Global Radio E-Mail System for EmComm usage
Example of EmComm usage

- **Rescue of the *Bounty* by WinLink**

Destruction during Hurricane Sandy 140 km east of USA-eastcoast, Fall 2012
Example of EmComm usage (II)

- Distress call via Maritime mobile Net (HF) and satellite phone failed
- Cpt. Robin Walbridge, KD4OHZ sent an E-Mail to US Coast Guard via PACTOR on HF (WinLink)
- 14 out of 16 crew members were rescued
- KD4OHZ and another crew member lost
Example of EmComm usage (III)

- Hurrican Cathrina 2005
- Amerikan Red Cross and Hams established a HF Network (HFLink) in split mode
- Mode: Automatic Link Establishment (MIL STD 181-141 + 188-110)
Requirements of digital modes for EmComm

- Communication with non-ham stations (AtC, AtA) → E-Mail, SMS etc.
- Asynchron Communication
- Availability independent of QTH (global)
- Internet connection to address non-hams
- Balance robust/fast/cheap
- Less Hardware requirements as possible
- Error free (error correction)
Requirements of digital modes for EmComm (II)

- easy to handle (intuitiv)
- Interoperability
- Adaptation of international standards (eg. WRC)
- Redundant and decentral network structure
Systems / networks

- WinLink 2000
- jPSKmail
- SCSmail
- RFSM 2400/8000
• WinLink 2000 - E-Mailnetwork for **hams** and **sailors** (HF/VHF/UHF); call@winlink.org
• global availability (established infrastructure)
• Redundant and synchron CMS (failsafe through intercontinentally redundancy)
• Error correction procedures
• Bulletins (e.g. weather, keps, broadcasts)
• different modes (interoperability): PACTOR, WINMOR, ALE, PR, D-STAR, (HamNet)
• robust soundcard modes (WINMOR, PR)
• high data transfer rates (PACTOR III and IV) up to 25 kbytes/Min @2,4kHz on HF
• File-recovery
• Peer-to-Peer (P2P)
• Automatically forward via HF if internet loss occurs (ROWN)
WinLink Topology
## HF Channel Selector

<table>
<thead>
<tr>
<th>Callsign</th>
<th>Frequency (kHz)</th>
<th>Mode</th>
<th>Grid Square</th>
<th>Hours</th>
<th>Group</th>
<th>Distance (km)</th>
<th>Bearing (Degrees)</th>
<th>Path Reliability Estimate</th>
<th>Path Quality Estimate</th>
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</table>
HF-Betriebsarten

• **WINMOR**
  – Sound card FSK and PSK 500/1600Hz

• **PACTOR I-IV (J2B)**
  – TNC-based FSK, DQPSK and QAM

• **Automatic Link Establishment (USA MIL-STD)**
  – soundcard 8FSK @2kHz
WINMOR

Need:
• SSB-Transceiver with VOX or CAT
• PC + Soundcard
• Soundcard interface

Software: RMS Express OR Airmail + BPQ32

Jakob P. Strickler, DK3CW EmComm liaison officer F05
• WINMOR (WinLink Mail over radio)
• OFDM (Orthogonal Frequency Division Multiplexing) modulation @ 500Hz and 1600Hz
• **500 Hz:** BW 2 carriers 46.875 Baud 4FSK or 93.75 baud PSK at TCM 4PSK, 8PSK or 16PSK
• **1600 Hz:** BW 8 carriers 46.875 Baud 4FSK or 93.75 baud PSK at TCM 4PSK, 8PSK or 16PSK
• Fehlerschutz: CRC, (RS)-FEC, Viterbi, ARQ
WINMOR TNC (Example 15 Car QPSK)

16QAM Circular Constellation
(White Gaussian Noise @ 5dB)
Each pixel = 1 symbol

Receive Level
Tuning Offset

”+” 3 Carriers decoded OK
Relative decode Quality
1 KHz waterfall

WINMOR Sound Card TNC
Settings Abort Help Select Test On Line Log
Connection State
IRS
Connected to: KN6KB
Transmit
Xmt Frame:

Data bytes queued: 0
Data bytes confirmed: 0

Rcv Level:
Offset:

0.0 Hz
-200 0 +200

Queued: 0 Sequenced: 2304
Rcv Frame: Long 3 Car 16QAM data

Decoding Quality 100

Waterfall 1 KHz
• **Advantages:**
  – Cheap (no need of expansive TNC)
  – Little setup, little weight:
    QRP-Transceiver (5W) + NVIS/Lngw-Antenne + Netbook
    + 12V/12Ah accumulator (buffered flexible solar panels)
  – 500Hz modus garants robust Connection during QRM
  – 1600Hz garants fast data throughput (need +6db S/N)

**Disadvantages:**
Not appropriate for large files (>20kb)
Portable-Setup for WINMOR:
- OE7/DK3CW/P
- FT-817ND, 5W
- Self made soundcard interface
- Netbook 1,1 GHz Dualcore, 2GB RAM, OS Windows XP
- 30m end-fed longwire, 6m abt. the ground
- 12V/12Ah accumulator
- QTH: A Valley in Tirol OE7

- ODX: OH4 on 40m by 2 Car 4FSK@500Hz
- Max. data throughput:
- DH2LC on 30m mit 8 Car 16PSK (=max. 1300Bit/s)
PACTOR I-IV

Need:
• SSB-Transceiver with data jacket
• PC + RS232/USB
• PACTOR-Controller (PTC/TNC)

Software: OR
• RMS Express
• Airmail
• Paclink
• PACTOR (Packet Teleprinting over radio)
• PACTOR I: 2AFSK@500Hz with 200Bit/s
• PACTOR II: 14DPSK@500Hz with max. 1200Bit/s
• PACTOR III: 18PSK@2400Hz with max. 5200Bit/s
• PACTOR IV: 32QAM@2400Hz with max. 10500Bit/s
• Modulation: (A)FSK, (D)PSK, QPSK und QAM
• Error correction through FEC and ARQ
• Huffman-Compression
• (Text) Pseudo-Markov-coding (Huffman * 1,3)
• Capital letter mode
• Run-length encoding
Benötigt:

- SSB-Transceiver mit VOX oder CAT
- PC + soundcard
- Soundcardinterface

OR

MIL ALE Rig

Software:

PCALE  ODER  MARS ALE
• automatic establishment of HF links due to propagation analysis (comparison of BER)
  Modulation: 8FSK
• primary selective calling, but can be used for short messages and position reports (WinLink, SMTP E-Mail, SMS)
• global HFLink Network with Pilotstations (cf. RMS)
• FEC and optional ARQ
• **Advantages:**
  – Military standard USA MIL-STD 188-141 / 188-110
  – Automatic Establishment due to live propagation analysis
  – No need of trying different bands, just start calling
  – WSPR alternative (cf. SSB bandwith)

• **Nachteile**
  – ALE is accident-sensitive (2200Hz BW)
Packet Radio 9k6

Nees:
- FM-Transceiver (with data jacket)
- PC
- TNC or Soundcard

Software:
- RMS Express
- Airmail
- Paclink

Jakob P. Strickler, DK3CW
EmComm liaison officer F05
APRSLink / Packet Radio 1k2

Needs:
- FM-Transceiver (with Data jacket)
- TNC or Soundcard

Software: Diverse (e.g. APRSIS32, UVView32 etc.)
Short message through APRS to „WLNK-n“, via APRSLink:
nr 32 p DK3CW 26 pool-town 2215 jan 14 = New city
please send us information about following person stop walter smith harbour street 4=
information bureau for river district disaster +
/ex
z.B.: Message from EA3DKP to DK3CW via RS0ISS-4 → EI4GB → APRSServer → CMS
D-STAR mit D-RATS

Benötigt:

• D-STAR Transceiver / Dongle /DVRPTR etc.
• PC
• Data cable

Software: D-RATS
D-RATS offers E-Mail transfer via D-STAR/Packet Radio and:

- Data file transfer
- D-APRS (only D-STAR APRS)
- keyboard-QSO
- QSTs (Bulletins e.g. weather, *.txt, HTML, RSS etc.)

Direct Connection to HF PACTOR or PR via Paclink
Hallo,

vy 73 de Jakob DK3CW
Paclink Bridge for D-STAR / PR↔ PACTOR / PR
Comparing Digimodes

Net bits/sec/Hz of BW (After ARQ overhead)

Assumptions:
1) 70% ARQ efficiency (typical of Pactor)
2) Max RAW data rate (good channel assumed)
3) 200 Hz guard band used in bandwidth calculations (allows automatic connections)
Compare PACTOR 2 / WINMOR 500

WINMOR 500 Hz vs P1, P2

- WINMOR 3 Car QPSK FEC
- Pactor 1 (PTC II)
- Pactor 2 (PTC II)
- WINMOR 3 Car 16QAM FEC
- WINMOR 3 Car 4FSK FEC
Compare PACTOR 2,3 / WINMOR 2000

WINMOR 2000 Hz vs. Pactor 2,3

ARQ Throughput (bytes/min)

S/N (3 KHz Bw)

- WINMOR 15 Car QPSK FEC
- WINMOR 15 Car 4FSK FEC
- Pactor 2
- Pactor 3
V4Chat

- Implementation of WINMOR protocol for V4Chat @200Hz for FEC and ARQ text transmissions (very robust, perfect for P2P)
- Simultaneously WINMOR and PACTOR WL2K/P2P and V4Chat using ONE soundcard and ONE transceiver
- Automatical E-Mail transfer and forward via Airmail (incl. PR and D-STAR)
WINMOR and V4Chat
Future of WinLink

- ROWN-System
- Included QAM into WINMOR protocol
- WINMOR Integration on iOS and Android, openMORE-Projekt

- WinLink isn’t in competition to PSKMail, both may complement one another