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**Modular Manufacturing of Honeycomb-Reinforced Charring Ablator
Systems for the Aeroshells of Large EDL Vehicles**

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Polymer-based charring ablator heatshields are made more robust by the use of honeycomb (HC) reinforcement. For large EDL vehicles of 3.5-m and greater (and especially for the massive HMMES vehicles planned for manned exploration of Mars), production by direct HC packing on vehicle aeroshells poses numerous and significant challenges. These challenges are greatly reduced by the use of modular manufacturing where pre-packed and precision-milled ablator units are secondarily bonding to vehicle structures. Producibility is enhanced, costs are lowered, and common manufacturing risks are eliminated. This paper discusses modular manufacturing techniques for EDL heatshields developed at the Ablatives Laboratory over the past four years of technical effort. Multiple modular units were produced and evaluated and the real benefits of this manufacturing approach will be discussed.