

NASA Advisory Council Recommendation

Heavy Lift Capability 2011-02-03 (EC-02)

Recommendation:

NASA should promptly start development of a new expendable main engine by a U.S. contractor that will supply sufficient power to support a 130 MT or a greater launch vehicle capability. This new engine must support a launch vehicle schedule consistent with the need of the 130 MT launch vehicle schedule.

Major Reasons for the Recommendation:

For the past 40 years, NASA has relied on the Space Shuttle Main Engines (SSME). Russia and other countries have developed main engines for their programs. New technologies and personnel resources as well as higher thrust main engine requirements are needed.

Consequences of No Action on the Recommendation:

The U.S. could potentially lose its leadership in space exploration.

NASA Response:

NASA concurs with the concern for the U.S. to remain a leader in propulsion capabilities. However, while NASA understands the desire for the development of a new expendable main engine at present, we recommend that development of the Space Launch System be based on liquid oxygen/liquid hydrogen propulsion core stage, upper stage, and main engines, taking the opportunity to gain efficiencies through synergies in manufacturing and systems in the core and upper stage. This key decision takes advantage of the existing knowledge base built from a 40-year investment in liquid oxygen/liquid hydrogen propulsion systems, expertise, experience, and supporting infrastructure. It is also in alignment with direction in the NASA Authorization Act of 2010. NASA will build off our experience in liquid oxygen/liquid hydrogen propulsion while implementing modern manufacturing approaches to reduce the production and operations costs. New manufacturing improvements have been incorporated into the new J-2X upper stage engine, and they continue to evolve. In parallel, NASA plans to conduct a full and open competition for the first-stage boosters that will open the field to consideration of new solid and liquid boosters that can further technologies through these developments.

While the current recommended architecture utilizes a liquid oxygen/liquid hydrogen propulsion system, the Agency is starting a new project in liquid oxygen/kerosene propulsion at the Marshall Space Flight Center under the Advanced Exploration Systems (AES) program. In FY12, it is funded at \$6.7M in full-cost accounting. The AES Liquid Propulsion Systems project is testing components from the AJ-26 engine that is produced by Aerojet for the Taurus II launch vehicle. The AJ-26 engine is a derivative of the Russian NK-33 engine. The

Enclosure

AES project will help to advance improved engine components and physics-based analytical models to predict engine performance. This work will also be an investment in regaining the knowledge base and expertise in liquid/kerosene, providing a more balanced understanding of propulsion technology among our engineering workforce.