WPI

Phase 3: Lunar Colony

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Goals

- Expand from 300 to 10,000 people within 10 years
- Complete a spaceport
- Establish almost fully self-sufficient colony capable of food production, waste management, limiting earth based resources to a minimum
- Establish new settlements using previous guidelines as needed

Spaceport

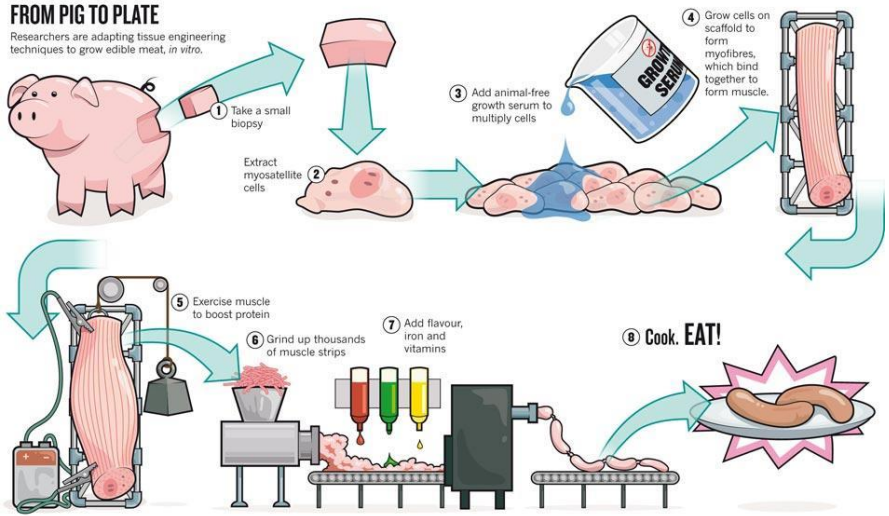
- Rocket Manufacturing Facilities
  - Constructed as much as possible from local materials
  - Local rocket fuel manufacturing
- Launch Station for Passengers
  - Support multiple takeoffs & landings per day
  - Specialized craft to transport between lunar orbit & surface, and lunar orbit & LEO
- Space Elevator Deployment For Cargo
  - L2 Elevator Counterweight Launch Platform
  - Can launch interplanetary craft without use of propellant
  - Large craft constructed in pieces on moon, shipped to counterweight, where it is assembled and launched

Structure & Development of Settlements

- Polar
  - Dig into sides of Shackleton, perhaps other craters
  - Rail around inside of crater, simulate 1G
- Equatorial
  - Construct settlements in other lava tubes, using same methods as first
  - Connect to Maglev System
- Additional Settlements Where Suitable
  - North Pole
  - Permanent outpost at far-side observatory
  - Specialized mining, research settlements
- Modular design, would be laid out as needed by colonists
- Separate "Districts":
  - Residential
  - Food Production
  - Research
  - Industrial
  - Recreational

Food Production

- At this stage food production will be virtually self sustained without aid from earth
- Food production will host a larger version of phase two automated aeroponic food production
- underground production will begin in the infancy of this stage
- Aboveground domes will provide natural sunlight for plant production while underground sectors will provide a backup supply starting after the first year while the domes are constructed and a backup supply is stored
- This will be supplemented by a 3 month stock of food capable of sustaining the colony and transient population
- In vitro meat production will be used to conserve energy while providing an alternative to plants



Radiation Shielding

- The limited amount of domes will be constructed with leaded glass or covered in regolith
- Building into the side of the dome will provide natural protection with the regolith layer
- A local magnetic field will be researched to provide protection, and if successful will be applied over the entire settlement

Mitigation of Gravitational Effects

- Preliminary research will be conducted to determine optimal methods of mitigation during phase one
- Phase 3 construction will also include the 1g gravity simulation train which will run on the outside of the parameter of the crater in a circle to induce a 1g force on colonists
- Mandatory exercise will also prevent the deterioration of the colonists health due to less than 1g exposure
- Supplements will be provided in order to offset these effects as well

Population Control

- Goal: 10,000 people 10 years into Phase 3
  - Add ~21 people every week
- Transportation:
  - Launch colonists into low earth orbit and transfer to shuttle
  - Shuttle transports colonists to lunar orbit
  - Specialized craft transfer from lunar orbit to surface & back
  - Could be done cheaply due to use of lunar materials in LEO
- Lunar births could decrease the number of people transported (pending Phase 1 and 2 research)

Tourism

- Benefits:
  - Generates revenue
  - Increases interest in lunar colonization
  - Allows potential colonists to experience the lunar environment without making a permanent decision
- Tourist activities:
  - Lunar hotels - part of existing infrastructure
  - Lunar history museum at Apollo 11 landing site
  - Guided moonwalks and lunar rover tours
  - Stargazing and astronomy
  - Lunar gravity sports

Expansion of Power Systems and Research

- Steady expansion of all power systems in the order of hundreds of megawatts, tentatively 500 MWe.
- Increase of efficiency using solar cells with greater conversion, and solar sails and/or free flying mirrors based on results of Phase 1 and 2 research.
- Use of local thorium to power Space Molten Salt nuclear reactors.
- Proof of commercial viability of large-scale microwave transmission of solar power to Earth for terrestrial use.
- Proofs of concept and commercial viability of large-scale Helium-3 nuclear fusion to provide power for local and terrestrial use.

Mitigation of Dust

- Surface coating comprising Tungsten Carbide and Aluminum Oxide. TC repels dust when activated by high voltage, and Aluminum Oxide protects from wear and damage.
- However, use of high voltage over all surfaces that require dust cover will require a lot of power, so it can only be used for larger (more susceptible) surfaces.
- Acoustic levitation and compressed air for cleaning smaller machines
- Improved power efficiency and methods of dust repulsion and clean up will be devised based on Phase 1 and 2 research

Lunar Resources

- Large-scale processing and manufacturing facilities - permanent structures
- Development of new methods to increase efficiency of recycling of used materials, extraction and mining processes.
- Pneumatic conveyance system to reduce power used for transportation
- Self-sustaining colony with little to no reliance on earth
- Extraction of resources such as Helium-3 and rare earth materials for use on earth

Works Cited

- All references and pictures cited in project report