HYBRID AIR VEHICLES LTD

"Hybrid Air Vehicles – Now and the Future"

Presentation
to
The Society of Naval Architects and Marine Engineers – Arctic Section

4th March 2009

Introduction

- The Hybrid Air Vehicles team have re-examined the basic principles behind Lighter-Than-Air Science and applied advanced modern technology and materials to this 100 year old concept.

- The result is a range of revolutionary products with global market potential. Demand is being driven, in particular, by changing environmental and defence requirements.

- Hybrid Air Vehicles have taken the first steps in the creation of a major new, Low Carbon Emission, aerospace business.

Corporate History

1971 -1979	**Aerospace Developments** 1980 Airship Developments acquire AD, then reverse takeover Thermoskyships Ltd and re-name Airship Industries.
1979 -1990	**Airship Industries** 1990 AI Military Assets acquired by Westinghouse
1990 -1995	**Westinghouse Airships** Design team continue under Westinghouse ownership. In 1996 W pull out of defence business, major hangar fire – ask RM if he wants his company back!
1996 -2006	**Advanced Technologies Group**
2006 -2007	**SkyCat Group**
2007 - date	**Hybrid Air Vehicles**

- *Engineering Team has exceptional expertise (in excess of 150 years of Lighter-Than-Air experience).*
- *Roger Munk has led the Engineering & Ops Team since inception in 1971.*

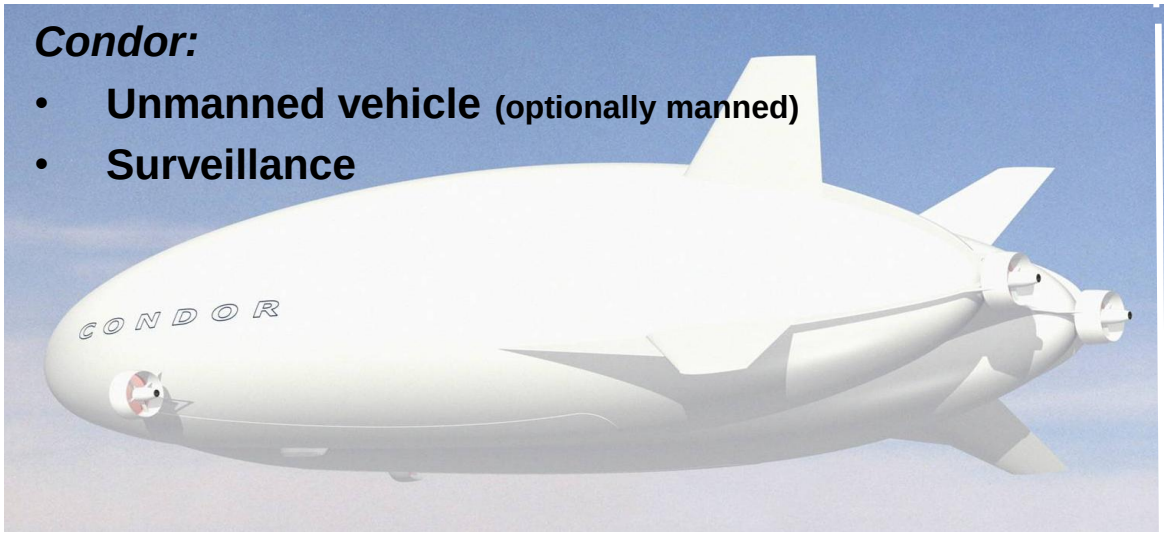
HAV Products

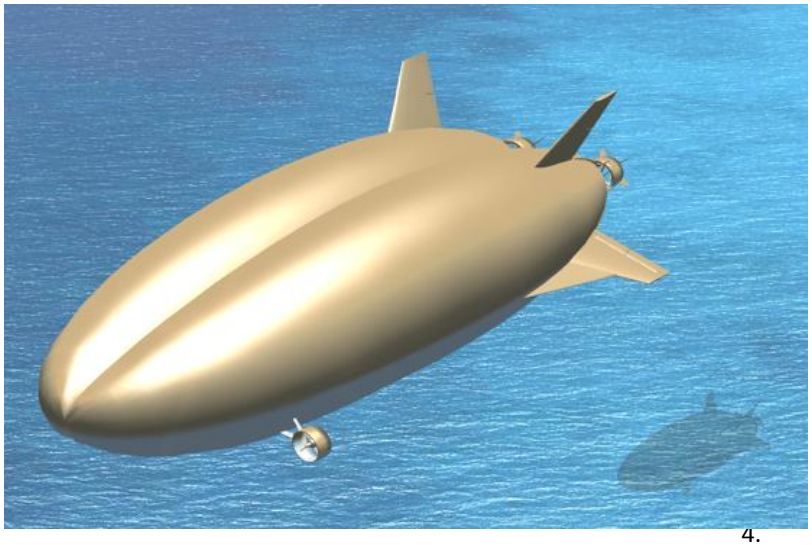
SkyCat:

- **Manned vehicle**
- **Logistics operations**
- **Surveillance & interdiction**

Condor:

- **Unmanned vehicle (optionally manned)**
- **Surveillance**





HAV Family

Hybrid Air Vehicles has two primary product areas both based upon HAV principles:

- *SkyCat* – A large, long-range freighter/logistics support vehicle; and
- *Condor* – An ultra long-endurance UAV surveillance platform.

Hybrid Air Vehicles

Medium Altitude Manned

High Altitude Unmanned

SkyCat

Condor

SkyCat 20

SkyCat 50

SkyCat 200

Condor 204

Condor 404

80 m long,
20 ton payload,
1,200 mile range,
80 Knots speed,
Up to 18,000ft.

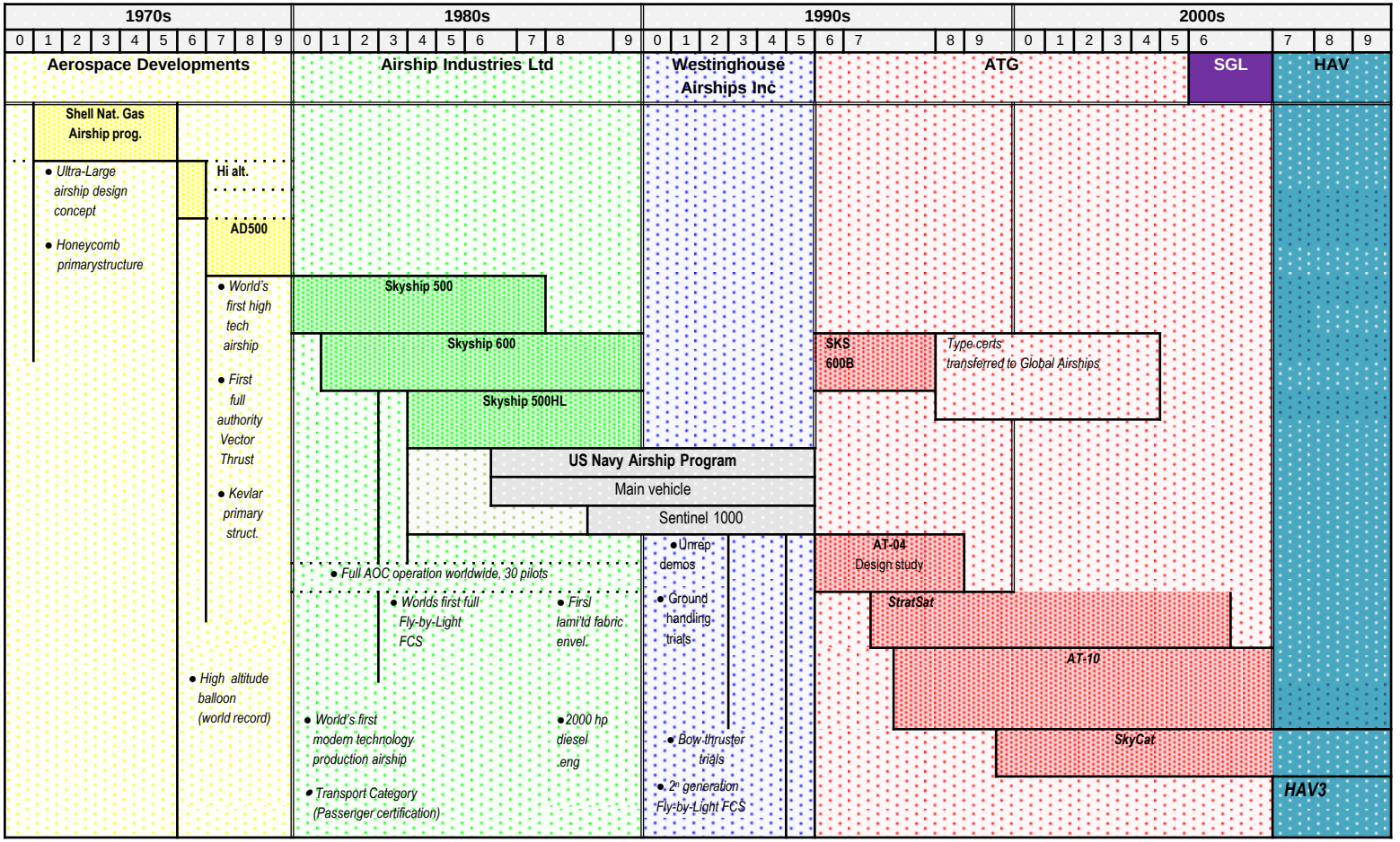
110 m long,
50 ton payload,
1,400 mile range,
90 Knots speed,
Up to 9,000ft.

165 m long,
200 ton payload,
3,200 mile range,
95 Knots speed,
Up to 9,000ft.

44 m long,
½ ton payload,
48 hrs endurance,
55 Knots speed,
Up to 20,000ft.

110 m long,
2 ton payload,
10 day endurance,
100 Knots speed,
Up to 40,000ft.

Technology Development History

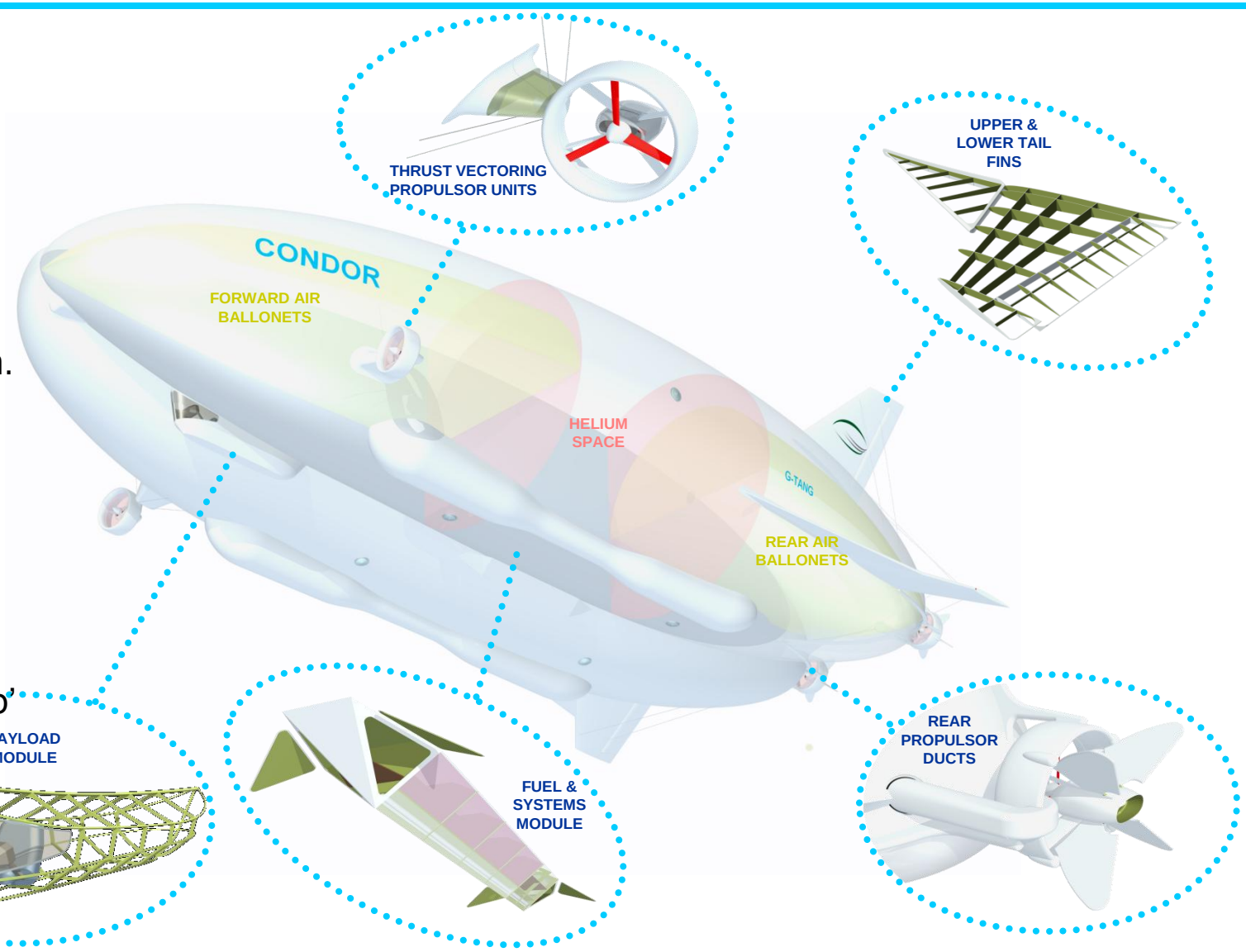


HAV LTA Vehicle Family –
Patented Technology, Common to *Condor* & *SkyCat*

HYBRID AIR VEHICLES

Unique Characteristics:

- Hi-tec fabric & composite materials.
- Lifting body hull shape.
- Bow Thruster.
- Fully amphibious, air cushion landing system.
- Highly manoeuvrable via - vectored thrust system. VTOL/ STOL.
- High performance diesels.
- “Fly by Light” control system.
- Fixes all the old ‘Airship’ issues.

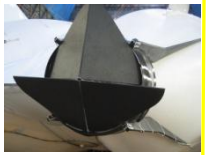


HAV Technology

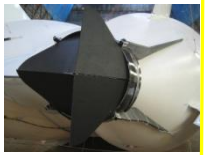
VECTORED THRUST control systems


zero vector (cruise flight)


full down vector

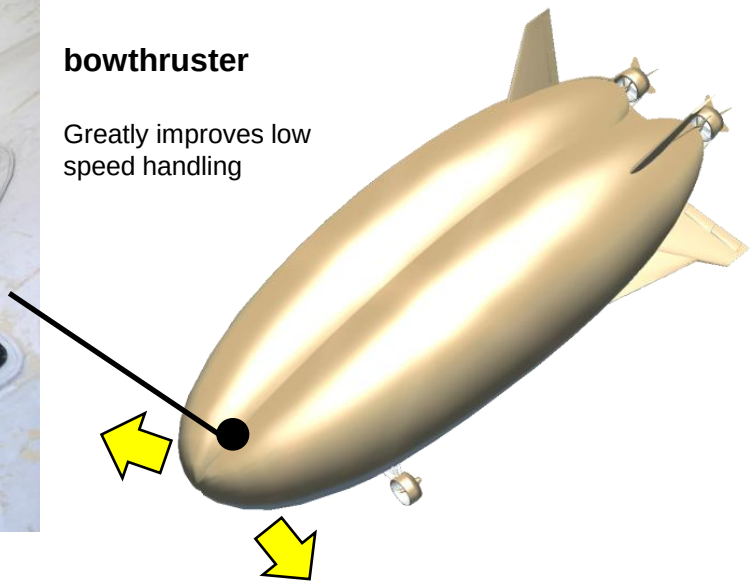

full up vector

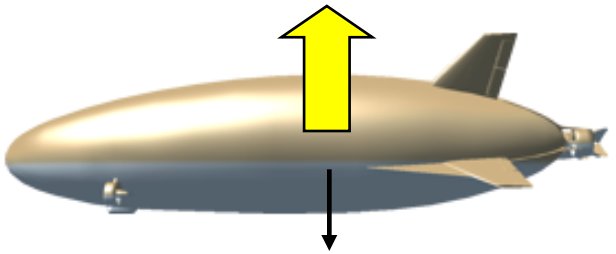

right vector


left vector

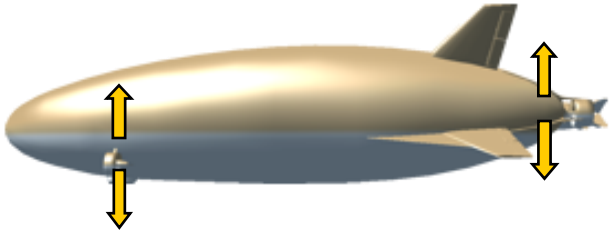
bowthruster

Greatly improves low speed handling

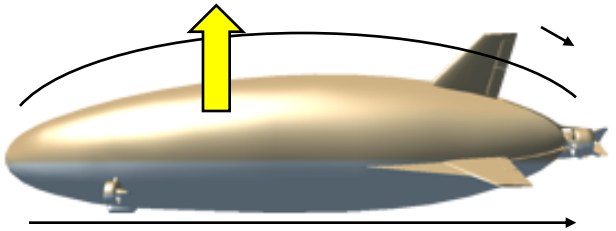




Aerostatic lift - generated by inert helium lift gas – at all times



Vectored thrust lift - take off and landing and zero airspeed operation



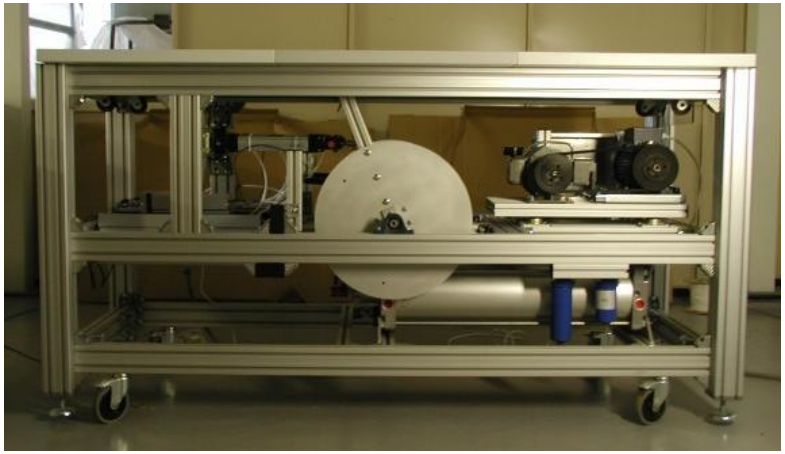
Aerodynamic lift – generated by lifting body hull – in cruise flight

HAV Technology

Hull

Tail structure

Engines



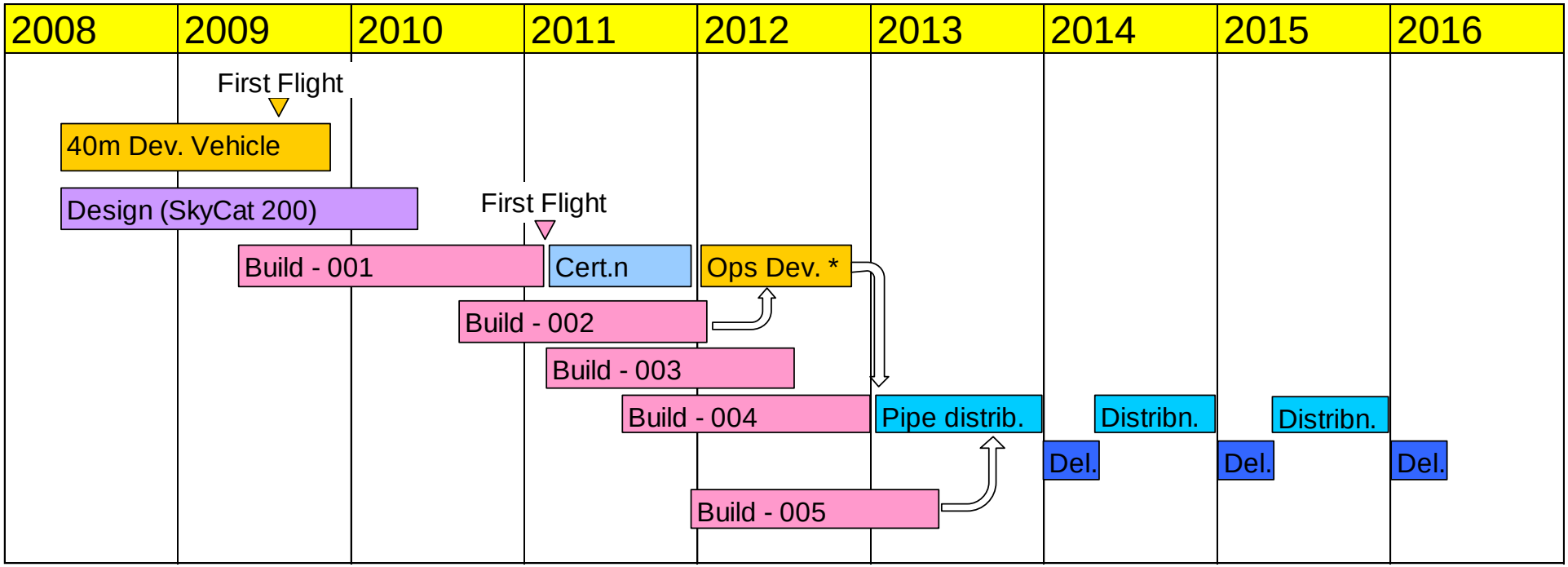
Flight control system

Ground control system

Payload module

Illustrative Program Schedule

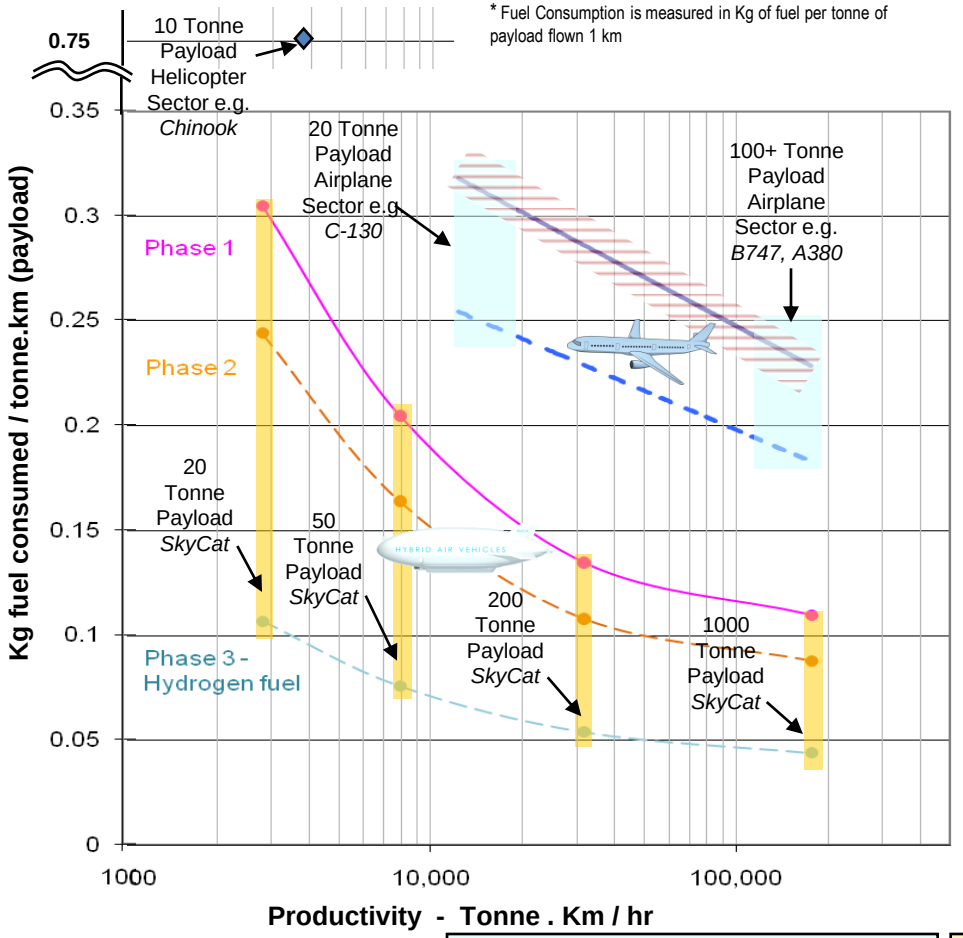
Top level schedule of events to support utilisation of *SkyCat 200* on the Mackenzie Valley Pipeline



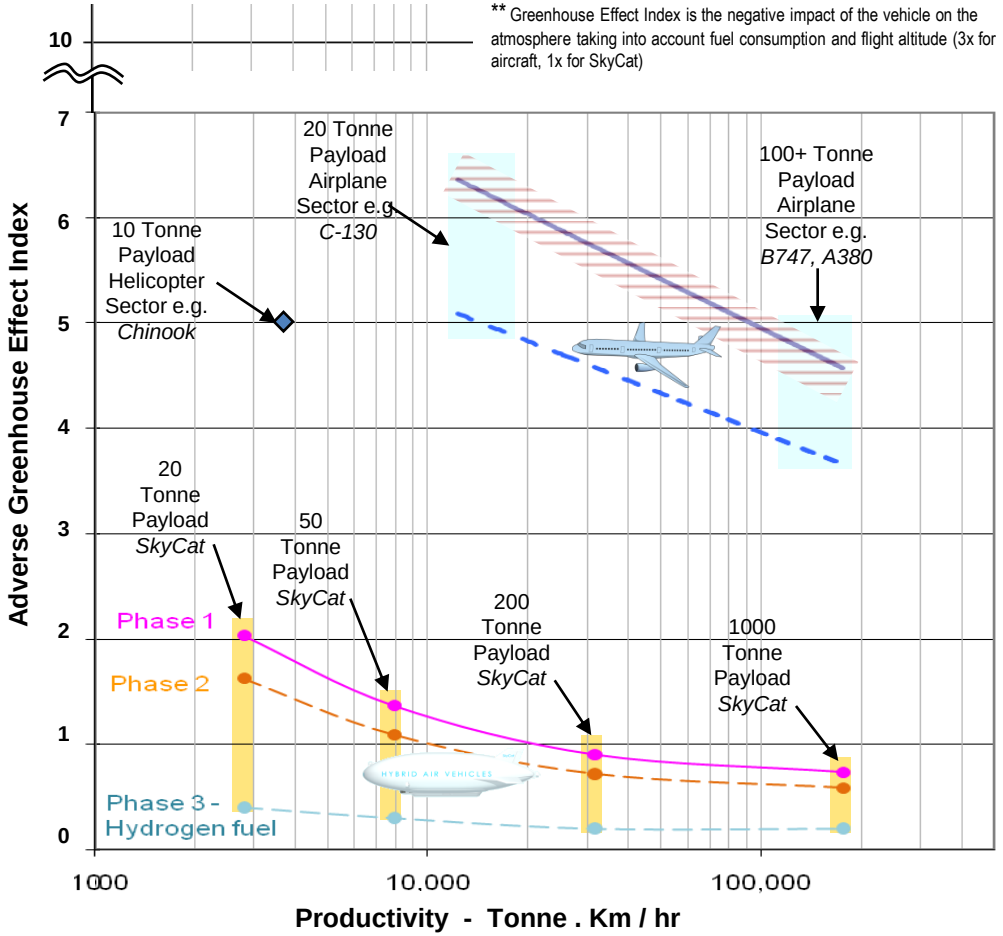
* Operations development in Canada including crew training

Our Green Credentials

Fuel Consumption* vs Aircraft Productivity



Greenhouse Effect** vs Aircraft Productivity



Fixed Wing

Current Technology Level

+10 year Technology Level (20% improvement)

SkyCat – Hybrid Air Vehicle

Current Technology Level

+10 year Technology Level (20% improvement)

With Hydrogen Fuel

Hybrid Air Vehicles - Overview

- **Environmentally benign** - No requirement for prepared runways or ice roads, greatly reduced CO^2 (¼ that of airplanes). A low noise, highly efficient 'green' solution using considerably lower power than fixed or rotary wing aircraft of similar transport capacity. Noise levels lower than for fixed or rotary wing.
- **Minimum infrastructure requirements** – can operate from practically any surface (land, water, marsh, snow/ice). All weather door to door capability - a new form of VTOL / ZTOL / STOL* freight delivery service – these aircraft can fly into and out of city centres with minimal safety issues / environmental impact utilising the buoyant lift of helium and an aerodynamic shape, to provide a low cost bulk freight delivery capability – provides significant cost savings against existing modes.
- **Wide ranging capabilities** - Multiple applications in Canada including prospecting, oil/mine/gas hardware supply, logistic supply to communities.
- **Scaleable** - Initially planned for Canada at 20, 50 & 200 tons payload capacity, but with potential to extend to 1000 tons with further development.
- **Low cost.** Acquisition costs of *Hybrid air vehicles* are lower than their fixed wing counterparts by a factor of circa 2. Their fuel costs are lower (per passenger mile) by a factor of 2 to 4 depending on cruise speed. The major saving is in ground infrastructure which is substantially less than for comparable fixed wing and an order of magnitude less than high-speed rail. First-of-type and certification costs are also modest (circa £100m).
- **Speed & Flexibility.** At up to 100 knots, the cruise speed of *hybrid air vehicles* is lower than for fixed wing aircraft but is broadly comparable to helicopter and high-speed rail operating over short routes sectors. Routes can be changed to meet changing or seasonal circumstances – a key advantage in these changing times.
- **Experience** - Our team has more experience in the new field of HAVs than any other company in the world and holds key world patents. Over a thirty year period we have certified & operated many LTA vehicle types in many countries.

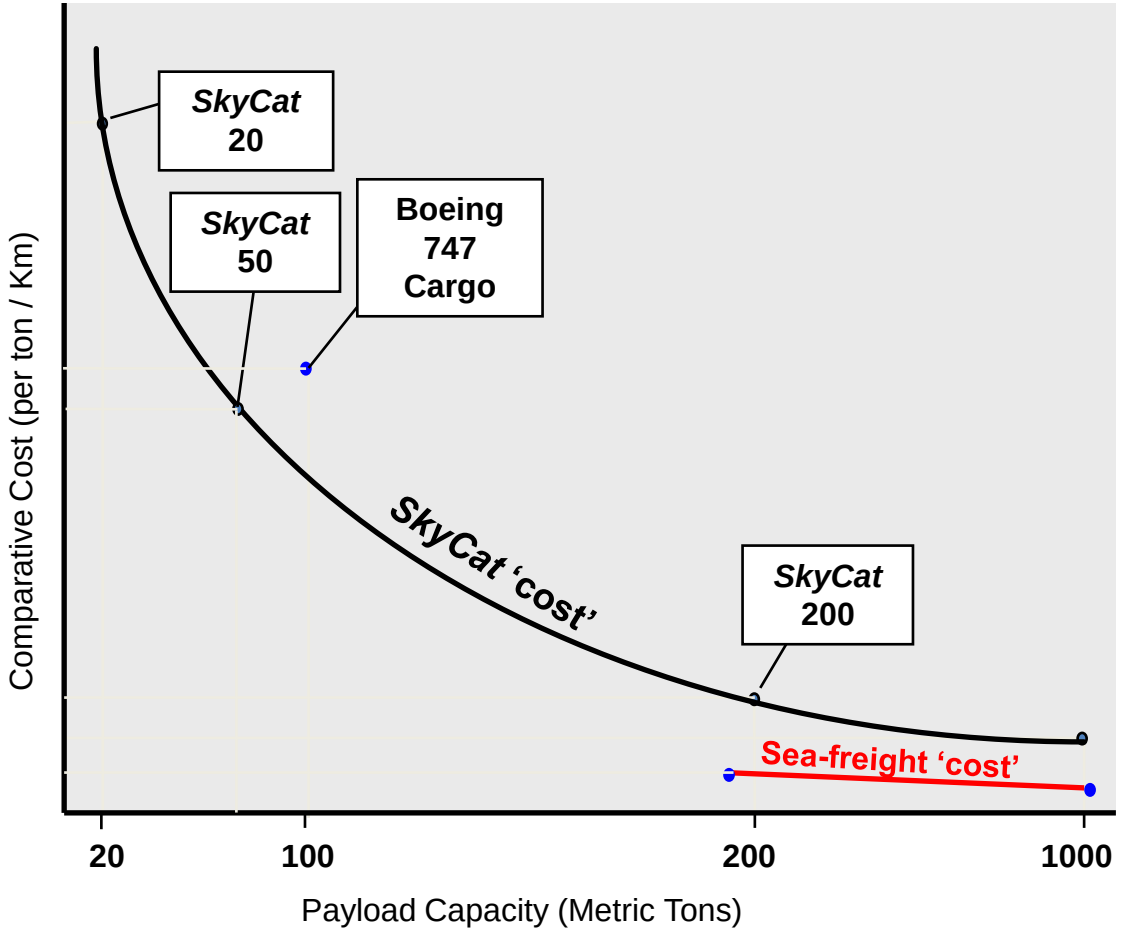
* VTOL: Vertical Take Off/Landing; ZTOL: Zero Take Off/Landing (45 degree); STOL: Short Take Off/Landing.

SkyCat – In Summary

What the *SkyCat* is designed to do in Northern Canada:

- Operate from existing gravel airstrips, from lakes or snow/ice surfaces with no infrastructure upgrade or specialist handling equipment required.
- Operate in -60ºC temperatures, windspeeds of up to 40 knots for takeoff/landing and 80 knots while airborne.
- Capable of delivery at up to 105 knots airspeed with high reliability.
- Carry everything the end user requires – pre-fabricated machinery, re-supply of hardware, consumables, fuel/oil, personnel etc, palletised or loose equipment.
- Primary load area developed as a 'robust' rather than aerospace structure to aid speed of loading / interface with commercial hardware.

Comparative Range - Cost vs Payload



Study has shown *SkyCat 50* can transport year round at less cost per ton mille than trucks using ice roads.

SkyCat – Mission Cost Benefit Comparison

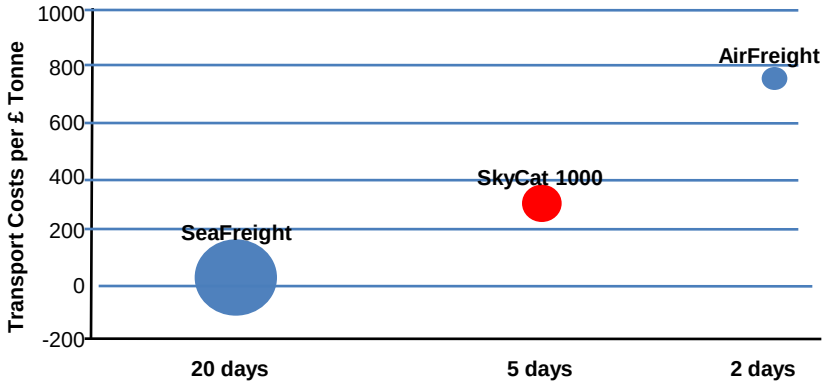
Strategic Freight – *SkyCat* 1000

- Low cost – similar costs to sea freight.
- End to end delivery times – similar to airfreight. Long Range.
- The larger *SkyCat* the more efficient.
- Point to point delivery – no choke points.
- Low emissions – lower environmental impact.

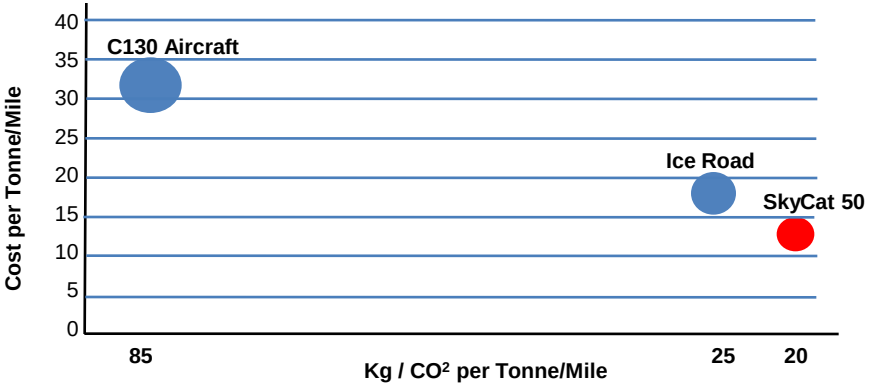
Canada North – *SkyCat* 20/50

- Low environmental impact.
- *SkyCat* 50 cheaper than the ice roads and ⅓ of the cost of fixed wing.
- Point to point delivery – all terrain landing.
- No specialised ground infrastructure – hover capable.

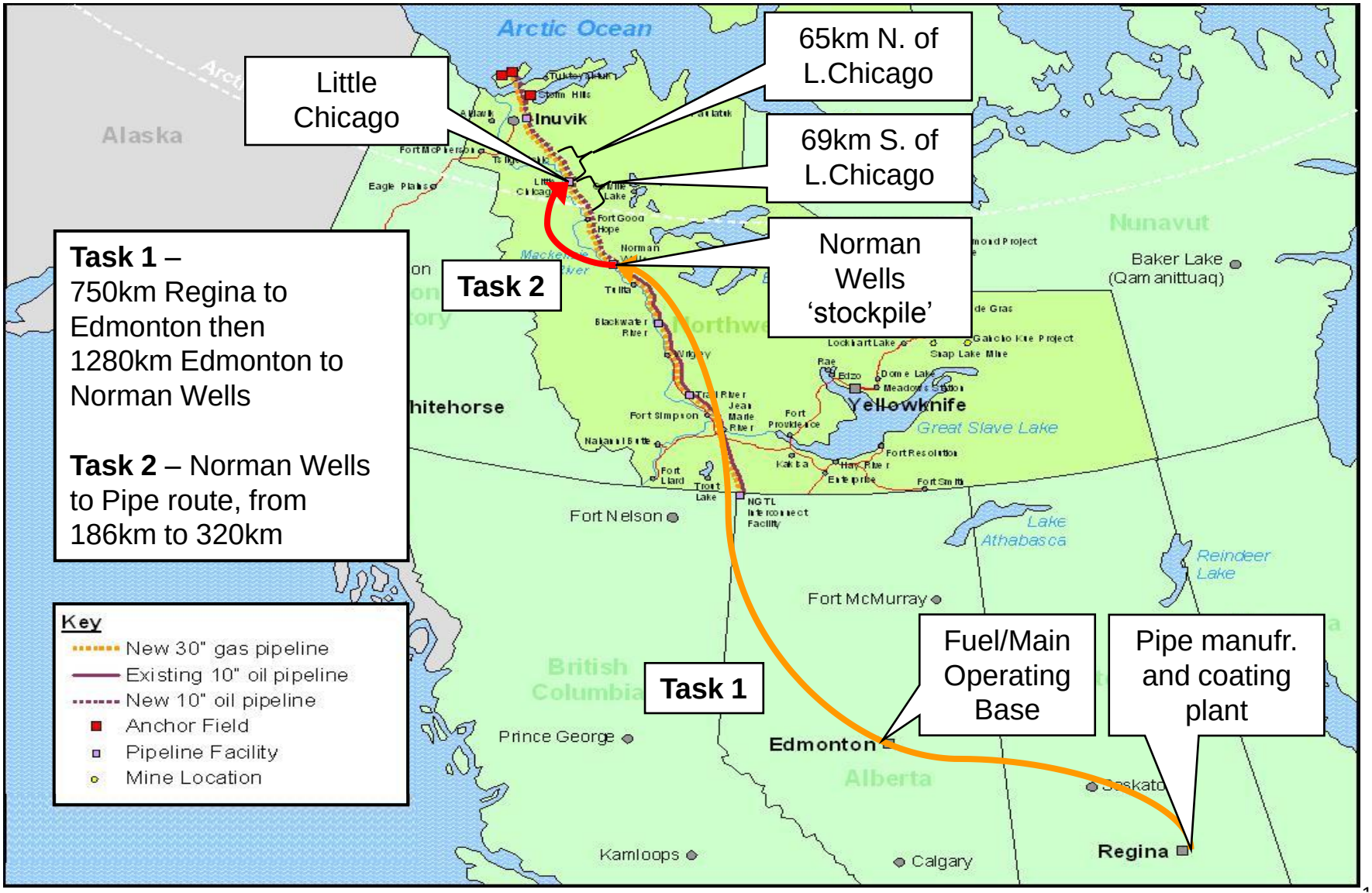
Shanghai to London freight costs compared with point to point delivery times



Transport Costs and Emissions Comparison in Canadian North



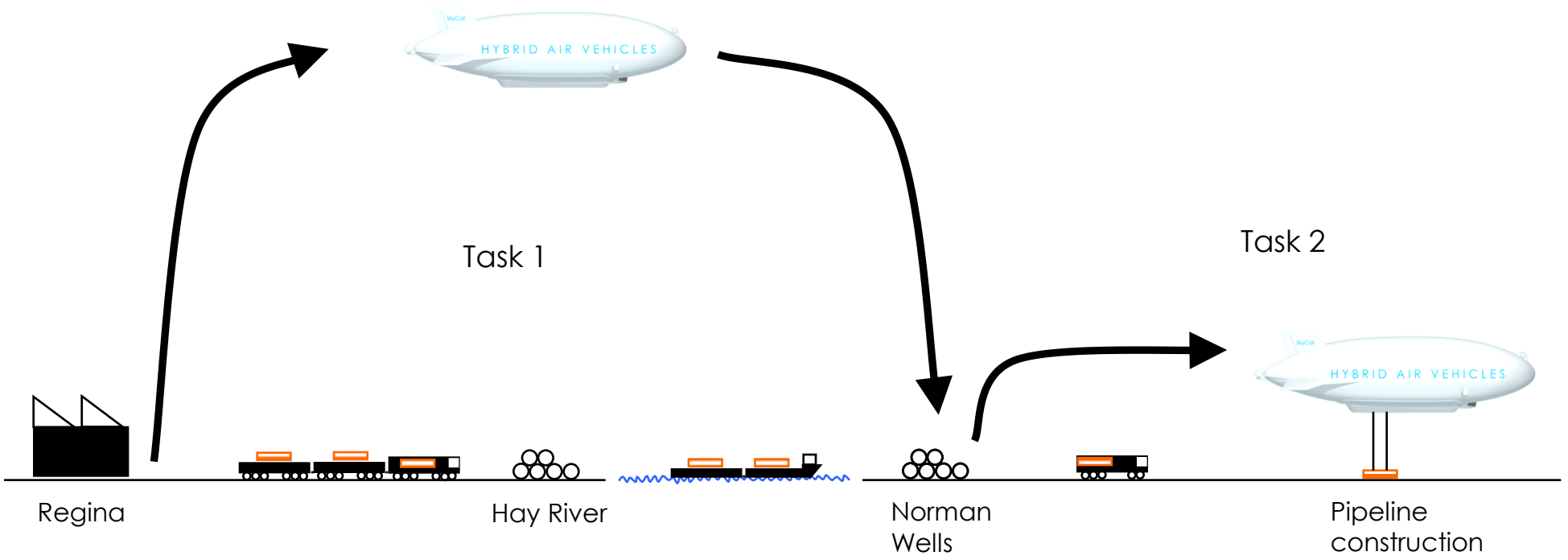
Example Routes, Distances & Assumptions



SkyCat Task Outline

Task 1 – Delivery of pipe ‘bundles’ year round (circa 160 tons) IPSCO to Norman Wells.
Task 2 – Delivery of pipe ‘bundles’ (circa 80 tons) Norman Wells to Trench.

Pipe bundles sized to require no repacking en-route and minimize handling.



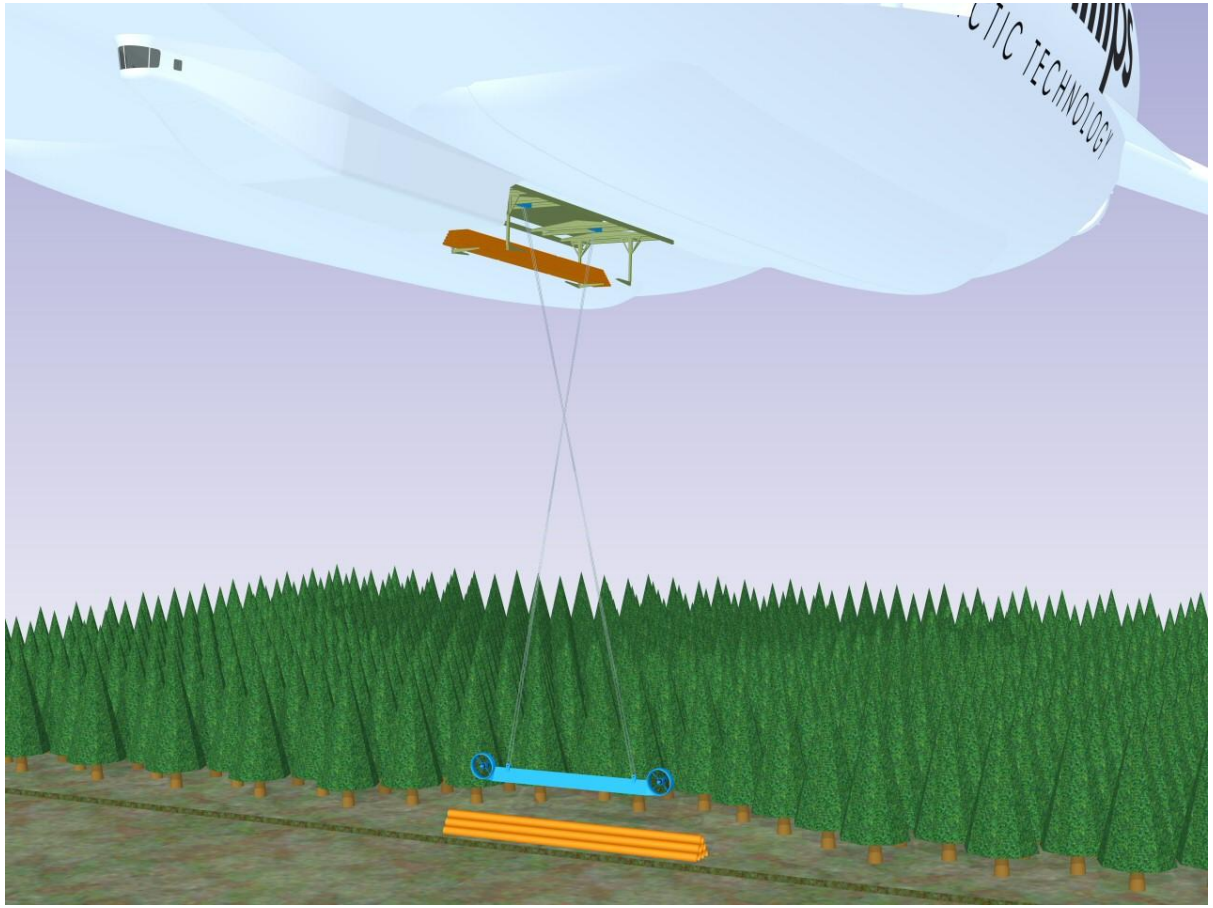
Pipe Load / Delivery System

Load / Delivery System:

Pipe bundles of up to 80 tons delivered from circa 250 ft above ground level.

Provides pipe bundle alignment with trench during delivery, regardless of wind direction.

Precision vehicle control to facilitate pipe delivery within circa 10m in limiting weather conditions.*



** Provisionally est. at 30 to 35 kts windspeed limit for airborne hover.*

Video Extract

- **Many environmental experts are now saying that the time has come to make fundamental changes in our approach to aviation transport and that we cannot continue the present trend…...**
- A DVD compilation (duration 7 minutes) follows, with extracts from new US television series re aviation and the environment – cites our development of *hybrid air vehicles*. (Broadcast on PBS 2008/9).

Play Video Extract

HYBRID AIR VEHICLES

Questions & Answers