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Executive Summary

Project Khonsu, named after the Egyptian god of the Moon and patron of travelers, is based on the AIAA's request for proposal for a Lunar Transportation System (LTS). The design satisfies the basic requirements, which comprise of a safe and affordable mission to get a crew of four members to the lunar surface and bring them back to Earth. The mission has to be launched at least once a year, starting no later than 2020. The safety of the crew, reliability and performance of the components, and the cost of the mission were the focus of this project and the major driving factors for the design of the LTS. The final LTS architecture satisfies these major requirements, while maintaining a design that is both flexible and applicable to a variety of mission objectives.

The mission is designed around a dual launch and a dual lunar transfer, with a rendezvous in the lunar orbit, and a single lunar landing. A single return trajectory and a ballistic reentry with a water landing will be utilized for the crew's safe return to the Earth. The mission timeline is designed to allow for a test launch and test missions before starting its full operation in the year 2018. Two separate vehicle combinations will be used. One will be the Cargo Transfer Mode (CaTM), carrying the lunar lander, the cargo and the return fuel. The second one will be the Crew Transfer Mode (CTM), carrying the crew, the Crew Transfer Vehicle (CTV), which is also the reentry capsule, and the Support Module (SM) containing consumables used en route to the moon. The CaTM will be launched first, and will utilize a Space Shuttle Derived Launch Vehicle (SDLV) due to its large mass of 147 mT. It will use a Weak Stability Boundary (WSB) trajectory which has a typical transfer time of 70-100 days with a lower ΔV than other transfer trajectories. The CTM, with a total mass of 56.5 mT, will be launched on a Delta IV Heavy-Launch derived vehicle once the CaTM reaches Low Lunar Orbit (LLO). It will take approximately 3 days on a free-return trajectory to get to the Moon. The two vehicles will rendezvous in the 100 km circular lunar orbit, and the crew will utilize the Lunar Operations Vehicle (LOV) to land on the moon. The CTV will be left in orbit. After 7 days of lunar operations, the crew will ascend to the LLO in the ascent vehicle, rendezvous with the CTV, and return to Earth on a direct return trajectory, also taking approximately 3 days. The estimated cost of the LTS is $93 billion.

This innovative approach allows greater mission flexibility and increased safety. The two transfer approach ensures all equipment necessary for lunar landing is in optimal condition before the crew is launched. This concept also allows for the ability to custom tailor each transfer for any particular mission needs. Thus, Project Khonsu provides the best solution for a safe and cost-effective lunar transport system.