Background
This work details the design of a first-generation lunar base camp. The base was designed as a proof-of-concept to be part of NASA’s Artemis mission that will sustain a crew of four for a 45-day mission focused on prospecting in-situ resources and proving the viability of moon colonization.

Team organization included 5 essential areas: Mechanical, Operations, Electrical, Bioastronautics and Programatics. Members were drawn from 4 UCCS departments & PPCC’s Engineering Program.

The base location was chosen inside Shoemaker Crater at the lunar south pole (Fig. 1). This crater is a vast 62 miles at its maximum diameter, permanently shadowed, and has strong evidence of the presence of ice water.

There will be 5 launches using the Space X Falcon 9 and Super Heavy rockets (Fig. 2). Once each launch reaches the moon, Skyranches will be used to lower the payloads to the lunar surface. The crew will follow in 2031.

Base Camp Design
The base camp (Fig. 3) is shown as it would appear when the Artemis crew arrives for its mission. The base is designed with a lifetime of 150 years, is expandable, and is designed to support over a thousand missions.

The structure of the base consists of three modules: the habitat, a modular node designed for expanding the base in the future, and an airlock (Fig. 4).

The main habitat is designed as a two-floor hexagonal module with a skin-stringer aluminum frame and two connection points. The airlock will prevent the collection of lunar dust in the base.

The airlock (Fig. 5) is comprised of three stages from entry (F) to habitat (A). It is equipped with exosuit docking ports (B) and dust-repellant suit covers (E). The first stage uses a pressure gradient and EM pulses to pull dust out to the lunar surface and then dust covers are removed and stored (E). The second stage is where exosuits are stored in a garage (B). Finally entry to the habitat (A).

The Environment Control and Life Support System (ECLSS) uses an integrated system to recycle the habitat’s atmosphere and has low energy usage. Primary power comes from 6 radioisotope generators. Lithium-ion battery backup cells will be arrayed around the reactors.

Conclusion
This project approach was the development of a centralized working team with a web of sub-teams to thoroughly address each essential system necessary to support human life and exploration in-situ via support from a constructed lunar base by the year 2031. Key design components from a systems engineering approach including detailed trade studies with consideration of risk and cost in order to make the most reasonable choices to ensure project success and future expansion. Future work would focus on the integration of all the base systems, as well as, fine-tuning operating procedures and the effective adaptation of exterior base systems to the lunar environment.

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Table 1: Cost Summary

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