University of Southern California

Engineering Project Portfolio

Luis Diaz
ladiaz@usc.edu

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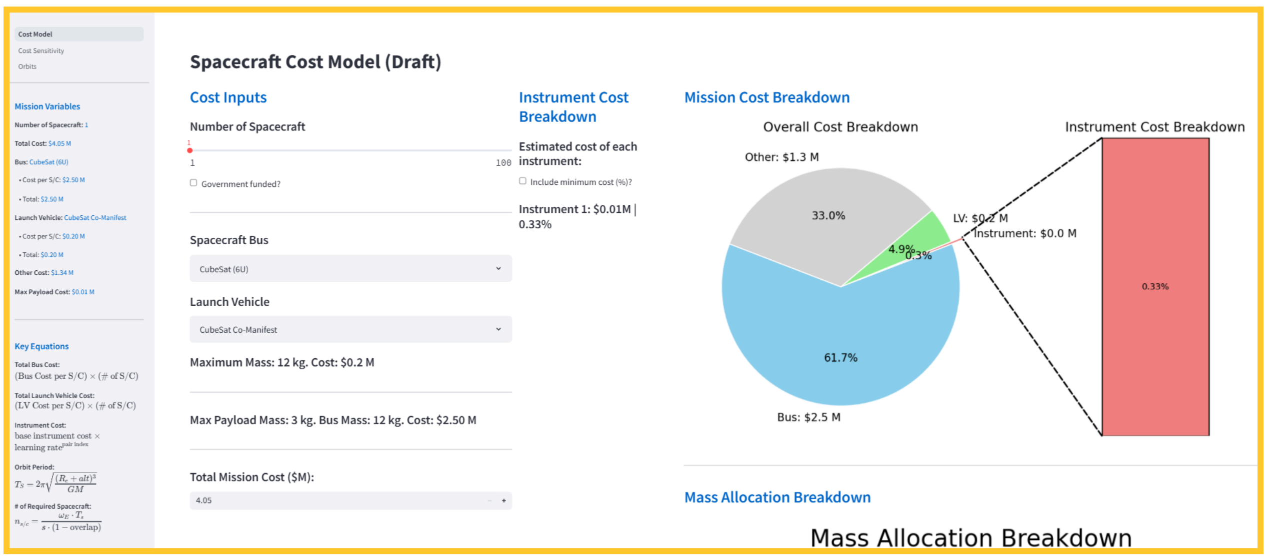
School of Engineering

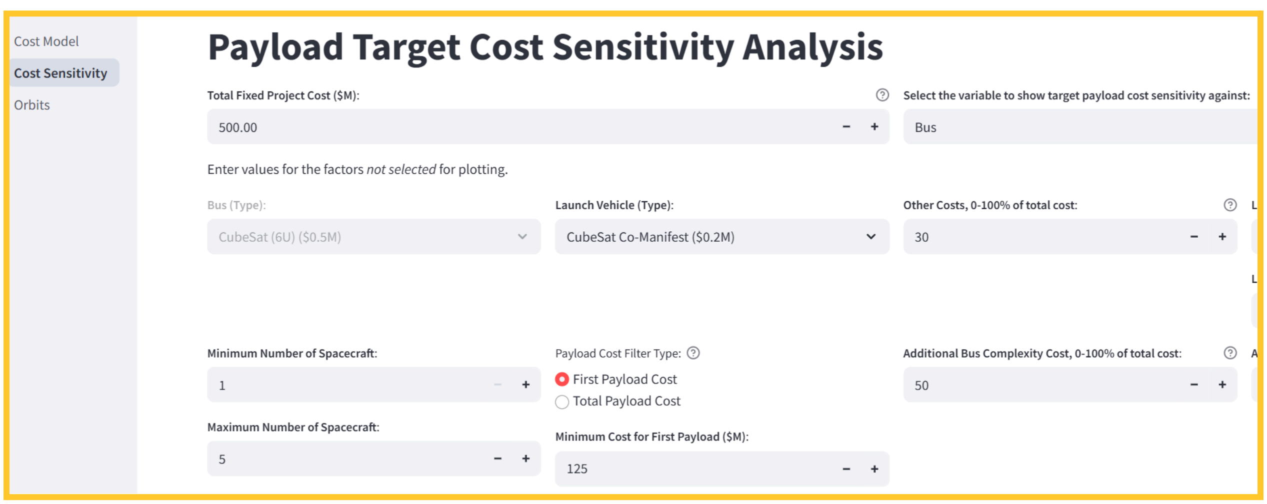
Jet Propulsion Laboratory

Earth Science Constellation Cost Model

By Luis Diaz // 06.11.2025

Designed in Python, this project uses mission design implementation to derive first-order cost targets for instruments. This analyzes current and planned missions by analogy and directly compares this to the parametric value that considers bus architectures, launch vehicle costs, a learning curve for R&D of instruments, as well as other cost such as science and mission assurance to provide credible, CML 3, competitive cost targets for instrument technologists of a given Earth observation category.





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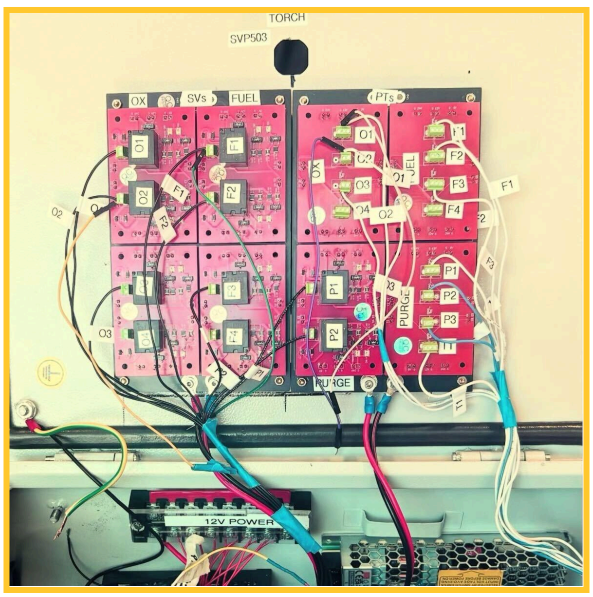
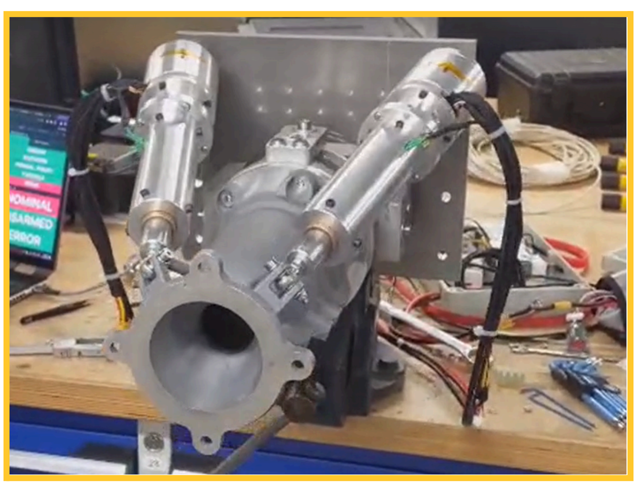
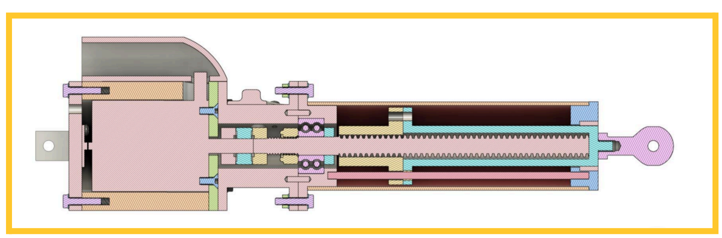
USC Liquid Propulsion Laboratory - GNC
Throttling & Thrust Vector Control

By Luis Diaz // 05.20.2025

Designed and implemented real-time control systems for kerosene-LOX cryogenic propulsion, supporting throttling and thrust-vector campaigns. Developed Python GUIs and C++ frameworks to integrate sensors, actuators, and valves for hot-fire testing. Optimized system stability, repeatability, and response while collaborating across hardware and software teams in Agile cycles toward a future hopper vehicle.







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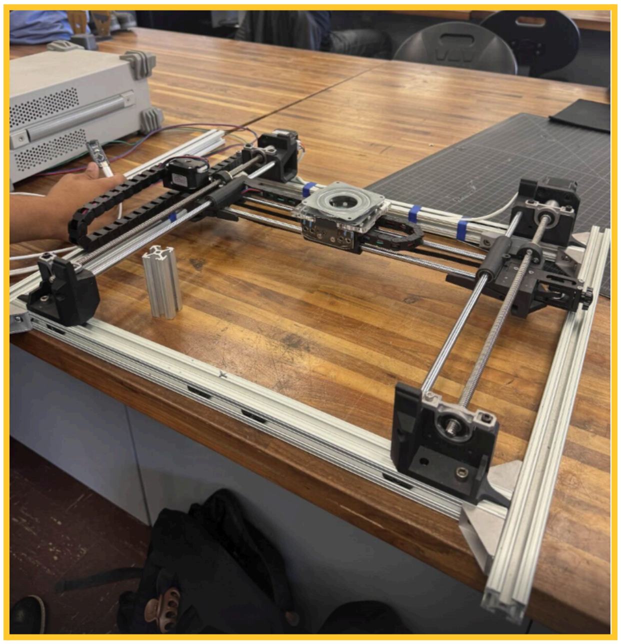
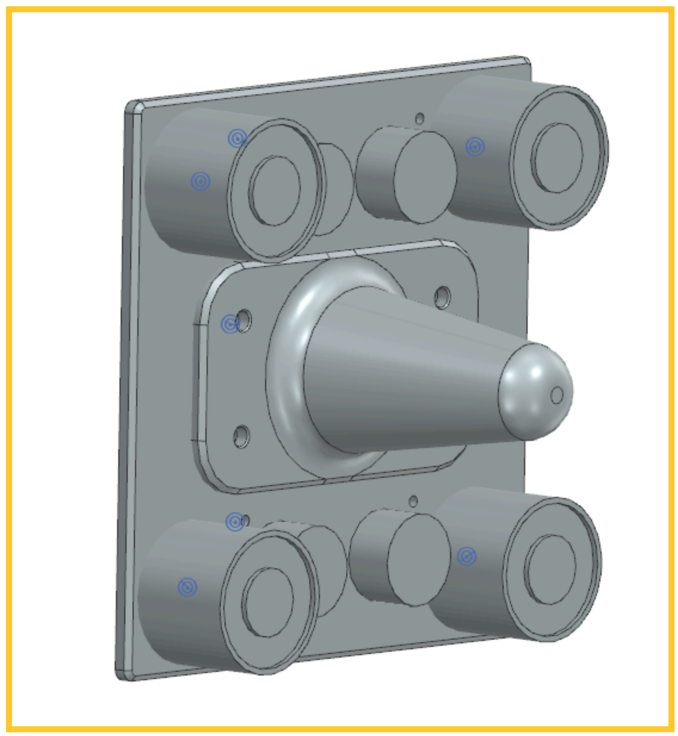
Senior Mechanical Design

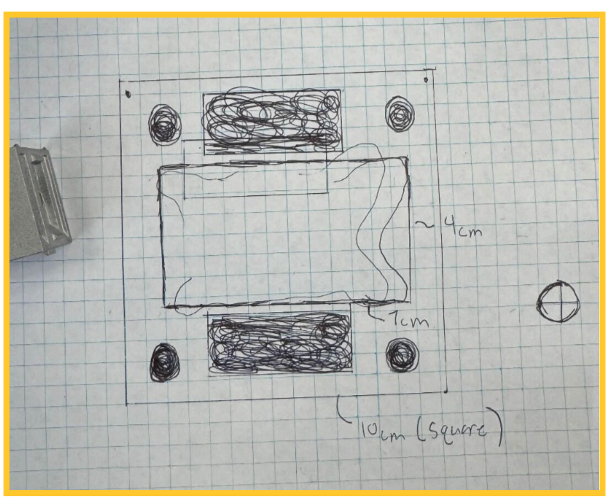
Electromagnetic Cubesat Dock

By Luis Diaz // 09.15.2025

Developed a prototype electromagnetic docking system for cubesats, featuring probe-drogue capture, force/distance sensing, and pogo-pin interfaces for cross-vehicle power sharing. Integrated control electronics and embedded firmware to enable autonomous docking operations on a 2D traverse gantry. Focused on scalable, modular solutions for in-orbit servicing and collaborative small satellite architectures.







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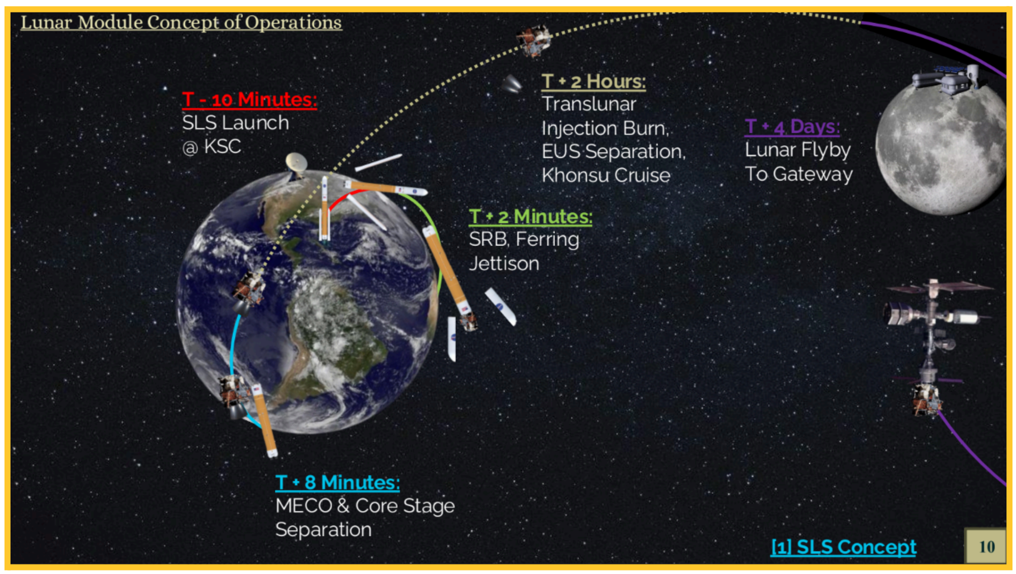
Spacecraft Systems Engineering – PRESENTATION

Lunar Lander – Khonsu

By Luis Diaz // 05.15.2025

Led lunar lander design team with ECLSS, Avionics, ACS, Thermal, Structural, Power, Telecom, & Propulsion subsystem analyses. Also fulfilled C&DH as CogE and secondary costing role for mission breakdown. Led meetings and deliverable agenda.



Specific Requirements:

- **Processing & Memory**
  - Quad-core, RAD-hardened w/ Triple modular redundancy (GR740)
    - Real-Time Operating Systems (RTOS) for Crew ECLSS vitals
    - 64 GB Flash memory w/ dual access & error correction (ECC)
    - Protection: Single-Event Effect (SEE) of LET > 10^4
    - 3 krad Total Ionizing Dose tolerance
  - **Communication Protocols & Data Handling**
    - Via TTEthernet ~ 1-ms accuracy w/ < 1-s drift per year
    - High-volume storage capacity for data logging ~ 1 TB
    - Multiple device communication via RS-422, RS-485 (10 vs. 35 Mbps @ short distances), LVDS for imaging
    - Active Watchdogs for processor and all interfaces
- **Software & Interfaces**
  - Crew Command Interface (CCI)
  - DO-178C FSW Certification

Card Sizing:

ECLSS Data	100000 bps
For the Day	8640 Mb
Margin	100%
Overhead	30%
Daily Total	22464 Mb
Daily Pass Duration	4.80 hrs
Required Downlink Rate	1300 kbps
Fault Response Time	0.01 Seconds
Margin	100%
NVM Size	216 GB

Facetime - Auxiliary	8000 bps
For the Day	691.2 Mb
Margin	100%
Overhead	30%
Daily Total	1797.12 Mb
Daily Pass Duration	4.80 hrs
Required Downlink Rate	104 kbps
Fault Response Time	0.01 Seconds
Margin	100%
NVM Size	17.28 GB

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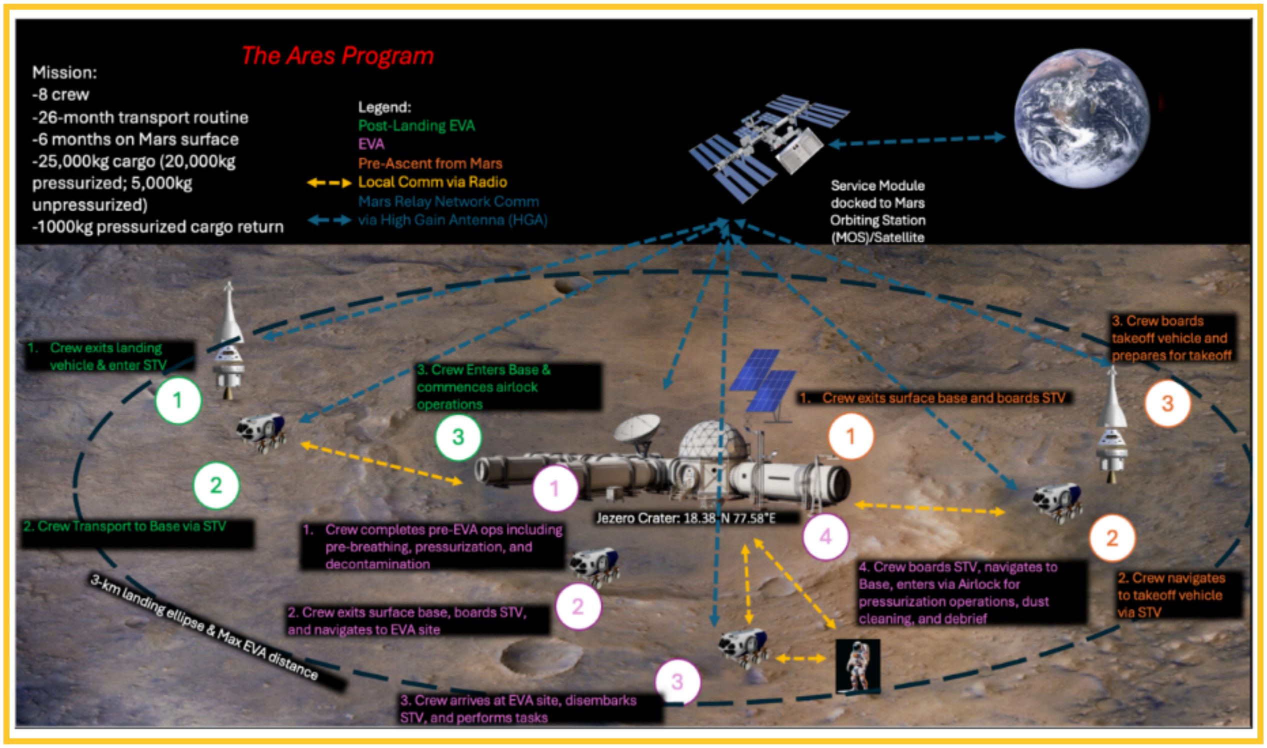
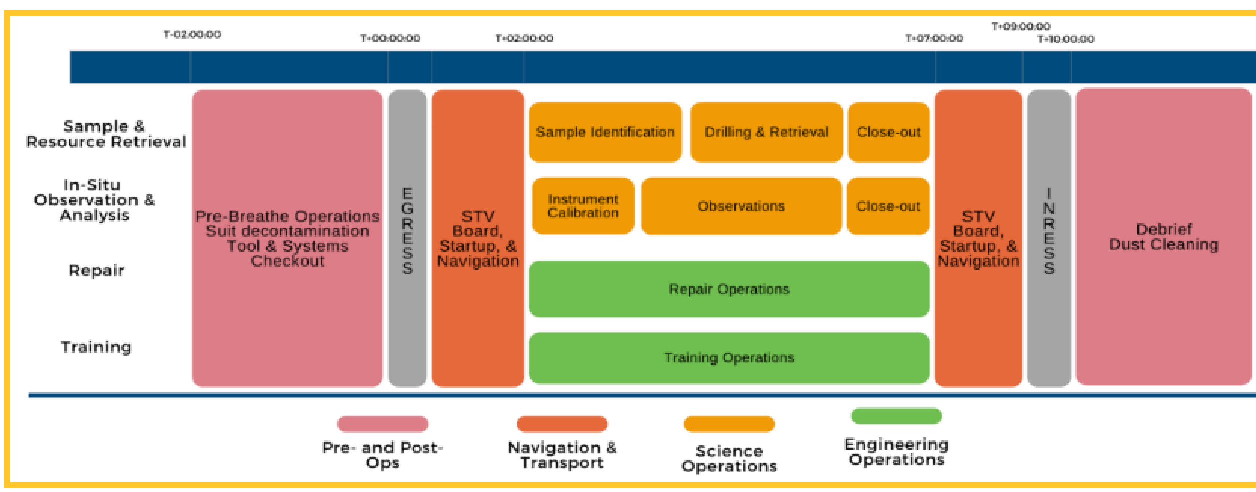
Life Support Systems & Spaceflight – [PAPER]

Mission to Mars

By Luis Diaz // 05.05.2025

Designed a Martian plan for environmental control & life support system feasibility. Included the design of spacesuits and displays tailored for Martian exploration. Included crew scheduling, EVA planning, and even risk mitigation.





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Spacecraft Subsystems – PRESENTATION

Avionics

By Luis Diaz // 05.02.2025

Used a Raspberry Pi to control electronic components like DHT20 temp/hum sensor and LED to demo validation and verification. This project creates a test procedure and executes expected behavior inside a UNIX terminal, simulating a large weather communication satellite. Includes design specifications with heritage considerations in C&DH.

8.1 TEST SET-UP **NOT PASSED**

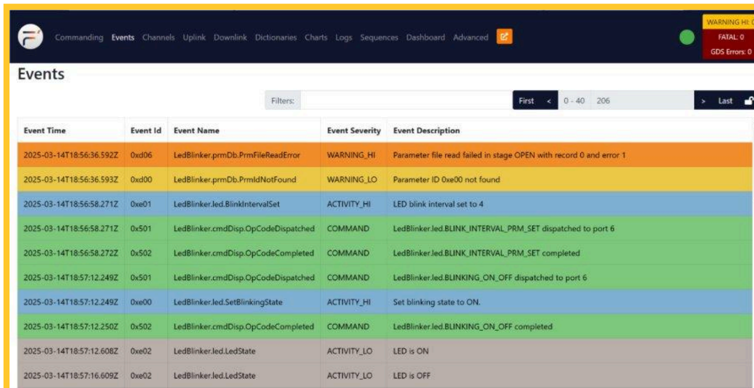
The following sets up the user interface as conducted by procedure lead on Windows:

1. Open a PuTTY terminal.
2. Host name will be "username@viterbi-scf1.usc.edu".
3. Load and save a session name that is descriptive and indicative of your procedure.
4. Navigate to Connection > SSH > X11 and enable X11 forwarding.
5. Go back to session and open the terminal. ✓

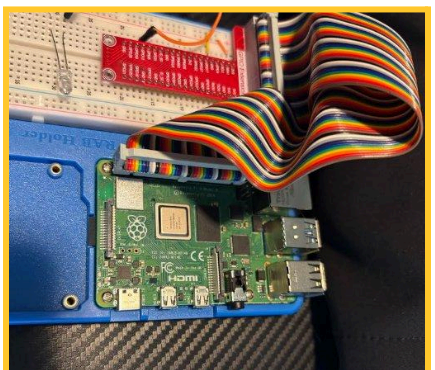
Display set up for testing procedure:

1. Credentials at window opening and at "ssh -X username@viterbi-scf1.usc.edu".
2. Navigate to the source folder using "cd 331a_FSW_Sp24/src". Verify you are in the correct directory using "ls". Spacecraft, Simulation, Events, and Telemetry files should be available. ✓
3. Open four xterm windows using "xterm &; xterm &; xterm &; xterm &". Each should be initiated with "source myvenv/bin/activate.csh".
4. Follow the next commands in the unique terminals. Choose a port # [1024-10000] that is not in use. Should an error be signaled, choose another. Port # **1024**
   A. "python3 sc_3.py [port]" → Displays "Sending Telemetry!" ✓
   B. "python3 sim_3.py localhost [port]" → Displays FSW is booting up ✓
   C. "tail -f Events.log" → Displays world and local times along with "SC Configuration file read" ✓
   D. "tail -f Telemetry.log" → Displays world and local times along with a command number and number of executed commands ✓
5. For the simulation terminal, enter spacecraft command "NO_OP"
   A. Displays "From (), received command string: NO_OP" ✓
   B. Displays "Did NoOp" ✓
   C. Displays "NO_OP received. Successful Counter (+1) ✓
   D. Command counter and Successful Counter incremented (+1) ✓

```
unittest(test_temperature)
{
  const int selectPin = 7;
  const int dataPin   = 6;
  const int clockPin  = 5;

  MAX6675 tc(selectPin, dataPin, clockPin);
  tc.begin();

  fprintf(stderr, "Temperature...\n");
  assertEqualFloat(MAX6675_NO_TEMPERATURE, tc.getTemperature(), 0.001);

  fprintf(stderr, "\nOffset...\n");
  for (int of = 0; of < 10; of++)
  {
    tc.setOffset(of * 0.1);
    fprintf(stderr, "%f\t", of * 0.1);
    assertEqualFloat(of * 0.1, tc.getOffset(), 0.001);
  }
}
```



Event Time	Event Id	Event Name	Event Severity	Event Description
2025-03-14T18:56:36.592Z	0xd06	LedBlinker.prmDb.PrmFileReadError	WARNING_HI	Parameter file read failed in stage OPEN with record 0 and error 1
2025-03-14T18:56:36.593Z	0xd00	LedBlinker.prmDb.PrmIdNotFound	WARNING_LO	Parameter ID 0xe00 not found
2025-03-14T18:56:58.271Z	0xe01	LedBlinker.led.BlinkIntervalSet	ACTIVITY_HI	LED blink interval set to 4
2025-03-14T18:56:58.271Z	0x501	LedBlinker.cmdDisp.OpCodeDispatched	COMMAND	LedBlinker.led.BLINK_INTERVAL_PRM_SET dispatched to port 6
2025-03-14T18:56:58.272Z	0x502	LedBlinker.cmdDisp.OpCodeCompleted	COMMAND	LedBlinker.led.BLINK_INTERVAL_PRM_SET completed
2025-03-14T18:57:12.249Z	0x501	LedBlinker.cmdDisp.OpCodeDispatched	COMMAND	LedBlinker.led.BLINKING_ON_OFF dispatched to port 6
2025-03-14T18:57:12.249Z	0xe00	LedBlinker.led.SetBlinkingState	ACTIVITY_HI	Set blinking state to ON.
2025-03-14T18:57:12.250Z	0x502	LedBlinker.cmdDisp.OpCodeCompleted	COMMAND	LedBlinker.led.BLINKING_ON_OFF completed
2025-03-14T18:57:12.608Z	0xe02	LedBlinker.led.LedState	ACTIVITY_LO	LED is ON
2025-03-14T18:57:16.609Z	0xe02	LedBlinker.led.LedState	ACTIVITY_LO	LED is OFF



Recommended Design

Hardware	Quantity	
Ball Heritage (Ball)	2	Dual string for LEO with RW ops, two Fli
Motor Control Electronics Box	2	Dual string assuming two-axis antenna c
Data Processing Unit (DPU)	2	High resolution telescopes (cameras)
Encryption Unit	2	Encryption for satellite comms at LEO

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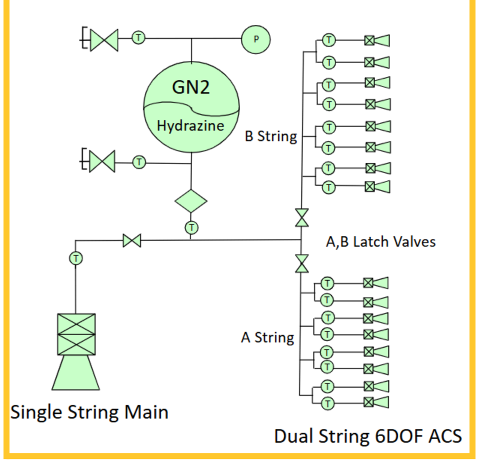
Spacecraft Subsystems

Propulsion Models

By Luis Diaz // 01.25.2025

This project uses the rocket equation and specific gas constants to size thrusters and tanks for all types of propulsion modes. Used for determining the appropriate propulsion mode for different mass/delta V requirements on mission.

Propulsion Subsystem Schematic



Problem 3: Bipropulsion Tank Sizing

Name	Units	Value	Comments
Overall			
Spacecraft Dry Mass	kg	1,000	Given
Delta V (ΔV)	m/s	500	Given
Min. Thruster Pressure	bar	5	Standard
Tank Max Exp. Op. Pressure (MEOP)	bar	20	Standard
Tank Capacity Margin	%	20%	Standard
Tank Initial Op. Pressure at BOM	bar	12.8	BOM Pressure if margin is unused
Total Pressurant Mass	kg	1.4	Using Ideal Gas Equation
Total Propellant Mass	kg	175.8	Rocket Equation with 3.5% Residual Account
Oxidizer Mass	kg	111.4	NTO
Fuel Mass	kg	64.4	NMMH
Pressurant Tank Volume	liters	62.8	Using Ideal Gas Equation
Oxidizer Tank Volume	liters	94.1	Max sizing between Ox and Fu, cheaper to have same size
Fuel Tank Volume	liters	94.1	Same as Oxidizer
Rocket Equation			
Type of Propulsion System	-	Biprop	
Specific Impulse (I_{sp})	s	325	Assuming NTO-MMH
Delta V (ΔV)	m/s	500	
Spacecraft Dry Mass (m_f)	kg	1,000	
Spacecraft Wet Mass (m_0)	kg	1,169.9	
Propellant Mass (m_p)	kg	169.9	Using Ideal Gas Equation
Bipropellant Mixture Ratio			
Propellant Type	-	NTO-MMH	
Mixture Ratio (Mox/Mfu)	-	1.73	
Residuals/Hold-up	%	3.5%	Propulsion lecture, chart 35
Total Propellant Mass (mp)	kg	175.8	Rocket Equation with 3.5% Residual Account, sum of Mox and Mfu
Oxidizer Mass	kg	111.4	
Fuel Mass	kg	64.4	

Name	Units	Value	Comments
Launch Vehicle Capability	kg	4,000	
Total Delta V (ΔV)	m/s	2,220	
Total Propellant	kg	2,003	
Monoprop	kg	182	
Biprop	kg	1,821	
Dry Mass Allocation	kg	1,797	

Maneuver	ΔV	Prop. Type	Isp	Initial Mass	Final Mass	Propellant Mass
	m/s	-	s	kg	kg	kg
Launch Injection Correction	30	Monoprop	209	4,000	3,942	58
Deep Space Maneuver (DSM)	215	Biprop	334	3,942	3,691	250
Interplanetary TCMs	20	Monoprop	209	3,691	3,655	36
Jupiter Orbit Insertion (JOI)	1,050	Biprop	334	3,655	2,653	1,003
Clean-up Maneuvers	20	Monoprop	209	2,603	2,578	25
Jupiter System Tour TCMs	150	Biprop	334	2,578	2,462	115
Europa Orbit Insertion (EOI)	665	Biprop	334	2,462	2,010	452
Europa Altitude Change	40	Monoprop	209	1,860	1,824	36
Orbit Maintenance	30	Monoprop	209	1,824	1,797	27
Total	2,220	-	-	-	-	2,003

Spacecraft Subsystems

Attitude Control Systems

By Luis Diaz // 01.12.2025

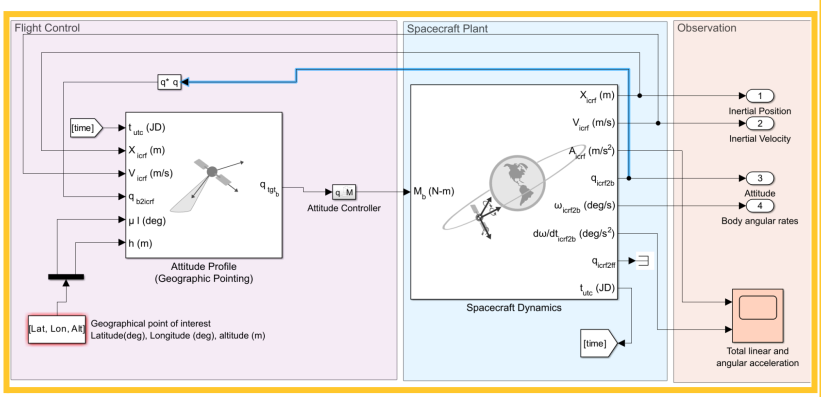
This project uses the worst-case deep space scenarios and moments of inertia to model the appropriate propellant required for RCS maneuvers and ACS slew rates, in consideration of pointing requirements. Base hardware can be seen as dropdowns for ease of access, heritage included. ISS data verified in Simulink using a PID Controller.

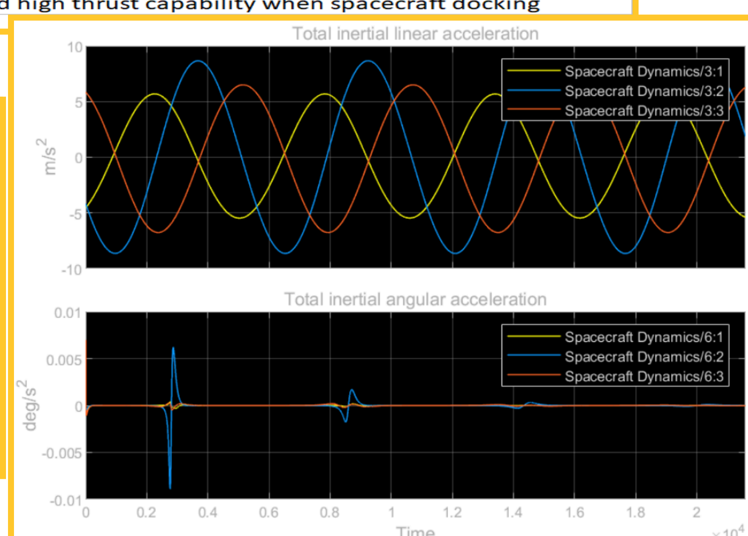
ACS Thruster & Propellant Sizing

Name	Units	Value	Comments
Common Parameters			
Standard Gravity (g_0)	m/s^2	9.8067	Earth gravity
Environment Assumptions			
Worst-Case Disturbance (T_d)	N-m	0.00003	Gravity Gradient
Mission & Spacecraft Assumptions			
Mission Duration	years	0.8	Plan for dual redundant timeline
Spacecraft Dimensions (l, w, h)			
Length (l)	m	5.0	
Width (w)	m	5.0	
Height (h)	m	8.0	
Thruster's Moment Arm (L)	m	5.34	Thrusters are located at corners
Spacecraft Mass in final orbit	kg	9,500	Assuming MOI is out of scope
Moment of Inertia for mapping (I)	$kg\text{-}m^2$	53,125	Assuming cube designation, at dry mass
Spacecraft Wet Mass (mi)	kg	9,500	Launch vehicle capability not including LV adapter (LV-side)
Worst-Case Moment of Inertia (I)	$kg\text{-}m^2$	53,125	With Wet mass
# of Thrusters / axis	#	2	
Thruster Size (F_{actual})	N	2	
Thruster Specific Impulse (Isp)	s	215	Assume Monoprop for desaturation

Recommended Design

Hardware	Quantity	Comments
IMU/IRU	2	Dual redundancy, internal
Fine Sun Sensor	16	Dual redundancy, extreme precision needed by space station
Star Tracker	2	Dual redundancy, external
RW/CMG Electronics	1	For CMG ops
Control Moment Gyros	4	Dual redundancy, mega-size, precision requirements
GPS Receiver	2	Dual reduncandy, attitude determination without stars
IR Earth Sensor	2	Dual redundancy, when sun is out of scope
RCS - Monoprop	1	Needed high thrust capability when spacecraft docking



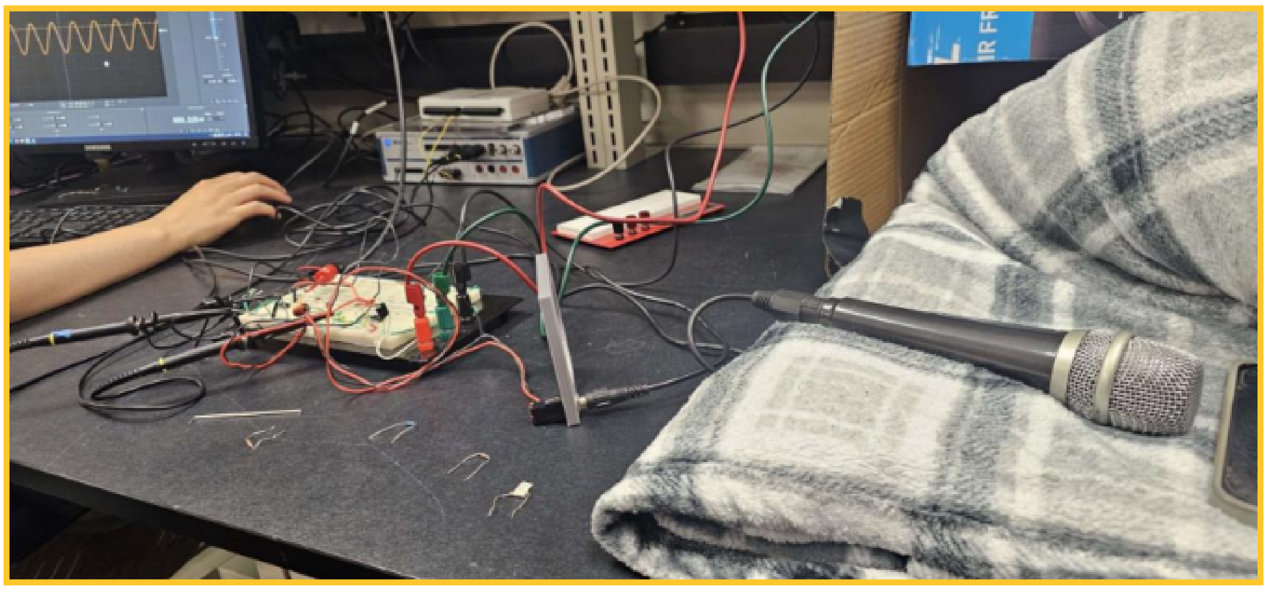


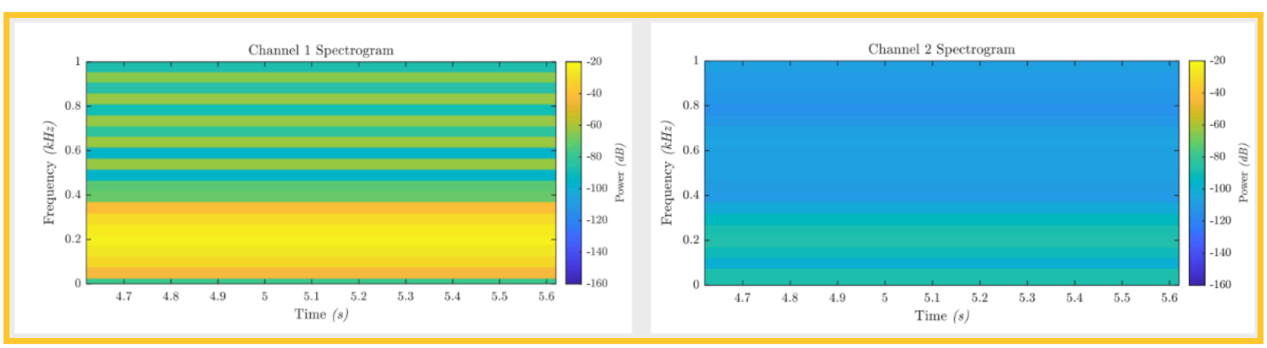
Mechoptronics Engineering – PRESENTATION

Acoustic Analysis of RLC Bandpass Filter

By Luis Diaz // 12.20.2024

Used RLC components, characterized their response, and then analyzed unfiltered vs filtered data received via microphone apparatus and applied by a wave generator combinator. Design, test, and validation.





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Spacecraft Subsystems

Telecommunications

By Luis Diaz // 12.15.2024

This project accesses the deep space network and creates a link budget compatible with all antenna sizes and the communication bands of interest.

1. Spacecraft Transmitter			Com
Bandwidth Selection	-	X-Band	
Frequency	MHz	8420	
Wavelength	m	3.56E-02	
Transmitted RF Power (W)	W	100	
Power Amplifier Efficiency	-	59%	
DC Input Power (required from S/C)	W	168.9	
Transmitted RF Power (dBm)	dBm	50.00	
Antenna Type		Parabolic	
Size (D, H, a)	m	9.00	
Size (b)	m	-	
Antenna Efficiency	%	0.55	
Antenna Gain	dB	55.40	
Circuit Loss	dB	-2.0	TBC
Pointing Loss	dB	-1.56	
Pointing Error	deg	0.10	
Beamwidth (3 dB)	deg	0.28	
Total Effective Isotropic Radiated Power (EIRP)	**dBm**	**101.84**	
2. Path Analysis			**Com**
Space Loss	dB	-234.48	
Atmosphere Attenuation	dB	-0.334	Fron
Total Path Loss	**dB**	**-234.81**	
3. DSN Receiver			**Com**
Antenna Selection	m	34-m	
Receive/Downlink Configuration	bands	X-Band, X-only	
DSN Antenna Gain	dB	68.33	
Min S/C Elevation Angle (from ground station)	deg	10.0	
Polarization/Ellipticity Loss	dB	-0.80	
Pointing Loss	dB	-0.10	
Total Receiver Gain	**dB**	**67.43**	

Data Rate (kbps)

S-Band	RF Power		
Antenna Size	50 W	100 W	200 W
1-m HGA	2.8	5.7	11.4
2-m HGA	11.3	22.7	45.4
5-m HGA	70.4	140.8	281.6

Data Rate (kbps)

X-Band	RF Power		
Antenna Size	50 W	100 W	200 W
1-m HGA	35.4	70.8	141.6
2-m HGA	139.7	279.5	559.0
5-m HGA	795.5	1591.0	3181.9

Data Rate (kbps)

	Frequency Band			
Antenna Size	S-Band	X-Band	K-Band	Ka-Band

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Spacecraft Subsystems

Power

By Luis Diaz // 11.29.2024

Models the implementation of secondary battery behavior coupled with solar arrays. RTG implementation forthcoming for the different modes like Launch, Cruise, Eclipse, and Safe-mode.

1. Power Analysis Table	Units	Launch	Cruise
Mode Duration	hr	2	-
Maximum Eclipse Duration	hr	2	-
Maximum Solar Distance	AU	1	1.47
Spacecraft Power Draw - CBE	W	150.0	290.0
Bus Power	W	150.0	250.0
Payload Power	W	0	40.0
Average Contingency	%	12%	12%
Spacecraft Power Draw - MEV	W	168	325
Margin	%	22%	250%
Spacecraft Power Draw - Available/Required	W	204	1135.87
EOL Solar Array Capability	W	-	1135.88
Solar Incidence Angle	°	-	0.25
Actual EOL Solar Array Capability	W	-	1135.87
Depth of Discharge	%	70%	-
Energy for Operations - Available/Required	Wh	408	-
Battery Drain (to recharge battery)	W	-	-
Available Power (after battery recharge)	W	-	-

2. Solar Array EOL Capability	Units	Value
Solar Irradience at 1 AU	W/m^2	1370
Solar cell efficiency	%	29.5%
Packing factor	%	88%
BOL - Mismatch & fabrication loss	%	98%
BOL - Wiring losses	%	96%
EOL - Radiation (high-energy particle) loss	%	94%
EOL - UV loss	%	98.5%
EOL - Micrometeorites	%	99.5%
Solar array size	m^2	8
Solar array EOL capability at 1 AU	W	2466
Solar array assembly (average mass per m^2)	kg/m^2	0.84
Number of array panels	#	2

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Spacecraft Subsystems
Mechanical

By Luis Diaz // 11.20.2024

Models the implementation of solar and planetary thermal effects on spacecraft, including surface adaptability and material selection.

Table 1: Primary & Secondary Structure Mass Estimation

Type	%	of Mass Type	CBE Mass	Estimated Mass
Primary Structure	5%	Internal High-Density	267.2	13.4
Primary Structure	15%	External High-Density	46.9	7.0
Primary Structure	20%	Distributed	60.0	12.0
Primary Structure Total				**32.4**
Secondary Structure	15%	Primary Structure	32.4	4.9
Secondary Structure	6%	External Support Systems	46.9	2.8
Secondary Structure	4%	Pressurant	5.0	0.2
Secondary Structure	4%	Propellant	130.0	5.2
Secondary Structure Total				**13.1**

Table 2: Additional HW Estimation

Type	%/#	of Mass Type	#/Total	Estimated Mass
Deployable Panels	1.5	Surface Area (kg/m2)	-	-
Latch/Release Systems	1.0	# of Systems	3.0	3.0
Integration Hardware	10%	Primary Structure	32.4	3.2
Ballast	1%	Dry Mass	755.8	7.6
LV Interface Adapter	5%	Total Wet Mass	**890.8**	**44.5**

Table 3: Flight System Mass Summary

		Units	Value
Spacecraft Dry Mass Total	Maximum Expected Value	kg	604.6
	Margin	%	25%
	Total	kg	755.8
Propellant Mass	Pressurant	kg	5.0
	Propellant	kg	130.0
Total Wet Mass		**kg**	**890.8**

Pre-existing Formula

Table 1. Flight System

Subsystem	Type	Component Name	#	Unit Mass	CBE	Cont.	MEV	Notes from Database	Type
Payload	Custom	EPIC	1	18.00	18.0	15%	20.7	Earth Polychromatic Imaging Camera	External High-Density
		NISTAR	1	12.00	12.0	15%	13.8	NIST Advanced Radiometer	External High-Density
		Plasma-Magnetometer Suite	1	9.00	9.0	15%	10.4	Fluxgate Mag, Faraday Cup, Elec Spet	Distributed
Mechanical	Boom	Generic (5.0-m)	1	5.00	5.0	15%	5.8	Magnetometer Boom	External High-Density
	Primary Structure	Parametric Estimate	1	32.40	32.4	15%	37.3	-	Primary Structure
	Secondary Structure	Parametric Estimate	1	13.08	13.1	15%	15.0	-	-
	Deployable Panels	Parametric Estimate	1	0.00	0.0	15%	0.0	-	Deployable Panels
	Latch/Release Systems	Parametric Estimate	1	3.00	3.0	15%	3.5	-	Latch/Release Systems
	Integration Hardware	Parametric Estimate	1	3.24	3.2	15%	3.7	-	Integration Hardware
	Ballast	Parametric Estimate	1	7.56	7.6	15%	8.7	-	Ballast
	LV Interface Adapter	Parametric Estimate	1	44.54	44.5	15%	51.2	-	SV-side LV adapter
	Harness	Parametric Estimate	1	47.80	47.8	15%	55.0	10% of all other dry mass	-
Thermal	Misc. Hardware	Surfaces, Heaters, Sensors, etc.	1	25.75	25.8	15%	29.6	3% of the subsystems, excluding Mech	Distributed
Propulsion	Propellant Tank (Liquid)	NG-80296-1 (58.6 liters)	1	3.60	3.6	15%	4.1	-	Distributed
	Thruster (Monoprop)	1-N MR-103G thruster (monoprop)	10	0.33	3.3	15%	3.8	Aerojet, flight proven	Distributed
	Additional Hardware	Latch Valves	1	0.70	0.7	15%	0.8	-	Distributed
		Pressure Transducers	2	0.30	0.6	15%	0.7	-	Distributed
		Service Valves	2	0.25	0.5	15%	0.6	-	Distributed
		System Filters	1	0.90	0.9	15%	1.0	-	Distributed
		System Tubes, fittings	1	0.48	0.5	15%	0.6	5% of other propulsion dry mass	Distributed
		Mounting brackets, fasteners	1	0.48	0.5	15%	0.6	5% of other propulsion dry mass	Distributed

Spacecraft Subsystems

Thermal

By Luis Diaz // 12.04.2024

Models the implementation of solar and planetary thermal effects on spacecraft, including surface adaptability and material selection.

Table 1: Inputs & Assumptions

Inputs & Assumptions	Abbr	Units	Value	Comments
General				
Stefan-Boltzman	σ	W/m^2 K^4	5.7E-08	from NASA Glossary
Solar Flux	Gs	W / m^2	1370	Suited for 1 AU
Distance from Sun	r	km	1.5E+08	Chose km for conceptualization
Earth				
Radius	Rp	km	6370	Assumed for Earth no cloud cover
Emissivity	εp	-	0.5	" "
Temperature	Tp	K	300	" "
Albedo	a	-	0.3	" "
Orbital Geometry				
Orbital Altitude	h	km	1500	Assumption for HW
Angular Radius of Planet	ρ	rad	0.94	Function of Rp and r
Reflection Factor	K	-	0.98	Function of ρ
S/C Power Budget				
S/C Power	Psc	W	420	Assumption for HW
Telecom RF Power	Prf	W	25	Assumption for HW
Additional Heater Power	Ph	W	15	5-80 W typical range given for N2H2 freeze
Total Dissipated S/C Power	Qd	W	410	Simplified model

Table 3: Resulting Thermal Balance

Outputs	Abbr	Units	Value	Comments
Qin				
Sun	Qs	W	89.1	Analysis in Table 2
Earth	Qp	W	2.8	" "
Sun Reflected from Earth	Qrs	W	16.0	" "
Power Dissipated within S/C	Qrad	W	33.4	" "
Total Head Load (in)	Qin	W	517.9	Qo may be included for systems like solar Arr
Qout				
Average S/C Temperature	T	K	300.00	Conversion: 26.85 °C
Total Radiated Heat (out)	Qout	W	33.4	Qvent typically 0
Delta Q		**W**	**-484.5**	**ΔQ = Qout - Qin**

Table A1: Material Properties for Common S/C Surfaces

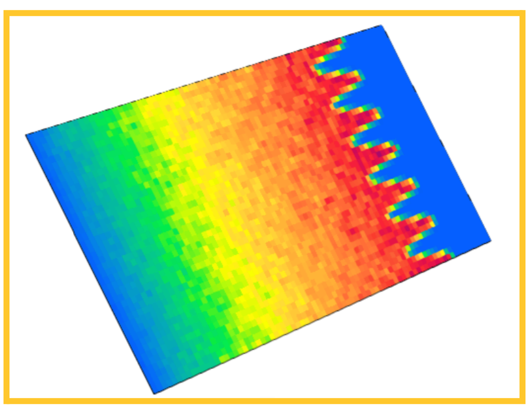
Surface Properties	Absorptivity α	Emissivity ε	Comments
Optical Solar Reflector	0.07	0.8	8 mil Quarts Mirrors
White Paint	0.22	0.85	S13G-LO
Black Paint	0.97	0.84	3M Black Velvet
Aluminized Kapton	0.38	0.67	1 mil
Metallic	0.13	0.04	Vapor Deposited Aluminum
MLI (white beta cloth cover)	0.45	0.04	~20 internal layers that result in an ε* of 0.04
MLI (aluminized beta cloth cover)	0.37	0.04	" "
MLI (tedlar reinforced cover)	0.3	0.04	" "
MLI (teflon-backed cover)	0.1	0.04	" "

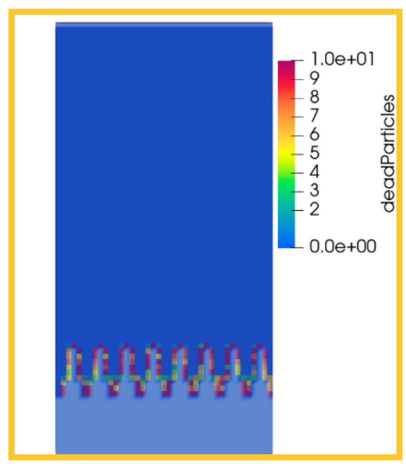
Computational Plasma Dynamics

Surface Roughness Modeling

By Luis Diaz // 05.02.2024

This project uses C++ in the Microsoft Powershell with the fundamentals of Electrostatic Particle in Cell modeling. Imaging is rendered in the Paraview software using Visual Toolkit output files. This project is set to model the surface evolution of a sample like silicon, when it is bombarded by rarefied gasses under certain parameters. Click the photo below to visit my presentation.↘





Google x Viterbi Internship – AI Project Showcase

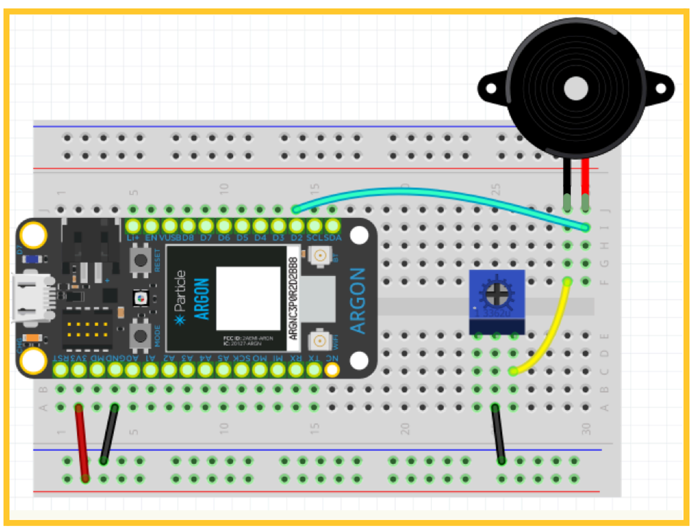
Tabling Activity

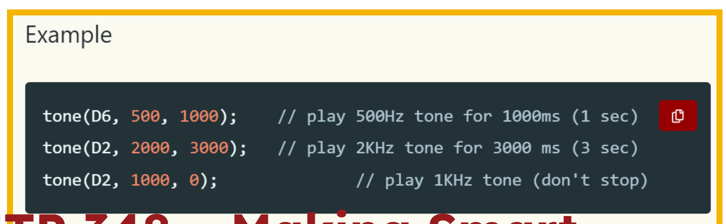
By Luis Diaz // 12.18.2023

This project uses the Arduino microcontroller along with the ChatGPT natural language processing product to act as an electronic tool that can communicate human direction into frequencies that are produced by a buzzer component. We are able to see if general AI systems can learn information and access long-term memory to produce quality code similar to human music.

Click the photo below to visit my presentation.↘

AI Buzzer Project




Example

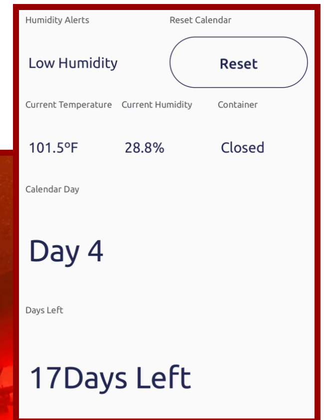
```
tone(D6, 500, 1000);    // play 500Hz tone for 1000ms (1 sec)
tone(D2, 2000, 3000);   // play 2KHz tone for 3000 ms (3 sec)
tone(D2, 1000, 0);              // play 1KHz tone (don't stop)
```

ITP 348 – Making Smart Devices: Introduction to Electronics and Wearables

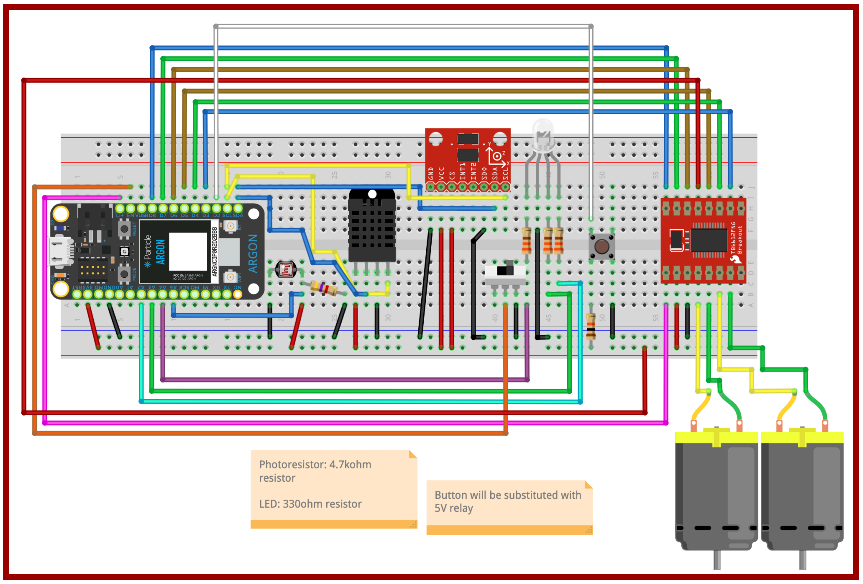
Egg IncuBYTEr

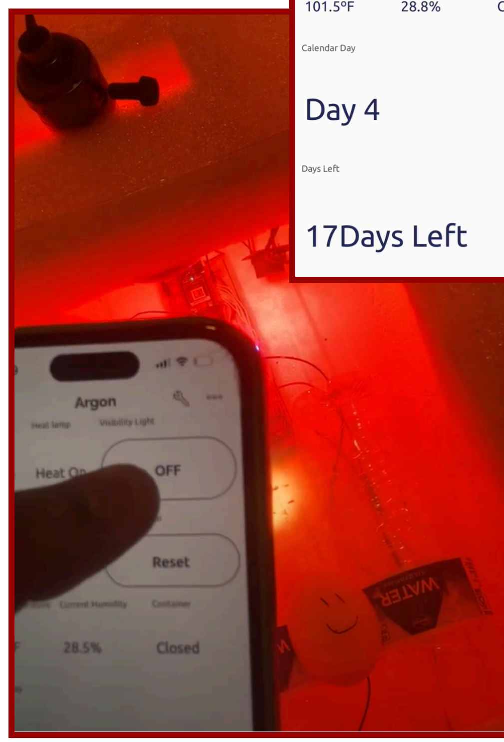
By Luis Diaz // 12.12.2023

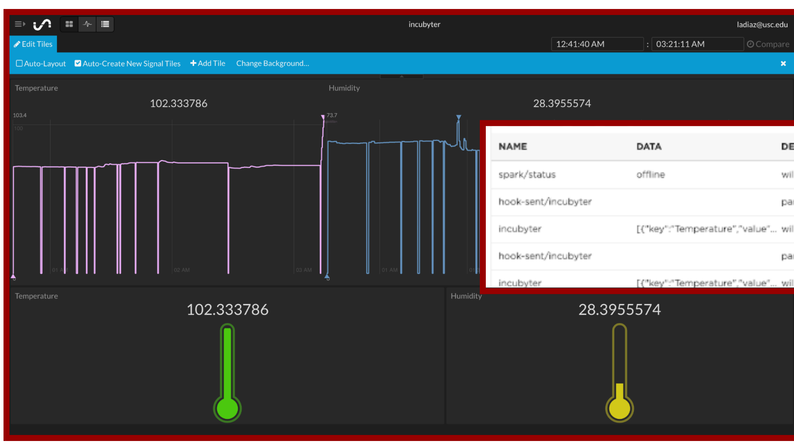
This project uses the Particle Argon microcontroller along with the Blynk bluetooth application Interface & Initial State Dashboard. It features a DHT20 temp/humidity control, DC motors, a photoresistor, an AC heat lamp, and other electrical components to power a successful incubator. The purpose of this was to create an environment that could sustain the growth of poultry eggs for farming purposes.

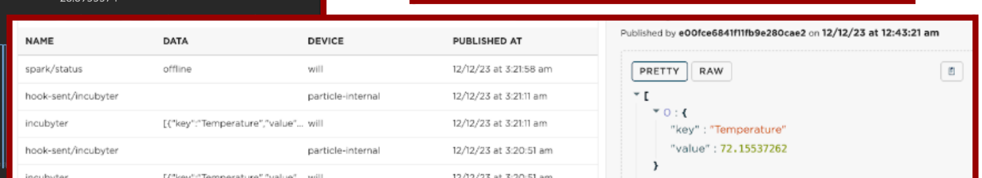


USC ITP348 Final Project Incubyter









JSON

Statics

Tree Body Diagram

By Luis Diaz // 12.03.2023

USC Viterbi
School of Engineering

This project uses the principles of Engineering statics of particles and rigid bodies, specifically trusses to develop mathematical relationships, as well as a Python code that can help one design a life-sized tree house. This was initially simulated with a craft tree-house, which could sustain point loads, distributed loads, and wind loads.

Click the photo below to visit my presentation.↘