Batteries to Enable Short Haul Electric Aviation

NAATBatt INTERNATIONAL

Annual Meeting & Conference

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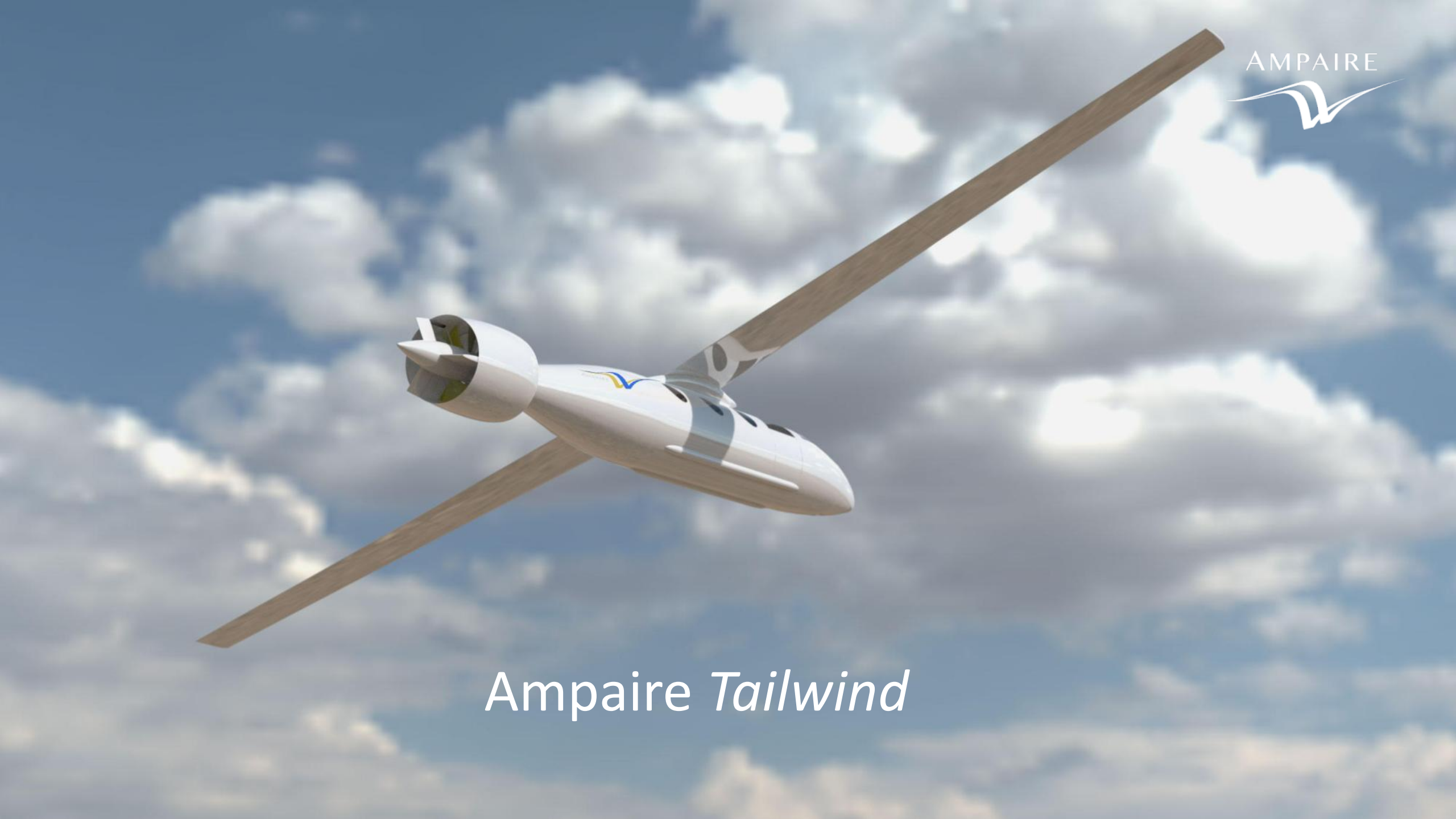


Ampaire *Tailwind*


Globally, aircraft make ¼ of the CO_2 of cars

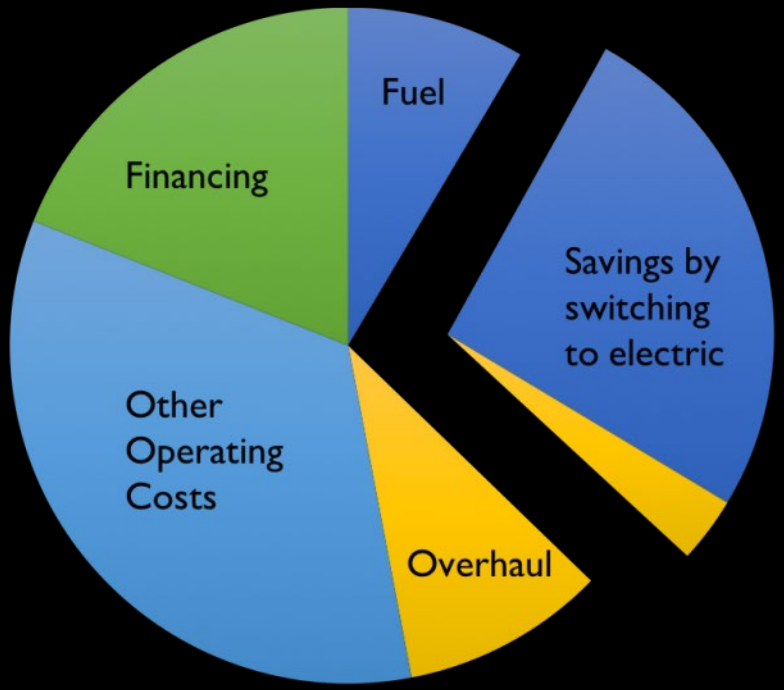
No emission controls for NOx, Particulates or others

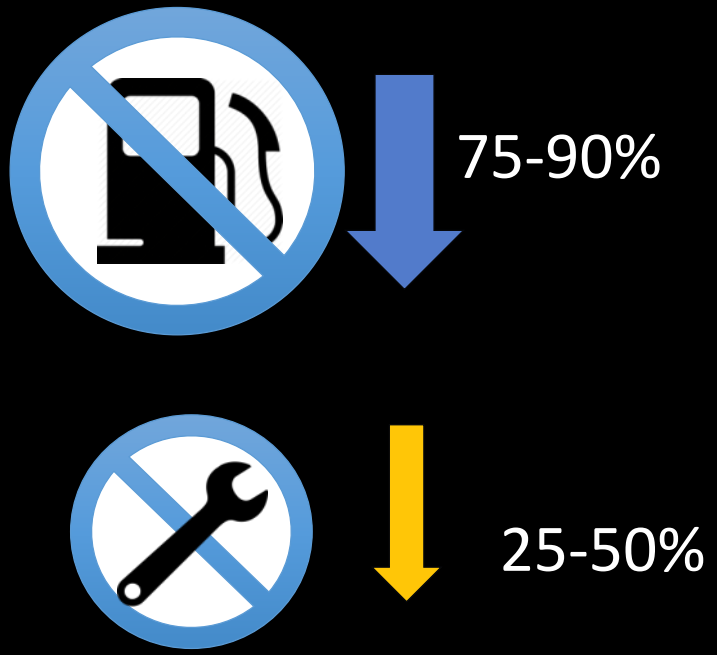

Emissions are more active at altitude


70% - 90% fuel cost savings

25% - 50% maintenance cost savings

Cost Savings Boost Airlines Bottom Lines





3x

Airline Profit Margin Growth

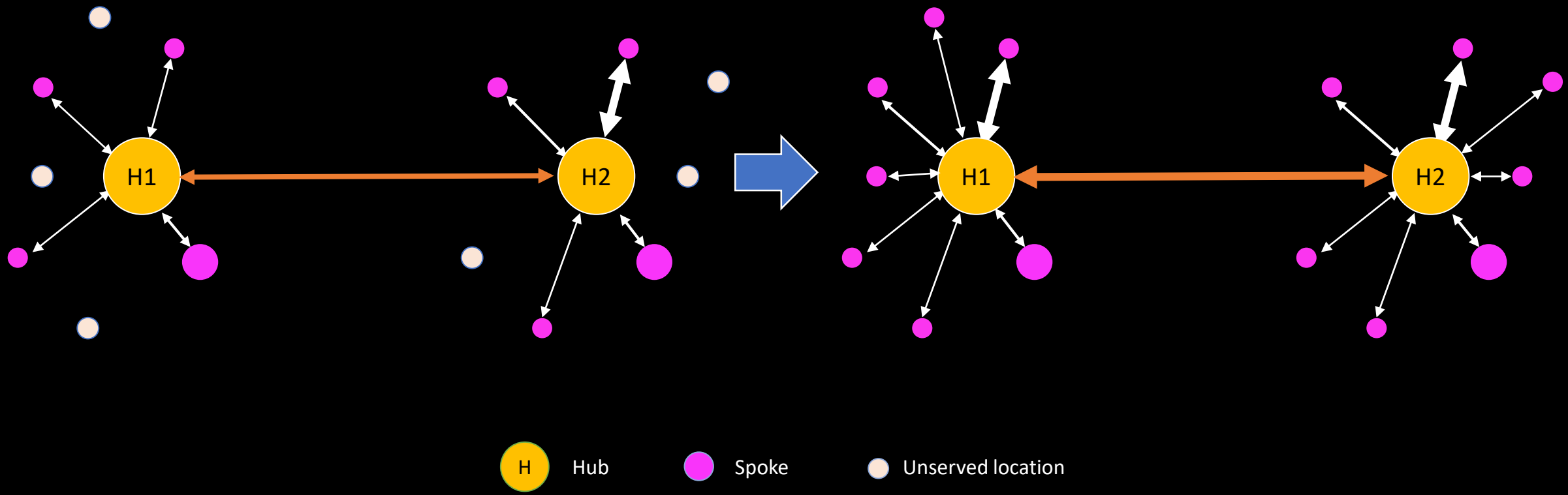

Customers value zero direct emissions


Customers Value quiet takeoffs and landings

Opening of Additional Short Distance Connections Feed Hubs and Enables Short Haul Aviation Growth

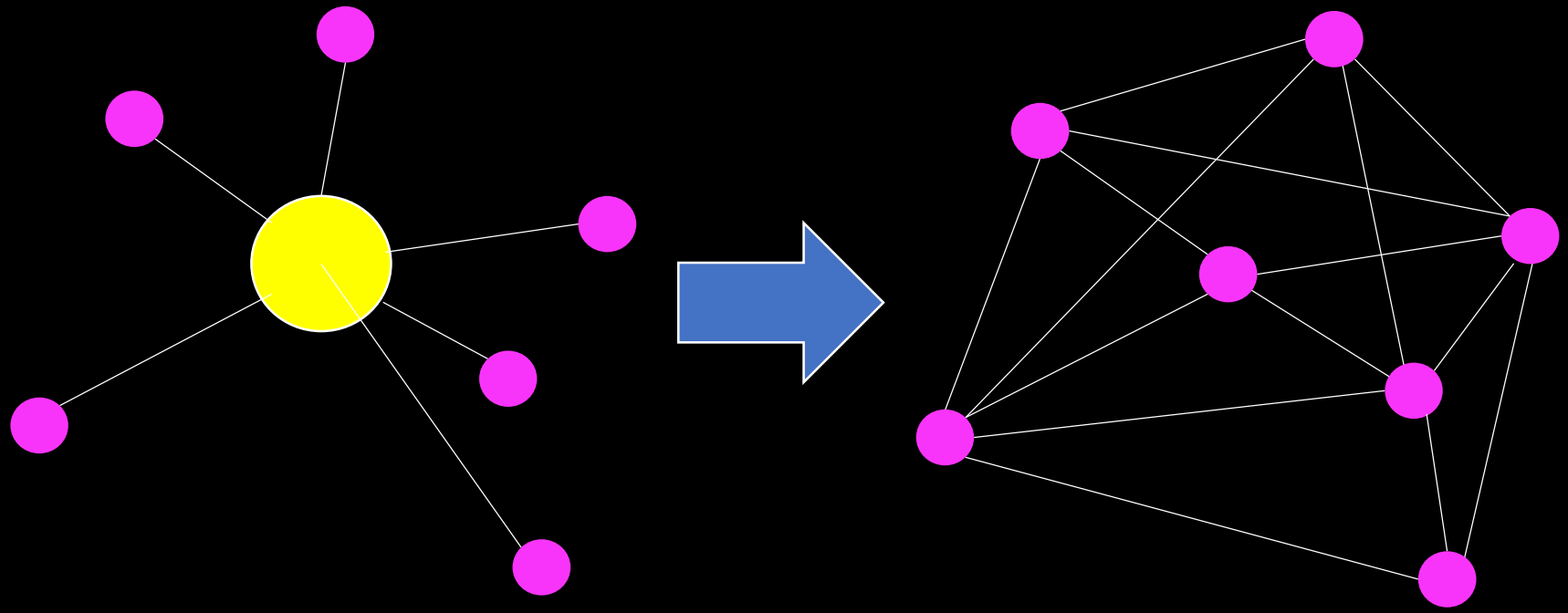
The air travel hub-and-spoke model…

is reinforced by lower economic and environmental costs of electric aviation



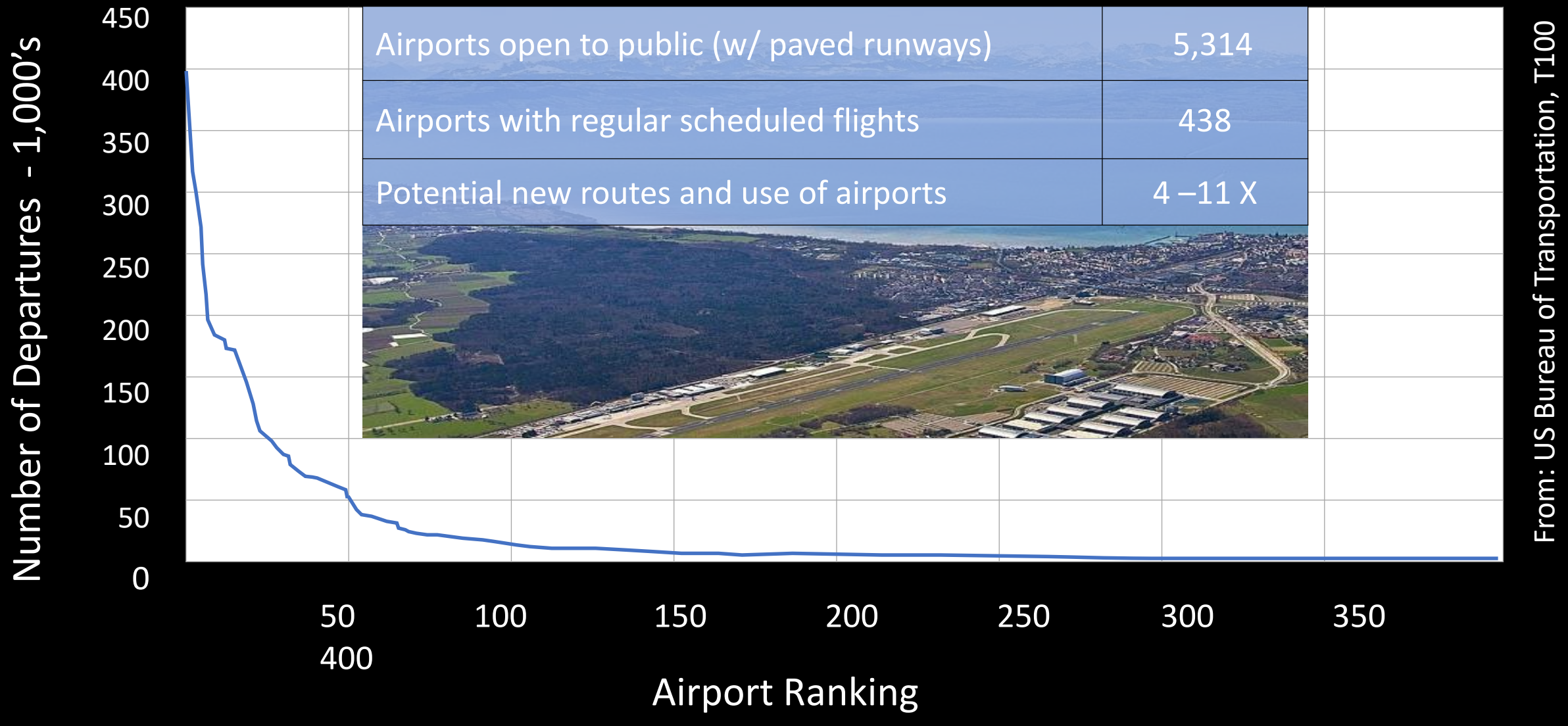
Point-to-Point (P2P)Travel Saves Travel Time and Further Lowers Environmental and Economic Costs

P2P TOPOLOGY and FREQUENCY is superior for throughput and total travel time

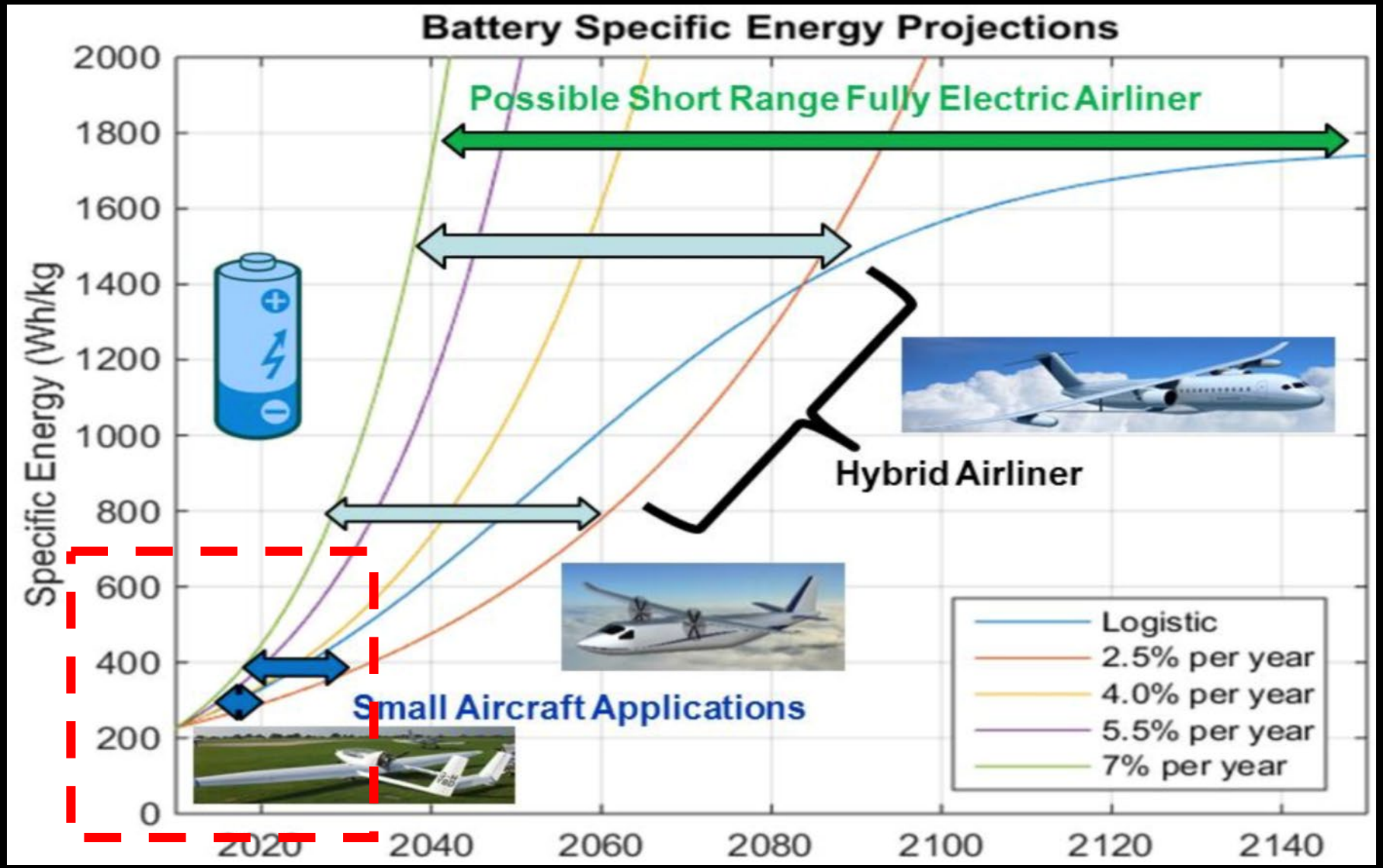


Excess Airport Capacity Supports Growth in P2P Travel

2018 Annual Departures – Passenger and Cargo (US)

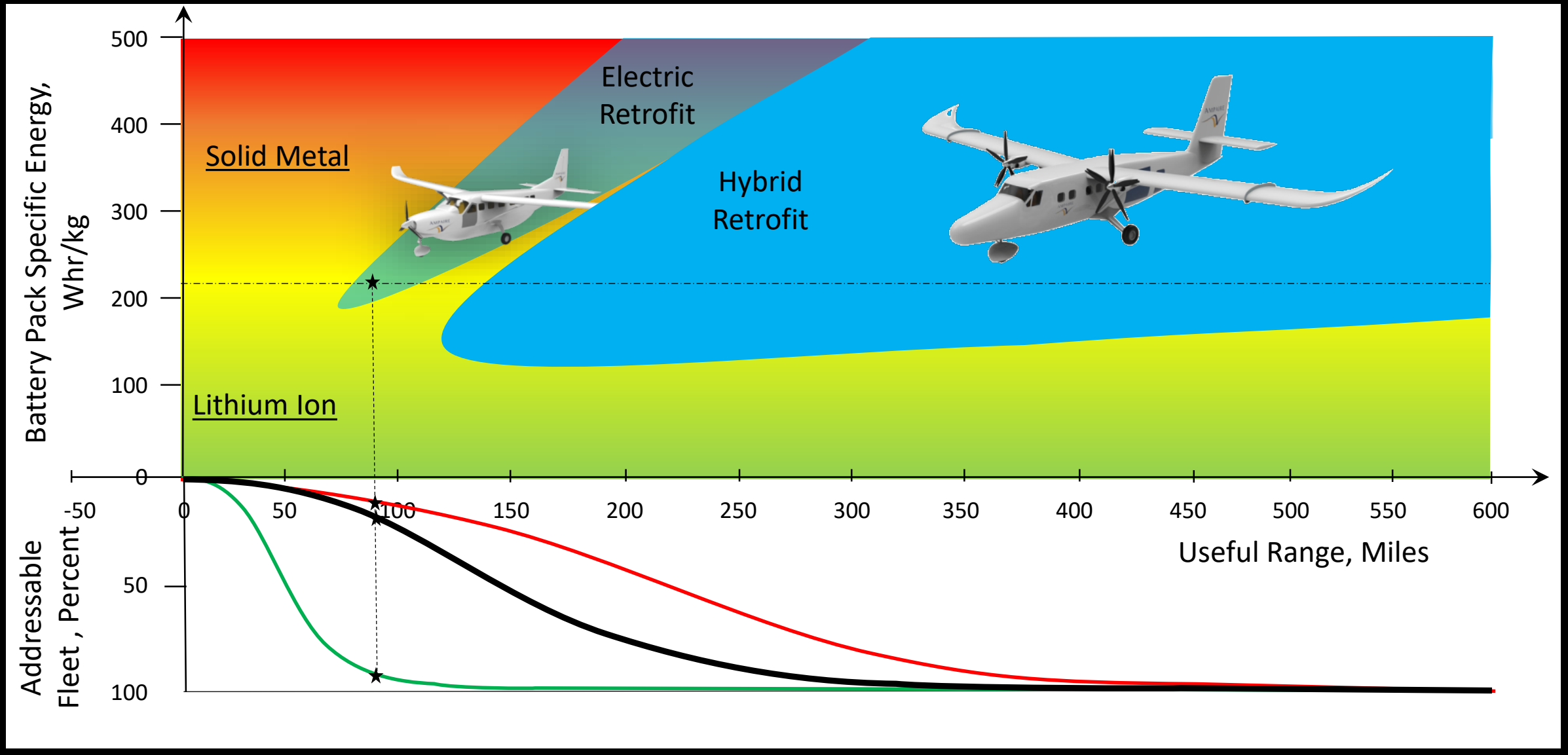


Battery Technology Paces Electric Aviation



From: M. Bradley, Boeing, 2015

Thin-Haul Fixed-Wing Electrification Space



Battery Needs For Short-Haul Fixed-Wing Aviation

- Cost – not bound by automotive price targets
- Cycle Life – can work with lower cycle life
- Volumetric Density – no direct targets
- Pack designs must contain propagation and keep cabin safe
- Operating Temperature – can control discharge and charge temps
- Discharge C - rate
  - Electric ~3.0 for 5 minutes; max 1.5 thereafter
  - Hybrid ~5.0 for 5 minutes; max 2.0 thereafter
- Charge C - rate
  - ~ 0.5 or less with Swap Concept
  - ~ 3.0 or greater without Swap

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Q and A