

## CASE STUDY



## Fuel Cell Systems – EMEC HyFlyer Refuelling Project

### CUSTOMER

EMEC

### LOCATION

Orkney, Scotland

### CUSTOMER REQUIREMENT

EMEC required a mobile refuelling platform to refuel ZeroAvia's aircraft on site.

### HYDRASUN SOLUTION

A 340 bar, mobile refuelling system capable of dispensing 20kg of hydrogen per day into a hydrogen fuel cell plane.

### BENEFITS

- H2 Refueller in 7.5 tonne trucks
- Bulk H2 Compression and Storage
- Transportable H2 from low pressure source to H2 vehicle
- ADR approval for 500 bar H2 transport
- High pressure compression at destination for 700 bar refuelling
- Highly flexible and mobile solution
- Responsive delivery lead time with short-term flexible solutions
- Significantly lower capital cost than a static station





## BACKGROUND

The HyFlyer project aims to decarbonise medium range small passenger aircraft by demonstrating powertrain technology to replace conventional piston engines in propeller aircraft. The conventional powertrain in the aircraft will be replaced with electric motors, hydrogen fuel cells and gas storage. The aircraft will perform initial test flights out of Cranfield and culminate in a 250 - 300 nautical mile (NM) A - B demonstration flight.

## CUSTOMER REQUIREMENT

The project is led by ZeroAvia, developers of hydrogen fuel cell powertrain solutions. Project partners Intelligent Energy optimised its high-power fuel cell technology for application in aviation whilst EMEC Hydrogen, producers of green hydrogen from renewable energy, were responsible for the supply of the hydrogen required for flight tests and demonstrations. FCSL were awarded the scope in 2019 to provide hydrogen refuelling services, taking hydrogen from the local source over to the plane and dispensing safely.

## FUEL CELL SYSTEMS LTD'S SOLUTION

The hydrogen refuelling solution, delivered by Fuel Cell Systems Ltd (FCSL), is a mobile solution consisting of a re-deployable modular electrolyser, trailer mounted air compressor and a first of its kind ADR-certified 350 bar refuelling truck.

Despite the global pandemic, the truck was built and delivered only a few months behind schedule. FCSL were also able to offer an interim solution of the FCSL HyTruck to ensure no impact to the project downtime. The HyFlyer HyTruck 350 was based on the original FCSL HyTruck design but with modified storage consisting of 12x 150L 500 bar cylinders. A key achievement in the project was gaining ADR approvals for the refuelling system allowing it to transport hydrogen on the road. The truck was delivered to site with full project document packs and handover guidance, manuals and training. ZeroAvia team were also able to refuel their Toyota Mirai on-site via our mobile refuelling solution.

The project was delivered in compliance with all relevant legislative and regulatory processes and controls but in place to control risk in an aviation environment. FCSL also participated in the HazOP / HazID workshops held between EMEC, ZeroAvia, Cranfield Airport Fire and Safety, and the Civil Aviation Authority. FCSL were able to share their knowledge of refuelling equipment, and their deep knowledge and experience of hydrogen refuelling operations in the field.

FCSL were later asked to integrate a small-scale electrolyser system into a 10ft shipping container to connect directly to the HyTruck, allowing the truck to use the onboard boosters to automatically fill directly from the electrolyser buffer tank. Initially, four electrolyser modules were sourced to produce just 4kg per day which were later upgraded to 10 modules producing 10kg per day. This upgrade was done with minimal downtime, managing most of the build offsite.

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