National Aeronautics and Space Administration

Power Generation and Storage

Cryogenic Flux Capacitor

A Device for Solid-State Storage and On-Demand Distribution of Cryogenic Fluid Commodities

NASA's Kennedy Space Center (KSC) seeks to license its Cryogenic Flux Capacitor (CFC). This new technology capitalizes on the energy storage capacity of liquefied gasses. By exploiting a unique attribute of nano-porous materials, aerogel in this case, fluid commodities such as oxygen, hydrogen, methane, etc. can be stored in a molecular surface-adsorbed state. This cryogenic fluid can be stored at low to moderate pressure densities, on par with liquid, and then quickly converted to a gas, when the need arises. This solution reduces both safety related logistics issues and the limitations of complex storage systems. Currently, high pressured gasses are stored in vessels with heavy thick walls that require constant pressurization and complex storage systems to limit boil-off. These systems are not well suited to overly dynamic situations where the tank orientation can change suddenly. NASA's CFC address all of the aforementioned issues, simplifying current operations and opening the possibilities for new applications and new markets from cryogenic liquid.

BENEFITS

- Compact fuel storage
- Light weight
- Low to moderate storage pressures
- Fast charge-up times
- On-demand, fast discharges

APPLICATIONS

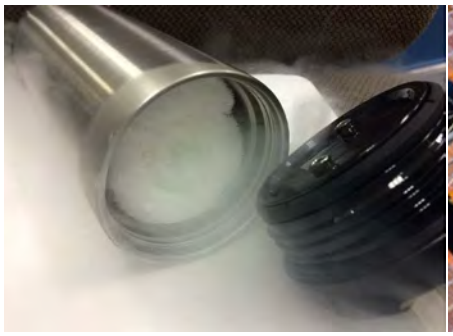
- Spacecraft
- Cubesats
- Aircraft
- Transportation
- Fuel Cells
- Medical

technology solution

THE TECHNOLOGY

Storage and transfer of fluid commodities such as oxygen, hydrogen, natural gas, nitrogen, argon, etc. is an absolute necessity in virtually every industry on Earth. These fluids are typically contained in one of two ways; as low pressure, cryogenic liquids, or as a high pressure gases. Energy storage is not useful unless the energy can be practically obtained ("un-stored") as needed. Here the goal is to store as many fluid molecules as possible in the smallest, lightest weight volume possible; and to supply ("un-store") those molecules on demand as needed in the end-use application. The CFC concept addresses this dual storage/usage problem with an elegant charging/discharging design approach.

The CFC's packaging is ingeniously designed, tightly packing aerogel composite materials withing a container allows for a greater amount of storage media to be packed densely and strategically. An integrated conductive membrane also acts as a highly effective heat exchanger that easily distributes heat through the entire container to discharge the CFC quickly, it can also be interfaced to a cooling source for convenient system charging; this feature also allows the fluid to easily saturate the container for fast charging. Additionally, the unit can be charged either with cryogenic liquid or from an ambient temperature gas supply, depending on the desired manner of refrigeration. Finally, the heater integration system offers two promising methods, both of which have been fabricated and tested, to evenly distribute heat throughout the entire core, both axially and radially.



Cryo-Flux Capacitor

Cube Sats

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

Kurt Kessel

Kennedy Space Center

MS LASSO-012
Kennedy Space Center, Fl 32899
(321) 867-8480
kurt.r.kessel@nasa.gov

http://technology.nasa.gov/

www.nasa.gov

NP-2015-02-1355-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

KSC-14075
KSC-TOPS-62