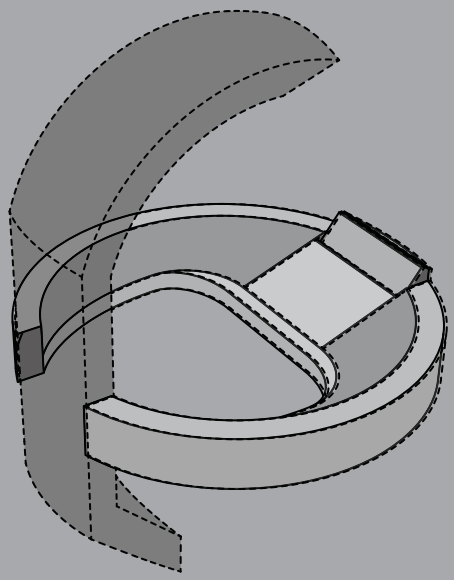
Single Person Spacecraft

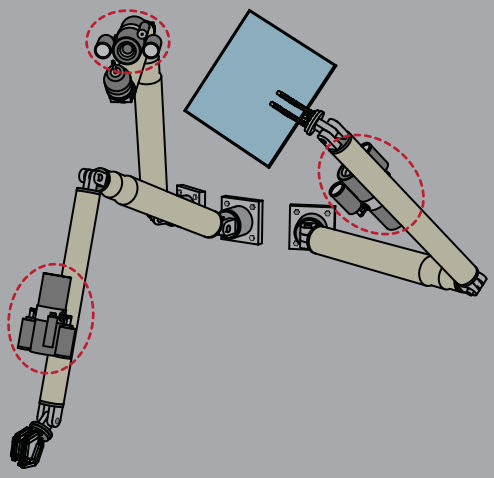
GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Key Design Features



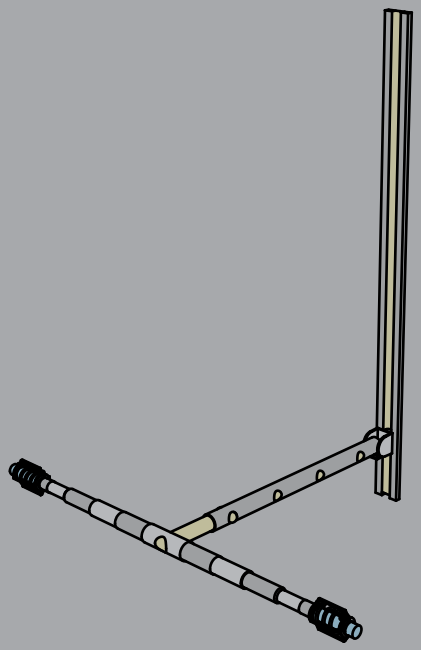
SLS Dashboard

Streamlined, Adaptable, & Sleek Design
Simple & Elegant Carbon Fiber Wrap



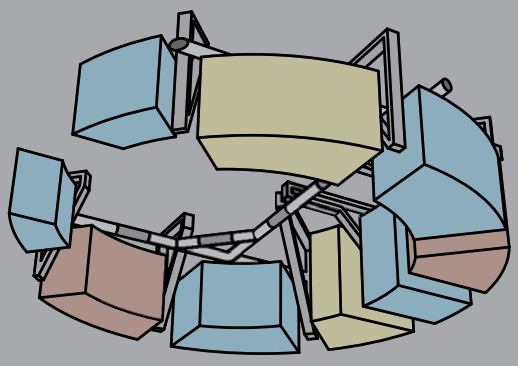
Arm Cameras

Maximized User Visibility & Control
Multi-Purpose & Multi-Operator Functions



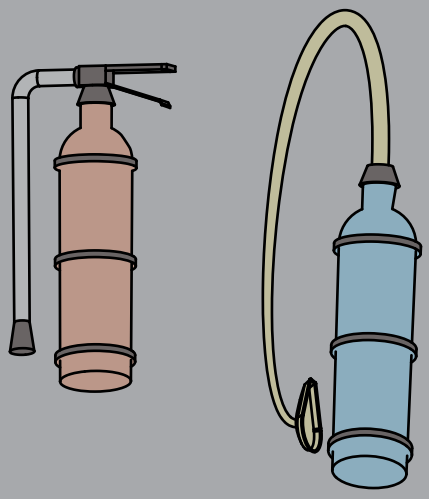
Foot Restraint

Simple & Unencumbered Design
Foldable, Expandable, & Secure



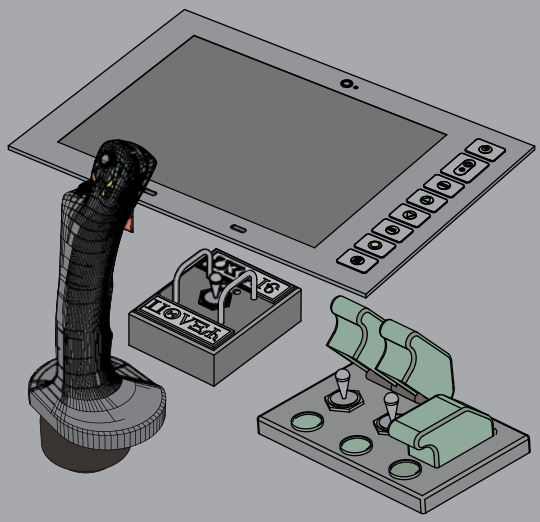
Internal Stowage

Modular & Customizable Light-Weight Fabric
Spaces for Tools, Food, Water, & Supplies



Fire Suppression

CO2 Extinguisher & Personal O2 Supply
Easy Access & Use for Rapid Deployment



Tested Elements

Military, Aerospace, & Nautical Parts
Rugged & Temperature Resistant

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

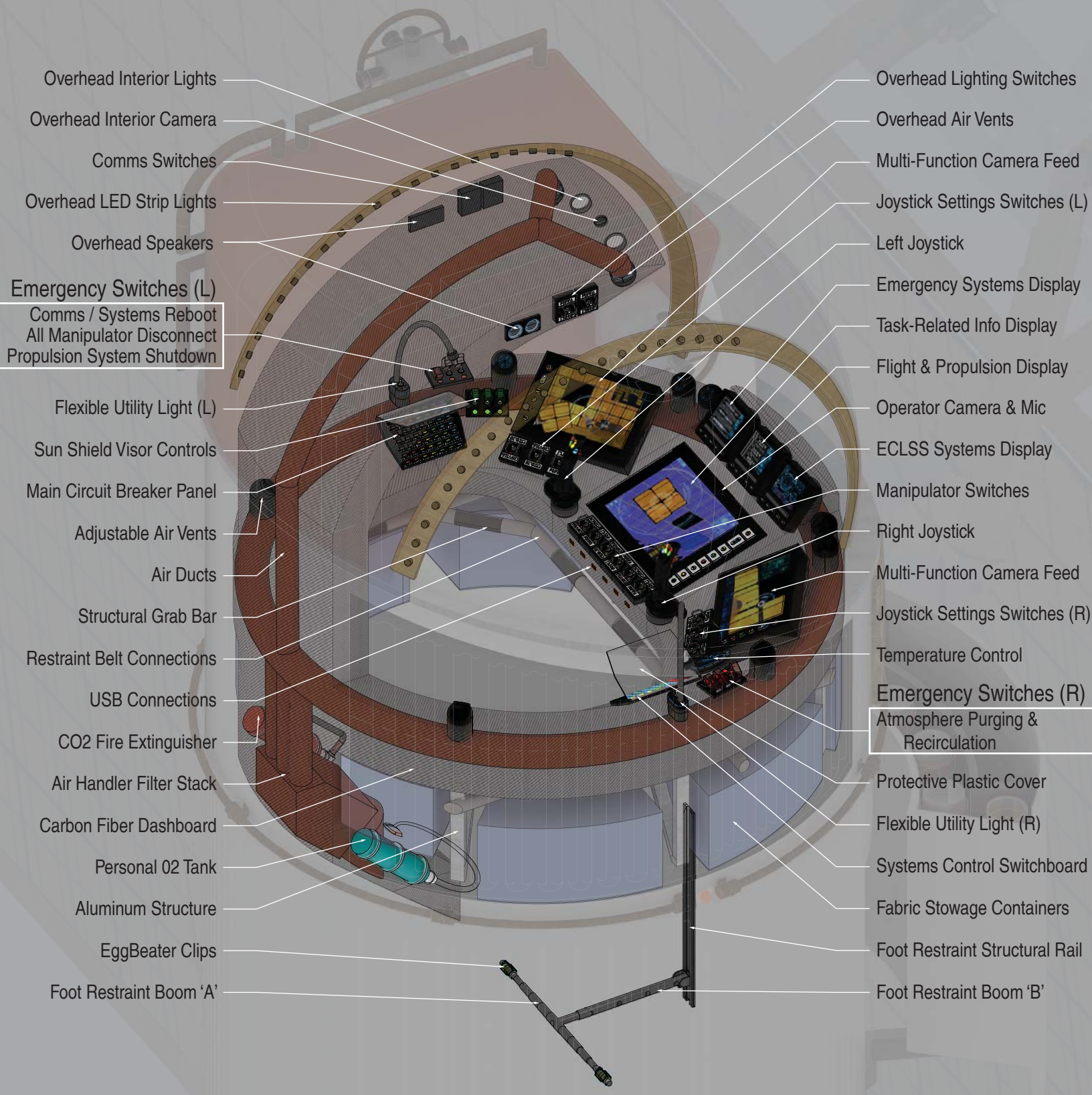
COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Single Person Spacecraft

GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Detailed Isometric



BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

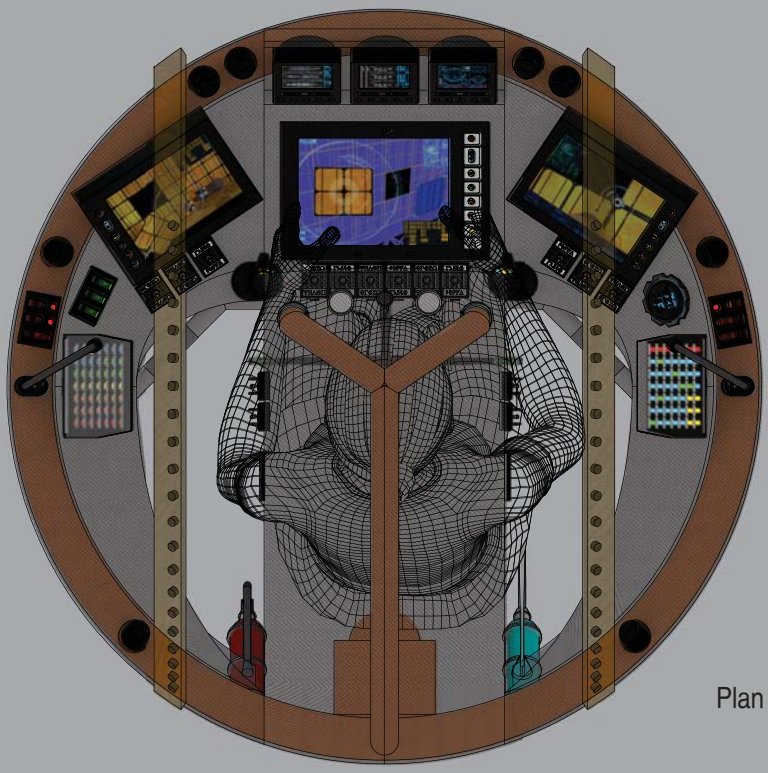
CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Single Person Spacecraft

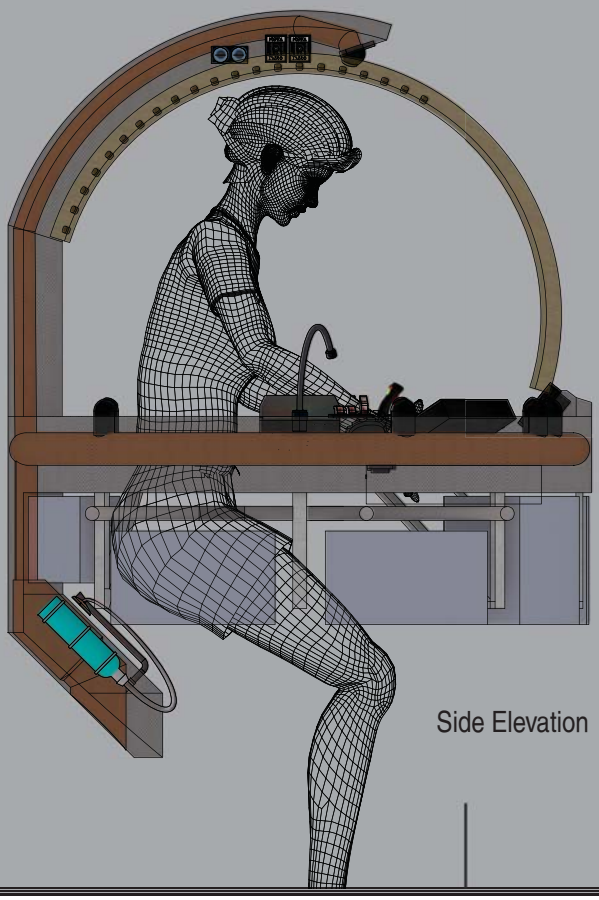
GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Orthographics

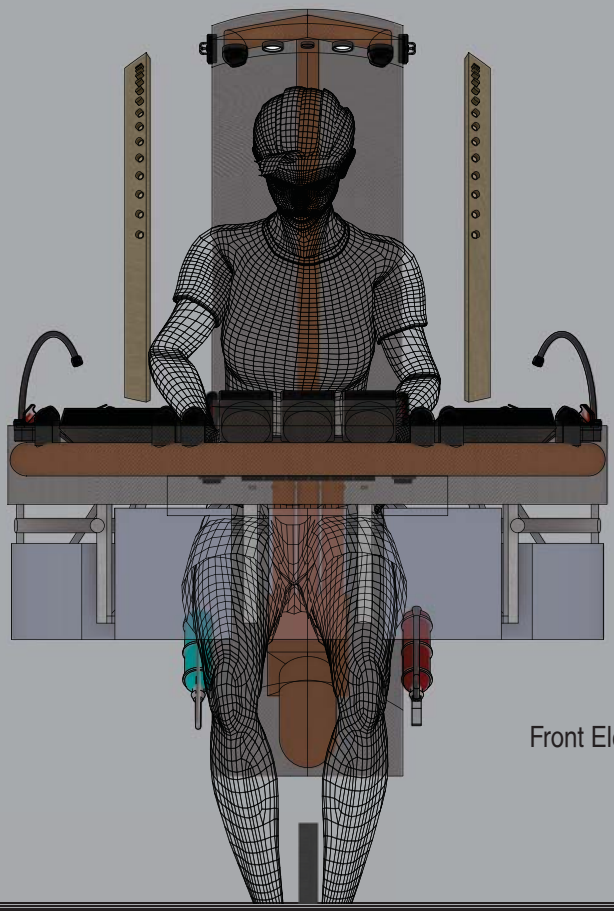
The human figure shown represents the 95th percentile male body dimensions.



Plan



Side Elevation



Front Elevation

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

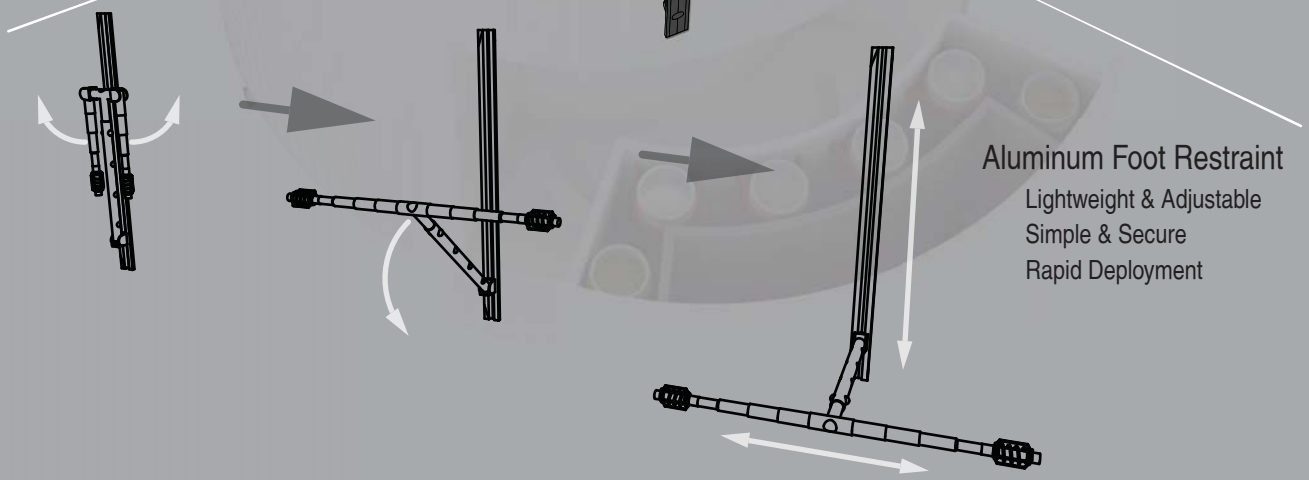
COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Single Person Spacecraft

GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Dimensions & Restraint Function



Aluminum Foot Restraint

- Lightweight & Adjustable
- Simple & Secure
- Rapid Deployment

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Single Person Spacecraft

GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Design Summary

USABILITY

Fundamentally, the design concentration has been adaptability, not only to dynamic environments and task requirements, but also to advances in technology and operator skills sets. For example, the panels have been designed to accommodate both the rugged, radiation hardened displays utilized by current spacecraft and the flexible, full-touchscreen displays of future spacecraft. The panel is sleek, simple, and scalable, allowing ample potential for customization to accommodate the technological advances.

Since the SPS features a cold gas thruster system that mimics that of the MMU, the control system also emulates that of the MMU, featuring joysticks for translational and rotational control as well as attitude and altitude hold buttons for optimal positioning control. Therefore, operator training can be easily adapted from the current programs.

The manipulators can be controlled either with the same joysticks used for propulsion control or through a gamepad-style controller. Each manipulator features a camera and lights to maximize the user's control and visibility.

SIMPLICITY

The design features many systems and parts included in the SPS demo mission. Additional parts and systems have been sourced from providers of marine, military, and nuclear equipment, thereby minimizing the upgrades required to adapt the products to space application. Two exceptions exist. The restraint system utilizes foot restraints derived from an all-terrain bike pedal designed by the bike equipment provider Crank Brothers. The pedal employs a clever system in which the user, wearing corresponding footwear, can quickly snap into the pedal and just as quickly (by simply angling the foot) disconnect from the system. Both the pedal and the adjustment system are lightweight aluminum. Secondly, the design proposes a modified gamepad controller. Although the controller requires alteration and testing to achieve a space-rated status, the potential of the part for both present and future applications is immense. As newer generations of astronauts take over, the likelihood that they have both familiarity and skill with gamepads becomes increasingly high. Additionally, gamepads are both fully and easily programmable and offer excellent precision and control. Furthermore, many robotic systems have been and continue to be developed with gamepad-controlled operation, which contributes to the craft's adaptability and interfacing capability.

MAINTAINABILITY

To increase maintainability, the craft interior features paneling that maximizes accesibility throughout the cabin. Also, there is optimal stowage space for tools, replacement parts, and multimedia devices. This capacity can reduce mission abort scenarios and alleviate data management issues. In addition, the craft possesses ample space for USB interfacing to accommodate software and firmware updates and simplify dat tranfer for collecting and storing usage data.

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Design Summary (Cont.)

DAY/NIGHT OPERATIONS

The frequent change in visibility has been combatted by the use of sunlight readable, backlit displays as well as illuminated buttons and switches. Additionally, adjustable overhead lights and mid-level utility lights provide additional illumination throughout the cabin. Furthermore, each manipulator possesses a camera and lighting system that provides increased visibility at the work site.

AIR HANDLING

The air handling system employs six single and two double vents that circulate air throughout the cabin. The air supply is routed to each vent through a simple network of ducts, each of which can be restricted by closing a simple valve. This will contribute both to the maintainability of the craft and to the the preference of each user. Additionally, the front double vents have been angled to direct air flow toward the mid-upper chest of the user to prevent the formation of a CO2 bubble near the face without directing air into the eyes.

ZERO-G RESTRAINT

After observing astronaut activity in microgravity, primarily that of Sunita Williams in her ISS tour video, it is apparent that only minimal restraint will be required aboard the SPS. The restraint system we've desiged immobilizes the user's feet and waist, leaving the upper body, which will be heavily involved in the craft's operating, unencumbered and free to rotate. The system utilizes lightweight, adjustable materials designed for use in all-weather, all-terrain environments in order to minimize both the weight requirmentand the upgrades necessary to adapt it to space application.

ANTHROPOMETRY

Since the craft is designed for operation in an extremely hostile, perilous environment, operator comfort is of paramount importance. In order to maximize operator comfort, all displays and controls have been positioned in reference to a common viewpoint, and the restraint system ensures this common viewpoint is accessible to the full range of astronauts from the 5th percentile female to the 95th percentile male body type. Additionally, all critical systems information has been positioned within the NASA-STD optimal viewing peripheral (30°), and all displays have been angled to accommodate the altered viewing angle of an operator in the neutral body posture.

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

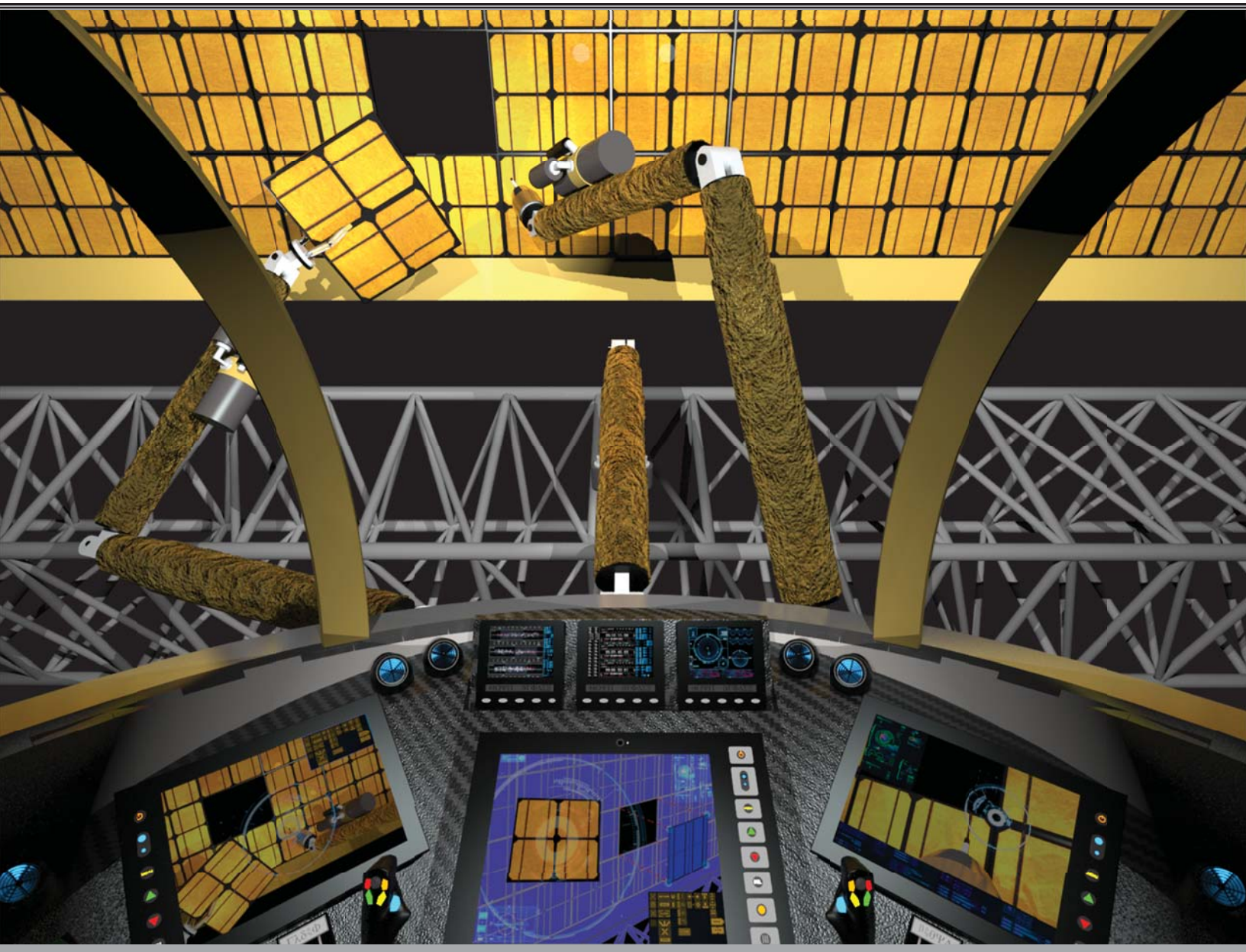
COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

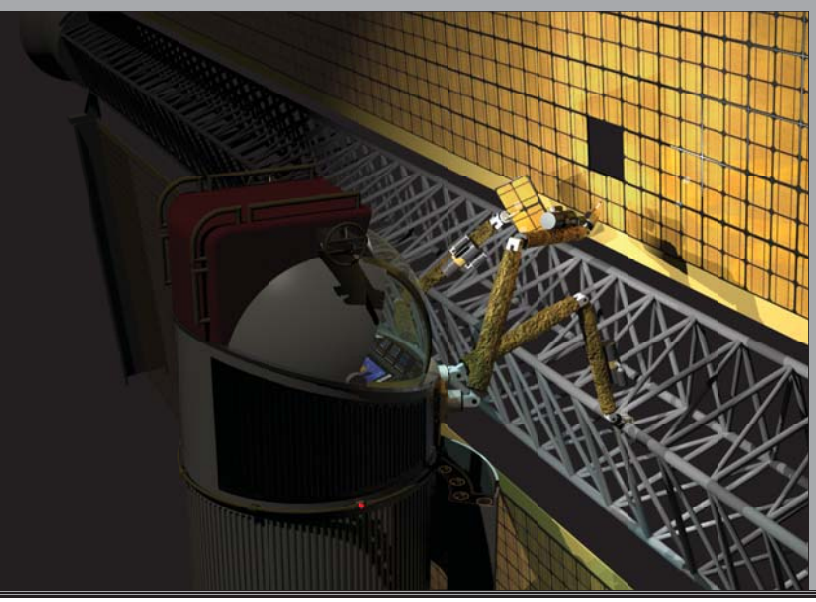
CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

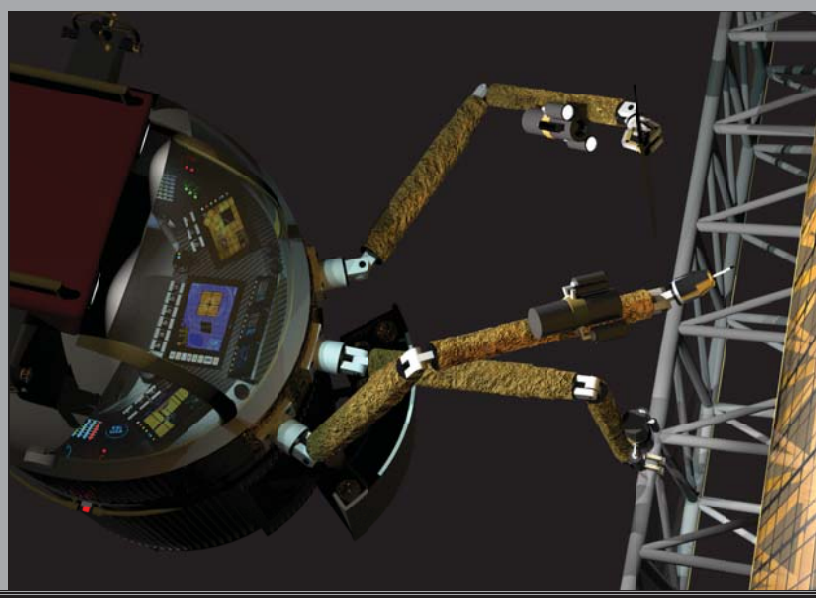
Single Person Spacecraft

GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY

Interior Design Competition







BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Single Person Spacecraft

GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Featured Parts

MI-MIL COTS Series

10.4” Monitor

NMEA 2000

3.5” Monitor (x2)

R981/C981 Compact System

Manipulator Cameras

R985 Single

Interior Cameras

MIL-DTL-3950

Toggle Switches w/ Guards

G-2

Flight Joystick

HaWC controller w/ Integrated Display

Gamepad

EggBeater

All-Terrain Bike Pedal

Amerex 2.5 lb tank

CO2 Fire Extinguisher

EROS Mask & Tank

Personal O2 Supply

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN

Single Person Spacecraft

GENESIS ENGINEERING
SOLUTIONS IN SPACE AND TECHNOLOGY
Interior Design Competition

Full Parts List

System	Part	Option	Source	Grade
Buttons & Switches	Atmospheric Panel Buttons	Custom	Zodiac Aerospace	Aerospace
	Circuit Breaker Switches	Custom	Zodiac Aerospace	Aerospace
	Toggle Switches w/ Guards	MIL-DTL-3950 Series	Eaton	Aerospace
Controls	Gamepad	HaWC Controller	Mason Controls	Aerospace
		Avatar Micro	RoboteX	Aerospace
		Xbox Controller	Microsoft	Aerospace
	Joystick	G-2	OTTO	Aerospace / Military
		L-159	Mason Controls	Military
Displays	10.4” Monitor	MI-MIL COTS Series	Marine PC	Military
	8.4” Monitor (x2)	SRMOB 8.4 Series	TRU-Vu	Industrial
	3.5” Monitor (x2)	NMEA 2000	Off-Shore Systems	Marine / All-Weather
ECLSS	Ducts	Custom	Eaton	Aerospace
	Quick disconnect couplings	Custom	Eaton	Aerospace
	Vents	ACS Single / Double	Aircraft Spruce Inc.	Aerospace
Emergency	Personal O2 Supply	EROS Mask & Tank	Zodiac Aerospace	Aerospace
	CO2 Fire Extinguisher	Amerex 2.5 lb tank	Fire Ext. Depot	Medical
Restraint	Lower Body System	EggBeater Pedal	Crank Brothers	All-Terrain
		Al Support Beam	Custom	Commercial
		Al Track	Custom	Commercial
	Mid Body System	Tactical Belt	Custom	Commercial
		Adjustable Straps	Custom	Commercial
		Seatbelt Components	Custom	Aerospace
Structure	Panel Support Trusses	AIRWARE Low Density Alloy	Constellium	Space

BRETT MONTOYA
LINKEDIN.COM/IN/BRETTMONTOYA

COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON

CANAAN MARTIN
LINKEDIN.COM/IN/CANAANSKYEMARTIN