

## Executive Summary

This report provides evidence that disproves the idea that an American-led human return to the Moon must cost taxpayers \$100 billion or more, and that a permanent base on the Moon must cost hundreds-of-billions-of-dollars.

NexGen assembled a team of former NASA executives and engineers to assess the economic and technical viability of an “Evolvable Lunar Architecture” (ELA) that leverages commercial capabilities and services already existing or likely to emerge in the near-term. This study’s primary purpose is to assess the economic feasibility and technical viability of new partnership approaches for achieving our national goals in space. This is a limited study that evaluated one architectural approach for a commercial return to the Moon. We did not evaluate all alternatives for returning to the Moon, nor using the same methods for alternative destinations.

The ELA concept is designed to be an incremental, low-cost and low-risk method for returning humans to the Moon in support of NASA’s long-term plan to send humans to Mars. The ELA strategic objective is the commercial mining of propellant from lunar poles for transport to lunar orbit for future NASA missions to send humans to Mars. The study assumes that A) the United States is willing to lead an international partnership of countries that leverages private industry capabilities, B) broad adoption of public-private-partnership models proven in recent years by NASA and other government agencies, and C) NASA would not receive any increase in funding.

Based on these assumptions, NexGen’s analysis concludes that by using an Evolvable Lunar Architecture that leverages innovative commercial and international partnerships:

- America could return humans to the surface of the Moon within 5-7 years of authority to proceed within NASA’s existing human spaceflight budget, at a cost of about \$5 Billion (+/- 20%) for each commercial service provider by using commercial partnership methods.
- America could develop a permanent base on the Moon of 4 astronauts about 10-12 years after first setting foot on the Moon, that provides 200 MT of propellant per year in lunar orbit for NASA, again within NASA’s existing deep space human spaceflight budget and for a total cost of about \$40 Billion (+/- 20%).
- A commercial lunar base providing propellant in lunar orbit would reduce the cost to NASA of sending humans to Mars by as much as \$10 Billion per year. Such a commercial service would substantially reduce the cost and technical risk of using the Space Launch System (SLS) to send humans to Mars, by reducing the number of SLS launches required from as many as 12 to a total of 3.
- A permanent lunar base operated by commercial industry could substantially, if not completely, pay for itself by exporting propellant to lunar orbit for NASA to send humans to Mars.

An independent review team — led by Mr. Joe Rothenberg, former head of NASA human spaceflight — and composed of former NASA executives, former NASA astronauts, commercial space executives, and space policy experts — reviewed NexGen’s analysis and concluded that the NexGen team *“has done an excellent job in developing a conceptual architecture that will provide a starting point for trade studies to evaluate the architectural and design choices.”*