Solar-Powered Unmanned Aerial Vehicle

NAU
SOLAR FLYERS

Update#3
11.18.22

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Project Sponsor: Gore
Project Advisors: Venkata Yaramasu, Ph. D & Alexander Dahlmann, GTA
Project Partners: ME 486C Team

Figure 1: Solar UAV Gantt Chart 11/18/22

Solar UAV

EE (NAU) Solar Flyers

Gabriel Martin & Sultan Alhazawbar

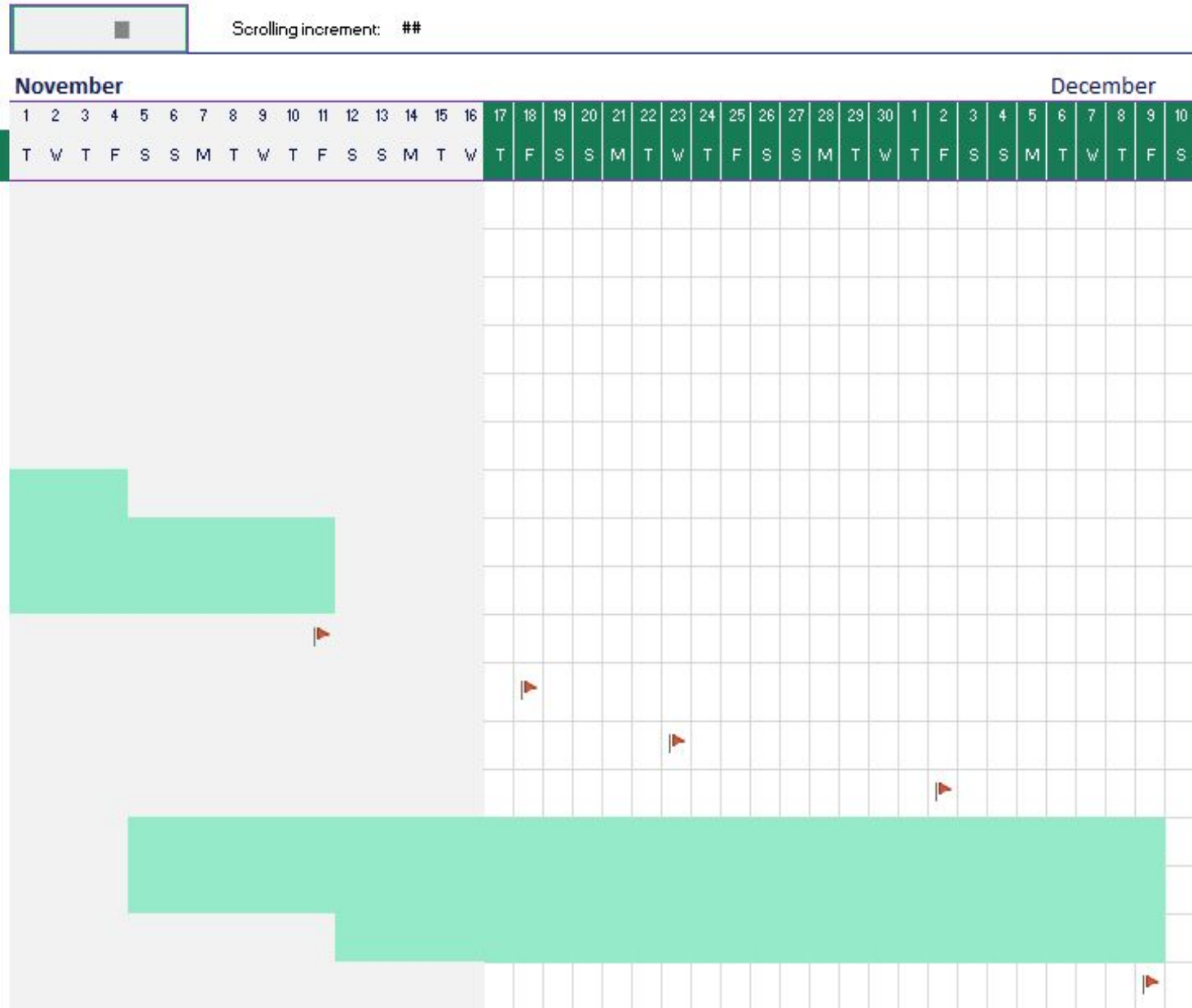
Project start date: 1/10/2022

Milestone marker: 1

Scrolling increment: ##

Milestones

Milestone description	Assigned to	Progress	Start	Duration (# Days)	Finish
EE476C					
EE486C					
Recap Assessment	G.M	100%	8/29/2022	10	9/9/2022
1/3 Build Assessment	G.M & S.A	100%	9/9/2022	37	10/14/2022
Individual Contribution Assessment	G.M & S.A	100%	10/14/2022	16	10/28/2022
Website Check I	S.A	100%	10/14/2022	16	10/28/2022
2/3 Build Assessment	G.M & S.A	100%	10/14/2022	23	11/4/2022
Team Design Document II	G.M & S.A	100%	10/14/2022	30	11/11/2022
Website Check II	S.A	100%	10/28/2022	16	11/11/2022
Prototyping Phase A: Array Assembly	G.M	100%	11/11/2022	1	11/11/2022
Prototyping Phase B: Charge Controller Configuration / Connection	G.M & S.A	50%	11/18/2022	1	11/18/2022
Prototyping Phase C: Full Integration	G.M & S.A	0%	11/23/2022	1	11/23/2022
UGRAD Symposium	G.M & S.A	0%	12/2/2022	1	12/2/2022
3/3 Build Assessment	G.M & S.A	0%	11/4/2022	37	12/9/2022
Team Design Document III	G.M & S.A	0%	11/4/2022	37	12/9/2022
Website Check III	S.A	0%	11/11/2022	30	12/9/2022
Project Completion	G.M & S.A	0%	12/9/2022	1	12/9/2022



Overview

Goal: To construct a solar powered unmanned aerial vehicle (UAV) that will fly 1 ½ times the duration that a sole onboard battery would fly it for.

Progress Update Since 11.4.22

1) Solar Cell Encapsulation
2) Array Assembly
3) Charge Controller Configuration
4) ME Progress
    - Successful Flight
    - Flight Controller
    - Final Iteration
5) Integration Approach
6) Next Steps

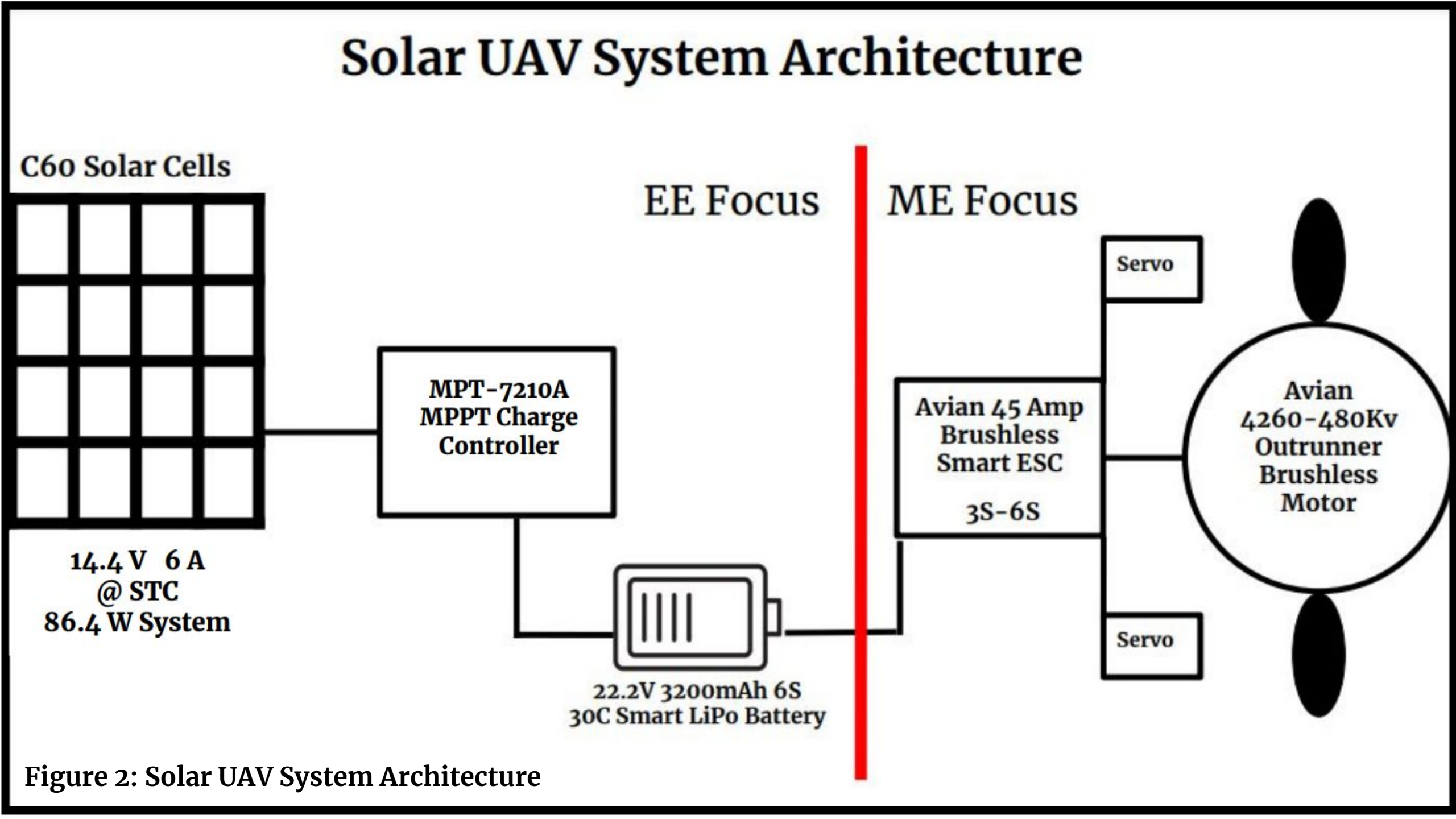


Figure 2: Solar UAV System Architecture

Solar Cell Encapsulation

Using lamination material for the protection of our solar array.

Figure 3: Solar Encapsulation Process (Backside)

- Self seal laminating
- No loss in efficiency with lamination film
- Frontside 100% covered
- Backside 90% covered with leads exposed
- Getting rid of air bubbles on front side

Array Assembly - Prototype A

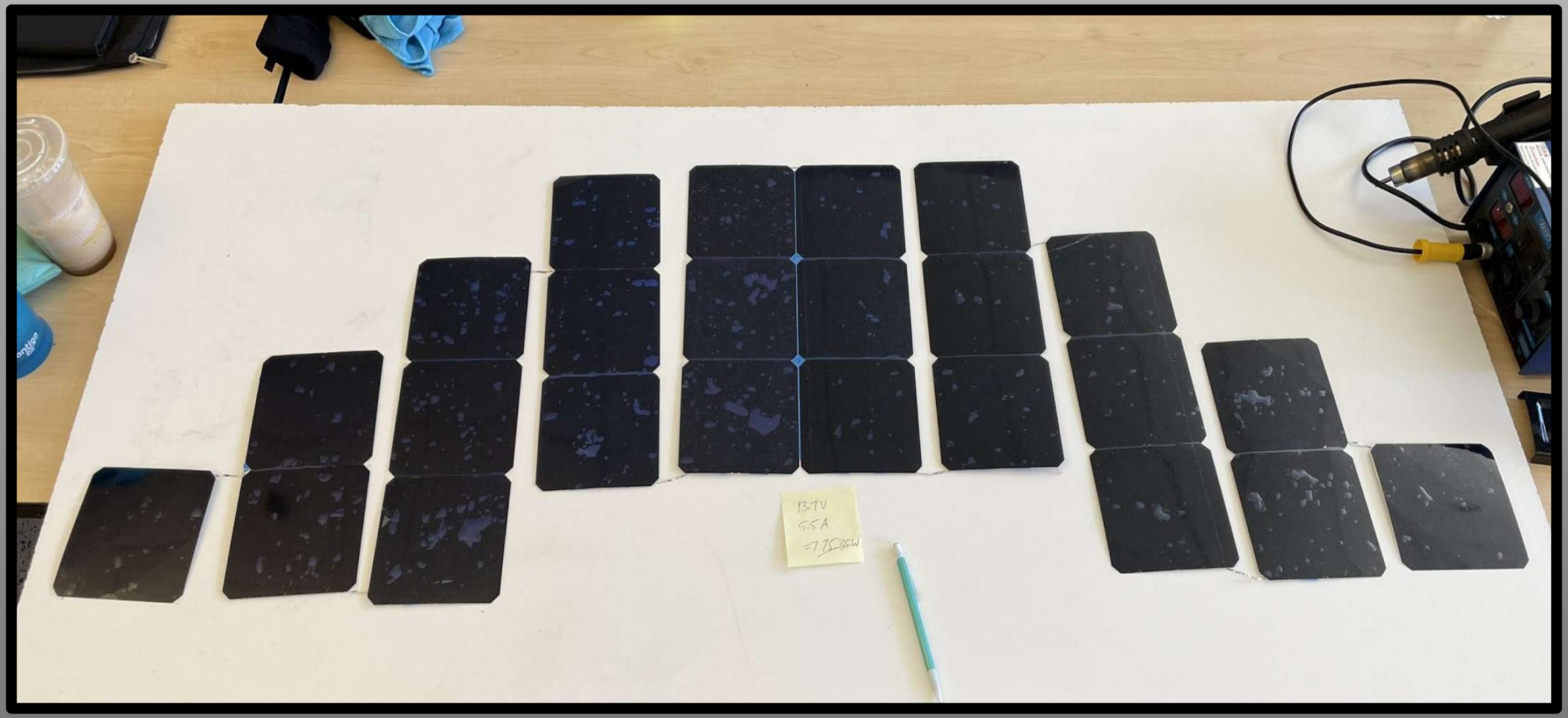


Figure 4: Full Solar Array (Frontside)

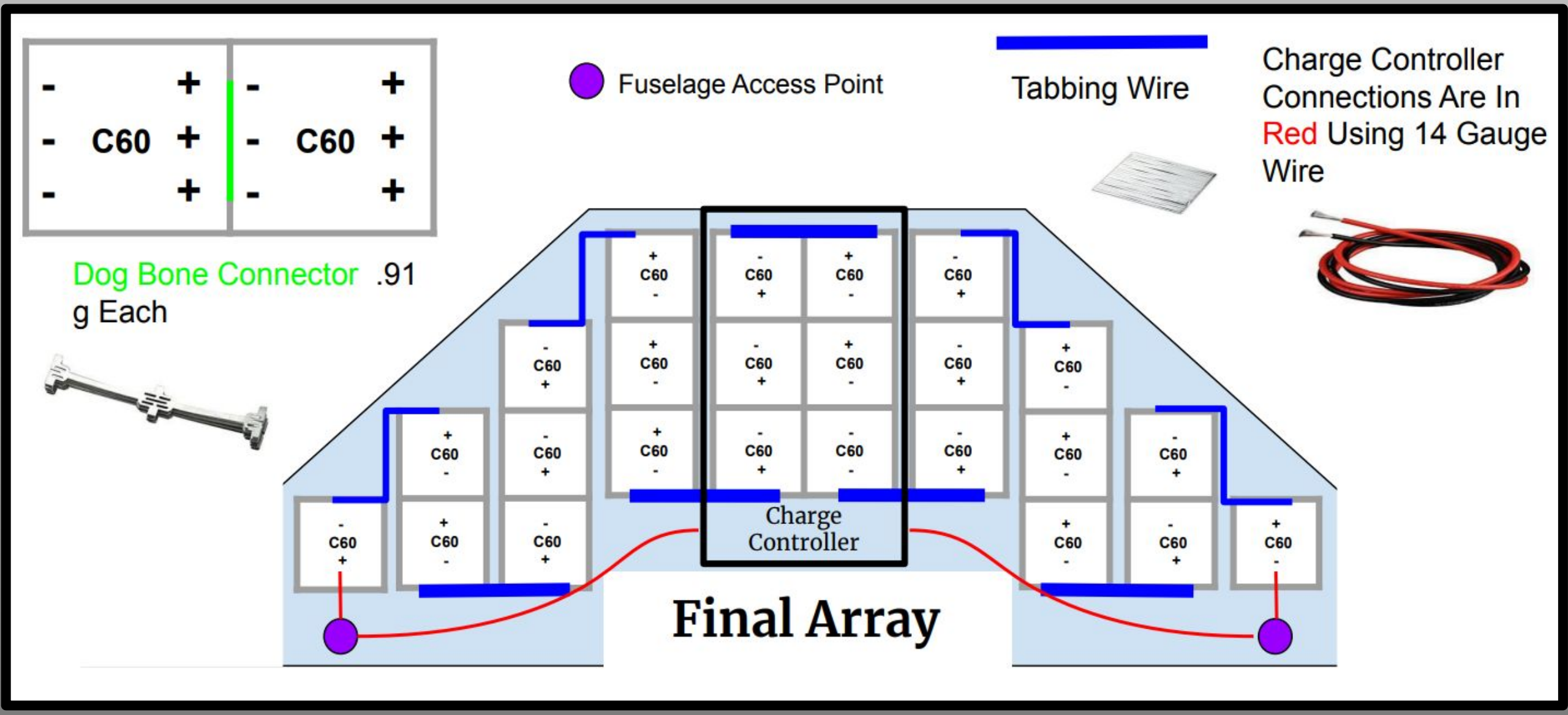


Figure 5: Schematic of Solar System on UAV

Array Assembly – Prototype A

Initial Reads for PV Array for Solar UAV	
- Ppv	71.96 W
- Vpv	12.58 V
- Ipv	5.72 A
- # of cells	24 Cells
- Weight	< 200 g
Testing Conditions	
- Time	12:30 PM on 11/13/22
- Temperature	43 ° F
- Array to the Sun's Orientation	Horizontal to Solar Noon

Table 1: PV Array Specifications

Charge Controller Configuration

MPT - 7210A Charge Controller	
• Input Voltage	DC 12 - 60V
• Input & Output Current	0 - 10 A Adjustable
• Output Power	20 - 600W
• Working Modes	MPPT and DC-DC Boost
• Item Size(approx)	131 * 96 * 54 mm
• Tracking Efficiency	98%
• Output Voltage	DC 15-90V Adjustable
• Initial Weight / Modified Weight	440g / 142g

Table 2: MPT-7210A Specifications

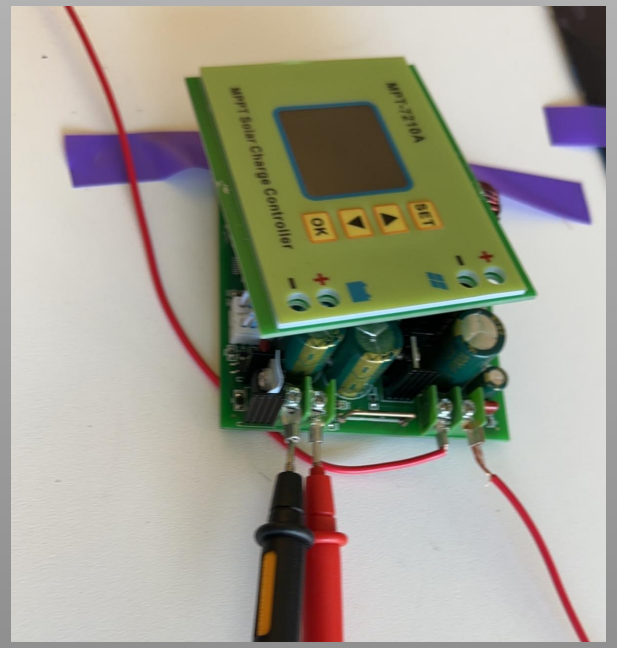


Figure 6: Unshelled Charge Controller

1) **Weight Adjustment**: Managed to shave the weight down to 142 g.
2) **Wiring**: 14 AWG wire from the array to the corresponding inserts by crimping the connectors onto the wire
3) **Initial Reading:** The charge controller took our input of 12 V and 5 ½ Amps, and output 30V and 5 Amps to the voltmeter and the charge controller's screen, demonstrating its MPPT/Boost functionality.

Charge Controller Configuration

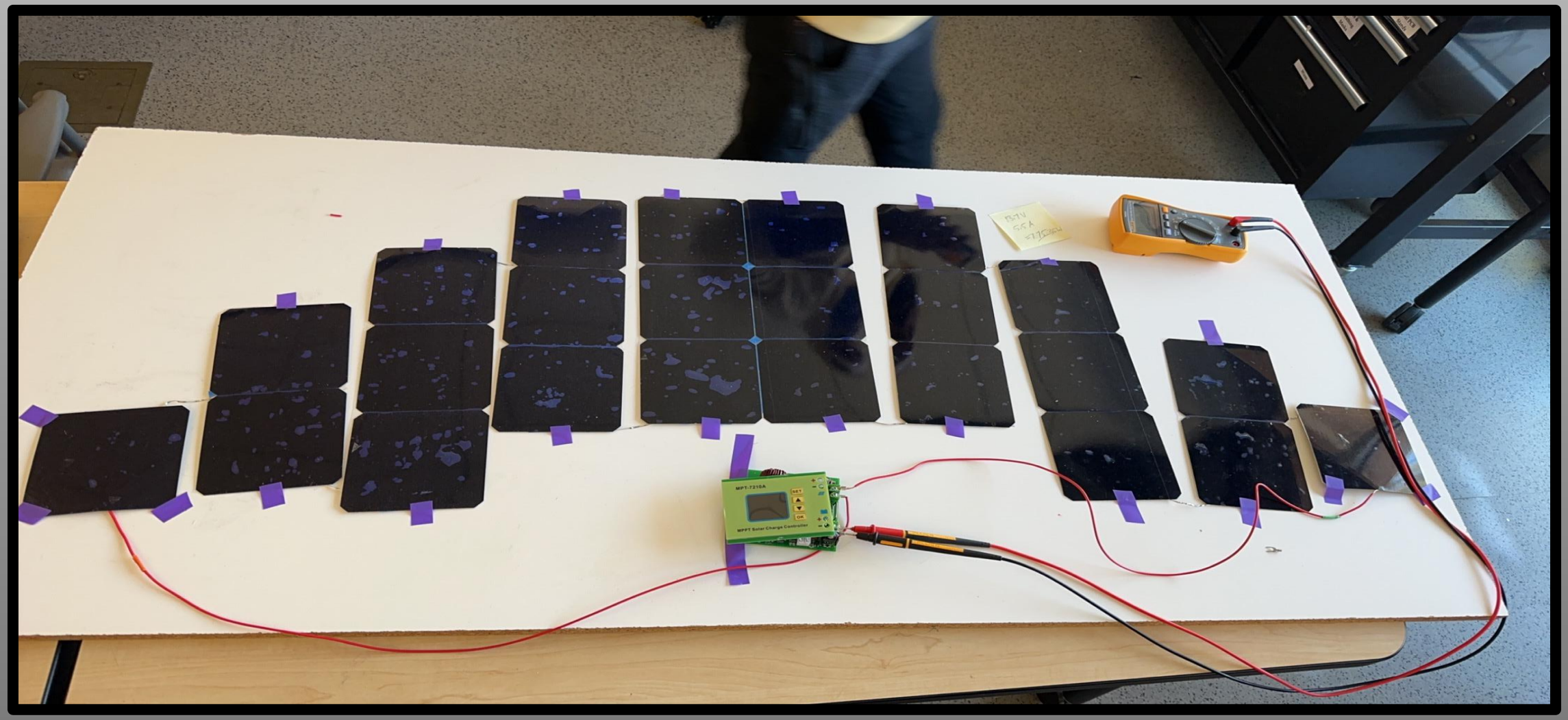


Figure 7: Solar System Connected to Charge Controller & Voltage Meter

ME Progress – Successful Flight

ME Progress – Flight Controller

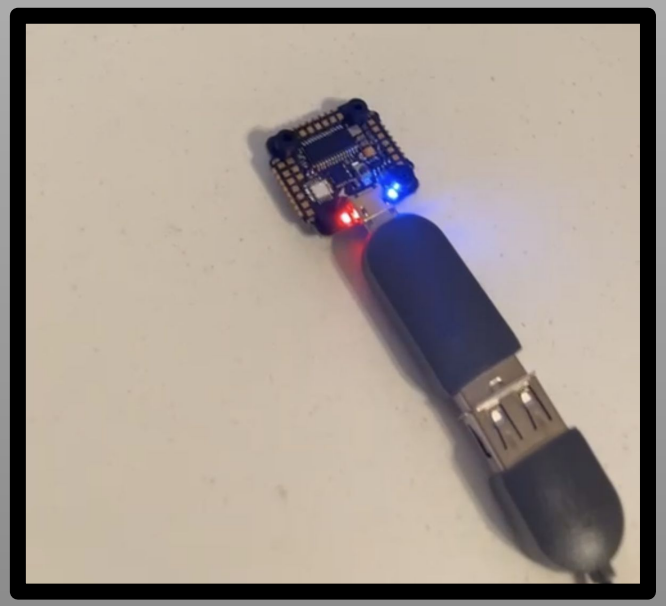


Figure 8: GPS for Flight Controller

Preset & Automated Flight

Real Time Tracking

GPS Navigation

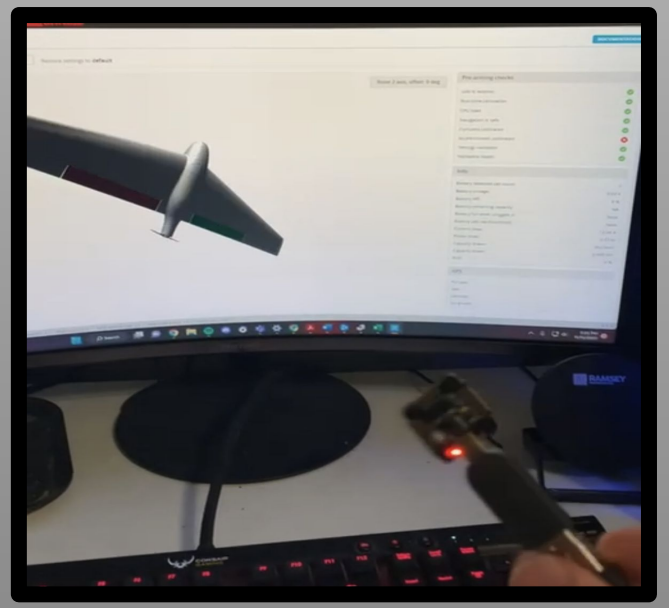


Figure 9: INAV Software for Flight Controller

Final Iteration of the Solar UAV

The 3rd iteration of the UAV has set the final conditions for our system:

- Back down to 24 cells
- New output power from array @ STC is around 86.4W
- Longer strips of tabbing wire because our cells will be spread out, but there no loss in efficiency
- Charge controller seems is working and is a perfect fit for our system.

Next Steps

1) Integration of our battery w/ charge controller
2) Monitor a successful flight without solar to set marks
3) Panel installation & full integration of our system onto the UAV
4) Demonstration of the final product
5) Class deliverables and UGRAD syponism preparation

Questions ?