

**SPATIAL TOOLS FOR LUNAR DEVELOPMENT: IDENTIFICATION OF THE LATEST BODY OF WORK IN THE FIELD OF ARCHITECTURE.** R. A. Nava and C. A. De Leon, Geedop, LLC–Geospatial, PO Box 17864, El Paso, TX, 79917 (rnava@geedop.com).

**Introduction:** We are seeing increased levels of activity in Space exploration and settlement during the last few years, both in the public and private sectors. NASA’s Artemis program brings us closer to a sustained human presence on the Moon with its aim of landing a crew by 2024 [1]. Several private enterprises have shown improvements in flight and landing systems capabilities. The amount of time it will take to have in place sufficiently stable space exploration systems to allow for human settlement of the Moon keeps decreasing with each achieved milestone and each new entity joining the effort. The possibilities of living on the Moon and beyond are rapidly increasing and, therefore, the endeavor could benefit from contributions to the processes by which living space for humans on the Lunar surface is defined.

**Objective:** Our overall objective is to assist human Space exploration and settlement through the development of spatial tools based on Geographic Information Systems (GIS). Our current work focuses on a preliminary survey of the latest body of work in Lunar and Space Architecture to identify areas that may benefit from new software development.

We’ve compiled a list of publications categorized by entity doing the work, ordered by date, and labeled according to the subject matter being discussed. We expect to obtain the most relevant and up-to-date studies from organizations involved in Space Architecture, our “primary” focus. However, we also include labels for other “secondary” fields mentioned in each publication as to document the relationship of this secondary field to the primary field. Our compiled list thus far has produced the classification labels on Table 1.

**Approach:** The criteria we used to discriminate between publications included in the list and the rest of the material available to us from journals and other publishing entities were to 1) only include publications with content mainly related to the field of Architecture, and 2) the discussion within the publication be centered around prolonged human presence on the Moon. Additionally, 3) the list was only to include 50 publications as a starting point, and 4) gathered from freely accessible online sources.

**Rationale:** Although work in Space exploration is done through many disciplines and fields, such as materials, engineering, propulsion, energy, and others, we’ve focused on the field of Architecture because it is human centered, and because it considers stability and permanence of construction at its core [2]. These two defining characteristics of Architecture directly align

with the goal of “sustained human presence on the Lunar surface” established in the Artemis program [1]. Moreover, Architecture concerns itself with the “big picture” in terms of its design approach [3].

Topic	Label
Architecture	ARC
Urbanism	URB
Energy	ENE
Structural Engineering	STR
Safety	SAF
Navigation	NAV
Costs	COS
Habitability	HAB
Construction	CON
Vegetation	VEG
Psychology	PSY
Systems Engineering	SYE
In-Orbit Architecture	INO

**Table 1.** Classification labels assigned to each publication based on subject matter covered.

Human communities and structures on Earth are designed through interdisciplinary processes where the features of a building are determined by the environmental context it is constructed in, the materials it is constructed with, and the human interaction that defines its function. It is therefore not the product of a single profession, or a handful, but of the collaboration of many – from the planet to the region, to the individual; from the time of construction to the time of retirement, many professional fields are concerned with its successful realization.

**Outlook:** Spatial digital technologies can most likely fill the gaps between disciplines to provide a framework for inclusive Lunar settlement designs. GIS are at the forefront of this type of work for infrastructure developments here on Earth. It is with this preliminary investigation that we try to “orient” ourselves as an initial step toward understanding areas in Lunar settlement activities in which we can assist through the development of spatial tools that serve similar purposes as those on Earth.

**References:** [1] NASA’s *Lunar Exploration Program Overview* (2020) NP-2020-05-2853-HQ. [2] Akerman J. S. et al. (2021) *Encyclopedia Britannica*. [www.britannica.com/topic/architecture](http://www.britannica.com/topic/architecture) [3] Bannova O. and Bell L. (2011) *Acta Astronautica*, 69, 1143–1147.