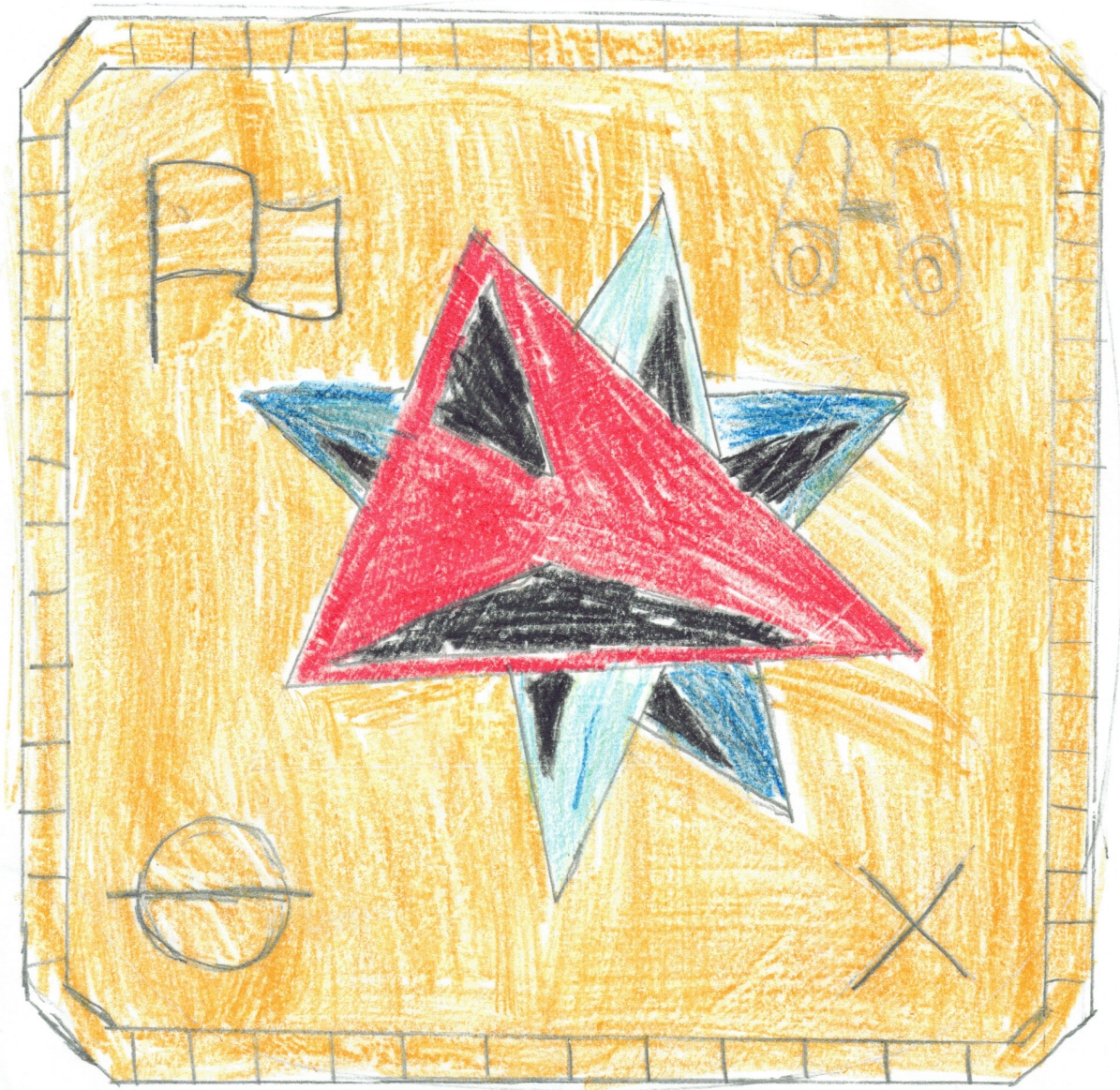
FIRST LEGO LEAGUE



IRON PATRIOTS SILVER

PRESENTATION

Expert Resources

Dr. Amelia Brown

Senior Lecturer in Greek History & Language
ARC Senior Research Fellow

Coach Kimberly Kay

FLL Coach and Program Manager
Technobotics 4H

Dr. Jen Thum

Egyptologist & Associate Director of Engagement & Research Curator at Harvard Art Museums

Dr. Anne Duray

Science and Tech Fellow
American Association for the Advancement of Science

Dr. Chris Motz

Manager of Digital Assets,
University of Michigan,
Kelsey Museum of Archaeology

Ashley Lemke

Associate Professor of Anthropology, University of Wisconsin-Milwaukee

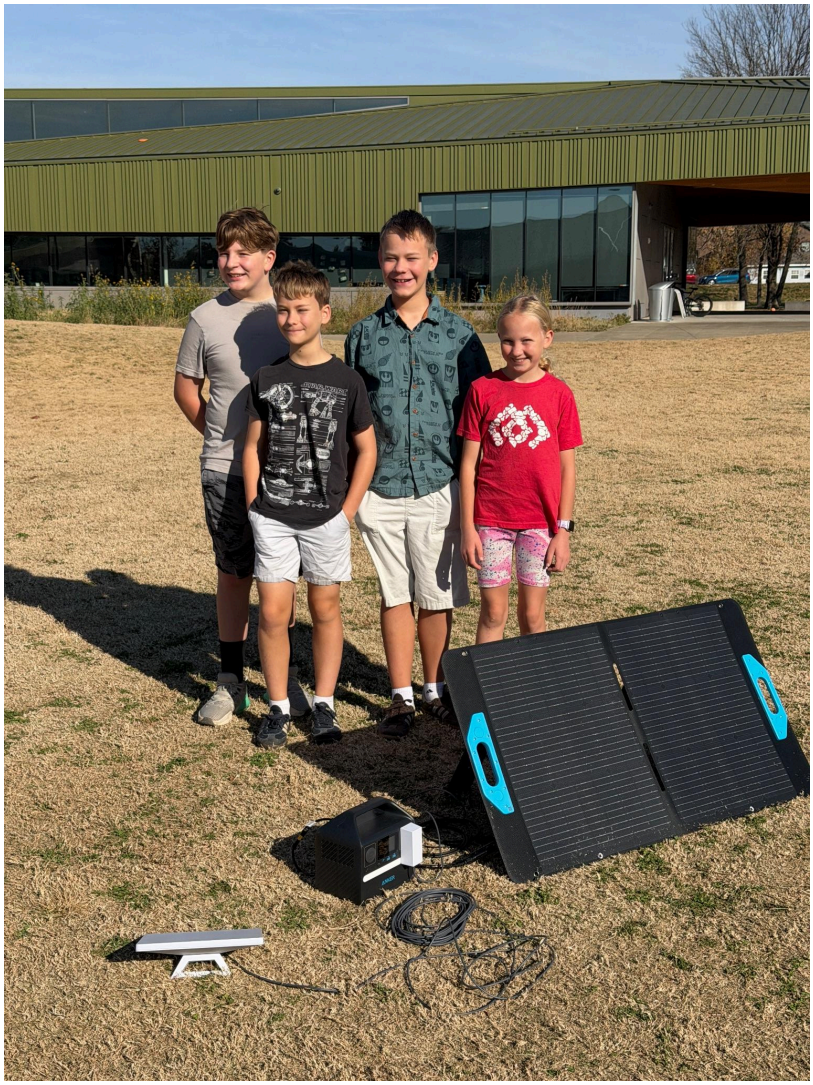
Taylor Cwikla

Corinth Excavations
Steinmetz Foundation Museum Fellow

David Cardona

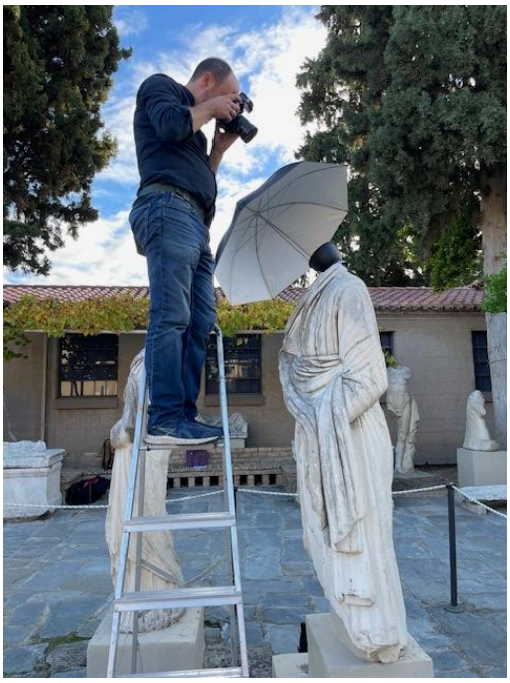
Senior Curator of Phoenician, Roman and Medieval Sites
Heritage Malta


mindset



Acropolis at Acrocorinth

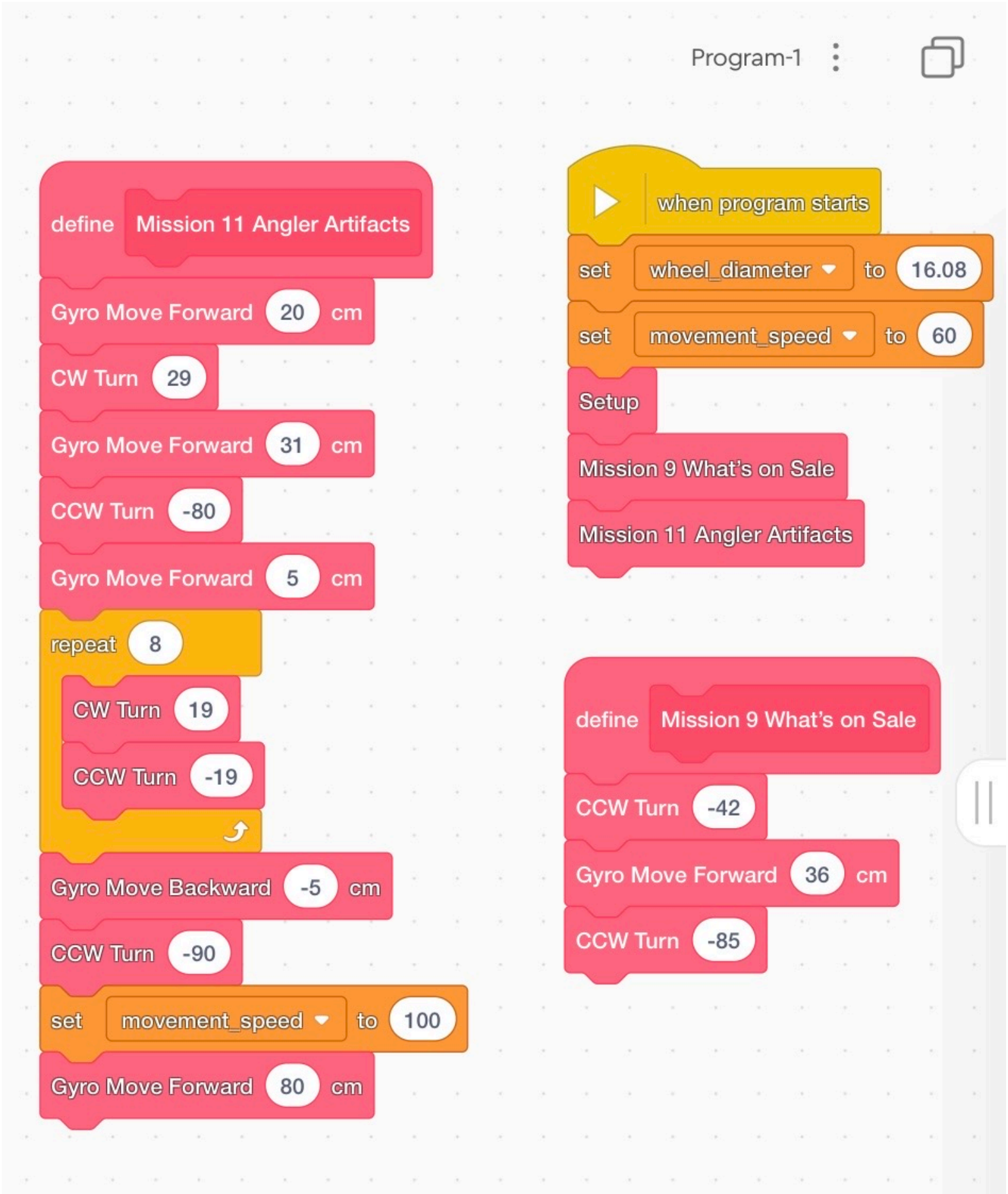
Dr. Amelia Brown & Dr. Sarah James

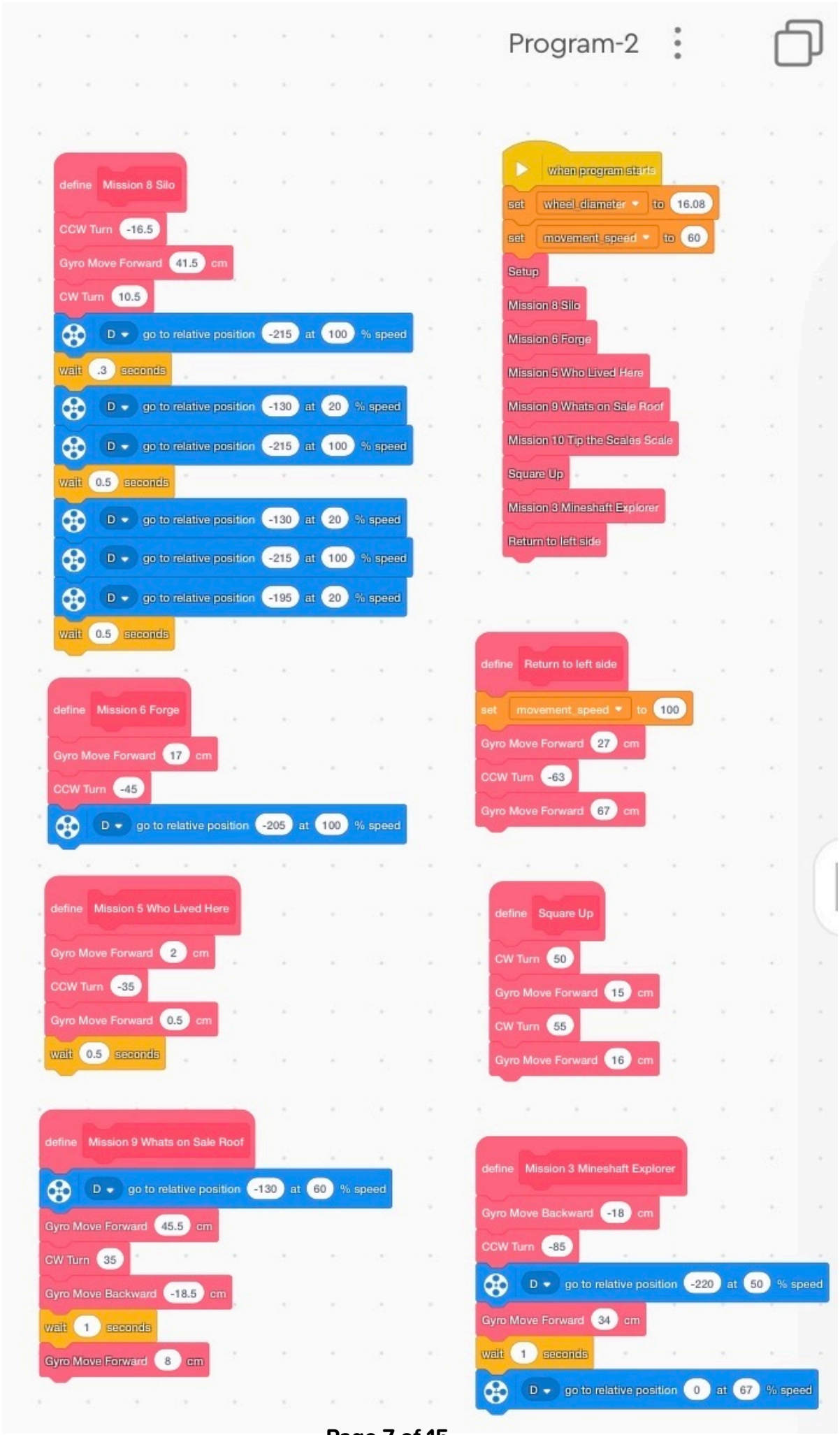


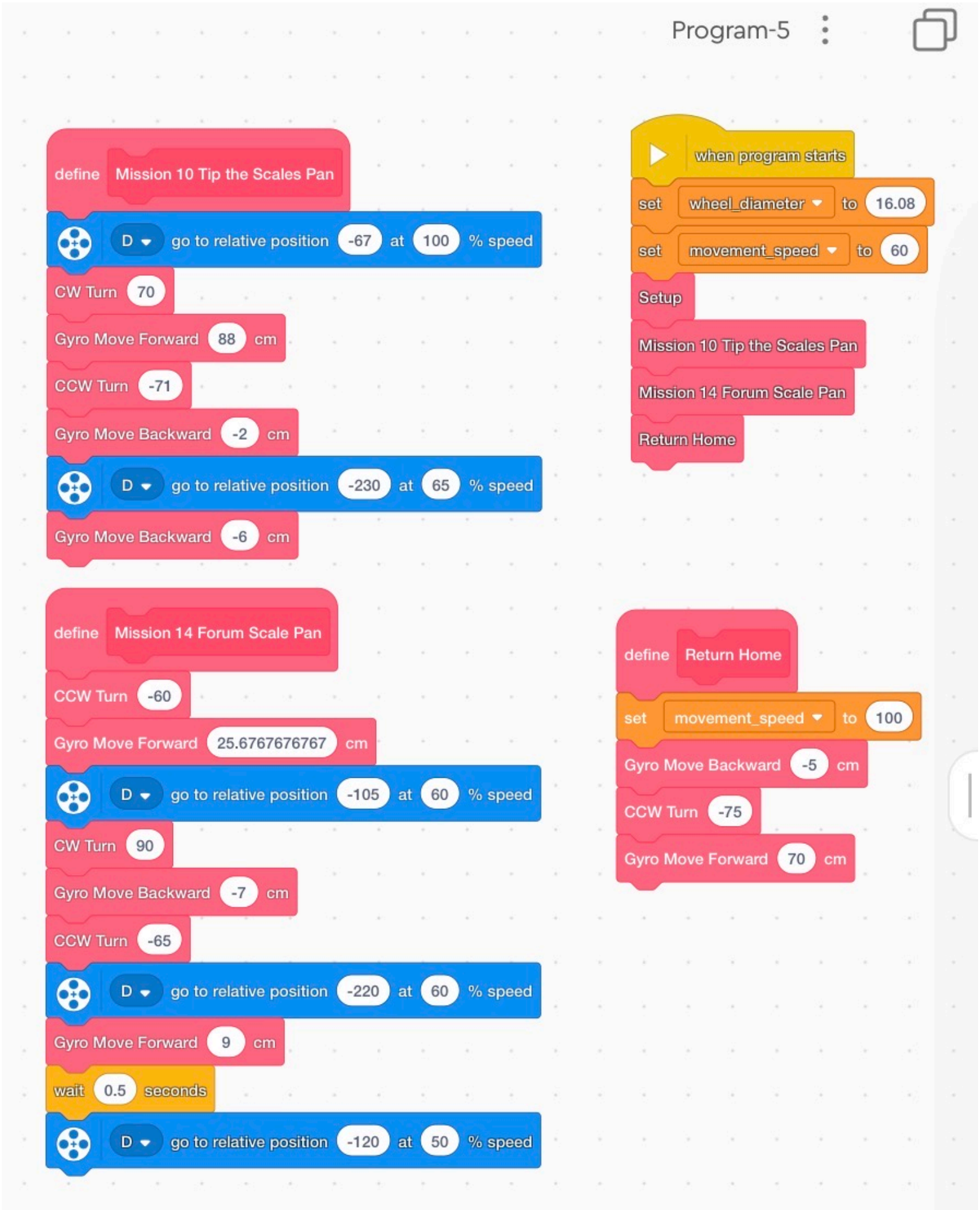
James Vanderpool

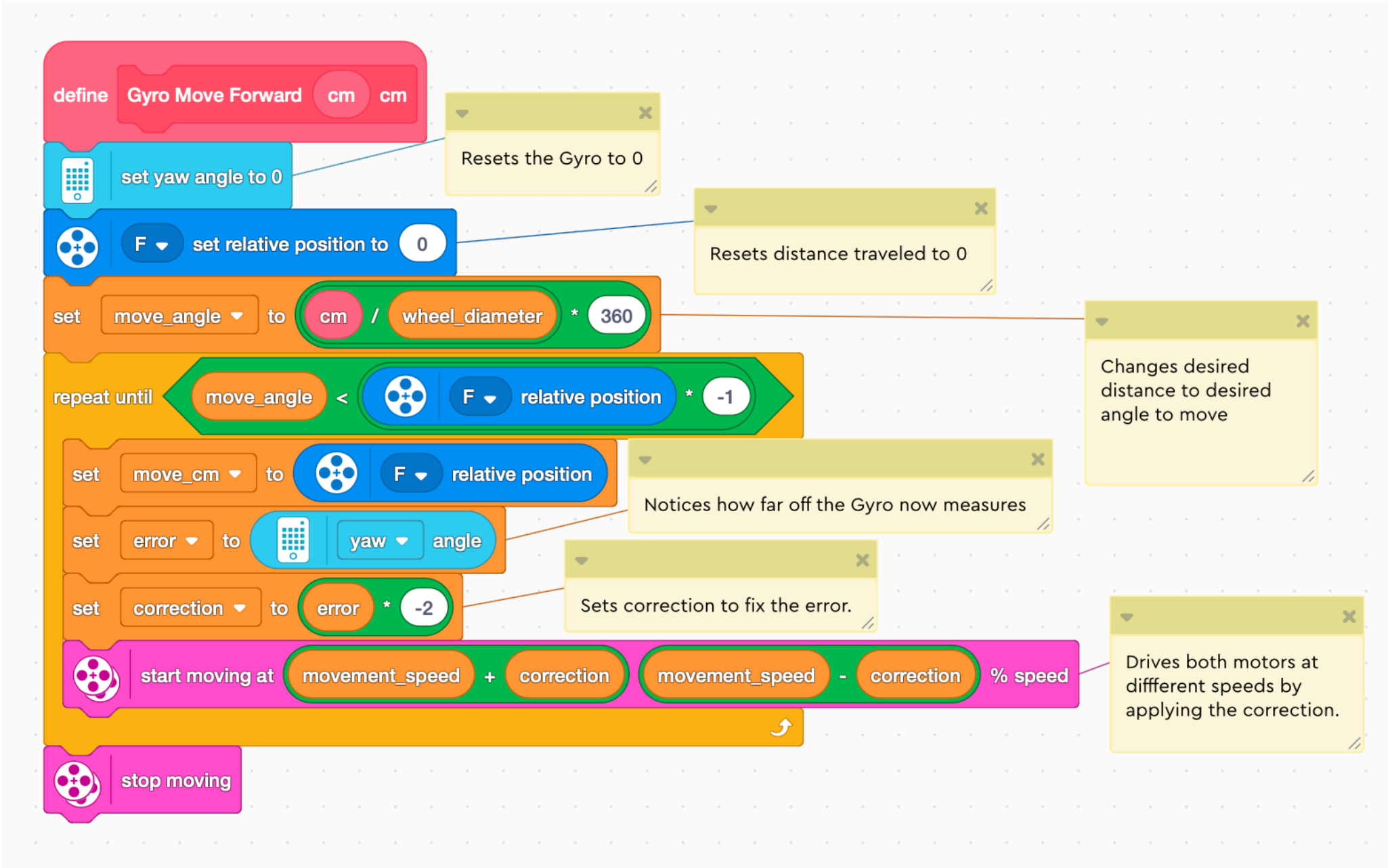
Max Points Possible: 455 of 545

Current Points Completed: 435

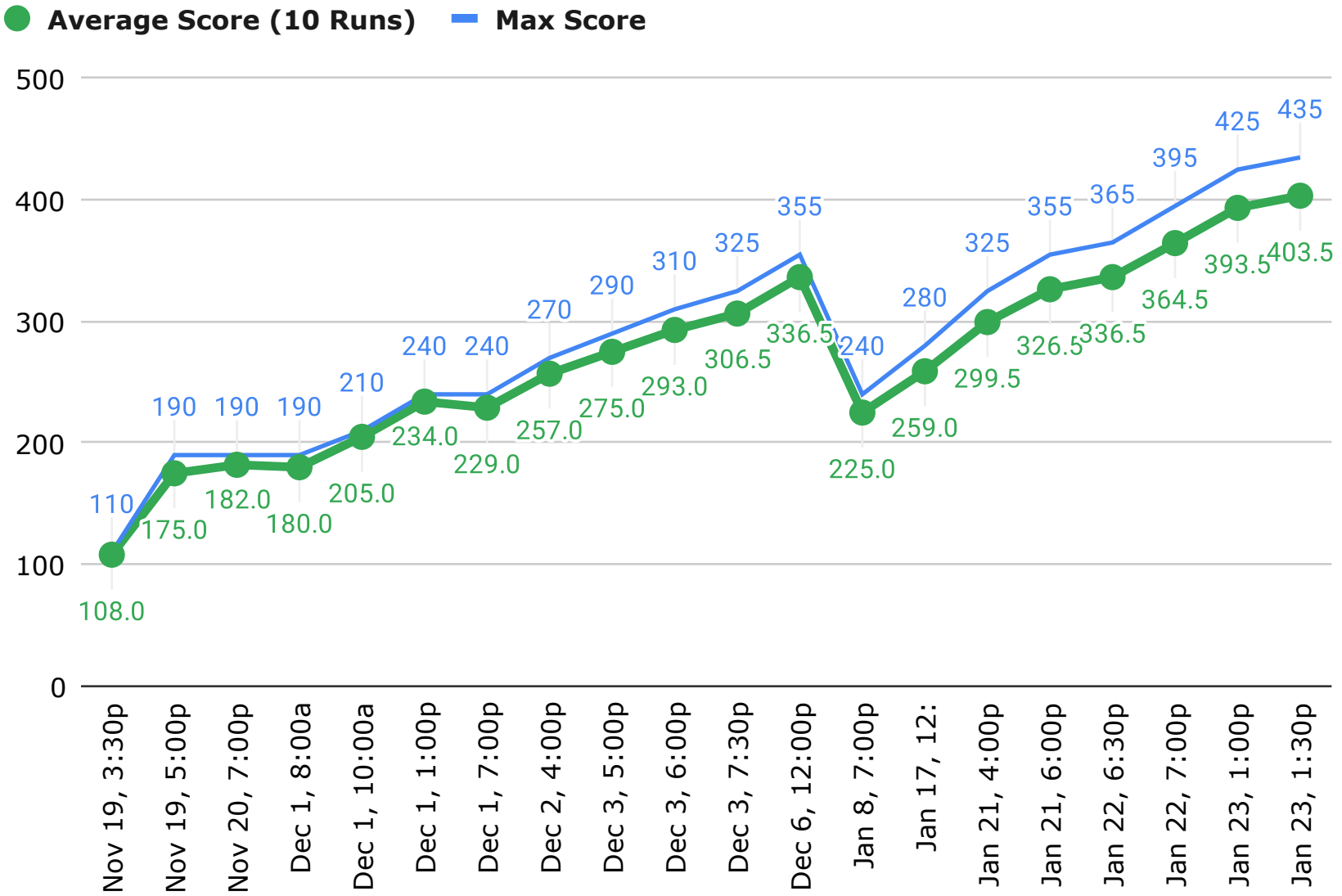

Program-1
define Mission 11 Angler Artifacts
Gyro Move Forward 20 cm
CW Turn 29
Gyro Move Forward 31 cm
CCW Turn -80
Gyro Move Forward 5 cm
repeat 8
CW Turn 19
CCW Turn -19
Gyro Move Backward -5 cm
CCW Turn -90
set movement_speed to 100
Gyro Move Forward 80 cm
when program starts
set wheel_diameter to 16.08
set movement_speed to 60
Setup
Mission 9 What's on Sale
Mission 11 Angler Artifacts
define Mission 9 What's on Sale
CCW Turn -42
Gyro Move Forward 36 cm
CCW Turn -85


Program-2
define Mission 8 Silo
CCW Turn -16.5
Gyro Move Forward 41.5 cm
CW Turn 10.5
D go to relative position -215 at 100 % speed
wait .3 seconds
D go to relative position -130 at 20 % speed
D go to relative position -215 at 100 % speed
wait 0.5 seconds
D go to relative position -130 at 20 % speed
D go to relative position -215 at 100 % speed
D go to relative position -195 at 20 % speed
wait 0.5 seconds
when program starts
set wheel_diameter to 16.08
set movement_speed to 60
Setup
Mission 8 Silo
Mission 6 Forge
Mission 5 Who Lived Here
Mission 9 Whats on Sale Roof
Mission 10 Tip the Scales Scale
Square Up
Mission 3 Mineshaft Explorer
Return to left side
define Mission 6 Forge
Gyro Move Forward 17 cm
CCW Turn -45
D go to relative position -205 at 100 % speed
define Return to left side
set movement_speed to 100
Gyro Move Forward 27 cm
CCW Turn -63
Gyro Move Forward 67 cm
define Mission 5 Who Lived Here
Gyro Move Forward 2 cm
CCW Turn -35
Gyro Move Forward 0.5 cm
wait 0.5 seconds
define Square Up
CW Turn 50
Gyro Move Forward 15 cm
CW Turn 55
Gyro Move Forward 16 cm
define Mission 9 Whats on Sale Roof
D go to relative position -130 at 60 % speed
Gyro Move Forward 45.5 cm
CW Turn 35
Gyro Move Backward -18.5 cm
wait 1 seconds
Gyro Move Forward 8 cm
define Mission 3 Mineshaft Explorer
Gyro Move Backward -18 cm
CCW Turn -85
D go to relative position -220 at 50 % speed
Gyro Move Forward 34 cm
wait 1 seconds
D go to relative position 0 at 67 % speed


Program-5
define Mission 10 Tip the Scales Pan
D go to relative position -67 at 100 % speed
CW Turn 70
Gyro Move Forward 88 cm
CCW Turn -71
Gyro Move Backward -2 cm
D go to relative position -230 at 65 % speed
Gyro Move Backward -6 cm
when program starts
set wheel_diameter to 16.08
set movement_speed to 60
Setup
Mission 10 Tip the Scales Pan
Mission 14 Forum Scale Pan
Return Home
define Mission 14 Forum Scale Pan
CCW Turn -60
Gyro Move Forward 25.6767676767 cm
D go to relative position -105 at 60 % speed
CW Turn 90
Gyro Move Backward -7 cm
CCW Turn -65
D go to relative position -220 at 60 % speed
Gyro Move Forward 9 cm
wait 0.5 seconds
D go to relative position -120 at 50 % speed
define Return Home
set movement_speed to 100
Gyro Move Backward -5 cm
CCW Turn -75
Gyro Move Forward 70 cm


define Gyro Move Forward cm cm
set yaw angle to 0
Resets the Gyro to 0
F set relative position to 0
Resets distance traveled to 0
set move_angle to cm / wheel_diameter * 360
Changes desired distance to desired angle to move
repeat until move_angle < F relative position * -1
set move_cm to F relative position
Notices how far off the Gyro now measures
set error to yaw angle
set correction to error * -2
Sets correction to fix the error.
start moving at movement_speed + correction movement_speed - correction % speed
Drives both motors at diffferent speeds by applying the correction.
stop moving

Robot Reliability Testing & Progress

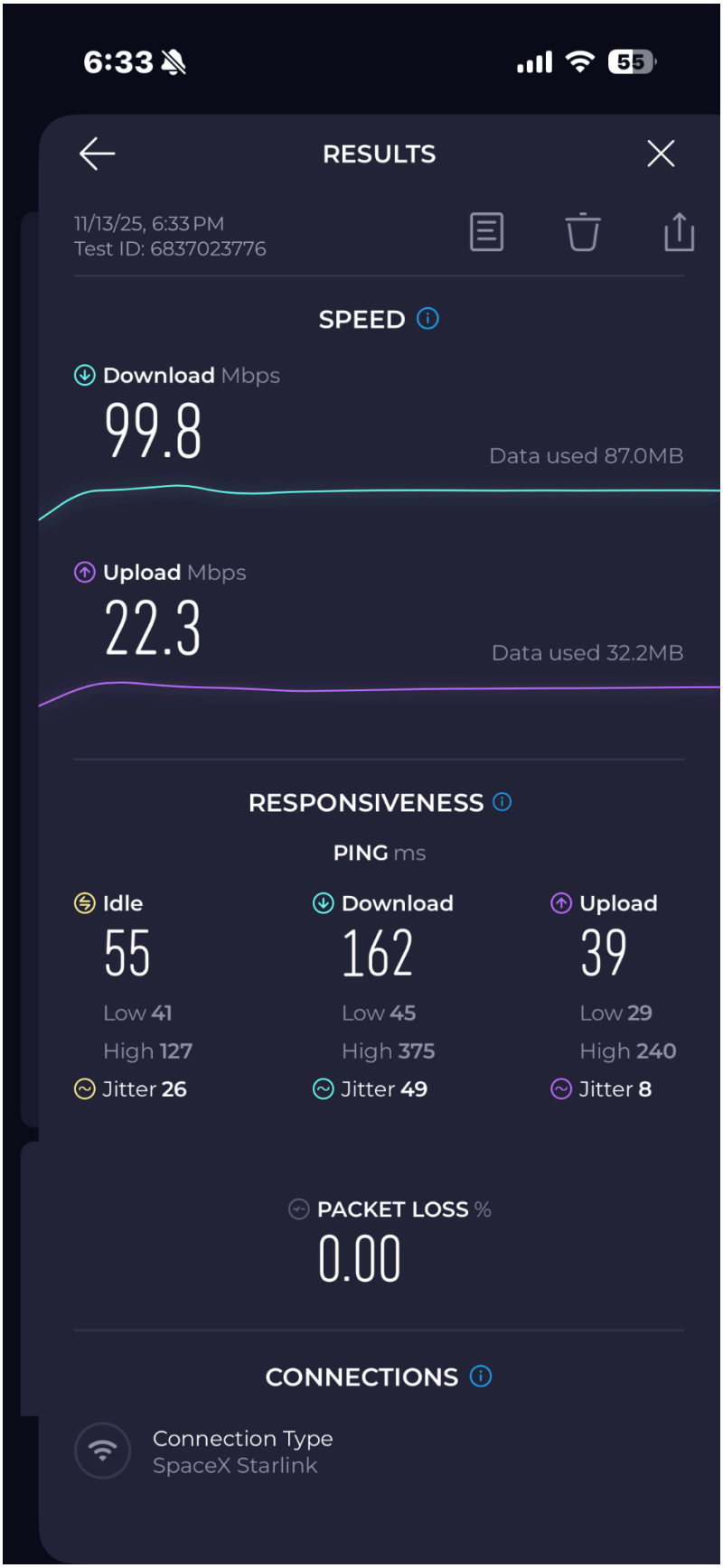


Mobile Internet Station (MIS) Components

Starlink Mini

Anker Solix PS 100 Solar Panel

Anker 521 Portable Power Station


6:33
55
RESULTS
11/13/25, 6:33 PM
Test ID: 6837023776
SPEED
Download Mbps
99.8
Data used 87.0MB
Upload Mbps
22.3
Data used 32.2MB
RESPONSIVENESS
PING ms
Idle
55
Low 41
High 127
Jitter 26
Download
162
Low 45
High 375
Jitter 49
Upload
39
Low 29
High 240
Jitter 8
PACKET LOSS %
0.00
CONNECTIONS
Connection Type
SpaceX Starlink

GET INTERNET WHILE ON A REMOTE DIG.

Our open source guide combines reliable internet from space, batteries, and solar panels so you can have a remote zoom call, access critical databases, and record findings while off grid. Even keep your laptop and other devices charged.

MOBILE INTERNET STATION COMPONENTS

Starlink Mini

This is the core of what gives you reliable internet from space. This draws on average about 30 watts of power.

Solar Panels

These help keep power flowing for your Starlink Mini or other devices and can charge your power station.

Power Station

These batteries are needed to even out the power from the solar panels so the Starlink Mini can keep running.

THINGS TO KNOW

1. From the Starlink Mini, you can expect speeds of around 100 megabits/second download and 20 megabits/second upload. **This is enough for an HD Zoom call while you're out in the field.**
2. The Starlink Mini needs **120° of open sky** to be able to find the sattelites.
3. The Starlink Mini pulls **30 watts on average**, but can be as low 15 watts and as high as 60 watts.
4. Because you're often getting less than direct sun, **we recommend at least 100 watt solar panels**.
5. To make sure you have enough power for the Starlink Mini throughout the day, **we recommend at least 240 watt hours** (30 watts × 8 hour work day = 240 watt hours).
6. For teams who want more power, all brands have great options for larger power station capacity and solar panels that generate more power.

BATTERY SAFETY

1. Power stations are made up of many battery cells. **Cheaper battery brands can be dangerous and can catch on fire or explode (it's called thermal runaway).** This also means they cannot be taken on planes (more than 160 watt hours), and they are very expensive to ship (Fedex told us $3,000 to ship from the USA to Europe).
2. If you're worried about power station batteries being dangerous, there's good news! **Solid state batteries are much safer and much less likely to catch fire or explode.** Brands such as Yoshino are already shipping a 241 watt hour power station (our recommendation is over 240 watt hours). They cost about twice as much right now, but are lighter and much safer.

BUYING ADVICE

1. Starlink Mini

You absolutely need a Starlink Mini. There's just no other option for getting reliable internet from anywhere in the world.

Buy this from SpaceX or a local vendor. In the US, you can buy this directly or buy from Target, Best Buy, or even Home Depot.

2. Power Station & Solar Panels

Typically, you'll want to buy the power station & solar panels from the same brand, as it's the easiest way to make sure the solar panels can charge the power station without an extra adapter.

Also, if you can find a power station in a specific brand in your region, you're probably going to be able to find matching solar panels too.

3. Brands to Buy

We recommend buying a power station / solar panel combo (also referred to sometimes as a solar generator) from Anker, Bluetti, Ecoflow, and Jackery. Generally, one of these brands is usually available no matter where you live in the world.

It's especially important to buy a known brand for the power station, as **cheaper brands are known to explode more often**.

DIFFERENT SOLAR CONNECTORS

If you're buying your solar panels and power station from different brands, make sure the solar panel output connect matches the power station. If they don't match, you'll need to find an adapter.

ABOUT US

We are a First Lego League team from 4th to 7th grade in Northwestern Arkansas, USA. We spent so much time testing our Mobile Internet Station and writing this guide that it was like having a part time job.

We made this guide for the 2025-2026 FLL Unearthed theme. Our innovation project is designed to help archeologists get internet while on a remote dig.

HELP US!

If you found this guide useful, please share it with others!

And please tell us your story of using this guide. Was it helpful? Do you have ideas for improvements? We would love to iterate and make things better!

Please send your story to fll@awesome.me. Thank you so much for helping us out!!!

OPEN SOURCE

The code for this open source guide is hosted on GitHub. Please contribute changes so we can make things better!