Gas Generators and Their Potential to Support Human-Scale HIADs

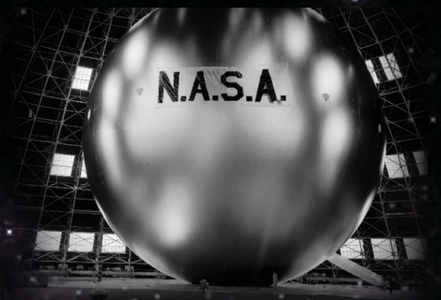
(Hypersonic Inflatable Aerodynamic Decelerators)

National Aeronautics and Space Administration

NASA

Introduction

As HIAD technology progresses from 3-m diameter experimental scale to as large as 20-m diameter for human Mars entry, the mass penalties of carrying compressed gas has led the HIAD team to research current state-of-the-art gas generator approaches. Summarized below are several technologies identified in this survey, along with some of the pros and cons with respect to supporting large-scale HIAD applications.

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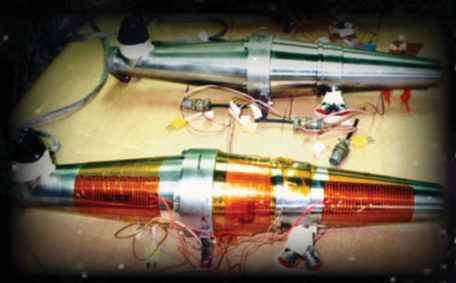


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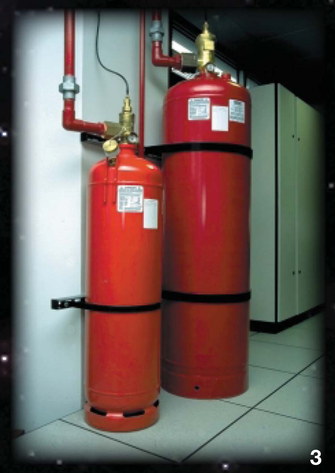
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	Sublimating Powders/Crystals	Hybrid Gas Generators	Solid Gas Generators	Metal Hydride/ Membrane Storage	Re-purposing of Fluids
Pros	• Used as far back as Echo-1 (1960) • Minimum support infrastructure • Fairly light weight	• Storing gas as a liquid increases storage density • Used to inflate some aircraft escape slides	• Several gases available • Tailorable output temperature • No pressure during transit	• No/low pressure during transit • Scaling of the chemistry is well understood • Release can be electrical or chemical initiated	• Some chemicals endothermic (reduce insulation) • Known technology
Cons	• High inflation pressure of the HIAD leads to difficult solutions • Slow sublimation limits failure mode protection • Potential for early deployment due to packing irregularities	• Risk of introducing liquid into inflatable • Still carrying pressurized components • Pressure vessel increases mass	• Concern about grain cracking as size increases • Still have pressure vessel during deployment	• Gas Temperature near system limits • Manufacture challenges with the hydrides (industrial scale)	• Risk of induced liquid into inflatable • Still carrying pressurized components • Pressure vessel increases mass

HIAD
Hypersonic Inflatable Aerodynamic Decelerator

1. Moore, Ron. "Re: Cut-Away Stored Gas Inflator." Web log comment. Fire House. Ron Moore, 12 Apr. 2003. Web. 7 June 2016. <http://www.firehouse.com/forums/t47854/>. .
2. Small metal hydride storage unit at SRNL, USA.
3. Kauffman Co. “FM-200 Fire Suppression Services.” FM-200 Fire Suppression Services. Kauffman CO/ Blue Corona, 2016. Web. 16 May 2016. <http://www.kauffmanco.net/fire-suppression-systems/fm-200>.