Loretto Abbey Team B
Galactic Gourmet

Food Storage and Preparation Module Design

Functions

1. Food storage
2. Food preparation
3. Water treatment and storage

Objectives

1. Lightweight
2. Low material cost
3. Low energy consumption
4. Palatable food taste

Constraints

1. Microgravity
2. Power limit: 5 kW
3. Dimensions: 3 m x 3 m x 6 m
4. Mass: 2500 kg

I. Food Storage

- Freeze Dryer **-** Eliminates the need for a constant power supply to refrigerate food
- Vacuum Sealer **-** Prevents oxidation and moisture buildup
- Storage Cabinets - Stores vacuum pouches of food items systematically for long periods

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II. Food Preparation

- Thermostabilizer **-** Reduces the mass of the food supply by 22% per day
- Microwave Oven - The lightest component able to heat food in a weightless environment

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III. Water Treatment and Storage

- Water Purifier - Triple filtration process that reuses wastewater from our freeze dryer and other modules
- Water Storage Tanks - Stores sufficient water for consumption and food preparation
- Water Dispenser - Enables astronauts to easily refill water bags and rehydrate food

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Calculations Appendix

Slide 17 - Required Food Storage Space

1. The daily caloric intake of astronauts is 2500-3700 calories per day.
2. With 4 astronauts on board and a maximum mission duration of 90 days:
   total calories needed = 3700 cals x 4 x 90 = 1,332,000 cals
3. Factoring in the caloric density of food (~500 cals / 100 g):
   total food weight = 1,332,000 cals x (1 g / 5 cals) = 266,400 g
4. Factoring in the weight density of common food items (~0.5 g/cm^3):
   total space needed = 266,400 g x (1 cm^3 / 0.5g) = 532,800 cm^3
5. Extra 20% food for emergency:
   total space needed = 532,800 cm^3 x 1.2 = 639,360 cm^3
6. Total space needed in m^3 = 639,360 cm^3 x (1m^3 / 1000000 cm^3) = 0.64 m^3
7. Extra 25% space for plastic packaging : 0.64 m^3 x 1.25 = 0.8 m^3

Slide 25 - Required Water Storage Space

1. 4.4 L of water is needed per astronaut for hydration and food preparation purposes.
2. Total liters needed for the entire mission = 4.4 L x 4 astronauts x 90 days = 1584 L
3. Extra 10% water for emergency = 1584 L x 1.1 = 1742L

Slide 27 - Energy Consumption

1. Freeze dryer: ~ 1.5 kW
2. Thermostablizer: ~ 0.2 kW
3. Microwave: ~ 1.2 kW
4. UV sterilizer: ~ 0.05 kW
   Total Energy Consumption ~ 2.95 kW
