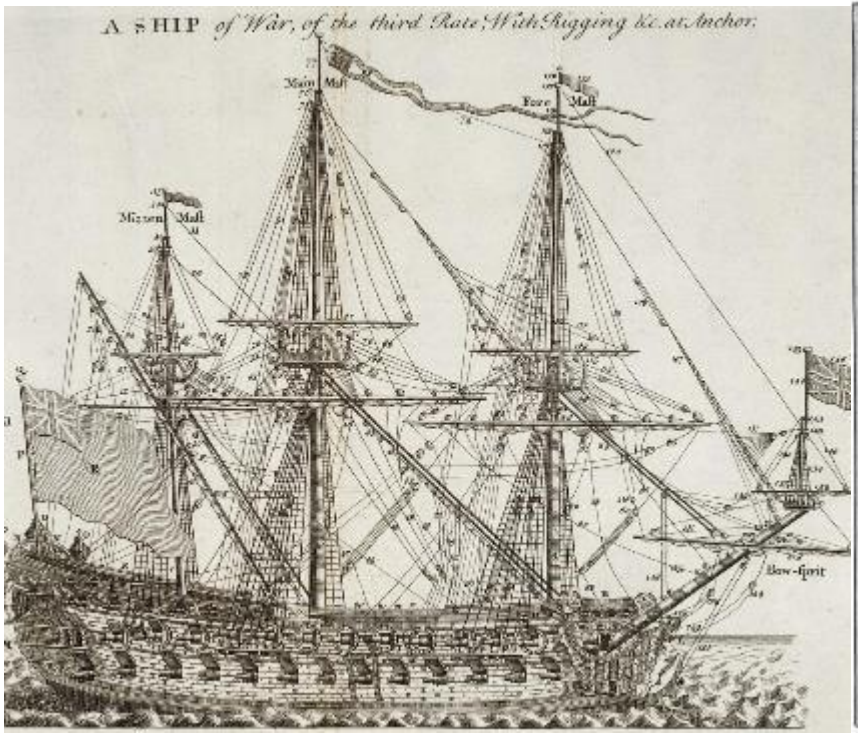
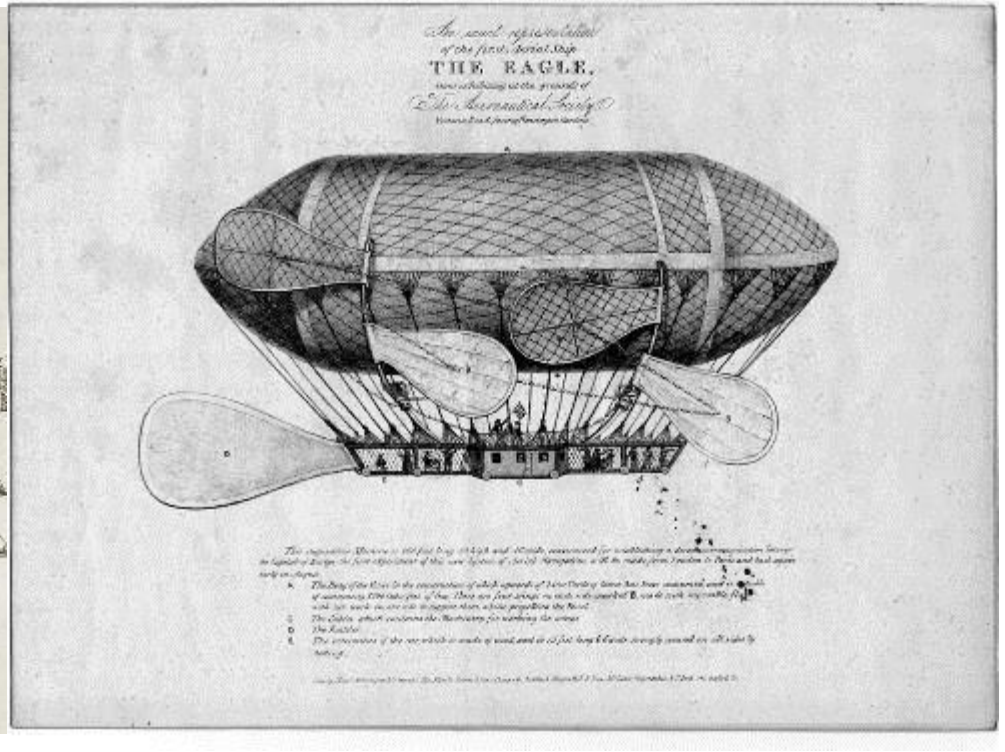
Hybrid Airships: Opening New Frontiers
Alaska House Energy Committee
April 4, 2017

HYBRID ENTERPRISES

LOCKHEED MARTIN

WHY AIRSHIPS?





Getting the Best of Two Modes

AIRSHIP TYPES

Non-Rigid
"Blimps"

Rigid

Semi-Rigid

Evolving since 1852

CONCEPTS & PROTOTYPES

Boeing- USA

Aeroscraft- USA

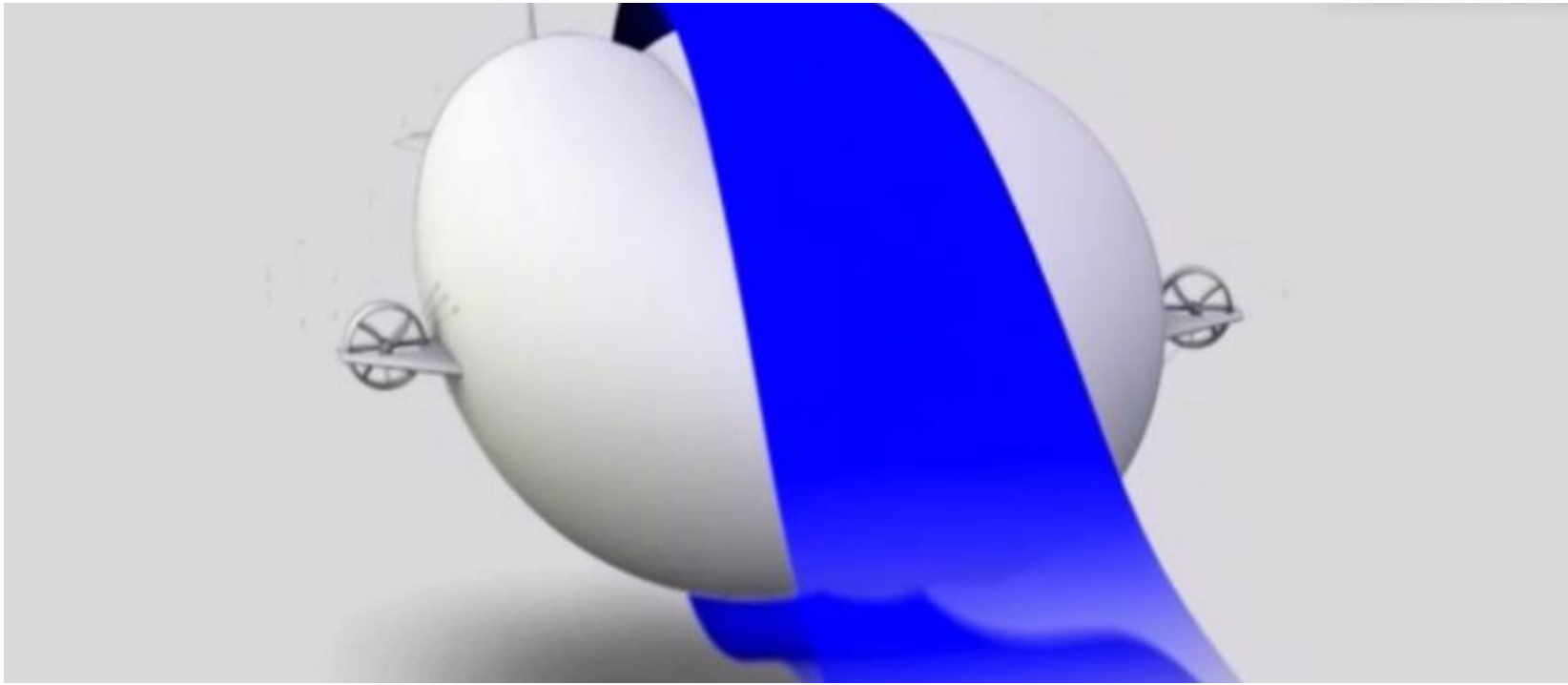
Varialift - UK

Piasecki - US

RosAeros Systems - RU

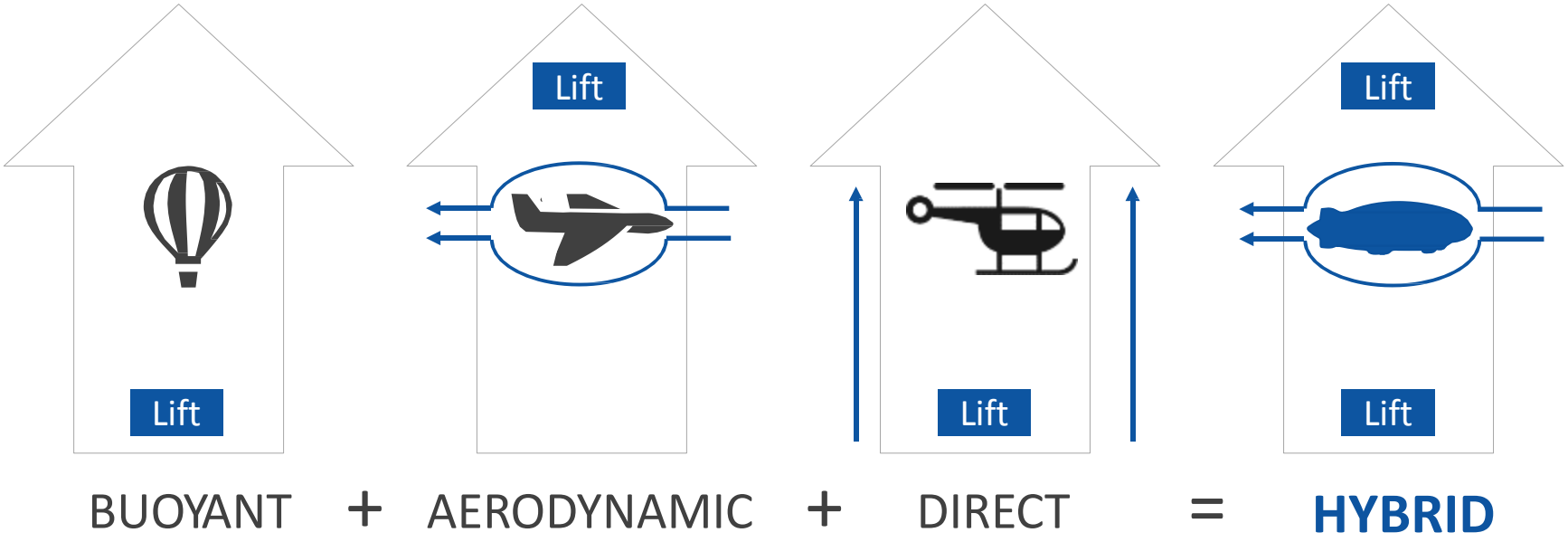
Hybrid Air Vehicles - UK

WHAT IS HYBRID LIFT? (video)



80% Lift from Buoyancy | 20% Lift from Aerodynamic or Direct Lift

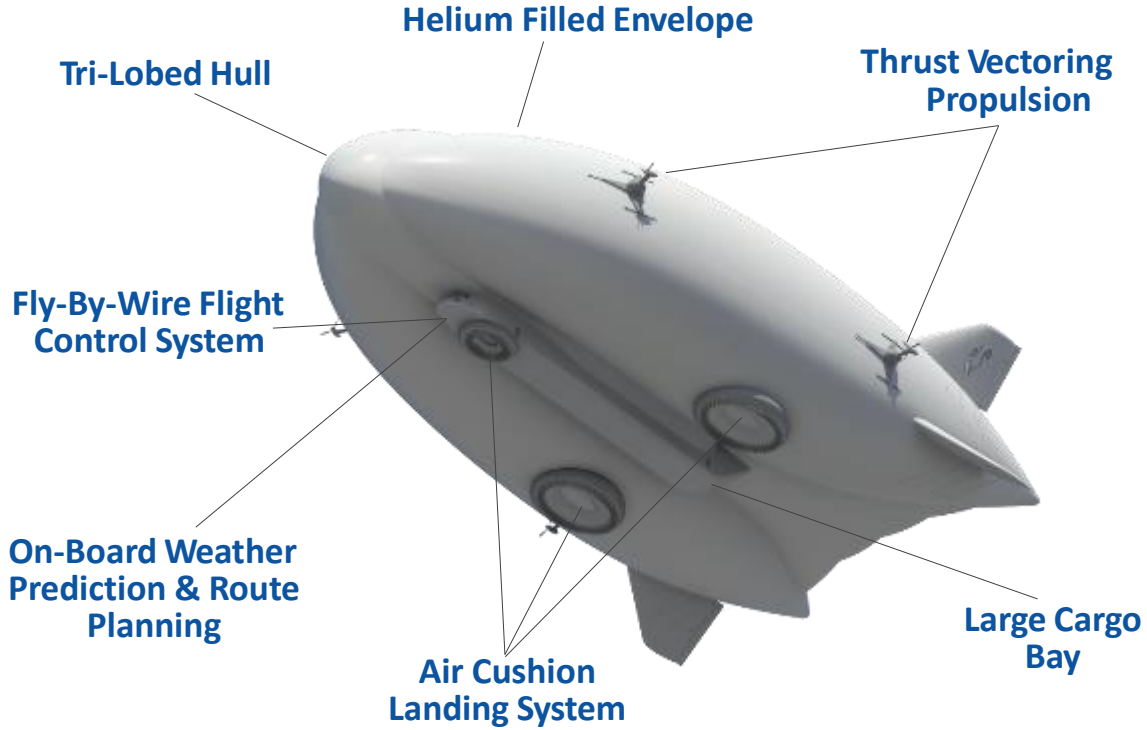
WHAT IS HYBRID LIFT?



80% Lift from Buoyancy | 20% Lift from Aerodynamic or Direct Lift

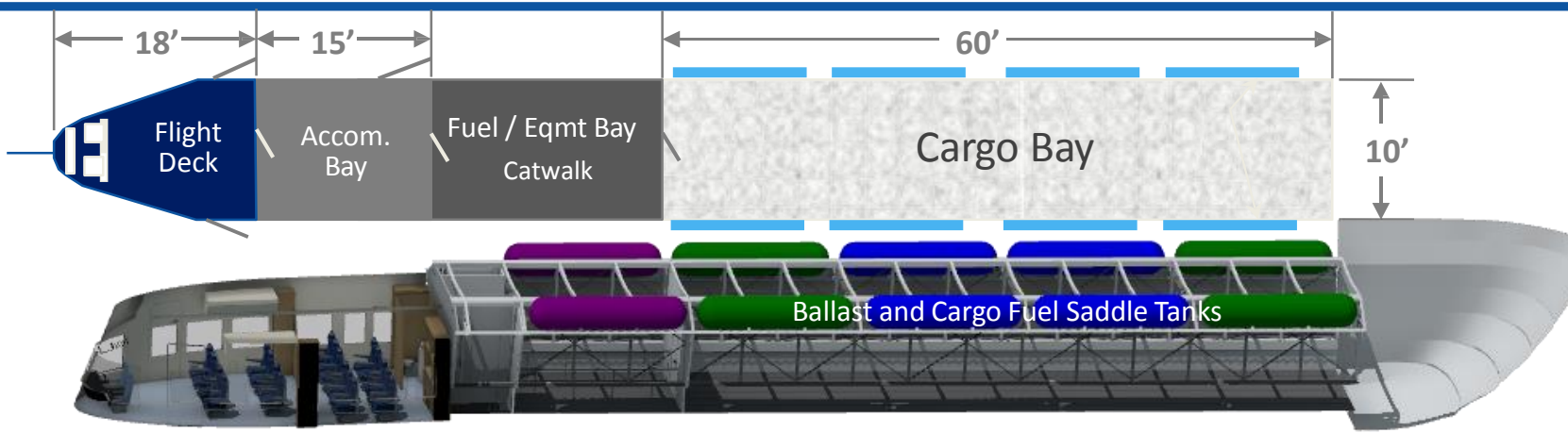
OUR HYBRID AIRSHIP

- Large payloads
  21.000 kg + 19 passengers
- Large volume cargo bay, roll-on roll-off
- Takes off and lands on unimproved surfaces, water, snow, ice, sand
- Overflies environmentally sensitive areas…quietly
- Low fuel consumption
  Lowest carbon footprint compared to other aircraft
- Little or no forward infrastructure



Hybrid Airships – Outstanding Remote Cargo Delivery

LMH-1 INTERIOR LAYOUT



- **Flight Deck - 2 pilots and 8-19 passenger seats**
- **Cargo Bay - 60’x 10’ floor area, 10’ height, truck bed height**
- **Aft full size door – extended loads capable with door open**
- **Saddle tanks for ballast water and optional cargo fuel**

Built for cargo with passenger capability

OPERATIONS (video)

#No Roads, No Problem

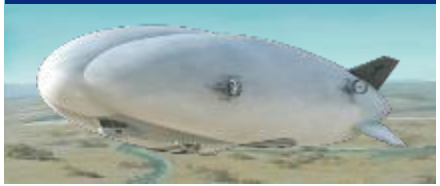
TECH DEMO TO OPERATIONAL CAPABILITY

P-791 (2006)

- Proven technology demonstrator
- Tri-lobe envelope design
- Digital flight control
- Full vectored thrust
- Air cushion landing system
- No payload – test only

P-791:
120’ long, 65’ wide
37’ tall

LMH-1 (2018)



- Remote cargo transport
- 1,400 nm range
- Take-off & land from unimproved fields or water
- Low operating costs (much less than helicopters)

22 Tons Payload:
~300’ Long

LMH-2 (2020s)

- Regional cargo transport
- 3,000+ nm range
- Lower operating costs (similar to fixed wing)

90 Tons Payload:
~400’ long

LMH-3

- Global cargo transport
- 6,000+ nm range
- Very large cargo hold
- Containerized freight mover
- Lowest operating cost

500 Tons Payload:
~700’ long

Three platform sizes – Decades of development and growth

DEMONSTRATOR FLIGHT (video)

GETTING TO MARKET

Oil and Gas

Mining

Logistics Providers

Transportation Providers

Financiers

OFFSHORE OPERATIONS SUPPORT

- Using the hybrid airships to support offshore operations has significant cost and range benefits
- Challenge is how to safely move personnel and cargo from the hybrid airship to the platform
- Sea conditions throughout the year at the platform locations may result in different solutions unique to each location

Hybrid Airship Requires Unique Considerations

OIL & GAS SUPPORT

- Exploration Phase
  - Surveillance & Communications
  - Aerial Surveying
  - Emergency Services
- Development Phase
  - Rig Relocation & Support
  - Pipeline Construction
- Production Phase
  - Spill Response
  - Transport & Resupply

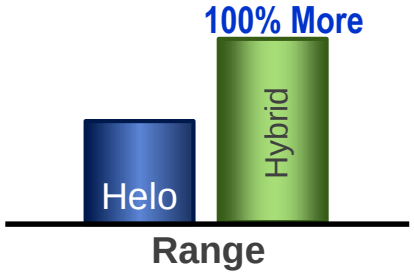
Broad Capability at Affordable Costs

HYBRID OPERATIONS CASE STUDY

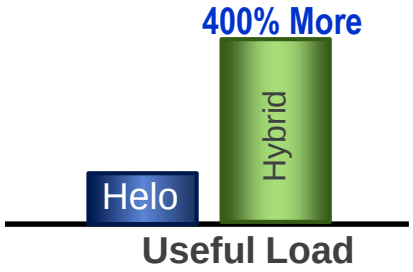
Remote Cargo Service Challenge

- No All Weather Roads
- No Rail Service
- No Ship Access
- No Runway Access
- Rates Extremely High
- Service Has Limited Volume
- Beyond Helicopter Range

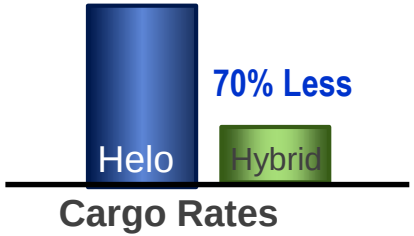
Better Range



Larger Loads



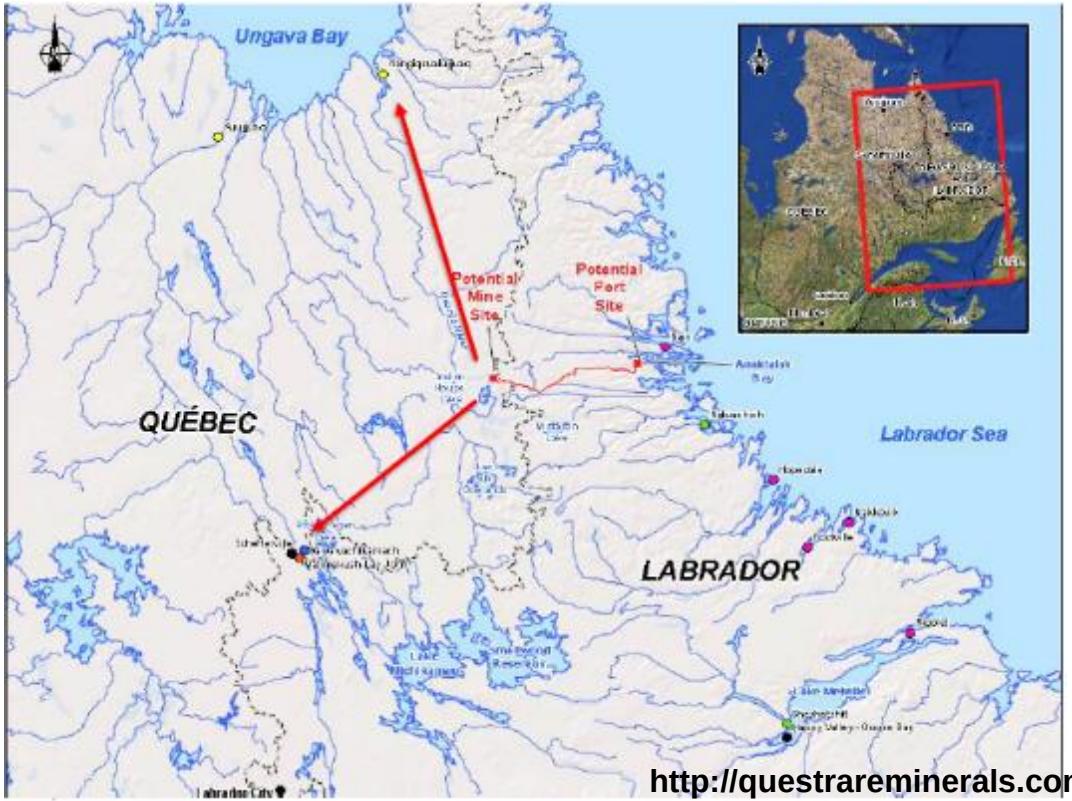
Lower Rates



Hybrids Bring Affordable Service to Remote Areas

* Photos curtesy of Wikipedia

THE “ROADLESS” MINE



http://questrareminerals.com/QRM-PR-NOV-16-2016.php

10 Year $850M Agreement to Move Product by Airship

ARTIC OPERATIONS - Ice Road Replacement – Point Thomson

2015-16 Budget

Transportation Mode
Truck *FBKS/DH*
Truck Ice Road
Helicopter
Tundra Vehicle
Barge
Fixed Wing *ANC/PT*
2015-16 Total

$xx M

2015-16 Estimate w/ Small Hybrid Airships

Transportation Mode
Truck *FBKS/DH*
Small Hybrid*
Fixed Wing *ANC/PT*
2015-16 Total

*Includes 40% margin for airship operator

Actual cost redacted due to proprietary information

25% Transportation Cost Reduction

HYBRID CASE STUDY

Komo Airfield and Infrastructure Costs

- Total actual project cost $**xxx**M, completed 2013

Hybrid Airship Alternative

- Total estimated project cost ≈$**xx**M

Actual cost redacted due to proprietary information

98% Reduction in Infrastructure Costs

HYBRID CASE STUDY

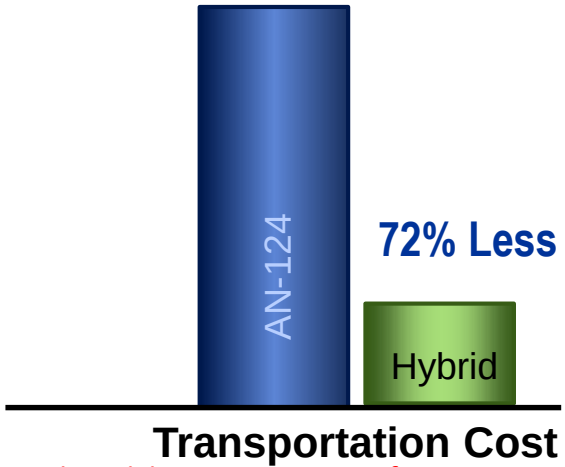
AN124 vs LMH-1– Remote Pacific

AN-124

- 89 flight days
- 6,219 tons delivered
- 70 tons per flight
- $xx M (actual cost)

LMH- 1 Hybrid

- 101 flight days
- 6,060 tons delivered
- 20 tons per flight
- $xx M



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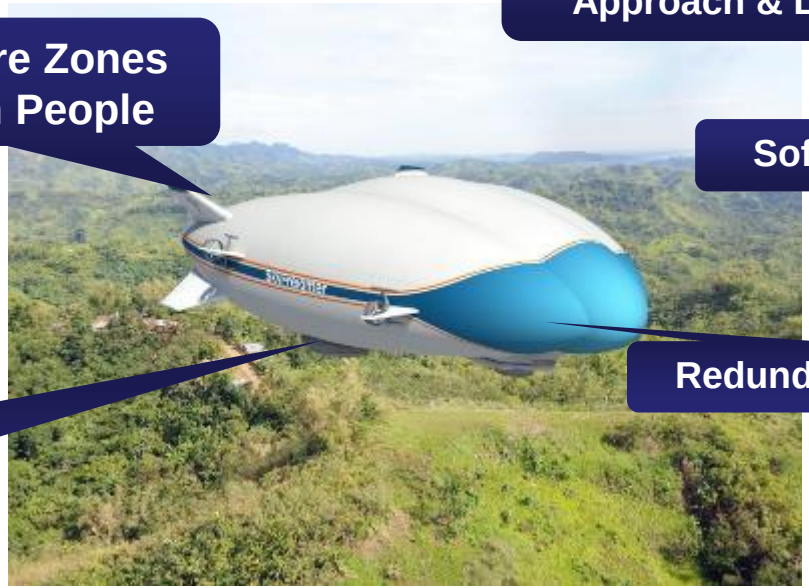
Hybrid Airships Reduce Delivery Cost by 72%

OPERATIONAL SAFETY



Low Speed Takeoff, Approach & Landing

Potential Fire Zones Away From People

Soft Structures

Redundant Systems

Ability to Land In Any Open Spaces and On Water

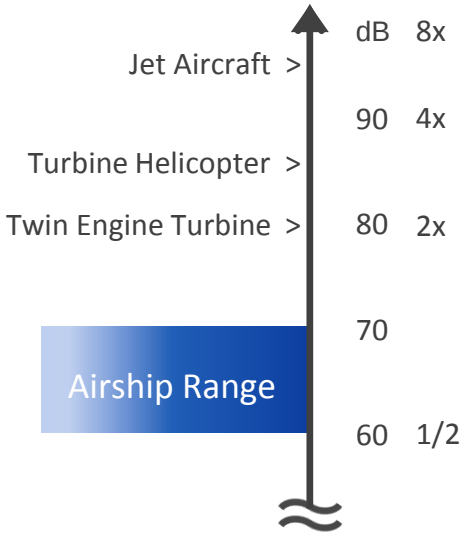
Excellent Safety Features

HYBRID AIRSHIP SUSTAINABILITY

LESS FUEL

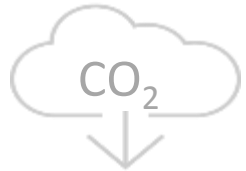
LESS NOISE

Aircraft Takeoff Noise (300m)



LESS EMISSIONS

Jet Aircraft
1.2 kg per ton mile



Airship
0.4 kg per ton mile

SUMMARY

Ideally suited for remote operations

Takeoff and land on unimproved surfaces

Low carbon emissions + low noise + eliminate infrastructure = environmentally friendly

Dramatic cost reduction in transportation for remote projects

Enable launch of projects previously thought inaccessible

Coming to Alaska – as early as 2019

Hybrid Airship

Opening a New Frontier

LOCKHEED MARTIN