Ham 45B – ASL Firmware: Pi Headless
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1. The diminutive Raspberry Pi (RasPi, Pi) is the predominant computer for ham experimenting, commercial control, and education. AllStarLink (ASL) operates under Linux OS built on the Raspberry Pi. AllStarLink is a program shell around the Asterisk telephone PBX, which lets you hang devices linked to ham radio. EchoLink is integral, and is the primary connection interface.

2. EQUIPMENT: Raspberry Pi of almost any vintage, µSD card, power supply, USB sound with radio adapter.

3. SETUP: AllStarLink.org Beginners Guide provides critical instructions.
   a. Creating a server for ASL is a multi-hour process. Record the User Id and Passwords for the Linux operating system (OS) and AllStarLink.org. Also record node numbers.
   b. From AllStarLink.org, download Raspberry beta latest version image to desk/lap computer. Unzip all.
   c. Use W*in32DiskImager* to write the *.img from computer to µSD card.
   d. Insert card in Pi.

4. HEADLESS: As a computer, a screen, keyboard, and mouse are common. However, the Pi can operate headless. These instructions assume the Pi has a microSD card with operating system already installed.

5. ETHERNET: Connect an Ethernet cable and apply power. Allow to get up to speed. Run an IP Network Scanner to find the Pi network address. It will be something like 192.168.1.92. The initial name is "repeater."

6. SSH (Secure Shell): The protocol allows secure transfer over an unsecure network. It is in virtually every data center. PuTTY is TTY-type terminal SSH program for Windows to communicate with the Pi. Another secure method is SFTP (secure file transfer protocol) connection.

7. PuTTY: Load on the desk/lap computer. Open PuTTY. Enter the IP network address. Enter OS User ID. Enter OS User password. Computer gives a warning of new device. Accept it.

8. COMMAND LINE: If at the terminal screen for the Pi, move to AllStar menu: *sudo /usr/sbin/asl-menu*. Similarly, move to Raspberry OS configuration menu: *sudo raspi-config.*

9. SECURITY: Change the default passwords. You can also change the SSH port number from the default '22'. To use SSH into the box remotely, setup "Port Forwarding" for that port to access the IP on your node.

10. ALLSTAR MENU: Configure the apps. ***Save configuration and make it live.*** Exit to command line and restart.

11. ROUTER. A restricted router requires configuration to allow incoming control..

12. CONNECTIONS: Since the Pi cube with AllStar is a telephone PBX, the only connections are *audio out* and *audio in*. The physical connection is via USB to a sound card such as a modified fob, or like MastersCommunications.com.

13. PTT: Radios need a push-to-talk control to switch between transmit (*audio out*) and receive (*audio in*). The PTT necessarily is created external to AllStar. Use a commercial sound card adapter. Alternately on a USB FOB, solder to the PTT pin of the DSP (digital signal processor).

14. CONTROL: Since audio is the only PBX connection, control uses DTMF (Dual tone multi-frequency) generated by a telephone or mic keypad. Add your control scrip in Pi rpt.conf.

15. CONFIGURATION: Most files are in /etc/asterisk as *.conf.

16. CHANGES: Use WinScp to remotely access and modify the Pi files. Be very careful! Modification of *.conf files must be by root. WinScp must be set-up for SCP protocol. This combination makes the files very vulnerable by you or someone else.

17. WIFI: Create file on AllStarLink.org. Save as wpa_supplicant.conf.
    Transfer file using WinScp to Pi folder /etc/spa_supplicant. In properties give privileges.
    Raspi-Config is disabled by ASL.

18. LOCAL: Connect Headphone to USB audio-out. Connect powered mic with DTMF keypad to USB audio-in.

19. RADIO: Connect Pi to USB radio interface (URI) with audio out, in, ground and connect COS & PTT.

20. ON-THE-AIR: Call the repeater or connected radio. Use DTMF to connect and control.

21. Once fully configured, save *.img with WinDiskImager. Read only allocated positions to save time. Save for backup.

22. Life is good. Enjoy!