DIGITAL EVA TRACKING FOR MDRS

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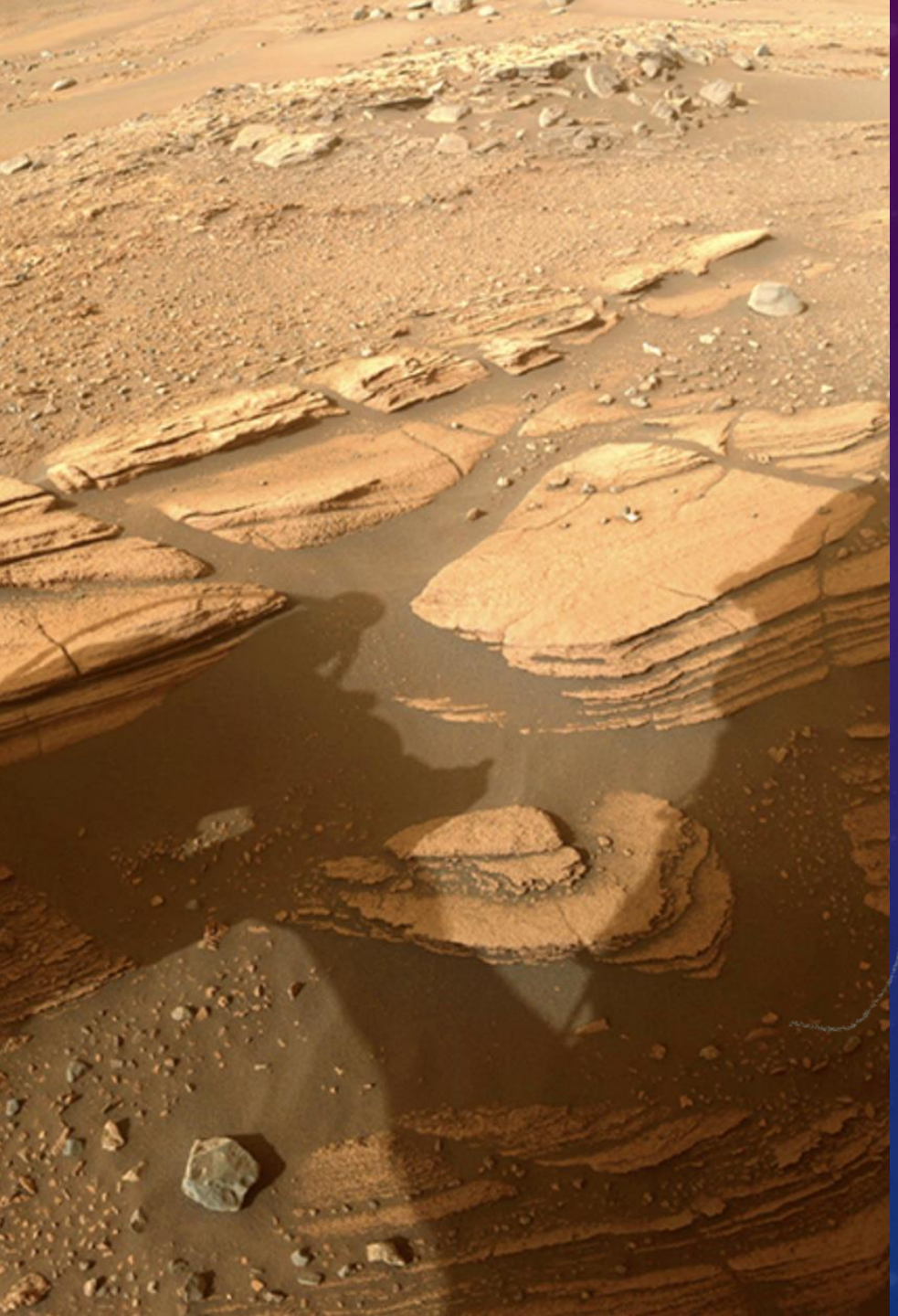
PRESENTED BY JASON SIMPSON

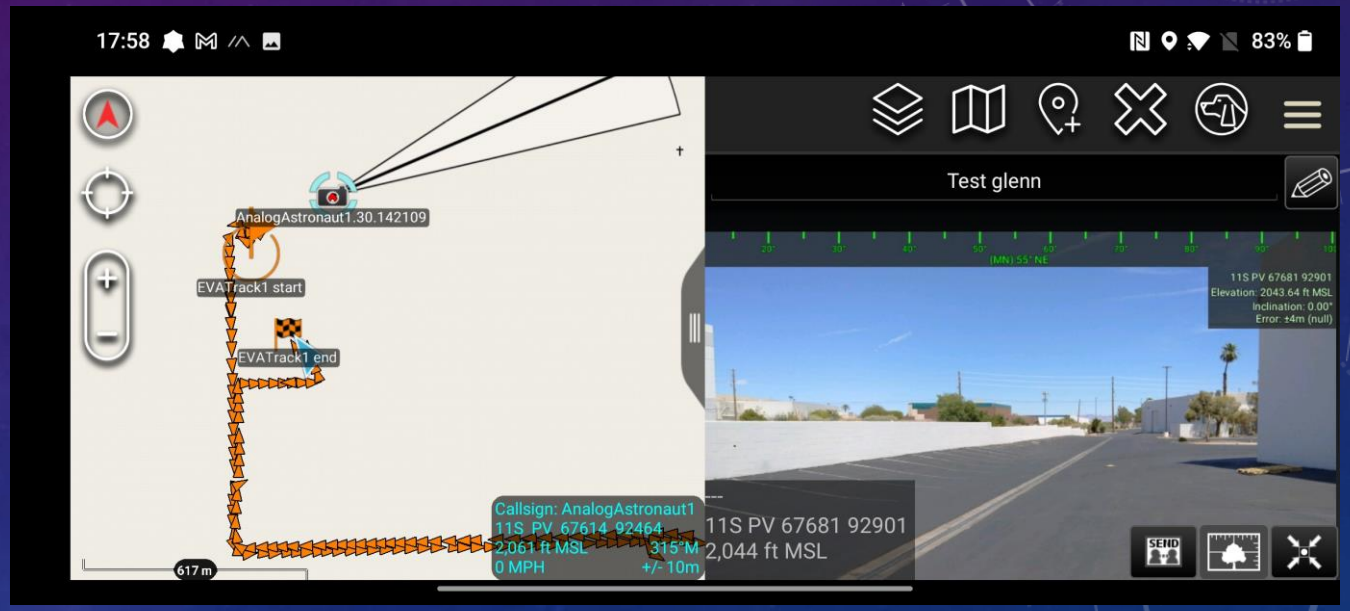


MISSION

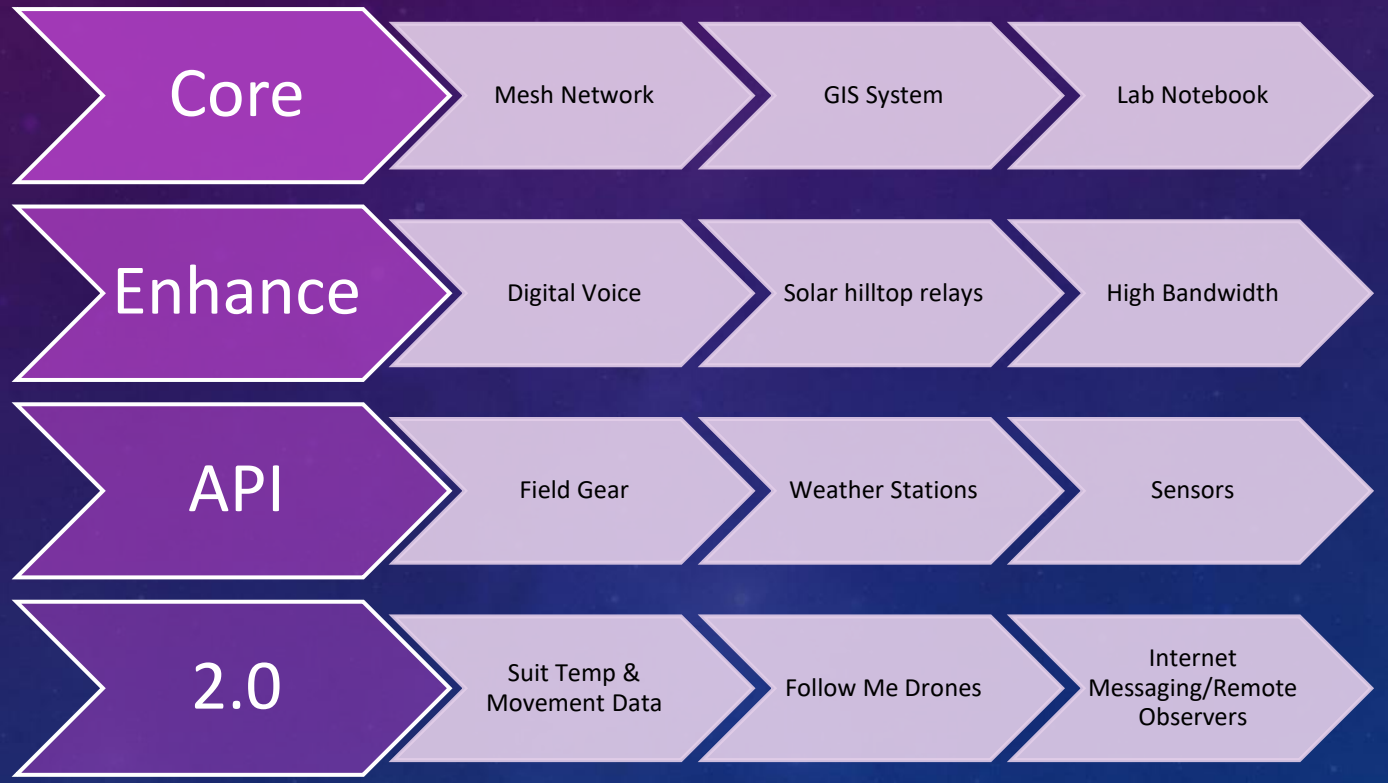
Develop a prototype mesh network using open-source software and low-cost hardware to support human and device communications for analog research stations.

PRIMARY GOALS

- GPS tracking of suits, ATVs, and supported equipment relayed to Hab periodically.
- Track geology sample positions in a permanent MDRS database (Science)
- Immersion in EVA/Mars experience (Sim)
- Log EVA paths and compare planned/actual paths (Mission Planning)
- Identify interesting locations for revisit/research



ROAD MAP


Core
Mesh Network
GIS System
Lab Notebook
Enhance
Digital Voice
Solar hilltop relays
High Bandwidth
API
Field Gear
Weather Stations
Sensors
2.0
Suit Temp & Movement Data
Follow Me Drones
Internet Messaging/Remote Observers

MESHNET TECH STACK

LoRa

Meshtastic

CIV-TAK

LORA HARDWARE
TTGO T-BEAM

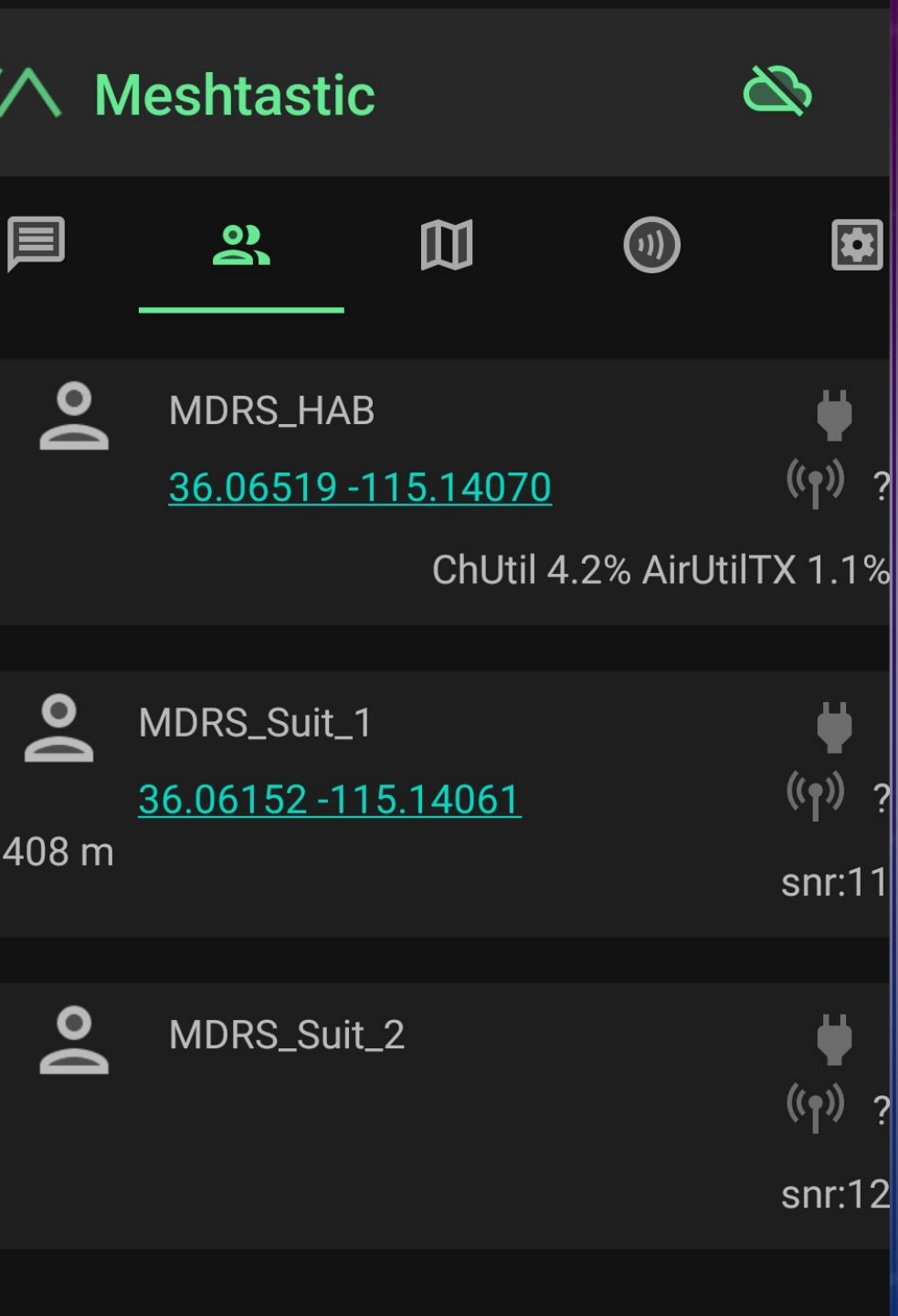
- Low Cost - $45
- Rugged, -40°C- +85°C
- Low Power, Solar Capable
- ESP32 - Wifi & Bluetooth
- SX1276 - LoRa Transceiver
- Frequency options:
  - 433 MHz
  - 868 MHz
  - 915 MHz
  - 923 MHz
- NEO-6M - GPS receiver
- SMA antenna connector
- **0.96 inch OLED display (soldering required)**

EVA SUIT LORA MESH NETWORK RELAY

Long range, low power text messages and data sets with GPS coordinates.

LORA Relay device connected via Bluetooth. (Backpack)

Android/iOS device (forearm) as terminal for text communications, GPS map

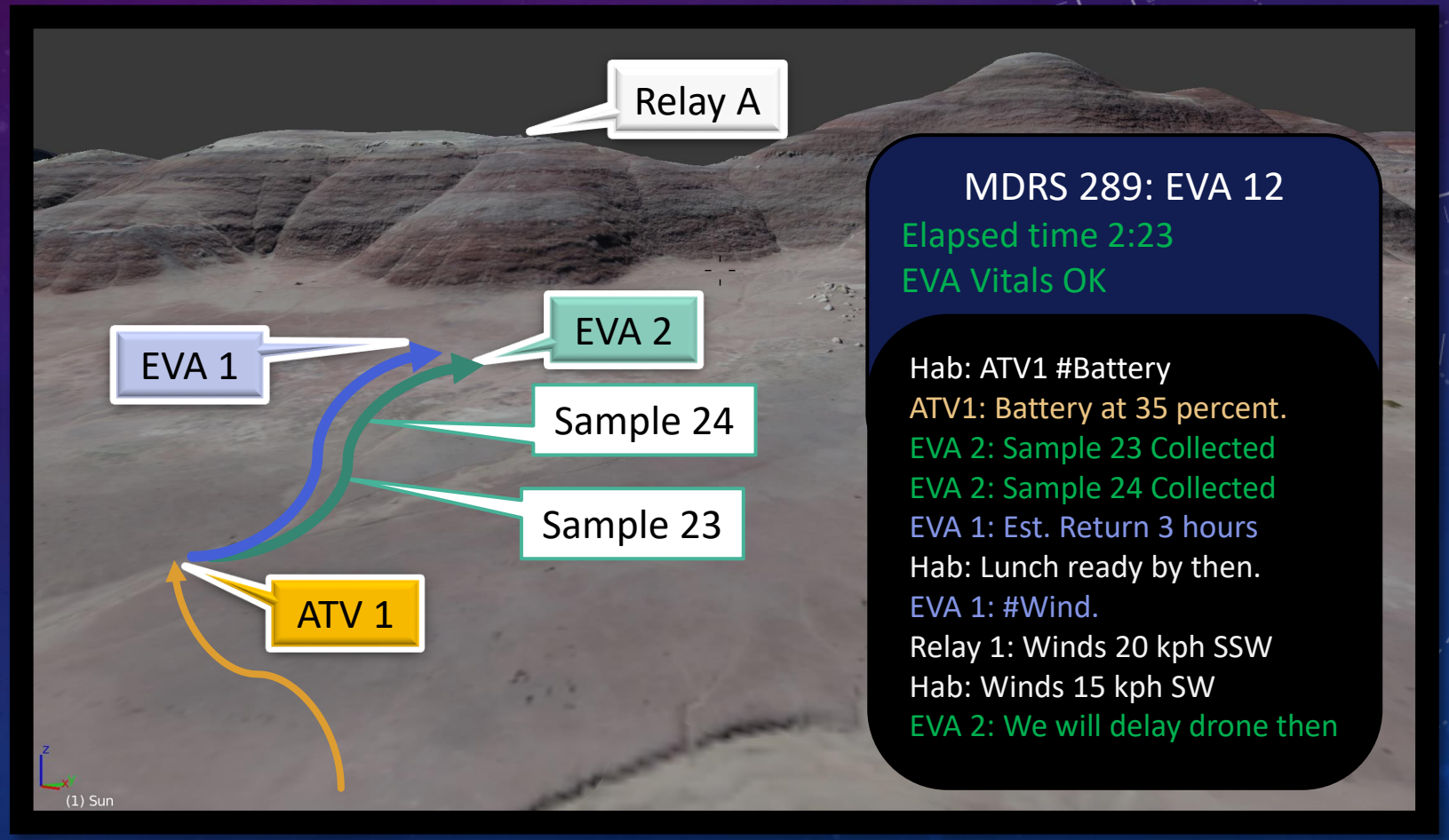


MESHTASTIC

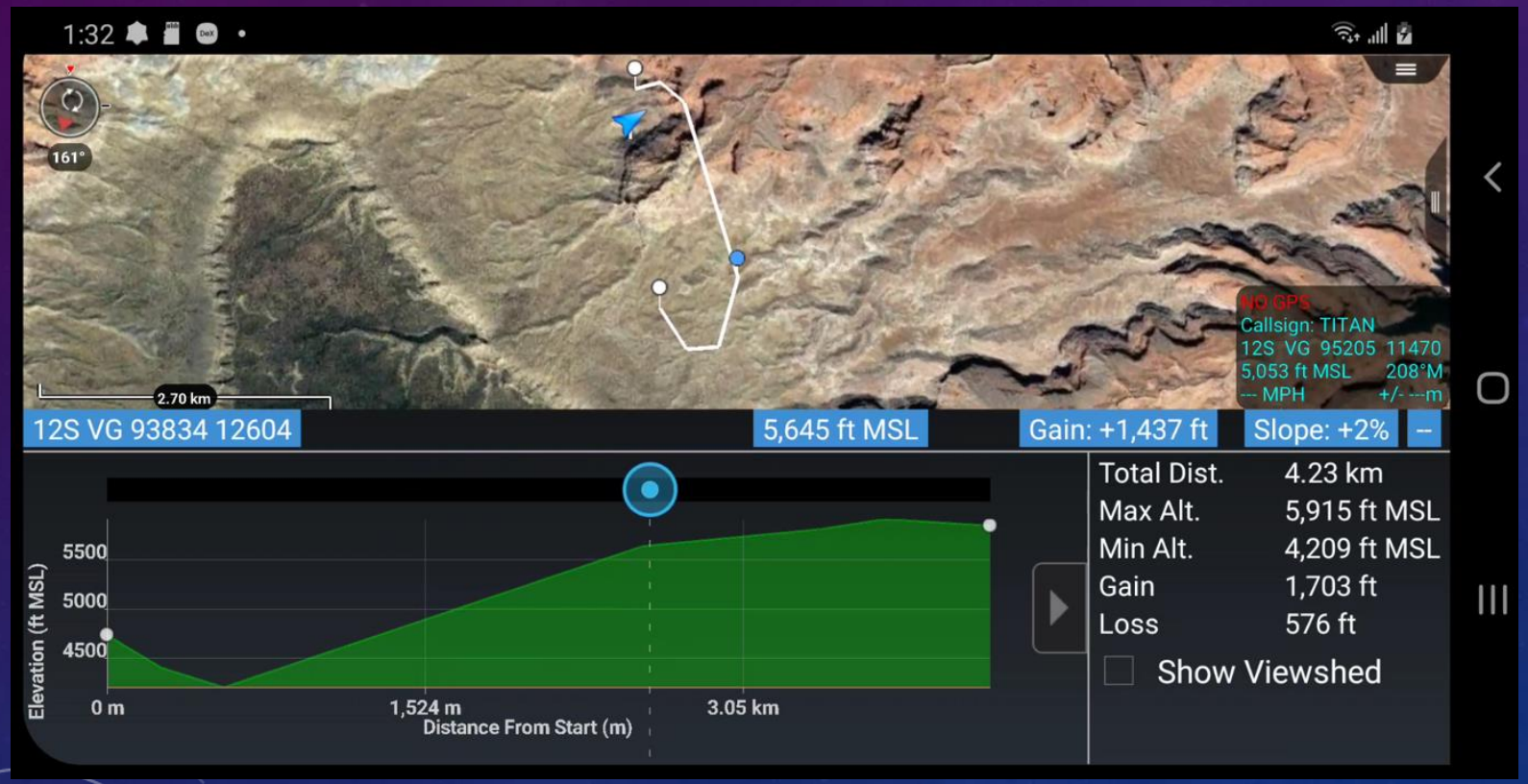
- Open-Source project using LoRa radios as long range, off-grid communicators.
- Radios automatically create a mesh to forward packets, internet forwarding using MQTT
- Supports up to 80 nodes

MESHTASTIC TELEMETRY USING I2C SENSORS & GPS

Sensor	Data Points
BMP280	Temperature and barometric pressure
BME280	Temperature, barometric pressure and humidity
BME680	Temperature, barometric pressure, humidity and air resistance
MCP9808	Temperature
INA260	Current and Voltage
INA219	Current and Voltage



CIV-TAK



- Created by Air Force Research Lab using the NASA WorldWind codebase
- Android based geospatial infrastructure and situation awareness app.
- Enables precision EVA planning, terrain and situational awareness, navigation, and data sharing.
- Plugins provide limitless flexibility

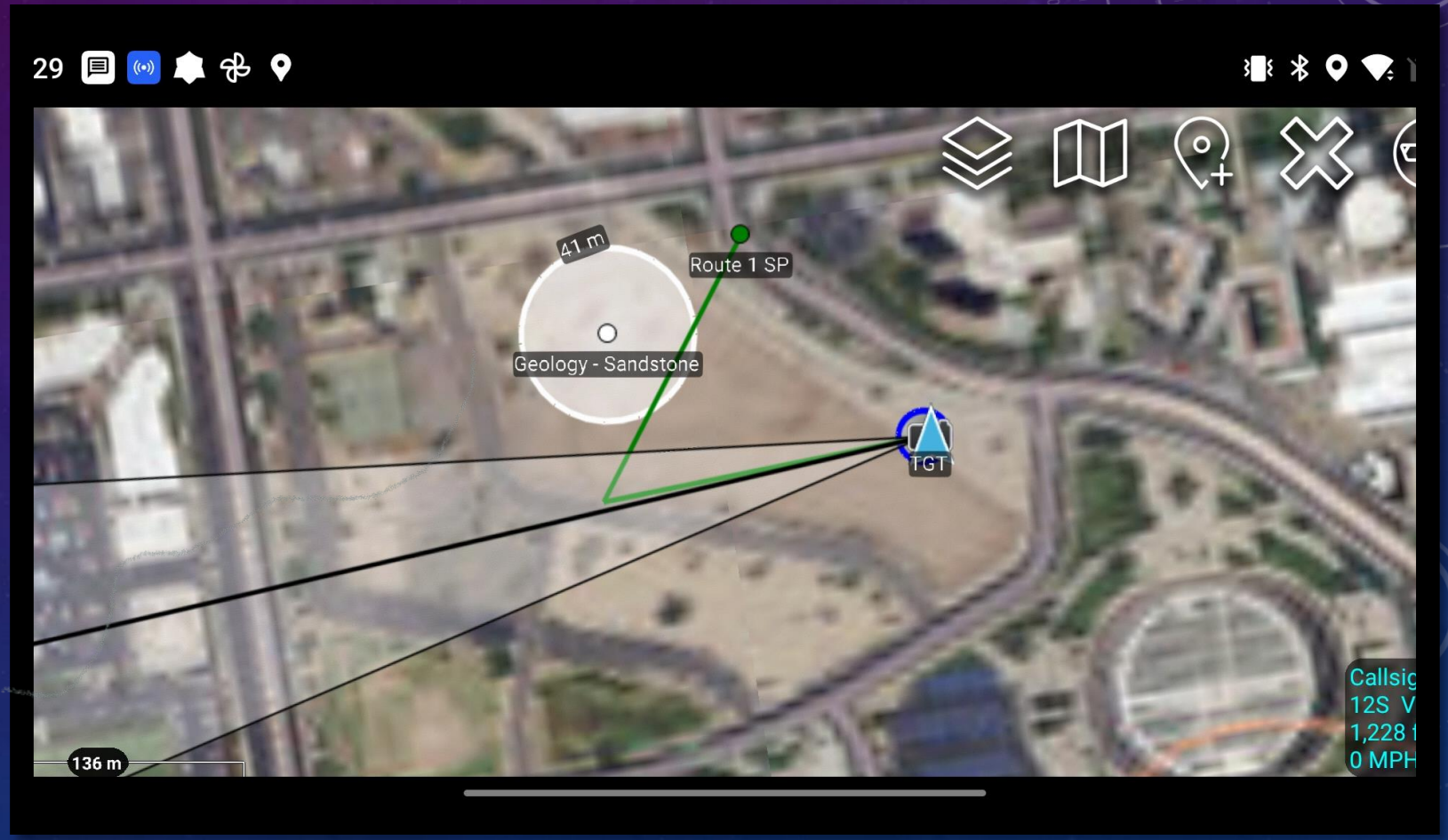
MDRS BASE STATION

Show EVA, communication in real time on 3D elevation map on a 4K monitor. Two-way texting with EVA crews at very long range.

Geotag samples in the field as collected.

Associate post-EVA lab work on those samples with the locations in this geotagged, searchable database.

Researchers can filter a map of locations for various sample collection sites (sandstone, gypsum, etc.) and plan further work. Science continuity across rotations.



MDRS LAB NOTEBOOK

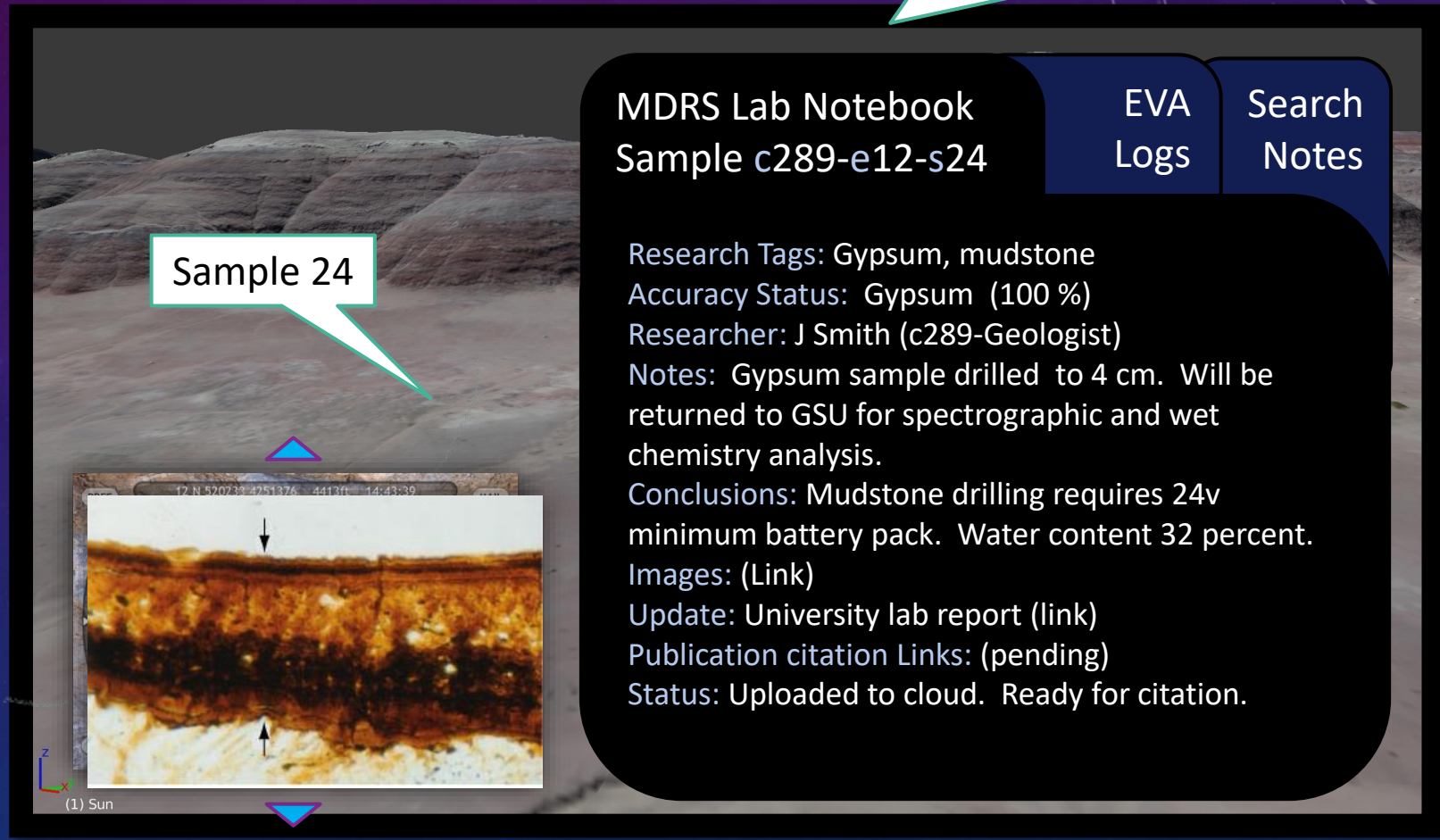
On return from EVA, initial research on a given sample is logged in a central database.

Future researchers can filter on the tags and find sample sites, images, and notes from past crews.

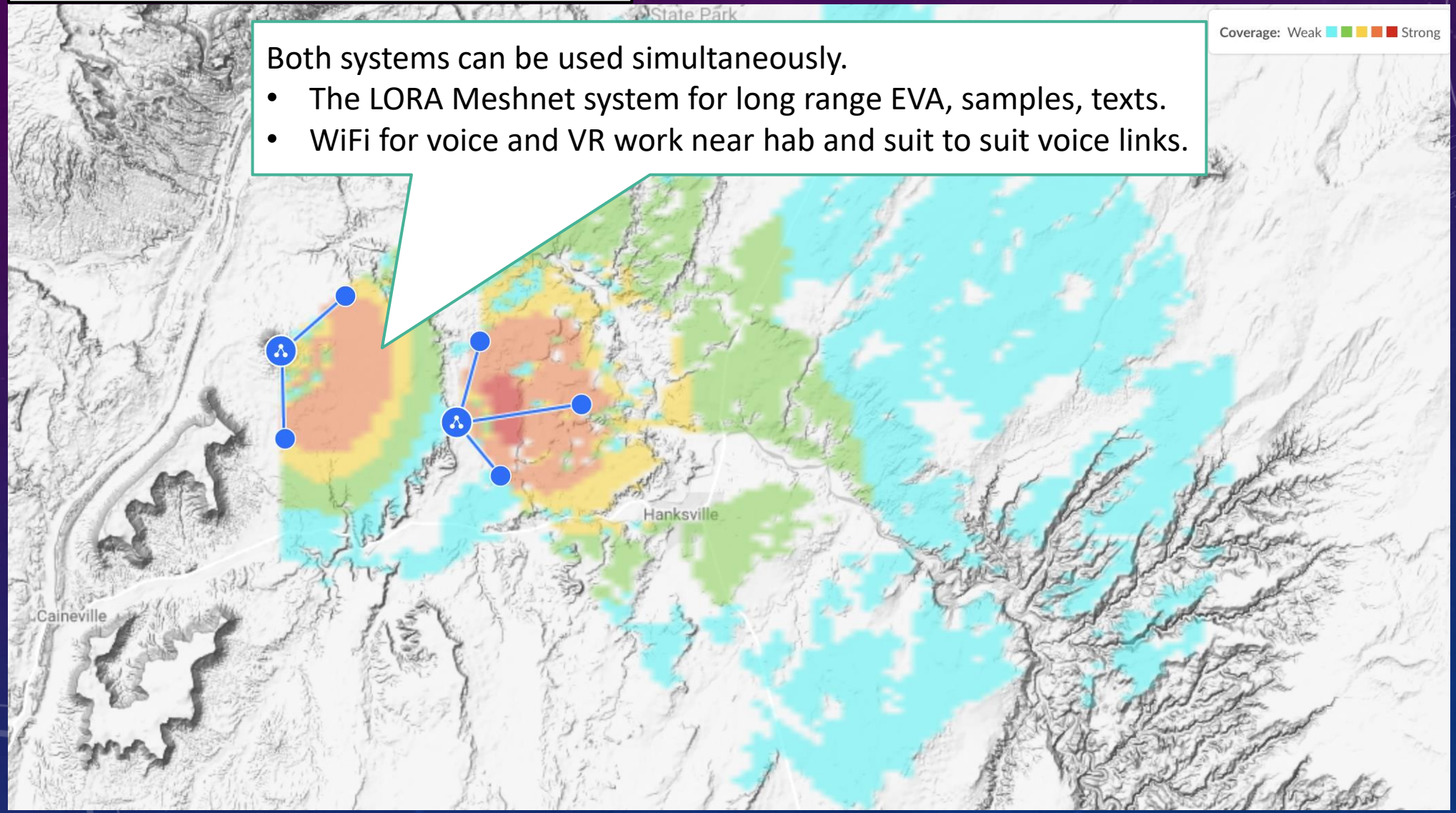
Remote “virtual explorers” can contribute to this analysis or conduct independent studies citing this database.

This provides research continuity across teams and a great model for any field exploration system

Lab notebook PC for sample analysis logging, photos, etc. (Crew 289, EVA 12, Sample 24. Generic Sample University)



Meshnet + Voice IP



TALENT NEEDED

Users	Tasks	Skills Needed
EVA Unit Assembly	• Assembly of units • Software loading units (Meshtastic) • Customization of CIV-TAK client on Android phone (long term).	• 3D printing • Soldering • Technical downloads in development environment
Hab Console Software Development	• Data Stream Logging at Hab (CIV-TAK to partitioned data) • Display of data on 3D GIS map	• Streaming input software development • GIS Visualization (Mars VR and GPS data set). • User Interface and Dashboard development
Science Lab Logging System	• Photo integration and lab equipment data collection • CIV-TAK JSON for equipment telemetry	• CMS development experience • Database and visualization (Geocodes, GeoJSON) • User Interface and Dashboard development • Lab equipment integration development
Long Term	• Remote science equipment integration • Bot queries (weather, power, etc.)	

JOIN US!

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