



Game Changing Development Program Office

# Composite Cryotank Technologies & Demonstration



*NASA has completed a complex series of tests on one of the largest composite cryogenic fuel tanks ever manufactured, bringing the aerospace industry much closer to designing, building, and flying lightweight, composite tanks on rockets.*

The primary objective of the Composite Cryotank Technologies and Demonstration (CCTD) project was to mature the technology readiness of composite cryogenic propellant tanks at diameters that are suitable for future heavy lift vehicles and other in-space applications. The success of this project could lead to rocket propellant tanks that are more than 30 percent lighter and 25 percent lower in cost to manufacture compared to the current state-of-the-art metallic tanks. Such advancements offer less cost for payload delivery to orbit and the potential of enabling advanced human and robotic space exploration missions.

## 2.4 Meter Tank



*A robotic arm applies composite laminate (Cytec CYCOM® 5320-1 pre-preg) to the tank at Boeing's Development Center in Washington.*

## 5.5 Meter Tank (18-foot-diameter)



*5.5m tank arrives at MSFC for testing*

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## 2.4m Tank Test Summary

On June 25, 2013 at NASA MSFC, the 2.4m diameter all-composite cryogenic tank was successfully pressure tested. The test met all requirements: stepwise fill with liquid hydrogen (-423°F) to 90% volume capacity followed by pressurizing the tank to 135 psig. The 2.4m tank was then cycled through 20 pressure/vent cycles, measuring hydrogen gas permeation on the tank dome.

“The composite tank project is giving us a great deal of experience and improved confidence and therefore is changing the way we look at composites for spacecraft applications,” said John Vickers, the project manager for CCTD.

## 5.5m Tank Test Summary

NASA's Super Guppy, a wide-bodied cargo aircraft, landed at the Redstone Army Airfield near Huntsville, Ala. on March 26, 2014 and since then NASA has completed a demanding series of tests inside the test stand at MSFC. Engineers added structural loads to the tank to replicate the physical stresses launch vehicles experience during flight.

In other tests, the tank successfully maintained fuels at extremely low temperatures and operated at various pressures. Engineers filled the tank with almost 30,000 gallons of liquid hydrogen chilled to -423°F, and repeatedly cycled the pressure between 20 to 53 pounds per square inch -- the pressure limit set for the tests.

## More Information:

In September 2011, NASA awarded Boeing the contract to design, manufacture and test two lightweight composite cryogenic propellant tanks.

CCTD is an agency-wide effort with Marshall Space Flight Center (MSFC) leading project management, manufacturing & test, Glenn Research Center (GRC) leading the materials, and Langley Research Center (LaRC) leading structures effort for this project. Significant contributions from LaRC & GRC loads/stress personnel contributed to the understanding of thermal/mechanical strain response while undergoing testing at cryogenic temperatures. The project finalized in August 2014.

### Website Links:

Project Website:

- <https://gcd.larc.nasa.gov/projects/composite-cryogenic-propellant-tank/>

Press Releases:

- <http://www.nasa.gov/press/2014/august/nasa-completes-successful-battery-of-tests-on-composite-cryotank/>

Video:

- [https://www.youtube.com/watch?v=IRutJfOsgII&feature=youtube\\_gdata](https://www.youtube.com/watch?v=IRutJfOsgII&feature=youtube_gdata)
- [http://www.boeing.com/boeing/Features/2014/03/corp\\_fuel\\_tanks\\_03\\_18\\_14.page](http://www.boeing.com/boeing/Features/2014/03/corp_fuel_tanks_03_18_14.page)

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