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M3Or1C-03: [Invited] Benefits of Alternate Cryogenic Fuels for Logistics and Thermal Management of Aerospace Transportation

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Alternate families of propulsion fuels such as hydrogen, hydrocarbons (methane, ethane, propane, butane, etc.), alcohols of hydrocarbons (methanol, ethanol, propanol, other), natural gas, biofuels, and other, are increasingly being considered for transportation industries and applications, including aerospace and rocket propulsion. And the cryo-cooled versions of these fuels are also increasingly being studied for transportation, since their higher volume densities critically affect cost, viability and performance benefits. The use of liquified-natural-gas (LNG) or bio-LNG has strong benefits for transportation, including much higher energy-per-mass, lower average cost, very high domestic reserves, and broadly located production and distribution piping networks.

This talk will be present about general properties and benefits of families of cryofuels for logistics and thermal-management, focusing mostly on aerospace applications. Relatively unknown fuels and properties will be presented, such as liquid mixtures that have much lower liquid freezing points $\sim 60\text{K}$, that can enable significantly higher power density and more efficient cryogenic power electronics using ultra-pure metals and superconductors. Cryofuels also have important system benefits to provide much larger cooling capacities, which will be important to address the increasingly larger and low-temperature thermal loads resulting from increasing electrification of propulsion.

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