



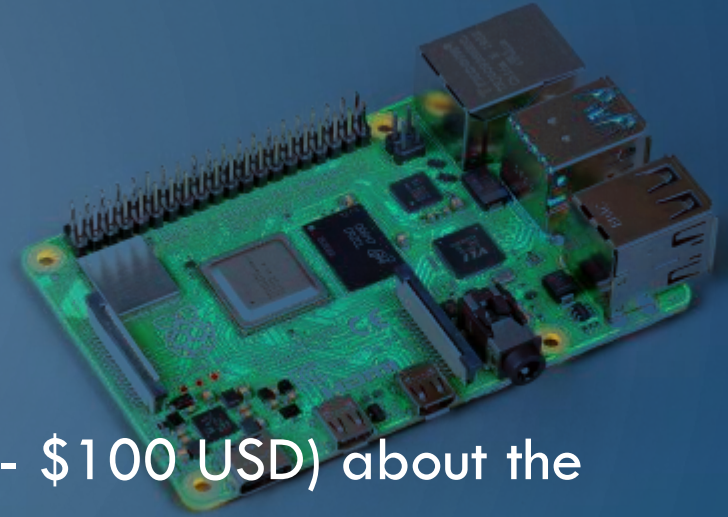
WHY USE A RASPBERRY PI FOR AMATEUR RADIO

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MODIFIED BY

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WHAT'S A RASPBERRY PI?



- RPi 4 : low cost completely functional computer (\$30 - \$100 USD) about the size of a card deck

CPU (ARM v8)	Micro HDMI
RAM (2GB – 8GB)	Micro SD Card Slot
USB (2x USB 2.0 + 2x USB 3.0)	Audio Jack
Ethernet (Gigabit)	Camera Port
WiFi (802.11ac)	GPIO Header!
Bluetooth (5.0 + BLE)	

WHAT OPERATING SYSTEMS DOES RASPBERRY PI USE?

Raspberry Pi OS Linux (Buster based on Debian) - “was Raspbian”	
Windows 10 IoT Core	Mozilla WebThings
Ubuntu	PiNet
Ubuntu MATE	RISC OS
OSMC	Weather Station
LibreELEC	DRAWS [Digital Radio Amateur WorkStation]

WHAT CAN I DO WITH RASPBERRY PI?

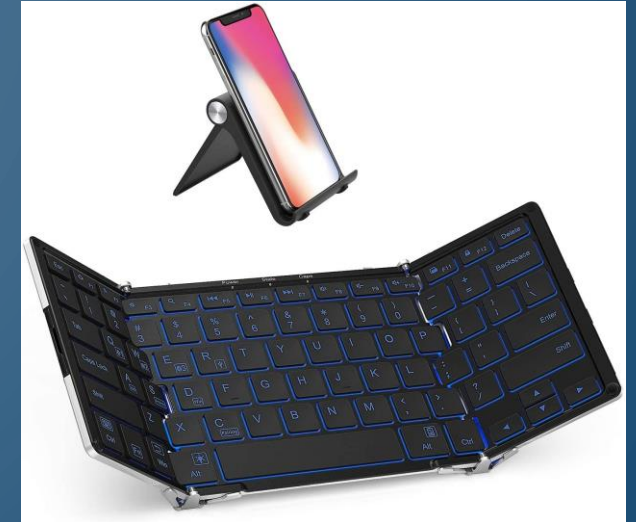
LibreOffice Suite (Word, Sheet, Present)	BitTorrent Server
Chromium (Web Browsing)	Home Automation
Media Player (Living Room PC)	Wireless network printer
Game Emulator	Music Streaming
Robotics	Kids First Computer
Windows 3.0	Computing Cluster
Learn to Program	Weather Station
File Server (NAS)	Ham Radio Station

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File Server (NAS)	Ham Radio Station
Radio Frequency transmitter (rpitx) - Frequencies from 5 KHz up to 1500 MHz.	

WHAT DO I NEED TO USE THE RASPBERRY PI?

- Headless with SSH
- Keyboard
 - Bluetooth
 - USB
- Monitor
 - HDMI
 - 12 inch (Portable Small)
- Mouse or a Trackball
- USB Audio Adapter External Stereo Sound Card



RASPBERRY PI 4 POWER REQUIREMENTS

- Input voltage of 4.0 V to 5.5 V with absolute max rating of 6V before damage occurs
- Reasonable power range is 5.1 V to 5.25 V
- Power supply recommended provides 3A (15W) if USB peripherals consume less than 500mA in total
- Original Pi 4 had **non-compliant USB-C** power port. This has now been fixed.

WHY USE RASPBERRY PI FOR HAM RADIO?

- Small form-factor
- Lightweight
- Low power needs
 - Some people even power from solar!
- Uses Linux which is already well supported



WHY USE RASPBERRY PI FOR HAM RADIO?

- Great in the shack or for going portable
 - Tactical Radio Carrier
 - With a Raspberry Pi they can be digital



WHY USE RASPBERRY PI FOR HAM RADIO?

- Portable / Remote Weather Station / repeater
 - Weather Board
 - Weather Meter Kit
 - SmartiPi Touch Pro case
 - Portable Antenna Tripod Mount



WHERE DO I START?

1. Determine needs for Raspberry Pi – will determine equipment
2. Buy Raspberry Pi + power supply + micro sd card from local retailer
 1. Use an SD of at least 64GB or larger and class 10
 2. Alternatively: SATA SSD + Cable or NVME SSD + NVME USB3 Adapter
3. Use USB keyboard, mouse and display. Don't forget the micro-HDMI cable!
4. Download software
 1. Download BalenaEtcher or Raspberry Pi Imager for Windows, Mac, Do not need for Linux
 2. flash micro-SD card

WHERE DO I START?

1. There are 5 ways to set up the Raspberry pi for use in amateur radio
 1. You can use DL2GKK's instructions
 1. Manual (good for a lite system)
 2. <https://dl1gkk.com/setup-raspberry-pi-for-ham-radio/>
 2. Use a script from KM4ACK
 1. Almost fully automatic
 2. <https://github.com/km4ack/pi-build>
 3. You can use a ready SD card image e.g. HamPi
 1. <https://sourceforge.net/projects/hampi/>
 4. You can buy a ready installed SD card e.g., from G4WNC
 1. Already setup for your radio and DRAWS
 2. <https://photobyte.org/>
 5. You can use a hardware solution e.g., DRAWS
 1. They also have a SD card image
 2. <http://nwdigitalradio.com/>

HAMPI IMAGE V1.6A1

- Custom-built ham radio software image chock full of >80 applications:
- Created using Ansible, software automation tool.

FIDigi Suite	CHIRP	CQRLog
WSJT-X	BlueDV	wsjtx_to_n3fjp
JS8Call	ADS-B Flight Tracker	Pat WinLink + ARDOP
CubicSDR	NOAA Weather Imaging	CW Applications
GQRX	DX Cluster Client + Server	Ham Test Trainers
Direwolf	Xnecview	GPredict
Xastir	YAAC	Support for SDR Hardware
D-Rats	TrustedQSL	...and DOZENS MORE!

WHERE DO I FIND HAMPI IMAGE V1.6A1?

- Find site??????
 - <https://sourceforge.net/projects/hampi/>
- Image is compressed with XZ in TAR format and is ~4GB.
 - Uncompressed 14.6Gb
- Over 6,000 direct downloads in first 60 days!

WHERE DO I GET SUPPORT FOR HAMPI V1.6A1?

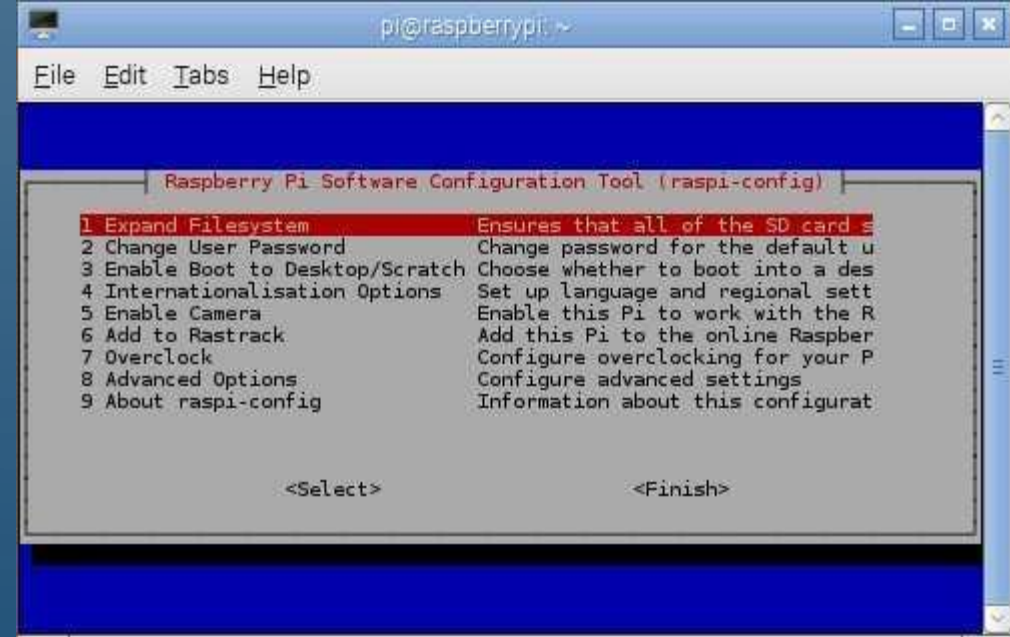
- HamPi Forum on Groups.io
 - <https://groups.io/g/Ham-Pi>
- GitHub Wiki:
 - <https://github.com/dslotter/hampi/wiki>
- QRZ
 - <https://forums.qrz.com/index.php?threads/hampi-1-0-released.711515/>
- [GARS Workshops!](#)

HOW CAN I PUT IMAGE ON (MICRO) SD CARD?

- You just can't copy the image as a file on to the (micro) SD card.
 - (some people have tried – and failed)
- One solution: dd (for Linux)
- But what if I have a Windows PC or Mac?
- Solution:
 - BalenaEtcher, available at <https://www.balena.io/etcher/>
 - Raspberry Pi Imager

HOW DO I EXPAND THE IMAGE TO USE ENTIRE (MICRO) SD CARD?

- You have a 128GB microSD card and the Pi is only using 16GB. What do you do?
- This is automatic on Raspbian Buster
- On older versions of Raspbian:
 - `sudo raspi-config`
 - Expand Filesystem



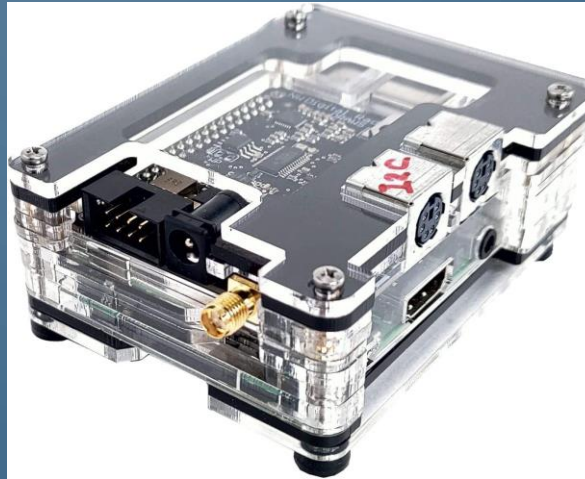
HOW DO I POWER MY RASPBERRY PI?

- In the Ham Shack: Power Adapter aka “wall wart”
- Also in the Ham Shack: Power over Ethernet (PoE) \$20
- GPIO Pin #2 (5V) GPIO Pin #6 (GND)
Dangerous – only use if you know what you’re doing
- Mobile Power – USB Battery Pack \$15+
- MoPi 2 – Hot-Swap Mobile Power £29
- PiJuice with Solar Panels
- 12V to 5V DC USB Type-C Step-Down Power Converter, Buck Converter



HOW DO I CONNECT THE PI TO MY RADIO?

- Short answer: USB
 - Cable from RIG
 - USB Sound Card
 - Signalink: \$135
 - Sabrent USB Sound Adapter \$7
- Another short answer:
DRAWS Ham Radio HAT by
[NW Digital Radio](#) \$150



DRAWS

DIGITAL RADIO AMATEUR WORKSTATION

- • Raspberry Pi 3 Compliant HAT
- • Power HAT and Pi from 6-15VDC
 - • Onboard Voltage Monitor
- • 2 Radio Interfaces
 - • Mini DIN-6 Connectors
 - • Optional Cables
- • On Board GPS
 - • Optional External Antenna w/LNA
 - • PPS for Stratum 1 Time Source
 - • Battery Backed Real Time Clock
- • Accessory Port
 - • PWR, IO, Serial Port, Analog In

Operating Modes:

- Headless, operate from your Computer
 - Network Attach or VNC
- Workstation, operate locally by adding
 - HDMI Monitor
 - USB Keyboard & Mouse

Open-Source Software:

An image is available for download with popular applications pre-installed, including:

- Packet
 - DIREWOLF 1200/9600
 - APRS, WinLink
- Soundcard Digital
 - FLDIGI, WSJT-X
- Digital Voice Repeater/Hotspot

HOW TO KEEP ACCURATE TIME ON THE PI?

- In the Hamshack: use timedatectl and NTP
 - Command: timedatectl
 - Command: ntpdate -q 0.us.pool.ntp.org
 - For more info, see <https://raspberrypi.com/time-sync-raspberry-pi/>
- In the Field: use GPS receiver & gpssd
 - GLONASS GPS Tracker Module for Raspberry Pi: \$8
- Alternative: RTC Module \$15
- Alternative: DRAWS Hat GPS Receiver \$150



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USE CASE: OPERATING DIGITAL MODES

<u>FDigi Suite by W1HKJ</u>	<u>gnss-sdr</u> - GLONASS satellite system Software Defined Receiver
<u>WSJT-X</u> - Weak Signal (FT8, FT4, etc.) by <u>W1JT</u>	<u>linpsk</u> - amateur radio PSK31/RTTY program via soundcard
<u>GridTracker</u> - Graphical mapping companion program for WSJT-X or JTDX	<u>multimon</u> - multimon - program to decode radio transmissions
<u>JTDX</u> - Alternate client for Weak Signal (FT8, FT4, etc.)	<u>multimon-ng</u> - digital radio transmission decoder
<u>JS8Call</u> - Messaging built on top of FT8 protocol by <u>KN4CRD</u>	<u>psk31lx</u> - a terminal based ncurses program for psk31
<u>JS8CallTools</u> - Get Grid coordinates using GPS	<u>twpsk</u> - a psk program

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USE CASE: LOGGING

- Software included:
 - [TrustedQSL](#) - LotW client from ARRL
 - [CQRlog](#) - Ham Radio Logging Application
 - [PyQSO](#) - Logging software (written in Python)
 - [klog](#) - The Ham Radio Logging program
 - [tlf](#) - console based ham radio contest logger
 - [tucnak2](#) - VHF/UHF/SHF Hamradio contest log version 2
 - [twlog](#) - basic logging program for ham radio
 - [wsjtx to n3fjp](#) - Logging adapter to allow WSJT-X to log to N3FJP by yours truly, W3DJS
 - [xlog](#) - GTK+ Logging program for Hamradio Operators

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USE CASE: APRS

- Software included:
 - [Direwolf](#) - Software "soundcard" AX.25 packet modem/TNC and APRS encoder/decoder
 - [Xastir](#) - APRS GUI client / Digipeater / Igate
 - [YAAC](#) - Yet Another APRS Client
 - [APRS Message App for JS8Call](#)
 - [aprsdigi](#) - digipeater for APRS
 - [aprx](#) - APRS Digipeater and iGate
 - [soundmodem](#) - Sound Card Amateur Packet Radio Modems

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USE CASE: CW / MORSE CODE

<u>aldo</u> - Morse code training program	<u>morse</u> - training program about morse-code for aspiring radio hams
<u>cw</u> - sound characters as Morse code on the soundcard or console speaker	<u>morse2ascii</u> - tool for decoding the morse codes from a PCM WAV file
<u>cwcp</u> - Text based Morse tutor program	<u>morsegen</u> - convert file to ASCII morse code
<u>xcwcp</u> - Graphical Morse tutor program	<u>qrg</u> - High speed Morse telegraphy trainer
<u>cwdaemon</u> - morse daemon for the serial or parallel port	<u>twcw</u> - sends morse code via the sound card or serial card (Needs RTC installed)
<u>ebook2cw</u> - convert eBooks to Morse MP3s/OGGs	<u>xdemorse</u> - decode Morse signals to text
<u>ebook2cwgui</u> - GUI for ebook2cw	<u>rscw</u> - Receive CW through Soundcard

HAMPI V1.6A1

USE CASE: D-STAR

- Software included:
 - d-rats - A communication tool for D-STAR
 - NOTE: THIS INCLUDES INSTANT UPDATE ABILITY
 - BlueDV - Client for D-Star, DMR and YSF (Phone)

HAMPI V1.6A1

USE CASE: SOFTWARE DEFINED RADIO (SDR)

<u>CubicSDR</u> - Software Defined Radio receiver	<u>SoapyMultiSDR</u> - Multi-device support module for SoapySDR
<u>cutesdr</u> - Simple demodulation and spectrum display program	<u>SoapyNetSDR</u> - Soapy SDR module for NetSDR protocol
<u>GQRX</u> - Software defined radio receiver	<u>SoapyRemote</u> - Use any Soapy SDR remotely
<u>SDRAngel</u> - SDR player	<u>SoapyRTLSDR</u> - Soapy SDR module for RTL SDR USB dongle
<u>lysdr</u> - Simple software-defined radio	<u>SoapySDR</u> - Vendor and platform neutral SDR support library
<u>quisk</u> - Software Defined Radio (SDR)	<u>SoapySDRPlay</u> - Soapy SDR module for SDRPlay
<u>SoapyAudio</u> - Soapy SDR plugin for Audio devices	<u>Rpitx</u> - Radio Frequency transmitter
<u>SoapyHackRF</u> - SoapySDR HackRF module	(and More!)



HAMPI V1.6A1

USE CASE: SATELLITE COMMUNICATION

- Software included:
 - Gpredict - Satellite prediction
 - predict-gsat - Graphical Predict client
 - gnss-sdr - GLONASS satellite system Software Defined Receiver
 - wxtoimg - NOAA weather imaging software
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HAMPI V1.6A

USE CASE: WINLINK / EMCOMM

- Software included:
 - [Pat WinLink](#) - WinLink for Raspberry Pi (and other platforms)
 - [ARDOP](#) support for Pat WinLink
 - [ARDOP-GUI](#) - Provides graphical representation of ARDOP connections
 - [Find ARDOP](#) - Retrieves local ARDOP sources by [KM4ACK](#)
 - [AX25](#) support for Pat WinLink
 - [PMON](#) - a PACTOR® Monitoring Utility for Linux

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USE CASE: ANTENNA MODELING

- Software included:
 - [antennavis](#) - Antenna Visualization Software
 - [gsmc](#) - A GTK Smith Chart Calculator for RF impedance matching
 - [nec2c](#) - Translation of the NEC2 FORTRAN source code to the C language
 - [xnecview](#) - NEC structure and gain pattern viewer
 - [yagiuda](#) - software to analyse performance of Yagi-Uda antennas
 - [VOACAP](#) - HF propagation prediction



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USE CASE: HAM TRAINING / TESTING

- Software included:
 - [fccexam](#) - Study tool for USA FCC commercial radio license exams.
 - [hamexam](#) - Study guide for USA FCC amateur radio (ham radio) license examinations.
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HAMPI V1.6A1

USE CASE: MISCELLANEOUS APPLICATIONS

- Software included:
 - [CHIRP](#) - Radio Programming Software
 - [QTel](#) - EchoLink client
 - [QSSTV](#) - Slow Scan TV (e.g. "Fax")
 - [FreeDV](#) - Free digital voice vocoder
 - [WsprryPi - WSPR software](#)
 - [ADS-B Flight Tracking Software](#)
 - [Xdx](#) is a DX-cluster client
 - [DXSpider](#) - DX Cluster Server

QUESTIONS

- RFI sensitivity concerns
 - Use Ferrite choke
- Other Information Sites
 - KM4ACK
 - <https://www.youtube.com/user/jasonoleham>
 - OH8STN
 - <https://www.youtube.com/user/SurvivalTechEU>

THANKS FOR WATCHING AND SOME IDEAS

- For mobile and portable use
 - Emergency use during disasters
 - Field day
 - For quick setup while traveling
 - For various events or shows
- In the home station
 - To support your ham station
 - Just for the fun of it