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ICOM 7300 Remote Control Demo Follow Up

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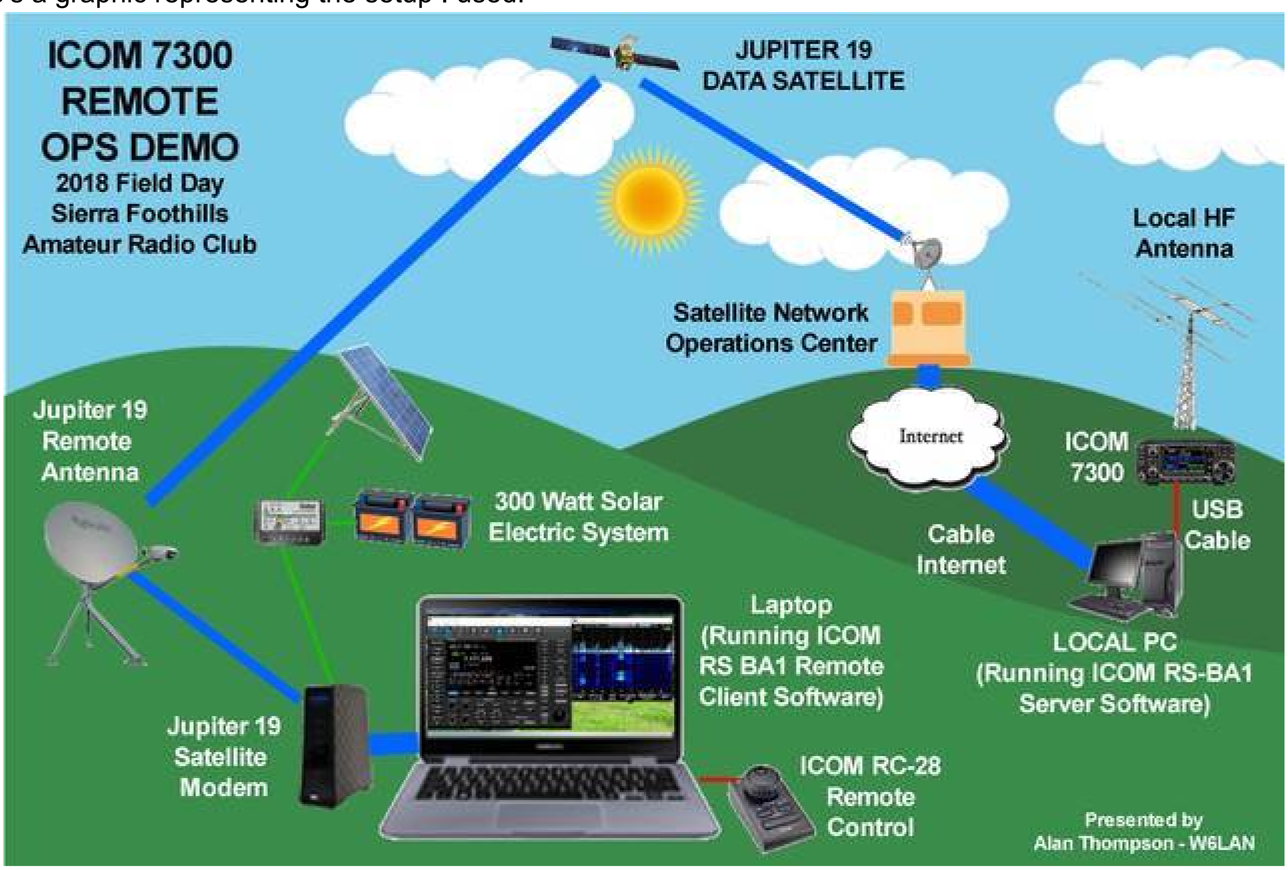
W6LAN (/g/sfarc/profile/@W6LAN) Jul 1 (https://w6ek.groups.io/g/sfarc/message/3781)

Hello All,

Thanks for the opportunity to try out this system during Field Day. My goal was to access and control an ICOM 7300 receiver, auto tuner and antenna located at my Base Station in Placerville from a completely self-contained Remote Station laptop connection, powered by solar, and assuming the absence of any conventional terrestrial power, Internet or cell service.

Here's a graphic representing the setup I used:



Not shown in the diagram, I had also connected a satellite-enabled ATA (analog telephone adapter) to the satellite modem to enable Remote Station VoIP telephone service. This provides an added benefit of placing and receiving conventional telephone calls over satellite in the absence of conventional phone communications.

This is a work in progress, and I still have more fine tuning to do before I can call the experiment finished.

Potential Advantages:

1. This type of "Remote Station" can be deployed virtually anywhere, and does not require erecting antenna masts or stringing wires into trees.
2. Can be deployed even in areas where an outdoor antenna may not be allowed or impossible to install.
3. Expensive radios, tuners, amplifiers and other station electronics can remain connected at the Base Station without subjecting them to the rigors of being hauled around and setup outside.
4. Base station antennas can be more robust and efficient than temporary Remote Station antennas.
5. Using solar for the power source works anywhere there is sunlight, does not require gasoline, is audio quiet and "green" friendly, and produces less fumes and pollution than a gas generator.
6. Satellite Internet has global coverage that can be accessed almost anywhere.

Potential Disadvantages:

1. Satellite Internet systems and solar panels are bulky, SLA batteries are heavy, and both take some effort to deploy.
2. Some heavily-wooded areas may not allow enough sunlight to charge solar electric batteries, and may also prevent adequate line of sight for a satellite Internet system.
3. Some Base Station radio and antenna control functions may not be available remotely, or may not operate well over a satellite Internet connection
4. The Base Station computer and radio gear must be left "on," at least in a standby condition and awake whenever there is a remote connection request.
5. Additional peripherals may be needed that are compatible with a laptop. These include headphones, mics, CW keyers, etc.

Challenges:

1. A Satellite Internet connection always has at least 600 ~ 800 Ms of latency (delay) due to the 90,000+ mile round trip the data has to travel to make a complete circuit up to the satellite, down to the network ops center/ground-based Internet, out and back to the Base Station, then back up to the satellite and then down to the Remote Station location. Also, there is a fair amount of "jitter" where data packets arrive with uneven spacing. The combined delay and jitter presents a real problem when transmitting voice packets, which cannot be error corrected or re-sent - they either make it through the first time or they don't.

   This seemed to affect SSB transmissions, causing them to stutter and breakup at the other end. CW transmissions did not seem to have a problem. Digital modes were not attempted but it's assumed they would have a good chance of succeeding due to the much lower bandwidth requirements.
2. A laptop may not have the usual inputs and controls like a radio for mics, headsets, CW keyers, etc. And some of the laptop's built-in hardware like mics and speakers may need to be disabled or reconfigured in order for external hardware to work.
3. Most Internet Service providers use dynamic IP addressing, meaning that the public IP address assigned to the cable Internet modem at the Base Station may change periodically. The Remote Station must know the public IP address to communicate with the Base Station. If it changes, the Remote Station will be unable to connect to the Base Station.
4. Satellite modems and laptops are normally powered by AC-to-DC power bricks, requiring a DC to AC inverter between the solar electric system and the gear. This reduces overall solar power efficiency.
5. Both the solar panels and the satellite Internet system require a clear unobstructed view of the southern sky in order to operate. Both systems can be moved around and re-positioned but not without some effort. This is more of an issue with the solar panels needing repositioning in wooded areas to deal with changing shade conditions throughout the day.
6. Added devices (laptops, switching power supplies, satellite modems, solar charge controllers, telephone adapters, and power inverters) all have the potential to generate RFI and interfere with other radios

operating nearby.

Lessons Learned:

1. Successful Remote Station SSB transmissions over satellite were acheived by adjusting a "pre-buffer" setting in the Remote Station settings. Further adjustments of some of the audio and pre buffer settings may be needed to fully implement support for SSB/Voice comms. Switching to a cell phone Internet connection also solved the problem with intermittant SSB comms.
2. Required equipment may need more testing before deployment to reduce problems in the field. Some equipment can radiate significant RFI, even devices with an FCC Part 15 compliance sticker on them. This was an issue that surfaced in a BESTEK 400 watt, consumer-grade DC to AC inverter. Fortunately, the problem was flagged early on, and the problem inverter was replaced with a 200 watt unit (with no FCC compliance sticker) that did not generate RFI.
3. To avoid carrying excessive weight, the solar panels and backup battery stack should be sized for the anticipated watt and work load. The solar electric system used in the Demo consisted of 300 watts in panels, and two 105 Amp-hour SLA batteries. The total draw of the laptop and the satellite modem was about 120 watts. A 120-watt load, running 24 hours per day, would equal ~ 2.9 kWh draw per day. Assuming good sun conditions, 300 watts in solar panels can produce an average of about 1.5 kWh per day, enough power in this case to support about 12 operating hours per day. Assuming limited, daily operations, a modest battery storage capacity of perhaps no more than 100 amp-hours (~7 kWh at 12 volts) would provide enough reserve capacity to ensure steady power during low/no sun conditions without discharging the batteries more than 50% of capacity.
4. It may be easier to simply carry a radio, generator and fuel, and deploy a temporary antenna, than to remote into a Base Station with a laptop via satellite. But, in the absence of terrestrial electricity, and Internet or cell service, the satellite/solar based system might prove to be a viable, "Green-friendly" alternative.

Next Steps:

1. Determine optimum audio and pre buffer settings for Remote Station SSB ops.
2. Learn CW and digital modes.
3. Determine Remote Station settings to support FT8 and CW.
4. Acquire a CW key with a USB or audio interface that will connect to the laptop.
5. Acquire or build a DC to DC transverter to eliminate the need for the conventional AC to DC switching power supplies currently used by the laptop and satellite modem.
6. Setup a "Dynamic DNS" name service so that the Base Station can always be reached by the Remote Station even if the Cable Internet Provider changes the Public IP address at the Base Station QTH.
7. Fabricate a fixed mount on top of the vehicle to quickly deploy solar panels.
8. Review equipment taken and compare it to equipment actually used to reduce weight going forward.
9. Solicit help and feedback to solve ongoing issues.
10. Apply solutions, test and repeat.
11. Develop a final presentation that can be demo'ed at other Clubs and Events (Makers/STEM).

Your feedback and suggestions are welcome.

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Best Regards,

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