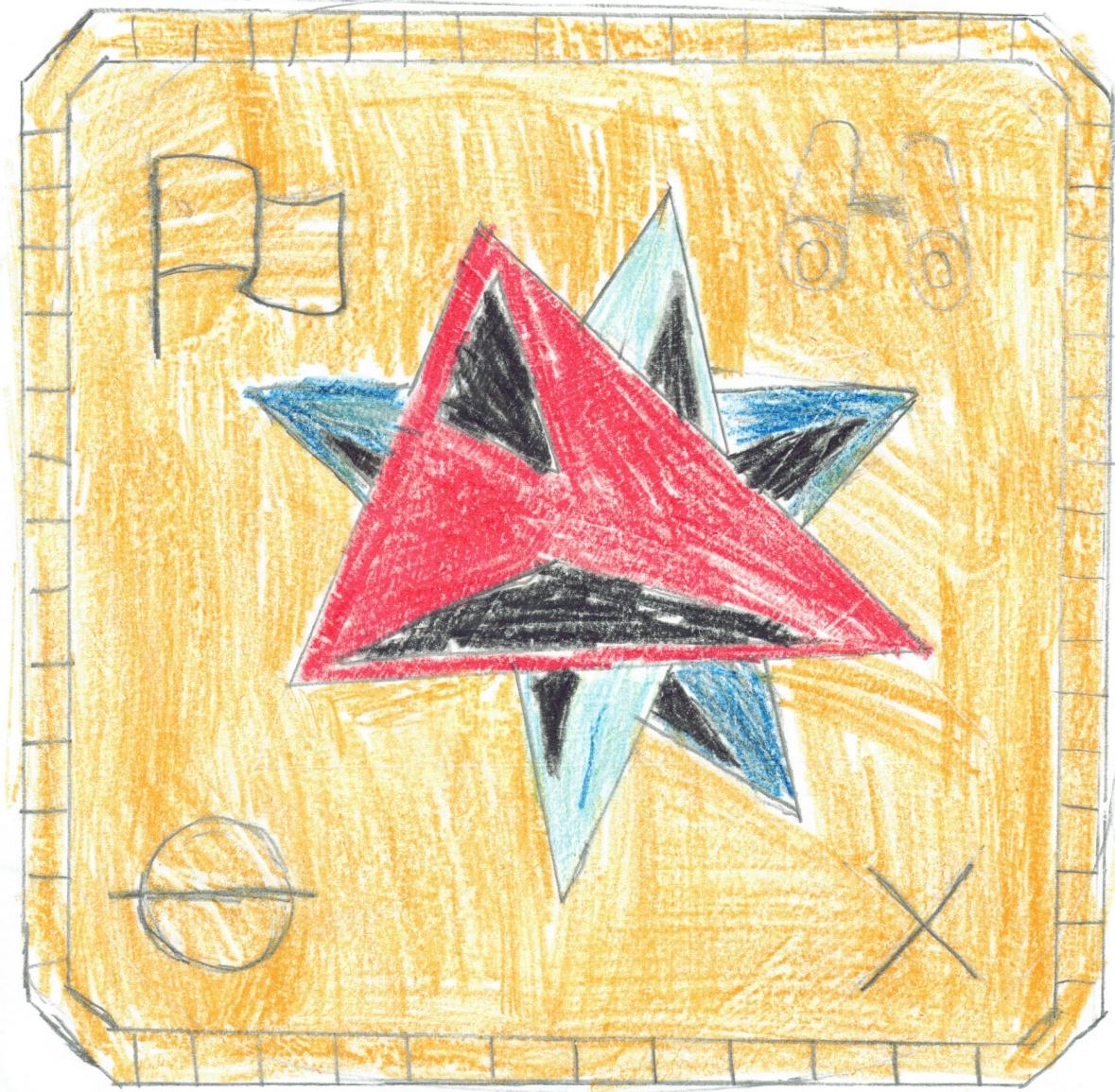


FIRST LEGO LEAGUE



IRON PATRIOTS SILVER

PRESNTATION

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. Chris Motz

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



Ashley Lemke

Associate Professor of Anthropology, University of Wisconsin-Milwaukee



David Cardona

Senior Curator of Phoenician, Roman and Medieval Sites
Heritage Malta



Taylor Cwikla

Corinth Excavations
Steinmetz Foundation Museum
Fellow

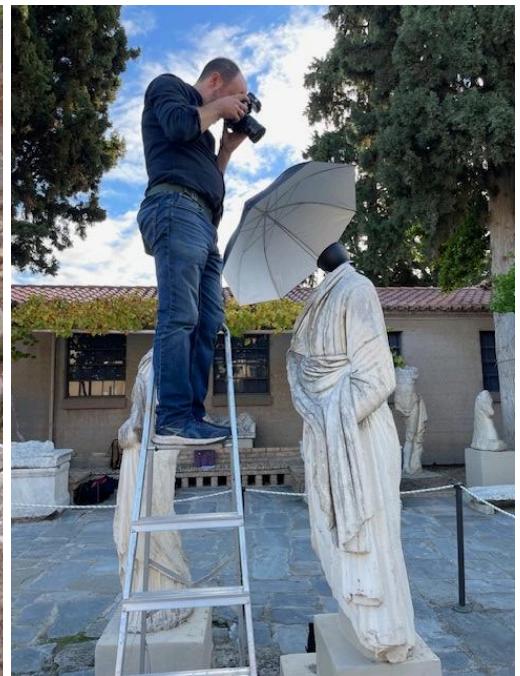




Acropolis at Acrocorinth



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

```

```

define Mission 6 Forge
  Gyro Move Forward 17 cm
  CCW Turn -45
  D ▾ go to relative position -205 at 100 % speed

```

```

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 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

```

```

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 Return to left side
  set movement_speed to 100
  Gyro Move Forward 27 cm
  CCW Turn -63
  Gyro Move Forward 67 cm

```

```

define Square Up
  CW Turn 50
  Gyro Move Forward 15 cm
  CW Turn 55
  Gyro Move Forward 16 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

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

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

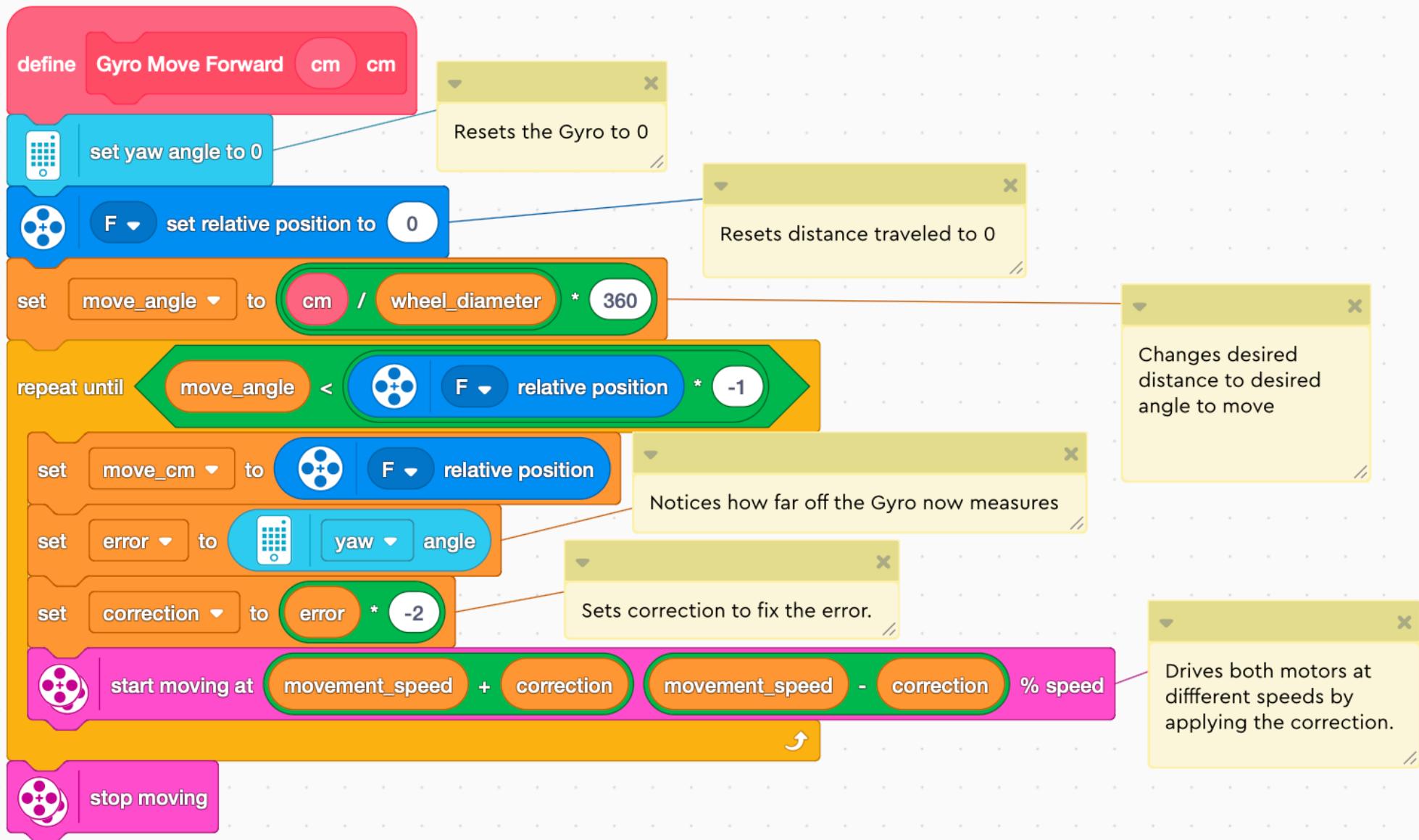
define Return Home

set movement_speed ▾ to 100

Gyro Move Backward -5 cm

CCW Turn -75

Gyro Move Forward 70 cm

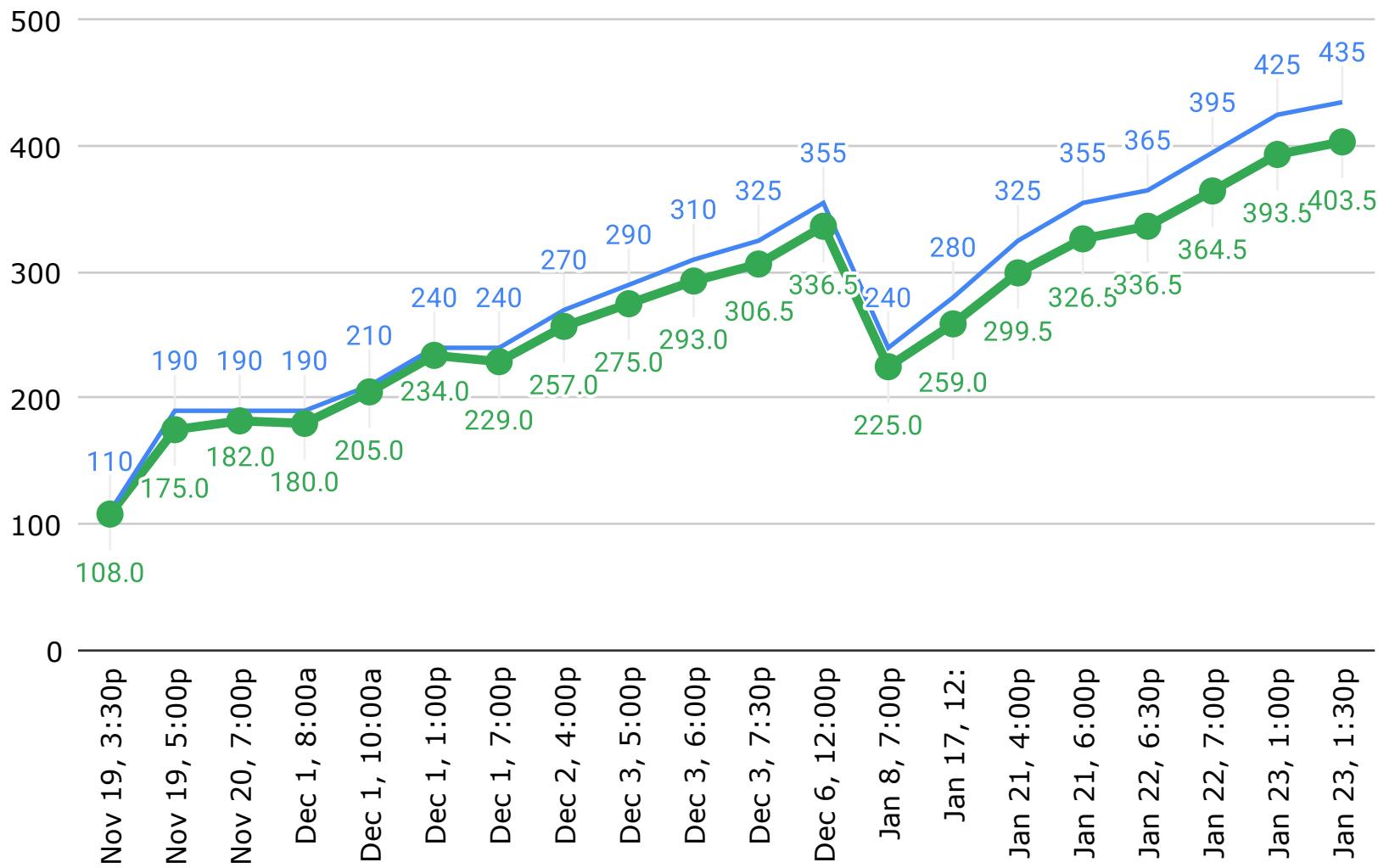


The Scratch script defines a custom block "Gyro Move Forward" which takes distance in cm as input. The script starts by resetting the gyro angle to 0 and the distance traveled to 0. It then enters a loop to move until the desired move_cm distance is reached. Inside the loop, it sets the relative position to move_cm, notices the current yaw angle, calculates an error, applies a correction, and moves both motors at different speeds based on the correction. Finally, it stops moving.

```
define [Gyro Move Forward : cm]
  set yaw angle to [0 v]
  set [relative position v] to [0 v]
  set [move_angle v] to [(cm) / (wheel_diameter) * (360)]
  repeat until [move_angle < [relative position * -1 v]]
    set [move_cm v] to [relative position]
    set [error v] to [yaw angle]
    set [correction v] to [(error) * (-2)]
    start moving at [movement_speed + correction v] [movement_speed - correction v] % speed
  end
  stop moving
```

Robot Reliability Testing & Progress

● Average Score (10 Runs) — Max Score



Mobile Internet Station (MIS) Components



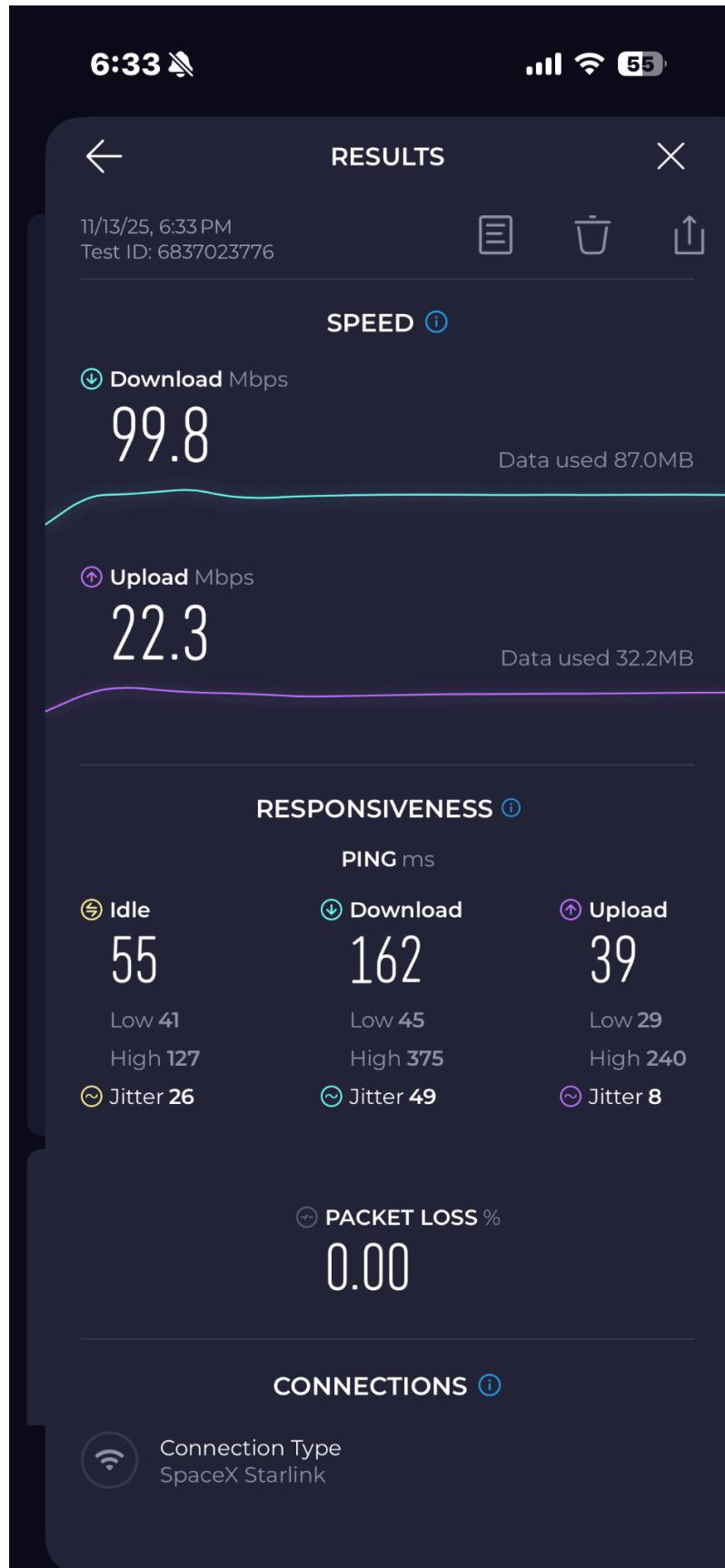
Starlink Mini

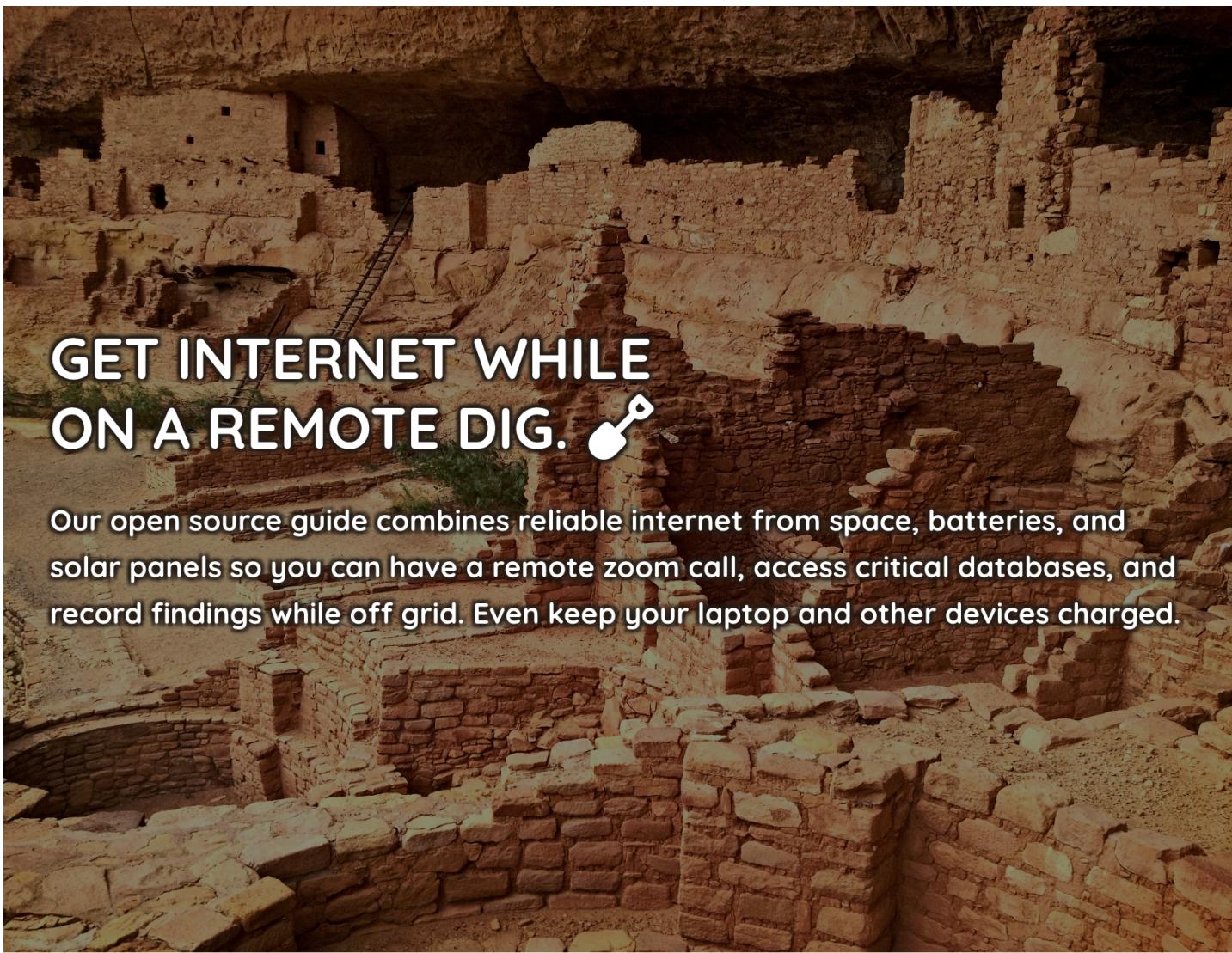


**Anker Solix PS 100
Solar Panel**



**Anker 521 Portable
Power Station**





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 satellites.
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** ($30 \text{ watts} \times 8 \text{ hour work day} = 240 \text{ watt hours}$).
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!