

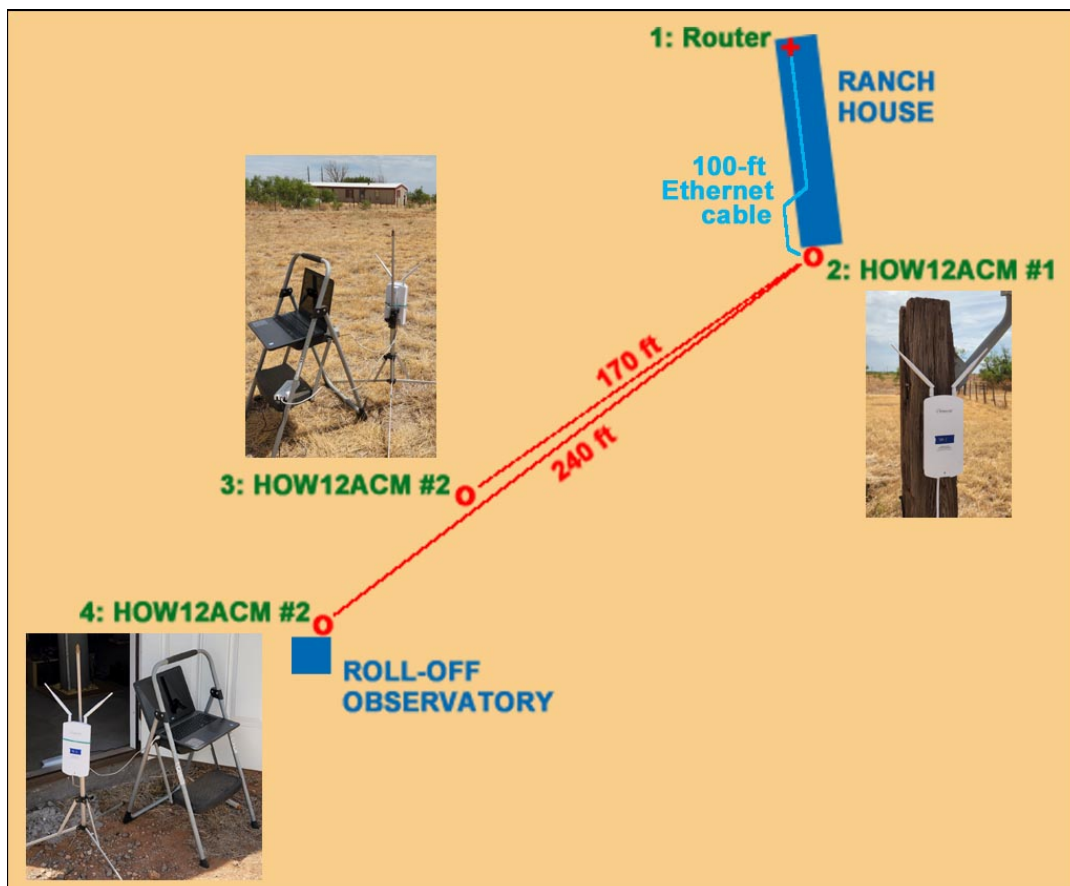
# TEST OF LONG-DISTANCE WiFi SYSTEM at CAT-STAR SKY RANCH, TEXAS

8 August 2022

A field test was run to assess the efficacy of using a long-distance WiFi system for point-to-point communication at Cat-Star Sky Ranch, Texas. The system could potentially be used to relay commands to operate astronomical equipment (mounts, cameras, etc.) located in remote observatories and upload acquired imagery. To be effective, the system would need to maintain high data transfer rates, particularly when uploading large amounts of image data.

The system tested was the Hawking Technology HOW12ACM Outdoor Wireless-ACT300 Managed Access Point/Extender (<https://gohawking.com/building-building-how12acmpoe-p-592.html>). The configuration tested involved two WiFi units, one operating in Access Point mode and the other in Repeater mode. Hawking Technology claims that this configuration will allow line-of-sight communications for distances up to 1000 ft with minimal reduction in transfer rates. Each HOW12ACM unit was powered by its own PoE (Power over Ethernet) Injector which provided power to the WiFi unit via an Ethernet cable connection.

The layout of the test is shown in the figure below. An incoming Internet service connection is



available in the north end of the Ranch House located on the Cat-Star Sky Ranch property. This service is provided by CapRock Telephone (<https://www.caprock-spur.com/>) via their regional fiber optic system. A router at this point provides local WiFi service for the Ranch House and Ethernet connections for other devices.

For the test, the HOW12ACM unit in Access Point mode (hereafter referred to as HOW12ACM #1) was attached to a post adjacent to the south end of the Ranch House. It was connected via the PoE Injector to the router using a 100-ft Cat-8 Ethernet cable. The HOW12ACM unit in Repeater mode (hereafter referred to as HOW12ACM #2) was placed sequentially at two locations southwest of the Ranch House. The first location was 170 ft from the HOW12ACM #1 unit. The second location was adjacent to an existing roll-off observatory at 240 ft from the HOW12ACM #1 unit. Both locations supported unobstructed line-of-sight communication.

During the test, Internet speed was measured using a Windows 10 laptop with Google Chrome running the Fast.com utility (<https://fast.com/#>). This utility provides measurements of Internet download and upload data transfer rates. Measurements of Internet speed were made at four locations:

- 1: At the router in the Ranch House via a short Ethernet cable directly connected to the laptop.
- 2: At the end of the 100-ft Cat-8 Ethernet cable via direct connection to the laptop. This is at the location of the HOW12ACM #1 unit.
- 3: At the HOW12ACM #2 unit located 170 ft from the HOW12ACM #1 unit. The laptop was connected via the PoE Injector serving the HOW12ACM #2 unit using a short Ethernet cable.
- 4: At the HOW12ACM #2 unit located at the roll-off observatory (240 ft from the HOW12ACM #1 unit). The laptop was connected via the PoE Injector serving the HOW12ACM #2 unit using a short Ethernet cable.

Measurements of Internet speed are summarized in the table below.

Location	Download Speed (Mbps)	Upload Speed (Mbps)
1	52	46
2	50	45
3	50	45
4	50	45

The measurements at Location 1 represent the maximum Internet speeds available to the Cat-Star Sky Ranch site as established by the Internet Service Provider (CapRock Telephone). The measurements at Location 2 show that Internet speeds are reduced only slightly by the 100-ft Cat-8 Ethernet cable providing communication to the HOW12ACM #1 unit. Measurements at Location 3 and Location 4 show negligible reductions in Internet speed at these locations resulting from using the Hawking Technology HOW12ACM Outdoor Wireless-ACT300 Managed Access Point/Extender.

## CONCLUSIONS

Hawking Technology's claims that use of the HOW12ACM Outdoor Wireless-ACT300 Managed Access Point/Extender will allow line-of-sight communications over substantial distances with minimal reduction in transfer rates appear to be verified by this test. These results suggest that this long-distance WiFi system may be effective for relaying commands to operate astronomical equipment located in remote observatories and uploading acquired astronomical imagery at Cat-Star Sky Ranch.

## ADDENDUM

### COMPARISON TO BURIED ETHERNET CABLE

Internet connections to remote observatories at Cat-Star Sky Ranch have previously been provided by buried Ethernet cable. For the roll-off observatory described previously in this document, a Cat-5 Ethernet cable approximately 300 ft in length was run from the router in the Ranch House to the site of the observatory. Approximately the first third of this cable was run above-ground along the exterior of the Ranch House to a point close to where the HOW12ACM #1 unit was located in the test. The remaining portion of the cable was run underground within PVC pipe to protect it from rodent damage. The pipe and cable emerged from the ground at the roll-off observatory. The cable was brought into the observatory building and was connected to a router serving the observatory.

Internet speeds associated with the buried cable were measured in the same manner as those for the test of the long-distance WiFi system, with the laptop being connected to the router in the roll-off observatory via a short Ethernet cable. Results are presented in the table below, along with comparable results obtained using the long-distance WiFi system.

System	Download Speed (Mbps)	Upload Speed (Mbps)
HOW12ACM	50	45
Buried Ethernet Cable	9	9

As the results show, both download and upload data transfer rates were much greater for the HOW12ACM Outdoor Wireless-ACT300 Managed Access Point/Extender compared to the buried Ethernet cable. The significant losses of Internet speed associated with the buried Cat-5 Ethernet cable are likely due to transmission characteristics over its substantial length.

This comparison suggests that the use of buried Ethernet cables to provide Internet service to other observatories at Cat-Star Sky Ranch is unwarranted.