DEPARTMENT OF AEROSPACE ENGINEERING

(Capstone Expo Assigned)**TEAM NUMBER**
Advanced Terrapin Lunar Architecture for Sustainability (ATLAS)

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Project Scope

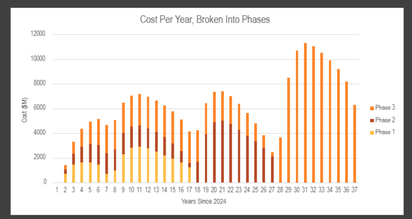
ATLAS will be an outpost located in the Lunar South Pole's Shackleton Crater that will design a permanent, self-sustaining lunar architecture with industrial levels of regolith mining & refinement, large-scale scientific discovery, and enable human expansion further into the solar system. By Phase 3 of our mission in 2060, ATLAS will be home to 40 astronauts working as doctors, refinement operators, greenhouse experts, and electricians.

Business

A.T.L.A.S. is funded through sale of excess resources to private investors. As early as Phase 1, excess metals and propellant will be sold, along with spare beds for lunar tourists in Phase 3.

Cumulative Program Cost: **$229 billion**

Cumulative Revenue (by 2060): **$22.7 billion**



Rovers

Mining Rover: Modular front loader design, 4-wheel independent suspension, mines 7.67 kg of regolith/min. Our 36 mining rovers will mine 300 kg/day.

Transport Rover: Lifts and transports 5000 kg, navigates a gradient of up to 20°, reaches speeds up to 0.5 m/s

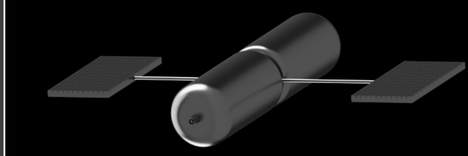
Power

- Utilizing 2 fission power systems located in ice-mining craters
  - Each capable of generating 2 Mwe
  - Closed-loop Brayton cycle (20% efficiency)
  - 21 metric tons
- Solar & battery system providing auxiliary power for habitat & communications

Total System Power Draw: 3611kW
Total Power Generated: 4695kW

Refinement

Using Molten Regolith Electrolysis (MRE), ATLAS will produce an overall 750 mt of metals, hydrogen, and oxygen annually from the refinement of lunar south pole regolith within our six refinement plants. From our powdered metal produced, we will use Field Assisted Sintering Technology (FAST) to make uniform sheets of aluminum, iron, and titanium that will further the construction of ISRU habitats, tanks, and pipes. ATLAS will also use microwave heating to extract 21.6 mt of water per year from icy regolith, which will help to sustain human life.



Habitat

12 aluminum habitats connected via a network of pressurized walkways. Habitats are capable of each holding 4 astronauts on rotating six-month shifts. Starting in Phase 2, habitats will be developed partly using ISRU.

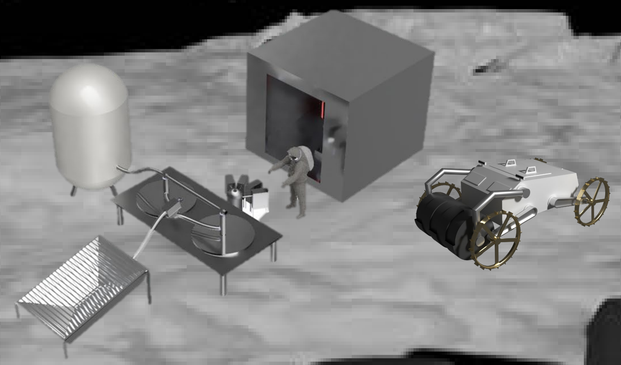
Features: crew quarters, kitchen, gym, bathroom, laboratory, med-bay, and life support systems.

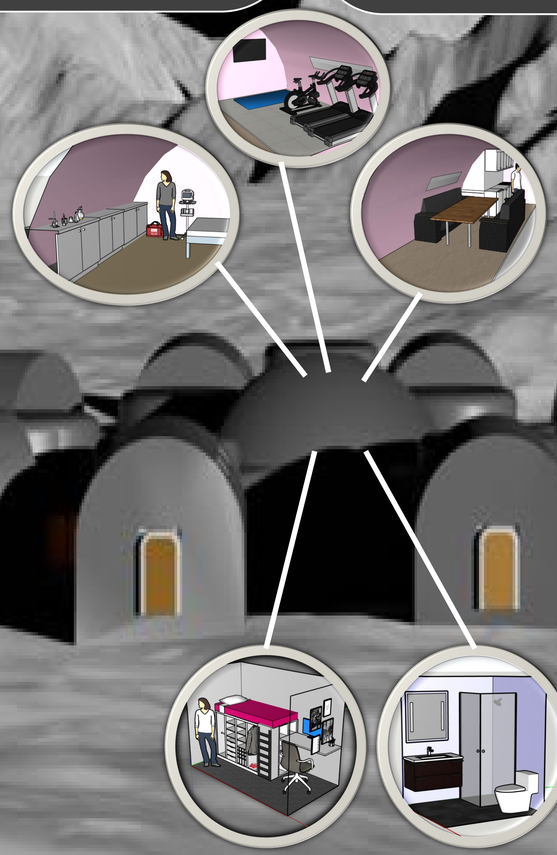
Mass (mt)	Diameter (m)	Length (m)	Empty Volume (m^3)	Cost ($M)
18.3	6	8	294	4000

Comms

Communicating between Earth and lunar surface using **NASA Gateway** and an auxiliary **lunar relay satellite.** Provides full-time coverage of entire lunar base

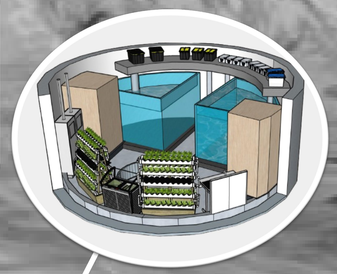
Auxiliary LRS Specs:
- X-Band & Ka-Band link with Earth
- S-Band & Ka-Band link with lunar surface
- NHRO orbit, ½ period
- 12kW Hall thruster, solar powered

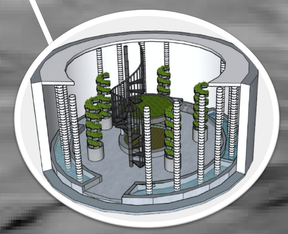




Greenhouse

2 Story Greenhouse (~50 m^2)
First Floor: Vertical hydroponics, soil beds, storage & nutrient tanks
Second Floor: Aquaponics & hydroponics





Crop Type	Area (m^2)	Yield (kg/year)
Leafy Greens (Spinach, kale, broccoli)	12	360-480
Fruit Veggies (Pepper, cherry tomatoes)	6	120-150
Legumes & Herbs (Dill, cilantro, mint)	4	40-80
Root Crops (Carrots, potatoes, onions)	5	40-60
Aquaponics Fish (Tilapia, trout)	8	640-800
Microgreens (Arugula, alfalfa)	5	200-300