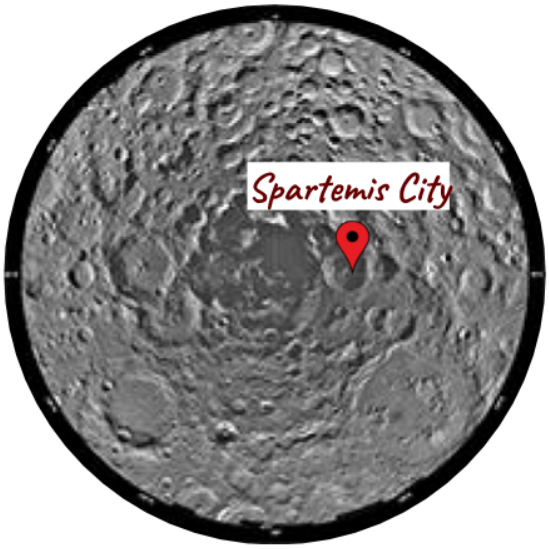
Spartemis City - A Lunar Print on History

City Overview



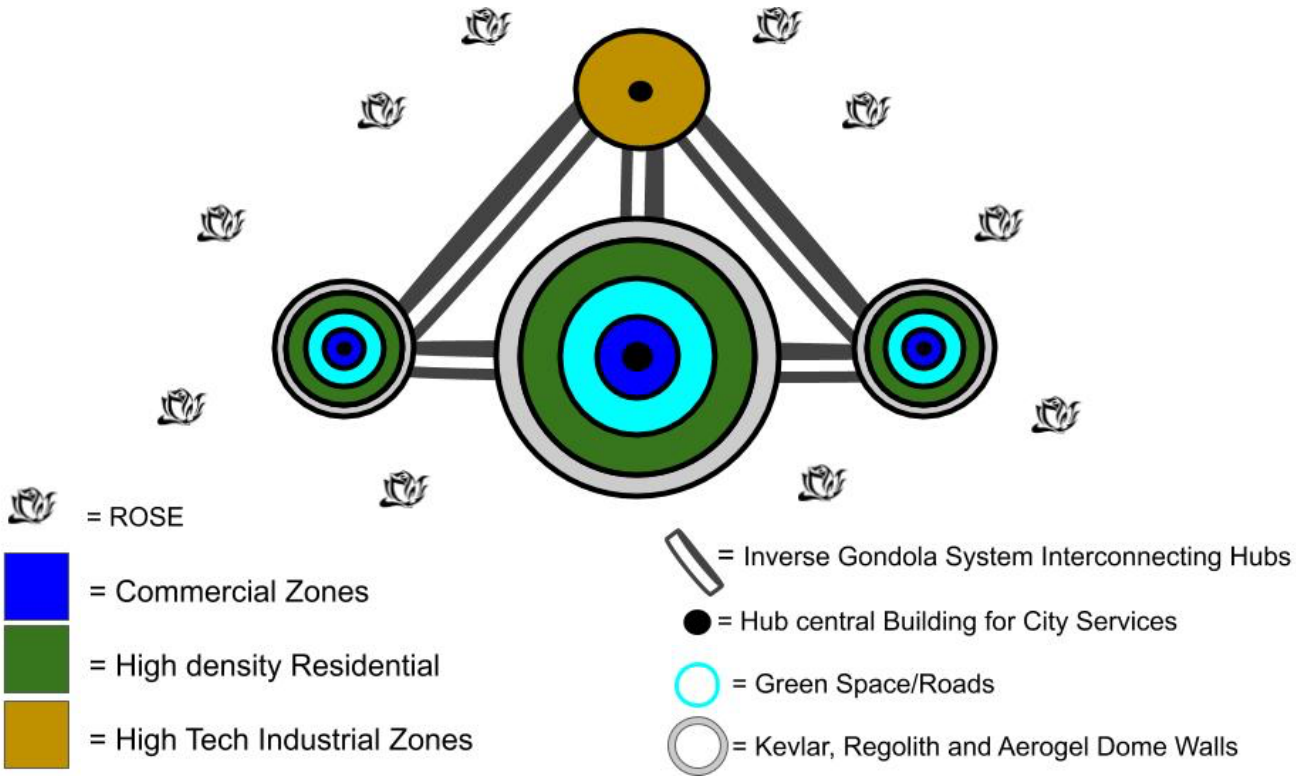
Northeast of the central mountains in Amundsen Crater at the lunar south pole, thriving Spartemis City combats the unforgiving features of Earth's moon. Spartemis City utilizes advanced technologies to create a unique self-sustaining lifestyle and environment for citizens. Abundant hydrogen deposits, multiple nearby Permanently Shadowed Regions (PSR's), and flat ground for expansion are a few geographic features of Spartemis' location. Regolith imports from bordering city stations are locally processed, extracting useful materials for technology manufacturing and 3-D printing of city infrastructure. Multi-domed interconnected environments in the sunlit region of the crater house 7,000 citizens in this progressive five square mile city.

City Location	Benefit to City/Residents	Risk to City/Residents	Resulting Tradeoff or Compromise
Amundsen Crater	Two mountains within crater	Minimal solar energy in PSRs; powering mining/processing equipment challenging	Minimal mining operations resulted in extended time to engineer solar panels from regolith components. Electricity from photovoltaics atop the sun-lit mountains now charge AI mining equipment in PSRs
	Nearby PSRs contain plentiful ice	Extremely cold temperatures	39% of energy generation is used for indoor climate control of gases and temperature.
	62-mile diameter	Varying extreme conditions	Deliberate slow city expansion plan due to limited technology and resource availability.

Lunar Life

As the mecca to all travelers and researchers interested in space exploration, Spartemis is the launchpad to the universe, literally and figuratively. After a 3-day flight, interstellar travelers visit Spartemis while refueling and preparing for further exploration. Rocket fuel processed from lunar ice is plentiful and the ⅙ gravity reduces the necessary thrust for launch. Tourism is a thriving economy in Spartemis.

With a predominant hub surrounded by three others, an “A” shape pointing north is created. To combat atypical light cycles at its location, Spartemis City’s 4 hubs maintain an artificial light cycle to simulate Earth.



Citizens health in ⅙ gravity is a priority. Spaceball (similar to rugby) and tension exercises occur daily along with calcium supplementation to minimize bone and muscle loss.

Spartemis City offers a variety of jobs. Scientists and engineers ensure a sustainable city structure in the domes. Construction operators 3-D print regolith to create biodomes within hubs. Citizens elect hub leaders who vote for city improvements. Police and fire departments

are volunteer-based. Citizens can own businesses, further enhancing the economy. One pet is permitted to each citizen to stabilize mental health.

Citizens don't pay taxes, businesses do, resulting in lower living costs.

Infrastructure

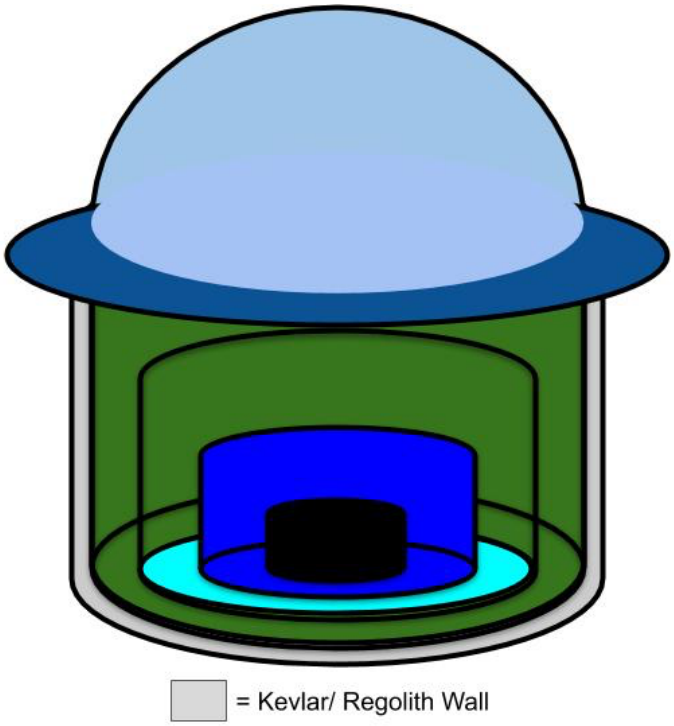
City planning for the expansion of a primitive lunar base was an exciting undertaking that began 100 years ago in 2035.

Transportation:

Spartemis offers numerous modes of transportation to its citizens. There are "inverse gondolas" for inter-hub travel, and magnetic bikes constructed with lightweight frames and electric assist from rechargeable Lithium-Air batteries. Walking is encouraged to reduce muscle loss. Emergency gondolas are also used as express routes between hubs.

Housing:

Spartemis' hubs are modeled after cylindrical Fujian castles with spherical roofs. The outside wall contains multi-level apartments. The hub walls are made from 3-D printed regolith covered in a Kevlar bullet proof polythene material surrounding a silica aerogel insulating layer. Mirrored and tunneled meteorite-resistant skylights provide natural light into the hub.



The centralized courtyards are paved with sintered regolith and have city services buildings. Large green spaces contain drought-tolerant plants that receive water through aeroponics.

Energy:

Spartemis City's main energy source is nuclear fusion, a process of fusing two hydrogen atoms to create a helium atom. This process creates immense amounts of energy, enough to power the entire city. The core has to be levitated, as it's heated to ten times the sun's temperature to start. Fusion doesn't create nuclear waste, making it a safe alternative to fission. Due to limited sunlight appearing over Spartemis, solar energy is accessed atop the two centrally located mountains, with panels manufactured from regolith-obtained materials. Algae photobioreactors produce oxygen for the indoor environments, all while generating energy. Electricity is stored with Lithium-Air batteries.

Food:

Citizens can rent space in aeroponic gardens to boost morale and access fresh produce. Although citizens' paychecks are less than Earth, they exchange employment-earned tickets to get food. Residents have mostly vegetarian diets due to abundant aeroponic farming. Because larger animals require more resources, Spartemis uses more efficient methods to obtain protein, such as farming insects and nuts. Insects are dehydrated (regaining water for human consumption) and processed into multipurpose high-protein flour. Algae is burned and the exhaust sent through an alkaline filter to eliminate carbon dioxide, resulting in a gas that is 95% nitrogen, used to supplement plant growth.

City Services

Prominent services with innovative adaptations to the challenging living conditions on the moon are abundant in Spartemis.

Education:

- Education is a hybrid between virtual and in-school, consisting of allocated courses delivered from Earth and locally.

- Personalized coursework by age twelve. Community fundamentals by age 15.
- Specifics for each career in the community are trainable, allowing citizens to explore professions via internships after age 15.
- After 20 years in a profession, citizens can continue working full time or they can utilize advanced pay work release to serve as educators.

Healthcare:

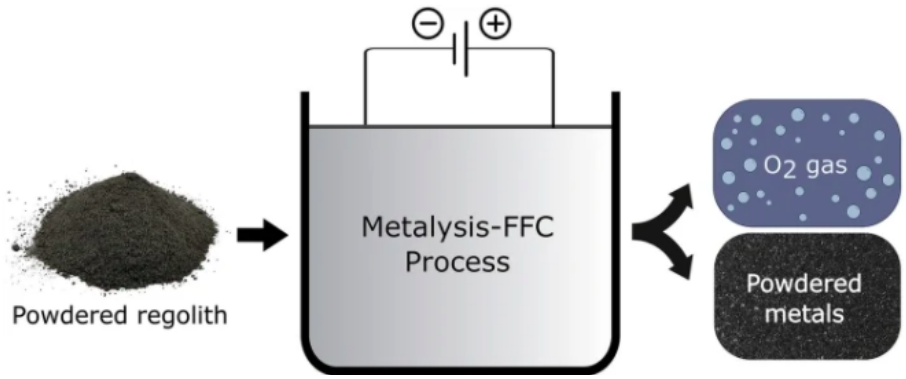
- Spartemis provides personalized healthcare to all citizens, using a Slim Optical Cellular-Checking Component (SOCCC), a device that monitors their health, while staying flush with their ankle. SOCCC provides information about oxygen levels, bone mass, exercise levels and other vitals. SOCCC notifies doctors in emergencies and fills prescriptions.

Fire/Police:

- Citizens 18 and older have the option to attend Fire Safety and Police Training courses where volunteers are trained for emergency response.
- Limited fire training is available as Spartemis' buildings are mostly kevlar, bulletproof polythene, aluminum, and regolith- materials unlikely to spread fires.
- Only volunteers with a clean criminal background are accepted into Spartemis.

Innovations for Lunar Living

Spartemis' Regolith Obtaining and Sorting Equipment (ROSE) is a simplistic system that gathers and filters regolith.



Lunar Ice Liquefier and Cleaner (LILAC) machines process potable water from ice within PSRs. On-board advanced solar ovens extract the water from the ice and mineral hydrate forms in the regolith.

Moon Challenges & Hazards

When constructing Spartemis, combatting hazards was crucial. Regolith on the lunar surface can be dangerous, so manufactured items are coated with layers of indium tin oxide that reduce electrostatic regolith cling, eliminating ingestion health risks. To combat weakening bones & muscles from reduced skeletal compression in the ⅙ gravity, SOCCC monitors and reminds citizens about daily tension exercise needs and calcium supplementation. Calcium and other vital minerals found in regolith are processed into the supplements. Weighted clothing made with iron from regolith helps counteract the low gravity. City water is taken from mixed ice and regolith deposits in nearby regions. Rechargeable Lithium-Air battery powered LILAC robots extract ice and liquefy and purify water. The extraction of oxygen from regolith and green space locations, contribute to the oxygenated hubs. Meteorite protection of the dome is provided by the 3-D printed regolith coated with a Kevlar polythene.

Moon Resources

The lunar surface may seem inhabitable and foreboding, but Spartemis has thrived by utilizing two main resources.

<u>Regolith:</u>

ROSEs obtain regolith using screens to sort the less compact material on the moon's surface from larger rocks. After screening, looser regolith is transported to factories. Utilizing a process called metalysis, regolith is combined with calcium chloride and heated to 950℃ in advanced solar ovens. An electrical current is then run through the mixture to extract the O_2 gas, leaving metals used for manufacturing.

<u>Lunar Ice:</u>

Spartemis' location is near ice and regolith deposits at the south pole. Aluminum-built LILACs collect, melt, condense (from gas) and make the water safe to drink. From there, water is transported to water tanks and distributed.

Benefits, Risks, Trade Offs, Compromises

Innovations come with risks and tradeoffs. Engineers had to make plenty of compromises:

Moon Resource	Benefit to City/Residents	Risk to City/Residents	Resulting Tradeoff or Compromise
Regolith	• Can be 3-D printed	• High temperature required • Must use binding agent	• Dunes of regolith were used to protect underground habitats until the expensive ROSE system was developed
	• Plentiful supply	• Abrasive and nano-sized; can cause cancer; electrostatically coats mechanics	
Lunar H_2O	• City located close to lunar ice in PSRs	• Extreme cold temperatures deadly to humans	• LILAC AI robots powered by Lithium-Air batteries (no solar power in PSRs) and require frequent charging breaks.
		• Untreated water non-potable	

Engineers

Engineers were vital when developing Spartemis. Aerospace engineers designed travel between Earth and Spartemis. Lunar environmental engineers pinpointed hazards and designed technologies to ensure safety. Mechanical engineers developed ROSE, which converts regolith into usable materials. Agricultural engineers created aeroponic farms and developed the algae photobioreactor. Spartemis' variety of advancements through innovative technology combat the moon's challenges, and ensure the highest standards for cities universally.

Word Count:
1458 – Essay with headings
40 – Captions
1498 - Total

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