

CTD

CryoCoat™ UltraLight™ Insulation

presented by:

Michael L. Tupper

COMPOSITE TECHNOLOGY DEVELOPMENT INC.

1505 Coal Creek Drive

Lafayette, Colorado 80026

January 2001

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The Innovation of UltraLight™

- *UltraLight™* is a high integrity, low density material...

that is not a foam!

- Mechanical integrity of a syntactic foam
- density & thermal conductivity of a chemically expanded foam
- Material lighter than 5 PCF has been fabricated
- Meet the requirements for insulating the space shuttle external tank

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The Systems Approach

- Layered, Cryogenic Insulation System
- Incorporates CTD's expertise:

Adhesives

Thermal Insulation

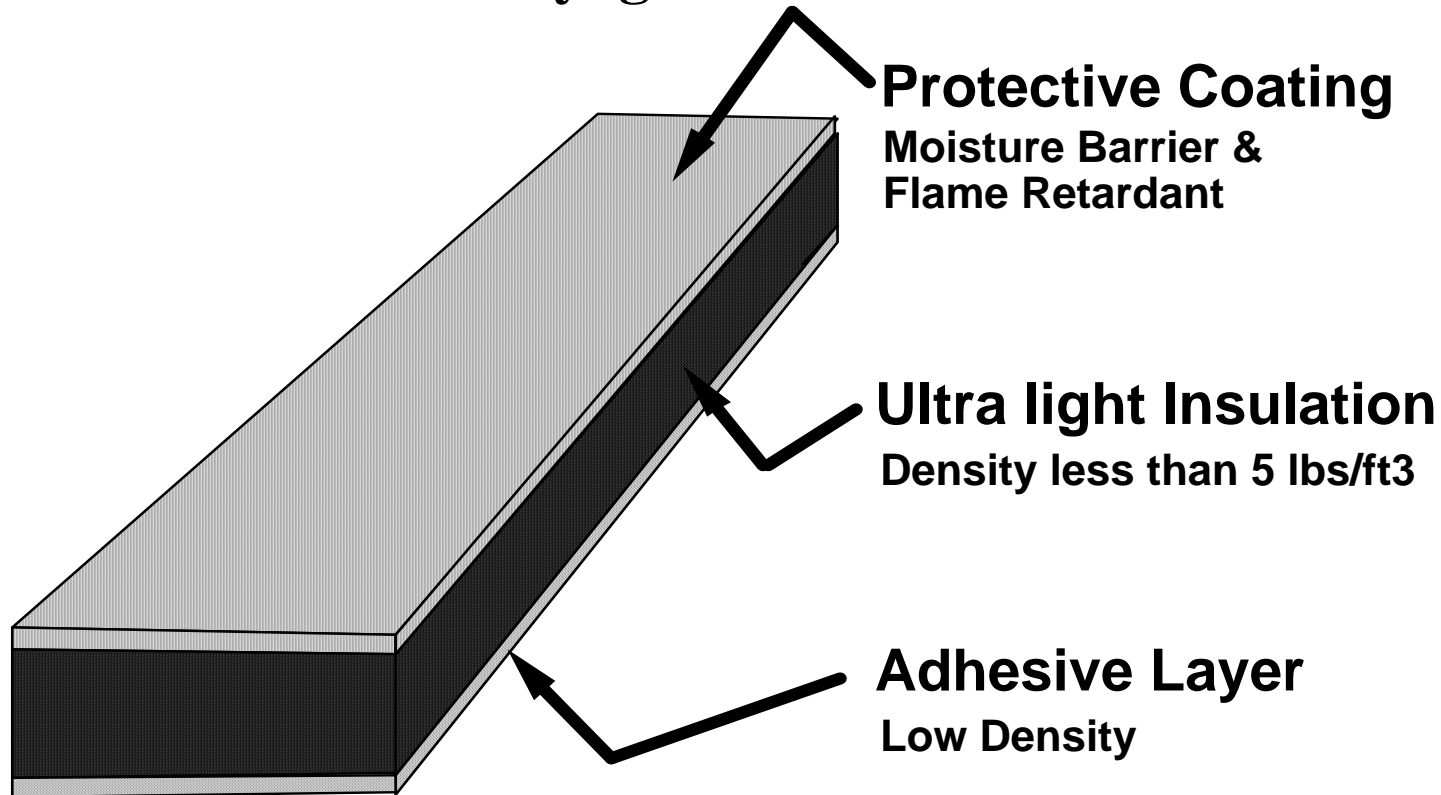
Protective Coatings

- Each layer can be optimized
 - gives best system performance

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CryoCoatTM UltraLightTM

Cryogenic Insulation



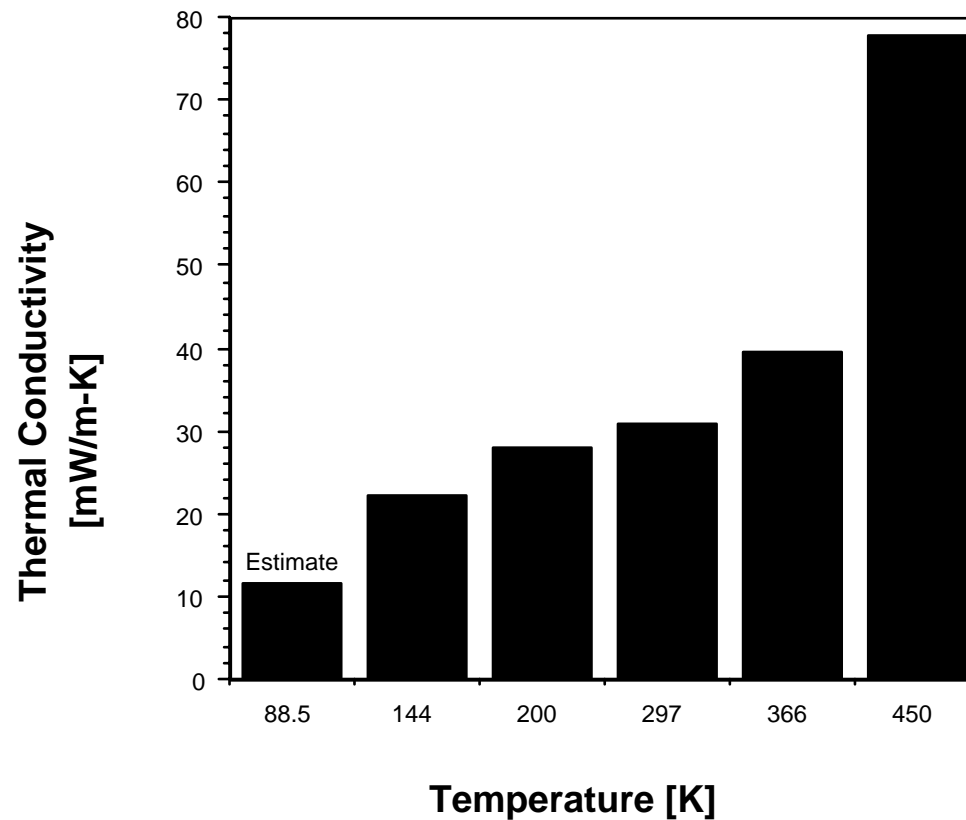
Advantages

- Light weight
- Dimensional stability
- Easily machined or modified
- Field repairable
- Consistent manufacturing process
- Easy to apply
- Tailorable properties
- Low cost



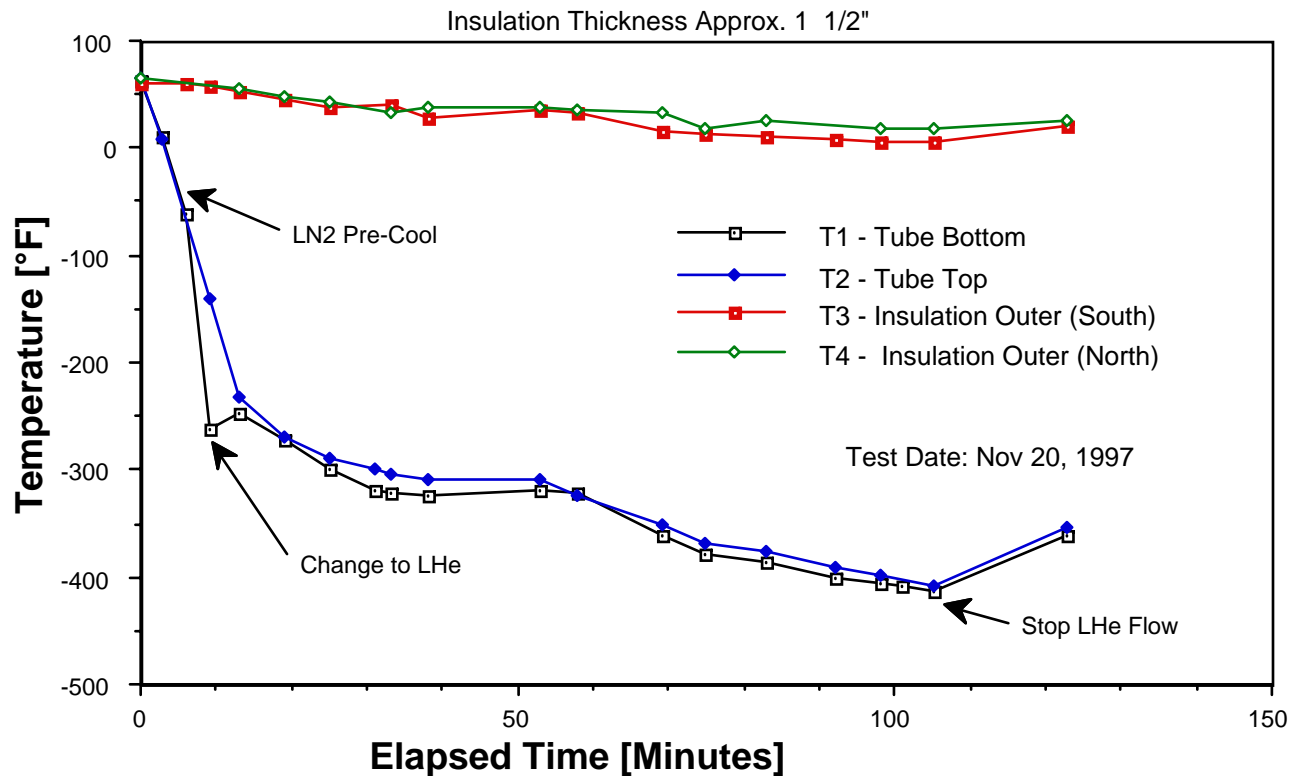
Thermal Conductivity Range

**Thermal Conductivity:
CTD UltraLight™ UL31xx**



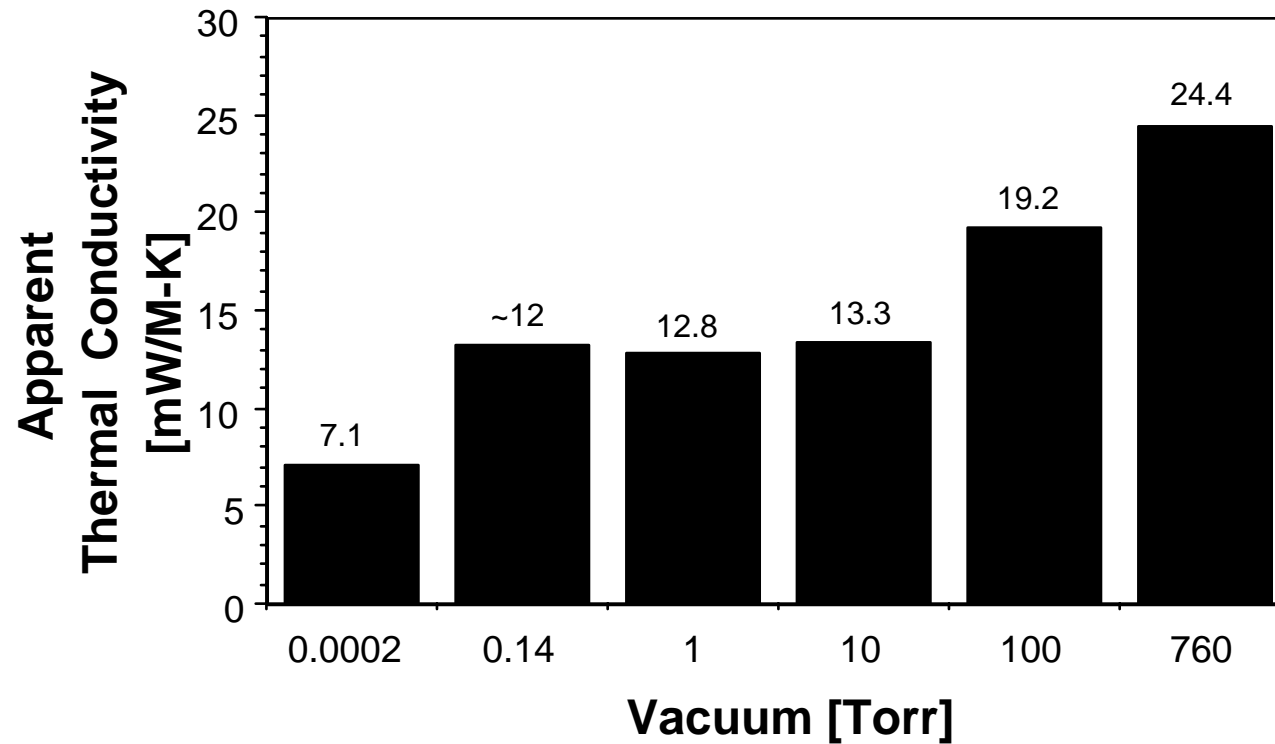
Helium Flow Test

Thermal Time History for Approximately 1 1/2" of Cryocoat™ UltraLight™ UL79 insulation on 4" Diameter Inconel Tube

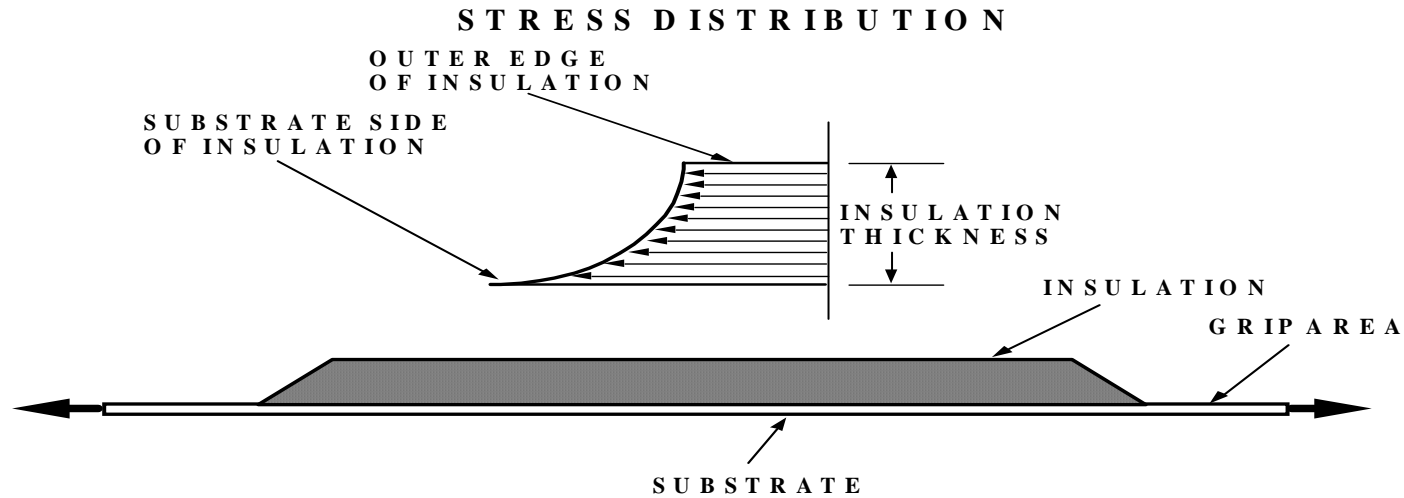


Apparent Thermal Conductivity UL79

between liquid nitrogen and room temperature
as a function of vacuum pressure
preliminary data from NASA Kennedy



Tensile Cryoflex Data



<u>Substrate</u>	<u>Temperature</u> <u>[K (°F)]</u>	<u>Maximum</u> <u>Substrate</u> <u>Strain [με]</u>	<u>Comments</u>
Aluminum	77 (-320)	>10,000	Substrate Yielded
Aluminum	4 (-454)	9,000	No Failure
Carbon Composite	77 (-320)	>6500	Insulation Cracking
Carbon Composite	4 (-454)	~5000	Insulation Cracking

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Tension Test Results

Material at	# of Specimens LN2 Temp	Strength (psi)	Modulus (Ksi)	Strain to Failure (microstrain)
CryoCoat™ 620T	2	4,111	1,093	3,800
PW 28	2	2,080	548	3,800
PW 30	1	520	338	1,600
PW31	3	1,585	308	4,500
UL79	2	111	8	12,000
at	Room	Temp.		
PW31	3	195	14	26,000
UL79	1	92	7	17,000

Moisture Barrier Coating

85% Relative Humidity at Room Temperature

