

The Winlink Radio e-Mail Network

E-mail with or without the Internet

Phil Sherrod
W4PHS

Developed by
The Winlink Development Team



Defense Secretary Leon Panetta warns of "Cyber Pearl Harbor".

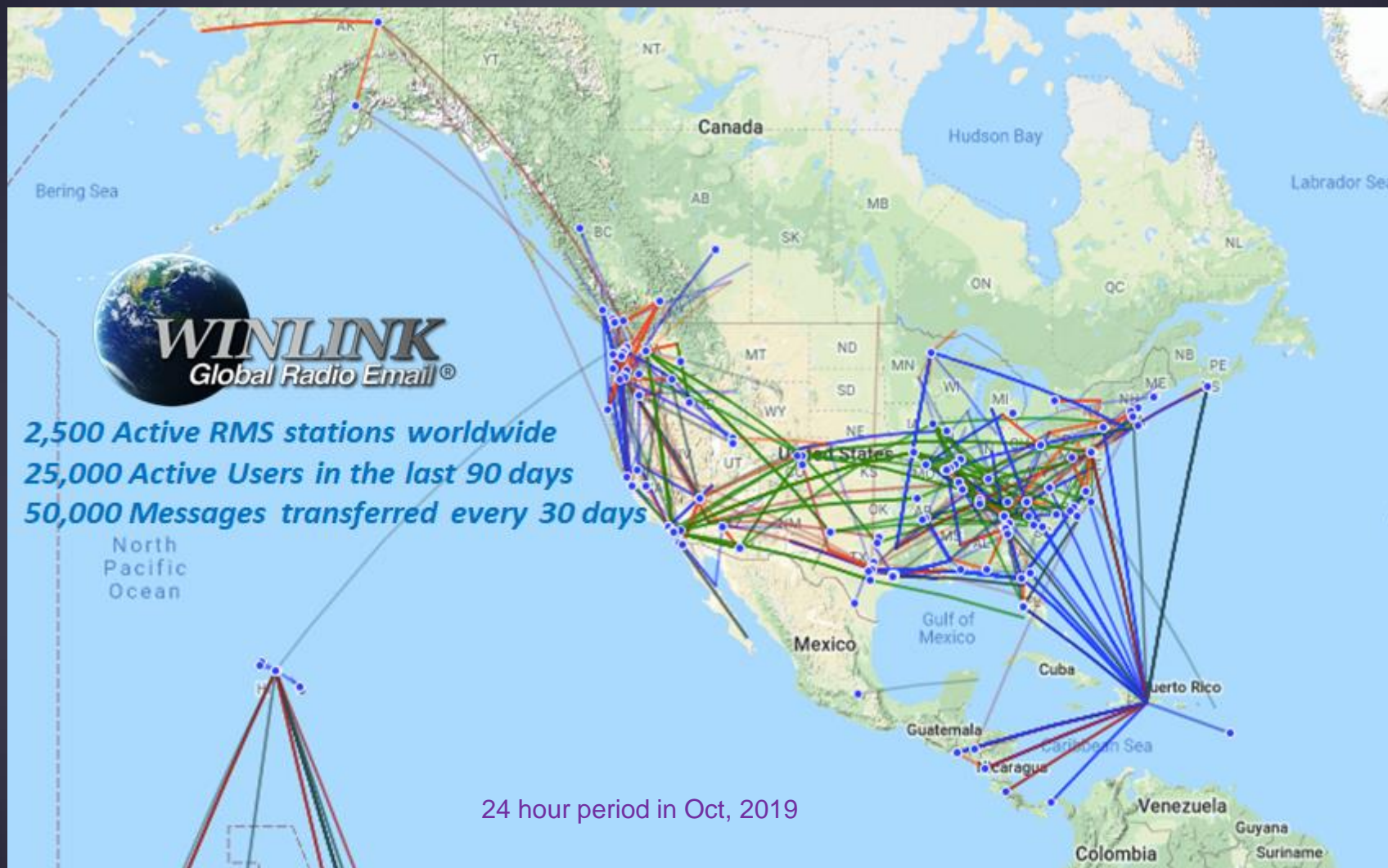
What is Winlink

- Worldwide system for sending/receiving e-mail via radio
- Provides e-mail from anywhere in the world.
- Mature, well-tested and full featured system.
- Adopted for contingency communication by many federal, state and county government agencies
- Used by the National Guard (14 units in Tennessee)
- Used by infrastructure-critical NGOs such as International & American Red Cross, Southern Baptist Disaster Relief, DHS Tiered AT&T Disaster Response & Recovery, FedEx, Bridgestone Emergency Response Team, etc.

Winlink Interoperability

- Connects amateurs, SHARES, MARS, NG, NGO, others
- HF – Pactor, Winmor, Vara, ARDOP
- VHF / UHF – Packet, Vara FM
- SMTP/POP/IMAP – Outlook and other mail clients
- MESH over microwave
- Iridium GO satellite connections
- APRS <--> Winlink bridge for e-mail
- Bridge to Internet e-mail allows connectivity to almost everyone in the world.
- A radio system is worthless unless it's interoperable with the person you want to reach.

Scope of Winlink System



Winlink Has Been Used in Many Incidents

TSA Activation



Demo for Congress



AT&T Disaster Recovery



Winlink System – Inexpensive & Portable

- Equipment for a Winlink station:
 - HF Radio and Power supply – Ham radios are fine
 - HF antenna – Must be frequency agile
 - Pactor modem
 - Cost about \$3,200



Why Do We Need HF Radio and Winlink?

- We have ever-expanding cell phone coverage, and – soon – FirstNet.
- You invested in a great public service radio system.
- So why do we need HF radio and Winlink...

- Because of hurricanes, ice storms, earthquakes, forest fires and many other events that knock out everything else.
- Because of its reach, HF radio can provide essential communication when all other communication is gone. Puerto Rico and New Orleans are good examples.

Disaster Assessment Picture – Kentucky Ice Storm



Kentucky Ice Storm 2009

Cell, Land-line or Fax? NO!

- Air Card? NO!

- Public Safety, Mutual Aid? NO!

- Satellite/Microwave? NO!

- Winlink Radio E-Mail?

Yes! Mobile from a TEMA vehicle.

This picture was one of several sent by TEMA mobile through the Winlink radio email system.

What Winlink Offers for EmComm

- Reliability, Accuracy and Flexibility:
 - High reliability (99.99% availability for 15 years)
 - 100% accurate message transmissions (ARQ protocol)
 - Radio connection bridge to Internet e-mail.
- Geographical dispersion and redundancy for reliability
- Interoperability – Winlink is used by *many* agencies and NGO. Even if they don't have a radio, you can send and receive Internet e-mail.

What Winlink Offers for EmComm (more)

- Standard e-mail format with many features
 - Binary file attachments (pictures, pdf, spreadsheets)
 - Automatic message compression/decompression
- Stores messages for pickup at a later time.
- Good operation at most power levels
- Not limited by station-to-station propagation
- Automatic message logging. ICS-309 report generation

Winlink Connection Modes

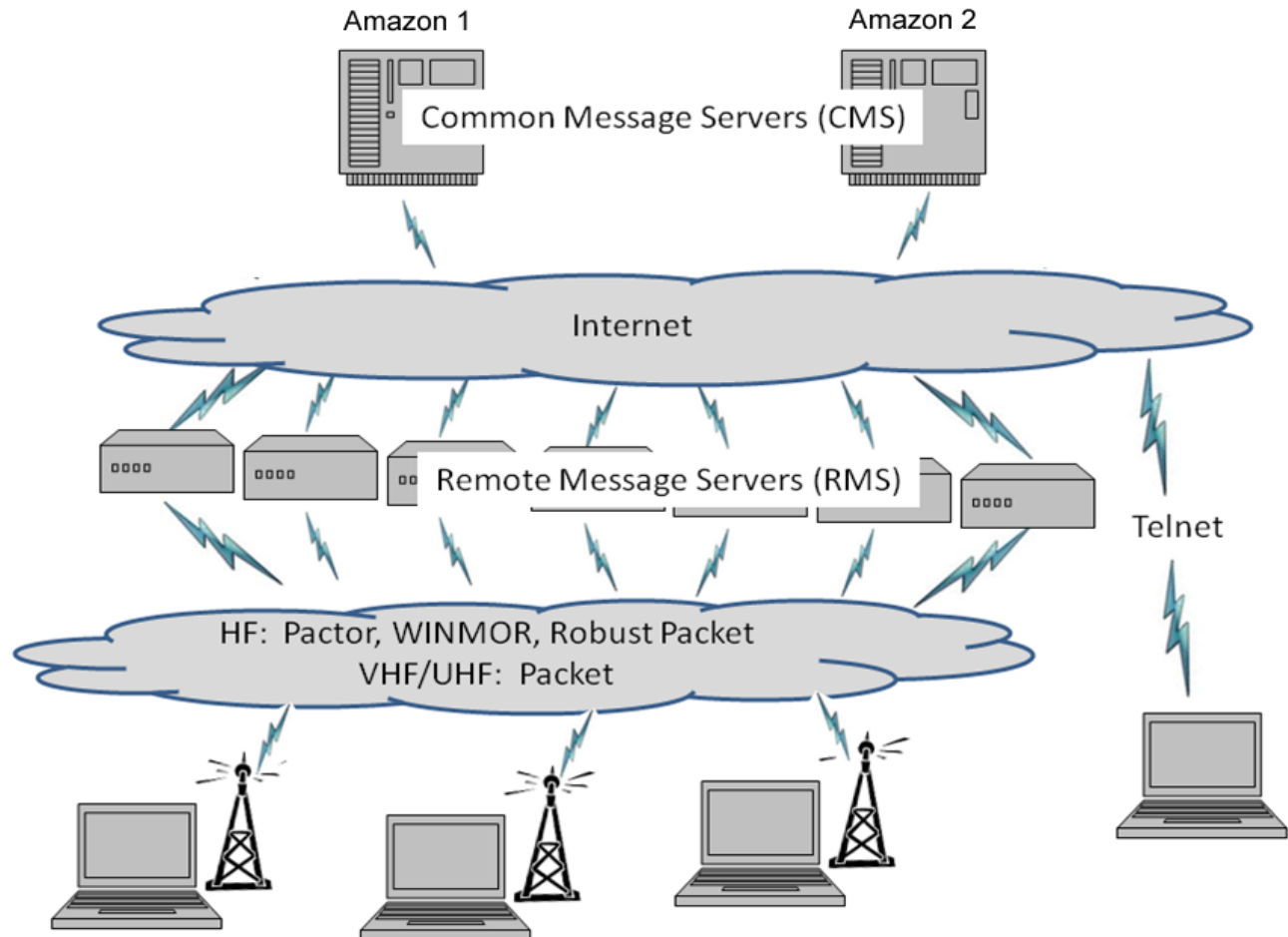
- **HF Pactor** – Fast but expensive - \$1,500.
- **HF WINMOR & Vara** – “Poor man’s Pactor”.
Uses soundcard. \$100 or \$0.
- **VHF/UHF Packet** – 9600 baud, \$400. 1200, \$100.
- **Vara FM** – Extremely fast. \$70. Uses soundcard.
- **Telnet** – Non-radio connection through the Internet.
Good for training or if no radio.
- **Iridium GO!** – Satellite phone connection.
- **MESH network** to Winlink “Post Office” (RMS Relay).

Winlink Operating Modes

- For efficiency, reliability and flexibility, the Winlink system provides four modes for transferring messages:
 - **Conventional** system that stores messages on CMS “backbone” servers. Uses Internet from RMS to CMS.
 - **Radio-Only (“Hybrid”)** network that transfers messages over long distances using automatic HF forwarding without the Internet.
 - **Peer-to-Peer** direct connections between two client stations without any use of Internet or Infrastructure.
 - **MESH Network**
 - **Peer-to-peer** through MESH between two Winlink Express.
 - **Post office server** hosted by RMS Relay.

Winlink Architecture (Conventional Mode)

- CMS
- RMS (gateway)
- Client (you)



Current Ham HF Pactor RMS Stations



Winlink Express RMS Channel List

HF Channel Selector									
Exit Select Update Table Via Internet Update Table Via Radio Forecast SFI All RMS									
Callsign	Frequency (kHz)	Mode	Grid Square	Hours	Group	Distance (mi)	Bearing (Degrees)	Path Reliability Estimate	Path Quality Estimate
WW4MSK	3592.500	P3, P2, P1	EM74UW	00-23	PUBLIC	159	117	89	57
AB4NX	3588.500	P3, P2, P1	EM73WT	00-23	PUBLIC	214	135	88	56
AJ4FW	3595.000	P3, P2, P1	FM07BC	00-23	PUBLIC	390	077	87	55
KC2HKU	3595.000	P3, P2, P1	EM85WX	00-23	PUBLIC	260	089	88	55
KA0NPJ	3591.000	P3, P2, P1	EM48VG	00-23	PUBLIC	244	311	87	55
W9DSR	3595.000	P3, P2, P1	EN51US	00-23	PUBLIC	405	349	83	54
KB5LZK	3598.500	P3, P2, P1	EM34UT	00-23	PUBLIC	321	256	85	54
KC8YJJ	3589.500	P3, P2, P1	EN90PL	00-23	PUBLIC	450	045	81	53
N2LEE	7102.500	P3	FM18HX	00-23	PUBLIC	554	066	74	53
KQ4ET	7102.700	P3, P2, P1	FM16XU	00-23	PUBLIC	600	081	81	53
KQ4ET	7101.500	P3, P2, P1	FM16XU	00-23	PUBLIC	600	081	81	53
W3JY	7100.400	P2, P1	FN20FA	00-23	PUBLIC	670	062	79	53
WB2LMV	7103.500	P3, P2, P1	FN21TS	00-23	PUBLIC	775	055	79	51
N3HYM-10	7102.500	P3, P2, P1	FM19FK	00-23	PUBLIC	557	062	68	50
N2LEE	3590.000	P3	FM18HX	00-23	PUBLIC	554	066	75	49
KQ4ET	3589.000	P3, P2, P1	FM16XU	00-23	PUBLIC	600	081	74	47
KC5TSU	3598.000	P3, P2, P1	EM13LD	00-23	PUBLIC	615	254	68	45

Estimate of Signal Path Quality

Winlink Express E-mail Client Program

Multiple modes

Multiple call signs

In-box, Out-box, etc.

Personal message folders

Contacts address book

RMS Express 1.1.7.6 - W4PHS

W4PHS Files Message Attachments Move To: Saved Items Delete Open Session: Pactor WL2K Logs Help

(Add call sign)

	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
	2012/05/15 10:44	R3HTZ06PDCVF	343	K1KY	K1KY	W4PHS ...	Service Code Error
	2012/05/07 09:05	FY7XIJ32L3VK	186	SMTP	SMTP:phil@phils...	W4PHS	Priority message
	2012/05/07 08:40	KMG4HK6PJ35M	1585	SMTP	SMTP:phil@phils...	W4PHS	Message with attachment

System Folders

- Inbox
- Read Items
- Outbox
- Sent Items
- Saved Items
- Deleted Items
- Drafts

Personal Folders

- Standard

Contacts

- AAA9AC
- AAR4MX
- AK4FA
- KA4OTB
- KB6BT
- KC0QOD
- KE3XB
- KI4PSR
- KK4AIZ
- KK4CQD
- KQ1Q
- PHIL
- PHS
- VA3LKI
- W4PHS

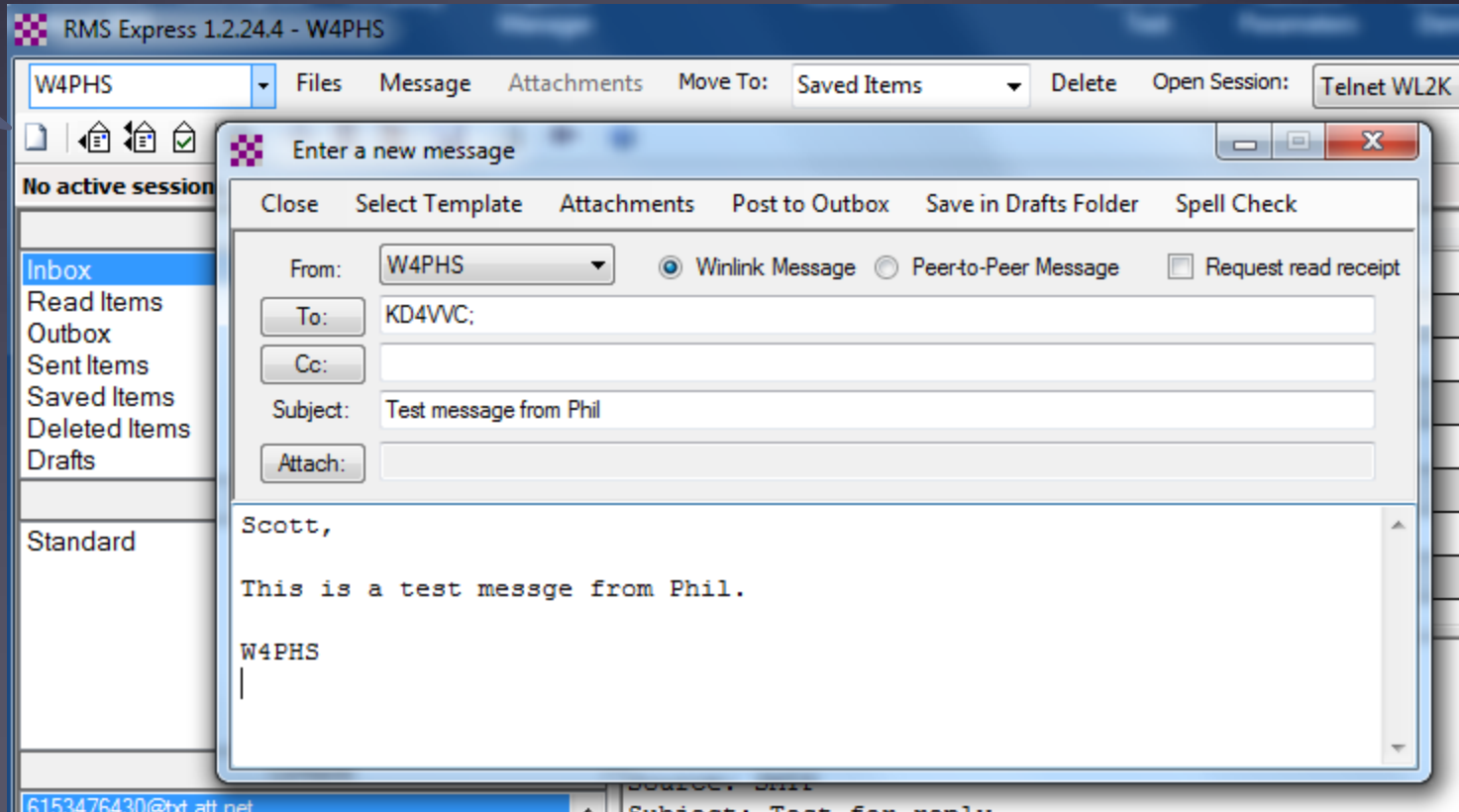
Message ID: KMG4HK6PJ35M
Date: 2012/05/07 08:40
From: phil@philsherrod.com
To: W4PHS
Source: SMTP
Subject: Message with attachment

----- NextPart_001_0354_01CD2C03.15A855D0
Content-Type: text/plain;
charset="US-ASCII"
Content-Transfer-Encoding: 7bit

This message has an attachment.

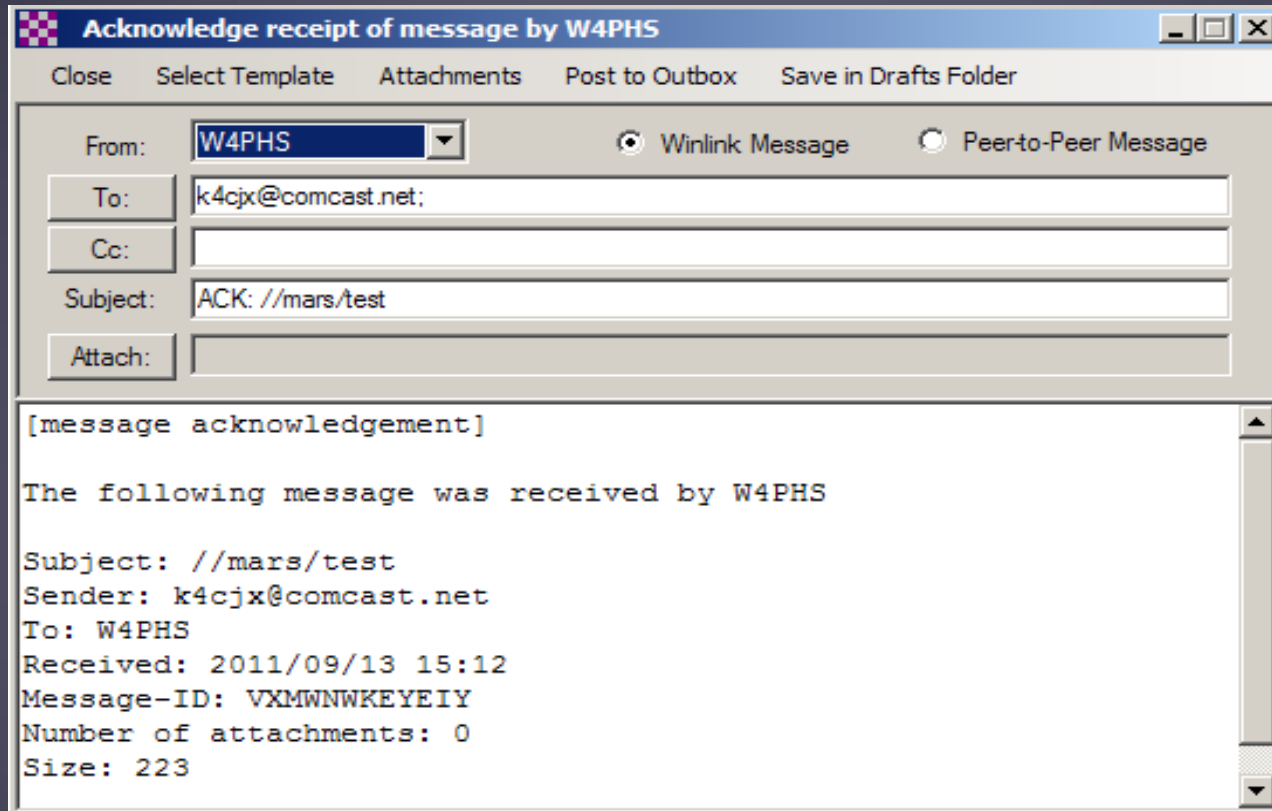
Composing a Message in Winlink Express

Click to start a message



Message Receipt Acknowledgements

- Positive acknowledgment that message was received
- Information about message filled in automatically



The screenshot shows a window titled "Acknowledge receipt of message by W4PHS" with a menu bar containing "Close", "Select Template", "Attachments", "Post to Outbox", and "Save in Drafts Folder". The form fields are as follows:

From:	W4PHS	<input checked="" type="radio"/> Winlink Message	<input type="radio"/> Peerto-Peer Message
To:	k4cjsx@comcast.net;		
Cc:			
Subject:	ACK: //mars/test		
Attach:			

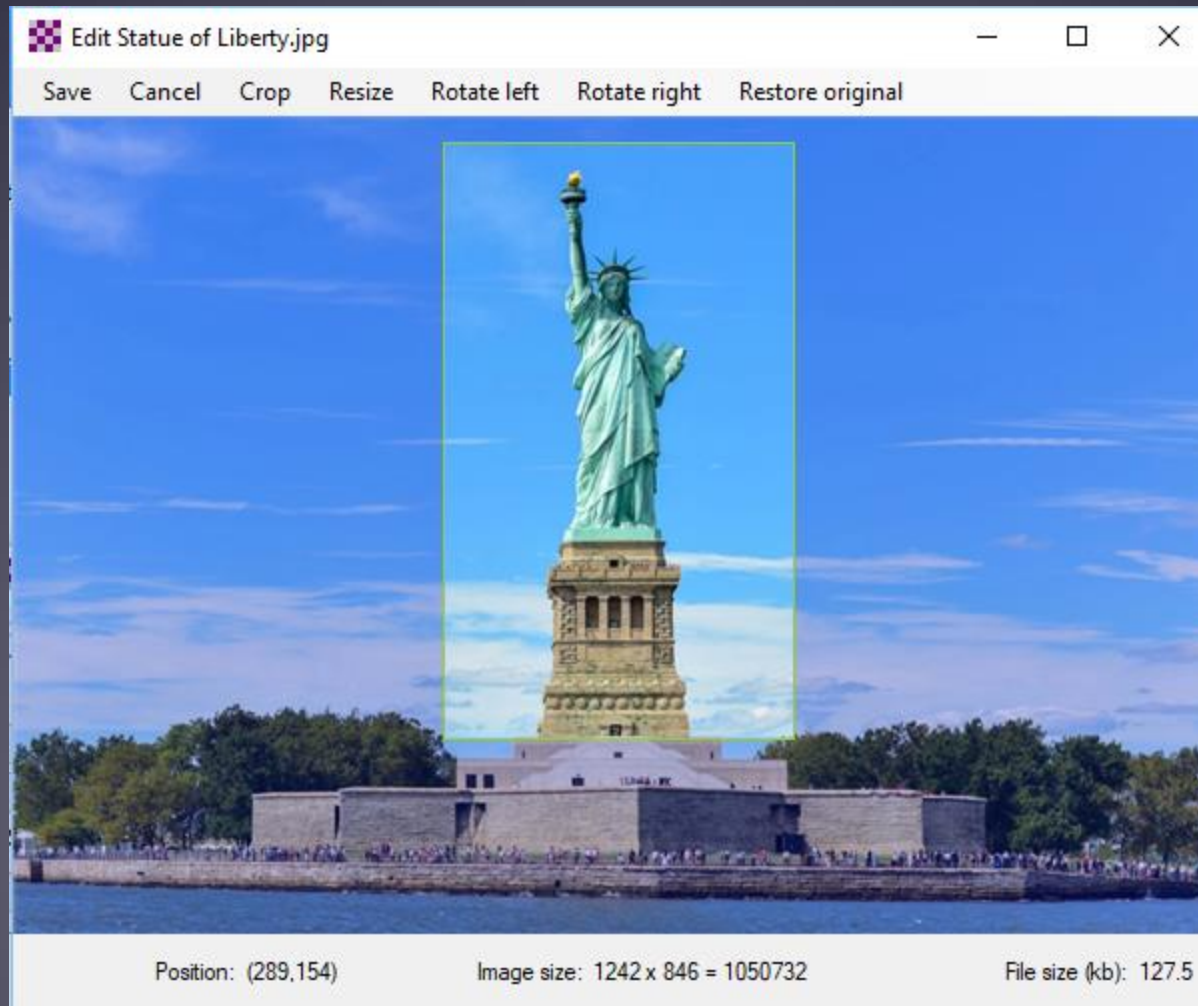
The main text area contains the following message acknowledgment:

```
[message acknowledgement]

The following message was received by W4PHS

Subject: //mars/test
Sender: k4cjsx@comcast.net
To: W4PHS
Received: 2011/09/13 15:12
Message-ID: VXMWNWKEYEYIY
Number of attachments: 0
Size: 223
```

Built-in Picture Cropping/Resizing



Winlink Catalog Requests

Winlink Query Catalog

Categories	Inquiry ID	Description	Size
METAREA_IV	ALIR.JPG	GOES IR Sat Image for Gulf of Alaska	42406
METAREA_IX	ALVS.JPG	GOES Visible Sat Image for Gulf of Alaska	55545
METAREA_V	BAJA_GOM.JPG	GOES Sat Pix of Baja and Gulf of Mex	39126
METAREA_VI	CAIR4.JPG	GOES IR Sat Image for Caribbean	87492
METAREA_VII	EUMETSAT	MET-9, MET-7, MTSAT1R, GOES11 and GOES13 (DWD)	315538
METAREA_VIII	GEIR.JPG	Eastern Pacific Southern Hemisphere IR	64937
METAREA_X	GLAPXRBL.JPG	GOES-East Gaylord, MI	57861
METAREA_XI	GLCURIR.GIF	GOES-12 Current IR satellite Imagery for Great Lakes	57861
METAREA_XII	GLCURVS.GIF	GOES-12 Current Visible satellite Imagery for Great Lakes	57861
METAREA_XIII	GLCWV.GIF	Great Lakes - Lake St Clair Wave Height	57861
METAREA_XIV	GLDLHRBL.JPG	GOES-East Duluth, MN	57861
METAREA_XV	GLDTRBL.JPG	GOES-East Detroit/Pontiac, MI	57861
METAREA_XVI	GLESFCUR.GIF	Great Lakes - Lake Erie Surface Currents	57861
NAVIMAIL	GLEWN.GIF	Great Lakes - Lake Erie Winds	57861
PROPAGATION	GLGRBRBL.JPG	GOES-East Green Bay, WI	57861
S/PACIFIC_WX	GLGRRRBL.JPG	GOES-East Grand Rapids, MI	57861
SAT_KEPS	GLHSFCUR.GIF	Great Lakes - Lake Huron Surface Currents	57861
SAT_PIX	GLHWN.GIF	Great Lakes - Lake Huron Winds	57861
UK_CADET	GLHWV.GIF	Great Lakes - Lake Huron Wave Height	57861
US_FIRE_INFO	GLMKXRBL.JPG	GOES-East Milwaukee, WI	57861
WL2K_FORMS			
WL2K_HELP			
WL2K_RMS			
WL2K_USERS			
WX_AK_COAST			
WX_ARCTIC			
WX_ATLANTIC			
WX_AUS			
WX_AUS_RAD			
WX_BC_COAST			
WX_BERMUDA			
WX_BRAZIL			
WX_BUOY			
WX_CANADA			
WX_CANARIES			

Selections

Double click to add or delete query selections.

Post Request

Last Update
0000-00-00 00:00

Update catalog list

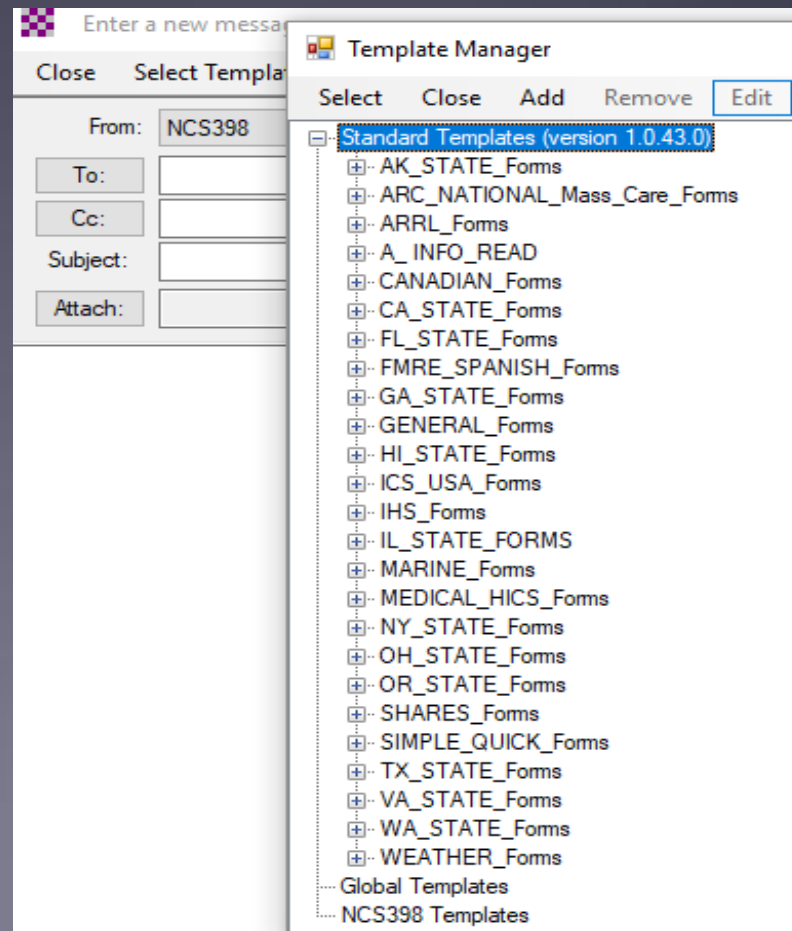
Update via Internet

Request update via radio

Cancel

Message Templates & Forms

- Winlink Express has built-in message templates and html forms.



Example 213 Message Form

General Message (ICS 213)		
1. Incident Name: Test 213 message form		
2. To (Name/Position): Phil Sherrod		
3. From (Name/Position): Phil Sherrod		
4. Subject: Test message sent as an ICS 213 form	5. Date: 2019-7-11	6. Time: 12:44
7. Message		
Situation at shelter:		
23 persons currently being held.		
20 adults and 3 children		
1 dog		
Running on generator power. Estimated fuel 12 hours.		
Food available for today, but not tomorrow.		
Water sufficient for two days.		
10 additional blankets needed.		
Dog food needed		
8. Approved by: Phil	Position / Title: Shelter RADO	

Built-in ICS-309 pdf Message Log Generator

Generate ICS-309 Communication Log

Generate an ICS-309 Communication Log as a pdf File

Select Message Mailboxes

Inbox Outbox Drafts Personal 1: Standard

Read Sent Deleted Personal 2: High Priority

Saved

Message Date Range

Limit start date/time: 2017-08-01 08:15 (Local time)

Limit end date/time: 2017-09-02 14:15 (Local time)

Options

Separate entry for each recipient

Combine recipients into a single entry

Task ID: Winlink Training

Task Name: Winlink Training

Operational period: Training period

Operator name: Phil

Station ID: W4PHS

Output pdf file: c:\test\309.pdf

COMMUNICATIONS LOG		TASK # Winlink Training	DATE PREPARED: 2017-09-13
OPERATIONAL PERIOD # Training period		TASK NAME: Winlink Training	TIME PREPARED: 08:02
RADIO OPERATOR NAME: Phil		STATION ID: W4PHS	
LOG			
TIME	FROM	TO	SUBJECT
2014-11-19 19:35	sub-server@sa1doos.com	W4PHS	GF S:31N,19N,090W,074W
2014-12-01 19:30	K4DK	W4PHS	/JWL2K Net announcements 12-01-14
2014-11-19 10:00	phil@philherod.com	W4PHS	Test
2014-11-19 10:28	phil@philherod.com	W4PHS	Test 3
2014-11-21 09:13	H8NDSE	W4PHS	/JWL2K P2P Scanning for Favorites
2014-12-03 15:16	N8KZB	W4PHS	/JWL2K FW: Unable to route message to W3NRG
2014-11-22 19:35	sub-server@sa1doos.com	W4PHS	GF S:31N,19N,090W,074W
2014-11-25 08:10	NNS4UR	W4PHS	Test folder
2014-11-24 19:22	K4DK	W4PHS	/JWL2K Net announcements 11-24-14
2014-12-01 15:52	judgeforresten@yahoo.com	W4PHS	Re: /JWL2K Winlink message with attachments from Phil Herod
2014-12-18 19:23	K1KY	W4PHS	P2P Message Test from K1KY-T2
2014-12-18 19:26	K1KY	W4PHS	Re: Greetings from Phil
2014-12-19 12:18	K1KY	W4PHS	Twinet P2P Message test to 2 addys
2014-12-19 12:33	W4CAT	W4PHS	Test message from W4CAT - Galatin over the MESH
2014-12-18 22:32	W4CAT	W4PHS	P2P Test from LaVergne K1KY-CP1 station via MESH to SMYRNA to Internet
2014-12-18 22:31	k4cp@comcast.net	W4PHS	Re: /JWL2K FW: K1KY-CP1 MESH Winlink Message to K1KY-T2
2014-12-11 17:09	K1KY	W4PHS	/JWL2K K1KY-10 9600 BAUD WINLINK RMS BACK ON THE AIR!
2014-12-18 17:48	K1KY	W4PHS	/JWL2K K1KY KPC 9612+ Winlink Settings in my RV
2014-12-19 00:48	K1KY	W4PHS	/JWL2K FW: P2P test Message from Galatin to Smyrna via MESH - Winlink
2014-12-18 19:15	k4cp@comcast.net	W4PHS	Re: /JWL2K K1KY KPC 9612+ Winlink Settings in my RV
2014-12-16 21:39	K1KY	W4PHS	/JWL2K FW: K1KY-CP1 MESH Winlink Message to K1KY-T2
2014-12-31 12:07	ADMIN	W4PHS	New Web App: Sysop's Message Monitor
2015-01-07 08:02	W4CAT	W4PHS	/JWL2K RMS Post Office Test
2015-01-08 09:14	W4CAT	W4PHS	/JWL2K Delivery time
2015-01-08 10:44	K1KY	W4PHS	/JWL2K Re: Greetings from Phil
2015-01-08 09:08	W4CAT	W4PHS	/JWL2K 1MB File - RMS Post Office
2015-01-08 09:11	W4CAT	W4PHS	/JWL2K Here are 2 files - nearly 2MB total
2015-01-08 12:03	W4CAT	W4PHS	/JWL2K 2 Mb transmit time 1:30
2015-01-08 12:30	K1KY	W4PHS	/JWL2K 2mb receive time 1:40
2015-01-08 18:31	K1KY	W4PHS	/JWL2K 3.13MB File received via MESH
2015-01-08 12:11	W4CAT	W4PHS	/JWL2K 3.13 MB transmitted 2:15
2015-01-08 18:23	K1KY	W4PHS	/JWL2K 3.13 MB file transfer time over MESH
2015-01-08 13:03	W4CAT	W4PHS	/JWL2K 3.2MB Max tested successful
2015-01-08 18:45	K1KY	W4PHS	/JWL2K 2nd test via MESH 3.13 mb file upload time 8:11
2015-01-08 19:07	K1KY	W4PHS	/JWL2K RMS Relay View Log status issue
2015-01-08 12:00	W4CAT	W4PHS	/JWL2K Large file test 2Mb
2015-01-08 12:07	W4CAT	W4PHS	/JWL2K 3 Mb file transfer test
2015-01-08 13:01	W4CAT	W4PHS	/JWL2K 3.2 MB File attempt

What if the Internet is Down?

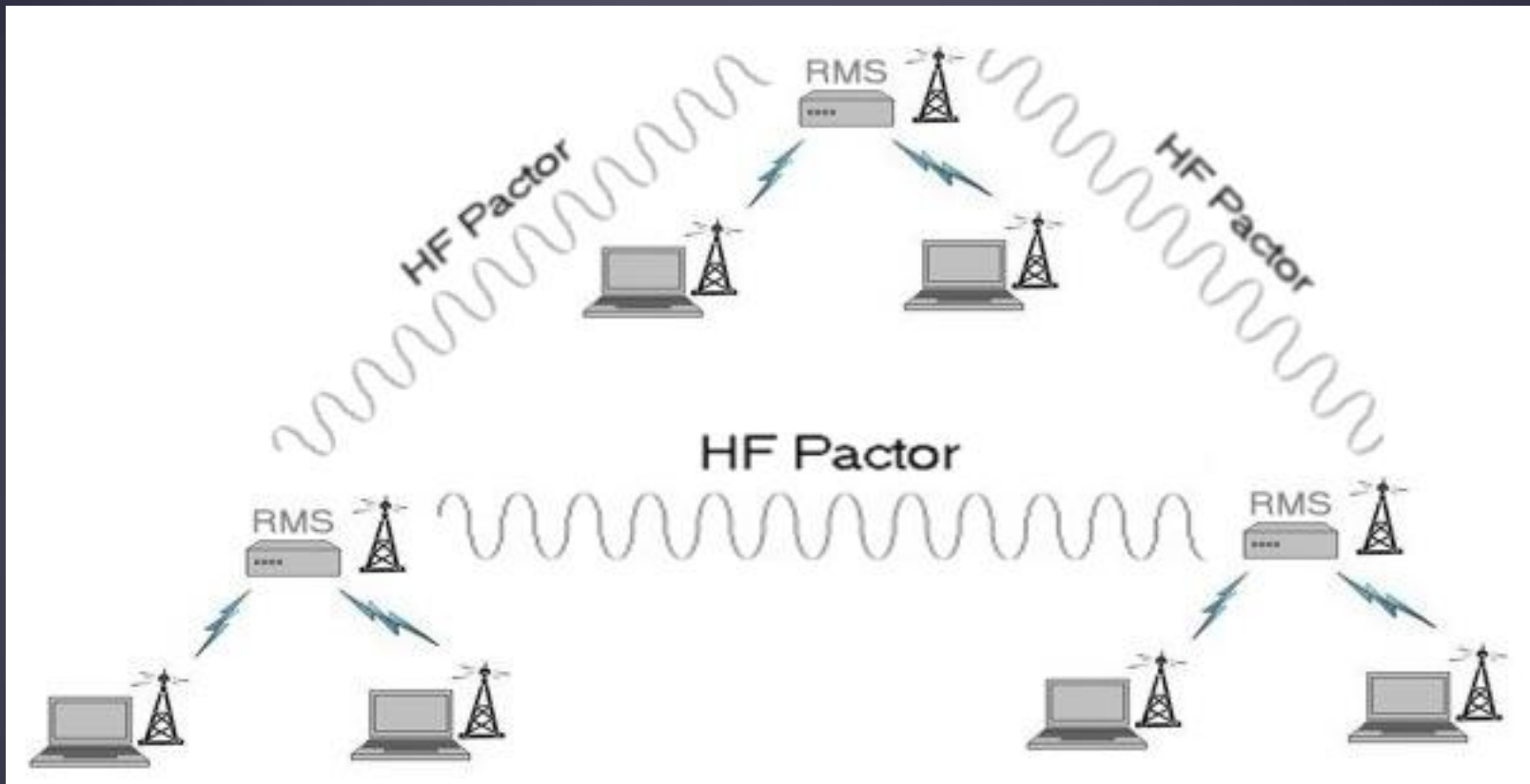
- Winlink offers a contingency “Radio-Only” operating mode that transfers messages without using the Internet.
- Not for use under normal circumstances, but it’s there if the need ever arises.

Concern About “Cyber-Pearl Harbor” Attack

- “The most destructive possibilities, Mr. Panetta said, involve ‘cyber-actors launching several attacks on our critical infrastructure at one time, in combination with a physical attack.’ He described the collective result as a ‘cyber-Pearl Harbor that would cause physical destruction and the loss of life, an attack that would paralyze and shock the nation and create a profound new sense of vulnerability.’”

The New York Times, October 11, 2012

Radio-Only Winlink Network (No Internet)



Pros and Cons of Radio-Only Network

- **Advantages:**

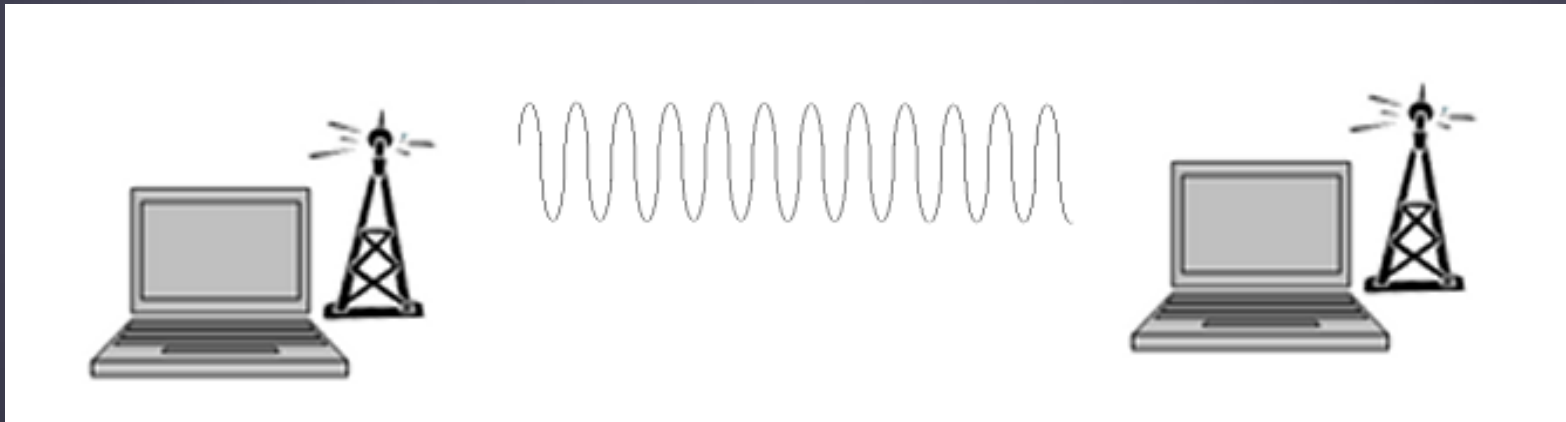
- Operates completely independent of the Internet.
- Fully automatic routing and forwarding.
- Automatic routing around unavailable RMS

- **Disadvantages:**

- Messages must be picked up from designated Message Pickup Stations (MPS).
- There is a delay in message delivery due to relaying.
- Reduced message traffic capacity due to HF relaying.
- Cannot send messages to Internet e-mail addresses.

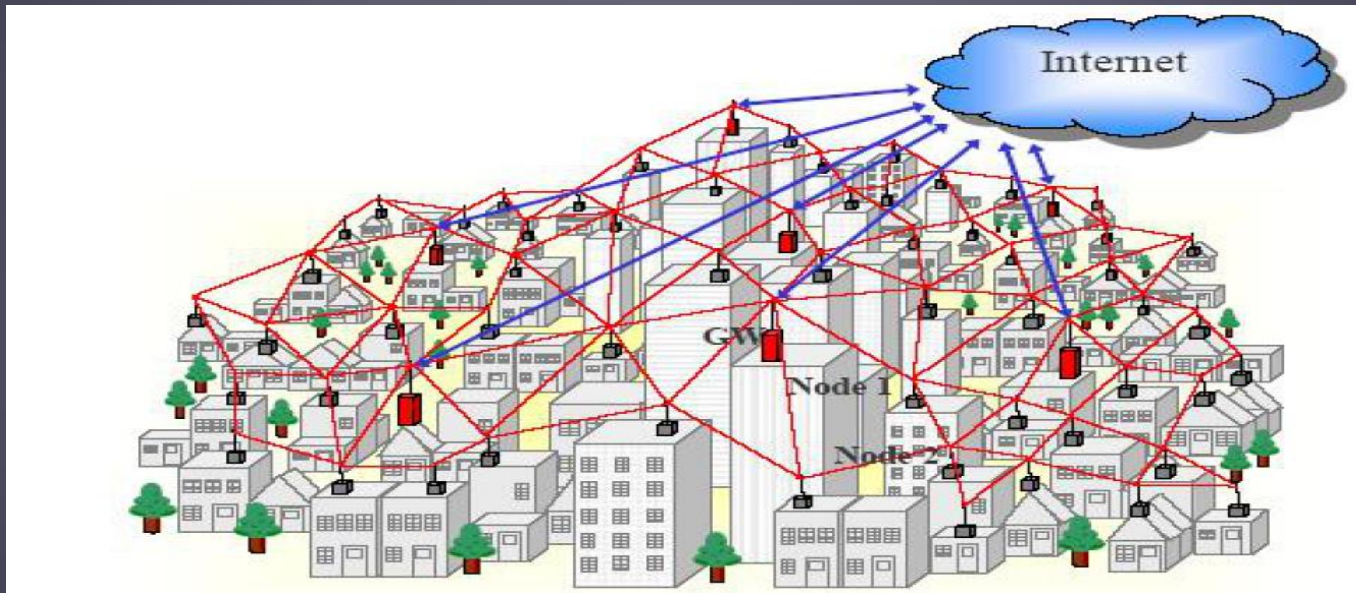
Winlink Peer-To-Peer Radio-Only Operation

- Peer-to-peer: direct radio connection between end-users
- The Internet is not used, all communication by radio.
- Only the two client stations are involved.
- 100% error-free transmission and file attachments.



Winlink and Wi-Fi/Microwave MESH Networks

- Wi-Fi based MESH is rapidly growing among amateur operators and civil agencies.
- Provides Internet speeds using inexpensive microwave Wi-Fi equipment.



Winlink over MESH Networks

- Winlink Express and RMS Relay have been adapted to work with MESH networks and LAN connections.
- RMS Relay can provide a MESH post office server where Winlink messages can be stored and picked up.
- Winlink Express can connect to Winlink MESH post office servers.
- SMTP, IMAP and POP connections to a RMS Relay post office server also are supported.
- RMS Relay can synchronize messages between multiple post offices over the network.

Iridium GO Satellite Connections

- Winlink Express supports the Iridium GO sat phone.
- Winlink Express dials, makes the connection, sends/receives e-mail all automatically.



Conclusion

- Proven availability, reliability and accuracy.
- Winlink use continues to grow, especially for EmComm.
- The Winlink Development Team continues to enhance capabilities to adapt to changing needs and new technology.
- Winlink now has four modes of operation:
 - Conventional connections to a CMS backbone server
 - Hybrid (Radio-only) MESH network with HF relaying
 - Peer-to-Peer connections between client stations
 - Broadband, Wi-Fi MESH networks.
- Steady improvements are being implemented.



- Thank you.
- Questions?
 - Phil Sherrod, W4PHS, NCS398
- Information about Winlink can be found at www.winlink.org
- White papers about Winlink can be found at www.qrz.com/db/W4PHS