

CONNECTING TO LAS VEGAS MESH NETWORK

Tom Davis – KB7HTA

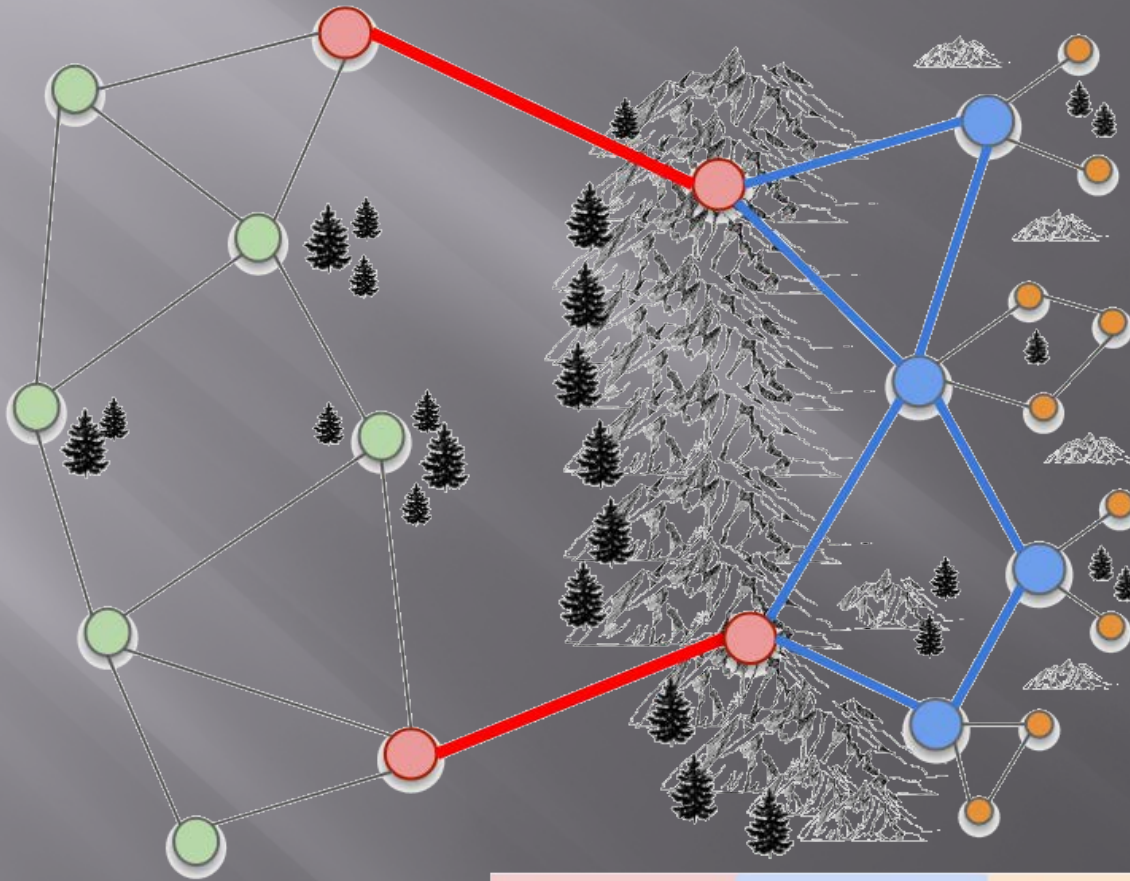
Las Vegas Mesh (LVMesh)

- ▣ LVMesh Group meets quarterly in person and on Sunday using Team Talk from 7:45 – 8:00 pm
- ▣ Created private Internet using Amateur Radio
- ▣ What you can do on the Internet you can do on the LVMesh Network.
 - Websites
 - Email Servers
 - Search Engines
 - Chat Rooms
 - IP Cameras
 - VoIP Telephones
 - Emergency Services

This Happens Using AREDN

- ▣ The AREDN™ acronym stands for “Amateur Radio Emergency Data Network”
- ▣ Provides a way for operators to quickly and easily create high-speed data networks for use in emergency and service-oriented communications.
- ▣ Uses FCC Part 97 amateur radio frequency bands (2.4 GHz and 5.8 GHz) to send digital data between devices which are linked with each other to form a self-healing, fault-tolerant data network.
- ▣ Uses off the shelf commercial Wi-Fi equipment

Types of Links



Backbone

Intermediate

Endpoint

Backbone (Backhaul) Links

- ▣ These form a superhighway along which large amounts of data can travel at relatively high speeds
- ▣ Typically the backbone or backhaul links are permanent installations on mountain peaks, tall buildings, or high towers
- ▣ They are point-to-point links with large high-gain antenna systems running on reliable power sources over distances between 10 to 30+ miles
- ▣ In some cases these links are designed with redundant radios which help ensure path protection

Backbone Potosi Mountain



Backbone Potosi Mountain



Backbone Potosi Mountain



Backbone Red Mountain



Backbone - Apex Peak

78 days 05:14:39

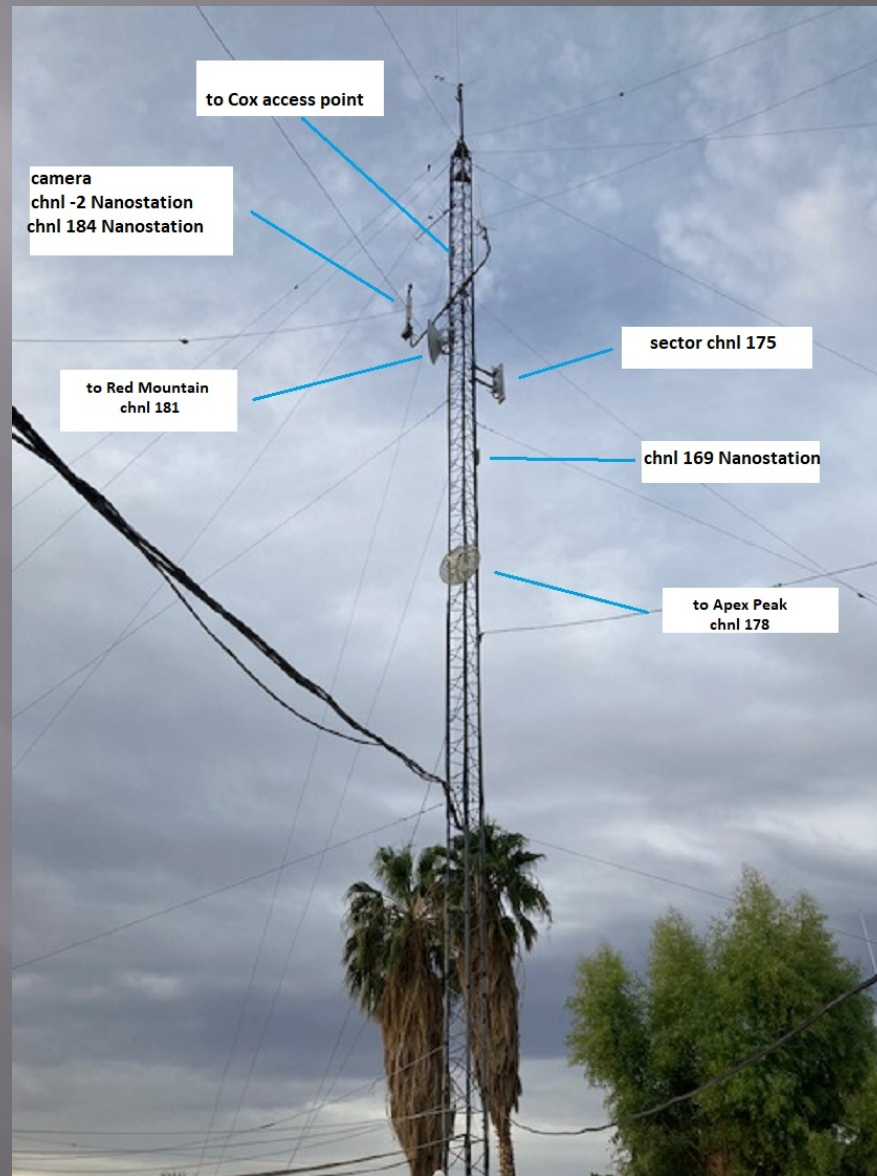
Apex Exterior



Backbone - Apex Peak Switch



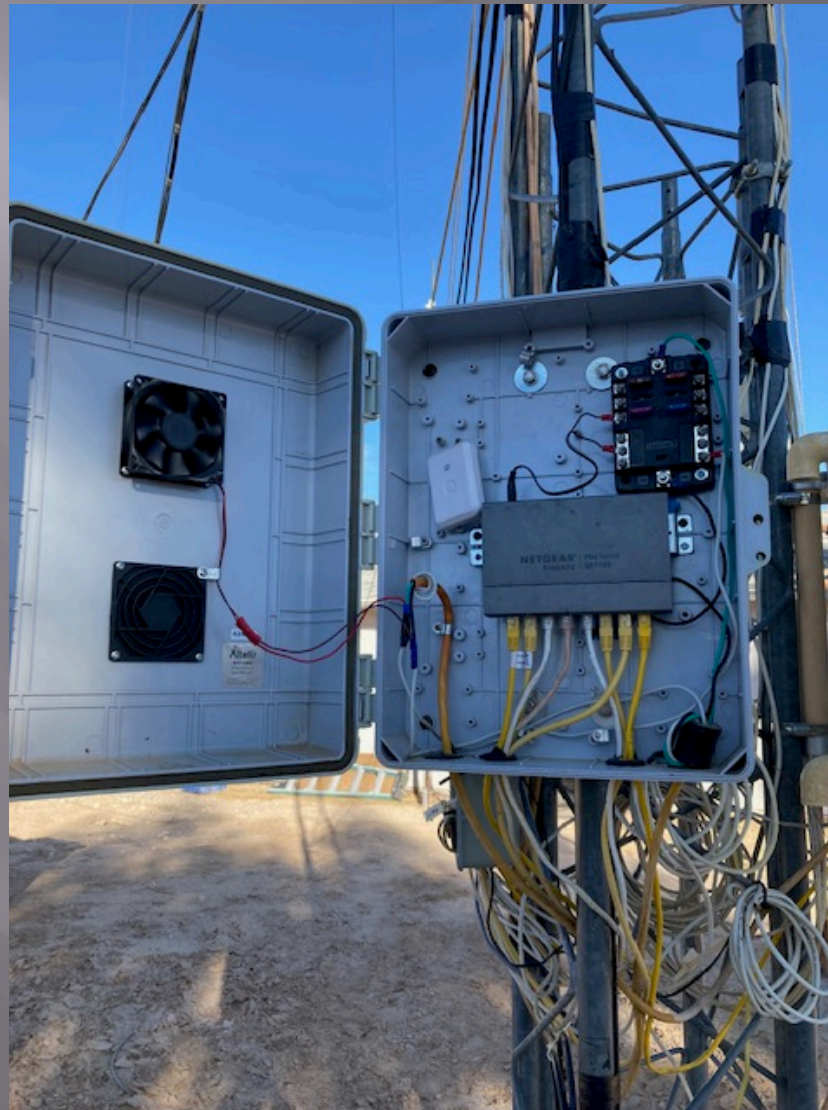
Backbone - QTH K000000



Backbone-K000000 to Potosi



Backbone – QTH K000000



Intermediate

- ▣ Links that bridge the gaps between endpoints and backhaul nodes
- ▣ Primary purpose is to pass network data, but in some cases they serve as access nodes for users
- ▣ Sometimes these links are called mid-mile, distribution, or relay nodes
- ▣ Usually installed on medium-height towers or buildings in order to achieve high signal quality with good line of sight to other nodes and operate over distances between 3 to 10+ miles.

Intermediate Link



End Point Links

- ▣ Endpoint links are used to connect destination nodes to the mesh network
- ▣ Sometimes these links are called “last mile”, “tactical”, or “terminal” nodes and serve either as the originator or the final destination for network traffic
- ▣ Endpoint links typically operate over distances of 3 miles or less.

Temporary Setup at RRSR



LVMesh Network Access



LVMesh Network Access Plan

- ▣ You will need a computer with OS and a wired Ethernet port (USB to Ethernet adapter)
- ▣ Consider the network map in the previous slide and select your best access point.
 - Red Mountain
 - Potosi Mountain
 - Apex Peak
 - KO0000 Site
 - Other
- ▣ Questions to ask yourself
 - Can I see the access point? Link Calculator?
 - How far away is the access point (< 20 miles)?
 - Best radio and antenna combination?

Radios Supported by AREDN

- ▣ Ubiquiti
 - Rocket M2/3/5
 - Nano Station M2/3/5
 - Bullet
- ▣ TP-Link
 - CPE-210/510
 - CPE-220
 - CPE-610
- ▣ MikroTik
 - hAP AC Lite
 - RBLHG-5HPnD-XL-US

List: [AREDN Supported Mesh Nodes](#)

Ubiquiti Rocket M2



Ubiquiti NanoStation



TP-Link CPE-210



MikroTik hAP AC Lite



MikroTik RBLHG-5HPnD-XL-US



Antennas

- ▣ Many radios come with the antenna attached to the radio, a sector antennas (90 °, 120°) or dish (6°).
- ▣ Others, like the Ubiquiti Rocket M2/3/5 need an antenna
 - Advantage – More durable with better specifications
 - Disadvantage – Price
- ▣ There are Omni-directional, dish (5-7°) and sector (60°, 90 °, 120 °) antennas

Omni-Directional Antennas



Dish Antennas



Sector Antennas



Putting It All Together

- ❑ Select the best LVMesh Network access point, radio and antenna.
- ❑ Flash your radio with AREDN firmware and set the channel to 172 with a bandwidth of 10 MHz
- ❑ Mount your antenna/radio on your property with a clear view of your chosen access point. If you are in an HOA, informing the board the dish is how you access the Internet will give them a good reason to allow you to keep the dish
- ❑ Run the CAT 5/6 Ethernet cable from the radio/antenna into your house and connect it to your computer and power using a POE adapter
- ❑ Open computer browser and enter the following: `http://localnode.local.mesh:8080` in the address block and hit enter

Example – Amerian Legion Hall

- ▣ The best LVMesh Network access point for the American Legion Hall Post 40 would be Red Mountain, approximately 5 miles
- ▣ A MikroTik RBLHG-5HPnD-XL-US was selected, because it is portable, easily attached to a tripod, can be battery powered and has excellent gain
- ▣ The demo MikroTik dish was flashed with AREDN firmware prior to the demonstration
- ▣ The MikroTik dish was mounted near the road in order to have an unobstructed view of Red Mtn.
- ▣ An additional MikroTik dish inside is used to access the one by the road due to the distance

Example – Continued

- ▣ Connect a CAT 5/6 Ethernet cable from the inside MikroTik dish (node) to the presentation computer wired LAN port and PoE adapter
- ▣ Enter `http://localnode.local.mesh:8080` into the address block of the browser on the presentation computer and hit enter.
- ▣ The inside node status page should now be displayed on the screen

Node Status Page



N7ZEV-KB7HTA-LVMESH-M5S9017-REDMTN

Location: 35.995435 -114.863816

Las Vegas Mesh Network Ubiquiti M5 with a 17dbi 90° Sector Antenna located on Red Mountain and pointed toward Boulder City

[Help](#)

[Refresh](#)

[Mesh Status](#)

[WiFi Scan](#)

[Setup](#)

[Select a theme](#) ▼

Wifi address	10.166.86.83 / 8	Signal/Noise/Ratio	-65 / -95 / 30 dB	Charts
LAN address	10.50.178.153 / 29	firmware version	3.21.4.0	
WAN address	none	system time	Mon Oct 11 2021 22:52:40 UTC	
default gateway	10.103.188.55 mid1	uptime	62 days, 9:53	
SSID	AREDN-10-v3	load average	0.00, 0.02, 0.04	
Channel	175	free space	flash = 752 KB /tmp = 29908 KB memory = 43556 KB	
Bandwidth	10 Mhz	OLSR Entries	Total = 174 Nodes = 57	

I Am Connected, What Now? - Mesh Status Page



K7RSW-K7FYI-RM590-West mesh status

Location: 35.995620 -114.863938

Rocket M5 / 20 dBi sector on Red Mountain pointed NW into Las Vegas

[Refresh](#) [Auto](#) [Quit](#)

Local Hosts

K7RSW-K7FYI-RM590-West

Services

Remote Nodes

ETX

Services

[K00000-5-Sureste-BH](#)

[KF7PSM-NW1](#)

[K00000-5-Oeste](#)

[K00000-5-Suroeste-BH](#)

[K00000-hAP-server](#)

● [ko0000-pi4-linux](#)

● [K00000-HF](#)

● [TeamTalk5](#)

[K00000-5-Noreste-BH](#)

● [UVC-G3](#)

● [piaware](#)

[N65FX-LVMESH-CPE510-N2](#)

[KE6BXT-N7ZEV-M2NB-100-74-0](#)

[KE6BXT-N7ZEV-to-Potosi-M2R-54-127-163](#)

[KE6BXT-N7ZEV-hAP-184](#) (tun*1)

● [N7ZEV-treetopcamera](#)

● [N7ZEV-ToughSwitch](#)

● [N7ZEV-HDMI-Port](#)

● [N7ZEV-184-Grandstream](#)

● [KE6BXT-SRicam-184](#)

[KE6BXT-LVQTH-hAP-Tunnel-22](#) (tun*2,van)

● [KE6BXT-LVQTH-hAP-Tunnel22-snom300-8D54D0](#)

● [KE6BXT-LVQTH-hAP-Tunnel22-IPPhone](#)

● [MeidaCodec](#)

● [KE6BXT-LVQTH-hAP-Tunnel-22-raspberrypi](#)

[KE6BXT-GigapartsLV-250](#) (tun*1)

1.10 [Red Mountain link](#)

1.10 [ARRL NEWS](#)

[WEB](#)

1.20 [west facing sector](#)

1.20 [High Potosi link](#)

1.20

Apache / BPQ / TT5

Winlink Hybrid gateway

IP / DNS=TeamTalk5.local.mesh

1.20 [Apex Peak link](#)

[HiDef camera](#)

[FlightAware virtual radar](#)

1.22

1.40

1.40

1.40

[10.68.43.154](#)

[10.68.43.147](#)

[10.68.43.149](#)

[10.68.43.150](#)

[10.16.98.241](#)

[10.16.98.249](#)

[HDMI_passthrough](#)

[HDMI_passthrough_2](#)

[Mesh Map](#)

[Node Report](#)

[Website](#)

[10.68.43.154](#)

Current Neighbors

LQ NLQ TxMbps Services

[K7RSW-K7FYI-RM5-Rdsh-Red-Mtn-NW](#) (dtd)

100% 100%

[KE6BXT-N7ZEV-MSR-98-90-23](#)

77% 100% 17.8

[KE6BXT-N7ZEV-MSR-OMNI-252-213-192](#)

2% 46% 0.0

[KF7PSM-MKTK5HP-2](#)

100% 100% 28.9

[N7BDP-1](#)

78% 92% 6.5

[N7ZEV-KB7HTA-LVMESH-M5S9017-REDMTN](#) (dtd)

100% 100%

● [SCDE34FF](#)

[BC NW camera](#)

[BC NW camera snapshot](#)

Previous Neighbors

When

[W7HEN-LVMESH-RM5S90-APEX1](#)

2 minutes ago

[10.251.223.179](#)

2.4 hours ago

OLSR Entries

Total 162

Nodes 53

Mesh Status Page Enlarged

[Refresh](#)[Auto](#)[Quit](#)

Current Neighbors

LQ NLQ TxMbps Services

[K7RSW-K7FYI-RM5-Rdish-Red-Mtn-NW](#) (dtd)

100% 100%

[KE6BXT-N7ZEV-M5R-98-90-23](#)

77% 100% 17.8

[KE6BXT-N7ZEV-M5R-OMNI-252-213-192](#)

2% 46% 0.0

[KF7PSM-MKTK5HP-2](#)

100% 100% 28.9

[N7BDP-1](#)

78% 92% 6.5

[N7ZEV-KB7HTA-LVMESH-M5S9017-REDMTN](#) (dtd)

100% 100%

● SCDE34FF

[BC NW camera](#)

[BC NW camera snapshot](#)

Previous Neighbors

When

W7HEN-LVMESH-RM5S90-APEX1

2 minutes ago

10.251.223.179

2.4 hours ago

OLSR Entries

Total

162

Nodes

53

Red Mountain NW Camera



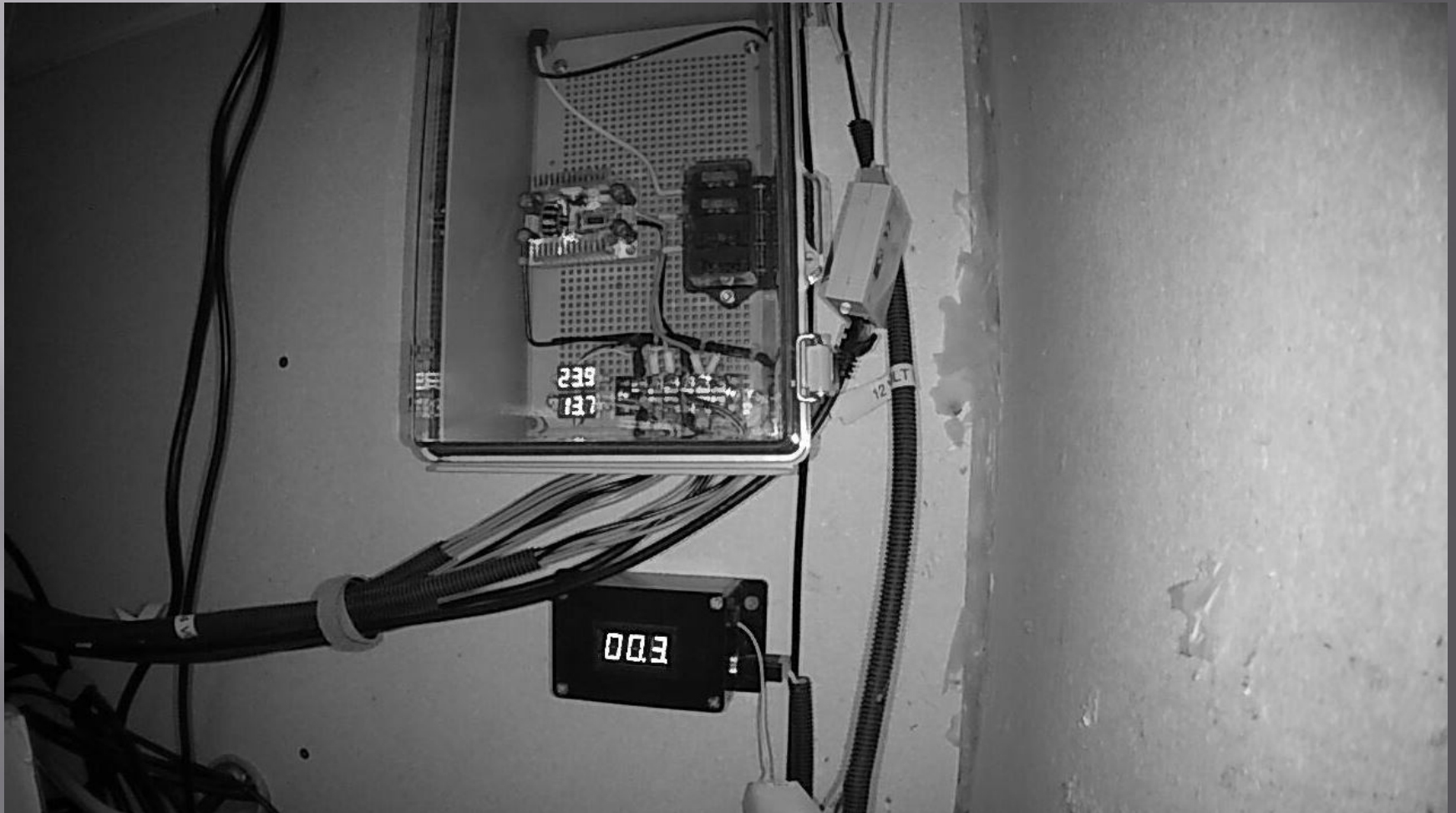
Potosi Mountain Cameras



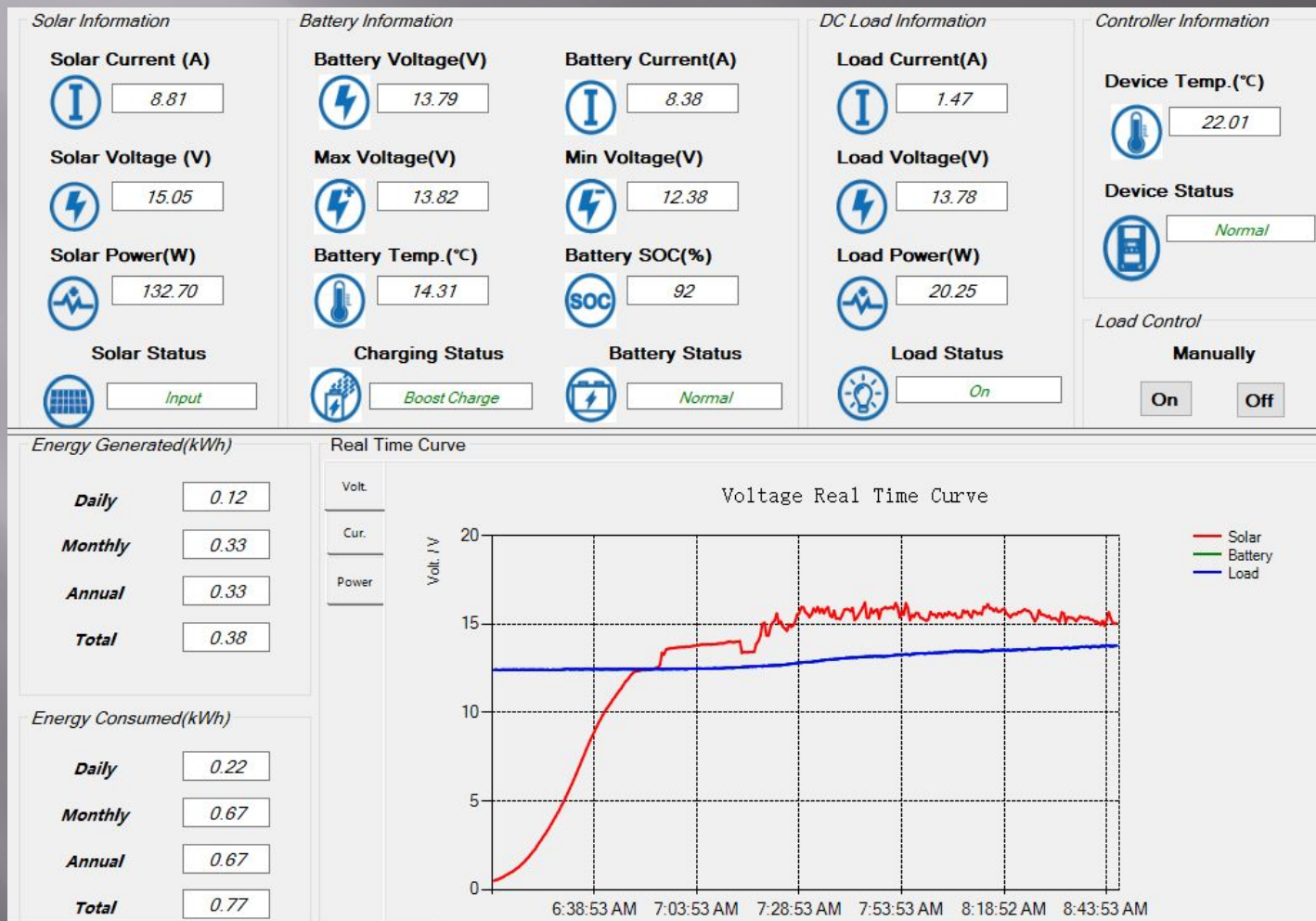
Apex NE Camera



Apex Solar Status Camera



Apex Solar Status Connect



LVMesh Website

[Home](#) [About](#) [Projects](#) [Gallery](#) [Members](#) [Contact Us](#)



Las Vegas Mesh Group



News & Events

Deployable Autonomous Mesh Node (DAMN) Project



In setting up an Amateur Radio Emergency Data Network (AREDN) in the Las Vegas Valley, it will become necessary to test node locations, of which some will not have power and are in remote locations. To this end, the LV Mesh group is developing a Deployable Autonomous Mesh Node. The design should allow the unit to operate days without being charged by its solar panels; stay onsite for days, weeks, months or years; allow for up to 3 nodes to be attached to the system; provide a UHF link for system reset, telemetry and power management; Ethernet link through the mesh network; and watchdog timer to prevent software lockup. Preliminary specifications follow:

Welcome to Las Vegas Mesh Group



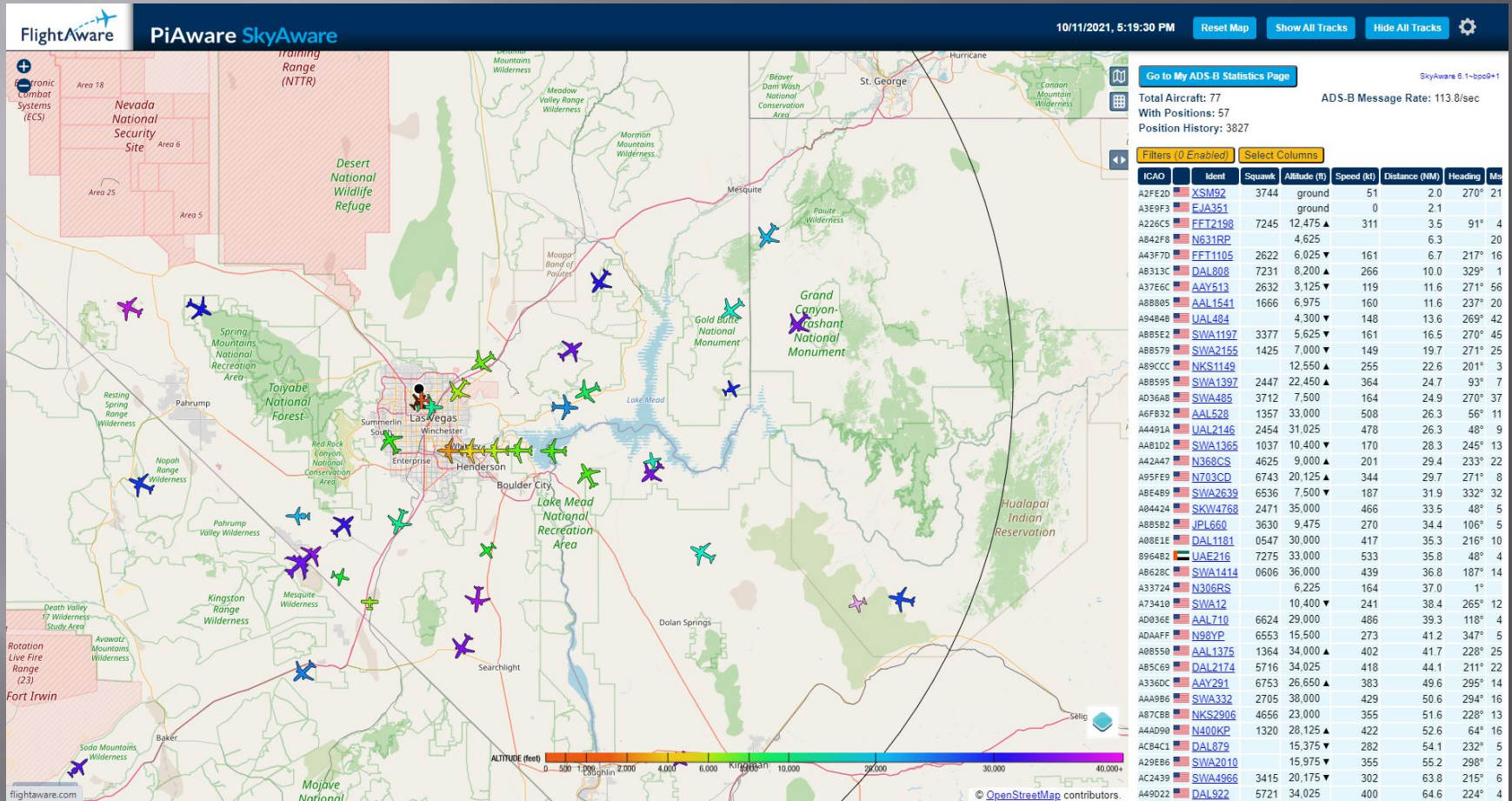
The Las Vegas Mesh Group was formed in February of 2019, out of the need to provide a reliable emergency data network in the Las Vegas Valley and surrounding areas. Off the shelf networking equipment will be used with software provided by Amateur Radio Emergency Data Network (AREDN) development team.

[Read more](#)

Activities

- **IMPORTANT!!** If you would like to be able to login and use the LVMesh Server contact Tom at tsdxmad@gmail.com for an account. It is a great platform for collaboration.
- **TeamTalk 5** is now being used on the LVMesh network for collaboration and a weekly NET. The first NET occurred on Saturday November 15, 2019, with Richard, KO0000, Rick, K7FYI and Tom, KB7HTA joining in on a discussion about TeamTalk software. The most recent NET, December 15, 2019 had 5 participants; Richard, KO0000, Rick, K7FYI, Dale, WA6MZW, Wayne, N7HWM and Tom, KB7HTA. TeamTalk is a conferencing system, which people use to communicate over the Internet using VoIP and video streaming. The TeamTalk

FlightAware – PiAware SkyAware



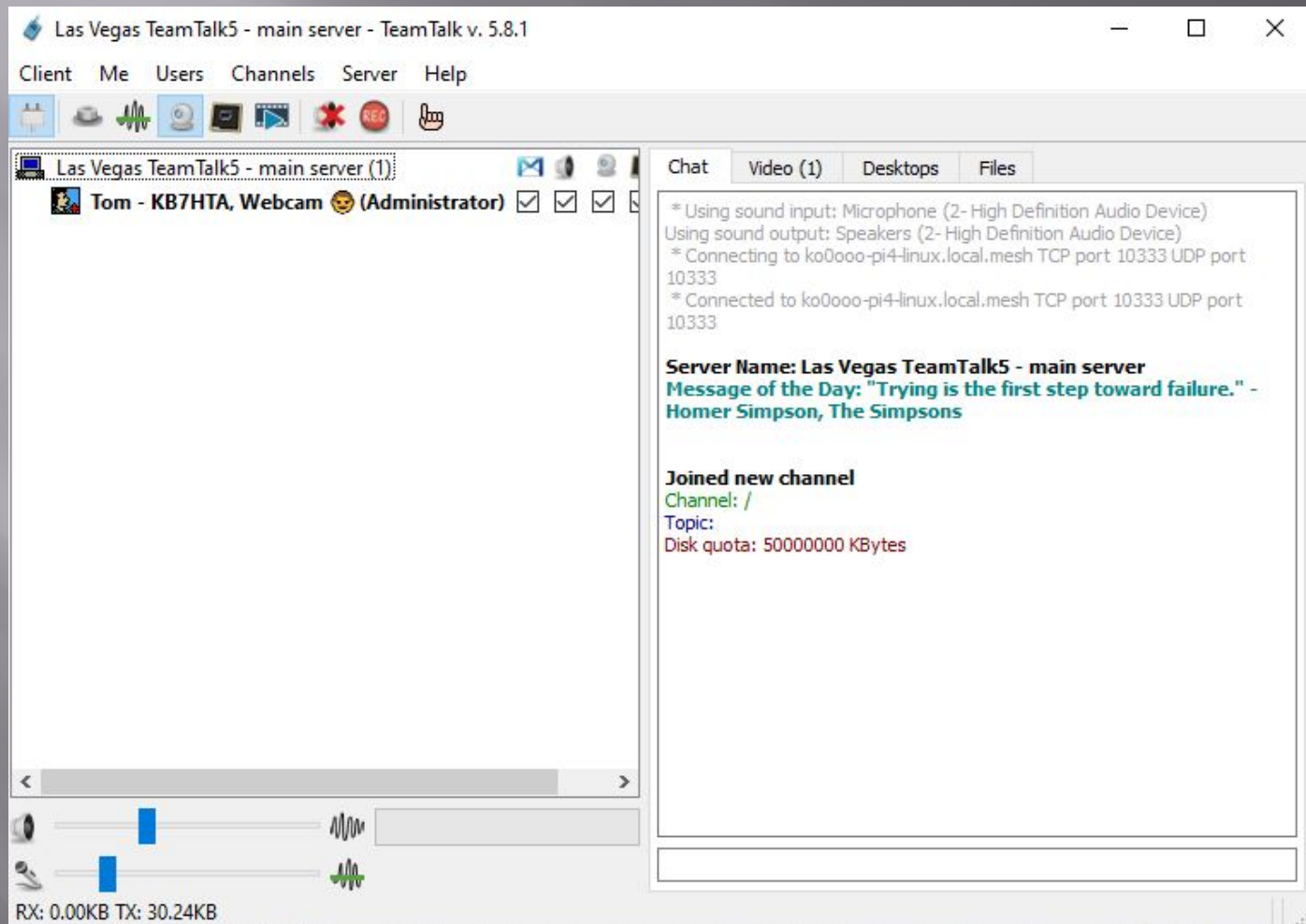
Corporate Challenge Bike Race



Corporate Challenge Bike Race



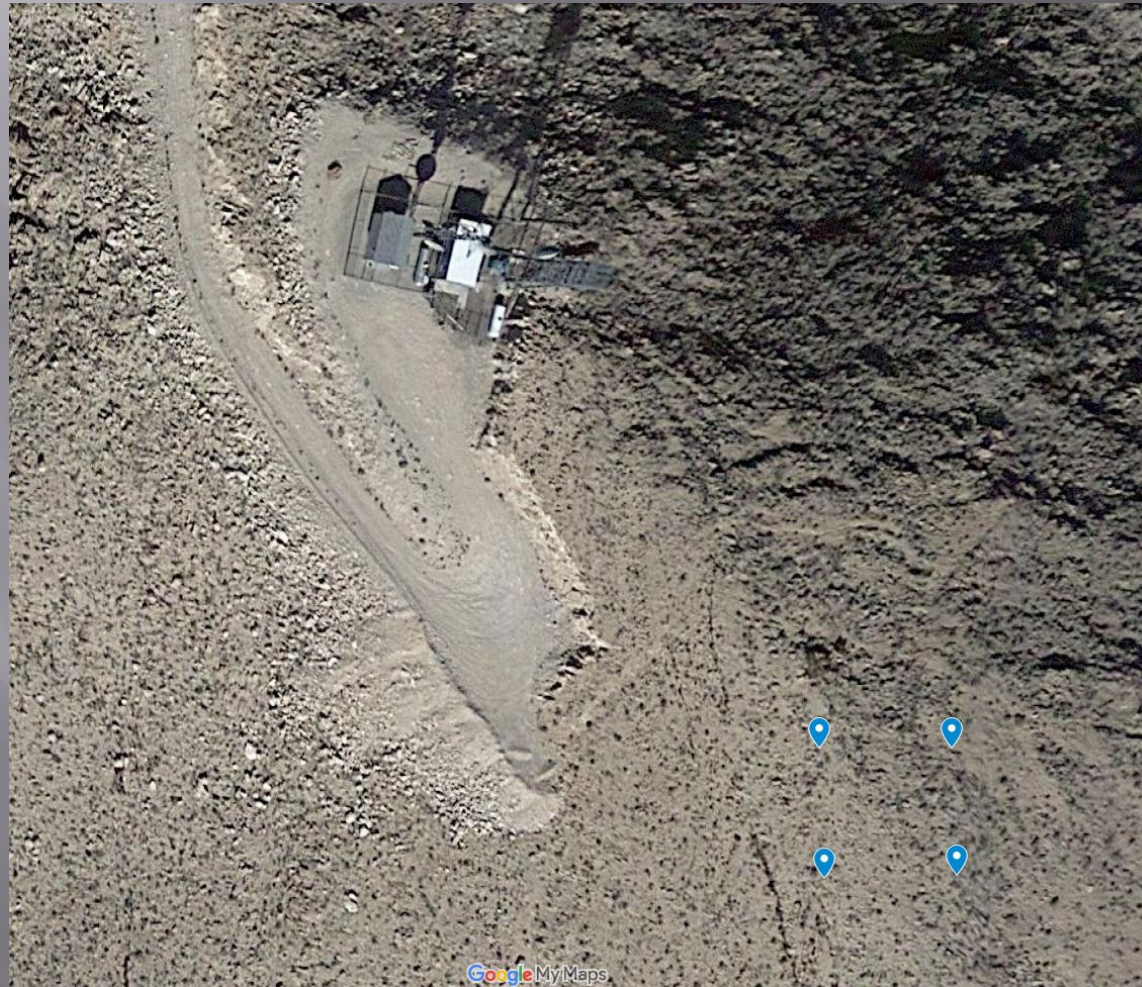
Team Talk 5 Demonstration (Zoom)



Future - Deployable Autonomous Mesh Node (DAMN)



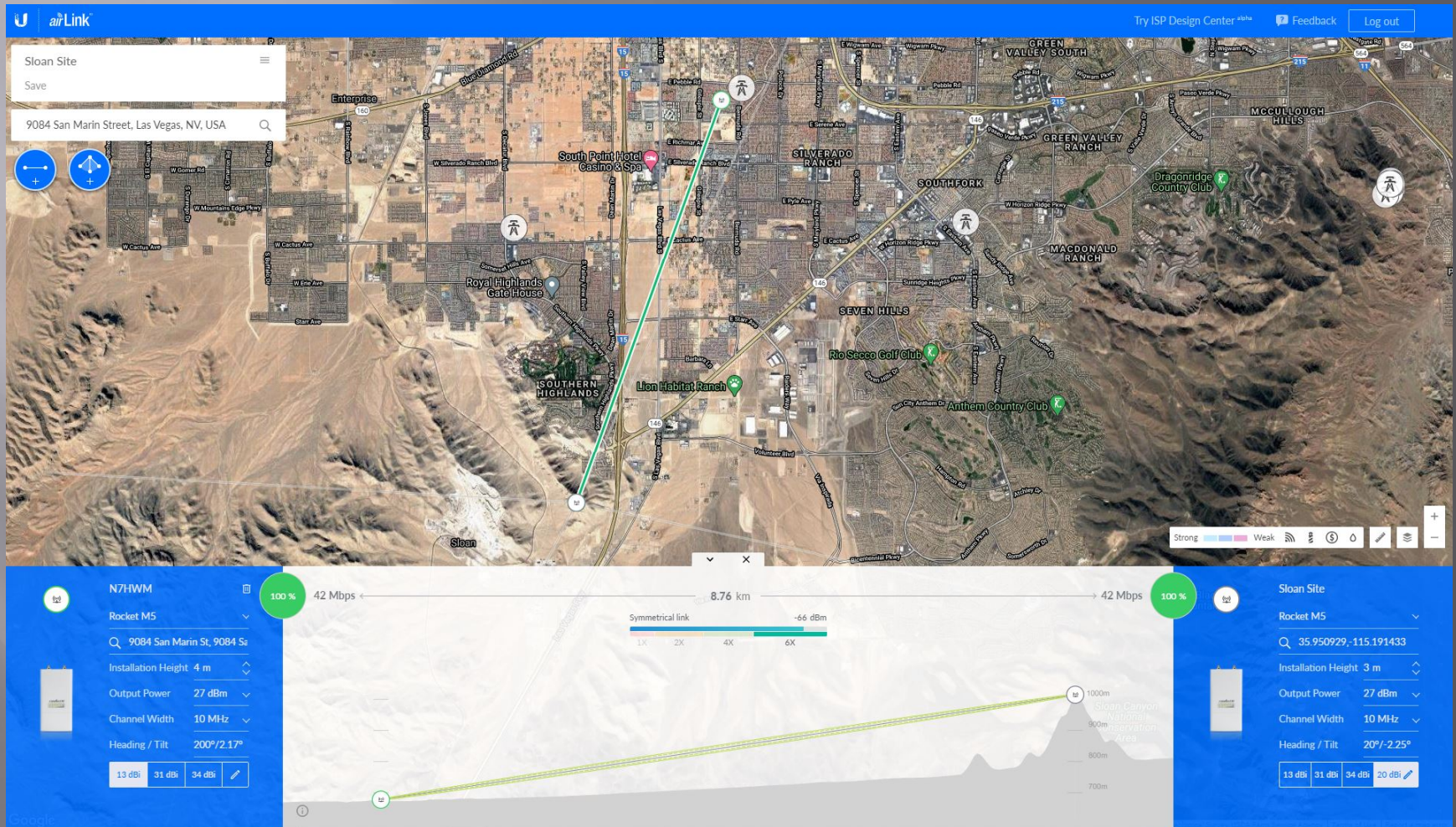
Aerial View of Sloan Site



Sloan Test



Link Simulation Sloan to N7HWM



Live Demonstration

- ▣ Node Status Pages
- ▣ Mesh Status Pages
- ▣ Cameras
- ▣ Solar Power Status Apex
- ▣ Team Talk 5
- ▣ Node Admin Pages

The End

- ▣ AREDN - [Amateur Radio Emergency Data Network](#)
- ▣ Link Calculations - [Ubiquiti Link Calculator](#)
- ▣ More information - [LVMesh Group Website](#)
- ▣ Questions ????
- ▣ Raffle