East Lake CERT Training

Introduction to Winlink

12/16/2023

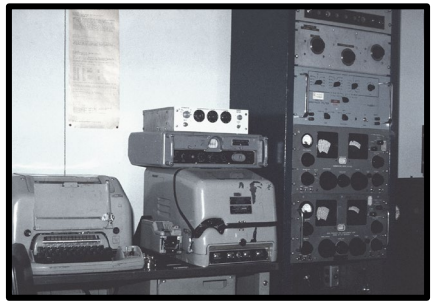
Mike Drake

Pinellas County ACS Training Officer

Agenda

- Introduction
- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications

Introduction
Instructor

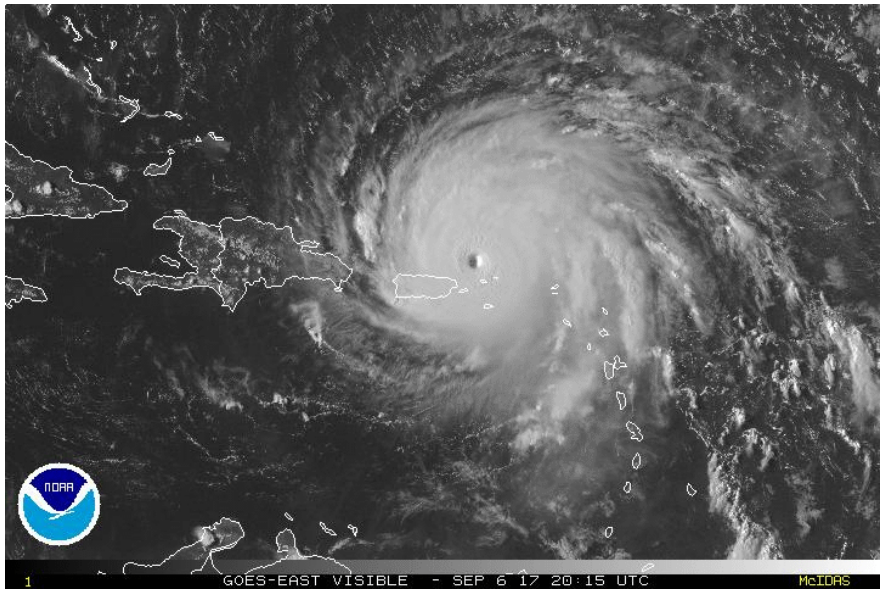


- Licensed since 1973
- Amateur Extra Class
- Army MARS
  - 1973 - 1975
- Navy MARS
  - 1977 – 1985
  - Adak Alaska, Augsburg West Germany, Pensacola FL
- University of Florida
- Retired – E-Systems/ECI – Raytheon
  - Systems Engineering – Communications, and Data Fusion Systems
- Training Officer – Pinellas ACS

WA1RYQ@ARRL.net

Introduction
PinCo ACS Training Objectives

- Support Pinellas ACS Mission
  - Augment Government communications during times of emergency when normal communication systems have sustained damaged, are being overtaxed, or backup radio operators are required.
    - Tropical Storms and Hurricanes
    - Non-Tropical Weather Events
    - Public Safety Communication Emergencies
    - Localized Emergencies
    - Regional / National Emergency



Hurricane Irma

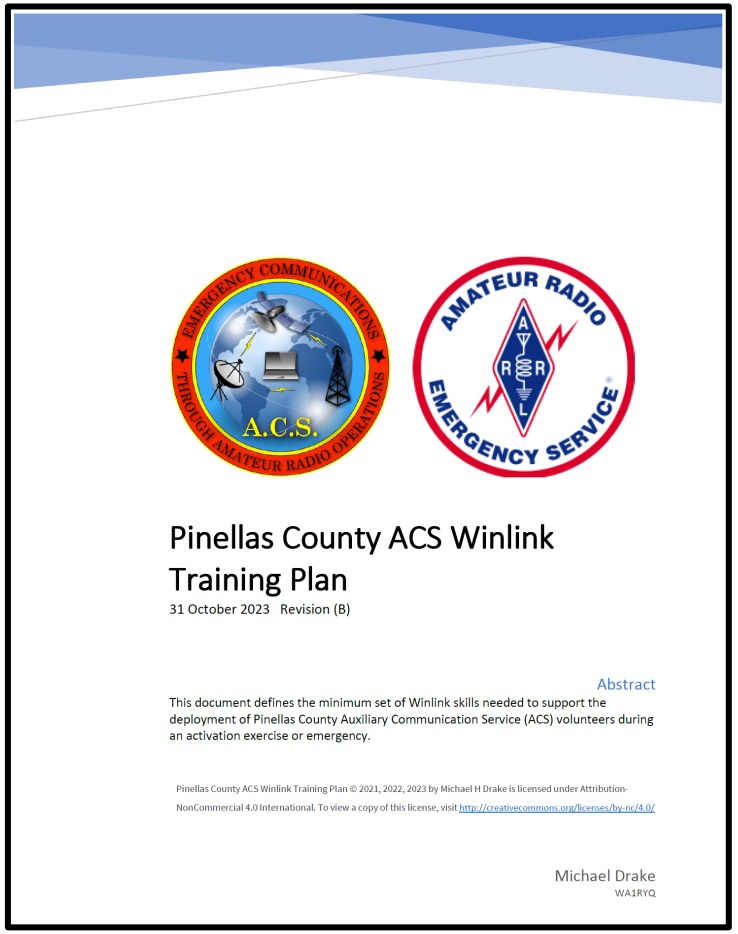
Introduction
Winlink Training Objectives

- Develop minimum skills needed for digital deployments using Winlink
  - Set-up and configure a Winlink station
  - Create, send, and receive messages using Winlink Standard Template Forms
    - Internet
    - VHF/UHF radios

- Assumptions
  - No previous Winlink experience is required.
  - Computer with internet access
  - Technician, General, Advanced, or Amateur Extra class Federal Communication Commission (FCC) License.

Introduction

Pinellas County ACS Winlink Training Plan



Pinellas County ACS Winlink Training Plan

31 October 2023 Revision (B)

Abstract

This document defines the minimum set of Winlink skills needed to support the deployment of Pinellas County Auxiliary Communication Service (ACS) volunteers during an activation exercise or emergency.

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Michael Drake
WA1RYQ

- Skills, Rationale, and Training Approach
  - Five Winlink Skills Sets Defined
    - Basic Winlink VHF/UHF Communication Skills
    - Basic Winlink HF Communication Skills
    - Deployment Ready VHF/UHF Communication Skills
    - Deployment Ready HF Communication Skills
    - Advanced HF/VHF/UHF Communication Skills
  - Web Site References
  - Located on PACS Website:
    - https://www.pcacs.org/training/training-documents/winlink-training/

Agenda

- Introduction
- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications

Winlink Overview
Description

- E-mail program
  - Download from the Winlink website (Winlink.org) - **No Cost**
  - Requires a valid FCC license
  - Users can exchange messages
    - Registered Winlink users (example: WA1RYQ to W7WMS)
    - Registered Winlink user to/from Internet addresses (Example: W7WMS to WA1RYQ@ARRL.net)
  - Messages can be exchanged using any of the following connections
    - Internet
    - VHF/UHF/HF Radio
    - AREDN Mesh
    - Satellite (Iridium)

A radio connection is *not* required to send or receive messages via Winlink

Winlink Overview
Description

- Reliability, Accuracy and Flexibility
  - High reliability (99.99% availability for 15 years)
  - 100% accurate message transmissions.
  - Radio connection bridge to Internet e-mail
  - Radio-only store and forward without Internet
  - Peer-to-peer connections between radio end-users
- Interoperability: Connect different types of systems
  - Bridge different radio capabilities (VHF/UHF/HF)
  - Bridge protocols: Pactor, ARDOP, Packet, VARA FM, VARA HF

- FEC – Forward Error Correction
- ARQ – Automatic Repeat Request

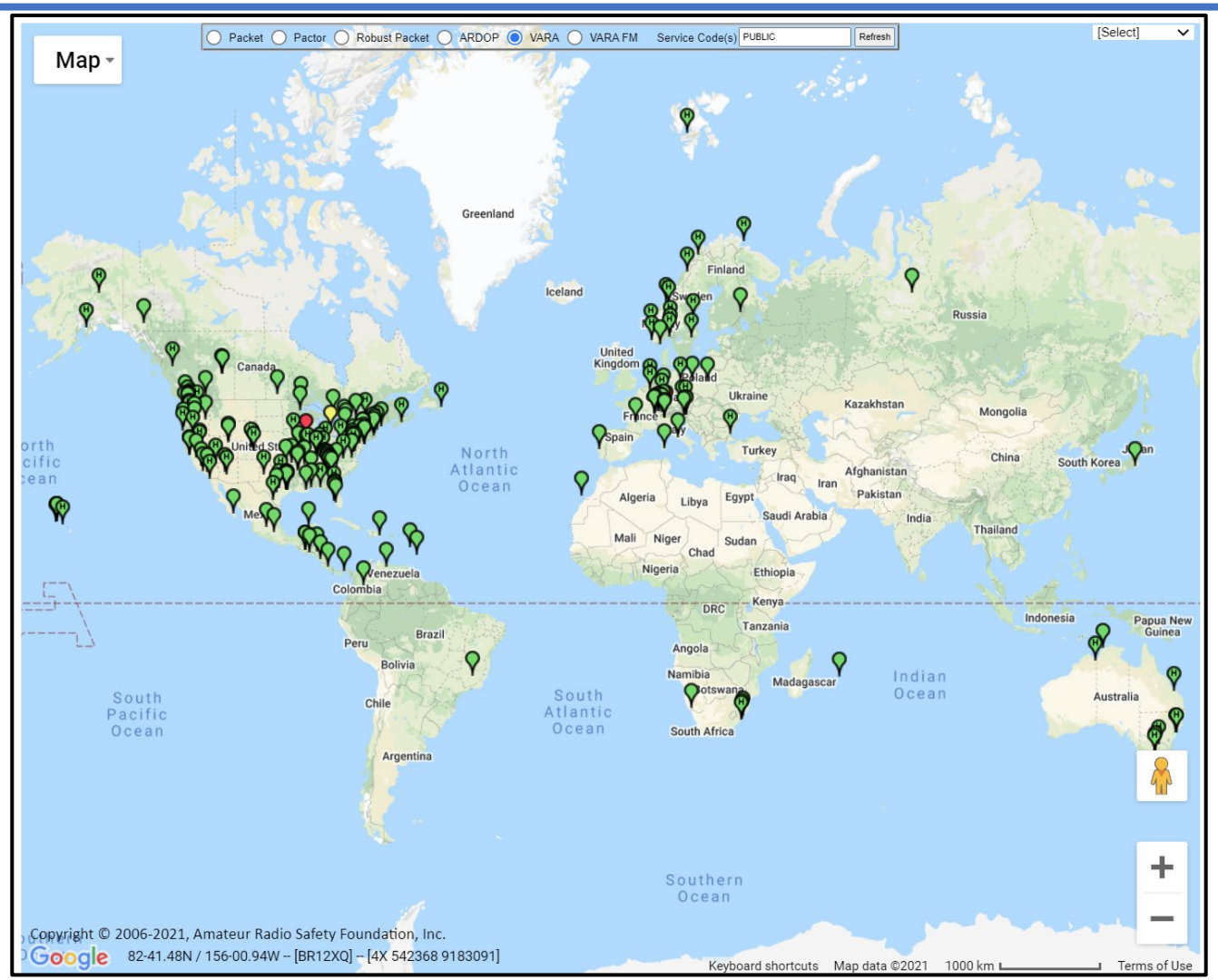
ARDOP – Amateur Radio Digital Open Protocol

Source material: “Winlink email network” by Phil Sherrod, W4PHS

Winlink Overview

HF Stations Located Worldwide

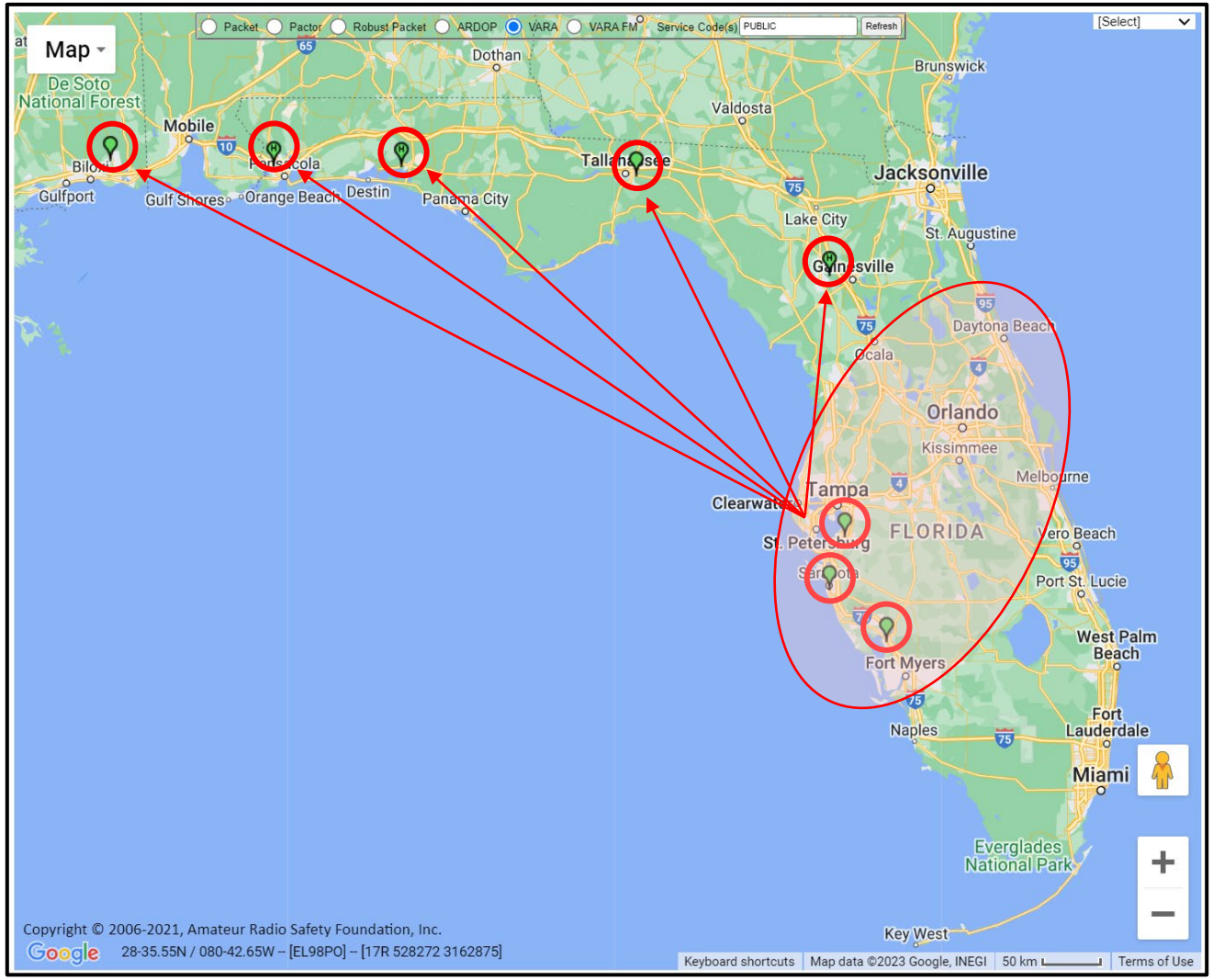
Geographical dispersion and redundancy improves reliability



Winlink Overview

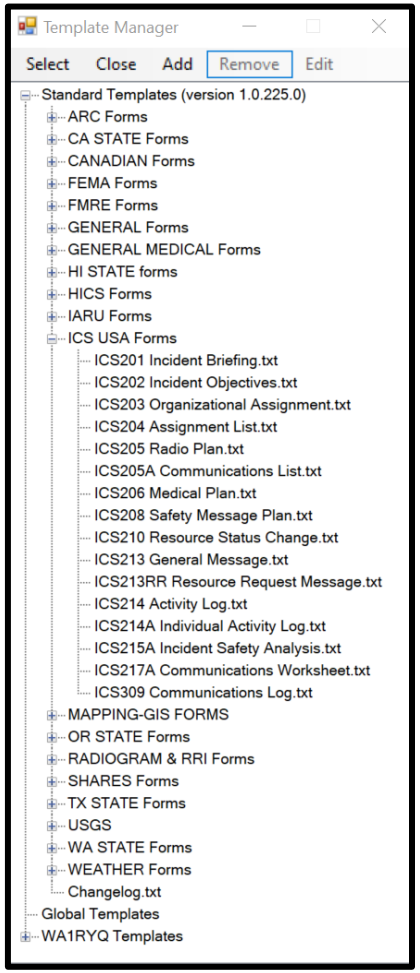
HF Stations Located in Florida

Geographical dispersion and redundancy improves reliability



Winlink Overview
Description

- Standard e-mail format with many features
  - Standard NIMS ICS Forms embedded within program
  - Binary file attachments (pictures, PDF, spreadsheets)
  - Automatic message compression/decompression
  - Whitelist used to control SPAM
- Automatic message logging and ICS report generation
- Stores messages for pickup at a later time



NIMS – National Incident Management System
ICS – Incident Command System

Source material: “Winlink email network” by Phil Sherrod, W4PHS

Winlink Overview
Description

- Frequency agility
- Good operation at most power levels
- Not limited by station-to-station propagation

HF Channel Selector

Exit | Select | Update Via Internet | Update Via Radio | Map | Forecast | SFI | All RMS

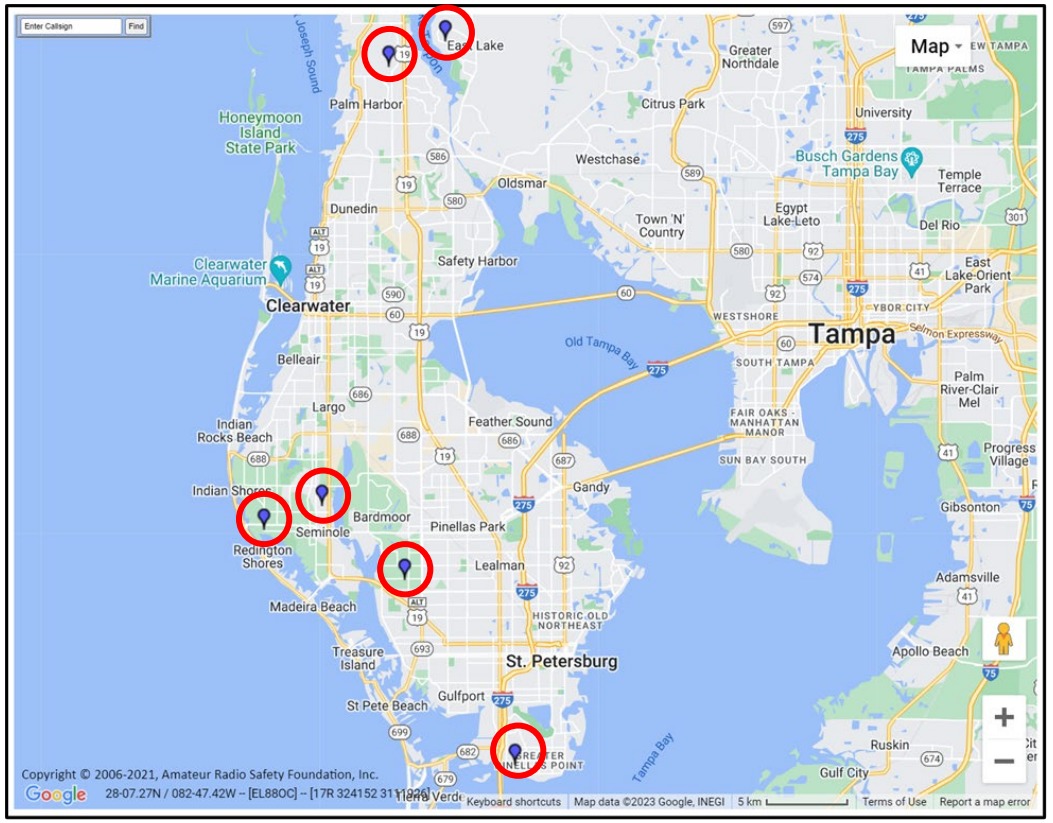
Callsign	Frequency (kHz)	Mode	Grid Square	Hours	Group	Distance (mi)	Bearing (Degrees)	Path Reliability Estimate	Path Quality Estimate
N4SER	3595.000	V2300	EL87RH	00-23	PUBLIC	40	158	99	99
K4KPR	7101.200	V2300	EL87TQ	00-23	PUBLIC	27	114	96	96
N4SER	7103.700	V2300	EL87RH	00-23	PUBLIC	40	158	96	96
K4KPR	10147.000	V2300	EL87TQ	00-23	PUBLIC	27	114	94	94
K4KPR	14109.500	V2300	EL87TQ	00-23	PUBLIC	27	114	92	92
AK4SK	10130.000	V500	EM60VL	10-07	PUBLIC	275	312	91	52
AK4SK	10146.850	V2300	EM60VL	10-07	PUBLIC	275	312	91	52
KX4Z	10147.000	V2300	EL89RQ	00-23	PUBLIC	128	007	90	53
KX4Z	7103.500	V2300	EL89RQ	00-23	PUBLIC	128	007	90	51
W4DIG	7082.500	V500	EL86XV	00-23	PUBLIC	80	145	89	52
N4SER	10146.200	V2300	EL87RH	00-23	PUBLIC	40	158	89	52
W4DIG	10146.500	V2300	EL86XV	00-23	PUBLIC	80	145	88	52
W4UC	10146.500	V2300	EM60IL	00-23	PUBLIC	326	305	88	50
K4KPR	21091.200	V2300	EL87TQ	00-23	PUBLIC	27	114	87	87
K4PAR-4	10144.600	V2300	EM83II	00-23	PUBLIC	381	356	86	49
WM4RB	14096.500	V2750	EM75ME	00-23	PUBLIC	523	346	85	49
AK4ZX	14110.500	V2300	EM75KA	00-23	PUBLIC	514	345	85	49

Source material: “Winlink email network” by Phil Sherrod, W4PHS

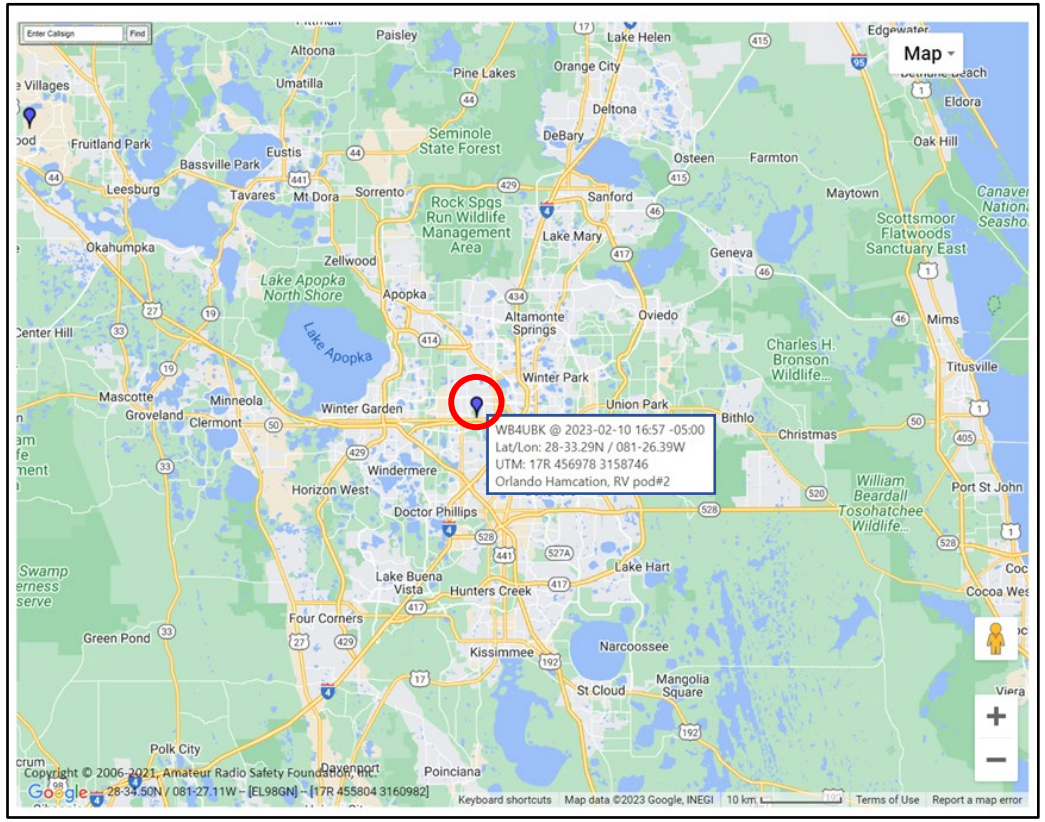
Winlink Overview

Description – Position Reports

Reports from ACS Winlink Training



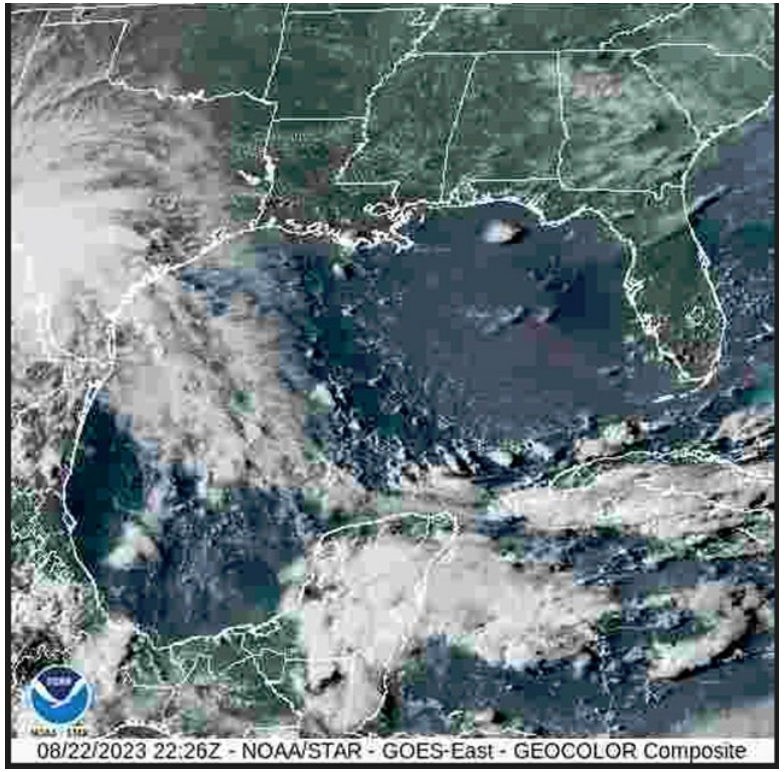
Detailed Information



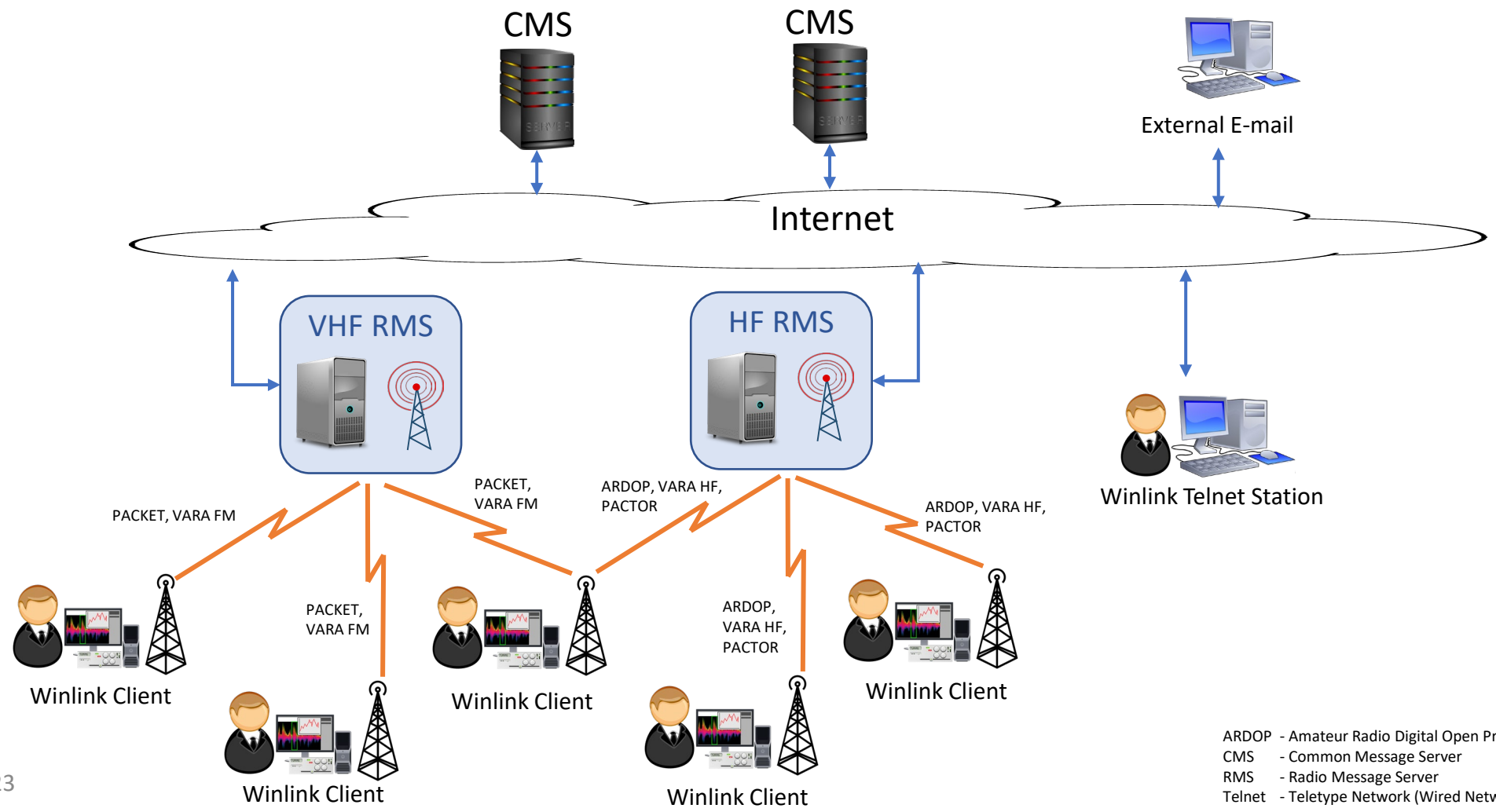
MGRS – Military Grid Reference System
UTM – Universal Transvers Mercator Coordinate System

Winlink Overview
Description

- Weather and Information Bulletins
- Wide adoption by EmComm related agencies
  - Amateur Radio Emergency Services (ARRL ARES)
  - Military Auxiliary Radio System (DOD/MARS)
  - Radio Amateur Civil Emergency Services (RACES)
  - National American Red Cross (ARC)
  - Southern Baptist Disaster Relief
  - Salvation Army
  - US Coast Guard
  - SHARES
  - Many Federal, state and local government agencies, world-wide



Winlink Overview
System Architecture



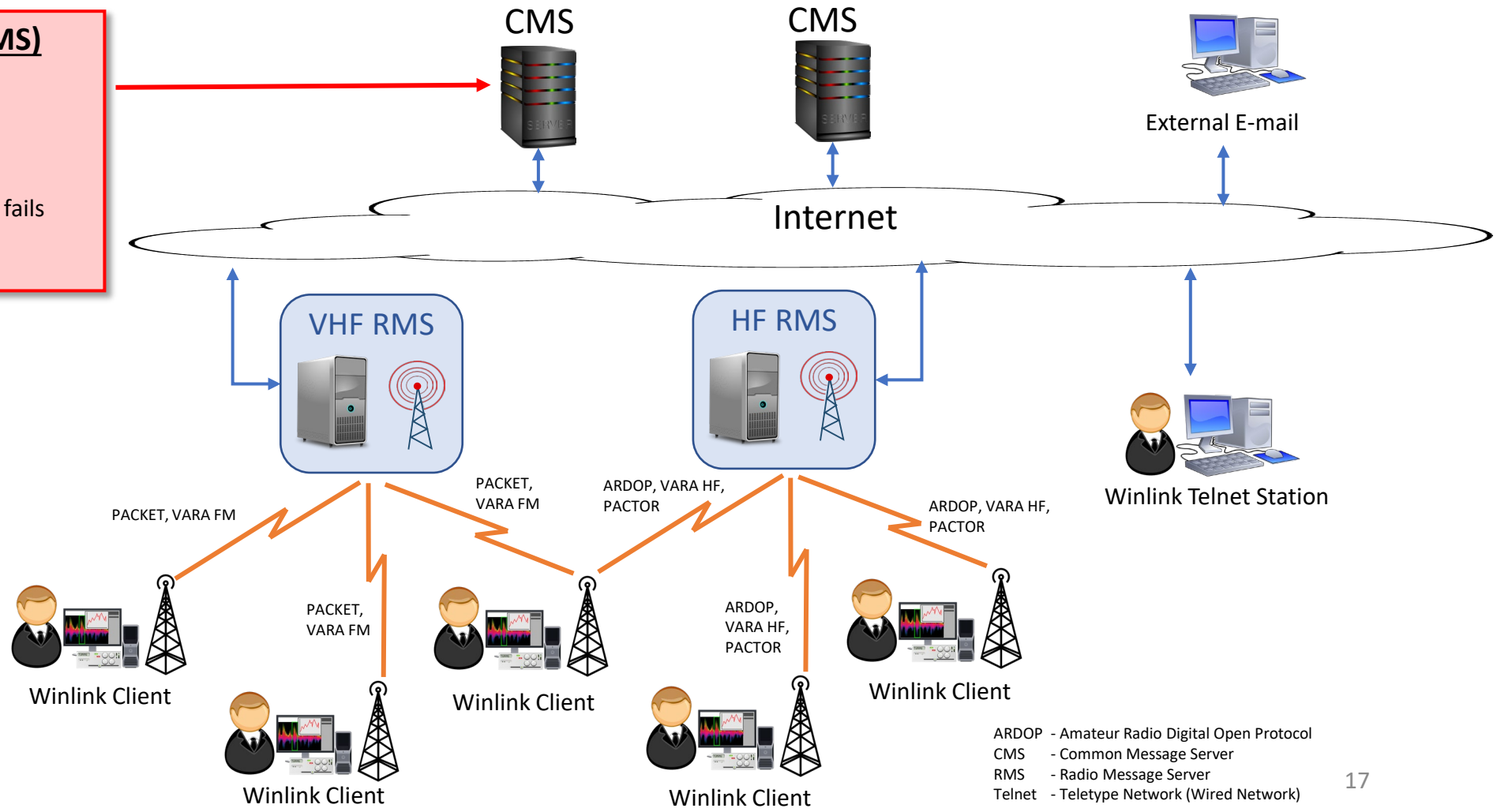
ARDOP - Amateur Radio Digital Open Protocol
CMS - Common Message Server
RMS - Radio Message Server
Telnet - Teletype Network (Wired Network)

Winlink Overview

System Architecture – Conventional Mode

Common Message Server (CMS)

- Winlink Email Server
- Redundant Locations
- Hosted by Amazon Web Services (AWS)
- Realtime Backups between servers
- Automatic switchover is primary Server fails



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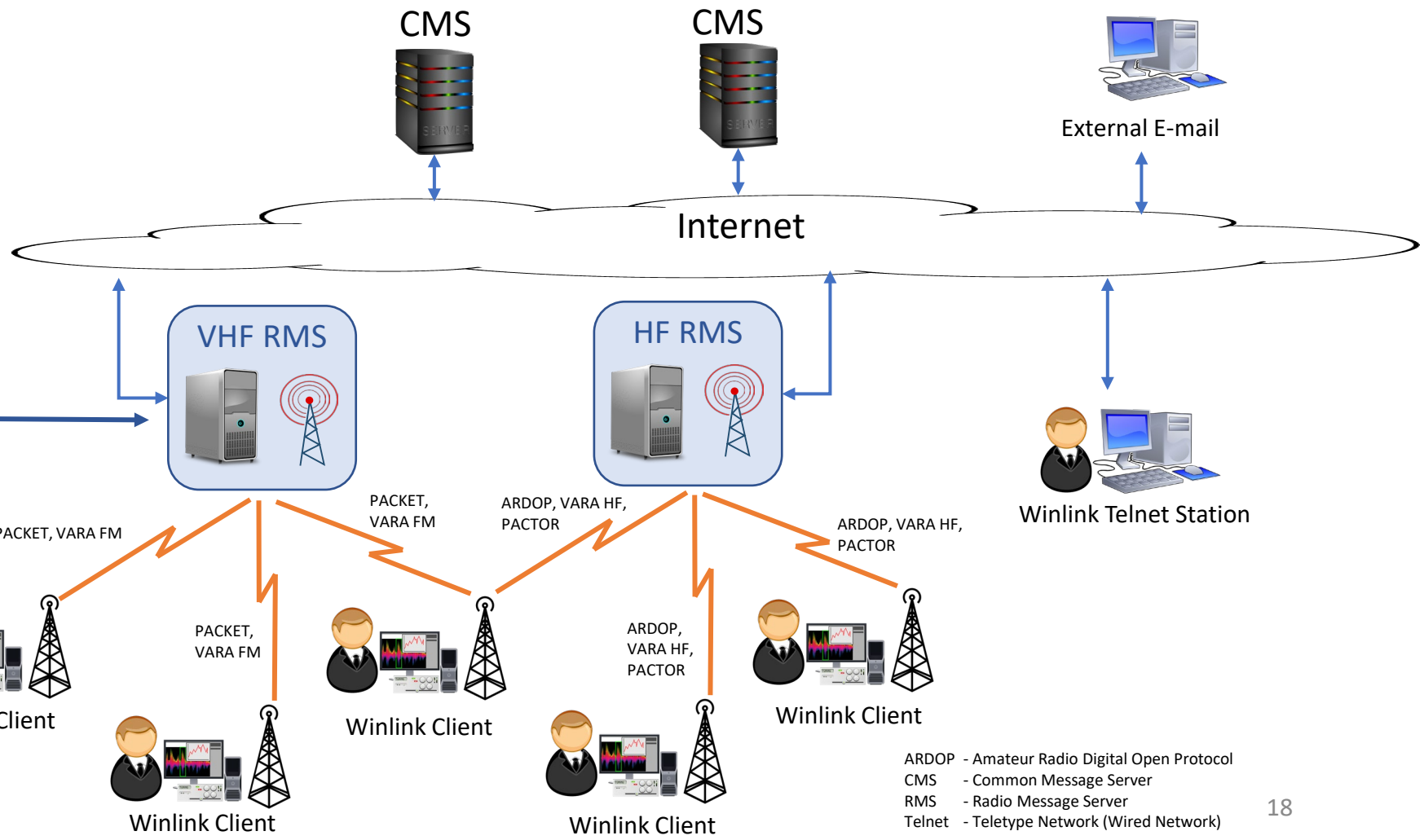
Winlink Overview

System Architecture – Conventional Mode



Radio Message Server (RMS)

- Gateway Station used to connect Winlink Radio Clients with Winlink CMS via internet
- VHF/UHF and HF Stations
- Can be configured as a standalone Hub during internet failures

ARDOP - Amateur Radio Digital Open Protocol
CMS - Common Message Server
RMS - Radio Message Server
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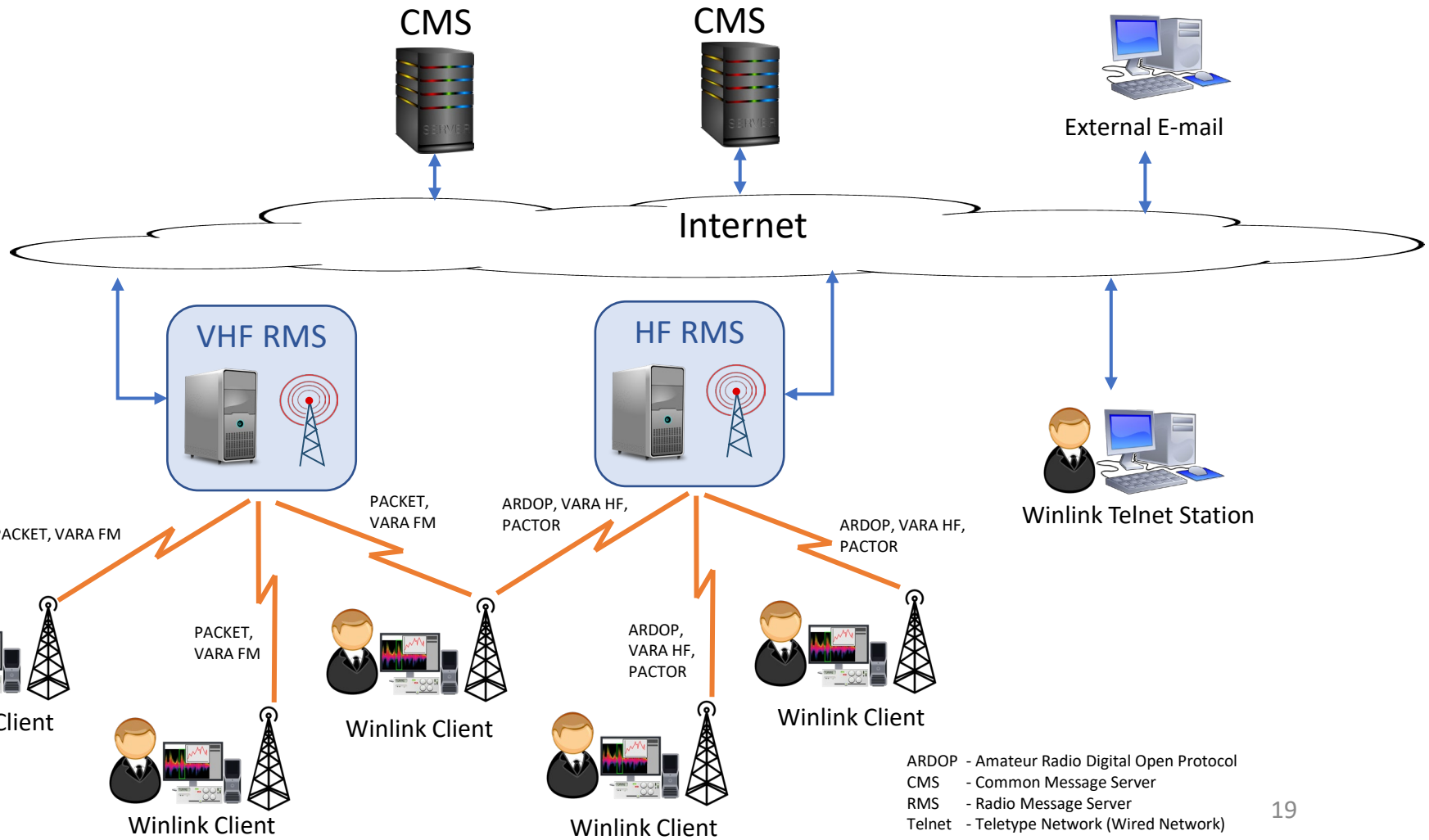
Winlink Overview

System Architecture – Conventional Mode



Winlink Client

- Individual Winlink User
- Winlink Express Computer Program
- Telnet
- VHF/UHF – Packet, VARA FM
- HF – ARDOP, VARA HF, Pactor

ARDOP - Amateur Radio Digital Open Protocol
CMS - Common Message Server
RMS - Radio Message Server
Telnet - Teletype Network (Wired Network)

Winlink Operating Modes
Peer-to-Peer (P2P)

- Direct radio connection between two HF or VHF/UHF client stations
- The Internet is not used
- Only the two client stations are involved.

Advantages

- Can operate independent of Internet and RMS
- Mixed mode nets possible on VHF/UHF (voice and digital)

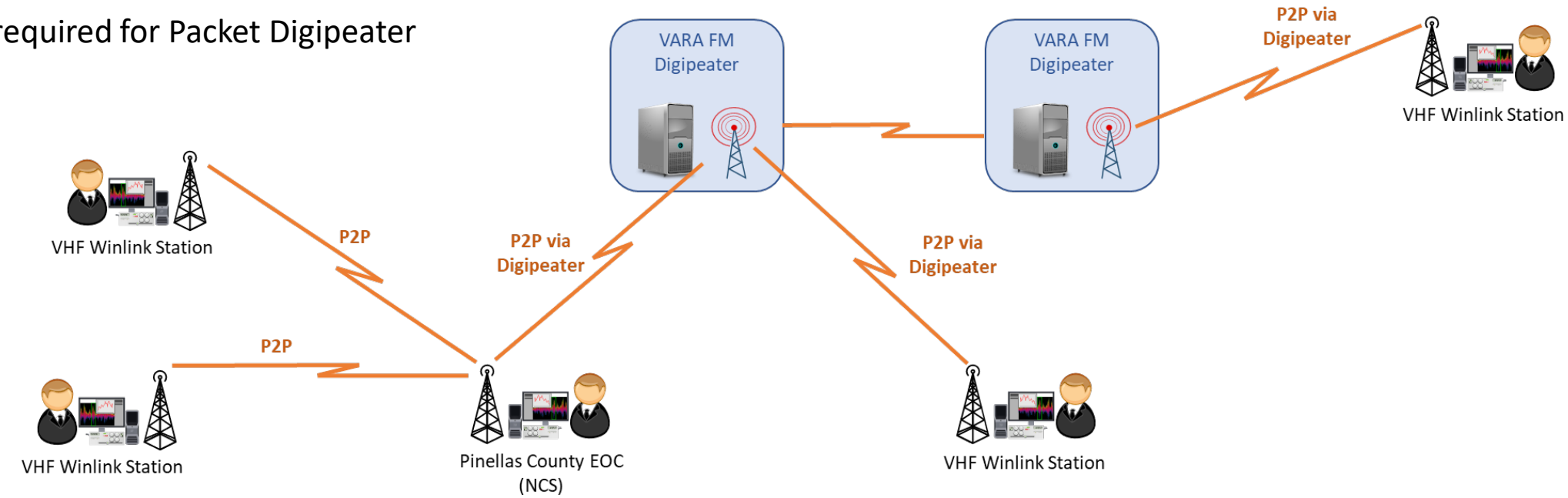
Disadvantages

- Connections are limited by RF propagation
- Both stations must be on the air at the same time
- Stations must use some other form of communication to coordinate connections or have a pre-established plan for frequency and time.

Winlink Operating Modes
Peer-to-Peer (P2P)

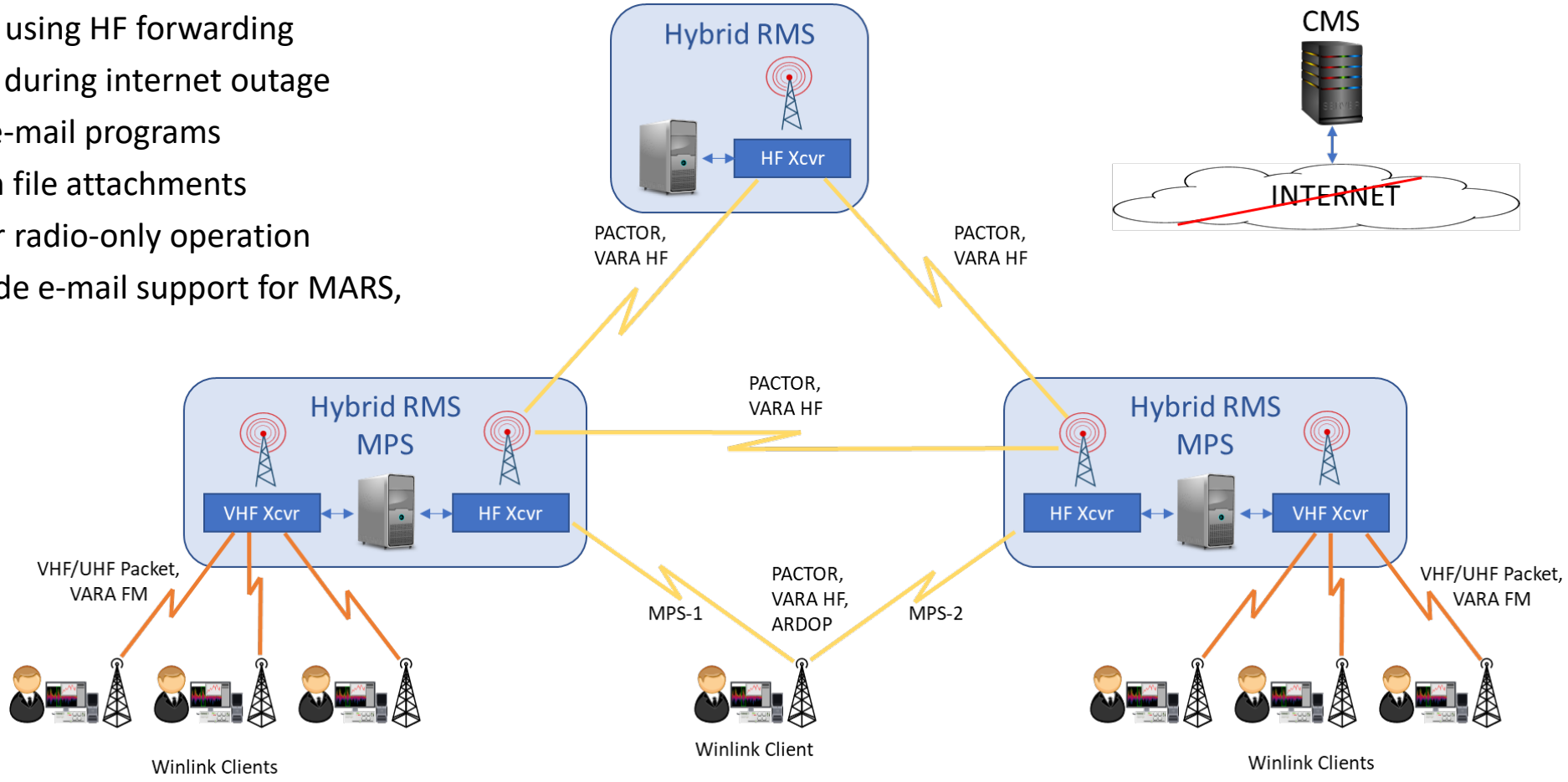
Digipeaters

- Extend the range of Conventional or P2P VHF/UHF Exchanges
- Winlink Supports exchanges through one or two digipeaters
- VARA License required to use VARA Digipeater
- No License required for Packet Digipeater



Winlink Operating Modes
Hybrid

- Wide-area, RF MESH network using HF forwarding
- Radio-only Winlink Operation during internet outage
- Uses standard Winlink client e-mail programs
- Supports standard e-mail with file attachments
- Satisfies DoDI requirement for radio-only operation
- Currently providing nation-wide e-mail support for MARS, SHARES and civil agencies

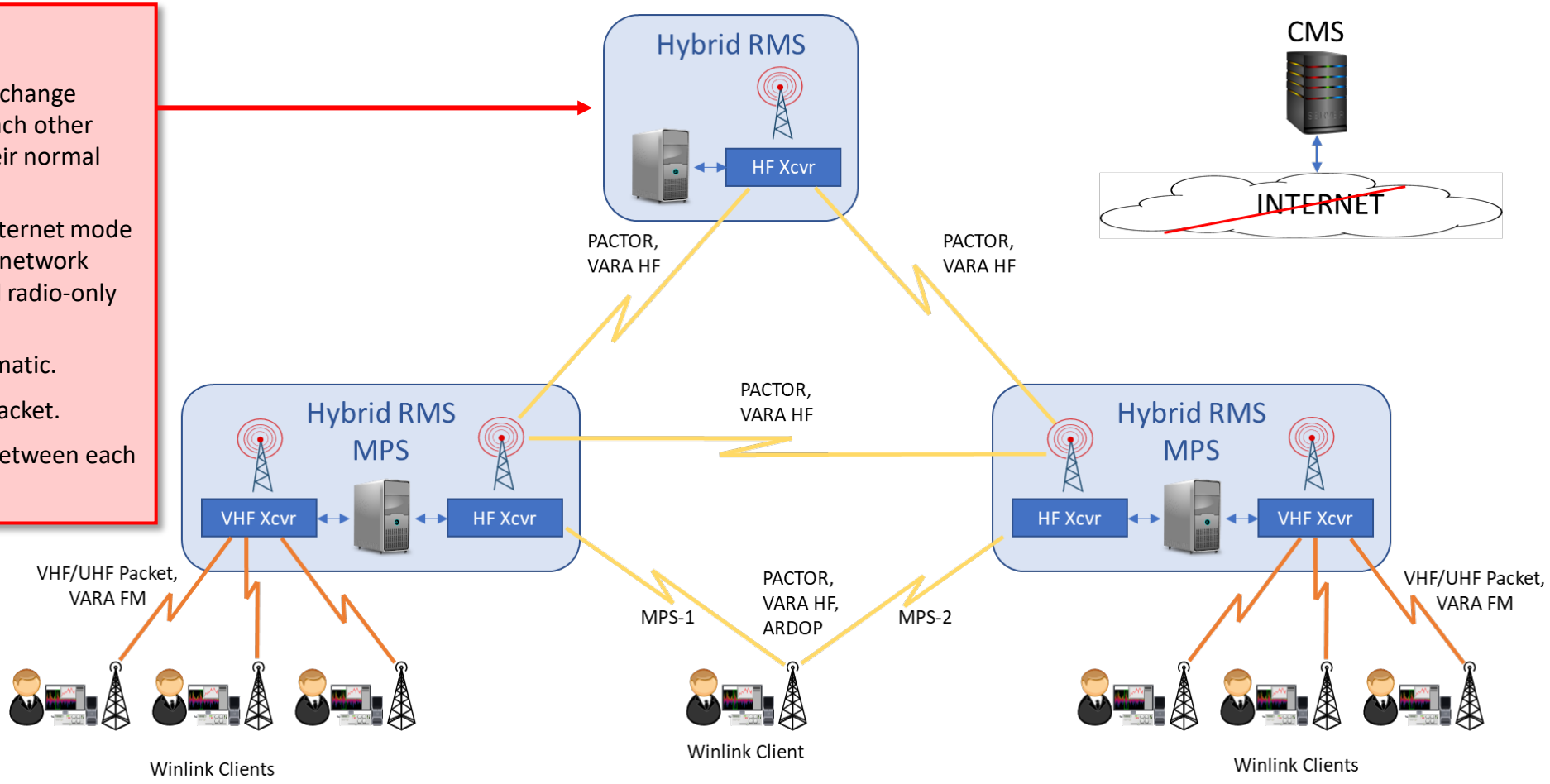


SHARES – SHAred RESources (SHARES) High Frequency (HF) Radio Program
MARS – Military Auxiliary Radio Service

Winlink Operating Modes
Hybrid

Hybrid RMS

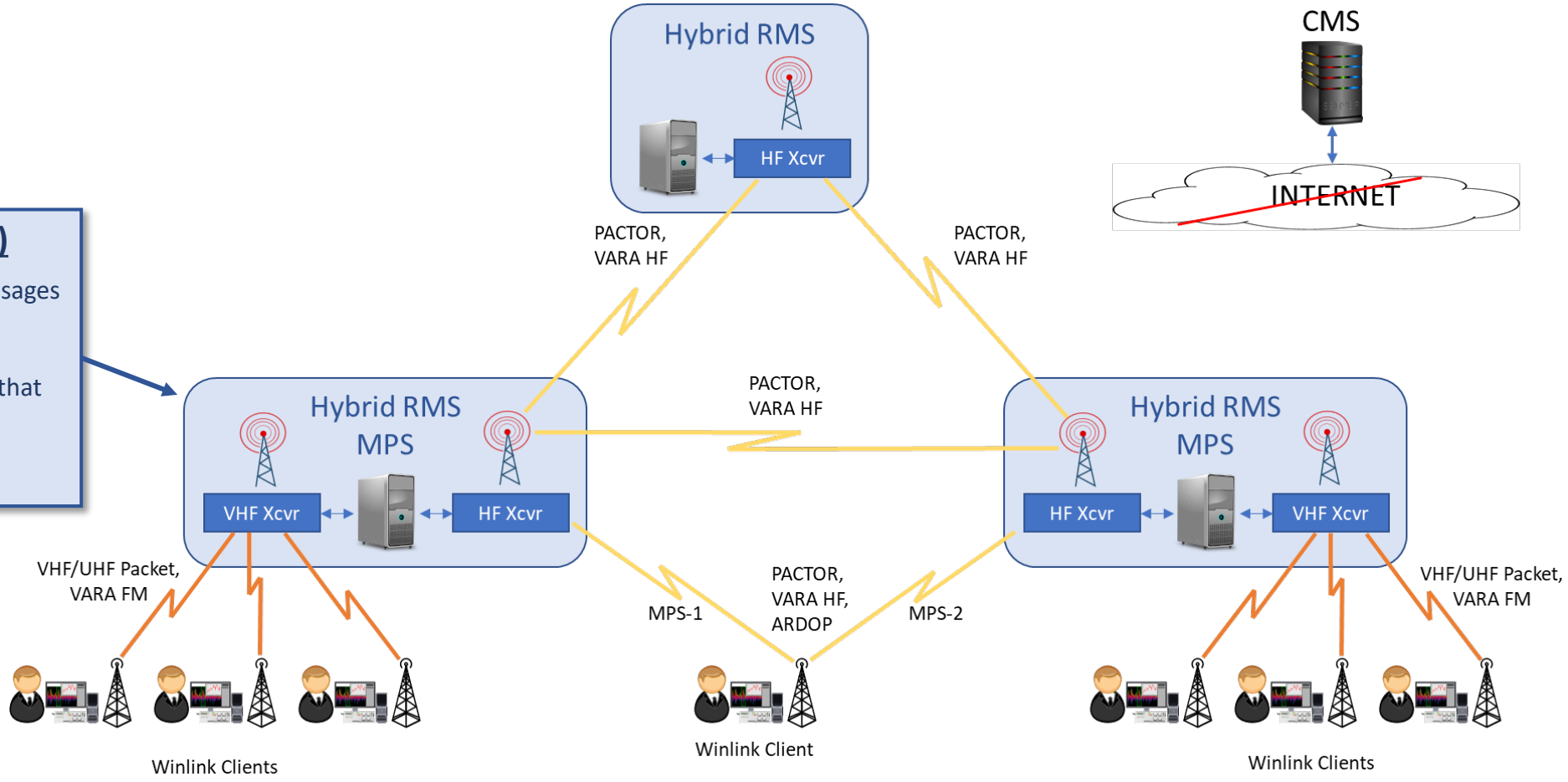
- RMS HF and RMS VHF/UHF stations that exchange messages (on behalf of others) between each other using "radio", in addition to performing their normal Winlink functions.
- Each Hybrid RMS runs in normal Winlink Internet mode and will switch automatically to radio-only network mode during an internet outage to forward radio-only messages.
- Message routing is dynamic and fully automatic.
- Users can connect using Pactor, VARA, or Packet.
- Pactor and VARA used for backbone links between each Hybrid RMS



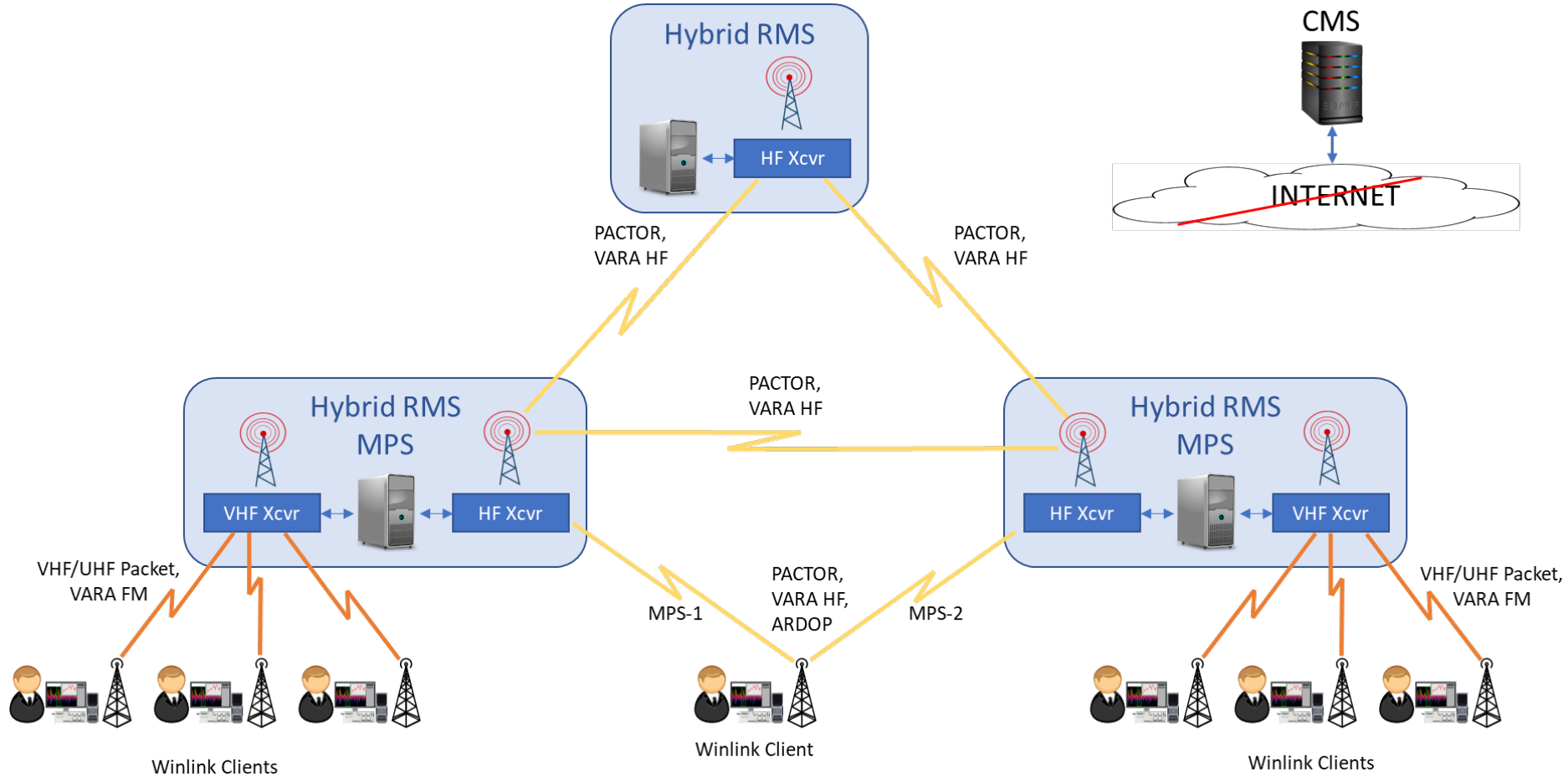
Winlink Operating Modes
Hybrid

Message Pickup Stations (MPS)

- Hybrid RMS used to by client to receive messages during an internet outage
- Each user can select up to 3 MPS to store incoming messages (Winlink Recommends that no more than 2 are selected)



Winlink Operating Modes
Hybrid



Winlink Client

- Individual Winlink User
- Winlink Express Computer Program
- VHF/UHF – Packet, VARA FM
- HF – ARDOP, VARA HF, Pactor

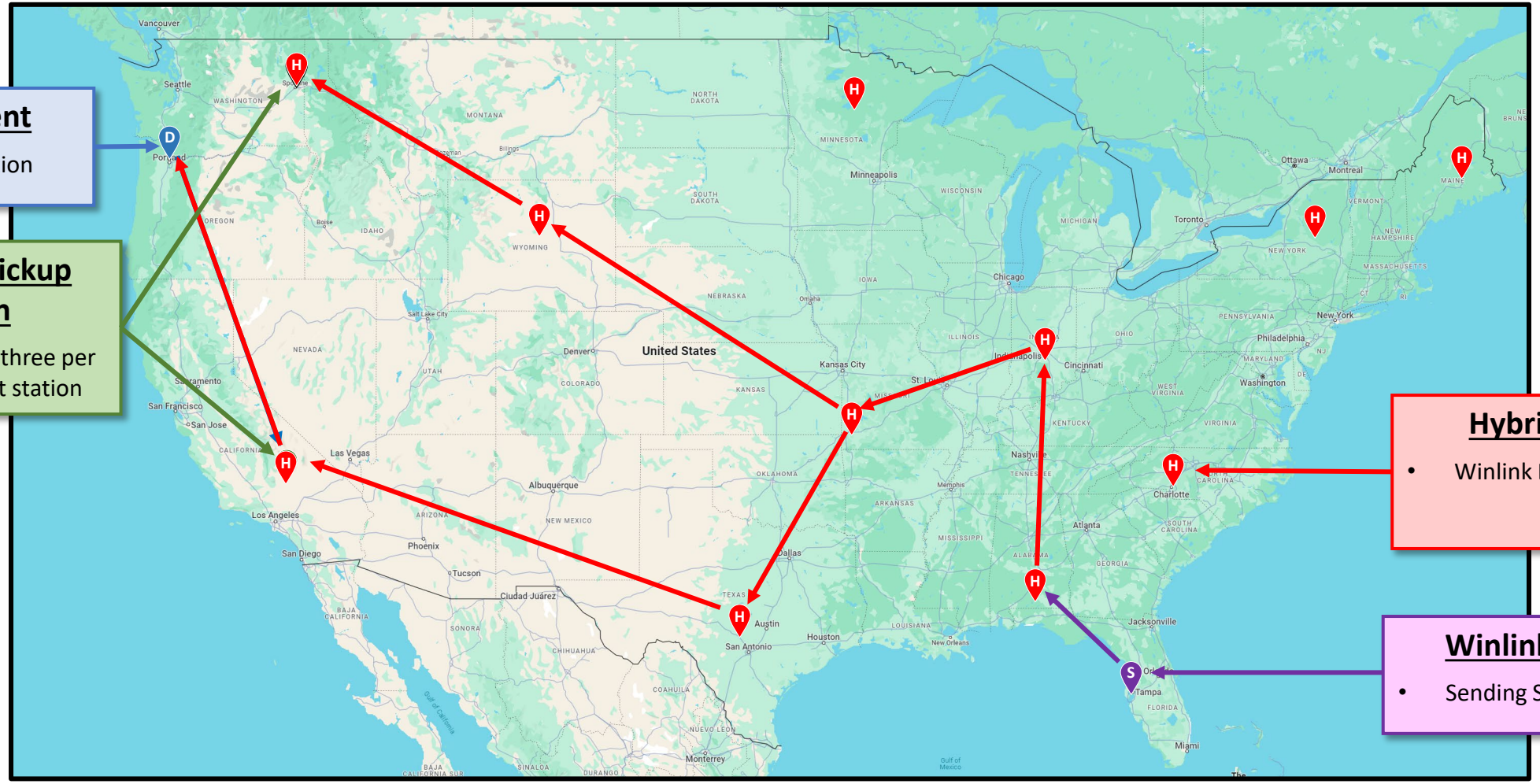
Winlink Operating Modes
Hybrid

Winlink Client

- Destination Station

Message Pickup Station

- Maximum of three per Winlink Client station



Hybrid RMS

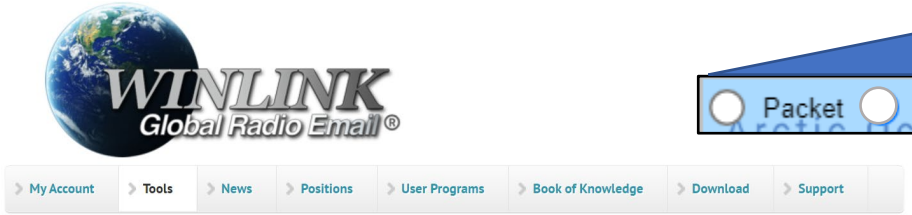
- Winlink Email Server

Winlink Client

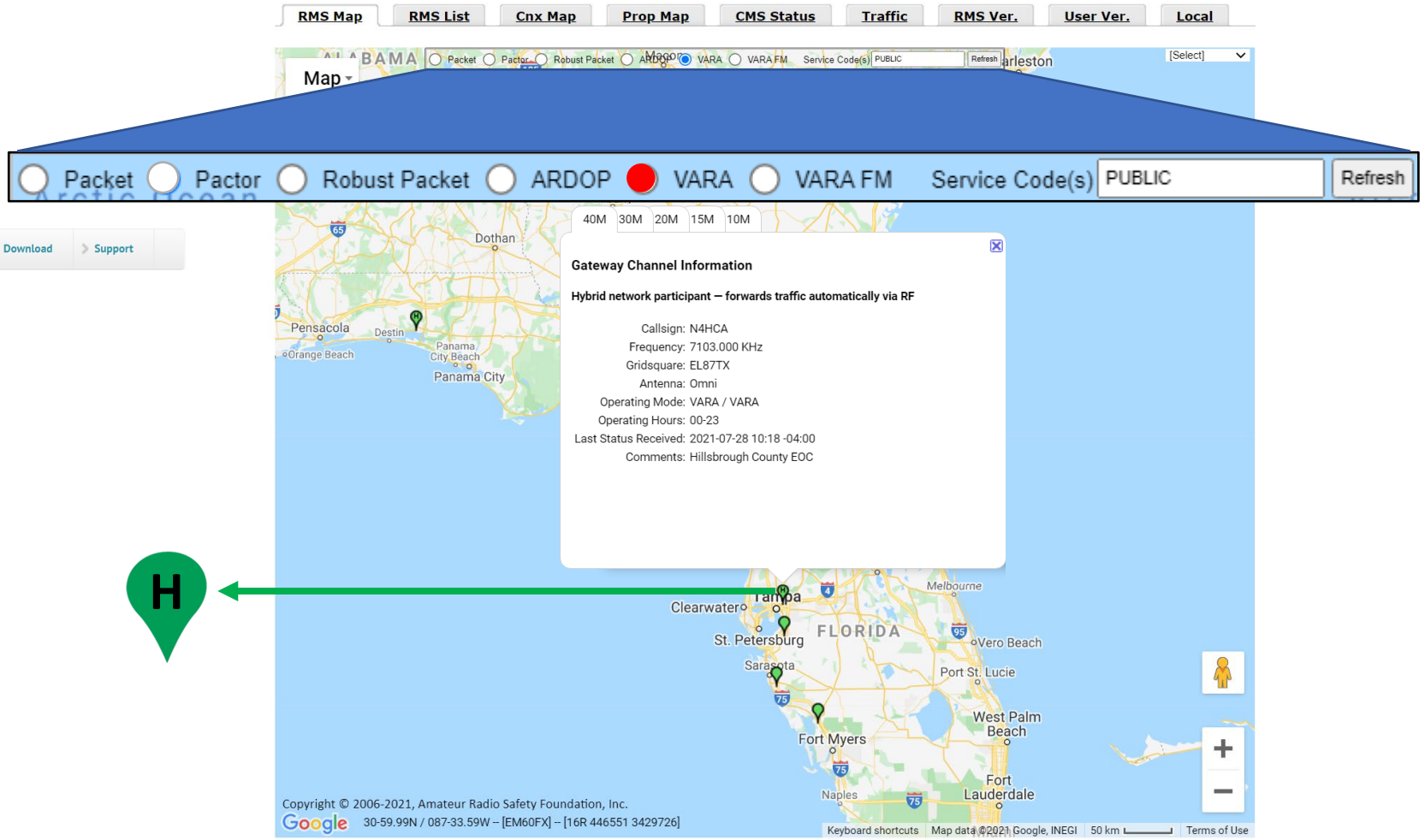
- Sending Station

Winlink Operating Modes
Hybrid Station Identification

Go to the Winlink Website



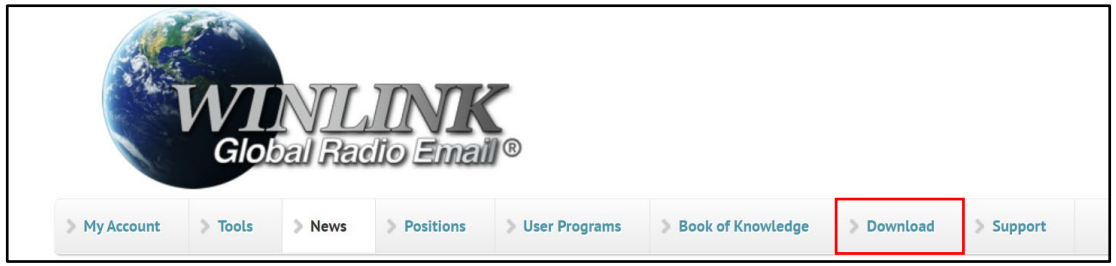
Select Tools



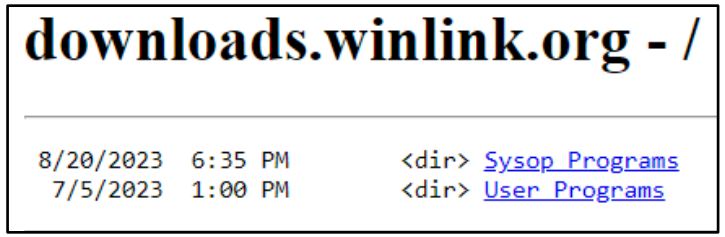
LEGEND:
'**H**' markers - Winlink Hybrid Network participants. They offer RF message forwarding if local internet links are not available.

Winlink Express Installation
Program Download

- Go to Winlink Web site and Download software

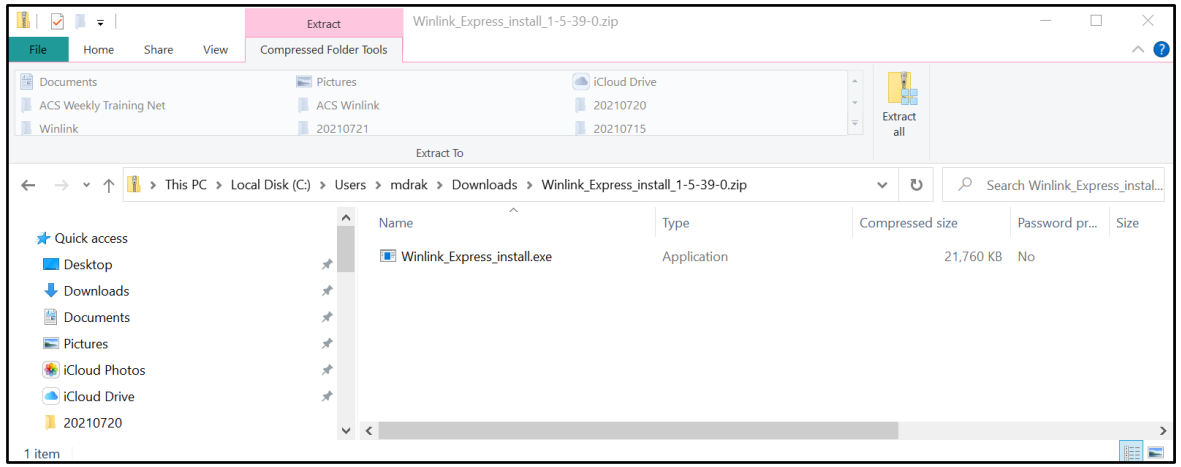


https://www.winlink.org/



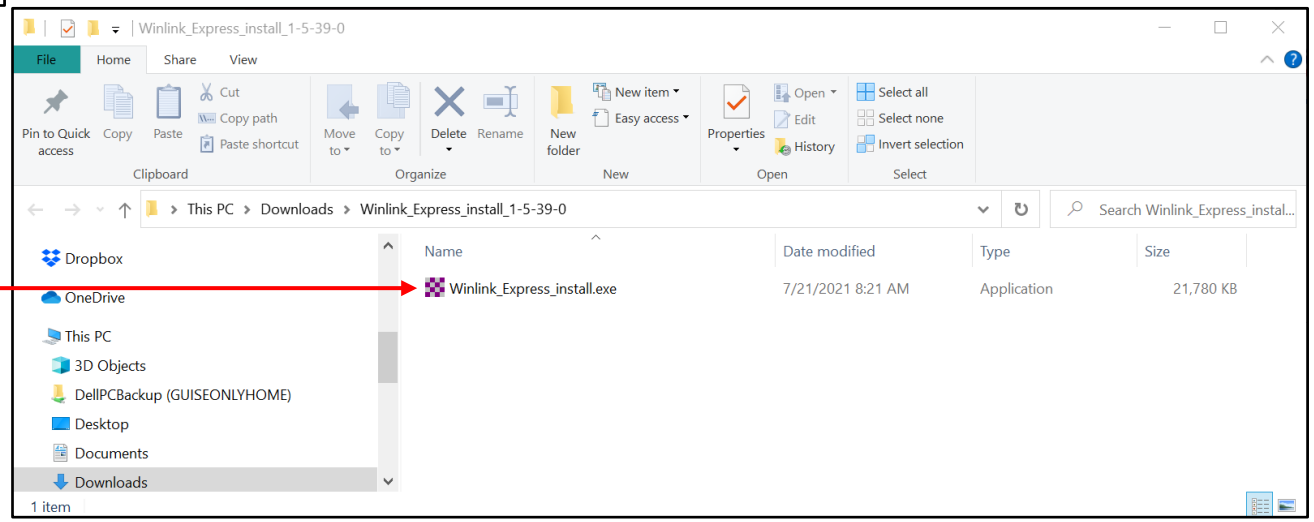
Winlink Express Installation

Program Download



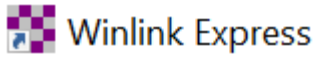
Unzip the Downloaded File

Run the file

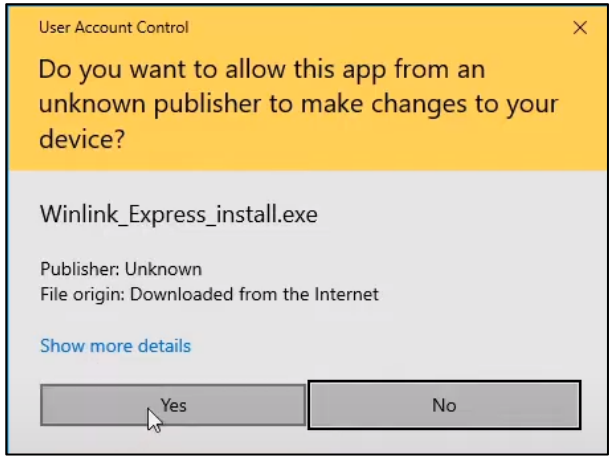


Winlink Express Installation

- Warning Pop-up may be displayed
  - Safe if file has been downloaded from Winlink.org
- Follow directions and install in default locations
- Recommend Desktop shortcut



- Run Winlink



Winlink Express Installation

Account Set-up

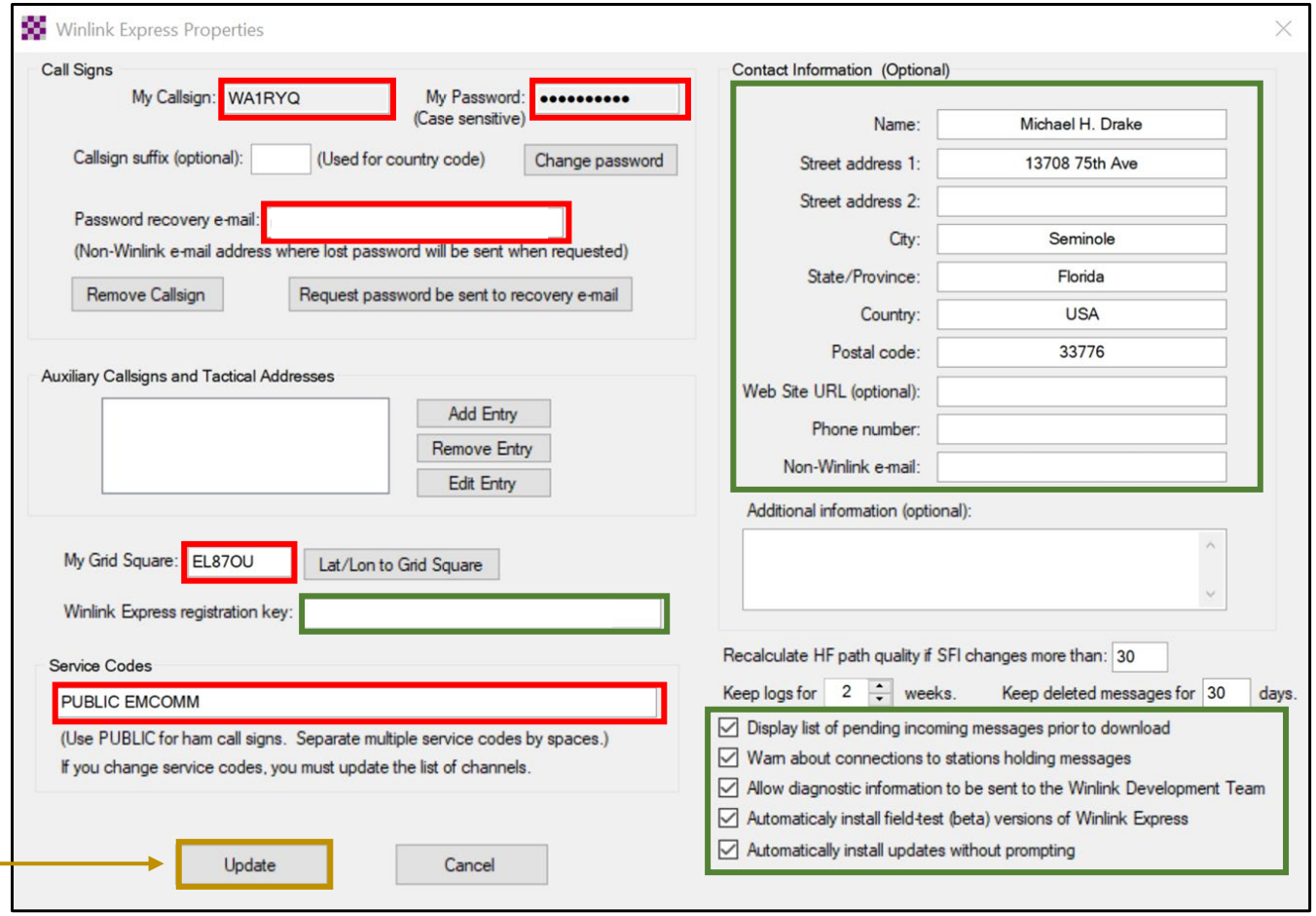
Required Fields

- My Callsign
- My Password (Case Sensitive)
- Password Recovery e-mail
- My Grid Square
- Service Codes

Optional Fields

- Contact Information
- Program Options
- Registration Key

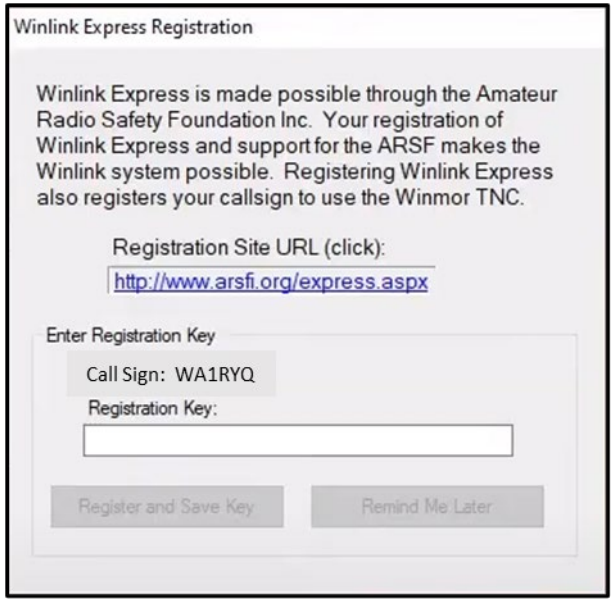
Click the Update Button



Winlink Account must be created within the Winlink Program

Winlink Express Installation
Registration

- Registration to your callsign is voluntary
- Supports Winlink system and all ARSFI projects
- Program will periodically display a registration reminder screen.
  - You can click a button to be reminded later and continue use the program without registering.
- If you register your callsign (Approximately $24)
  - You will receive a hexadecimal key linked to your call sign
  - Enter key on the setup screen
  - Once your registration key has been entered, the registration reminder will not display.



ARSFI - Amateur Radio Safety Foundation Inc.

Agenda

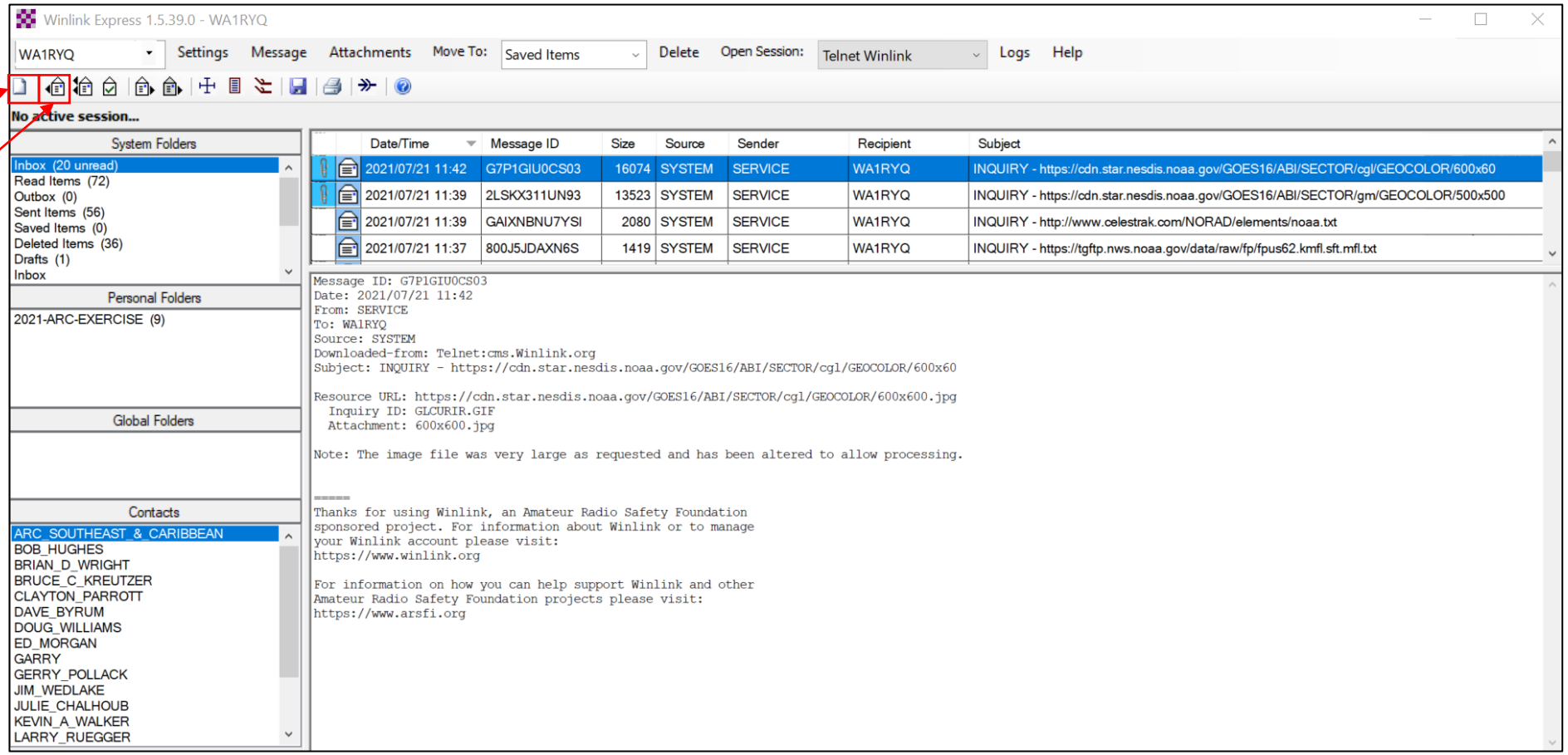
- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications

Winlink Express Operation

Create and Send a Message via Telnet

New Message

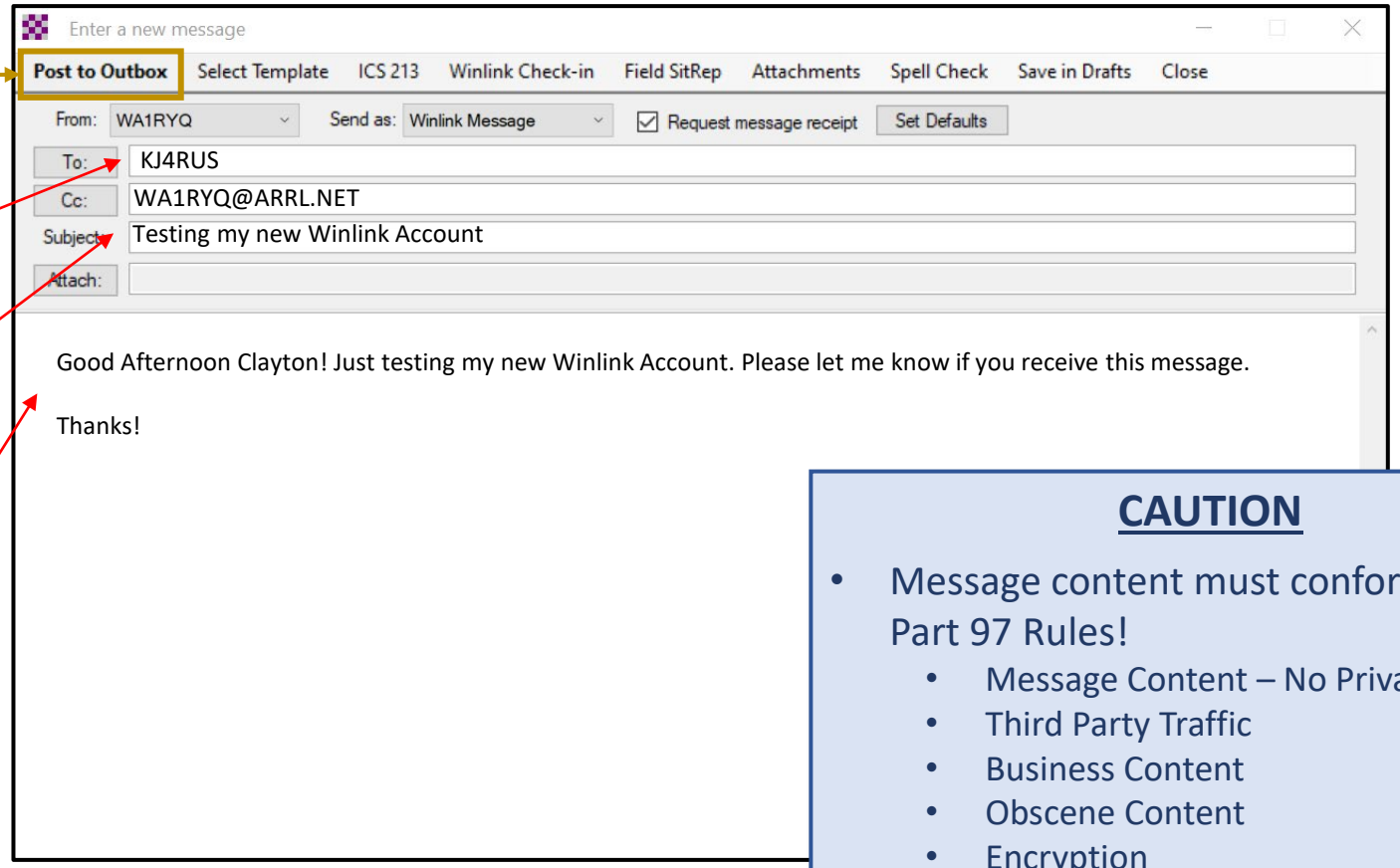
Reply to Message



Winlink Express Operation

Create and Send a Message via Telnet

Once the message is complete, Click the Post to Outbox Button



Enter a callsign or internet Email Address

Enter a message Subject

Enter your message

CAUTION

- Message content must conform to FCC Part 97 Rules!
  - Message Content – No Privacy
  - Third Party Traffic
  - Business Content
  - Obscene Content
  - Encryption

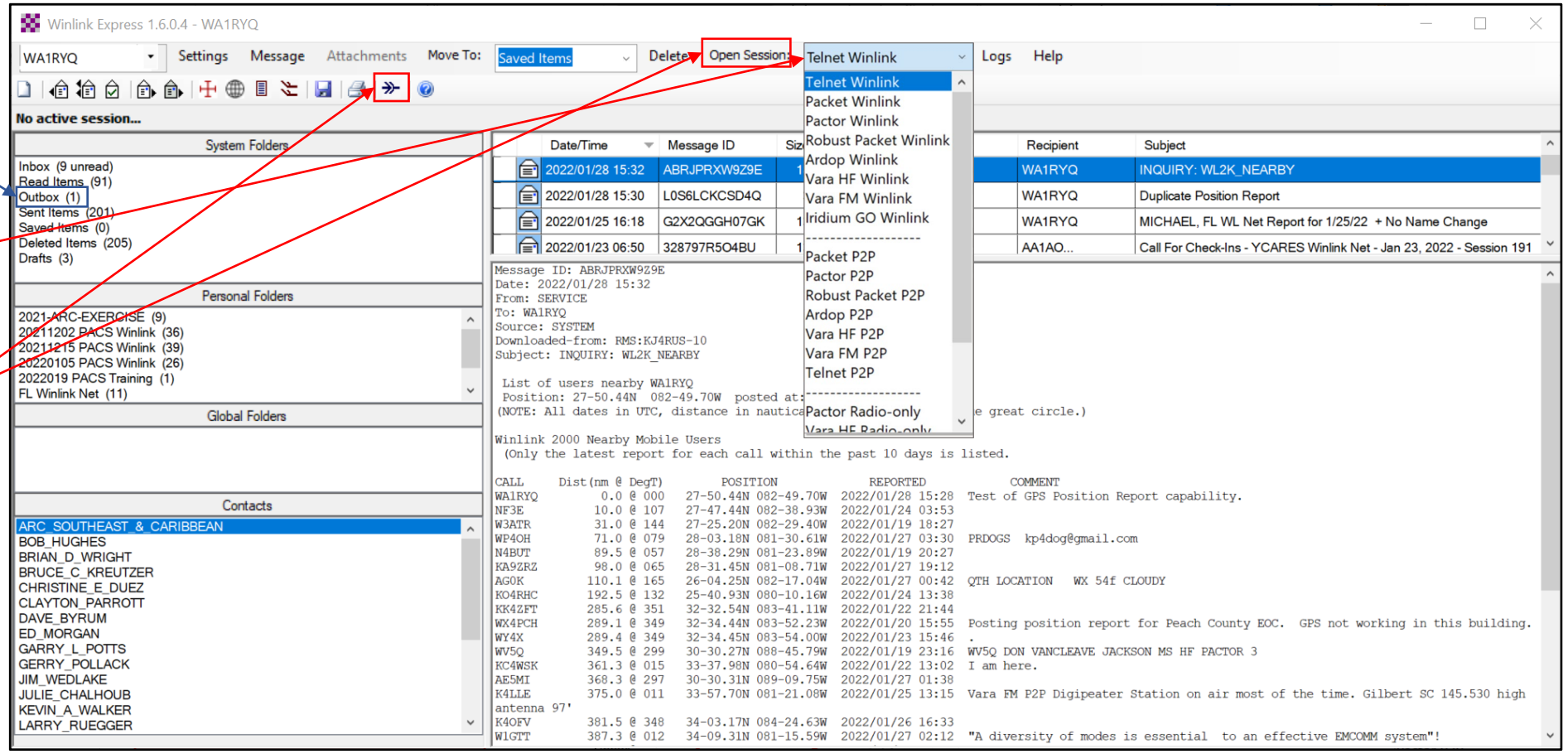
Winlink Express Operation

Create and Send a Message via Telnet

One Message in the Outbox

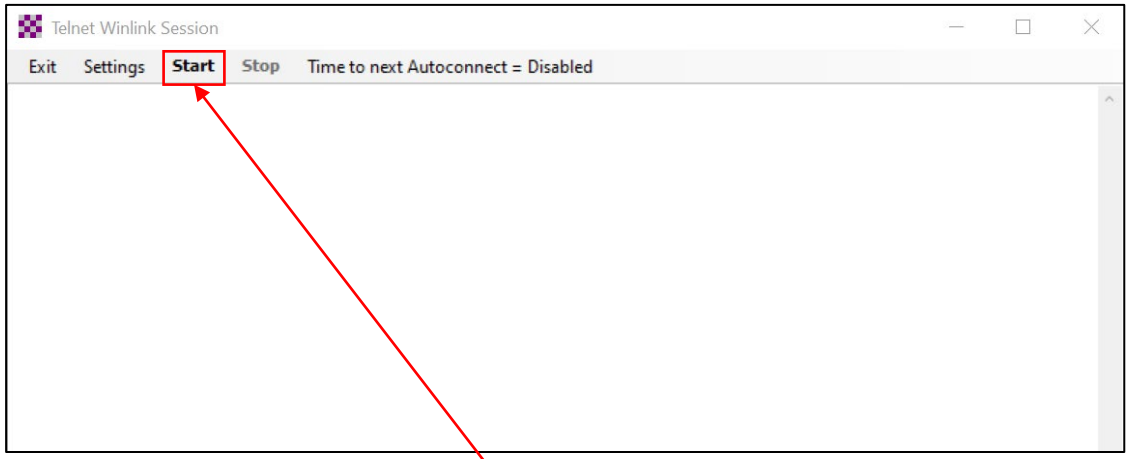
Step 1: Winlink Session Type Select "**Telnet Winlink**"

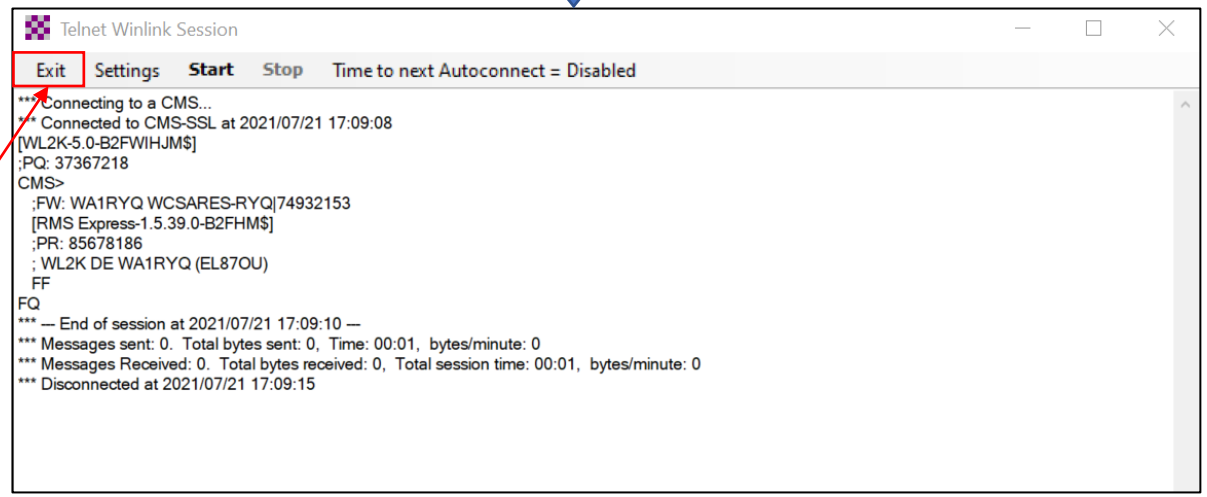
Step 2: Open Winlink Session



Winlink Express Operation

Create and Send a Message via Telnet





Step 3: Depress the **Start** Button

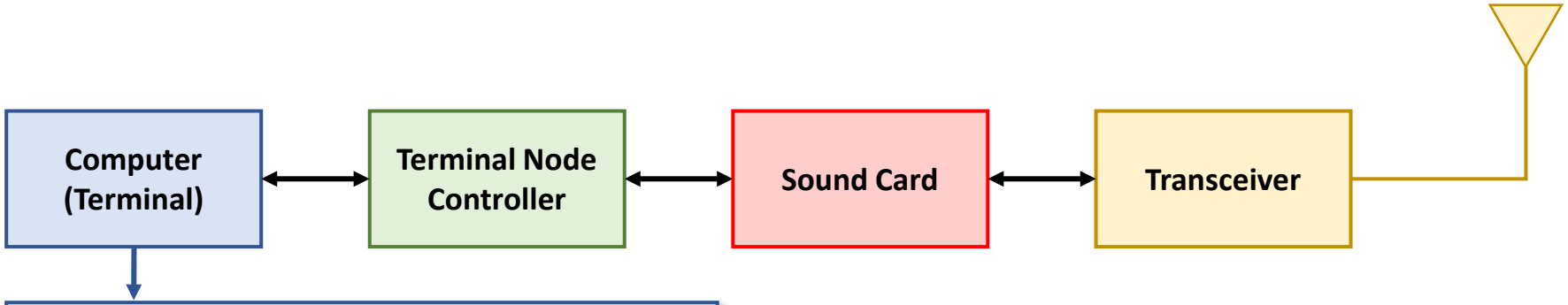
Step 4: Depress the **Exit** Button

Message has been Sent!

Agenda

- Winlink Overview and Installation
- Winlink Express Operation
- Digital Communications

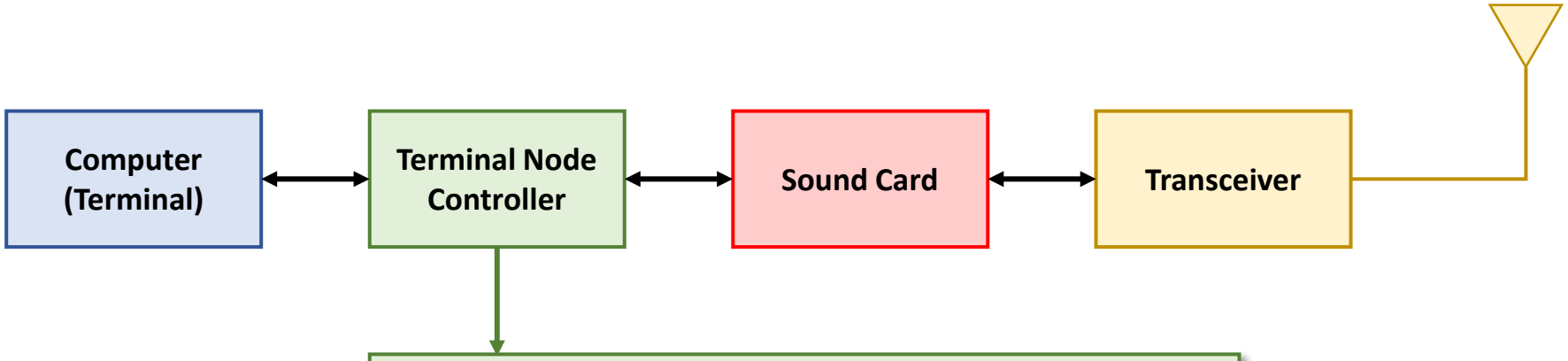
Digital Communications
Functional Description



Computer (Terminal)

- Data Input/Output Device
- Controls the operation of the TNC
- Winlink Application resides here

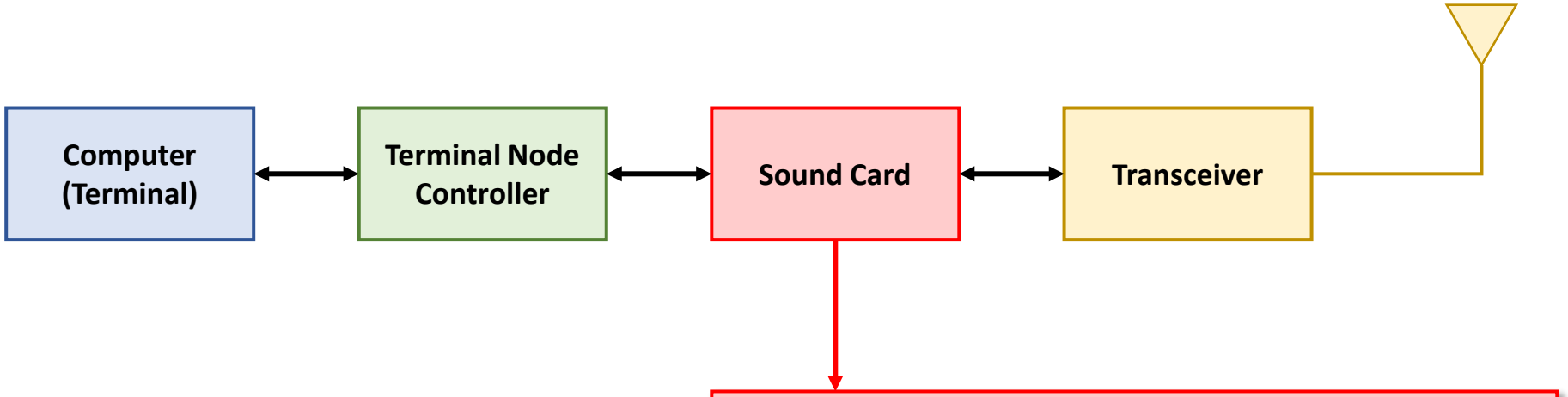
Digital Communications
Functional Description



Terminal Node Controller

- Implements Communications Protocol
  - Packet (AX.25), Pactor, ARDOP, VARA
- Formats data for transmission
  - Headers, Compression, Encoding, etc.
- Decodes receive data

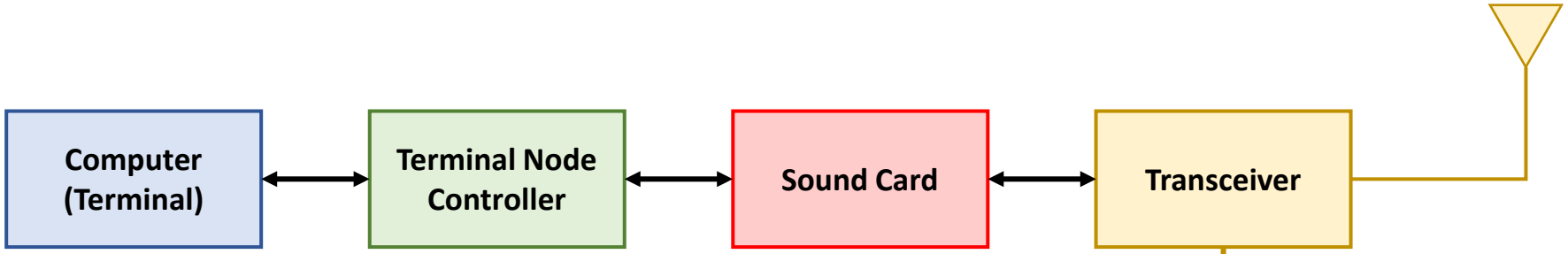
Digital Communications
Functional Description



Sound Card

- Converts Digital information from TNC into Audio signal for transmission
- Generates Transmitter keying signal for Transceiver
- Converts Audio data from Transceiver into Digital Information for the TNC

Digital Communications
Functional Description

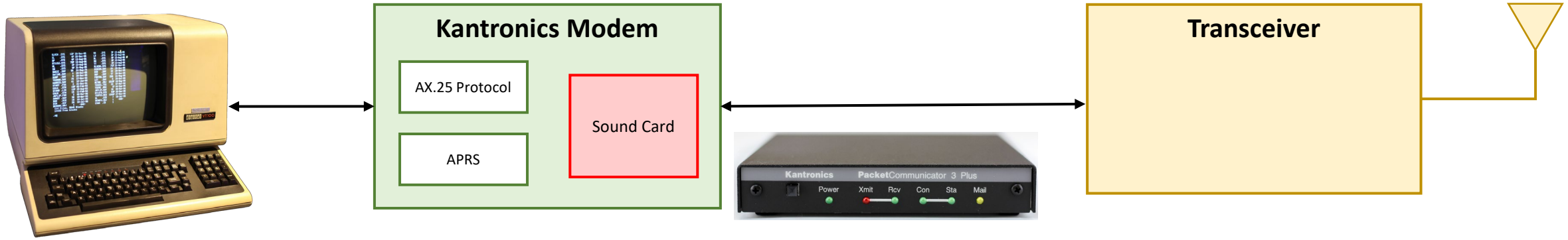


Transceiver

- Transmits the audio data received from the sound card
- Receives data and sends audio to the sound card

Digital Communications

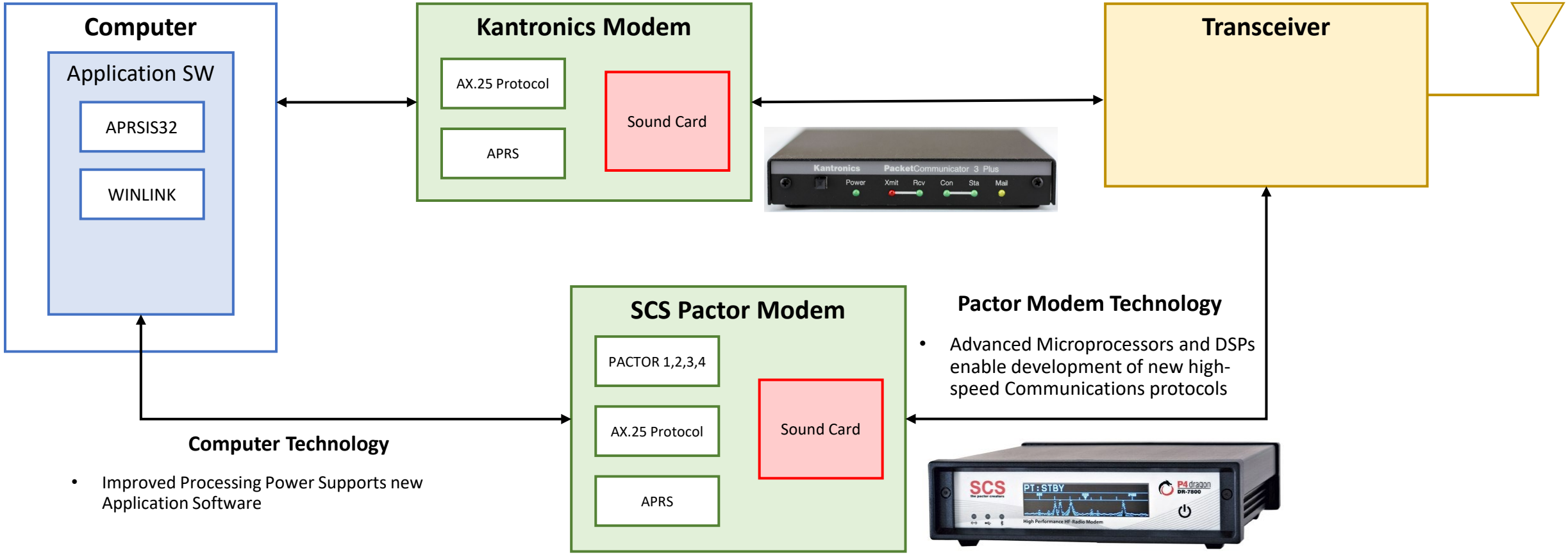
Functional Description – Development History



- Dumb Terminal / Microcomputer
  - Input and display unit
  - No application-based computing capability
  - Command line control of TNC
- Terminal Node Controller
  - Dedicated Hardware
  - Manages all aspects of Packet data exchange
  - Packet Assembler/Disassembler

Digital Communications

Functional Description – Development History



Computer Technology

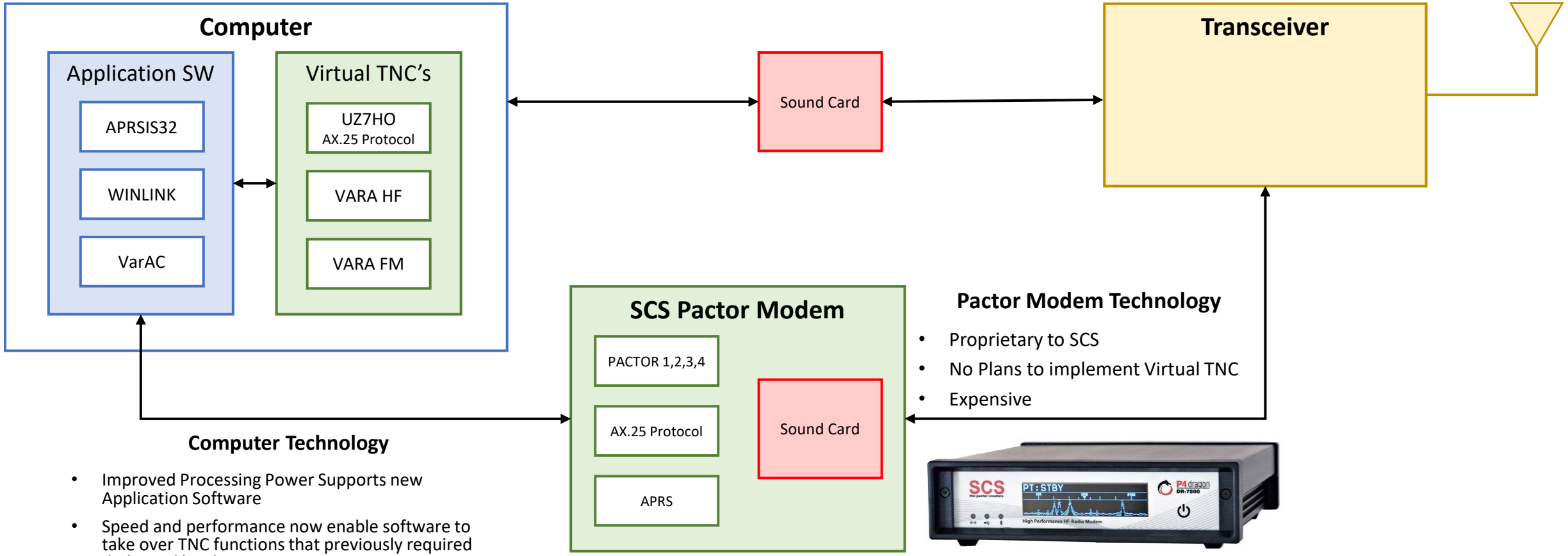
- Improved Processing Power Supports new Application Software

Pactor Modem Technology

- Advanced Microprocessors and DSPs enable development of new high-speed Communications protocols

Digital Communications

Functional Description – Development History



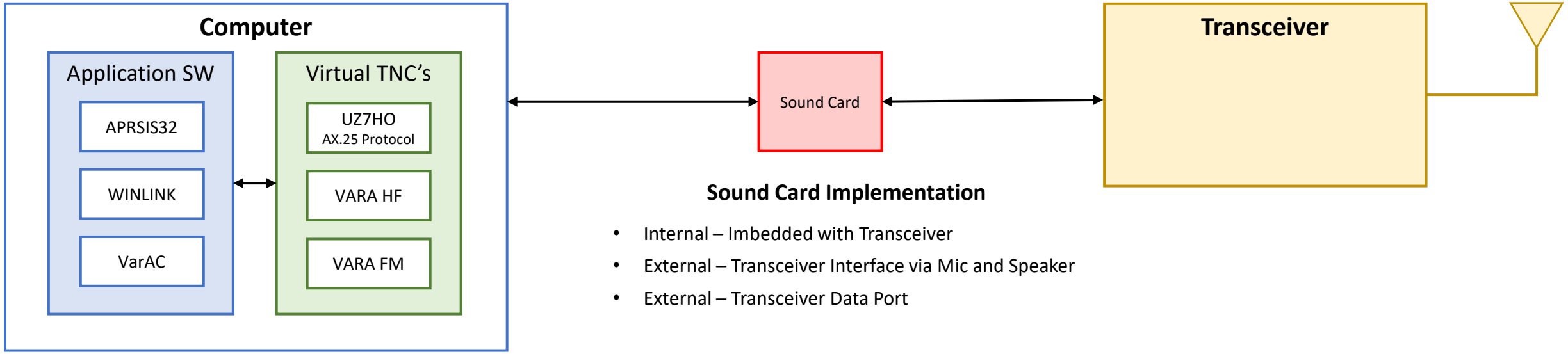
Pactor Modem Technology

- Proprietary to SCS
- No Plans to implement Virtual TNC
- Expensive

Computer Technology

- Improved Processing Power Supports new Application Software
- Speed and performance now enable software to take over TNC functions that previously required dedicated hardware
- Virtual TNCs – Low or no cost to user

Digital Communications
Implementation



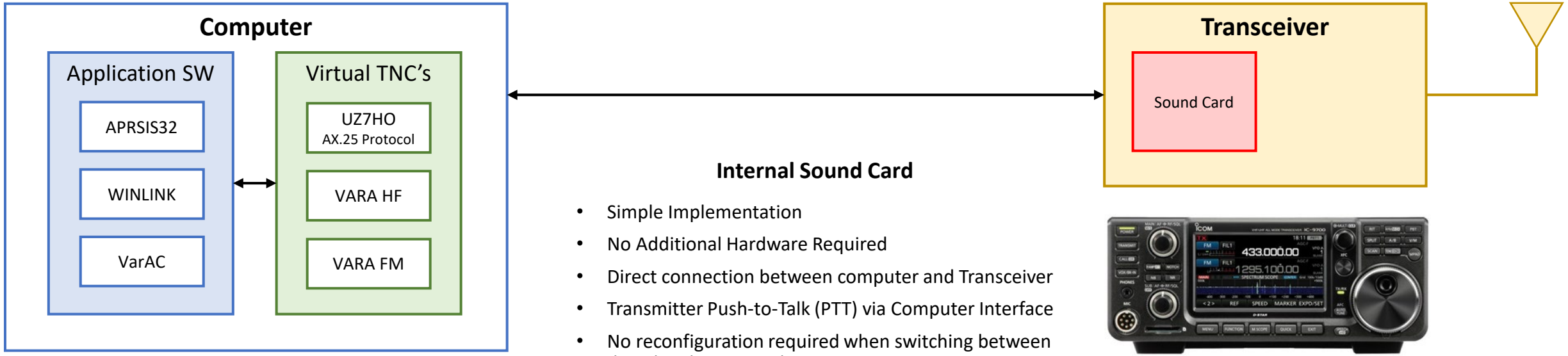
Sound Card Implementation

- Internal – Imbedded with Transceiver
- External – Transceiver Interface via Mic and Speaker
- External – Transceiver Data Port

Computer Technology

- Improved Processing Power Supports new Application Software
- Speed and performance now enable software to take over TNC functions that previously required dedicated hardware
- Virtual TNCs – Low or no cost to user

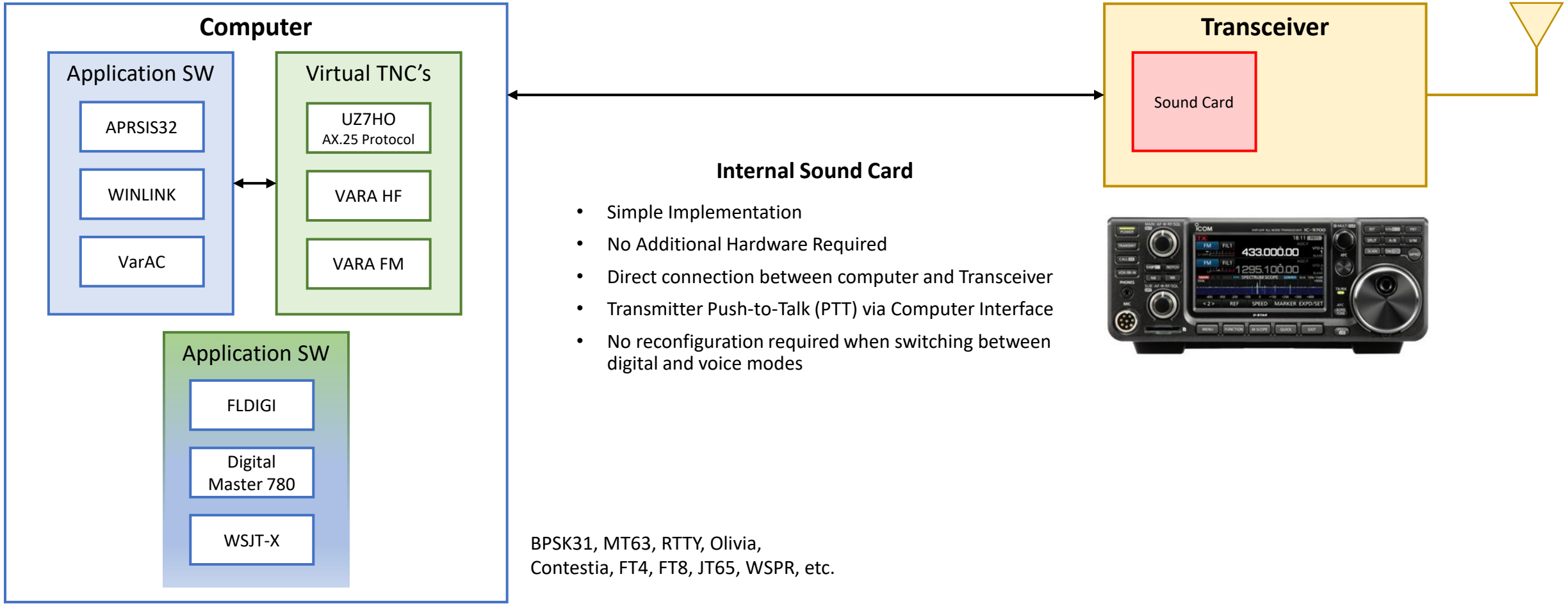
Digital Communications
Implementation – Internal Sound Card



Internal Sound Card

- Simple Implementation
- No Additional Hardware Required
- Direct connection between computer and Transceiver
- Transmitter Push-to-Talk (PTT) via Computer Interface
- No reconfiguration required when switching between digital and voice modes

Digital Communications
Implementation – Internal Sound Card



Internal Sound Card

- Simple Implementation
- No Additional Hardware Required
- Direct connection between computer and Transceiver
- Transmitter Push-to-Talk (PTT) via Computer Interface
- No reconfiguration required when switching between digital and voice modes

BPSK31, MT63, RTTY, Olivia,
Contestia, FT4, FT8, JT65, WSPR, etc.

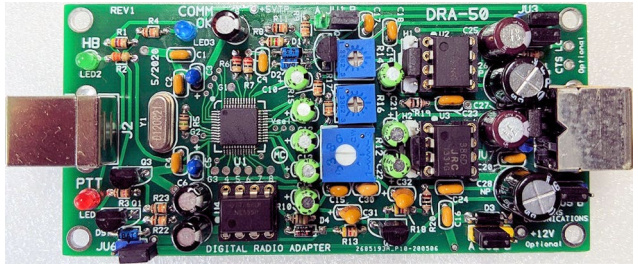
WSPR - Weak Signal Propagation Reporter

Digital Communications
Implementation – External Sound Cards

Many Options Available

Tigertronics SignaLink™ USB

- Transformer Isolation
- Easy to Configure
- Hardware and Radio Cable Less than $150
- Connects to Radio Data Port or Mic/Speaker
- Newer Design Support VARA Wide



Masters Communications

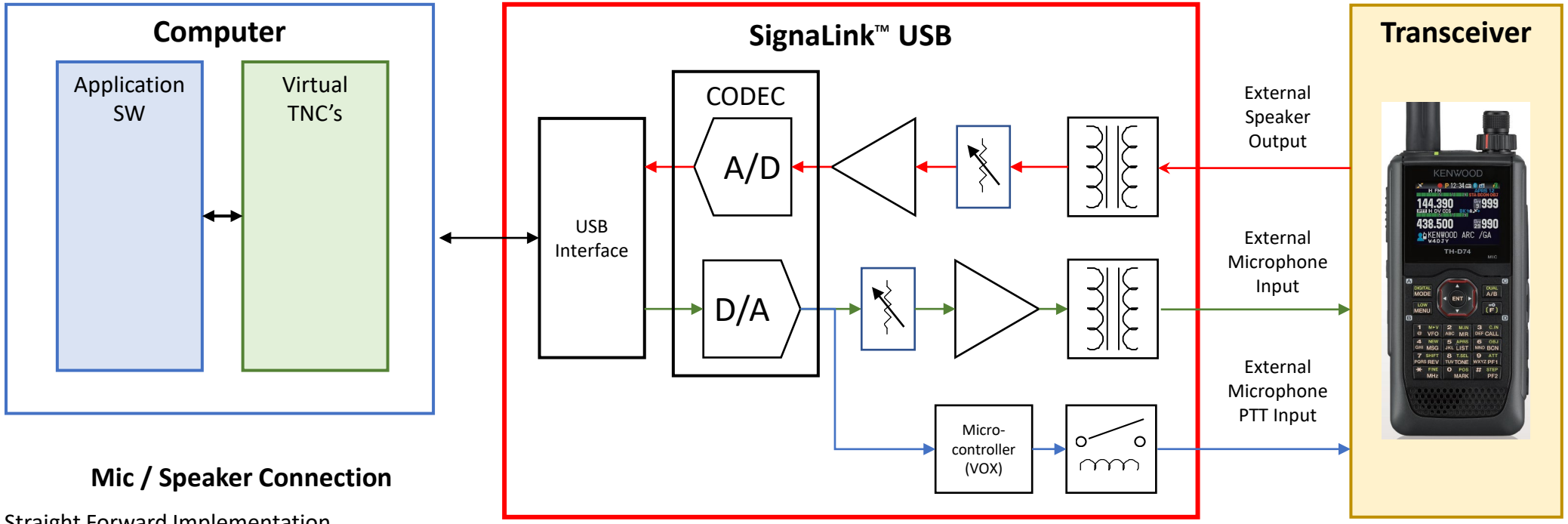
- DRA Series (DRA-50 Shown)
- Purchased as a kit or prebuilt and tested
- Kit and Case $70; Assembled, Tested, with Case $100
- Wide Audio Range support VARA Wide
- HeartBeat monitor to prevent stuck PTT
- Best suited for connection to radio data port

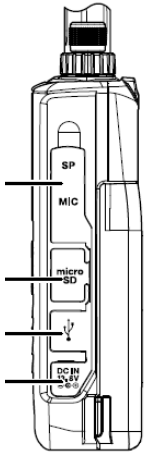
Digirig Mobile

- Hardware and Radio Cables – Approx $100
- Connects to Radio Data Port or Mic/Speaker
- Supports VARA Wide

Digital Communications

Implementation – External – Mic and Speaker Connection





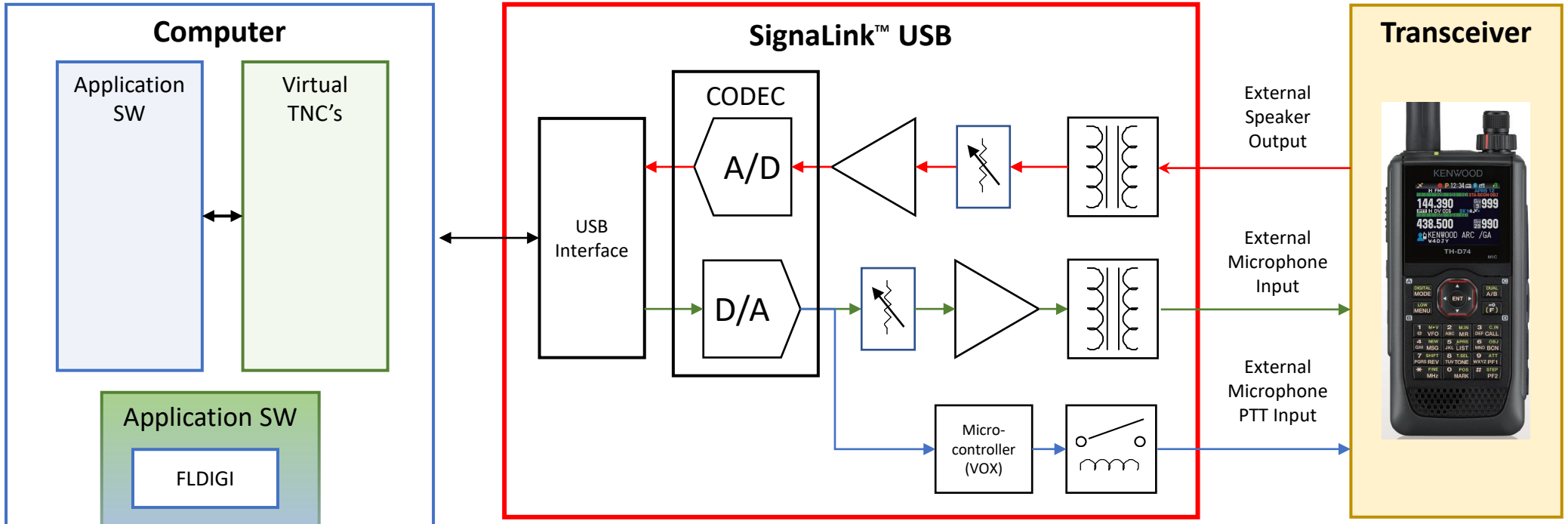
Mic / Speaker Connection

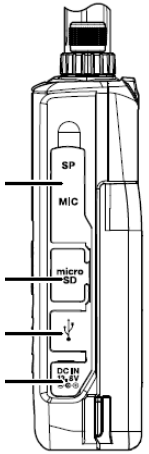
- Straight Forward Implementation
- Disadvantage
  - Cable reconfiguration required when transitioning between voice and digital modes.
  - Support for VARA Narrow only

CODEC - Coder/Decoder

Digital Communications

Implementation – External – Mic and Speaker Connection

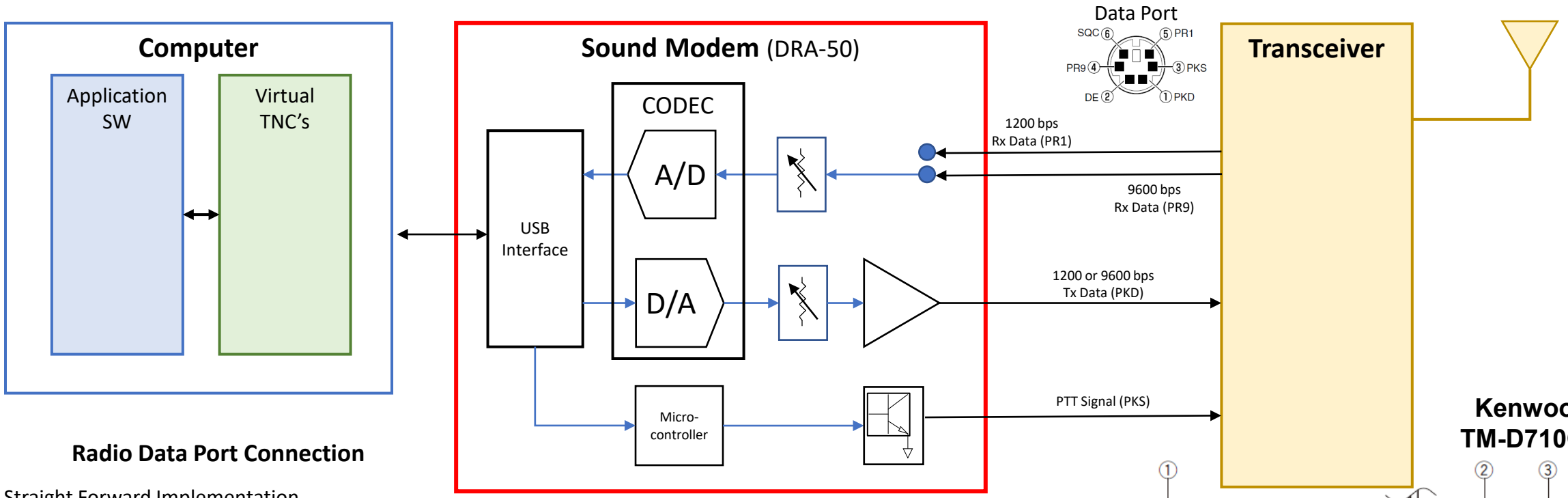




CODEC - Coder/Decoder

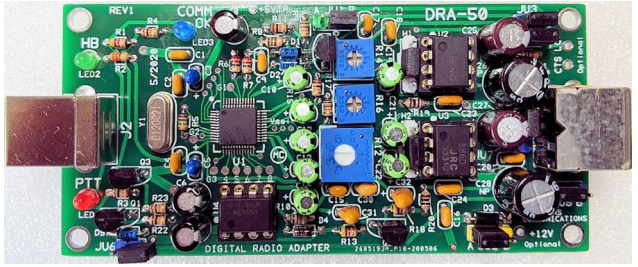
Digital Communications

Implementation – External – Radio Data Port

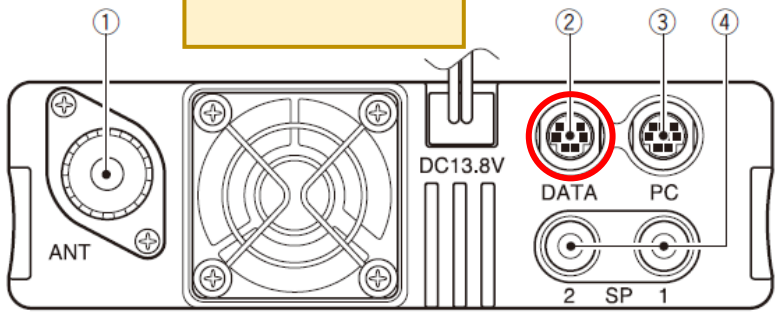


Radio Data Port Connection

- Straight Forward Implementation
- No Reconfiguration required when switching between digital and voice modes
- Support for High-Speed VARA Wide Modes



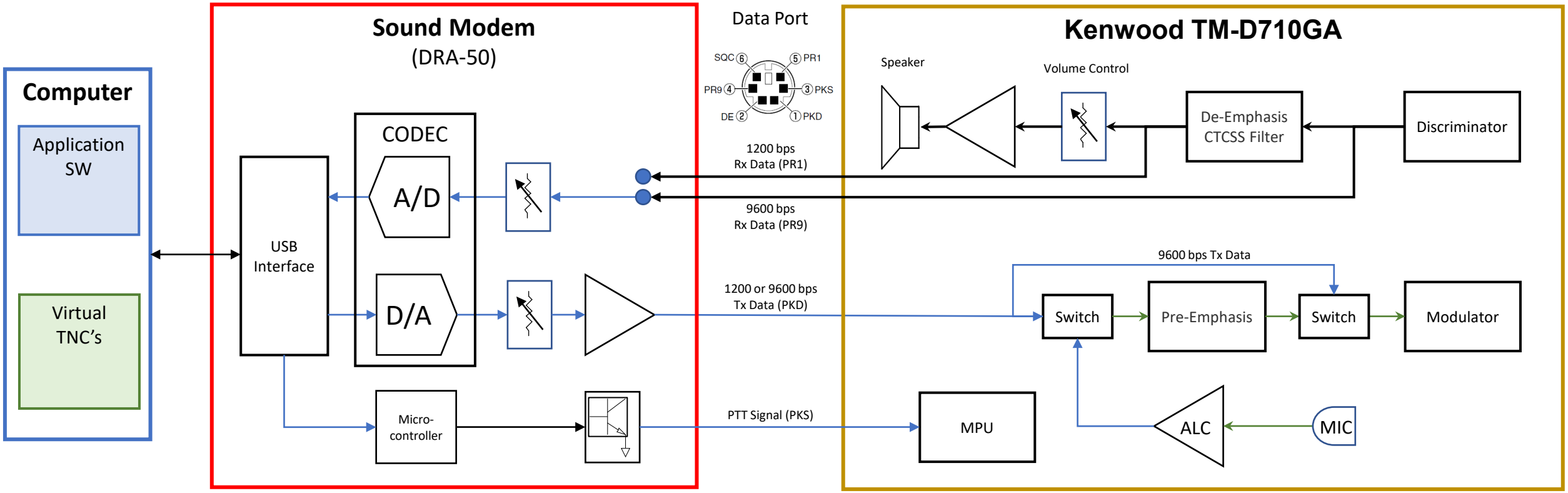
Kenwood TM-D710GA



① ANT
② DATA
③ PC
④ SP (SP1/SP2)

Digital Communications

Functional Description – External Sound Card



A/D - Analog to Digital Converter
ALC - Automatic Level Control
BPS - Bits per second
CODEC - Coder-Decode
CTCSS - Continuous Tone Coded Squelch Sys
D/A - Digital to Analog Converter
MPU - Microprocessor Unit
PTT - Push to Talk
TNC - Terminal Control Unit
USB - Universal Serial Bus

Conclusion

- Questions

Back-up

Winlink Operating Frequencies

§ 97.221 Automatically controlled digital station

- A station may be automatically controlled while transmitting a RTTY or data emission on the 6 m or shorter wavelength bands, and on the following segments.

28.120–28.189 MHz	**18.105–18.110 MHz,**	**10.140–10.150 MHz**
24.925–24.930 MHz	**14.0950–14.0995 MHz**	**7.100–7.105 MHz**
21.090–21.100 MHz,	**14.1005–14.112 MHz**	**3.585–3.600 MHz**

- Except for channels specified in § 97.303(h), a station may be automatically controlled while transmitting a RTTY or data emission on any other frequency authorized for such emission types provided that:
  - The station is responding to interrogation by a station under local or remote control; and
  - No transmission from the automatically controlled station occupies a bandwidth of more than ***500*** Hz.