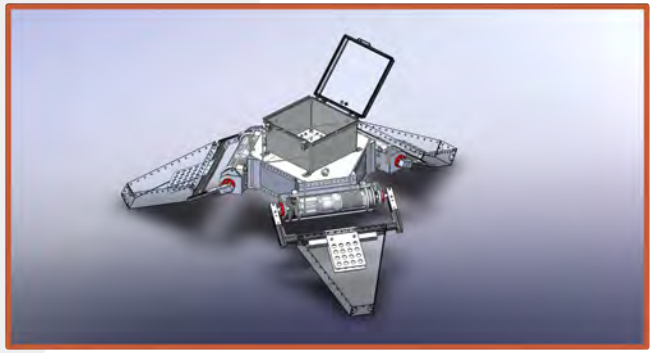


Full CAD assembly

Development and Testing of a Wave Powered Offshore Sensing System

Areesh Sobhani (Purdue University)
Samuel Loving (Florida Atlantic University)

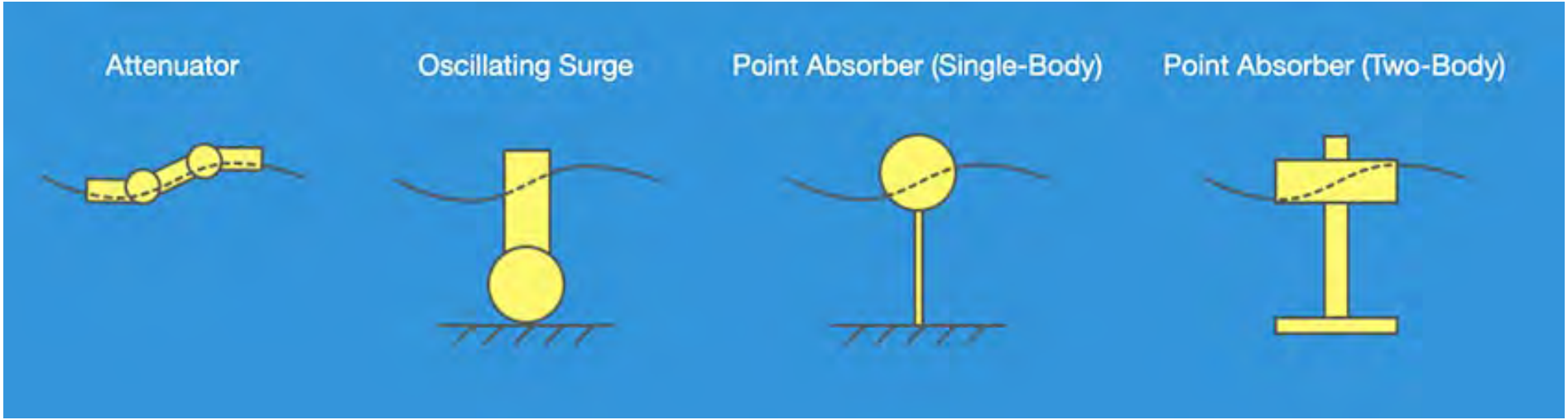
Dr. James VanZwieten

FAU
Florida Atlantic University

80,000 TW/Year

~800,000,000,000,000 A19 10W LED Lightbulbs

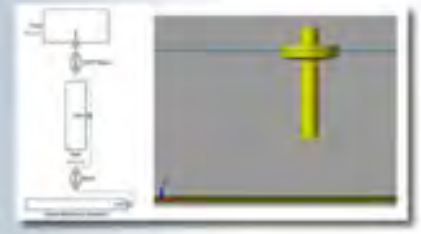
Wave Energy Converters (WECs)

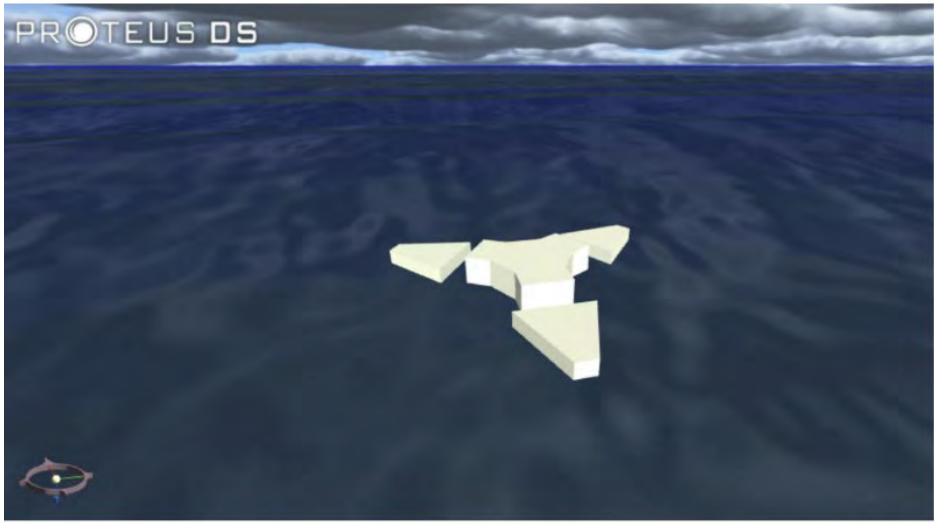


Types of Wave Energy Converters

WEC-Sim

Wave Energy Converter SIMulator





Knowledge and Development Gaps

Simulation Validation

Validation of Electrical and Mechanical Power Ratings, as well as optimization of the two characteristics

Performance Characterization

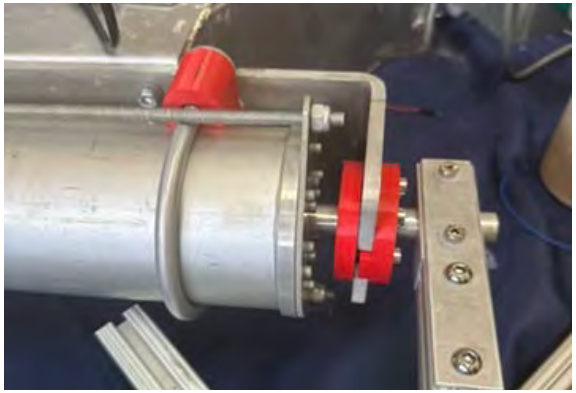
Wave Characterization to Record Performance in different environmental circumstances

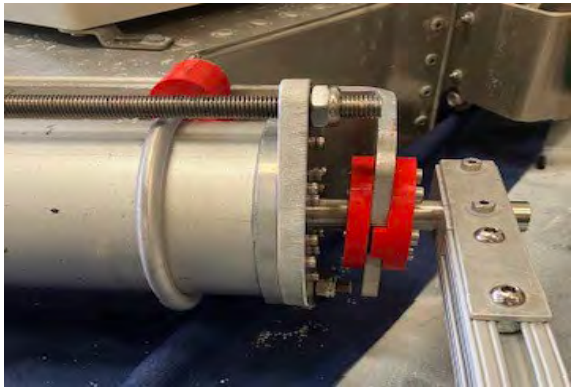
System Repair, Maintenance, and Upgrades

Improving the testbed to record reliable data

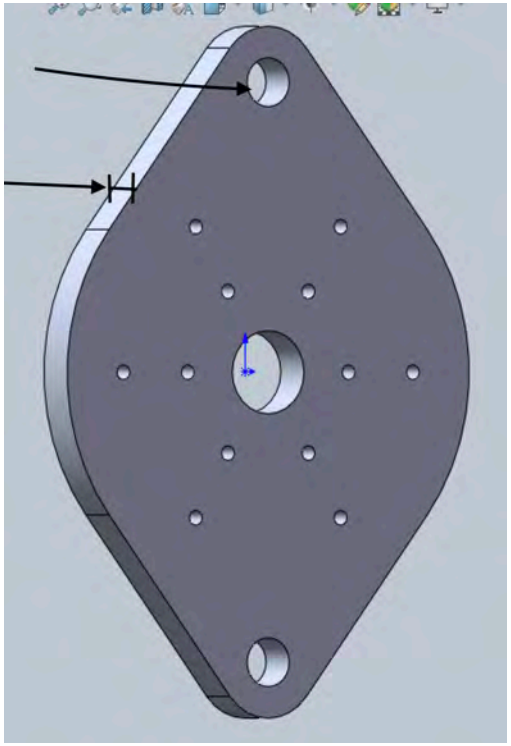
Mechanical Repairs (Motor Pods)

Original motor pod





Motor pod with replacement plate and shaft

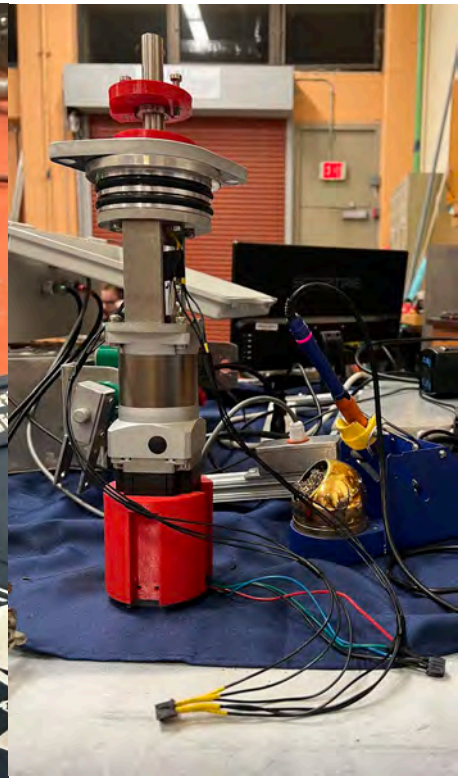


Retention plate CAD model

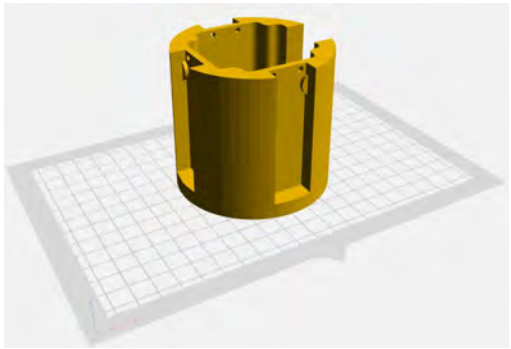
Motor shaft CAD model

Mechanical Repairs & Upgrades (Motors)

Original motor



Replacement motor, fitted with a brace and connectors

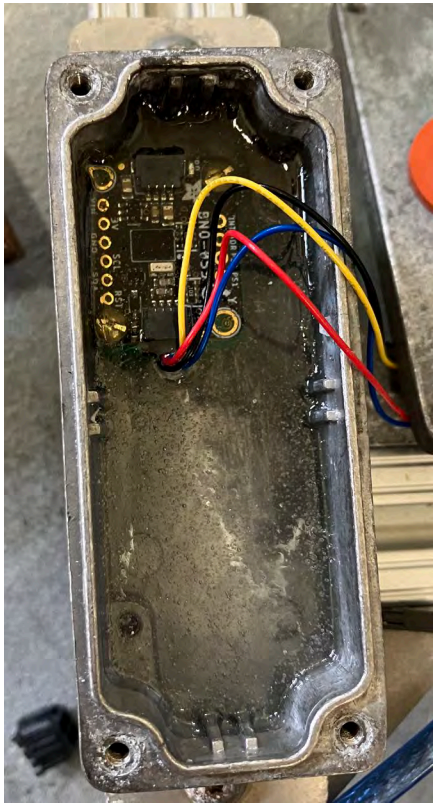


Brace CAD model

Brace leak sensor slot

Mechanical Repairs (IMUs)

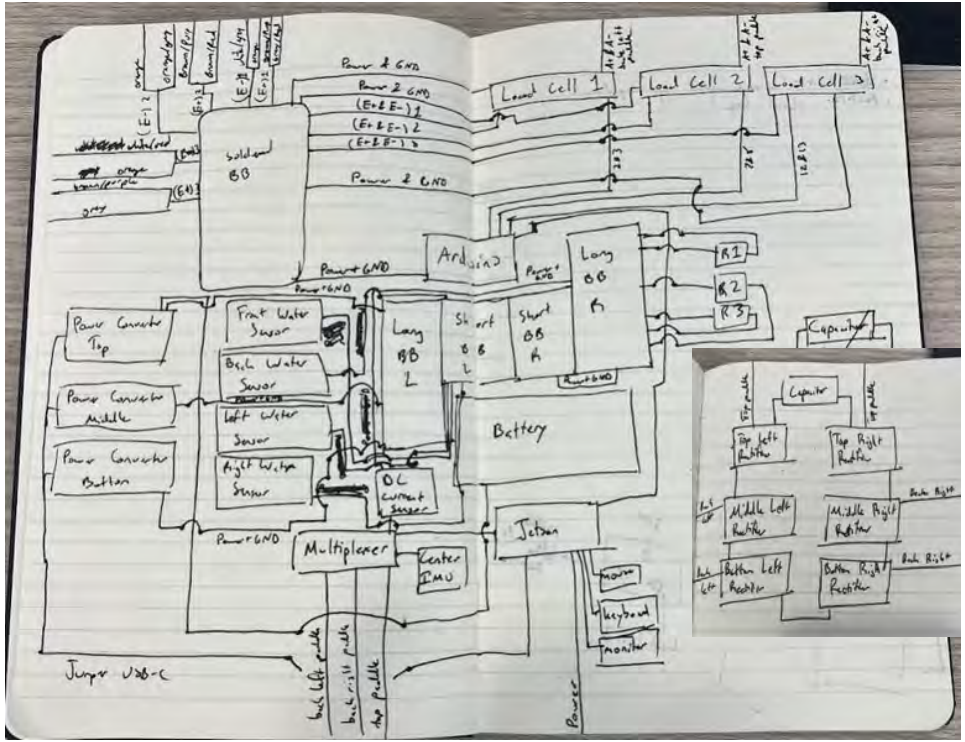
Original IMU unit



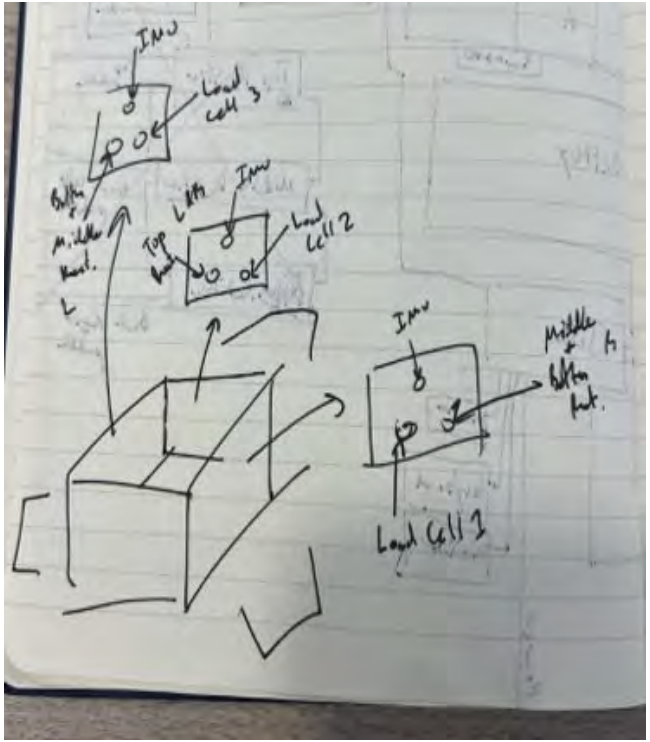
Replacement IMU unit set in resin

- Inertial Measurement Unit
- Provides angular velocity and elevation data
- Set in resin within enclosures to reduce potential water damage

Initial Electrical System Documentation

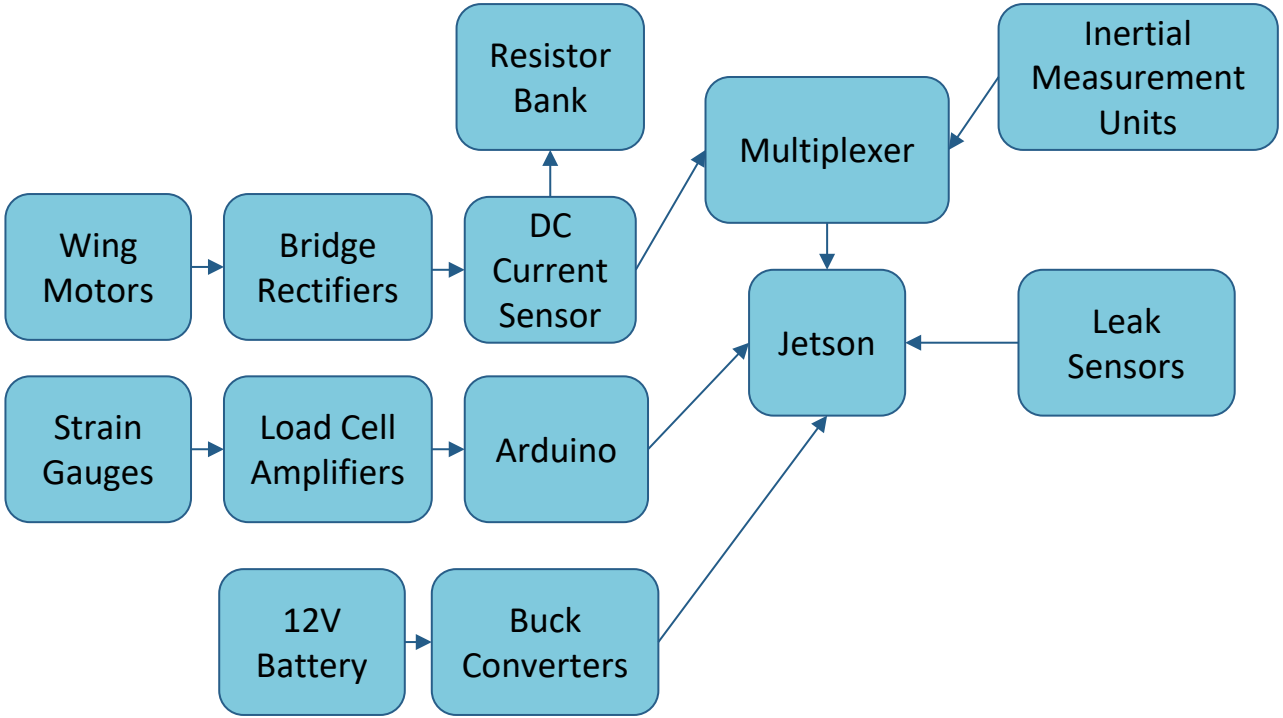


WEC wiring drawing

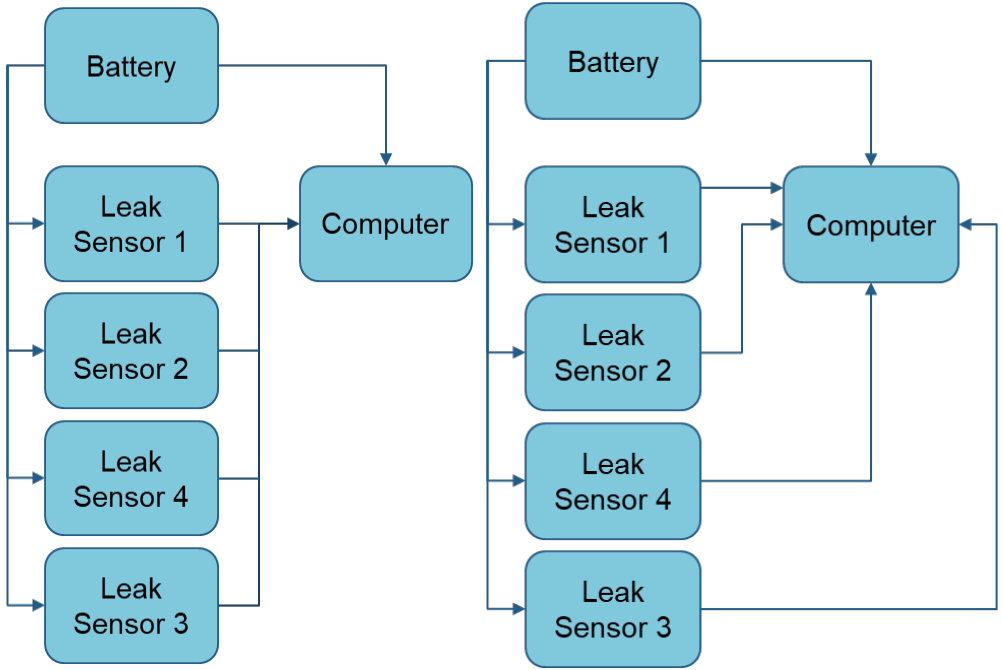


Signal-out reference drawing

Initial WEC System



Leak Sensing System



"Consolidated" signal path

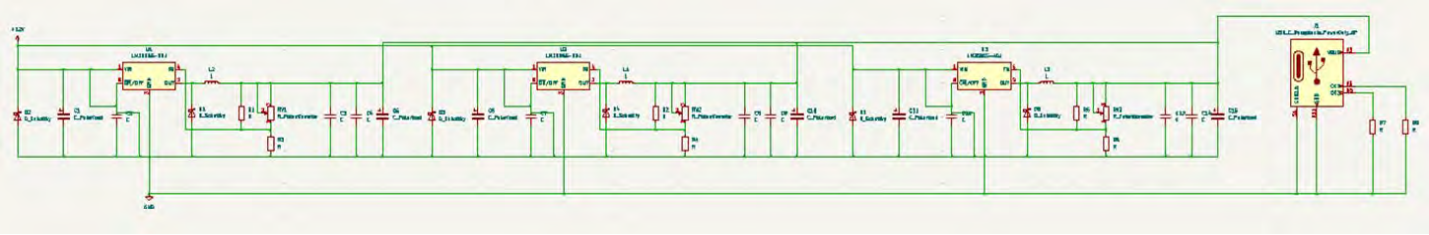
"Individual" leak path

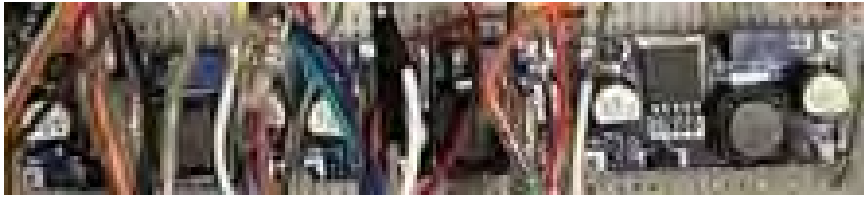
Jetson Nano Dev-Board Expansion Header

Alt Function	Linux(BCM)	Board Label			Board Label	Linux(BCM)	Alt Function
DAP4_DOUT	78(21)	D21	40	39	GND		
DAP4_DIN	77(20)	D20	38	37	D26	12(26)	SPI2_MOSI
UART2_CTS	51(16)	D16	36	35	D19	76(19)	DAP4_FS
		GND	34	33	D13	38(13)	GPIO_PE6
LCD_BL_PWM	168(12)	D12	32	31	D6	200(6)	GPIO_P20
		GND	30	29	D5	149(5)	CAM_AF_EN
		D1/ID_SC	28	27	D0/ID_SD		
SPI1_CS1	20(7)	D7	26	25	GND		
SPI1_CS0	19(8)	D8	24	23	D11	18(11)	SPI1_SCK
SPI1_MISO	13(25)	D25	22	21	D9	17(9)	SPI1_MISO
		GND	20	19	D10	16(10)	SPI1_MOSI
SPI2_CS0	15(24)	D24	18	17	3.3V		
SPI2_CS1	232(23)	D23	16	15	D22	194(22)	LCD_TE
		GND	14	13	D27	14(27)	SPI2_SCK
DAP4_SCLK	79(18)	D18	12	11	D17	50(17)	UART2_RTS
		RxD/D15	10	9	GND		
		TxD/D14	8	7	D4	216(4)	AUDIO_MCLK
		GND	6	5	SCL/D3		
		5V	4	3	SDA/D2		
		5V	2	1	3.3V		

NVIDIA Jetson Nano CircuitPython pinout

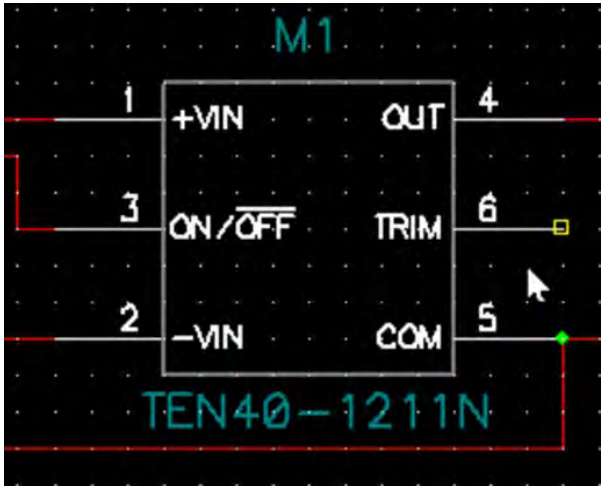
Power Distribution System



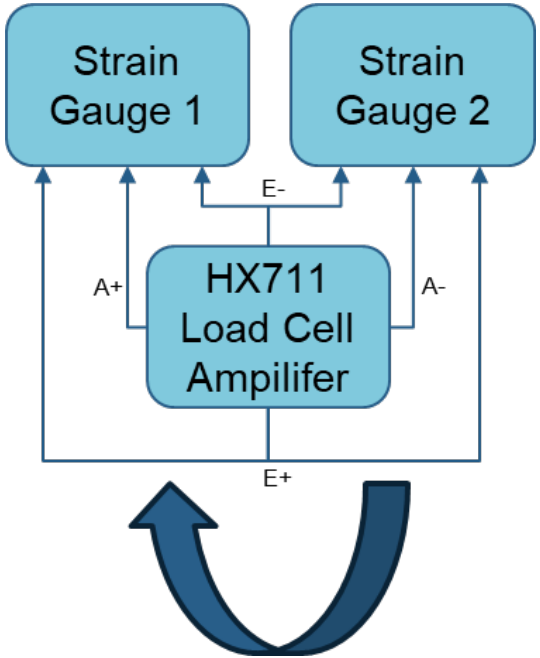


DC buck converter chain & associated schematic

Traco Power ten40-1211E DC/DC converter & associated schematic



Strain Sensing System



Corrected signal path

Anchored strain gauge

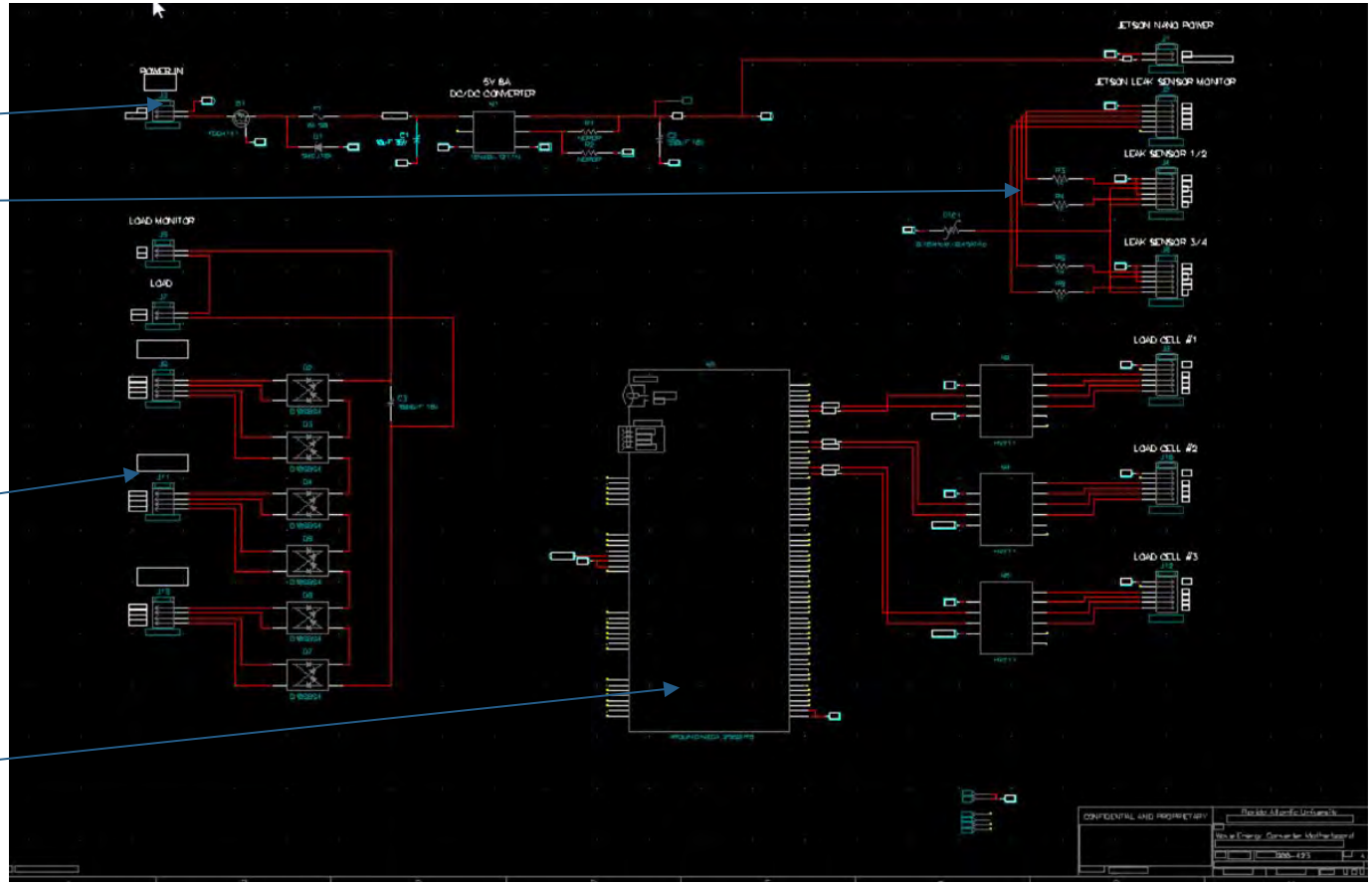
WEC Schematic

Power Distribution

Leak Monitoring

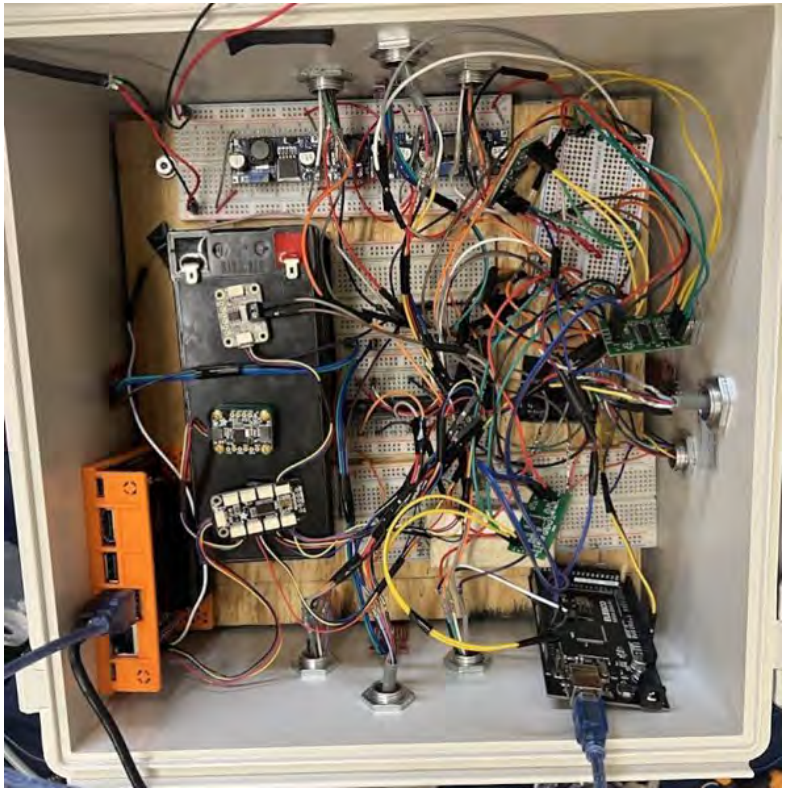
Power Sensing

Strain Monitoring



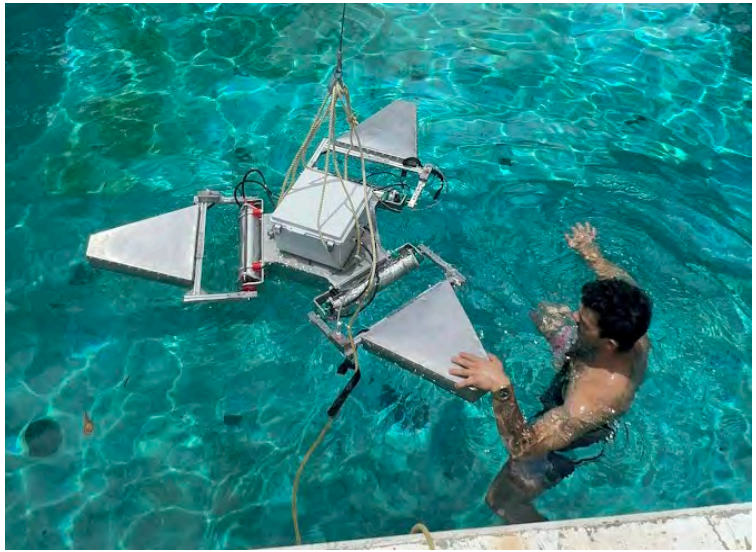
WEC Printed Circuit Board (PCB)

PCB Implementation



Original electronics box

Updated electronics box



Joshua Masturzo handling the WEC in the Engineering West Pool

In-Water Testing

Peak wattage during pool testing

```
Motor output voltage : 25.549   V
POWER :  4.368   W

no leak on 1
no leak on 2
no leak on 3
no leak on 4
(-0.98175048828125, -0.0755615234375, 0.00872802734375, -0.1741943359375)
```

Going Forward

01
Gen2 Layout

02
Strain Gauge System

03
Re-simulation

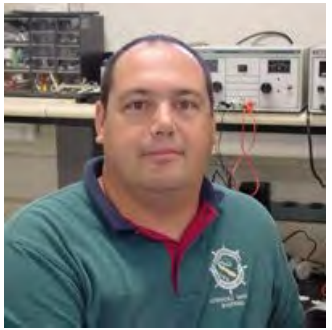
04
High-Vol Test Data

05
System Buoyancy

Acknowledgments

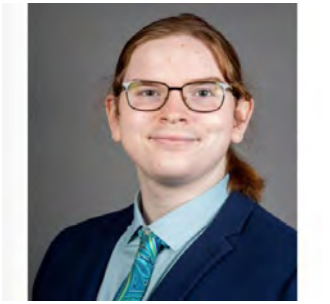
Dr. James VanZwieten

Ed Henderson



Joshua Masturzo

James Laumeyer



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