

## Cryogenic Rated Composite Material Significantly Improves Functionality of Liquid Air Life Support System

The National Aeronautics and Space Administration (NASA) has been developing the next generation of life support systems in conjunction with CryoLife Support Systems (CLSS) in Titusville, FL. This improved design by CLSS features a novel pickup of the liquid air that allows air to be supplied even when the pack is 90° off vertical. This feature greatly increases the safety and functionality of this system for terrestrial applications such as firefighting and other first responders.

### Problem & Solution

CLSS approached Norplex-Micarta to address issues with excessive heat leakage into the cryogenic liquid air from several metal components. While CLSS has many options for insulation systems, the materials available that had the mechanical strength required, and a low thermal conductivity were limited.

Norplex-Micarta proposed two CryoLAM™ materials, NP500CR and RT521M for this application. These materials have been proven in cryogenic applications in space, oil and gas, laboratory, and processing industries for several decades. Adapting them to this environment required overcoming some size limitations and supporting the design work with detailed mechanical and thermal data at cryogenic temperatures.

### Validation Process

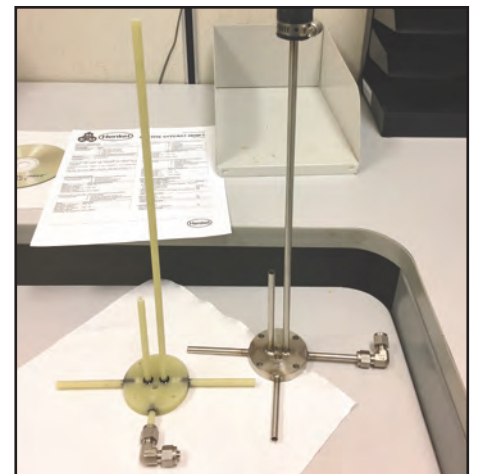
While the final configuration and approval of this improved device is ongoing, initial testing shows that frost only formed at the areas of active flow, while the remainder of the flange was at ambient. In addition, preliminary test results indicate that the boiloff rate has been reduced by roughly 50% – exactly the result that was expected and confirmation of good thermal properties.

**“The Norplex-Micarta materials performed very well, reducing our heat leakage by about 50%. In addition, the material was much easier to work with than Stainless Steel allowing us to manufacture parts in-house with common tooling. This solution will significantly reduce the heat leakage into our packs. This will keep the pressures lower in the pack, increasing standby time, and reducing boil off losses, which ultimately increases the time a user has in the hostile environment.”**

– David Bush, Engineer,  
 NASA Kennedy Space Center



Firefighters testing liquid air pack vs. standard SCBA - Photo courtesy of CLSS



Original steel design with prototype composite design - Photo courtesy of NASA



Steel assembly in test



Composite assembly in test

- Photos courtesy of NASA

## CryoLAM™ Composite Materials for a range of cryogenic devices and applications



CryoLAM™ materials are specified in many demanding applications such as pipeline gaskets and pipe shoe supports. NP500CR is widely used in the LNG industry for pipe and storage applications (both stationary, over-the-road tanks, and shipboard bunkering) as well as insulator blocks for ladders, walkways and scaffolding where dangerous icing can occur. Furthermore, this material is used in engine rooms of LNG-powered ships.

NASA and other aerospace designers and manufactures choose CryoLAM™ since these materials maintain strength in extreme cold and are unaffected by vacuum, a critical property for components used in outer space. In addition to performing in the cold of space, CryoLAM materials have the shear, tensile, and compressive strength necessary at elevated temperatures to withstand the stresses created during the launch of the spacecraft.



CryoLAM™ materials in sheet and tube form are used in various medical and scientific devices where storage or transportation of cryogenic liquids and specimens is required. These materials are used as tank supports, dewar neck tubes, and in vacuum insulated tanks and equipment. In critical storage applications, CryoLAM™ materials can be engineered with vapor barriers to essentially eliminate the permeability of low molecular weight materials.

## CryoLAM™ materials are used because they are:

### Insulators

While CryoLAM™ materials are as strong as steel, they are both thermal and electrical insulators. Thermal and electrical data is available.

### Structurally Strong

CryoLAM™ materials are specially formulated to provide excellent strength and stiffness across a wide range of temperatures.

### Low Moisture Absorption and Low Out Gassing

Low moisture absorption makes them ideal for thermal cycling, while low outgassing allows for use in vacuum environments.