AVIATION H2

Anhydrous Ammonia as a strategy for decarbonising jet aircraft

September 1st 2022 | ACN: 656 073 353

Aviation H2 Limited | 3rd International Hydrogen Aviation Conference Presentation

Dr Helmut Mayer

Experience

- Director – Aviation H2 Limited, an aviation start-up for carbon-free propulsion.
- Helmut's career began in the 1980s as a commercial pilot and, prior to joining the family engineering business, he spent eight years in general aviation.
- Over 30 years experience in machine design and development.
- Has been the Principal Engineer and Project Director on numerous machine design projects in Australia, South Africa, India and Colombia.
- Machine delivery from feasibility through design to turnkey hand over.

Education and affiliations

- PhD, B.E.-Aerospace, B.Sc .-Psych.
- FIEAust, RPEQ, CPEng, MRAeS.
- Admitted by the Council of The University of New South Wales to the degree of Doctor of Philosophy for his research on mitigating the effects of errors on the outcome of design processes.

Background

Aviation H2's goal of becoming Australia's first hydrogen-fuelled aviation company is coming into fruition, with the construction of its first modification prototype expected to begin soon.

The company has successfully completed their feasibility study and will soon start modifying turbofan engines to test and prove the concept.

The results from their studies were very positive, showing that converting a Falcon 50 to Liquid Ammonia Turbofan Combustion as the most efficient and commercially viable avenue to building a hydrogen-powered plane.

The company's team of world-renowned engineers believe making use of current technologies and infrastructure will be important to future customers because it allows them to modify the aircraft they have already invested in, rather than buy a whole new fleet.

Once the test flight is successful in the 2023, Aviation H2 will have a patentable method for modifying aircraft so they operate on carbon-free fuel.

The Mandate

The Brief:

- The mandate is to make an aircraft fly on carbon-free fuel.

- The company elected to work with a mid-sized aircraft using turbofan engines, meaning a business jet.

The goal is to achieve a tangible outcome quickly:

- Modification versus designing new aircraft.

- 2050 is when the industry is looking for net-zero and what that means is that by 2035 a solution needs to be ready; by this point no more aircraft using conventional fuels can be put into service.

The Approach

Review current technologies:

- Conduct a study on existing technologies to identify anything that can be used to minimise the need for development.
- Evaluate a variety of power path options and establish the most appropriate strategy for achieving the mandate.

Key pressure points were:

- Desirability for the modification by business jet owners, who value range and luxurious cabin appointment.
- Weight increment of making a modification.
- Fuel supply, fuelling and refuelling.
- Emissions other than carbon — for example, NO_x.

Feasibility Study

After three months of research, Aviation H2 found that modifying a Falcon 50 jet plane using liquid Ammonia to turbofan combustion energy path offers the most commercially viable and efficient avenue to carbon-free flight.

Over the period, Aviation H2's engineers ran comparative studies across four power paths.

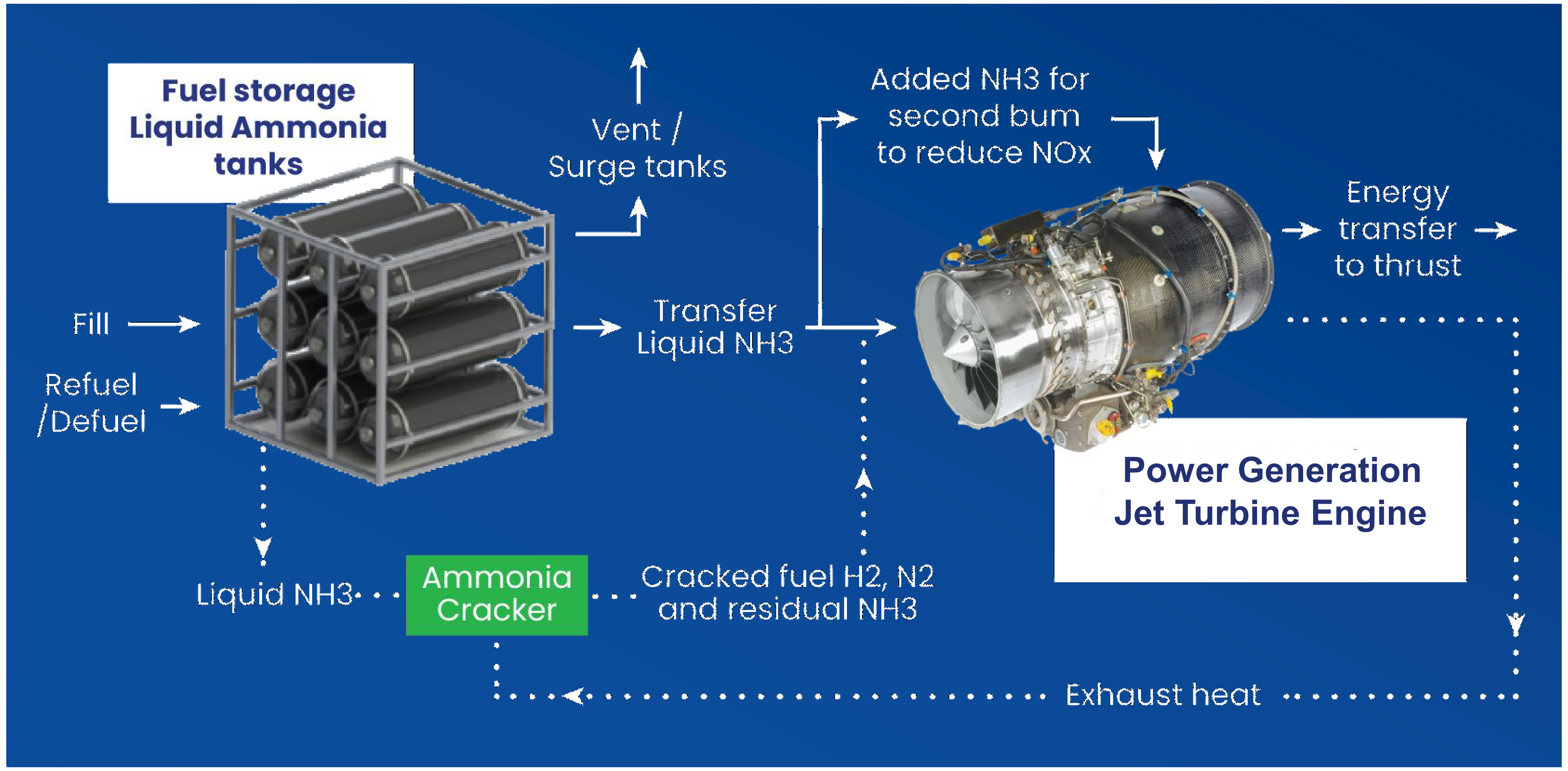
Liquid Ammonia to Turbofan Combustion

Gaseous Hydrogen to Fuel Cell to Radial Flux Motor

Solid substrate storage to Turbogen to Axial Flux Motor

Liquid Hydrogen to Turbogen to Hybrid Flux Motor

The results showed "Liquid Ammonia to Turbofan combustion" was the best avenue to carbon-free flight as it outperformed the others in fuel selection/storage, power generation, thrust generation and weight capacity.



Evaluating Technologies

Technology and project risks:

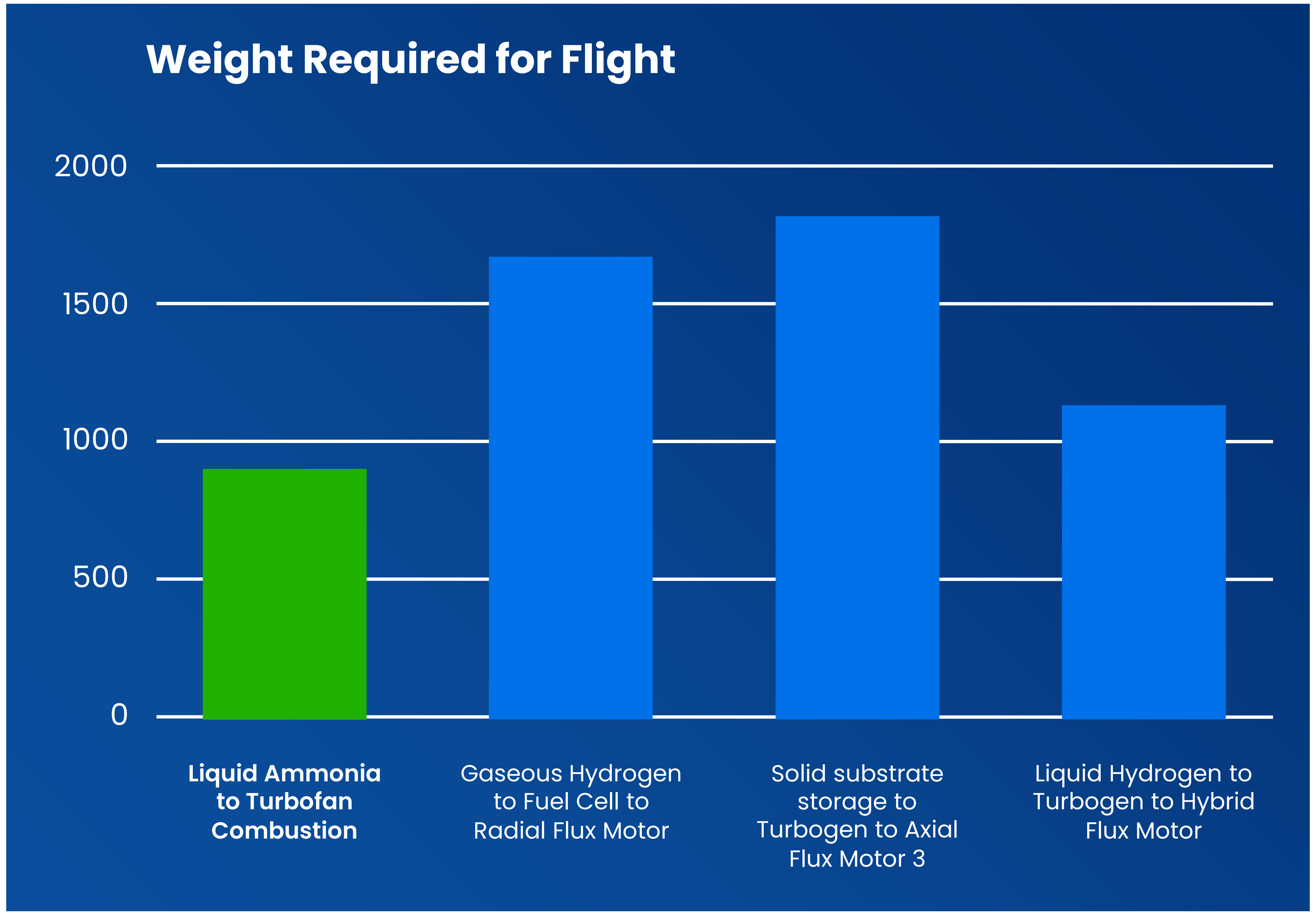
- Design novelty, outcomes and cost uncertainties.

Modification weight and cost:

- With reference to the one-hour flight profile.

Fuel storage and infrastructure:

- Mass and volume.
- Storage on-board and infrastructure required in industry and airports.



Benefits of NH3

Hydrogen has incredibly low density creating:

- On-board volume challenge as the mass of hydrogen in litre of NH_3 is more than the mass of hydrogen in litre of liquid H_2.

Ammonia production needs scaling rather than the development of a new technology:

- Similar to Liquid Petroleum Gas.
- Easier to roll out, especially to remote airports.
- On-board tanks can still be shaped other than as a cylinder by using modern pressure tank technologies.
- The on-board ammonia can be used to break down NO_x pollutants created by the combustion process.

AVIATION H2

Any Questions?

Email: hello@aviationh2.com.au
Website: aviationh2.com.au/

Media Contact
Angus Kennelly
Director of Communications
Email: angus@lecapital.com.au