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## Paper Session II-B - NASA's Heavy-Lift Cargo Launch Vehicle Needs and Options for the Post 2000 Period

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# NASA's Heavy-Lift Cargo Launch Vehicle Needs And Options For The Post-2000 Period

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## Abstract

Effective space exploration requires reliable transportation, a balance of good science, and a progressively expanding space infrastructure starting with the Space Station. Adequate, reliable, lower cost space transportation is a key to the nation's future in space. Primary in the critical near term, is making more effective use of the systems we have and evolving from them to provide affordable increased capability to support the projected needs.

The Space Shuttle will remain the primary manned access to space for many years and upgrades are planned to improve reliability, safety, and operational efficiencies. In addition, added flexibility is needed in transportation systems by the year 2000, including addition of heavy lift capability complementary to the Space Shuttle to assure delivery of Space Station transportation node hardware, lunar and planetary vehicles, and other key payloads. Turn-of-the-century requirements will establish a need for a new unmanned modular, low cost heavy-lift launch vehicle with perhaps new liquid boosters and new  $\text{LO}_2/\text{LH}_2$  engines for enhanced mission reliability, safety and flexibility.

Future unmanned transportation systems such as Shuttle derived vehicles (SDV), sidemounted and inline cargo carriers, and Advanced Launch Systems (ALS) are being studied. The Lunar/Mars missions will require a heavy-lift launch vehicle (HLLV) to keep the flight rates and orbital assembly to a minimum. NASA is currently analyzing derivative vehicles to establish the desired path for future unmanned launch vehicles.

This paper presents the HLLV requirements, architectures and concepts. The paper focuses on vehicle options and facility requirements/impacts associated with unmanned heavy-lift cargo vehicles needed to assure future missions can be achieved.