~~The~~ A Future of Flight

John Reavy
Director and Principal Account Leader - Aviation

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Non-confidential - Standard

We’re a global engineering, management and development consultancy.

Our purpose is to improve society by considering **social outcomes** in everything we do, relentlessly focusing on **excellence** and **digital innovation**, transforming our clients’ businesses, our communities and employee opportunities.

MOTT MACDONALD

Global aviation experience with a local presence

40+ years of experience

1,000+ aviation projects

120+ countries worked in

75bn of airport transactions

12 airlines

260 airports

18 governments

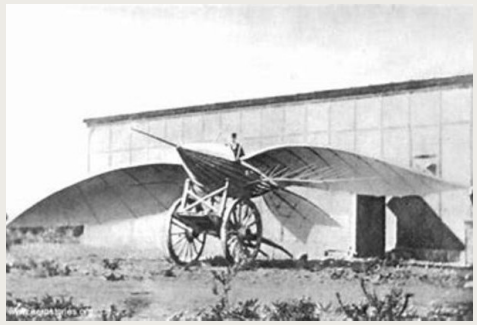
2 AAM infrastructure providers

Mott MacDonald

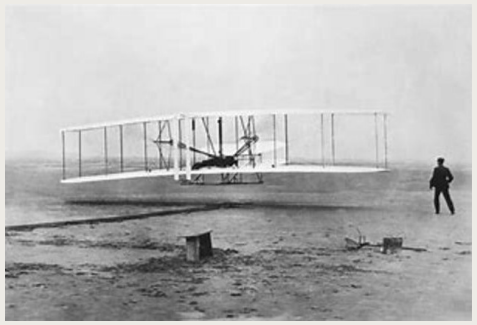
The History of Flight

Some major milestones

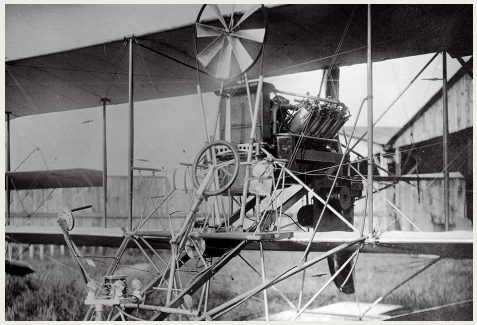
1680 – Giovanni Borelli – human muscle is insufficient to sustain flight



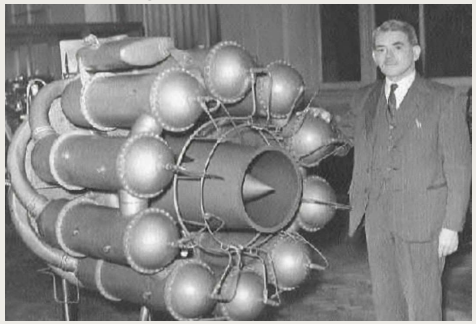
1709 - Bartolomeu Laurenco de Gusmao – designs model glider



1903 – Wright Brothers – First powered, sustained and controlled flight



1914 – Lawrence Sperry - linked a gyroscope to sensors to create autopilot



1930 – Frank Whittle – invents jet engine

1933 - Boeing 247 – first modern passenger airliner

2005 – Airbus A380 – world's largest passenger airliner

2016 – Solar Impulse – first circumnavigation of the earth by a piloted solar powered aircraft

The Future of Flight

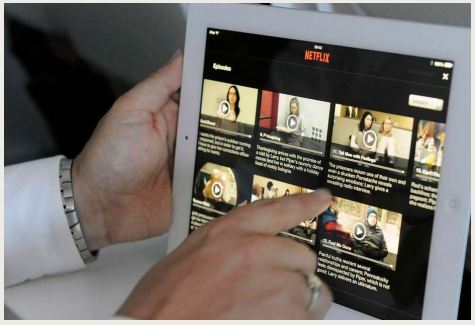
Aircraft – unpiloted aerial vehicles/drones

Artificial Intelligence and Real-time Data

Capacity Constraints – including surface access

Digital Security

Environment – Aircraft Fuels & Airport Carbon



Inflight Entertainment

Single Token & Biometric Passport

Self Service

27 September 2022

Recent Maiden Flights

Eviation Alice

Source: Eviation

Vertical Aerospace VX4 eVTOL

Source: Vertical Aerospace

Advanced and Urban Air Mobility

Different Use Cases

Advanced Air Mobility – an air transportation system that moves people and cargo between places previously not served or underserved by aviation using revolutionary new eVTOL aircraft.

Urban Air Mobility - describes future means of transporting, or connecting, people or goods by air, in an urban setting. There are three key distinct main use cases:

- **Last-mile delivery of cargo**: delivery of packages from distribution centres to the receiving party.
- **Air metro**: akin to public transport, with fixed routes and regular scheduled movements.
- **Air taxi**: bespoke door-to-door transport, with potential for ride-sharing models.

Cargo: Last-mile delivery

Air Metro

Air taxi

eVTOL Aircraft

Mott MacDonald have identified over 200 different eVTOL aircraft under different stages of development – from prototype to flight testing.

eVTOL Concepts

Urban Mobility

The Urban Mobility concept essentially revolves around the use of eVTOL aircraft as airborne taxis, operating within a limited area such as a major urban region or city. As such the range of these aircraft is limited to around 20-25 miles and many are planned to carry 2-4 passengers, which initially includes the pilot within the payload restriction. This range capability is essentially defined by the battery life and the speed of aircraft.

Regional Mobility

There are a number of companies looking to develop eVTOL aircraft which provide an extended range capability (60–185 miles) with a payload of four passengers. As with the Urban Mobility aircraft, this range capability is based on the battery life and the speed of the aircraft, but the marked difference is a fixed wing.

Volocopter's VoloConnect will use a hybrid lift and push design.

- 100km distance at a speed of 180km/h
- Top speed 250km/h

Source: Volocopter

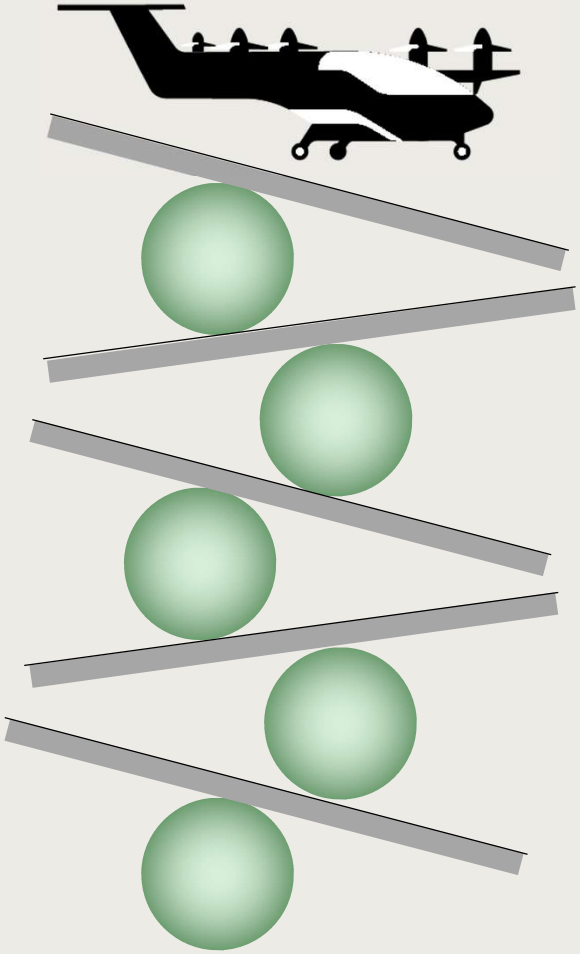
Vertiport/Droneport Considerations

An opportunity for aviation to support surface access – examples of challenges to overcome

Regulatory
- Planning approvals
- Airspace impact assessment
- CAA/EASA/FAA Regulations
- Cross-border operations
- Climate regulations
- Fire codes

Airspace
- Airport proximity
- Helicopter corridors
- Military use airspace
- Sensitive infrastructure
- Aircraft performance
- Traffic density
- Migratory patterns

Physical constraints
- Surrounding buildings/towers/cranes
- Trees
- Power lines
- Integration with other infrastructure
- Future land use
- Lightening



Safety
- Safety by design
- Safety management system
- Emergency procedures
- Bird strike protection and prevention
- Passenger areas and airfield interaction
- Emergency access

Environmental
- Prevailing wind direction, including up and down drafts
- Heat pockets
- Seasonal weather
- Operational impact on wildlife
- Water runoff / snow removal
- Temperature variation

Neighbours
- Distance to maintenance facility
- Local fire station
- Visual distractions to pilots/road users
- Impact on local community and traffic
- Hazards from specific land use
- Animals – zoos, farms, wildlife

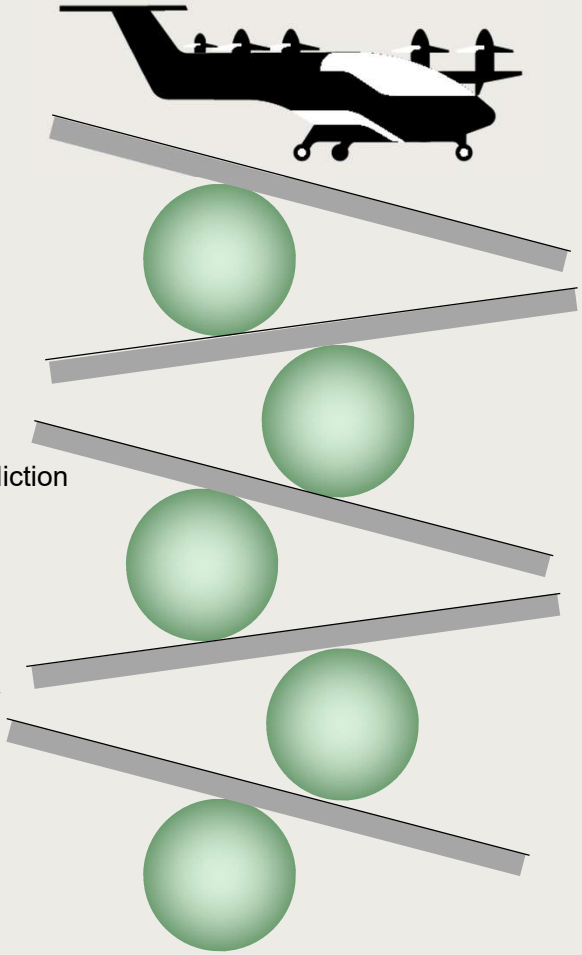
Vertiport/Droneport Considerations

An opportunity for aviation to support surface access – examples of challenges to overcome

Utilities
- Electrical demand and service
- Projection of future demand
- Integration with grid
- Water, including fire and drainage
- Energy storage
- Charging speed
- Resilience

Demand and Level of Service
- Peak hour demand
- Multi-modal integration
- Scheduled or dynamic – demand prediction
- Seasonality
- Capacity limit
- Expandability

Security
- Vertiport, staff and passenger security
- Passenger screening
- Baggage/cargo screening
- Network & data security
- Procedures & emergency plans
- Local/national regulations

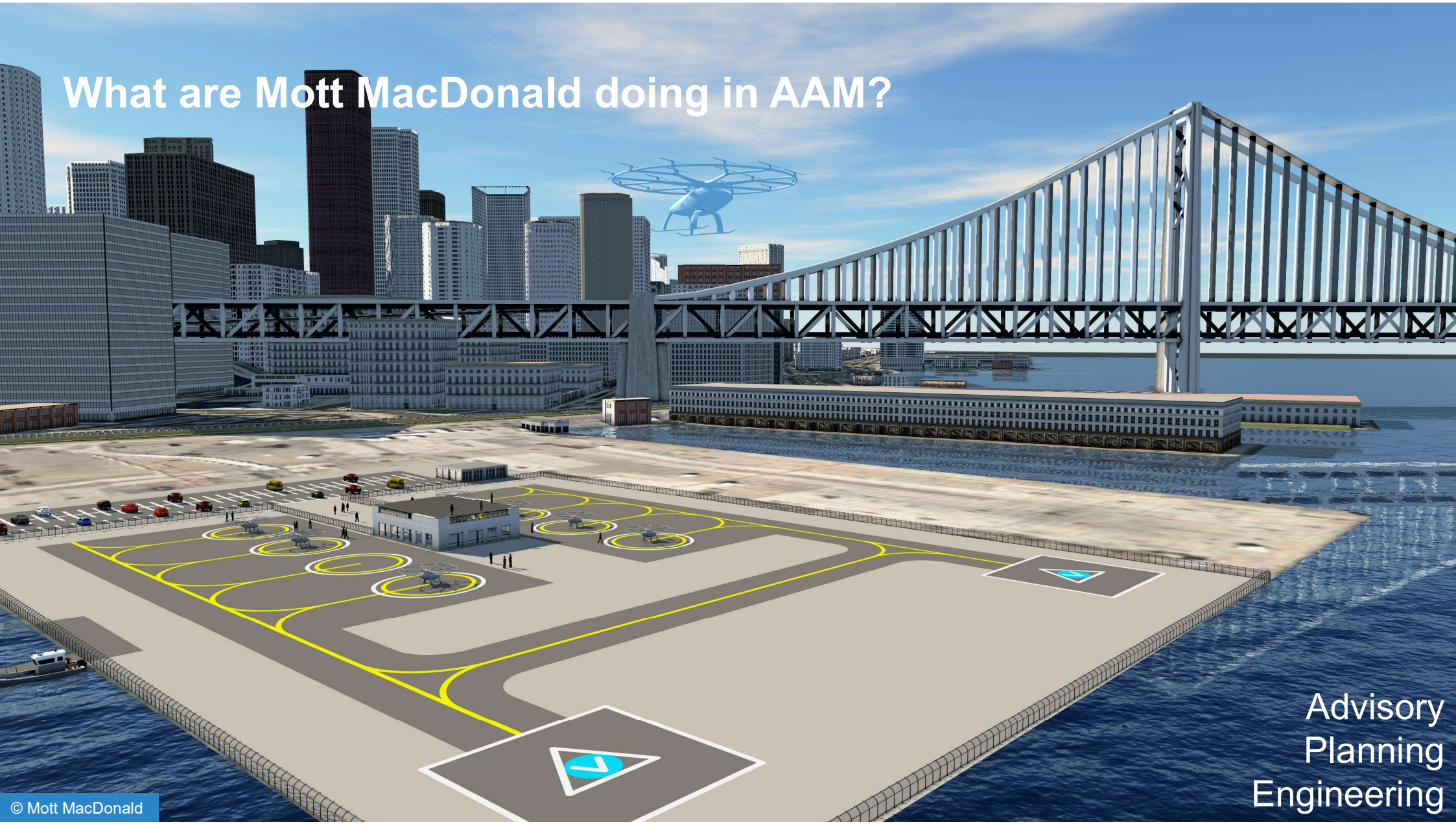


Economic
- Business case
- Capital expenditure
- Operational expenditure
- Site cost – buy/lease/concession
- Revenue model

Systems
- Bandwidth & connectivity
- Infrastructure – antenna, transmitters
- Data security
- Lost communications procedures
- Performance metrics
- Vertiport network connectivity
- Ground to aircraft connectivity

Design
- Types of aircraft, power units and charge time
- Level at/above ground
- Optimal sizing – overall footprint, airfield, terminal
- Concept of operation
- Accessibility
- Shared or single operator
- Usage – passenger, cargo, emergency

What are Mott MacDonald doing in AAM?



Advisory
Planning
Engineering

ferrovial MOTT MACDONALD GRIMSHAW

UK Vertiport Network

Announced at COP26

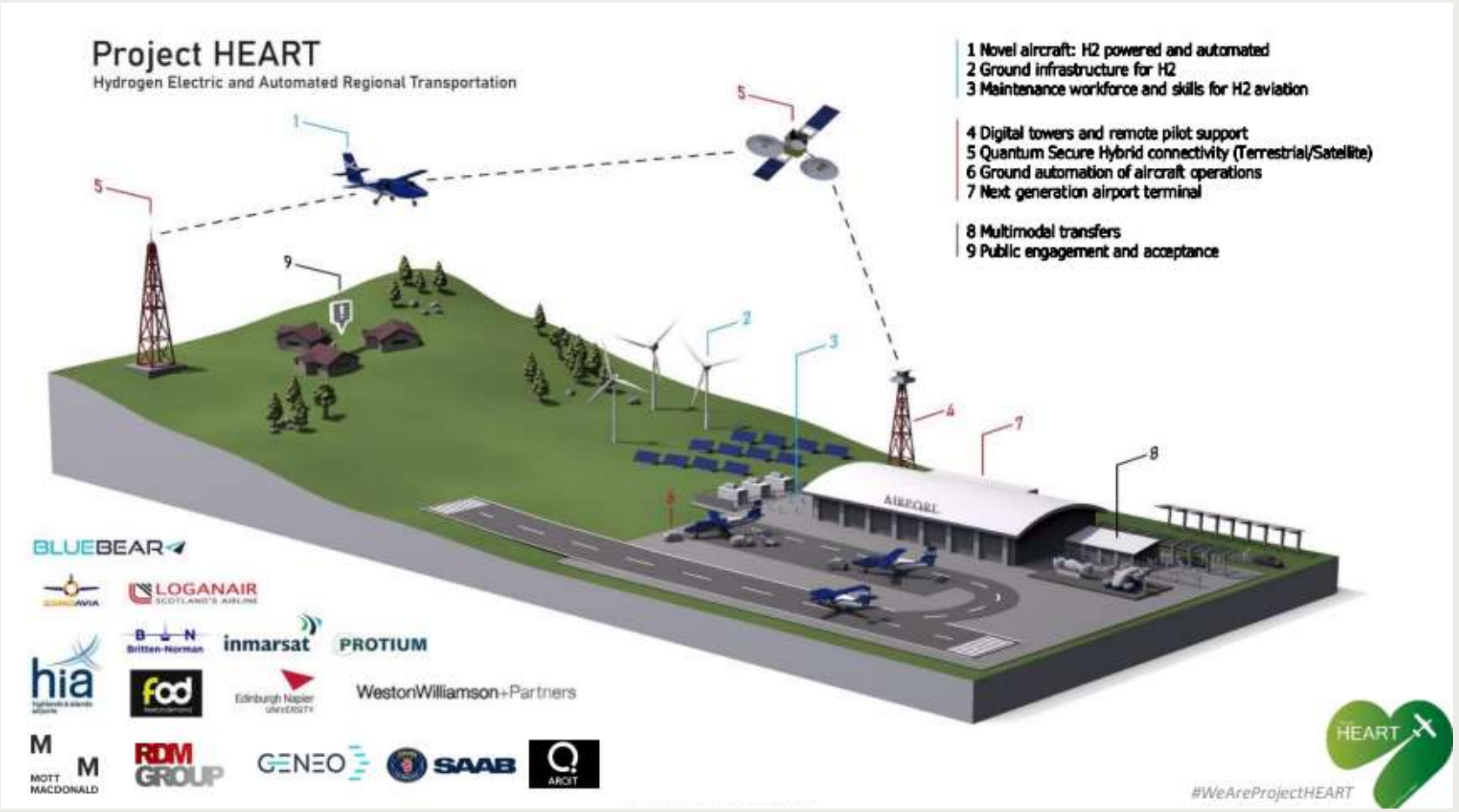
Ferrovial

A leading global infrastructure investor and operator

United Kingdom

Expertise

- Strategy advisory
- CONOPS development
- Planning
- Concept design
- Electric infrastructure evaluation
- Cost planning



UK Research and Innovation

Future Flight Challenge Phase 3

Develop an automated end-to-end travel experience and conduct flight trials

UK Research and Innovation

United Kingdom

Expertise (Mott MacDonald)

- Customer experience
- Terminal planning
- Simulation modelling

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Thank you