

Developing the Space Workforce through LEAP2 and LCATS Industry Clusters and International Student Exchange

Samuel W. Ximenes and Louise L. Cantwell

WEX Foundation
email:info@wexfoundation.org

ABSTRACT

Industry clusters, considered the building blocks of modern economies is an economic concept used to identify and define the geospatial density, growth and network behavior associated with innovation and economic performance. Our research uses cluster analysis related to Space-STEM education and space-industry to identify aerospace system-sector industry clusters and factors on a global scale related to Lunar Site Technology Development. The goal is to document and encourage space-industry cluster network development, facilitating space-STEM workforce and economic development for communities, based on technologies relevant to particular community areas of interest and aerospace resources.

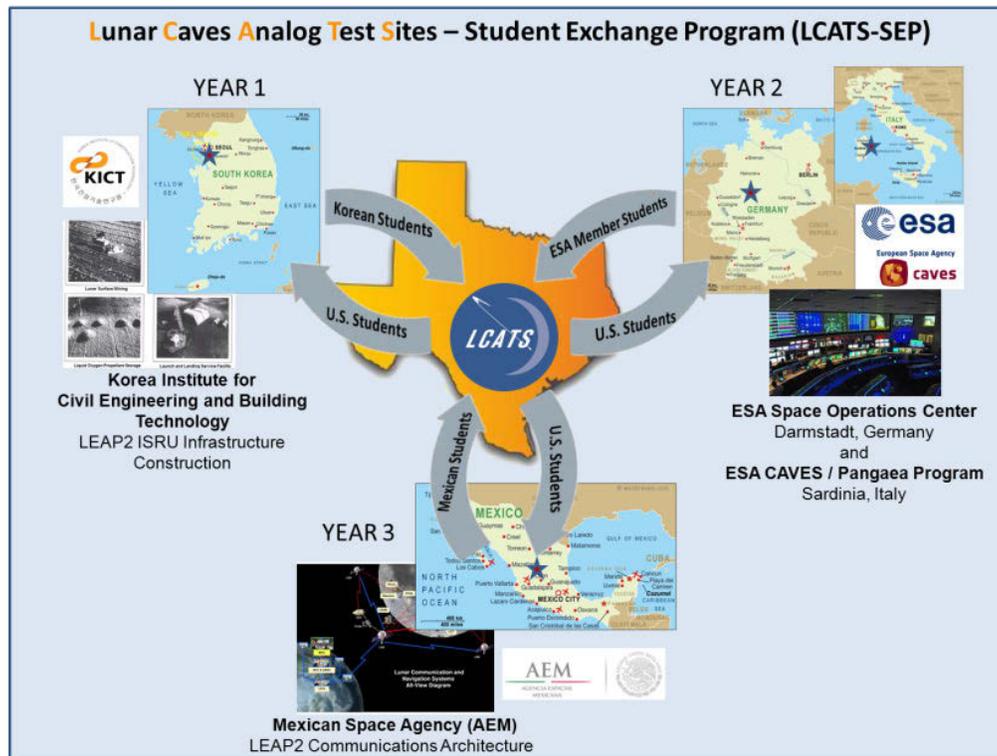
Initial cluster network participants identified for system-sector component technologies needed for lunar exploration architecture include: Satellite Communications (Mexico), Mission Operations (Germany and Italy), ISRU Vacuum Chamber Test Environment (Korea), and Lunar Ecosystem and Architectural Prototype development (United States). Program participation is underway through the LCATS and LEAP2 Global Space-STEM Education Network project, a Lunar Caves Analog Test Sites (LCATS) for Space-STEM learning performance, featuring a Lunar Ecosystem and Architectural Prototype (LEAP2) as a framework for technology development.

To expand the LCATS and LEAP2 initiative, our research seeks to identify, map, and analyze additional potential collaborating corporate, industry and governmental agency players representing other system-sector components needed for lunar site development. Aspects examined include local, regional, and international factors from the perspective of evolving a global space-STEM education network beneficial to the local community of the collaborating organization relevant to their expertise in system-sector component development. Expertise sought includes mining and energy generation; food and waste processing; water production for fuels; vehicles and equipment systems, and logistics, to name a few.

As a practical implementation of this effort, a Lunar Caves Analog Test Sites-Student Exchange Program (LCATS-SEP) is in development between current system-sector program participants. Anticipated types of program experiences and products for student exchange in this global network of LEAP2/LCATS Space-STEM communities include:

- Year 1 student summer program in Seoul, South Korea for In-Situ Resource Utilization (ISRU), testing excavation methods and 3D printed habitat technologies, robotics, and drilling.
- Year 2 student summer program in Europe, choice of mission control operations in Darmstadt, Germany or mission simulation and performance skills in cave environment in Sardinia, Italy.

- Year 3 student summer program in Mexico learning about satellite communications and lunar communication architectures.
- Years 1 – 3, international students from partner international organizations join US students in San Antonio, Texas, USA, for summer program to build CubeSat satellites which will be launched from the International Space Station.



Anticipated outcomes for student involvement include:

- Attitudes toward STEM and STEM careers
- Increase in knowledge & skills:
 - Space-STEM concepts/challenges
 - Robot programming/operation
 - Written & oral communication
 - Collaboration between teams and international participants
 - Critical thinking, problem-solving, creativity, & innovation

Space exploration and space science are typically international endeavors often involving multiple countries and international space agencies. Anticipated project goals, objectives, and intended outcomes for LCATS-SEP are to demonstrate to our students the value of international collaboration which is so prevalent in our industry for many space exploration missions. The understanding of space is a global concern, requiring multi-level international collaborations for optimal success. Through our project-based learning experiences we can help build a robust, multi-generational, international space workforce for the future. Collaboration between communities with international exchange programs can change students' lives by opening their eyes to different ways of doing things, and that the friendships students make abroad promote the cause of international cooperation and world peace.

KEYWORDS: STEM; STUDENT-EXCHANGE; SPACE-WORKFORCE