

42nd STUDENT CONFERENCE (E2)  
Student Team Competition (3)

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EXTRATERRESTRIAL OUTPOST (EXO): DESIGN AND IMPLEMENTATION OF A LONG-TERM  
SUSTAINABLE LUNAR HABITAT**Abstract**

The purpose of the Extraterrestrial Outpost (ExO) project is to address and resolve some of the challenges that currently limit lunar colony development. The design of a permanent lunar colony will have to include an economically stable and sustainable funding program, a detailed logistics plan on how to expand from a primitive outpost into a permanent 30-person habitat, and a strategy to incorporate enabling in-situ resource utilization (ISRU) technologies to reduce resupply demands of the base. It is important to note that these three issues are often coupled; more accurate cost estimates can be modeled by better defining the logistics plan and ISRU technology needs. To address the funding issues, a team of graduate students at the University of Colorado has conceived of a non-profit organization called Space Colony Developers (SCDev) that will manage the development, build-up, and operations of the lunar habitat. SCDev will work with NASA, international space agencies, and commercial companies to develop the first permanent sustainable lunar outpost. ExO will serve as the next international platform for space science research and a test bed for space colonization. The purpose of SCDev is to generate an economic incentive for commercial companies to invest in and develop new markets on the Moon. Creating an economically sustainable market will allow government space agencies to reduce their funding

contributions and spend more on future expansion into space. To create an accurate and viable business plan for SCDev, a detailed logistics plan for the development, build-up and operations of the habitat was analyzed. An important aspect of this study was to compare transitions from a 4-person to a 30-person habitat while balancing launch requirements and crew mission durations. The plan encompasses multiple build-up scenarios that allow for flexible funding profiles. A key element to developing a sustainable, permanent outpost is taking advantage of ISRU opportunities on the Moon. Determining the amount and type of resources that can be feasibly produced via ISRU are major stepping stones for confirming the commercial viability of a lunar outpost. A detailed analysis of large-scale ISRU production including the logistics of equipment delivery, production, storage, and transportation of ISRU products is addressed. By addressing these three major issues – funding, logistics, and ISRU – for lunar habitat development, a better understanding of the challenges can be established, thus enabling future programs to set more realistic and achievable goals.