

**Derby Medical Society  
Open Meeting  
Thursday 24th November 2022**

**Speaker**

Alan Newby

**Towards Sustainable Aviation**

As Director of Aerospace Technology and Future Programmes Alan is responsible for the formulation of the global technology strategy and delivery of the supporting programmes to underpin product development and enable new business opportunities. Previous engineering leadership roles included EVP, Future Programmes, Engineering Director Rolls-Royce Deutschland and Chief Engineer V2500. He joined Rolls-Royce in 1987 from NEI Parsons. Alan is a Fellow of the Royal Academy of Engineering, Institution of Mechanical Engineers and Royal Aeronautical Society. External appointments include non-Executive Director of the Henry Royce Institute and Aerospace Technology Institute and Chair of the Derby Branch of the Rolls-Royce Heritage Trust.

**Where we came from in aviation**

From going faster, to fuel efficiency then driven by environmental performance.

Can now fly 9500 miles in one flight.

Efficiency uses less fuel so cheaper to fly. This has brought ticket prices down

Post-Covid the drive has been towards net zero carbon emissions.

Global warming was identified as early as 1911 - work by Francis Molena.

Aviation accounts for a small amount of carbon emissions.  
Transport produces 24%, aviation is 2.8% of this proportion.

Aviation produces CO<sub>2</sub>, there are nitrous oxide emissions, contrail trails can form and have an impact. Balance between avoiding contrail while minimising CO<sub>2</sub> emissions.  
Research ongoing to investigate how problematic contrails can be.

Altogether aviation contributes to 4% of global heating.  
The problem is that more people are flying. 75 fold increase in air travel since the 1960's.  
Aviation efficiency has improved 11 fold since the 1960's.  
Proportionally aviation has less CO<sub>2</sub> emissions per person than other forms of transport.

The obvious solution is to stop flying but that does not take into account the human need to travel, air freight, economic impacts and the aviation industry as an employer.

The problem is carbon.

**Pathways to net-zero by 2050**

Fuel efficiency

Alternative fuels (hydrogen, biological fuels)

Carbon dioxide removal - these are being used and further development ongoing.

### **Pillars to achieve net-zero**

Less fuel - step change in efficiency

Cleaner fuel - synthetic and sustainable alternatives to kerosine

Zero carbon fuel - 3rd generation technologies.

Ultrafan - next generation turbine engines.

Sustainable aviation fuel (SAF)

V10 petrol is an example.

Used oils and fats popular in aviation.

Algae based fuel is being developed.

Principle is recycling existing carbon.

Alternative fuel sources cannot be in competition with human food stocks.

Small modular reactors can generate synthetic fuels.

Take CO<sub>2</sub> from the air and mix with hydrogen.

SAF challenges

2-5x the cost currently

Scalability

Global manufacturing capacity

Policies and incentives globally.

Alternative Energy sources

Aviation looks at weight and volume it takes up.

Batteries 60x worse than kerosine.

Hydrogen has high energy but a large volume.

Zero carbon electricity with green hydrogen could offer efficiency and performance.

Hydrogen fuel cells are more efficient than batteries.

All electric

Internal combustion

Hybrid

These are used in cars and can be used in aviation.

Worlds fastest all electric plane was built by Rolls Royce.

Currently developing small propeller, urban air mobility and small commuter aircraft as all-electric.

The issue is developing the technology for larger aircraft.....

There is less pay off with larger planes as the fuel takes up 40% of the weight.

Batteries take up even more weight so not feasible in larger planes.

Hydrogen in aviation

Green hydrogen needs to be produced on a large scale. Currently majority of hydrogen comes from burning fossil fuels.

Feasibility of alternative energy solutions is mission and time dependent.

### **The Challenge**

“Ours is an overwhelmingly fossil-fuelled civilisation, and the size and complexity of our extensive super system of fuel extraction, processing, distribution, storage, and conversion means that a

complete displacement of it will affect every person and every industry, not least the growing of food and the long distance transport of goods and people” - Vaclav Smil, Taming the climate is far harder than herring people to the Moon.

**Questions:**

Are timelines too far in the future?

Engagement of governments to SAF

Is the technology transferable?

Collecting contrail particulate

Development of nuclear fusion

Using bodies for aviation fuel rather than cremation!