



# DIGITAL EVA TRACKING FOR MDRS

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PRESENTED BY JASON SIMPSON





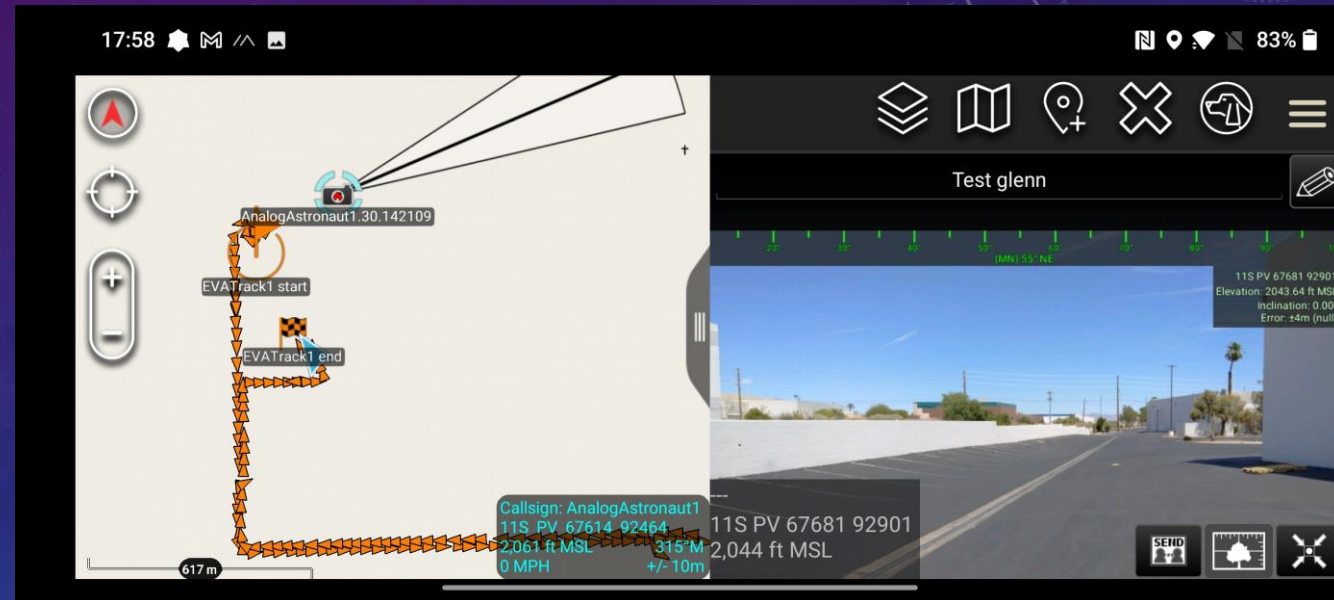
# MISSION

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



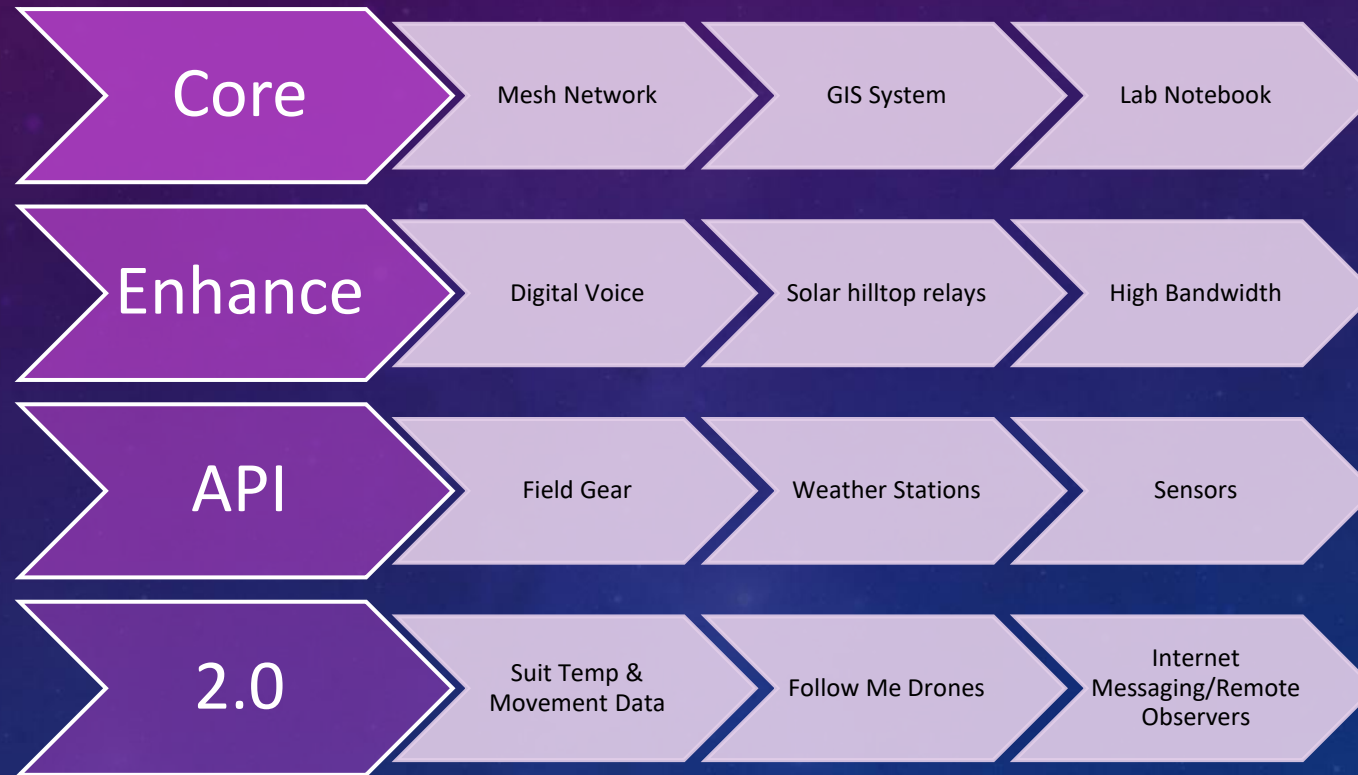
# PRIMARY GOALS

- 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



# 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



MDRS\_HAB

[36.06519 -115.14070](#)



ChUtil 4.2% AirUtilTX 1.1%



MDRS\_Suit\_1

[36.06152 -115.14061](#)

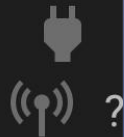
408 m



snr:11



MDRS\_Suit\_2



snr:12

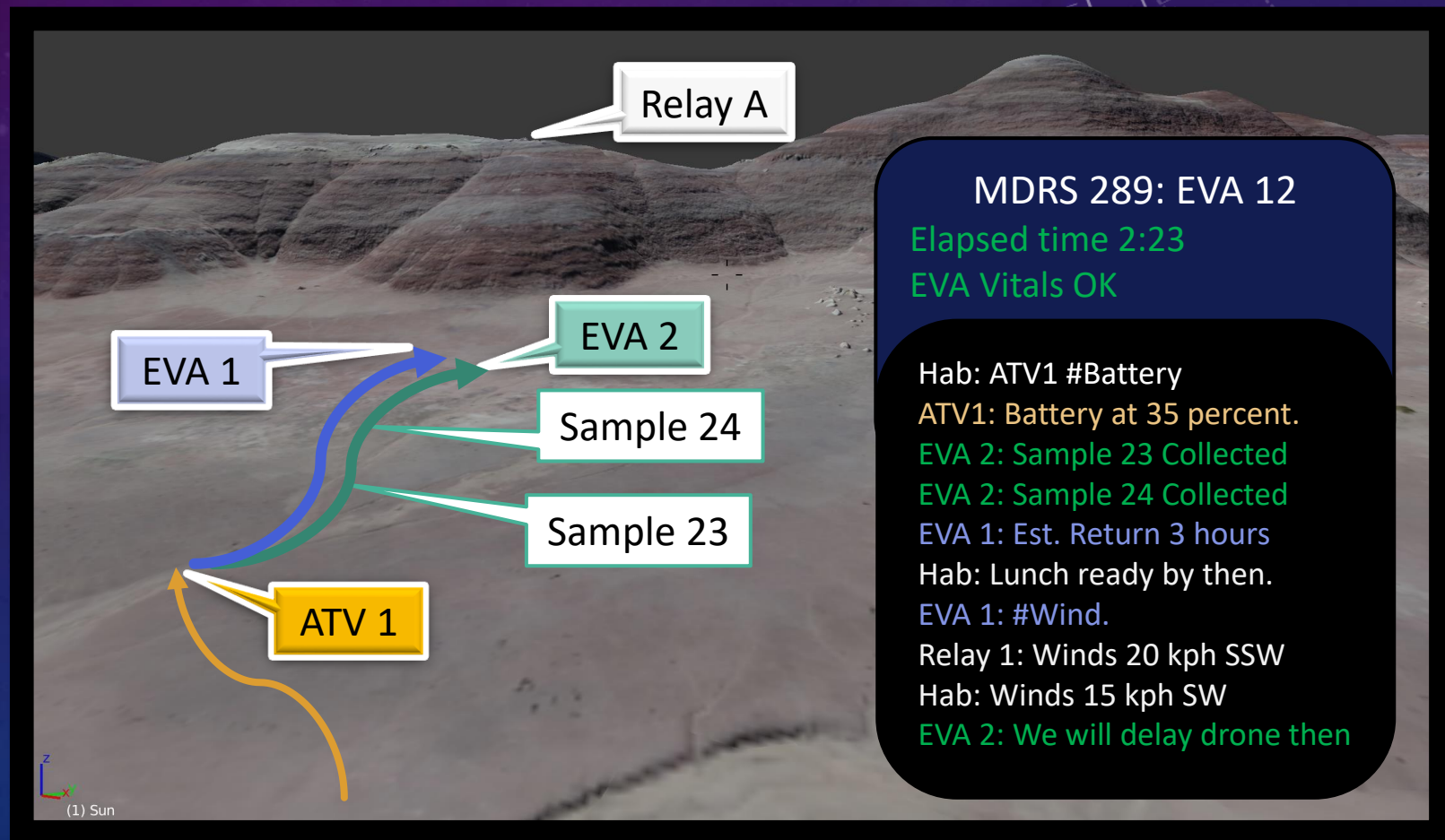
# MESHTASTIC

- 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

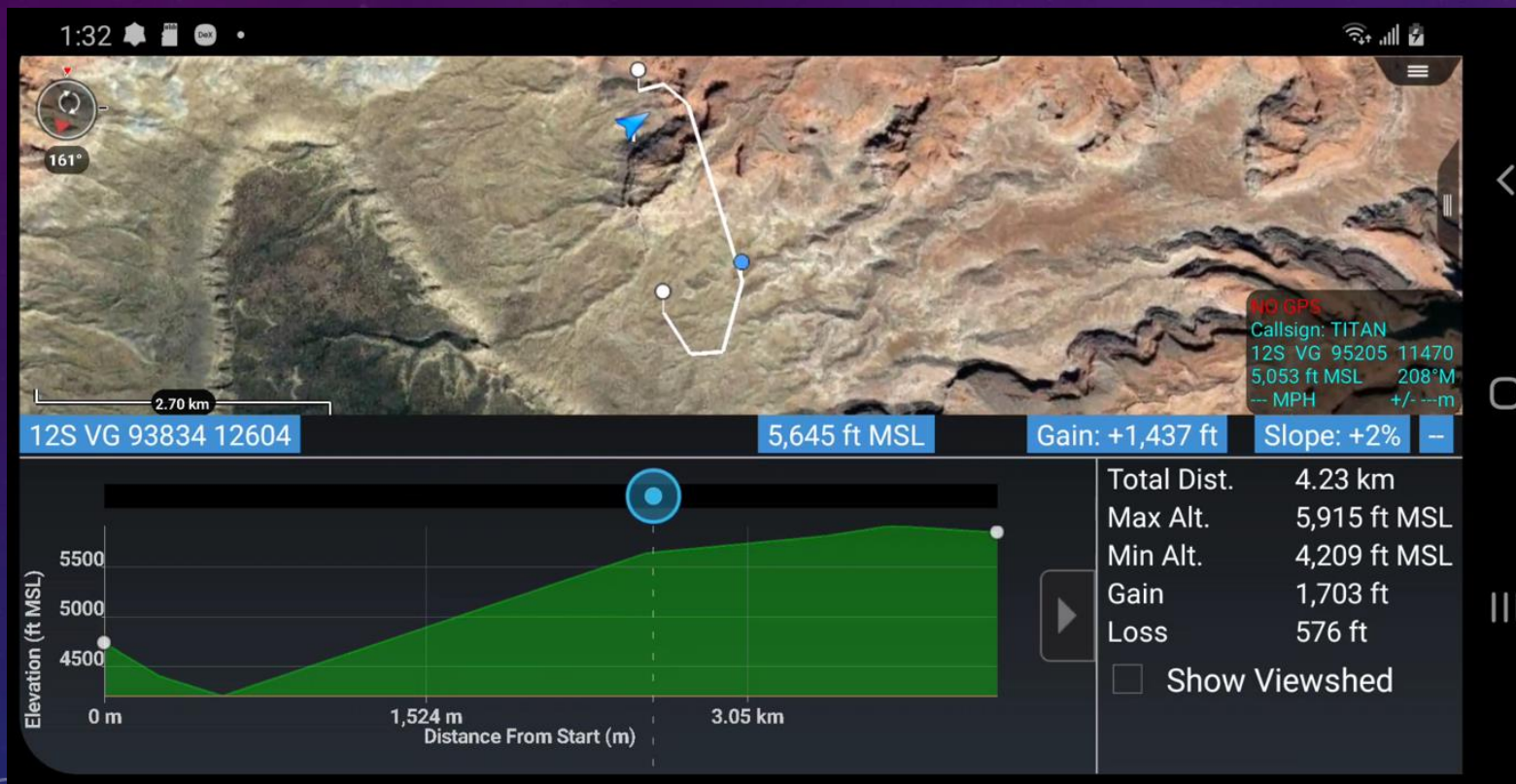


# MESHTASTIC TELEMETRY USING I2C SENSORS & GPS

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



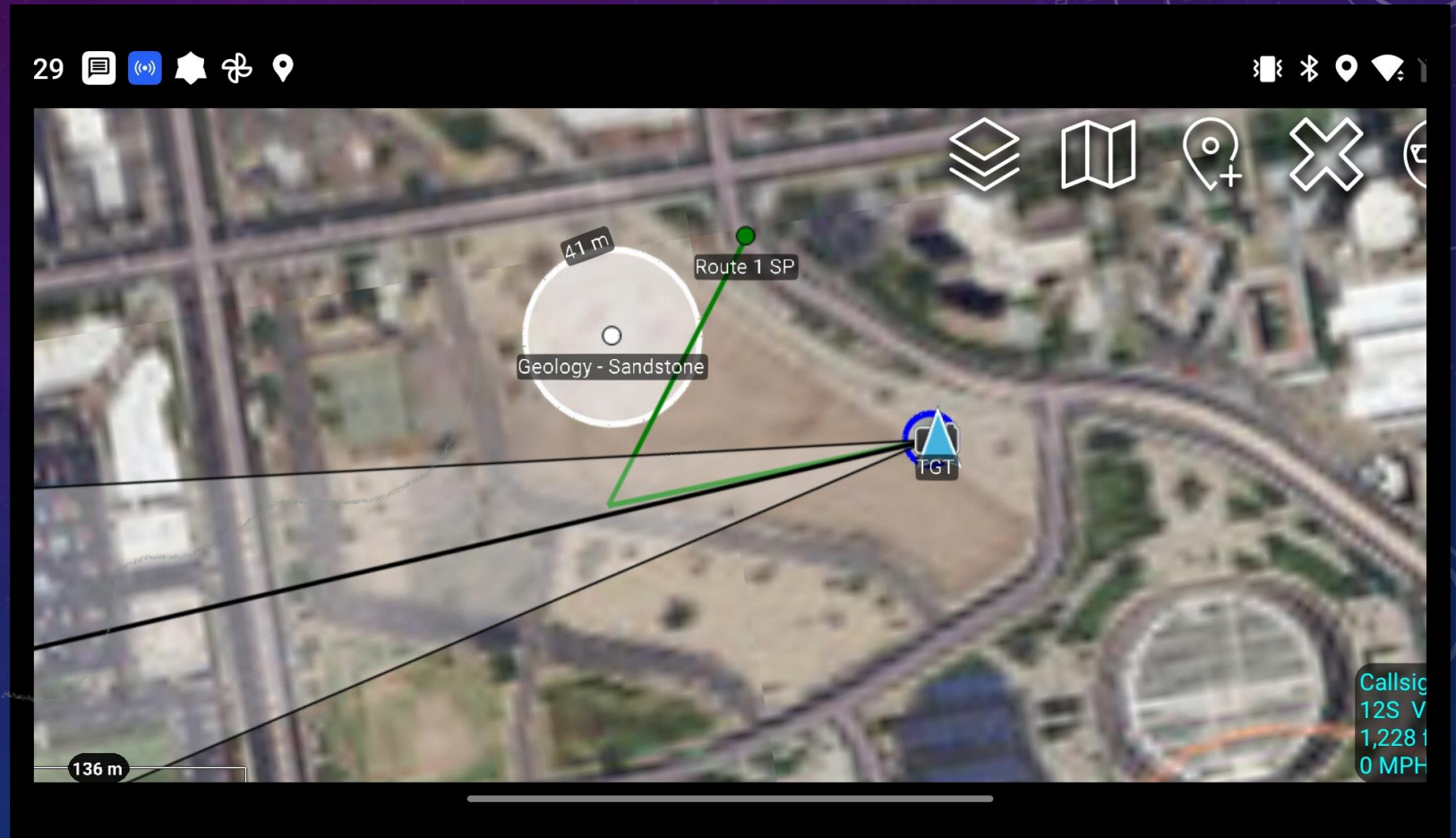
# MDRS BASE STATION

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

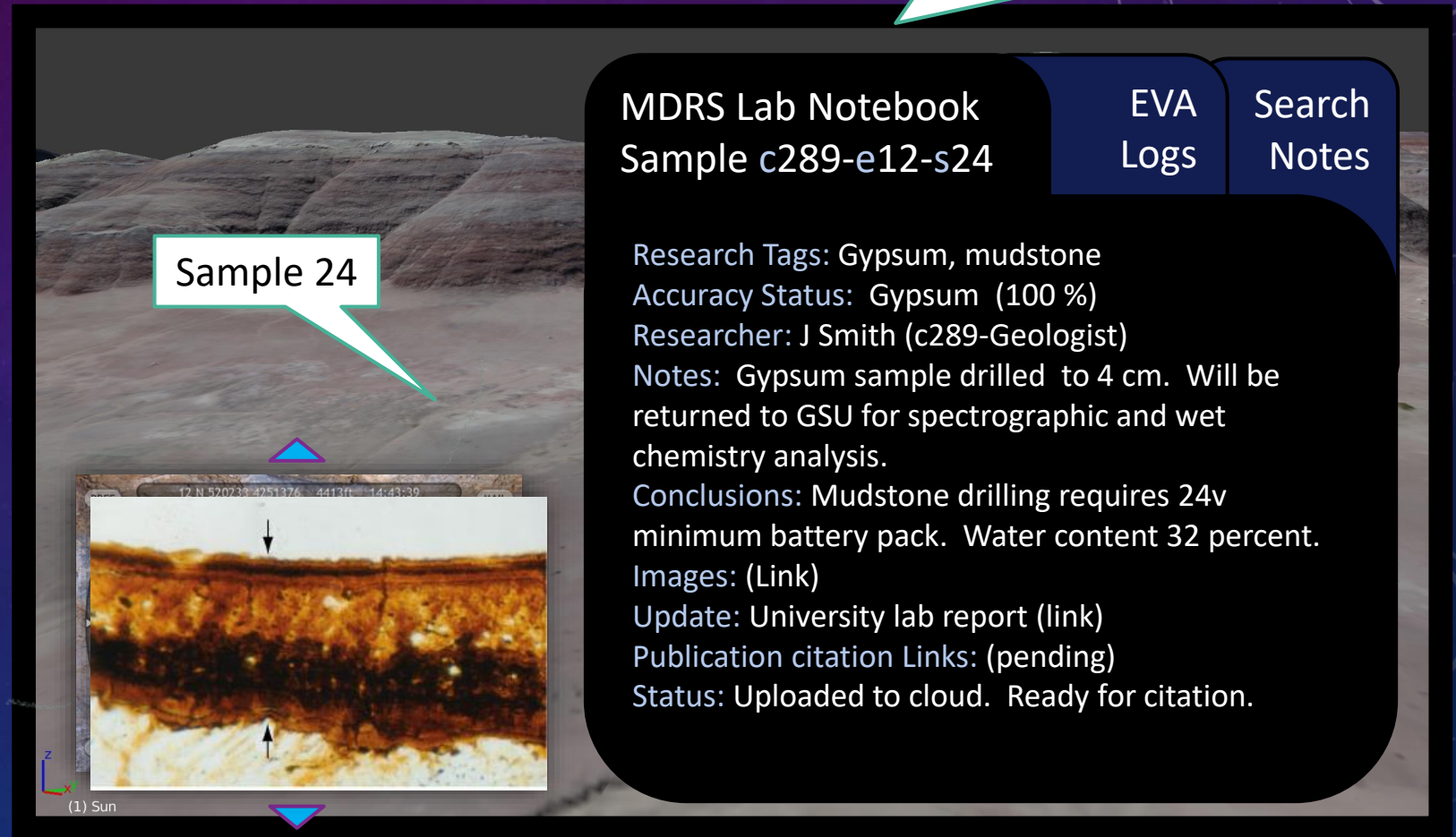
On return from EVA, initial research on a given sample is logged in a central database.

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)



The screenshot displays the MDRS Lab Notebook interface. On the left, a large image shows a rocky, reddish-brown landscape. A white callout box with a green border points to a specific location on the ground, labeled "Sample 24". Below this, a smaller inset image shows a close-up of a rock core sample, with two black arrows indicating the drilling depth. The top of the inset image shows a timestamp: "12 N 520733 4251376 44130 14:43:39". In the bottom left corner of the inset, there is a small 3D coordinate system icon and the text "(1) Sun". On the right side of the interface, there is a dark blue panel with a white border. At the top of this panel, it says "MDRS Lab Notebook" and "Sample c289-e12-s24". To the right of this text are two tabs: "EVA Logs" and "Search Notes". Below the tabs, the panel contains the following information: "Research Tags: Gypsum, mudstone", "Accuracy Status: Gypsum (100 %)", "Researcher: J Smith (c289-Geologist)", "Notes: Gypsum sample drilled to 4 cm. Will be returned to GSU for spectrographic and wet chemistry analysis.", "Conclusions: Mudstone drilling requires 24v minimum battery pack. Water content 32 percent.", "Images: (Link)", "Update: University lab report (link)", "Publication citation Links: (pending)", and "Status: Uploaded to cloud. Ready for citation."

Sample 24

MDRS Lab Notebook  
Sample c289-e12-s24

EVA Logs Search Notes

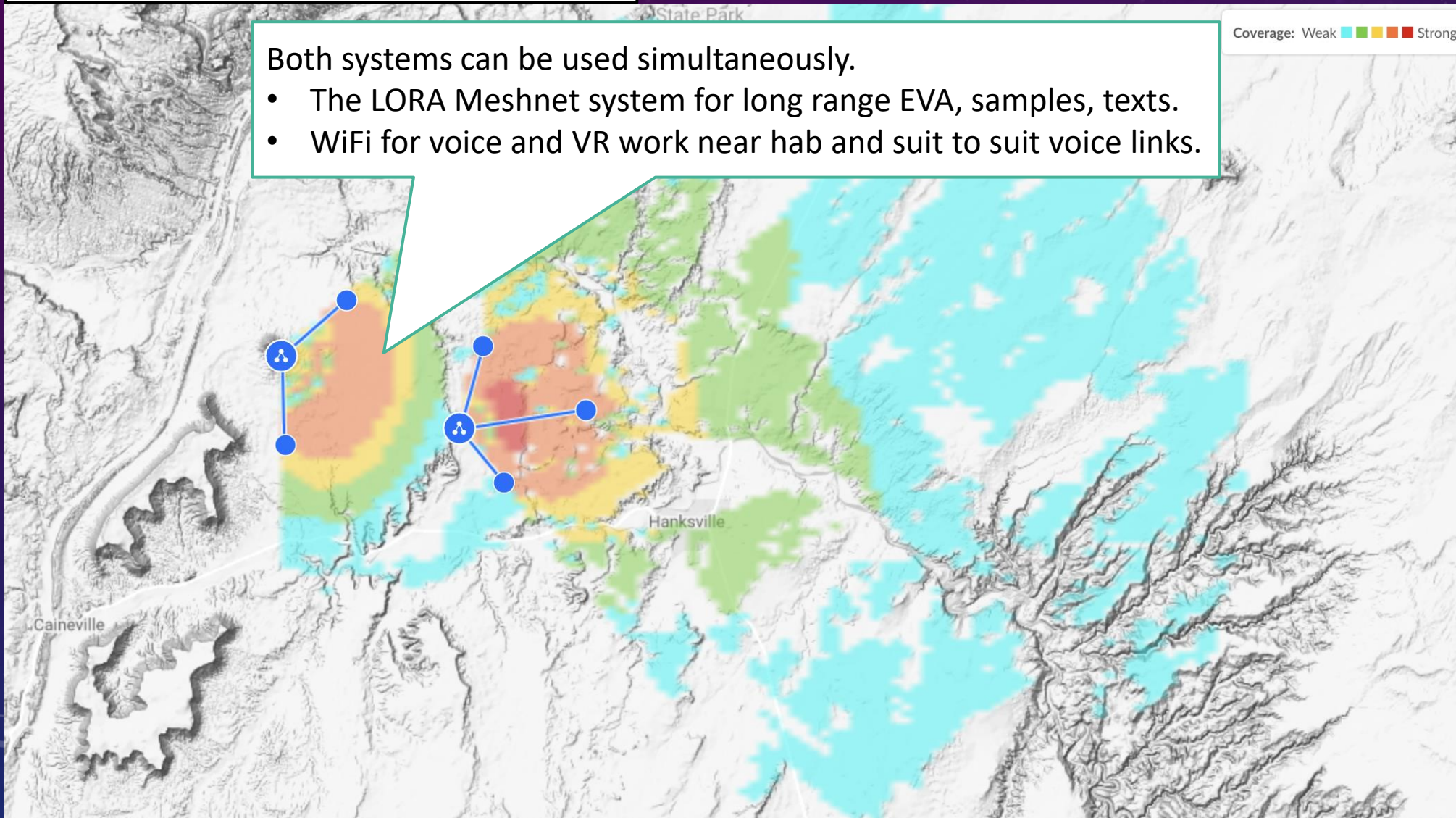
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Accuracy Status: Gypsum (100 %)  
Researcher: J Smith (c289-Geologist)  
Notes: Gypsum sample drilled to 4 cm. Will be returned to GSU for spectrographic and wet chemistry analysis.  
Conclusions: Mudstone drilling requires 24v minimum battery pack. Water content 32 percent.  
Images: (Link)  
Update: University lab report (link)  
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# Meshnet + Voice IP

Both systems can be used simultaneously.

- The LORA Meshnet system for long range EVA, samples, texts.
- WiFi for voice and VR work near hab and suit to suit voice links.



# TALENT NEEDED

Users	Tasks	Skills Needed
EVA Unit Assembly	<ul style="list-style-type: none"><li>• Assembly of units</li><li>• Software loading units (Meshtastic)</li><li>• Customization of CIV-TAK client on Android phone (long term).</li></ul>	<ul style="list-style-type: none"><li>• 3D printing</li><li>• Soldering</li><li>• Technical downloads in development environment</li></ul>
Hab Console Software Development	<ul style="list-style-type: none"><li>• Data Stream Logging at Hab (CIV-TAK to partitioned data)</li><li>• Display of data on 3D GIS map</li></ul>	<ul style="list-style-type: none"><li>• Streaming input software development</li><li>• GIS Visualization (Mars VR and GPS data set).</li><li>• User Interface and Dashboard development</li></ul>
Science Lab Logging System	<ul style="list-style-type: none"><li>• Photo integration and lab equipment data collection</li><li>• CIV-TAK JSON for equipment telemetry</li></ul>	<ul style="list-style-type: none"><li>• CMS development experience</li><li>• Database and visualization (Geocodes, GeoJSON)</li><li>• User Interface and Dashboard development</li><li>• Lab equipment integration development</li></ul>
Long Term	<ul style="list-style-type: none"><li>• Remote science equipment integration</li><li>• Bot queries (weather, power, etc.)</li></ul>	



JOIN US!



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