



ARRL The national association for
AMATEUR RADIO

Rob Jagde – KD2GRS
Assistant DEC Nassau County ARES

Winlink for EmComm

Ham Radio University
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Amateur Radio & Emergency Communications

- EmComm is one of the fundamental reasons for the Amateur Radio Service:

FCC CFR Title 47 – §97.1 Basis and purpose.

The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

- ARES – (ARRL) Amateur Radio Emergency Service
- Also a dedicated service RACES
 - §97.407 Radio amateur civil emergency service
 - A radio service using amateur stations for civil defense communications during periods of local, regional or national civil emergencies.

EmComm Options for NLI

- Voice nets (FM)
 - Presently backbone of our operations for ARES / RACES.
- FLDIGI – digital communications on FM simplex & repeaters
 - Weekly drills, can handle many digital communication needs
- D-Star – voice & data, DRATS
 - We have a NC2EC D-Start repeater system, but not many operators have equipment
- DMR – LIMARC and other groups have linked repeaters throughout the NLI section
- Winlink
 - 2M Packet stations in the section or close by, including W2KPQ digipeater
 - Also a few Vara FM stations
 - HF (out of area)

EmComm – Current Trends

- Goal is an organized, managed and professional response to disaster.
- Operate under NIMS (National Incident Management System) and ICS (Incident Command Structure)
 - There can be many agencies involved that have to work together so they need common language, forms, procedures and organizational system.
- For Amateur Radio operators this is applicable to ARES, RACES, AuxComm or direct volunteers.
- Radio operators are "communicators" and need to use not only radio but all other means available - e.g. agency radios, Internet, FAX, phone, etc... whatever works.

Winlink for EmComm - Outline:

- What is Winlink?
- What are it's capabilities?
- Why is it useful for EmComm?
- What are the major components of Winlink?
- How does it function?
- What comprises a basic Winlink client station?
- How does the client connection to Winlink.
- References, how to learn more, how to get started.

What is Winlink?

- Worldwide system for sending e-mail via radio.
- Provides a service, similar to e-mail, from almost anywhere in the world.
- Entirely supported and operated by amateur radio volunteers (Amateur Radio Safety Foundation, Inc.).
- Started as “SailMail” providing support for sailors.
- Winlink Express software for Windows computers is the preferred client application.
- Adopted for contingency communication by many government agencies.
- Used by infrastructure-critical NGOs such as International & American Red Cross, Emergency Response Team, etc.

What Winlink offers for EmComm

- Flexibility:
 - Internet-only (Telnet) direct connections to Winlink (no radio needed).
 - Radio link bridge to Internet e-mail.
 - **Radio-only store and forward messaging.**
 - Peer-to-peer connections between radio end-users.
 - Familiar and simple e-mail client interface.
- Interoperability: Connect different types of systems
 - Bridge different radio capabilities (VHF/UHF/HF).
 - Seamless integration with Internet e-mail.
- Not limited by station-to-station propagation.
- Geographical dispersion and redundancy for reliability
- Time independence (stations do not have to be on air at same time).
- Ability to collect messages while unattended.

Winlink for EmComm (2)

- Standard e-mail format with many features.
 - **Limited** Binary file attachments (pictures, pdf, spreadsheets).
 - Automatic message compression/decompression.
 - White listing used to prevent spam.
- Good operation at most power levels.
- Message logging, and ICS-309 report generation.
- Extensive ICS & agency form library.
 - Winlink internal forms
 - Send flmsg files as attachments
- Wide adoption by EmComm related agencies.

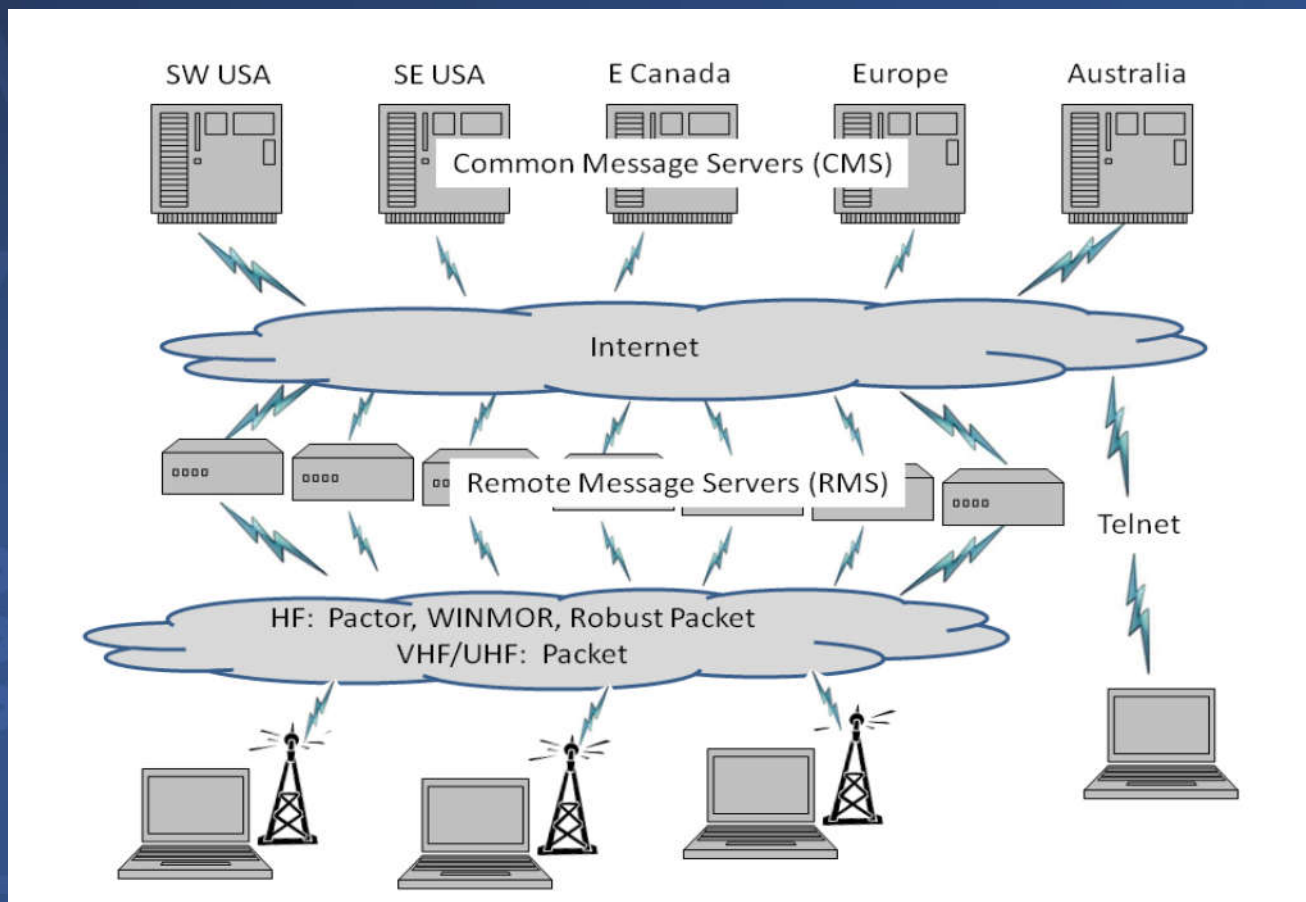
Winlink Restrictions

- All FCC Part 97 rules must be followed
 - No commercial messages
 - No foul or indecent language
 - No criminal activities
 - 3rd Party Message traffic rules for foreign stations
- All messages can be viewed by ANY Winlink user via Winlink.org web page.
- Attachments are supported but are **SEVERELY** limited in size.
 - The total size of a Winlink message after compression including all file attachments may not exceed 120 kb.
 - Usually pictures must be resized to very low resolution.
- Low bandwidth.
 - VHF packet is 1200 (common) or 9600 (not common) baud
 - HF can be as slow as 300 baud!!! *This is excruciatingly slow.*

Winlink Architecture

- Hierarchal levels of the Winlink system:
- 1 - Common Message Servers (CMS) – Winlink backbone.
 - uses AWS (Amazon Web Services)
 - redundant, fault-tolerant
- 2- Radio Message Server (RMS) – Radio gateway between the client (end-user) and the Winlink system backbone.
- 3- Client system – Radio, computer with Winlink software (Winlink Express), TNC (or sound card) and you, the end-user!

Winlink Architecture Diagram



As of November 1, 2017, the CMS servers have been moved into the Amazon Web Services (AWS) cloud for greater redundancy.

Winlink Infrastructure

- Uses Amazon Cloud (AWS) as backbone.
- Worldwide radio stations on HF and VHF with a variety of protocols.
- Use HF radio to contact RMS stations outside the affected area.
- Use VHF/UHF to contact RMS stations inside the affected area.
- Peer-to-peer connectivity is possible with both HF and VHF as well.

Winlink Express Main Screen

Create Message

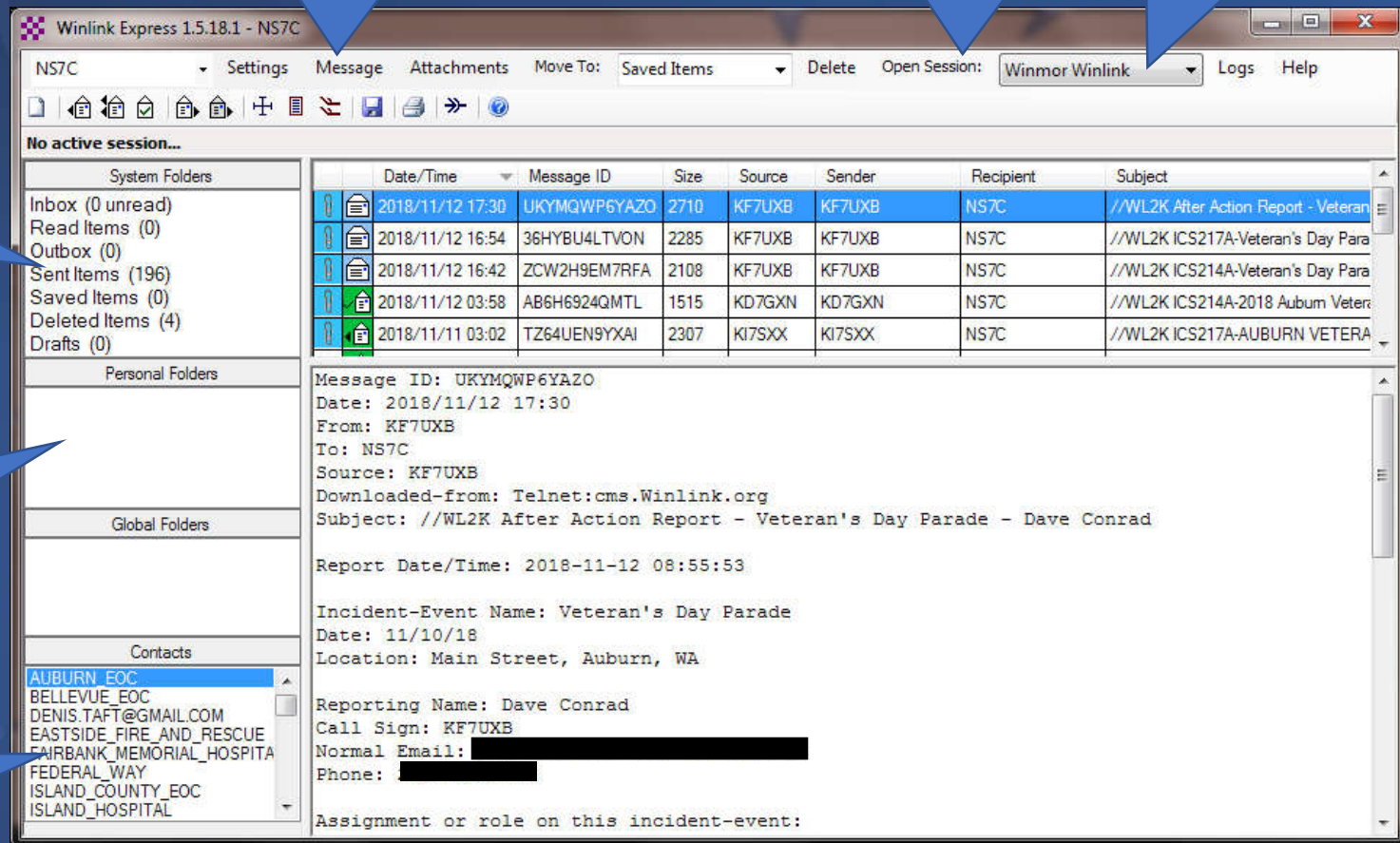
Begin connection

Connection Mode

Standard
Folders

Personal
message
folders

Contacts
Address
Book



The screenshot shows the Winlink Express 1.5.18.1 - NS7C main screen. The interface includes a menu bar (NS7C, Settings, Message, Attachments, Move To, Saved Items, Delete, Open Session, Winmor Winlink, Logs, Help) and a toolbar. A status bar at the top indicates "No active session...".

The left sidebar displays a folder tree with three categories:

- System Folders:** Inbox (0 unread), Read Items (0), Outbox (0), Sent Items (196), Saved Items (0), Deleted Items (4), Drafts (0).
- Personal Folders:** (Empty)
- Global Folders:** (Empty)
- Contacts:** A list of contacts including AUBURN_EOC, BELLEVUE_EOC, DENIS.TAFT@GMAIL.COM, EASTSIDE_FIRE_AND_RESCUE, FAIRBANK_MEMORIAL_HOSPITAL, FEDERAL_WAY, ISLAND_COUNTY_EOC, and ISLAND_HOSPITAL.

The main pane displays a table of messages:

	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
	2018/11/12 17:30	UKYMQWP6YAZO	2710	KF7UXB	KF7UXB	NS7C	//WL2K After Action Report - Veteran's Day Parade - Dave Conrad
	2018/11/12 16:54	36HYBU4LTVON	2285	KF7UXB	KF7UXB	NS7C	//WL2K ICS217A-Veteran's Day Parade - Dave Conrad
	2018/11/12 16:42	ZCW2H9EM7RFA	2108	KF7UXB	KF7UXB	NS7C	//WL2K ICS214A-Veteran's Day Parade - Dave Conrad
	2018/11/12 03:58	AB6H6924QMTL	1515	KD7GXN	KD7GXN	NS7C	//WL2K ICS214A-2018 Auburn Veterans Day Parade - Dave Conrad
	2018/11/11 03:02	TZ64UEN9YXAI	2307	KI7SXX	KI7SXX	NS7C	//WL2K ICS217A-AUBURN VETERAN'S DAY PARADE - Dave Conrad

Below the table, the details for the selected message (Message ID: UKYMQWP6YAZO) are shown:

Message ID: UKYMQWP6YAZO
Date: 2018/11/12 17:30
From: KF7UXB
To: NS7C
Source: KF7UXB
Downloaded-from: Telnet:cms.Winlink.org
Subject: //WL2K After Action Report - Veteran's Day Parade - Dave Conrad

Report Date/Time: 2018-11-12 08:55:53

Incident-Event Name: Veteran's Day Parade
Date: 11/10/18
Location: Main Street, Auburn, WA

Reporting Name: Dave Conrad
Call Sign: KF7UXB
Normal Email: [REDACTED]
Phone: [REDACTED]

Assignment or role on this incident-event:

Winlink Message Form

Enter a new message

Post to Outbox

Select Template

Attachments

Spell Check

Save in Drafts

Close

From: KD2GRS

Send as: Winlink Message

☐ Request message receipt

Set Defaults

To: KD2GXL

Cc:

Subject: Winlink Check in Exercise - KD2GRS - Red Cross, Mineola

Attach: RMS_Express_Form_Winlink_Check_In_Viewer.xml;FormData.txt

Check-in

Status: [Exercise]

Date/Time: 2023-01-01 21:57:47

Initial Assigned Operators: KD2GRS

Station Contact Name: Rob Jagde

Call/Tactical Sender: KD2GRS

Location: Red Cross, Mineola

GPS Coordinates: LAT 40.729167 LON -73.708333 MGRS Coordinates: 18TXL0907609495 Grid Square: FN30dr

Band Used: VHF

Session Type: Packet

Call/Tactical Sender: KD2GRS

Comments:

Radio room is operational at Red Cross HQ in Mineola.

Below Info Used for Copy and Paste to Spreadsheet

TAB Delimited:

VHF	2023-01-01 21:57:47	KD2GRS	KD2GRS	Rob Jagde	Red Cross, Mineola	40.729167,-73.708333	18TXL0907609495	FN30dr
Packet	Radio room is operational at Red Cross HQ in Mineola.							

Winlink Message Template View

Winlink Check In

Setup

Click to add your agency/group name to title

Load Check in Data

Form Info

This is for an initial check in via Winlink Express. Also sent as plain text in message body for non-Express users.

Date/Time

2023-01-01 21:57:47

Select Status

Exercise

Net

REAL EVENT

Band

-N/A-

VHF

220

Mode

Telnet

Packet

Vara FM

Send To

KD2GXL

Clear ALL "Send To" Entries.

Entries will remain until you change or clear them

Calls Signs of Initial On-Site Operator(s)

KD2GRS

Station Contact Name:

Rob Jagde

Station Call sign

KD2GRS

Location

Red Cross, Mineola

Latitude and longitude: LAT

40.729167

LON

-73.708333

MGRS

18TXL0907609495

Grid

FN30dr

LAT/LON and MGRS default to the center of the grid square listed in Express Settings, unless a GPS is used or Lat/LON or MGRS must be entered manually. Without properly formatted GPS coordinates this form cannot be mapped in Winlink Express.

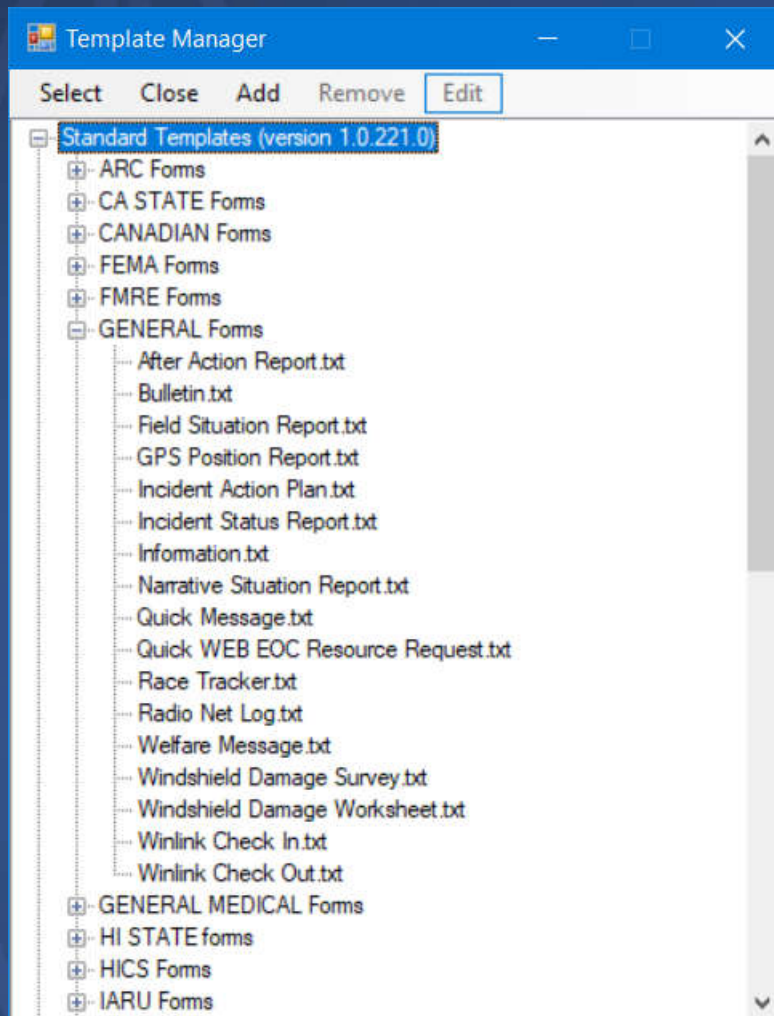
Comments

Max Characters 220

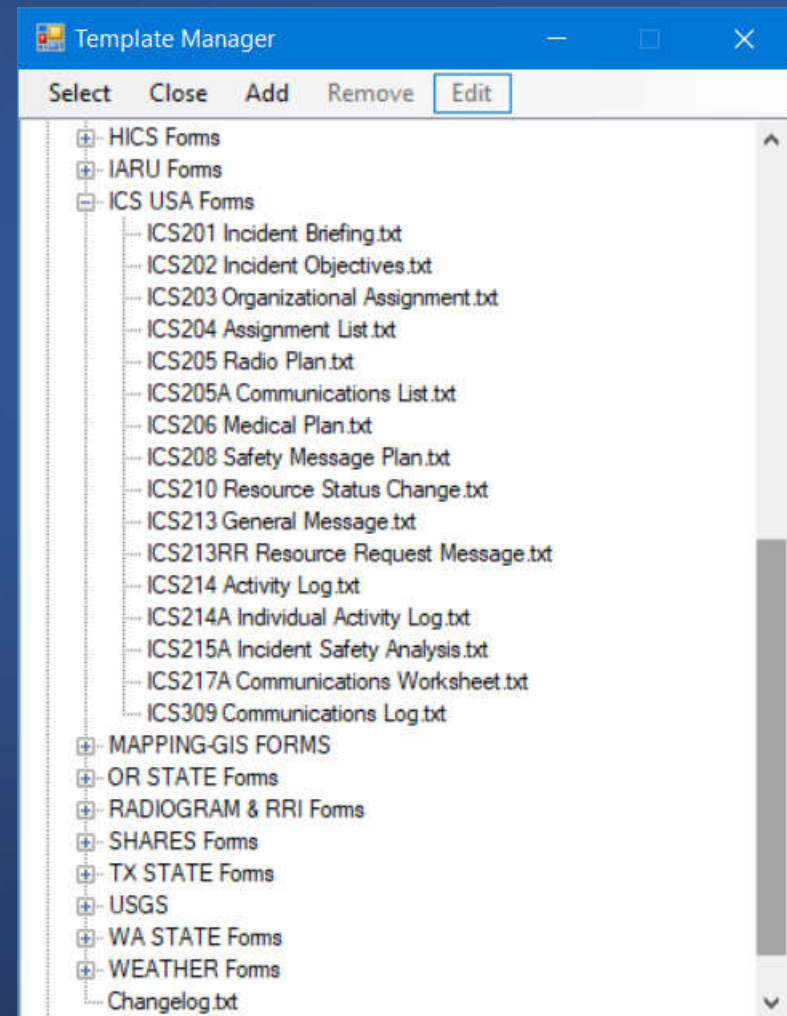
Radio room is operational at Red Cross HQ in Mineola.

Winlink Message Templates

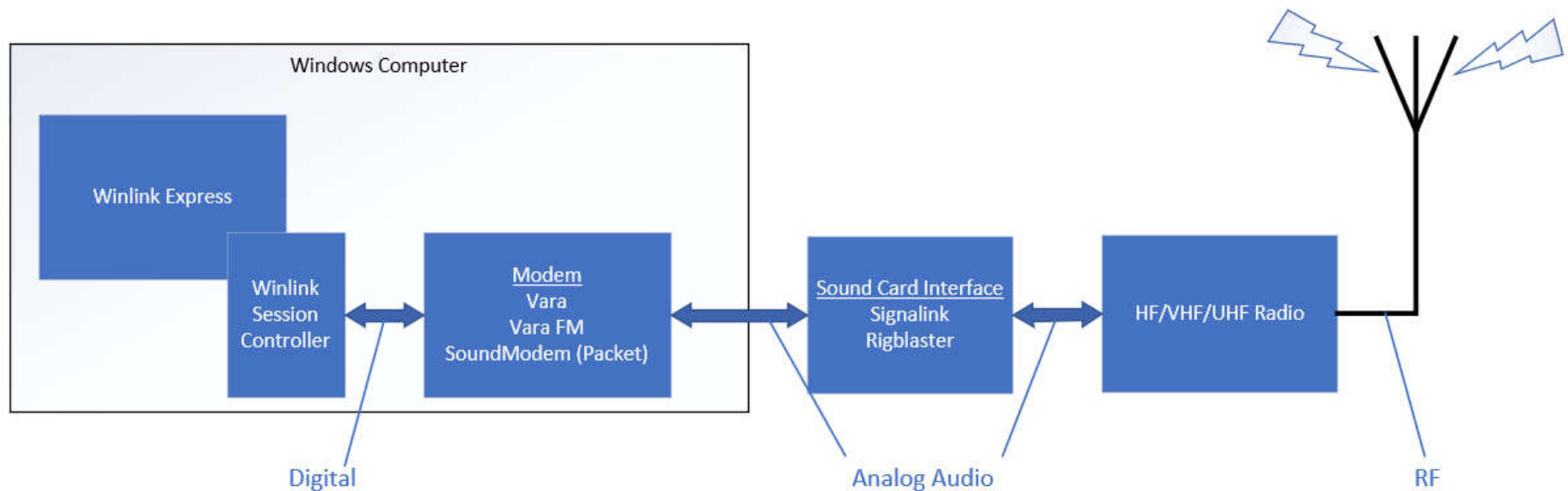
General Forms



ICS Forms



Typical Winlink Client Station (Block Diagram)



Winlink / Vara HF Client Session

The image displays two overlapping software windows. The background window is Winlink Express 1.7.3.0, showing a message list and folder structure. The foreground window is Vara HF v4.6.2, showing a control interface with various meters and status indicators.

Winlink Express 1.7.3.0 - KD2GRS

Menu: KD2GRS, Settings, Message, Attachments, Move To: Saved Items, Delete, Open Session: Vara HF Winlink, Logs

Help

In Vara HF Winlink session.

	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
Inbox (0 unread)	2022/12/23 01:18	FQVS3CL14WK4	219	KB2HWL	KB2HWL	ETO-02	winlink thursday
Read Items (0)	2022/12/22 20:12	QQUB5O4BO6MM	7451	KB1IGT	KB1IGT	ETO-01...	ICS 213RR- ETO-01,santa F
Outbox (0)	2022/12/21 19:01	5ZW08ALDSBAR	415	KC2YFX	KC2YFX	KD2GRS	ACK: Re:wl2k message for C
Sent Items (5)	2022/12/20 14:41	W82BOCI29ULC	427	W3NRN	W3NRN	KD2GRS	ACK: Re:wl2k message for C
Saved Items (179)	2022/12/20 01:01	UJCW77E8IKAA	415	KC2FYJ	KC2FYJ	KD2GRS	ACK: Re:wl2k message for C
Deleted Items (20)	2022/12/19 22:55	WUQGU921EZY8	1771	N2RQ	N2RQ	SMTP:kd2men@...	WL2K message for Decembe
Drafts (2)	2022/12/19 18:16	CHFVUV6HXADV	415	WA2YYL	WA2YYL	KD2GRS	ACK:
	2022/12/19 01:15	LEL8FYRT50ZA	410	K2IZ	K2IZ	KD2GRS	ACK:

System Folders: Inbox (0 unread), Read Items (0), Outbox (0), Sent Items (5), Saved Items (179), Deleted Items (20), Drafts (2)

Personal Folders: ARES_SET_2022 (41), COMEX 22-2 (11), ETO_20220120_In (42), ETO_20220120_Out (42), ETO_20220127_In (57)

Global Folders

Contacts: AC2KQ, AC2KQ@NCARESMAIL.NET, AK1NS, ARCN, ARES-DRILL, CTRIDST@REDCROSS.ORG, K2JBC, K2JBC@NCARESMAIL.NET, K2KNB@NCARESMAIL.NET, K2OL, K2OL@ARRL.NET, KA2IYI, KA2IYI@NCARESMAIL.NET, KC2AED@NCARESMAIL.NET, KC2FYJ, KC2FYJ@NCARESMAIL.NET

Vara HF Winlink Session - KD2GRS

Exit, Settings, Switch to Peer-to-Peer, Channel Selection, Map, Forecast, Best chan., Next chan., Start

W3LUZ Center Freq. (kHz): 3588.500 Dial Freq. (kHz): 3587.000 Bearing: 290

Favorites: Select Add to favorites Remove from favorites

Channel Free In: 0/0 Out: 0/0 BPM: 0/0 Disconnected

*** Launching VARA TNC
*** Successfully connected to VARA TNC.
*** Vara signal bandwidth is 2300 Hz.
*** Using lcom 7100, COM4, 9600 baud
*** Ready
*** This is a registered version of Vara TNC that can operate at full speed.

VARA HF v4.6.2 KD2GRS

Settings, View, Log*, Monitor, Help

Graph: bps (0.0 to 1.0)

Meters: VU (Audio Input: -17 dBFS), CPU (CPU Usage: 10%), AFC, S/N

Buttons: DATA, ACK, IDLE, NACK, BREAK, REQ, QRT

Bottom Bar: RX Disconnected, 500 LISTEN, TCP, BUSY

Complete Winlink Client Station



Note: 50W Mobile or 100W HF radio recommended for actual use.

Winlink Operating Modes

For efficiency, reliability and flexibility, the Winlink system provides three modes for transferring messages:

1. Conventional system that stores messages on CMS “backbone” servers.
2. Peer-to-Peer direct connections between two client stations without any use of Internet or infrastructure
3. Hybrid MESH network that transfers messages over long distances using radio-only HF forwarding.

Winlink Connection Modes

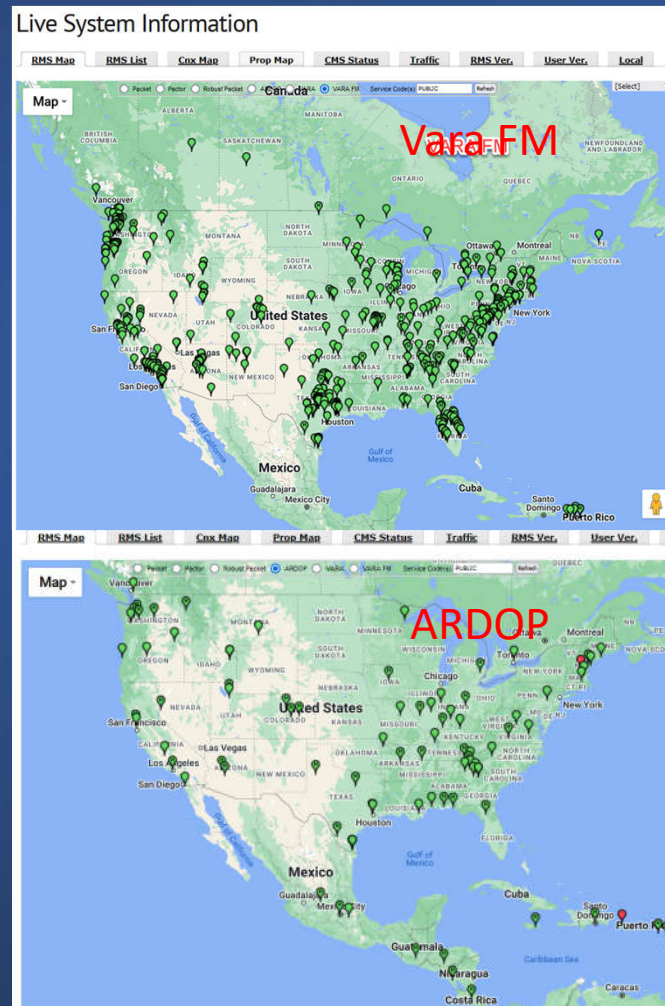
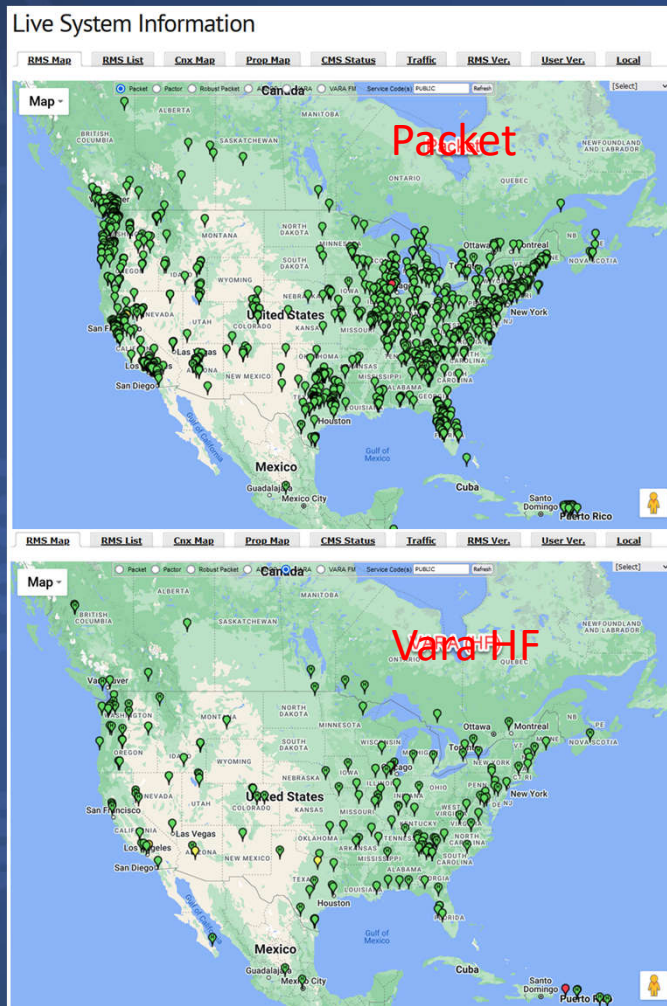
- **Telnet** – Non-radio connection through the Internet.
 - Good for training (no radio equipment required) and use if radio is down or network is busy.
 - Use if available! Quickest and easiest method to get message through.
- VHF/UHF Packet & Vara FM – Local Connections, Line of Sight
 - 1200 baud – Slower, but can use inexpensive TNC like TinyTrak-4, TNC-X, or even software based soundcard modems. Will work with virtually any FM radio.
 - 9600 baud – Fast, reliable, range limited and requires \$\$\$ modem (Kantronics or SCS Tracker). Radio must be 9600 capable. **Not that common.**
 - Vara FM – alternative to packet, potentially much greater throughput.
- HF – Long Distance Connections, depends on propagation
 - Vara HF – “Poor man’s Pactor”. Not as good as Pactor4, but operates with an inexpensive sound card device.
 - HF Pactor 1, 2, 3 and 4 – Fast and reliable but requires an expensive modem.
 - Pactor 4 only allowed in the United States by special FCC order.
 - ARDOP – used before Vara HF was introduced.
- All RF modes can be Peer-to-Peer

Winlink Connection Modes Performance

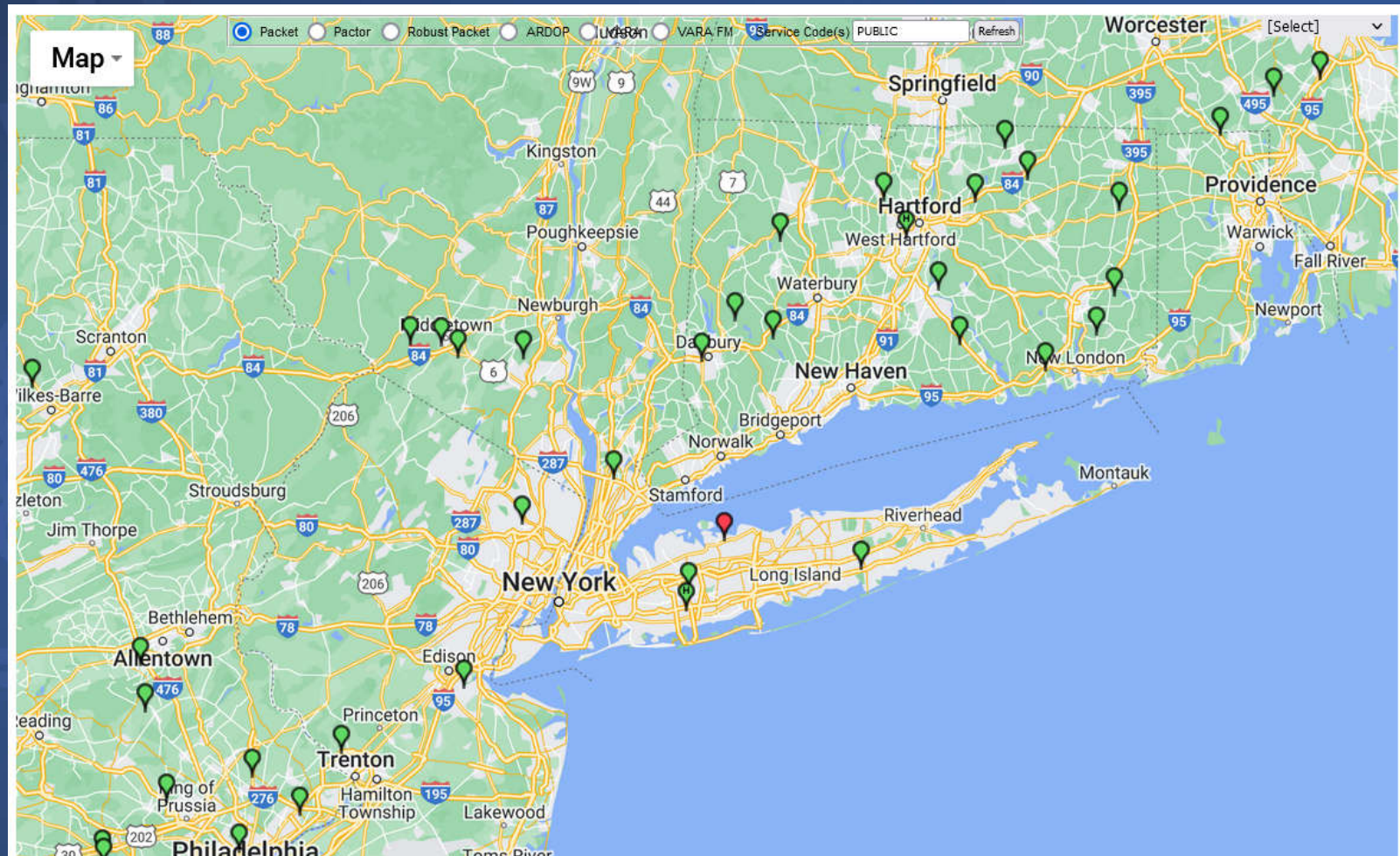
- Typical connection throughput with various Winlink modes.
 - Winmor has been discontinued.
 - ARDOP being phased out for Vara.
 - VARA (HF and FM) continue to improve.
- Jose Alberto Nieto Ros EA6HVK is the author of VARA-HF and VARA-FM. Winlink is supplied with standard speed versions of Vara, enhanced speed versions are available for purchase.
- NLI section primarily has 1200 bps 2M packet, one Vara FM station has been added recently.

Mode	Speed
Winmor (HF)	Up to 1300bps
ARDOP (HF)	Up to 4,000bps
Vara (HF)	Up to 7,000bps
Packet (V/UHF)	1200/9600bps ¹
Vara FM (V/UHF)	Up to 17,957bps

Winlink RMS in United States



RMS Station Map NLI (VHF Packet)



Determining an RMS to use.

- Winlink provides a list of possible RMS stations to connect to for each operating modes.
- This is based on your current location.
- For HF, there is a propagation prediction to further assist.

HF Channel Selector

ExitSelectUpdate Via InternetUpdate Via RadioMapForecastSFIAll RMS

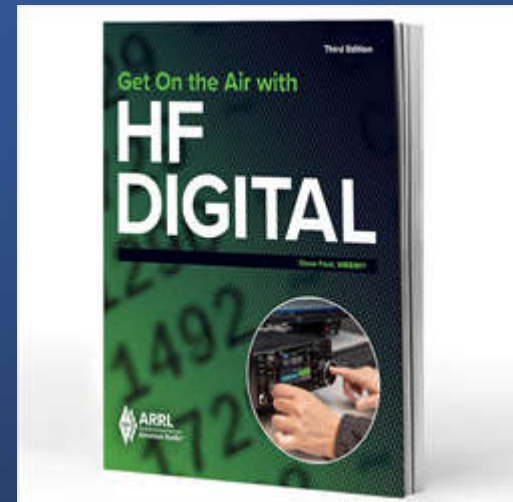
Callsign	Frequency (kHz)	Mode	Grid Square	Hours	Group	Distance (mi)	Bearing (Degrees)	Path Reliability Estimate	Path Quality Estimate
W3LUZ	3588.500	V500	FN21AH	00-23	PUBLIC	124	290	96	59
W1AW	3584.000	V500	FN31PR	00-23	PUBLIC	86	037	96	60
W1AW	3586.500	V2300	FN31PR	00-23	PUBLIC	86	037	96	60
K1EHZ	3578.500	V500	FN42EX	00-23	PUBLIC	188	034	96	59
K1EHZ	3596.500	V2300	FN42EX	00-23	PUBLIC	188	034	96	59
WA3MEZ	3587.500	V2300	FM19OJ	00-23	PUBLIC	187	242	96	59
W2GSA	7090.500	V500	FN20WG	00-23	PUBLIC	39	215	96	96
KB3PCY	3593.500	V2300	FM29EV	00-23	PUBLIC	116	241	96	59
W1EO	3597.900	V2300	FN42IM	00-23	PUBLIC	176	045	96	59
KD2DO-11	3588.500	V2300	FN13EC	00-23	PUBLIC	259	310	95	58
NA3MD	3593.500	V2300	FM18QT	22-10	PUBLIC	204	230	95	58
AJ4FW	7103.600	V2300	FM07BC	00-23	PUBLIC	415	235	95	58
WB3KAS	3590.000	V2300	FM18NR	00-23	PUBLIC	217	232	95	58
N2LEE	3595.000	V2300	FM18HX	00-23	PUBLIC	229	239	95	58
KD4JWF	7089.000	V500	FM06RH	00-23	PUBLIC	401	222	94	58
VA2XMP	5348.000	V2300	FN35BQ	00-23	PUBLIC	342	359	94	58
VA3ETN	3834.500	V2300	FN02FW	22-08	PUBLIC	336	299	94	57

How to Learn and Participate

- Install RMS Express software, register / sign up for Winlink.
 - <https://downloads.winlink.org/User%20Programs/>
- Join a local ARES group such as Nassau County ARES
 - <https://www.nassaucountyares.org/>
- EmComm Training Group – weekly and semi-annual drills:
 - <https://emcomm-training.org>
- Contact Lew, N2RQ at n2rq@arrl.net and ask to be placed on the Nassau County ARES Weekly Winlink Message (Monday nights).

Other Resources

- "Get On the Air With HF Digital 3rd Edition" - Steve Ford WB8IMY
 - <https://home.arrl.org/action/Store/Product-Details/productId/200374587>
- Excellent resource on connecting your radio to your computer and controlling it.



Credits / References

- Credit – some slides / graphics from:
 - Stanislaus County (CA) ARES
 - <https://www.stanares.org/wp-content/uploads/2019/04/Winlink-Express-Setup-and-Sending.pptx>
 - Communications Academy
 - Scott Currie, NS7C - Auburn Emergency Management
 - <http://comacademy.org/>
 - Winlink – web site, RMS Express help file
 - <http://winlink.org>
 - ARRL
 - <http://arrl.org/files/file/On%20the%20Air%20Email/Winlink%20spread.pdf>

Thank-you!



For further information contact:

Robert Jagde ADEC, KD2GRS – kd2grs@arrl.net

Visit <https://www.nassaucountyares.org/>