Lighter Hydrogen Tanks Promise Longer Range

Startup HyPoint has partnered with an aerospace R&D company to combine its high-power-density fuel cells with lightweight liquid-hydrogen tanks to offer manufacturers the ability to carry more hydrogen for greater range.

HyPoint is developing turbo air-cooled hydrogen fuel cells for zero-emission aircraft propulsion. Now the company has partnered with Gloyer-Taylor Laboratories (GTL), which is developing carbon-composite cryotanks that allow more liquid hydrogen (LH_2) to be stored with lower weight.

The ratio of the mass of fuel carried to the mass of the tank system when full is called the gravimetric index (GI). A May 2020 report on hydrogen-powered aviation by Europe's Clean Sky and Fuel Cells and Hydrogen Joint Undertakings said the latest concepts for commuter-aircraft LH_2 tanks have a GI of 20%, adding that an index of 35% needs to be reached for short-range aircraft and 38% for long-range aircraft.

According to California-based HyPoint, a 2.4-m-long (7.9-ft.), 1.2-m-dia. cryotank developed by GTL that is able to hold more than 150 kg (330 lb.) of LH_2 weighs 67 kg including the composite tank, skirt and vacuum dewar shell. This equates to a GI of almost 70%. The tank has been demonstrated to be leak-tight after repeated cryo-thermal pressure cycles and is at technology readiness level 6, HyPoint says.

Both the inner tank and outer dewar shell use GTL's blended hybrid laminate (BHL) composite technology, which was developed to prevent leaks in cryogenic applications and uses a combination of proprietary material and manufacturing processes that have been demonstrated for DARPA and NASA.

"An aircraft equipped with GTL's dewar tank technology could achieve as much as four times the range of a conventional aircraft using aviation fuel," HyPoint says. An analysis conducted by the startup concluded that a De Havilland Canada Dash 8-300 regional turboprop converted to fuel-cell propulsion would have a maximum range of 4,488 km (2,425 nm) with GTL's BHL tank, compared with 2,640 km for an LH_2 tank built on conventional technology and a baseline 1,558 km with kerosene fuel.

Designed to contain more than 150 kg of liquid hydrogen, GTL's carbon-tank weighs 67 kg.

"That's the difference between this plane going from New York to Chicago with high carbon emissions versus New York to San Francisco with zero carbon emissions," says Sergey Shubenkov co-founder and head of R&D at HyPoint. The analysis was based on HyPoint's next-generation 3-kW/kg fuel-cell system.

GTL also is developing hydrogen storage system assemblies that will deliver warm gaseous hydrogen to fuel cells from its ultra-lightweight LH_2 cryotanks. These systems use BHL composite tubing that is four times lighter than conventional tubing, with 1/10th the thermal mass, HyPoint says.