Applying Computers to Smarten Up Your Amateur Radio Hobby

Joseph Kasser, G3ZCZ/VK5WU

http://therightrequirement.com

Rev 1.3

Topics

- Conventional amateur radio
- Introduction of computers
- OSCAR
- Digital communications
- Automating Communications
- The Internet
- The future?
- Concerns
- Discussion

State of art 1981

Conventional amateur radio

- Communicating
  - Rag chews
  - Contests
  - Chasing DX
- Experimenting
  - Hardware and software
  - Contests
- Record keeping
  - Logs
  - Awards

Introduction of computers

- **Logging**
- Packet radio
  - Copy of the Internet
    - Messages and bulletins
  - APRS
- DX alerts
- Contests
- Award records
- Propagation predictions
- SSTV

AMSAT Lab 1981

Logs

Logbook: hflog.dbf

Logbook Find Display Card File Tools QSL

DATE	TIME	BAND	CALL	RX	TX	MODE	POWER	S	R	COMMENTS
2001/09/10	1217	15	RU3QW	599	559	PSK31	100	-	-	quick qso poor copy
2001/09/10	1315	20	PAQJR	449	479	PSK31	100	-	-	poor copy lost him
2001/09/12	1047	20	JA4IQR	599	599	PSK31	100	-	-	Yoo, Okayama
2001/09/12	1109	20	JA2EX	599	599	PSK31	100	-	-	Miz, PM85
2001/09/12	1119	20	W3GQ	569	599	PSK31	100	-	-	Paul
2001/09/12	1145	20	FR5HA	599	599	PSK31	100	-	-	Jose AF16 St Louis
2001/09/12	1219	20	KG4FJ	599	599	PSK31	100	-	-	Ronni- not sure of c
2001/09/12	1225	20	K5EJ	599	599	PSK31	100	-	-	EJ EM45
2001/09/12	1243	20	DS1KVP	599	599	PSK31	100	-	-	Seoul
2001/09/12	1255	20	W5RIB	599	599	PSK31	100	-	-	Paul
2001/09/12	1316	20	K6BRD	457	599	PSK31	100	-	-	John Pinetop AZ

2001/09/17 | 0357 | | 20 | PCKT | 100 | 599 | 599 | - | - | | Log

Display order: Calls / Date

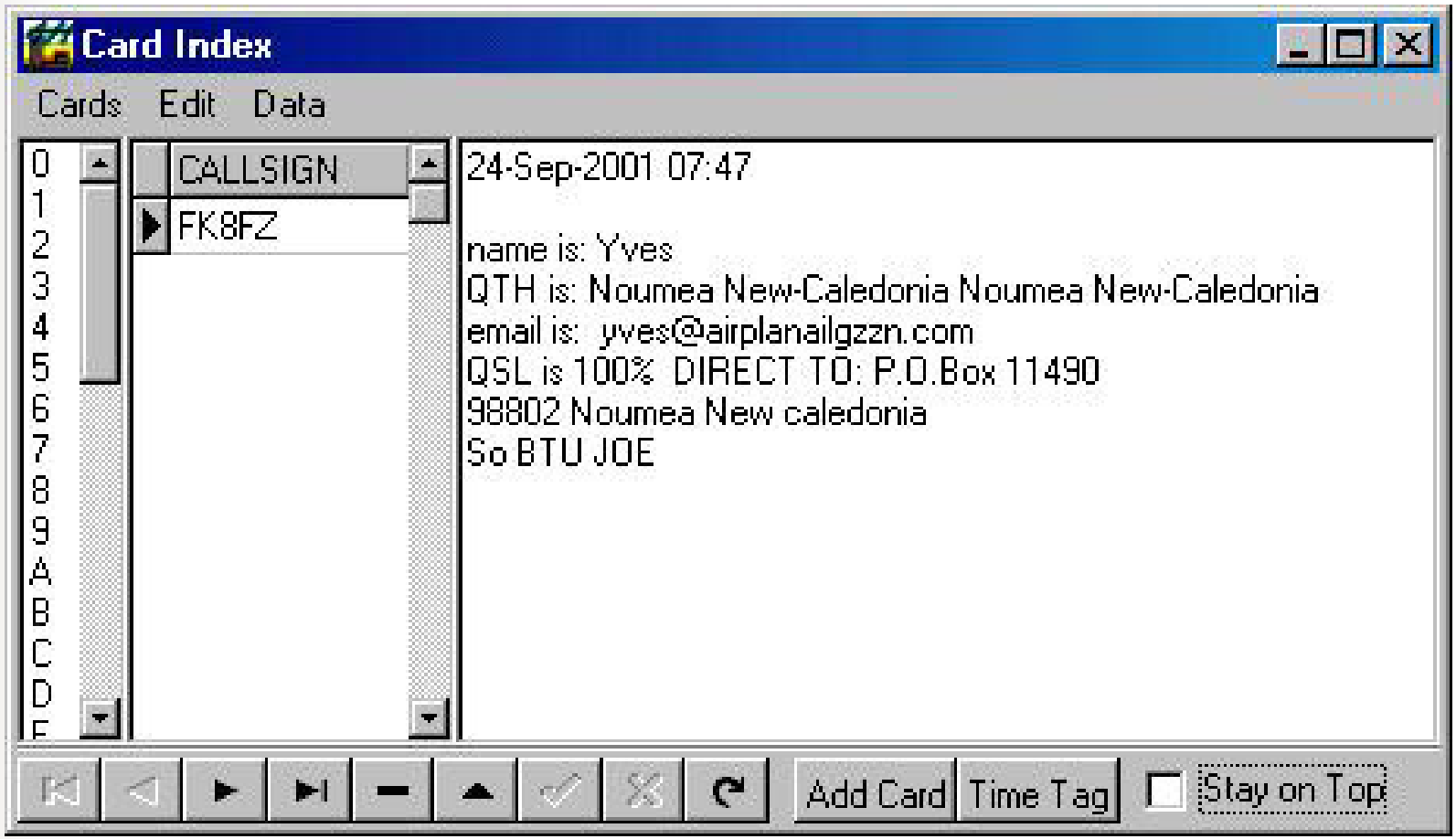
Write to disk

Stay on Top

QSL

QSL Current Entry

Card files



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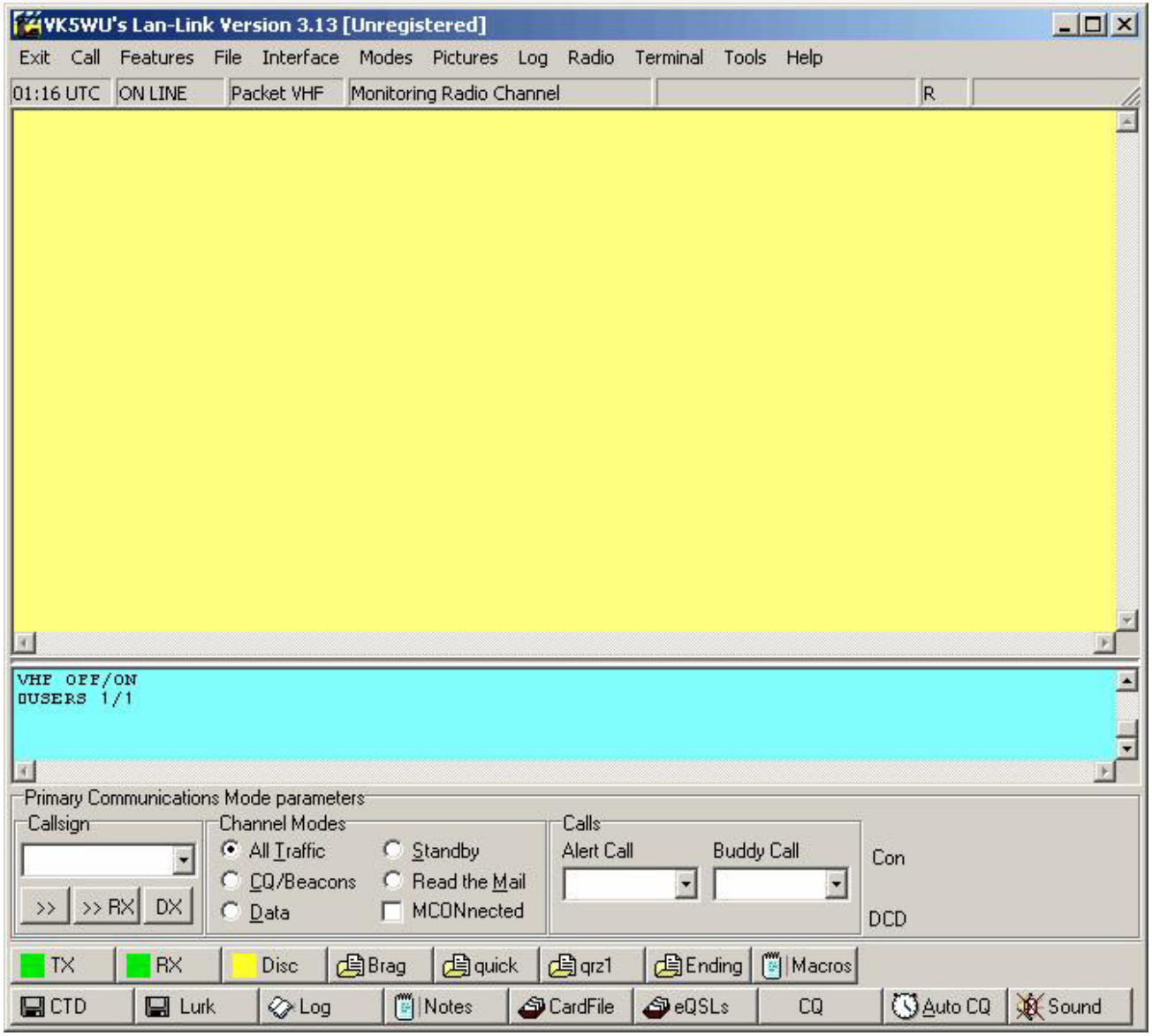
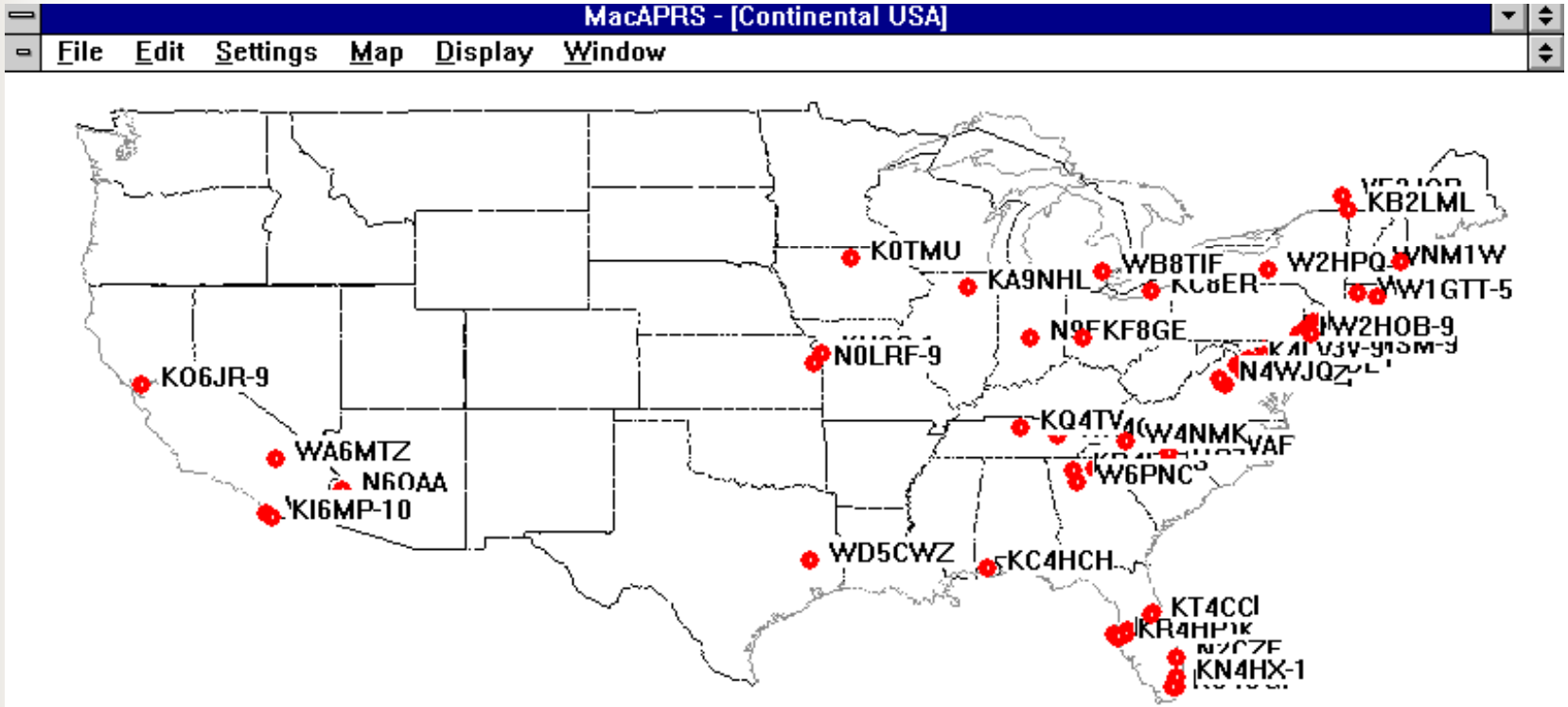
Packet radio

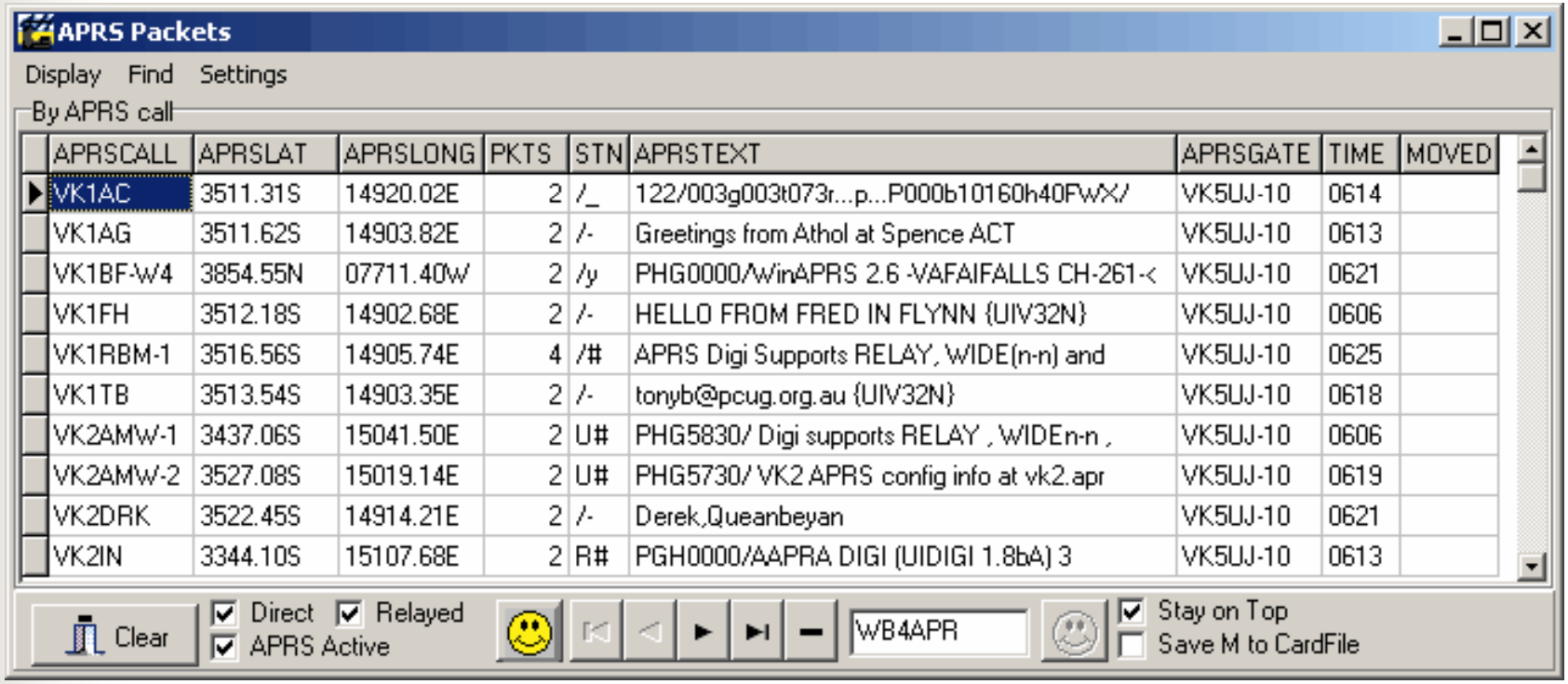


Automatic Position Reporting System (APRS)



Source: http://aprs.rutgers.edu/WinDemo.htm

Automatic Position Reporting System (APRS)



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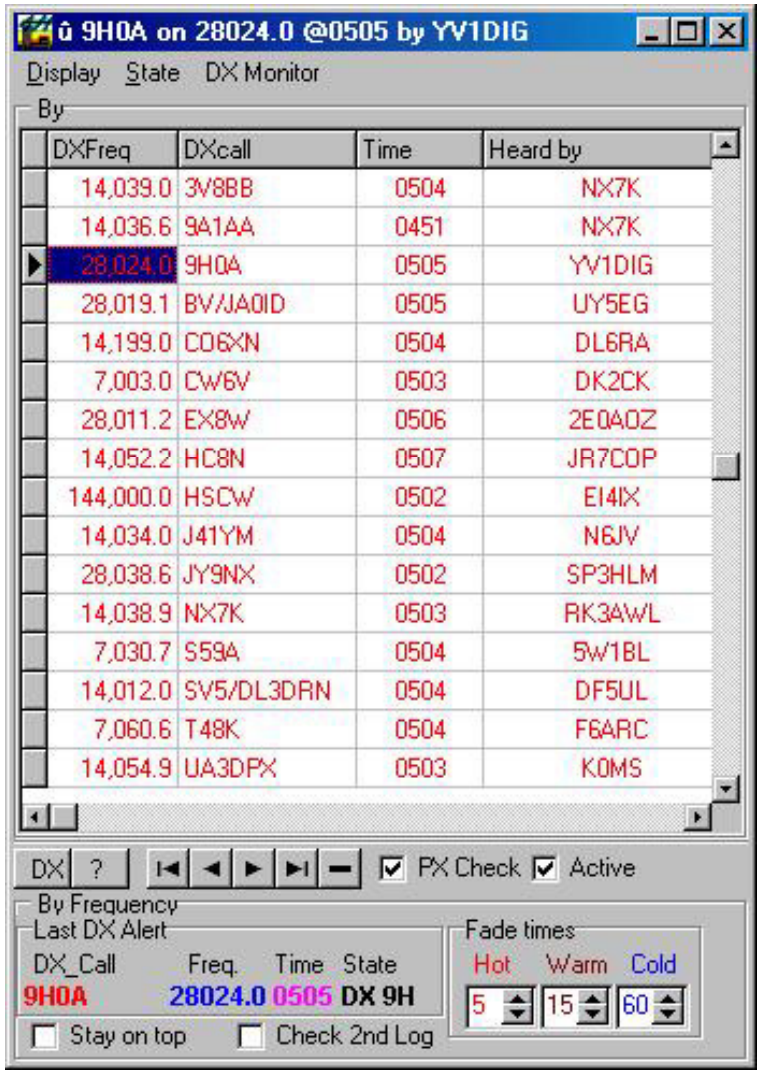
Software for Amateur Radio 1981

DX alerts

```
DX de N7ON:      10114.6  KL7J                                    0419Z□□
WCY de DK0WCY-3 <4> : K=2 expK=3 A=10 R=228 SFI=235 SA=act GMF=act Au=no□□
DX de UA6JY:     24893.0  FR5FD                                   0421Z□□
DX de N6KD:      10105.9  ZK1QMA       up 1                       0421Z□□
DX de WA2JQK:     3793.0  M0KKW                                   0423Z□□
DX de JE1NCP:    24893.0  ZL7/G3TXF    up2 FB SIG                 0425Z□□
DX de ND8L:      14070.0  W6I          PSK Route 66 Special Events St 0429Z EN91□□
DX de UA6JY:     24898.0  FR5FD        CQ                         0429Z□□
DX de SP8HQQ:    14004.9  3D2AG        599  qsx up                0432Z□□
DX de K2VCO:     21023.0  ZL7/G3SXW    up 1                       0434Z□□
DX de JA6TMU:    24898.0  FR5FD                                   0435Z□□
DX de WA7BOD:    14005.0  3D2AG        UP                         0437Z□□
DX de N7HIY:     24893.0  ZL7/G3TFX    up 1                       0437Z□□
DX de N4SU:       1834.4  DF2PY        wolf--big sig poor band    0439Z□□
DX de N7HIY:     24893.0  ZL7/G3TXF    corr call                  0439Z□□
DX de OK1FM:     10105.2  ZK1QMA       MY GREYLINE START-HE IS QRT 0443Z□□
DX de K6UT:      14195.0  FOOFLA       Dave                       0439Z□□
DX de UA6LGR:    14005.0  3D2AG        QSX UP 1                   0443Z KN97□□
DX de 9A5ST:     14005.0  2D2AG        up via CBA                 0443Z JN83□□
DX de 9A5ST:     14005.0  3D2AG        sry call                   0444Z JN83□□
DX de LA6CHA:    14004.9  3D2AG                                   0440Z□□
```

Packet radio

- Sortable
  - Frequency
  - Callsign
  - Time
- Colour changes to show age
- Radio interface
- Click to access

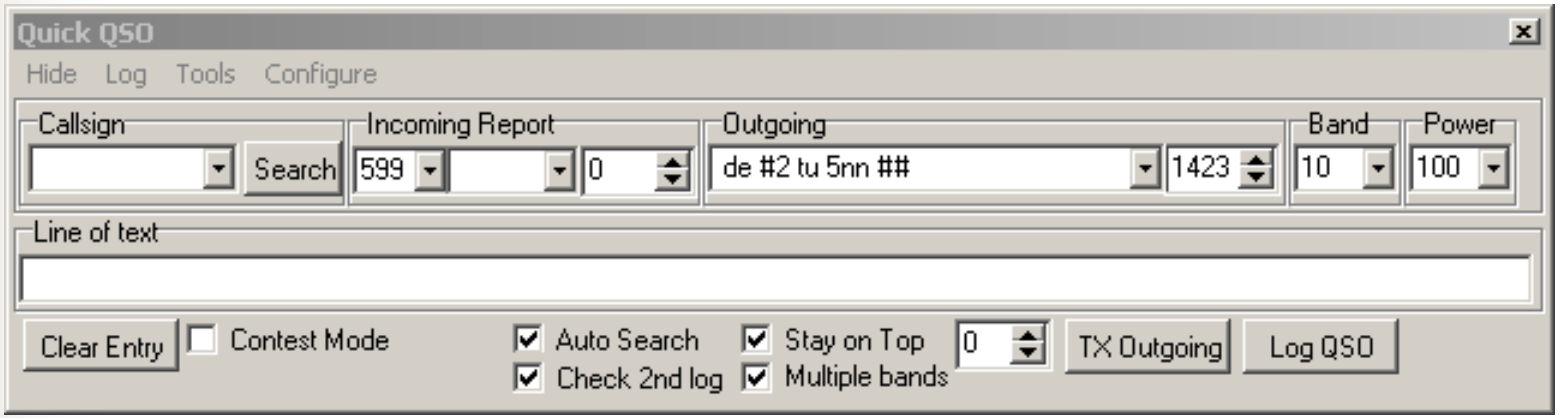


Contests –Scenarios

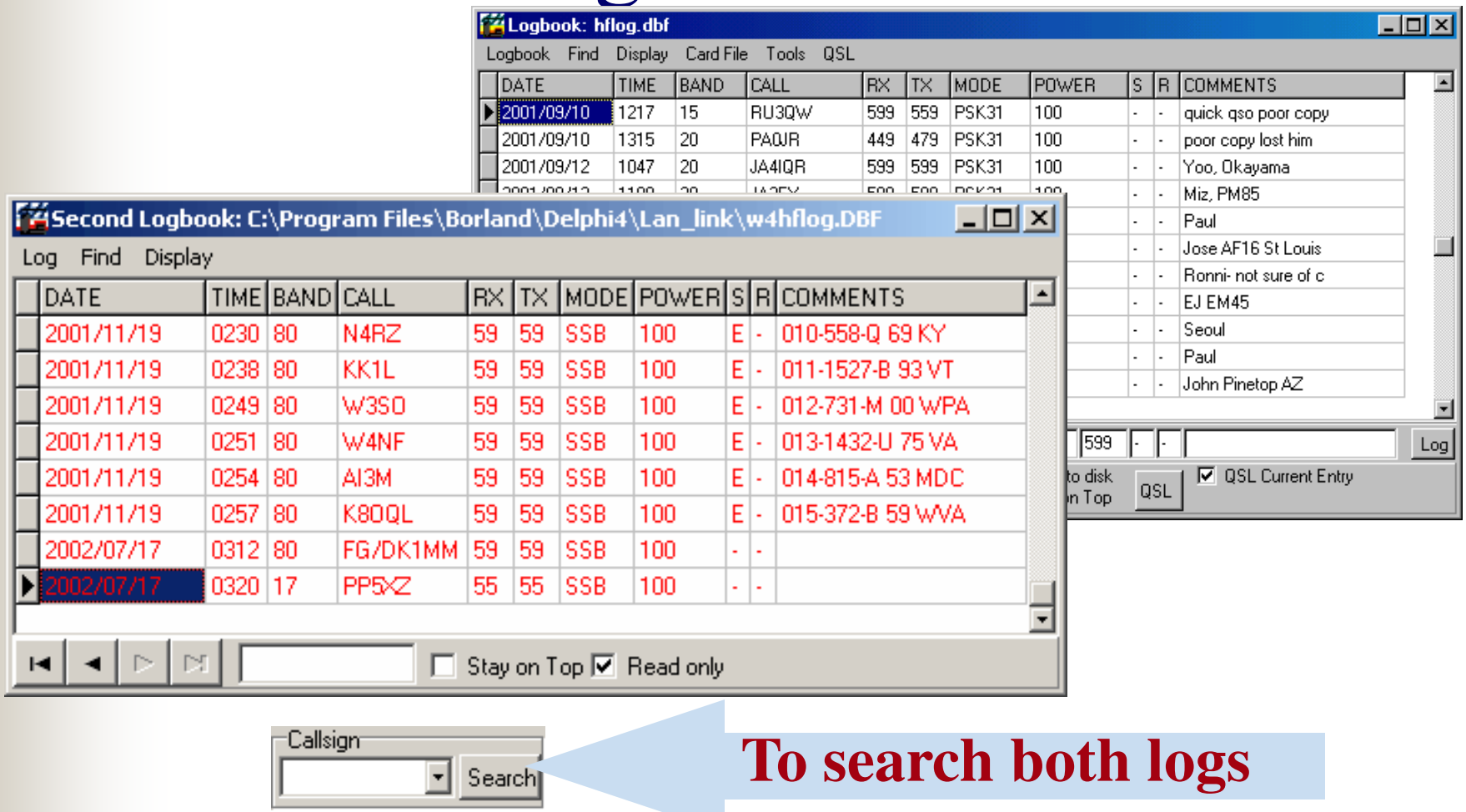
- Scenario
  - Many stations on the air for a fixed period of time
  - All want a quick QSO and generally need to contact you
  - Lots of QRM
- Opportunity
  - Work new entities
    - DX, IOTA, States, Counties, Grid Squares, Other
  - Test something
    - Hardware or software

Contests – software to work new DX countries

- Set up the software for finding new DX countries
- Use it



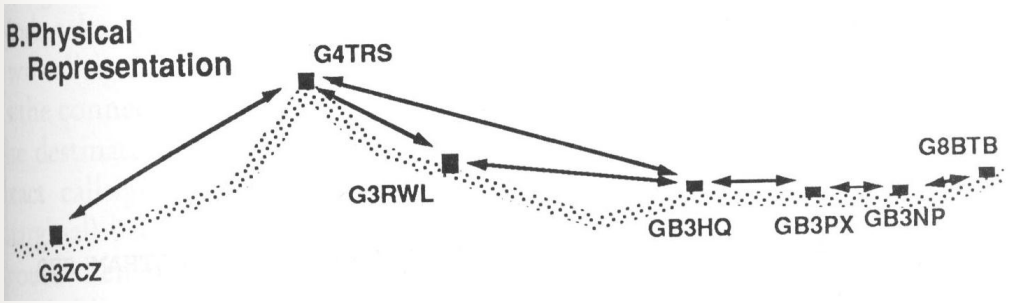
Contests - logs

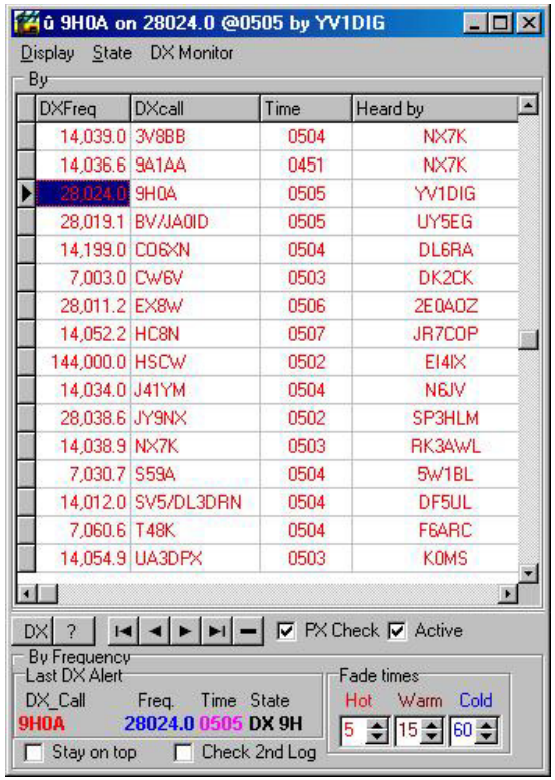


To search both logs

Contests – finding the stations

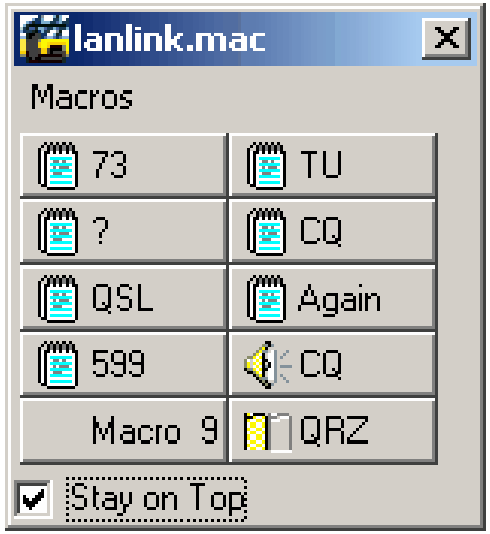
- Know when the band is open
- Tune for them
- PacketCluster
  - Radio
  - Internet





Contests – transmitting information

- Use Macro keys for data and Voice
  - CQ
  - Exchange
  - Common messages
    - QRZ
    - Call?
    - Worked B4



Automating contests - digital

Sometimes you need to step outside during a contest

- Automatic Beacons –report in real time
  - AMTOR
    - 4X/G3ZCZ to VU2IJ Asynchronous QSO
      - 1987/04/22 – 1987/08/08
    - DX
- AMTOR
  - +?
- Packet
  - > at end of line
- Pactor

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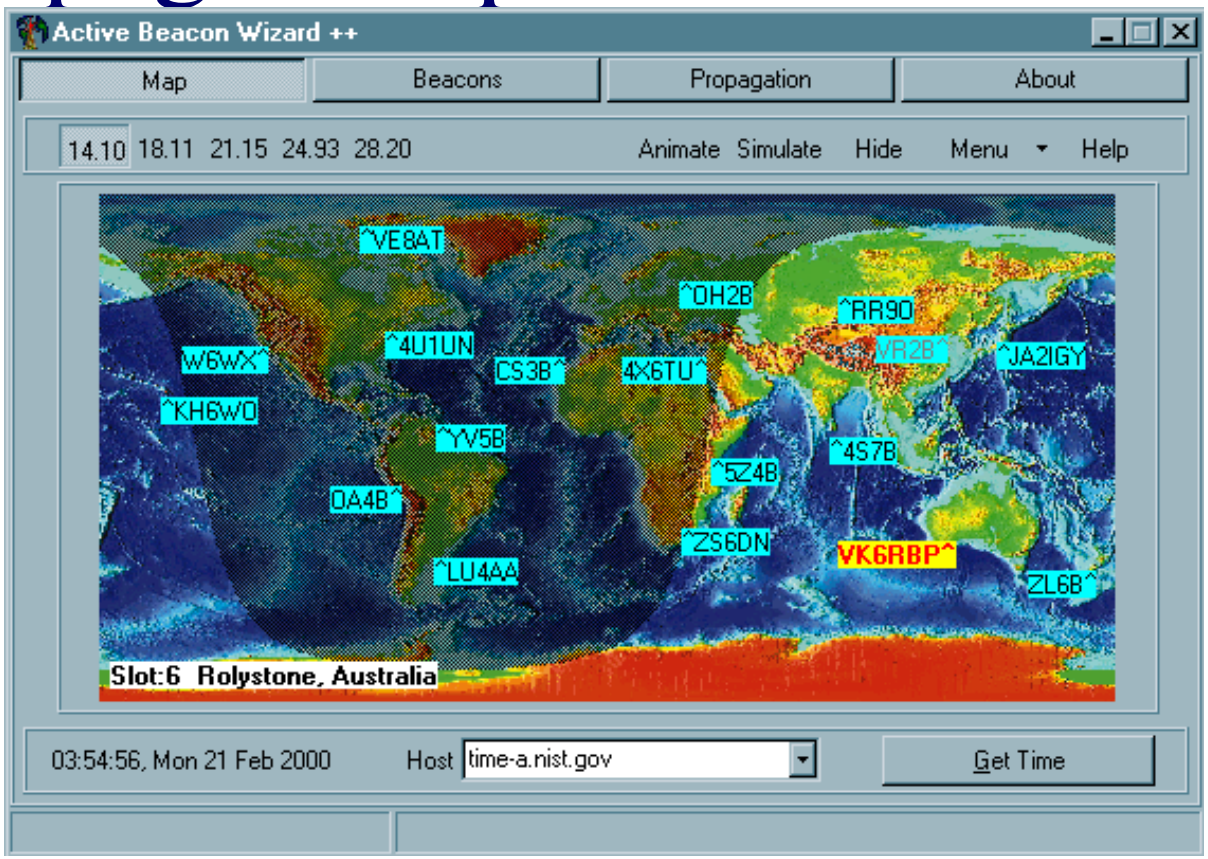
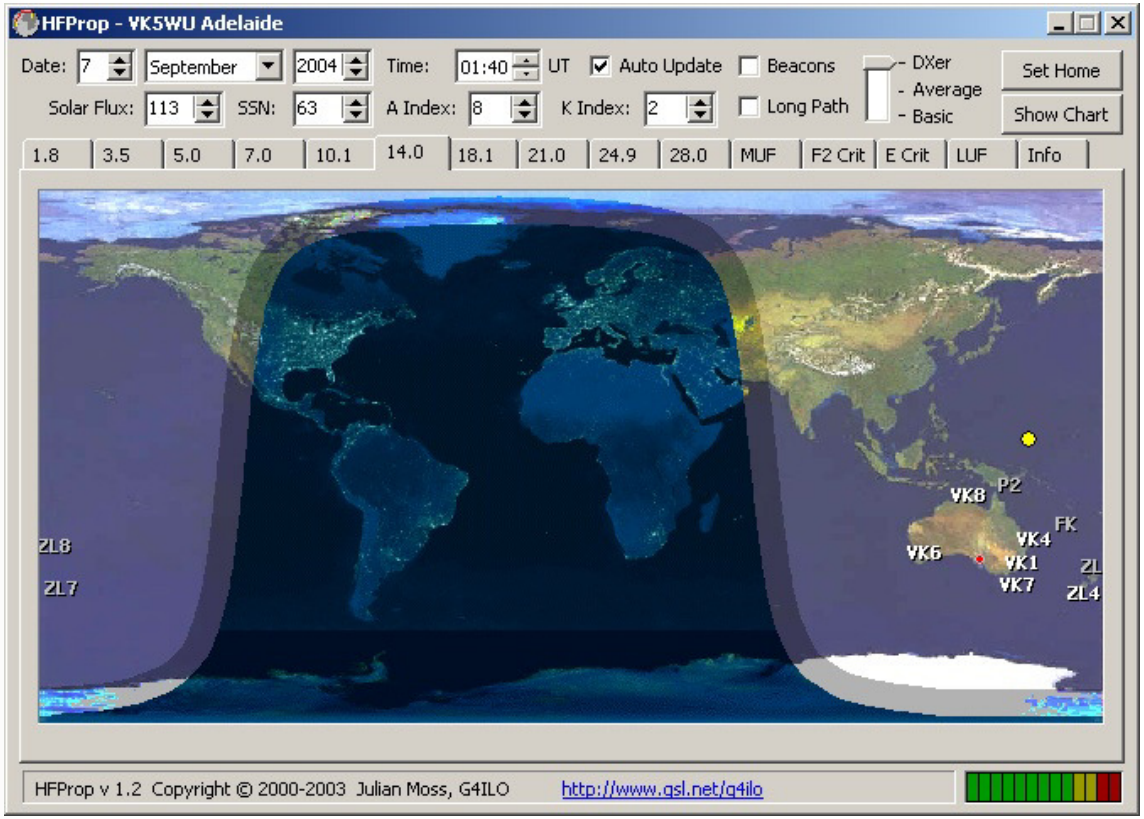
[young] **Martin Sweeting at UoS**

Propagation predictions-1



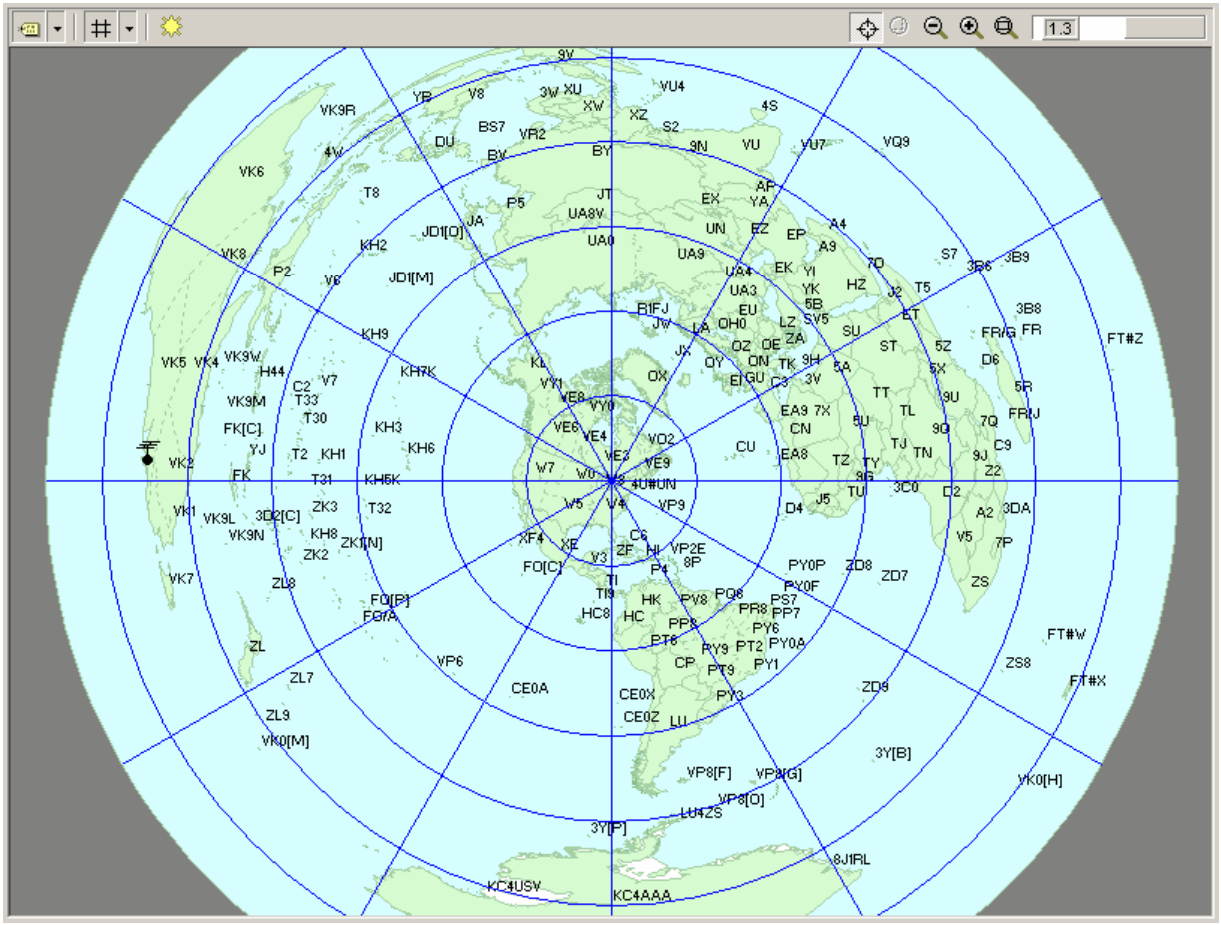
Source: HTTP://www.taborsoft.com/abw/

Propagation predictions-2

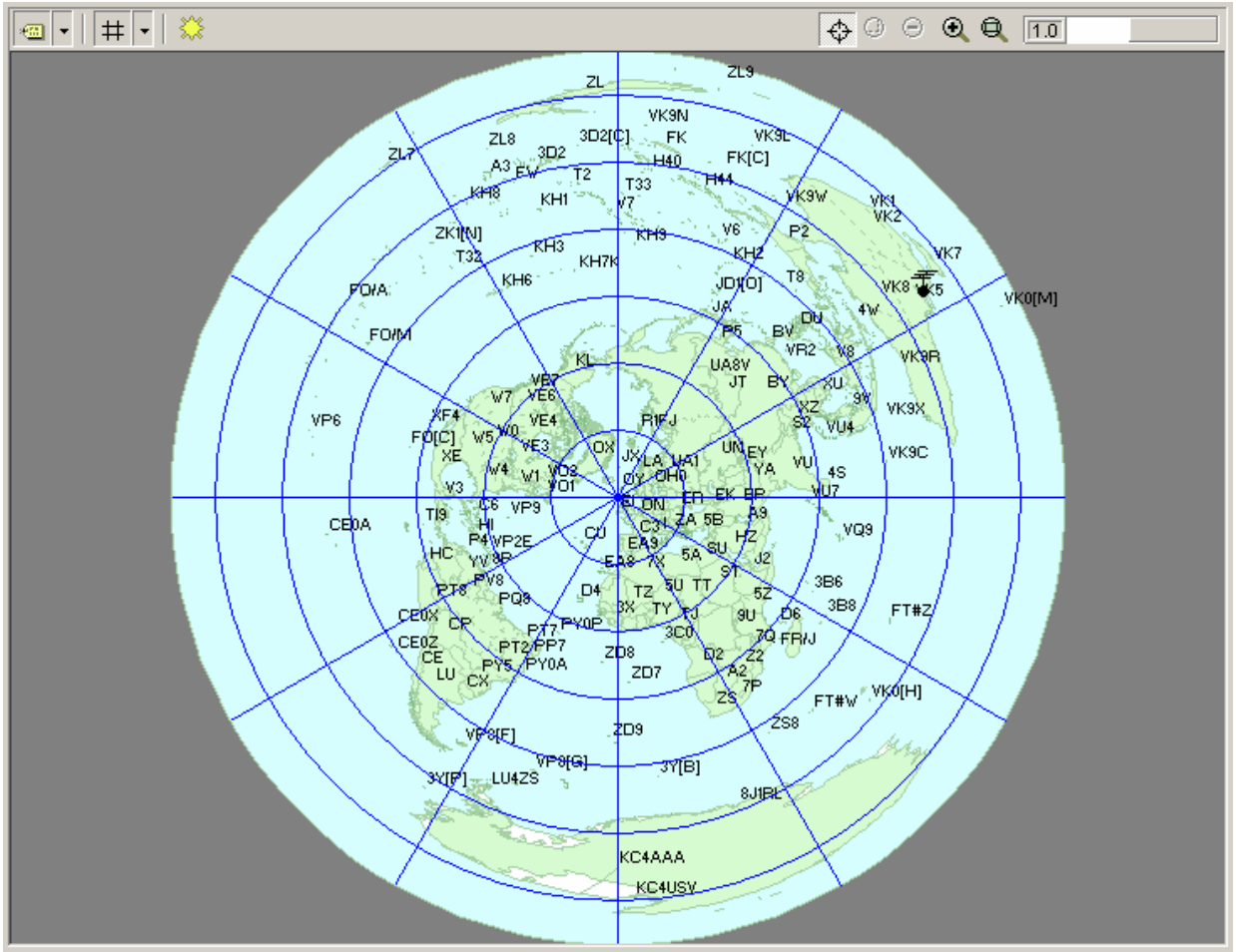


Source: HTTP://www.qsl.net/g4ilo

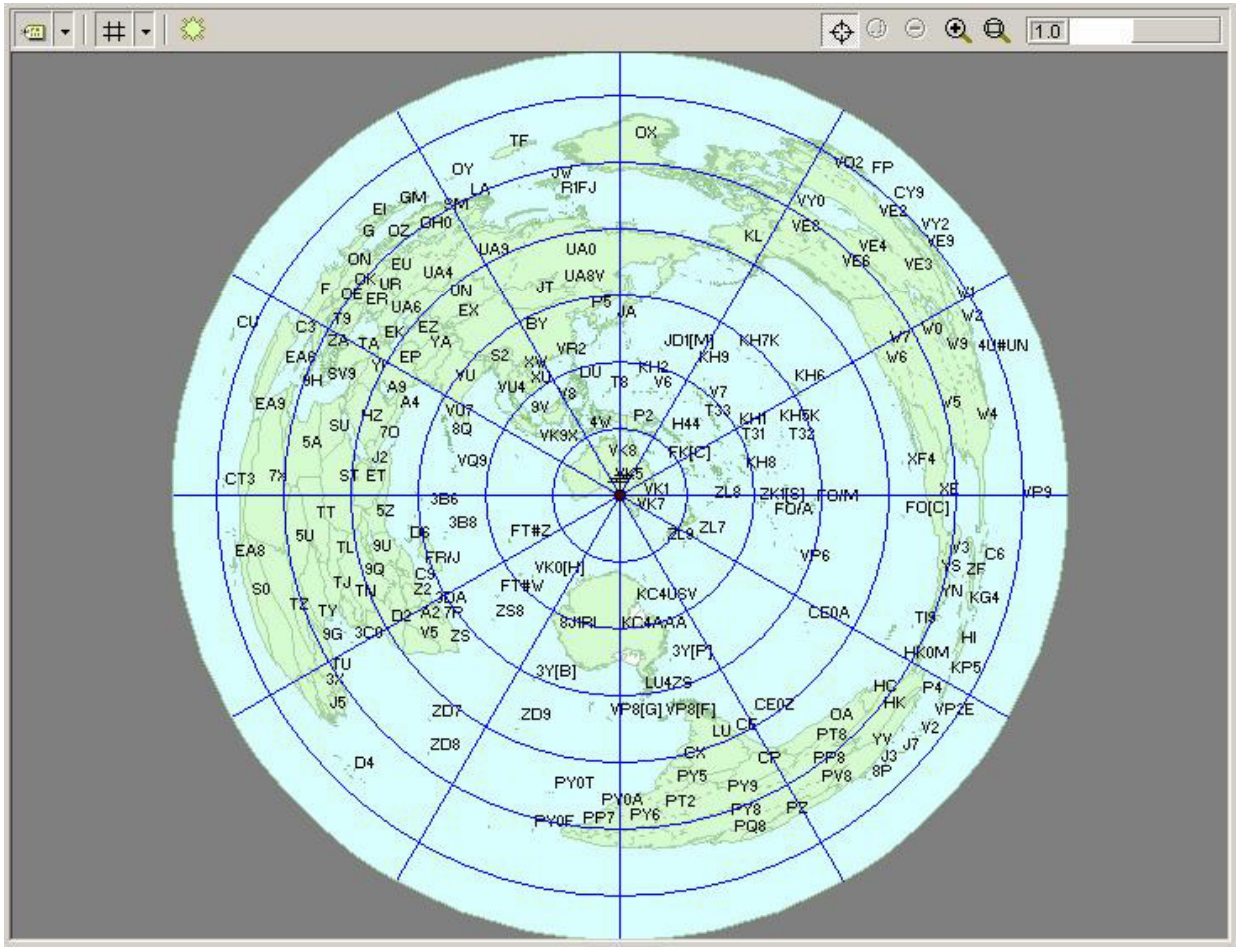
DX Atlas – W8 centric



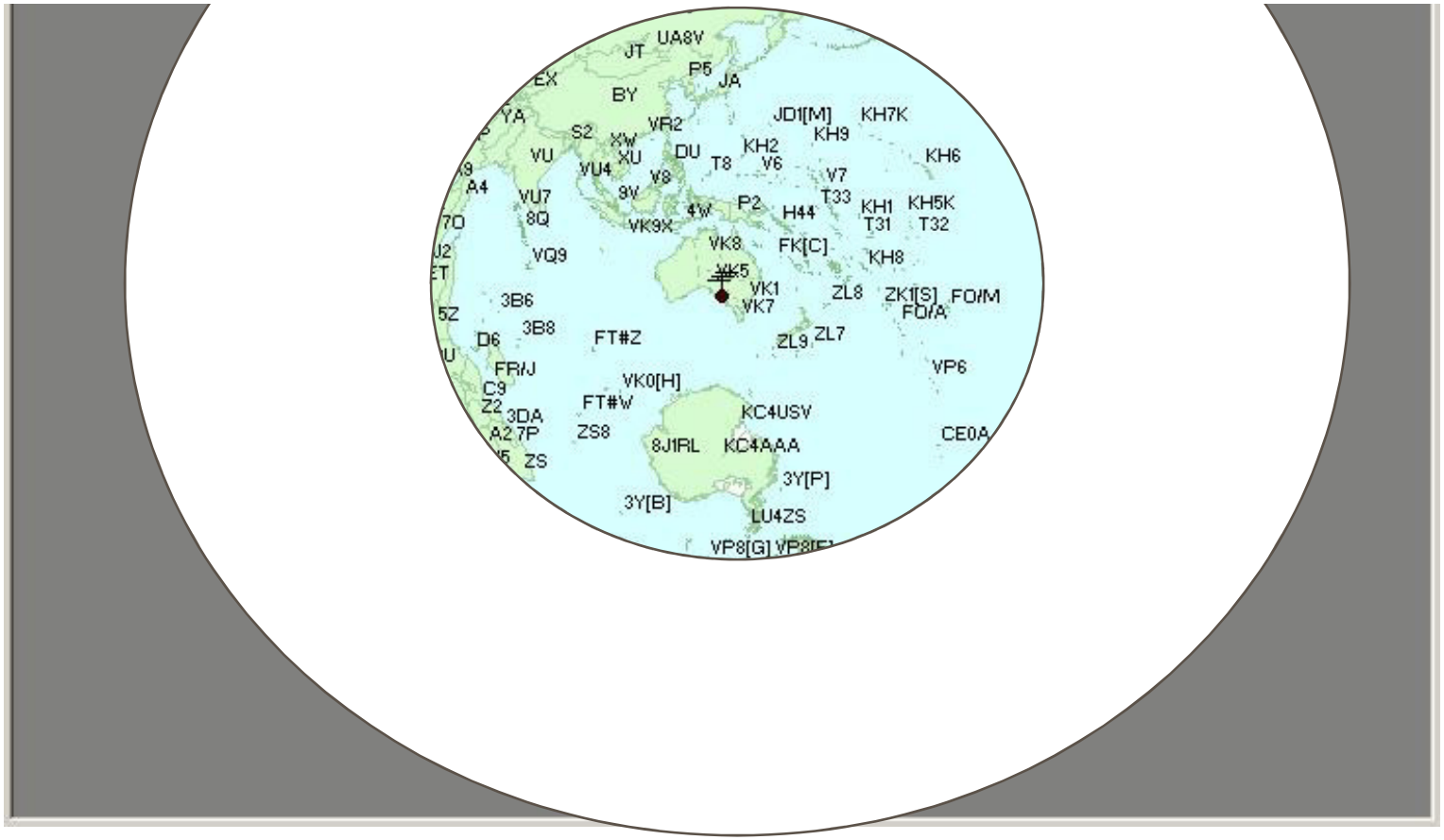
DX Atlas – G3 centric



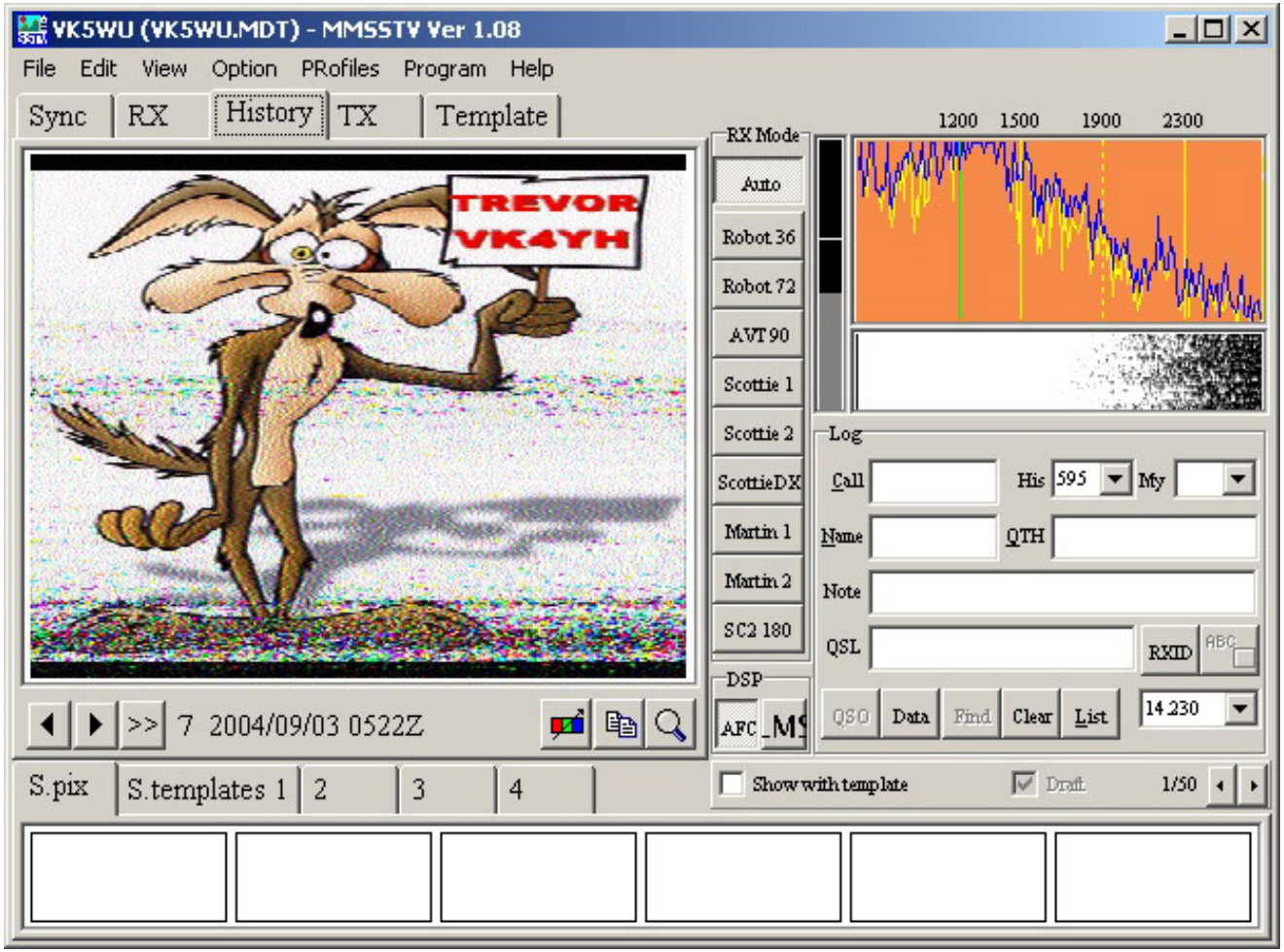
DX Atlas – VK5 centric



DX Atlas – VK5 centric



SSTV



Http://www.qsl.net/mmhamsoft/

SSTV pictures (off the air@vk5wu)

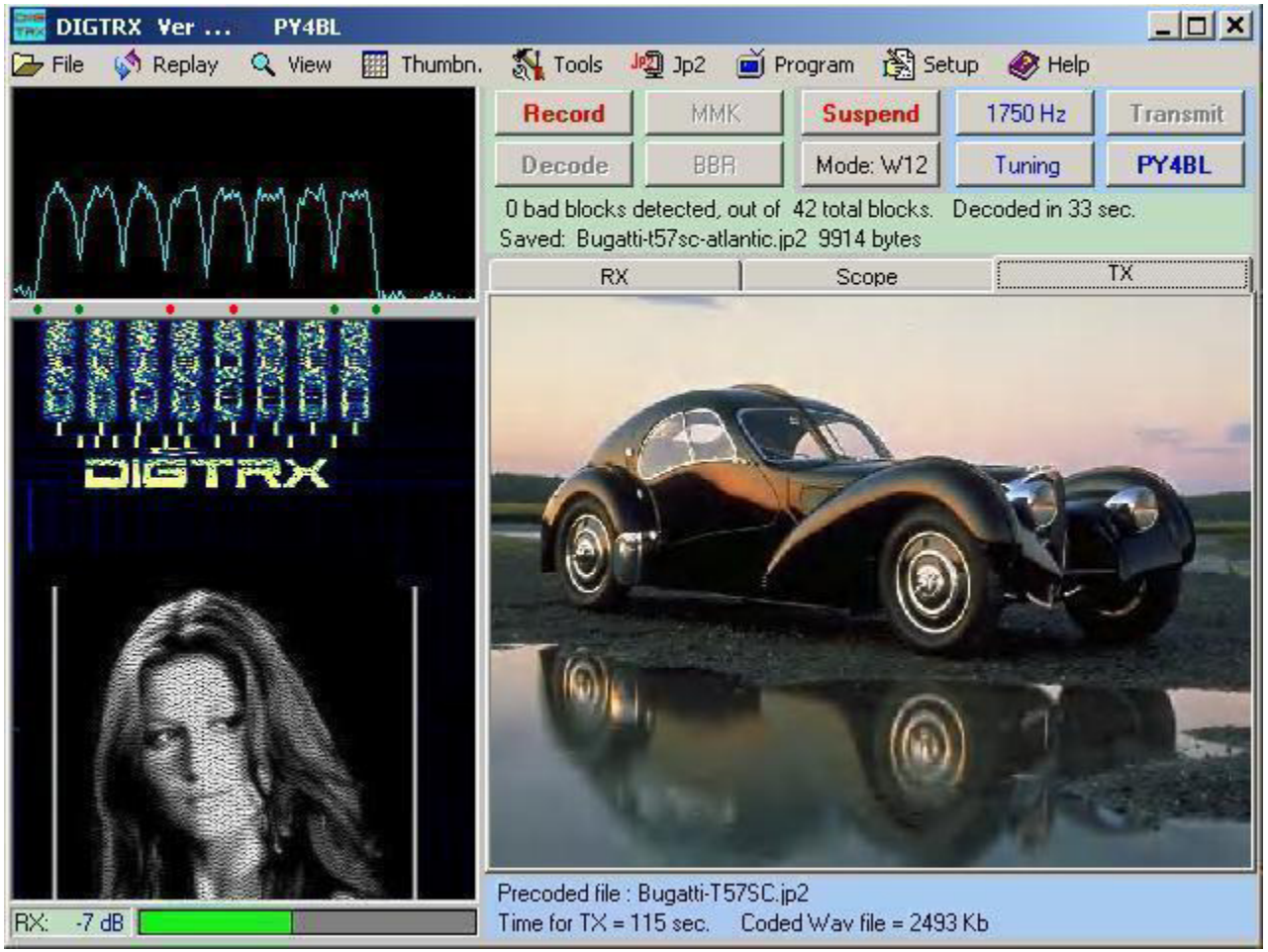
Digital SSTV no error correction

As sent

Noise burst

As received (simulated)

Digital SSTV



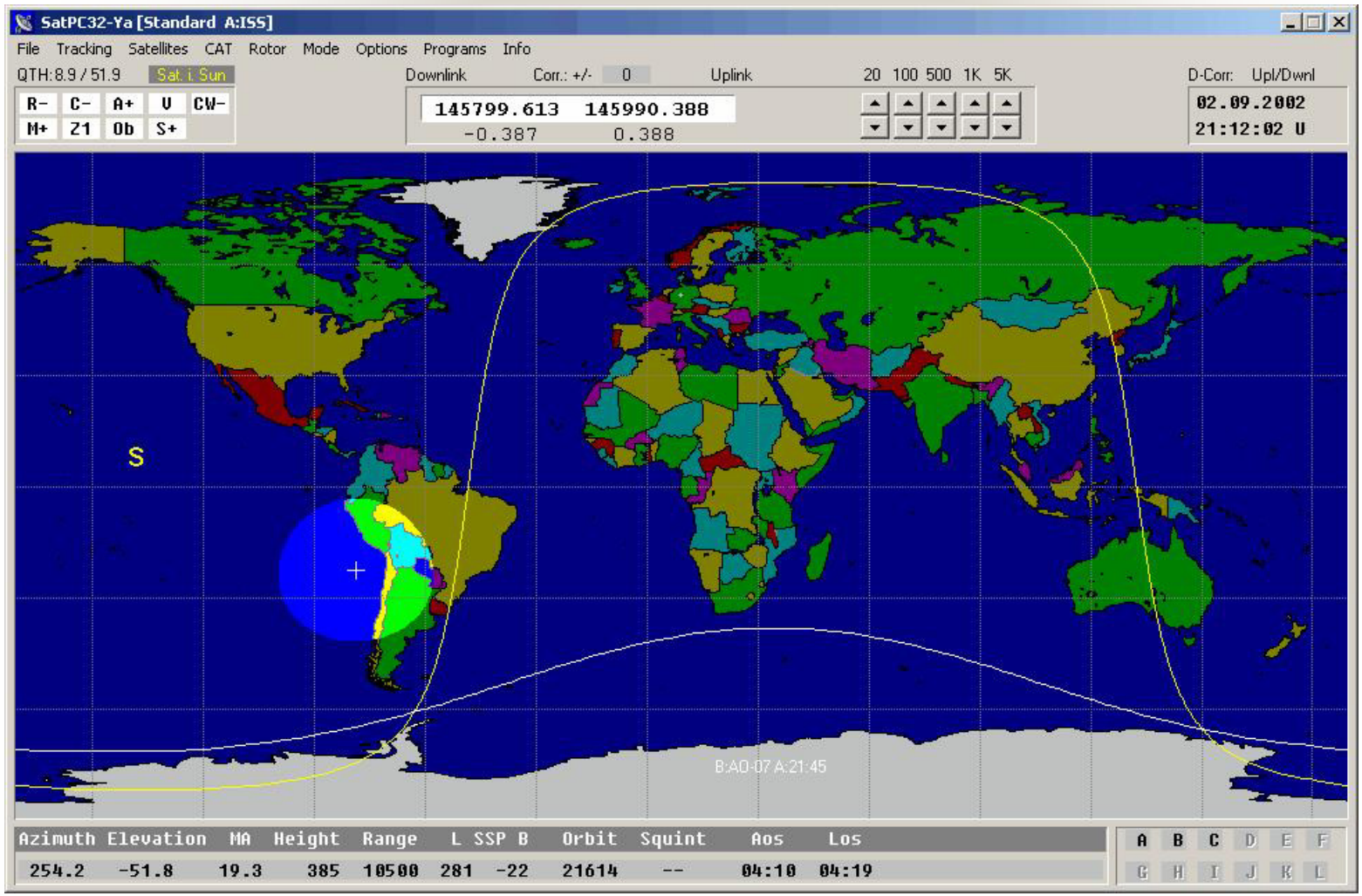
Topics

- Conventional amateur radio
- Introduction of computers
- **OSCAR**
- Digital communications
- Automating Communications
- The Internet
- The future?
- Concerns
- Discussion

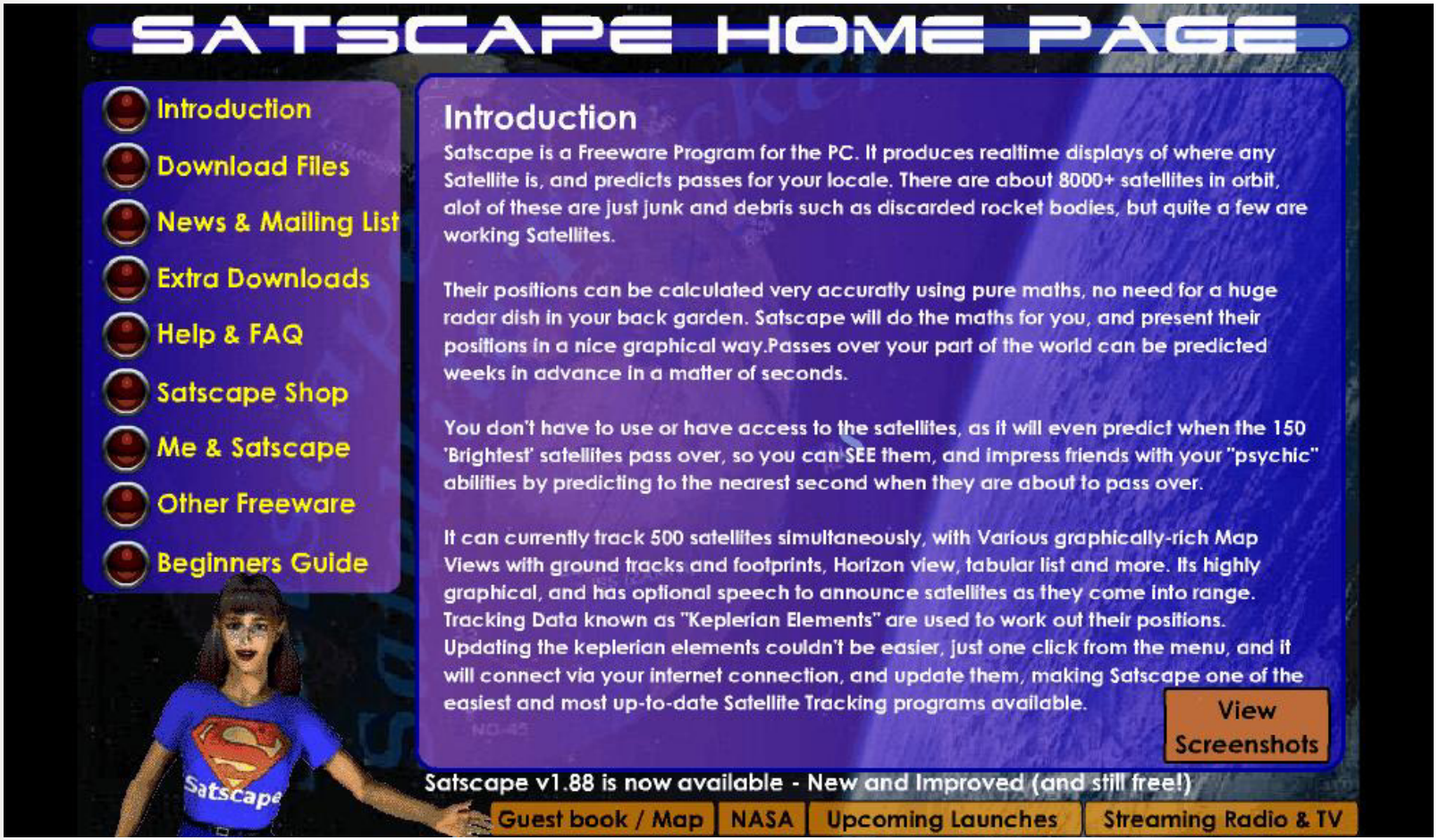
OSCAR

- Spacecraft
  - Command and control
  - Telemetry
- Ground segment
  - Orbit predictions
  - Command and control
  - Telemetry formatting and display
  - Automated operations

Pass predictions



Satscape



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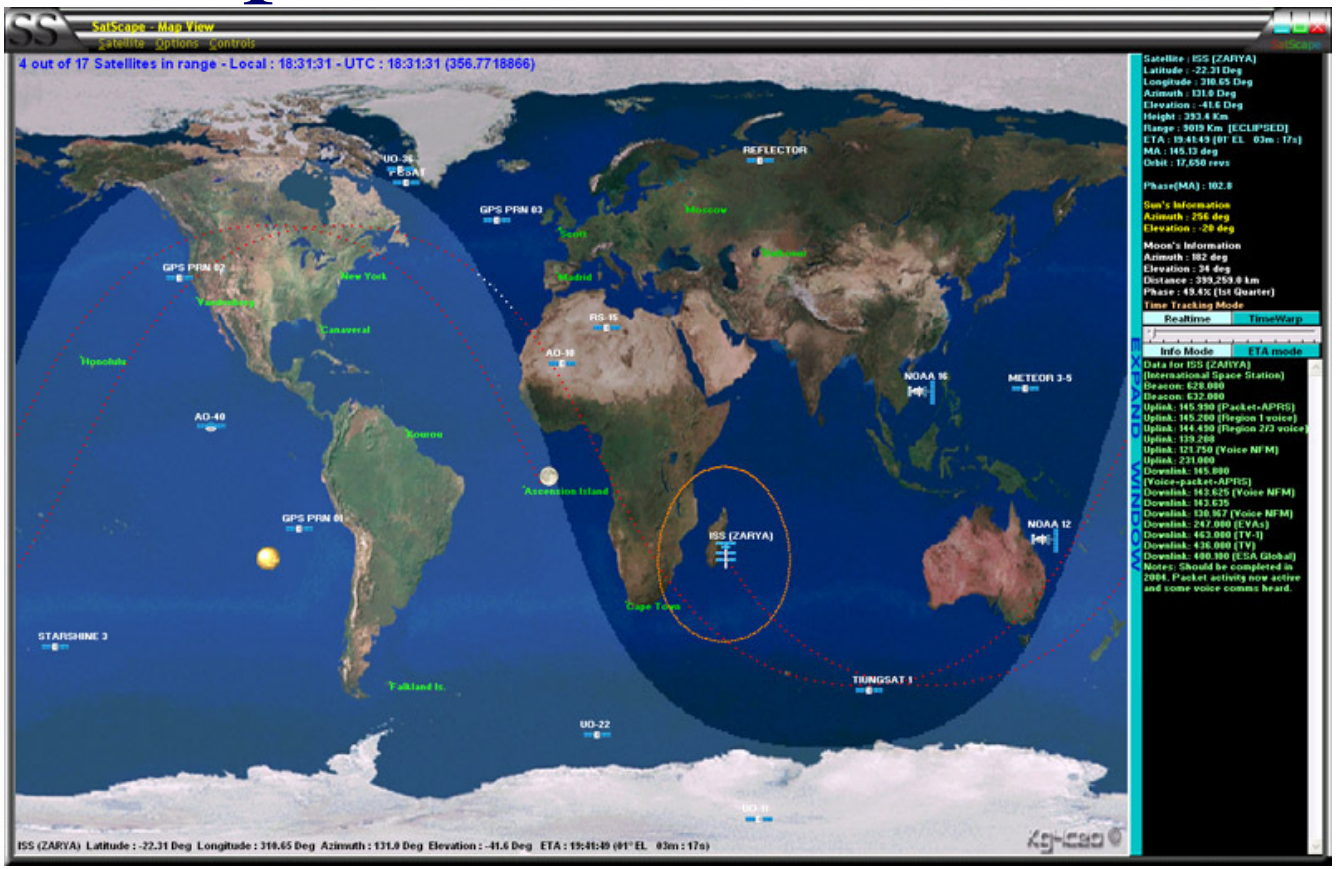


http://www.satscape.co.uk/images/ss-screen1.jpg

Raw UoSAT Telemetry

ASCII WITH ERROR CHECKING ON EACH DATUM

```
00519D01413702676503614004046605O3;4 6019E07045608040C08036C
10519C11298312000313056114069A15529A!6188;1754521859051950S8
20519F21220322662223000124001725000726093E27541528564D294681
30519E31041732287C33568B34007035217236276637393D38426B39455E
4064;;;ghghf42647343061044162545000146000247444748454949422x
50456251108D52634653284p54663215000056p00357451258447A59460E
60826A615FC1625F4A6333416444026516046617426770066800OE69000F
UOSAT-2            9101281004625

Note : Errors due to noise.
```

10 Channels per line, fixed format NNDDDC

Channel Number (2)
Data (3)
Checksum (1)

Raw UoSAT Telemetry

ASCII WITH ERROR CHECKING ON EACH DATUM

```
00519D01413702676503614004046605O3;4 6019E07045608040C08036C
10519C11298312000313056114069A15529A!6188;1754521859051950S8
20519F21220322662223000124001725000726093E27541528564D294681
30519E31041732287C33568B34007035217236276637393D38426B39455E
4064;;;ghghf42647343061044162545000146000247444748454949422x
506251108D52634653284p5466321500005 6p00357451258447A59460E
826A615FC1625F4A6333416444026516046617426770066800 0E69000F
UOSAT-2            9101281004625

Note : Errors due to noise.
```

10 Channels per line, fixed format NNDDDC

Channel Number (2)
Data (3)
Checksum (1)

Fuji-OSCAR 20 raw telemetry

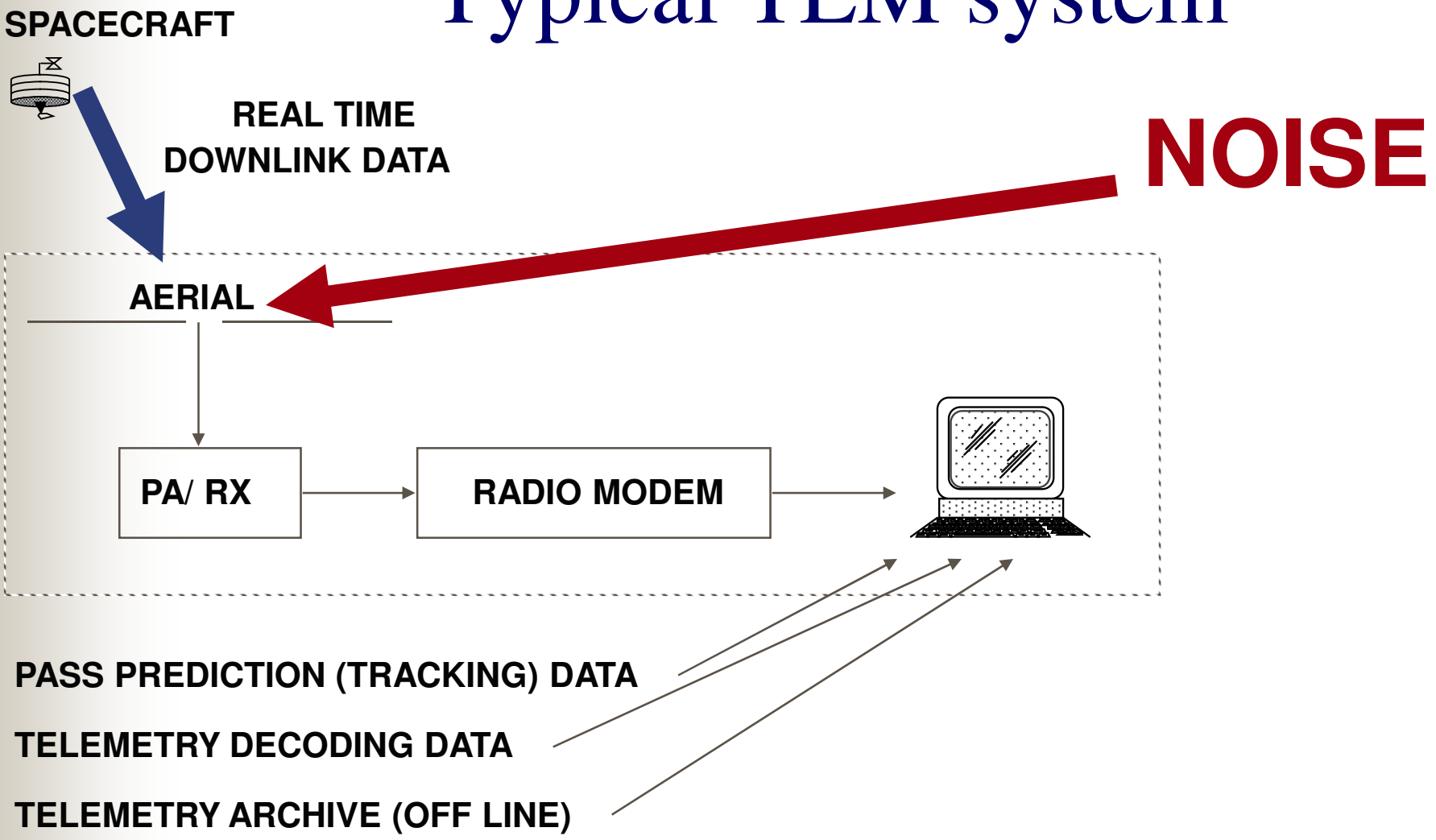
```
05-Jun-91  09:43:35  8J1JBS*>BEACON:
JAS1b RA 91/06/05 09:39:58
493 481 688 691 854 839 850 833 002 746
615 000 418 453 457 448 451 454 651 000
683 681 745 713 999 643 874 385 1BE 000
010 111 011 000 111 100 001 100 111 000
```

- AX.25 LINK DOES ERROR CHECKING
- FIXED FORMAT

Fuji-OSCAR 20 decoded TLM

Solar Panel Temp #1:	15.20 Deg.C	Total Array Current:	1105.89 mA
Solar Panel Temp #2:	31.92 Deg.C	Battery Charge :	102.87 mA
Solar Panel Temp #3:	32.68 Deg.C	Battery Voltage :	14.806 V
Solar Panel Temp #4:	29.64 Deg.C	Battery Center :	6.744 V
Baseplate Temp. #1 :	40.73 Deg.C	Bus Voltage :	17.259 V
Baseplate Temp. #2 :	41.42 Deg.C	+5 V Regulator :	5.214 V
Baseplate Temp. #3 :	40.87 Deg.C	-5 V Regulator :	0.000 V
Baseplate Temp. #4 :	41.14 Deg.C	+10 V Regulator :	10.471 V
Temperature Cal. #1:	1.30 V	Offset Voltage #1 :	0.000 V
Temperature Cal. #2:	1.29 V	Offset Voltage #2 :	0.000 V
Temperature Cal. #3:	1.75 V	Calibration Volt #2:	1.230 V
Battery Temp. :	45.04 Deg.C	JTA TX Output Power:	0.46 W
JTD Temperature :	42.12 Deg.C	JTD TX Output Power:	3.52 W

Typical TLM system



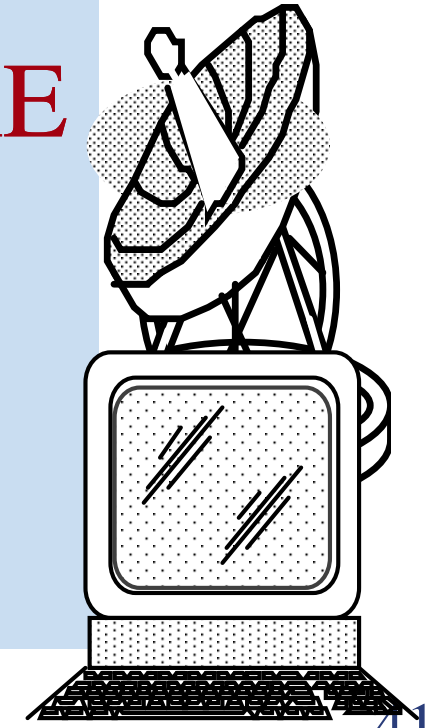
Need for Standards

AMATEUR SATELLITE TELEMETRY

PAST, PRESENT & FUTURE

JOE KASSER, G3ZCZ

National Telesystems Conference, May 1992



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- The Internet
- The future?
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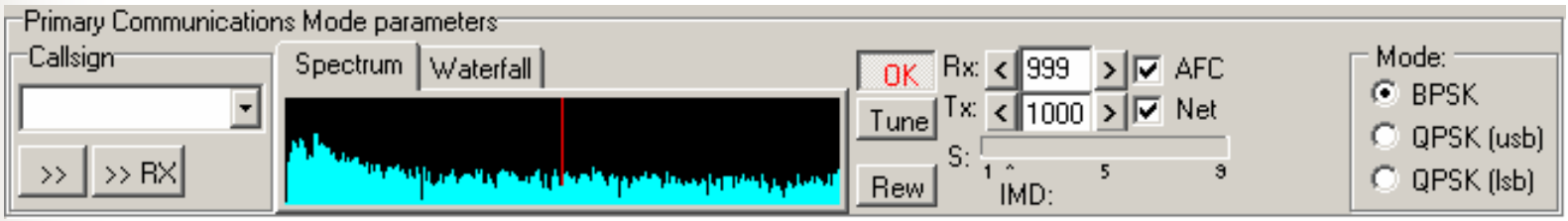
Digital communications

- Teletypewriter replacements
  - RTTY stayed at 45/50 Baud
- New modes
  - AMTOR
  - Packet radio
  - PACTOR
  - PSK31, MFSK
  - Etc.



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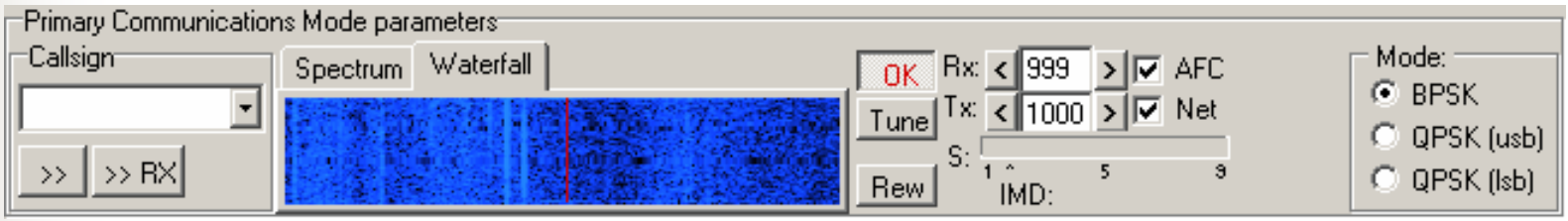
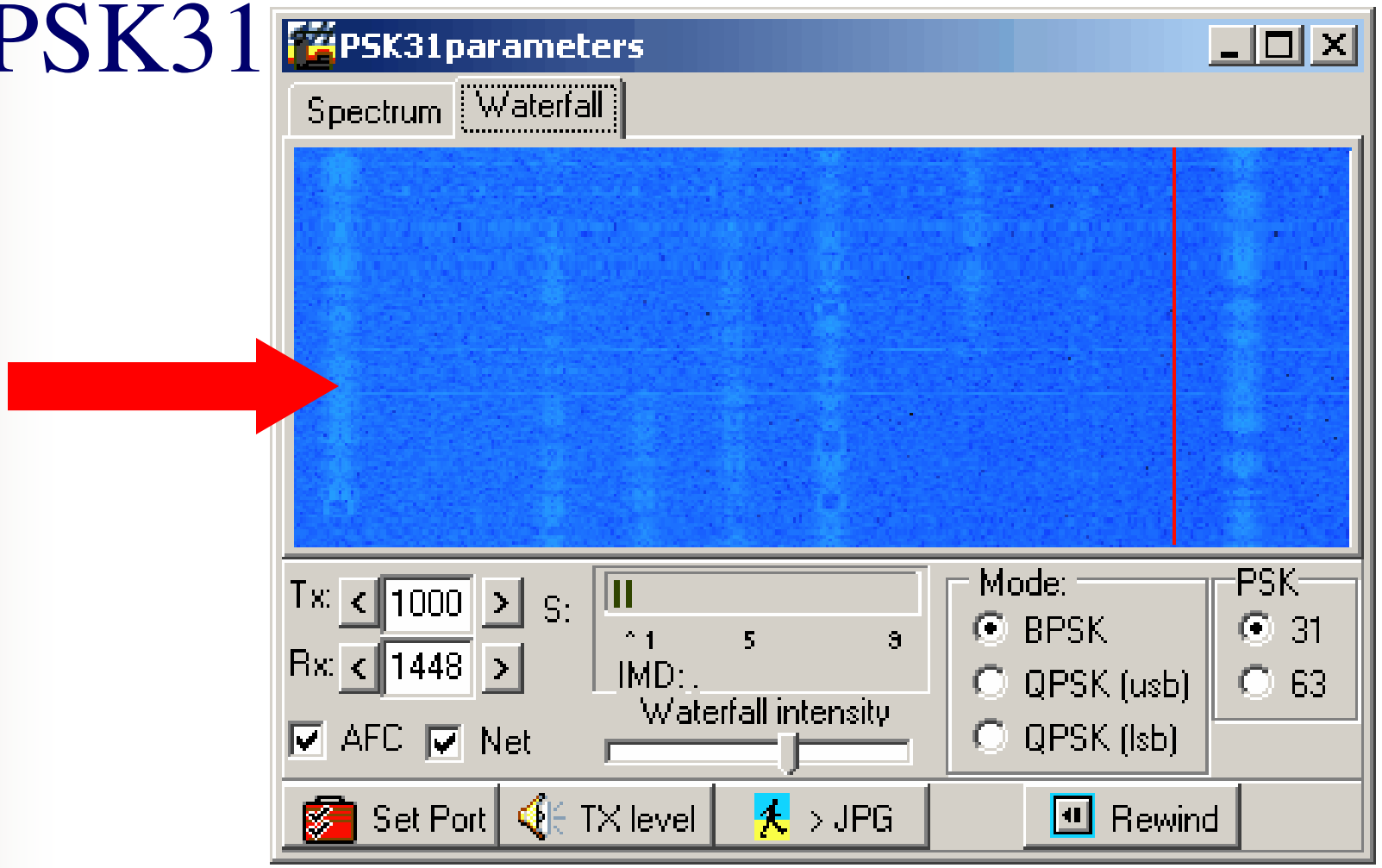


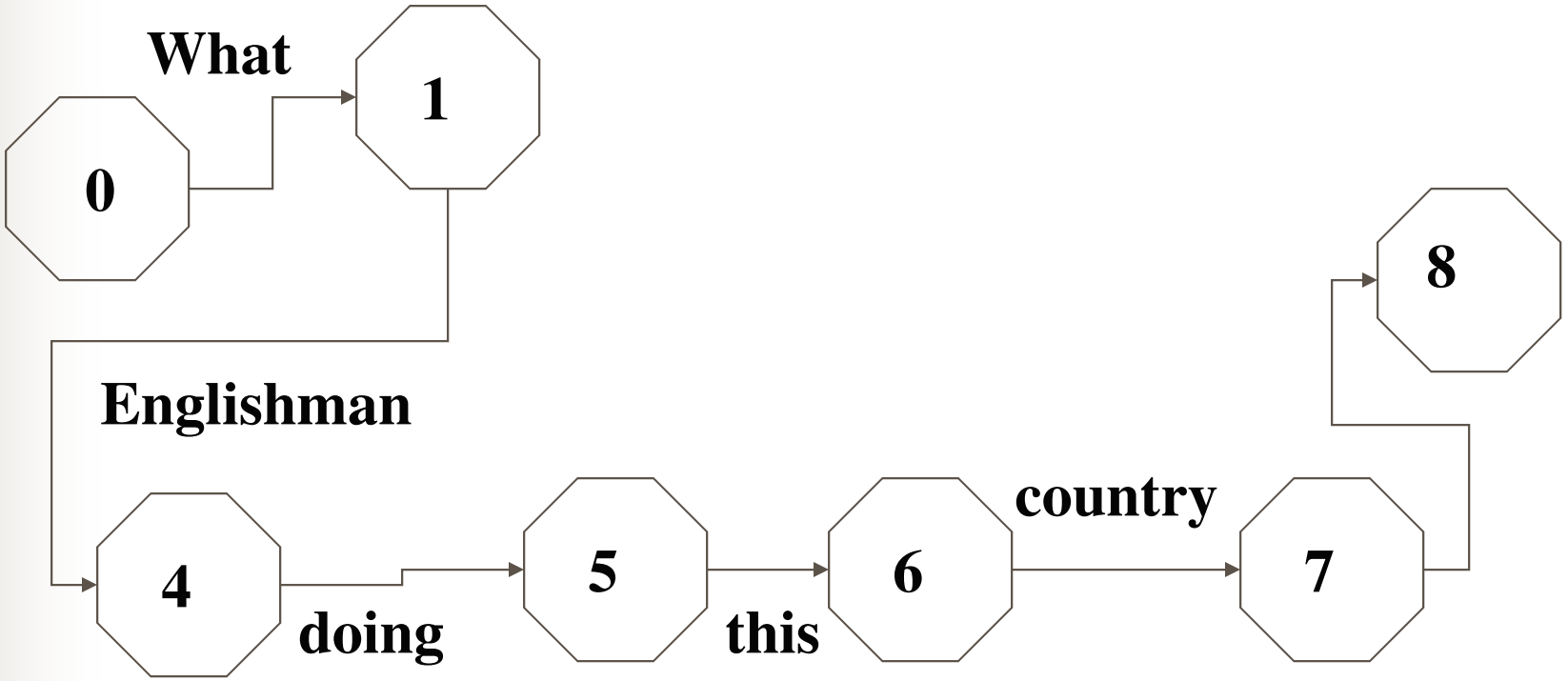
PSK31



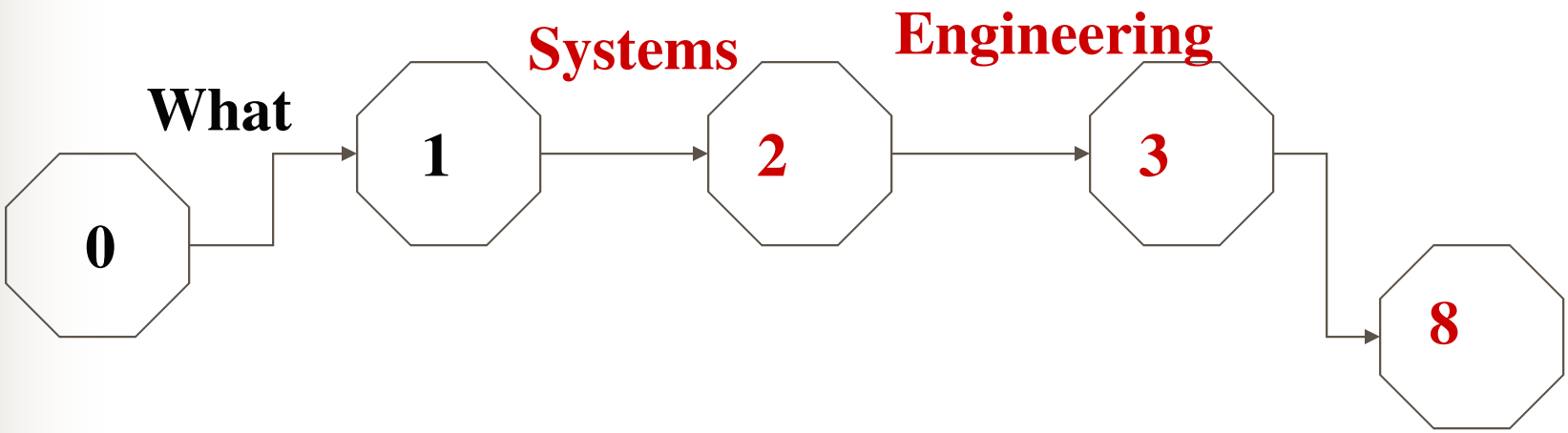
Automating Communications

- Automatic CQ devices
- Automatic Packet radio message passing
- Automatic QSY for LEO OSCAR passes
- CW keyboards and readers
- DX alerts can tune radios to DX frequency
- Accessories
  - DX Atlas
- Automating QSOs
  - Smart brag tapes

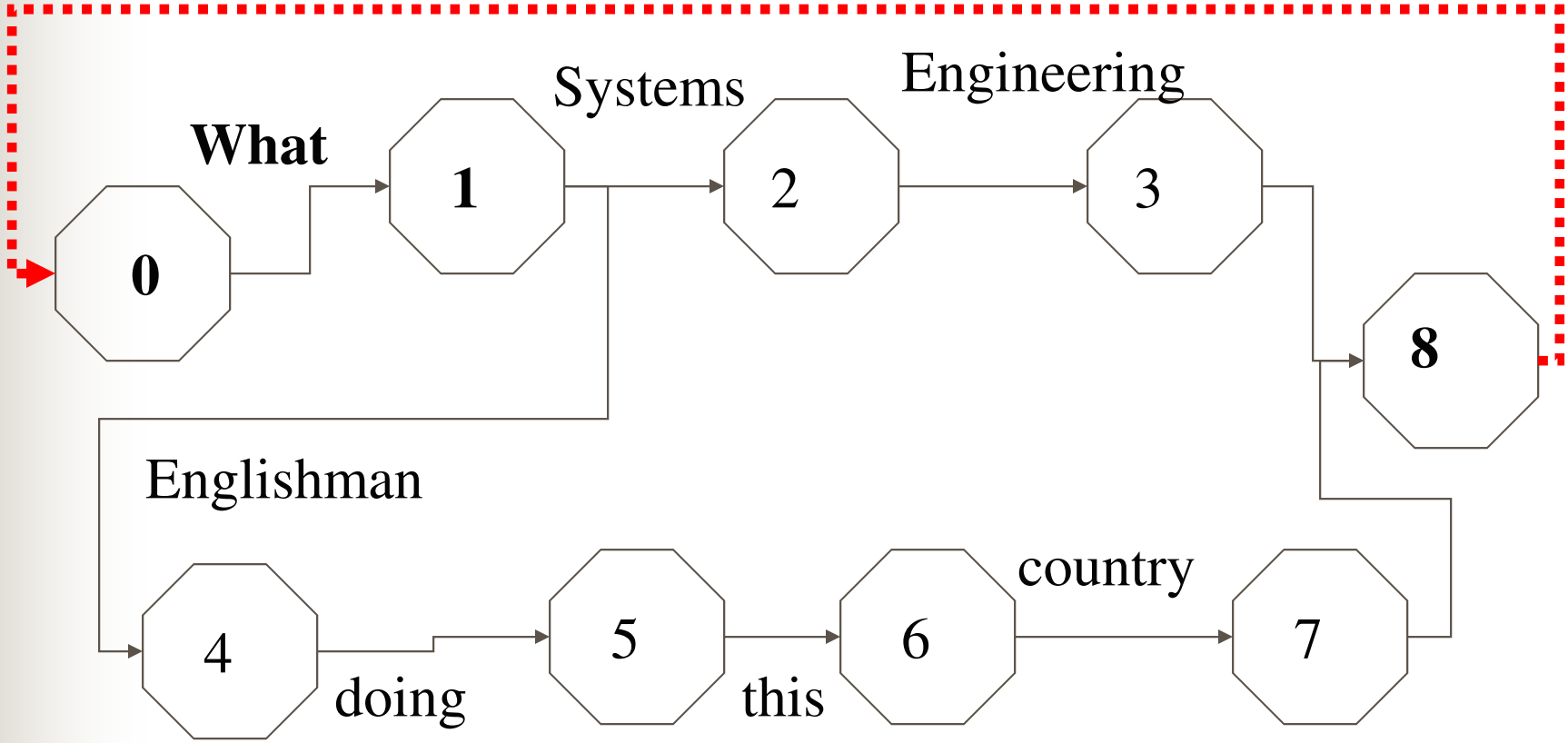
Automating QSOs



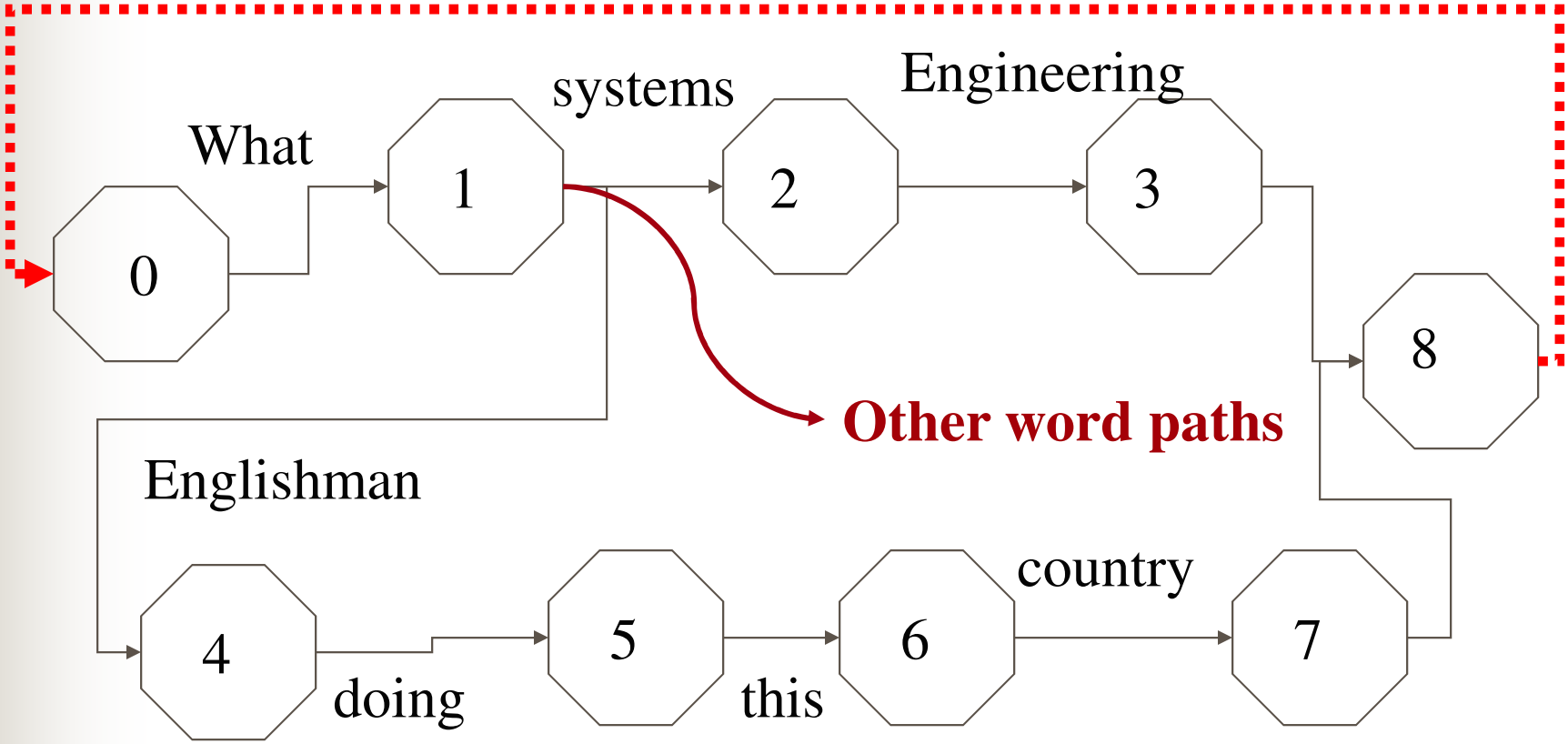
Automating QSOs



Automating QSOs



Automating QSOs



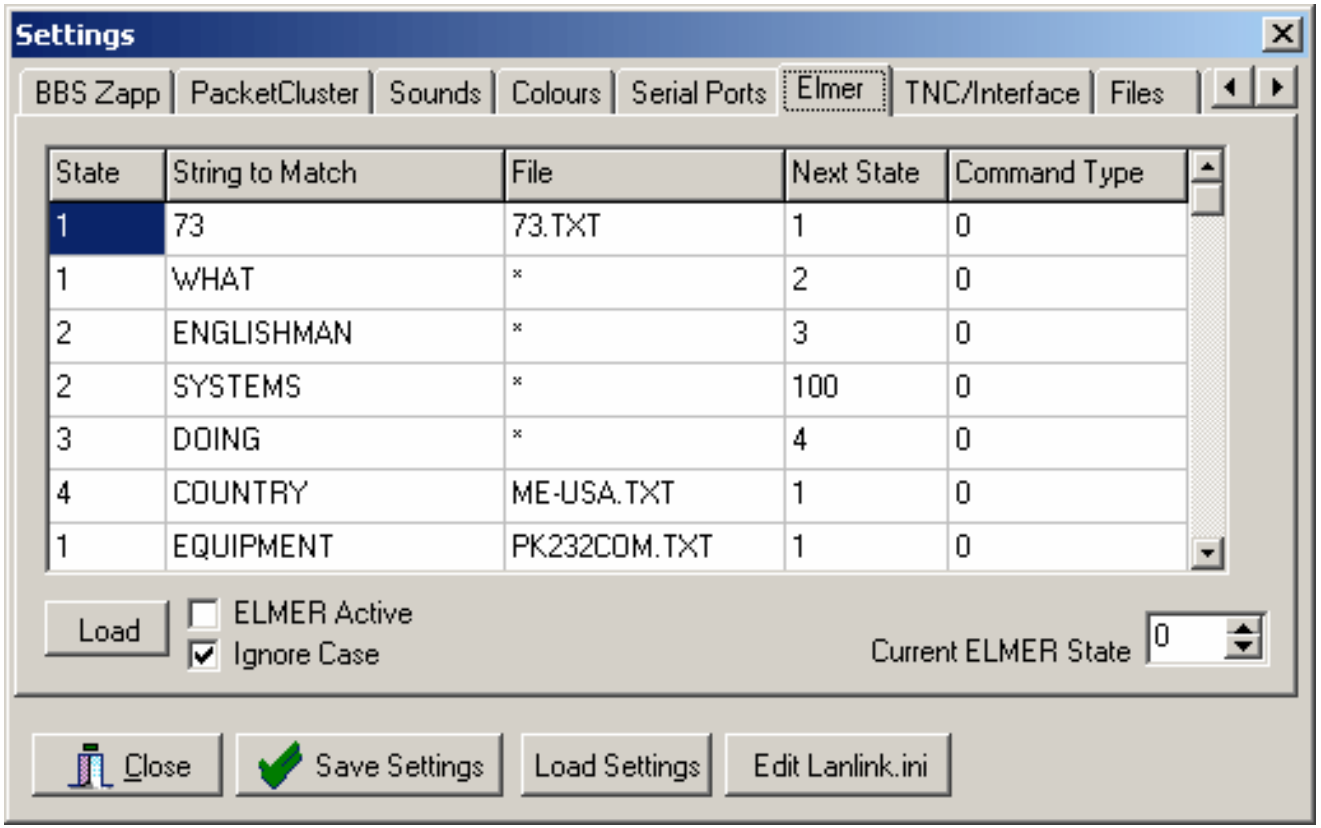
State functions

- Do nothing/ wait for another word
- Send a file
- Turn transmitter on and send a file
- Send a file, then turn transmitter off
- Execute a program
- Overlay state table

State table - section

State	Word	Function	Next state	File	Repeat
0	What	nothing	1	N/a	Yes
1	systems	nothing	2	N/a	No
1	Englishman	Nothing	4	N/a	No
6	country	Send file	7	Country.txt	No

Elmer



"ELMER: An Expert System Based on a Finite State Machine", *AMSAT Symposium*, Washington DC., 1992

The Internet

- **Provided "wormholes"**
- Replaced message aspects of packet radio
- Providing new 'voice bands'
  - IRLP
  - Echolink
- Provides video and audio QSOs
- Providing experiment features via remote receivers
  - W4MQ and W7DXX
- Low cost

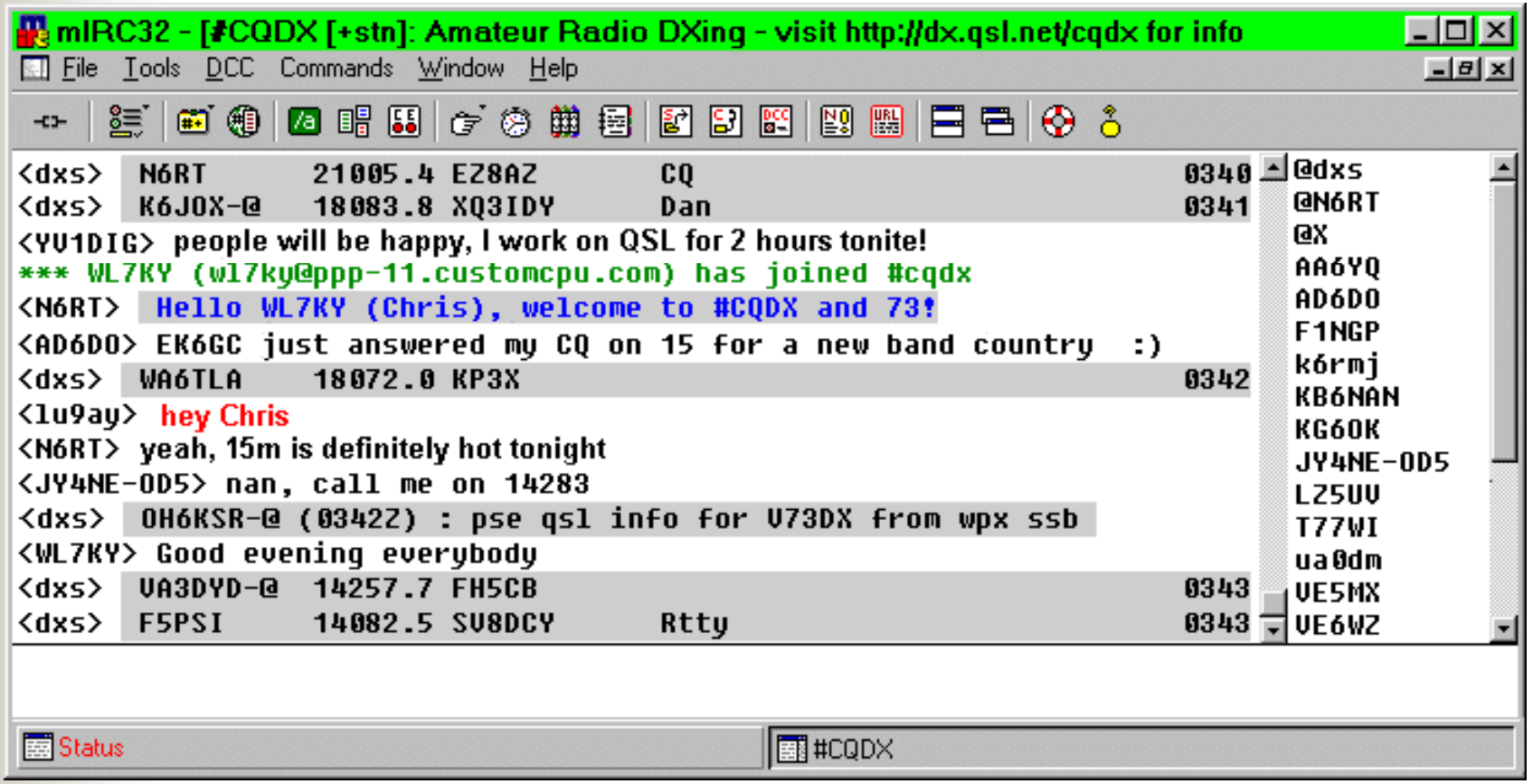
Partial list of Nodes available via the WA3NAN Node circa 1993

BLWNDE:VK3BLW-2
BOWR48:VK2XDM-2
BRADIP:WB9UUS
CHAVER:N3BBF
CNBBPQ:F6CNB
DCA1:K3AF-1
DXWHO:VE7CC-3
EDUBBS:PP5UF-8
EHQBBS:VK2EHQ
EWABBS:KB3RM
EZF:KC4ASF-3
EZFBB:KC4ASF-1
GIN48:VK1RGI
GLSBPQ:KG5RG-3
HAISIP:VK3ERM-3
HGN:W3BRZ-9
HNL:KJ9U
HOCOBB:NB3P
HOLD2:VK3RPS
HOLD70:VK3RPS-7

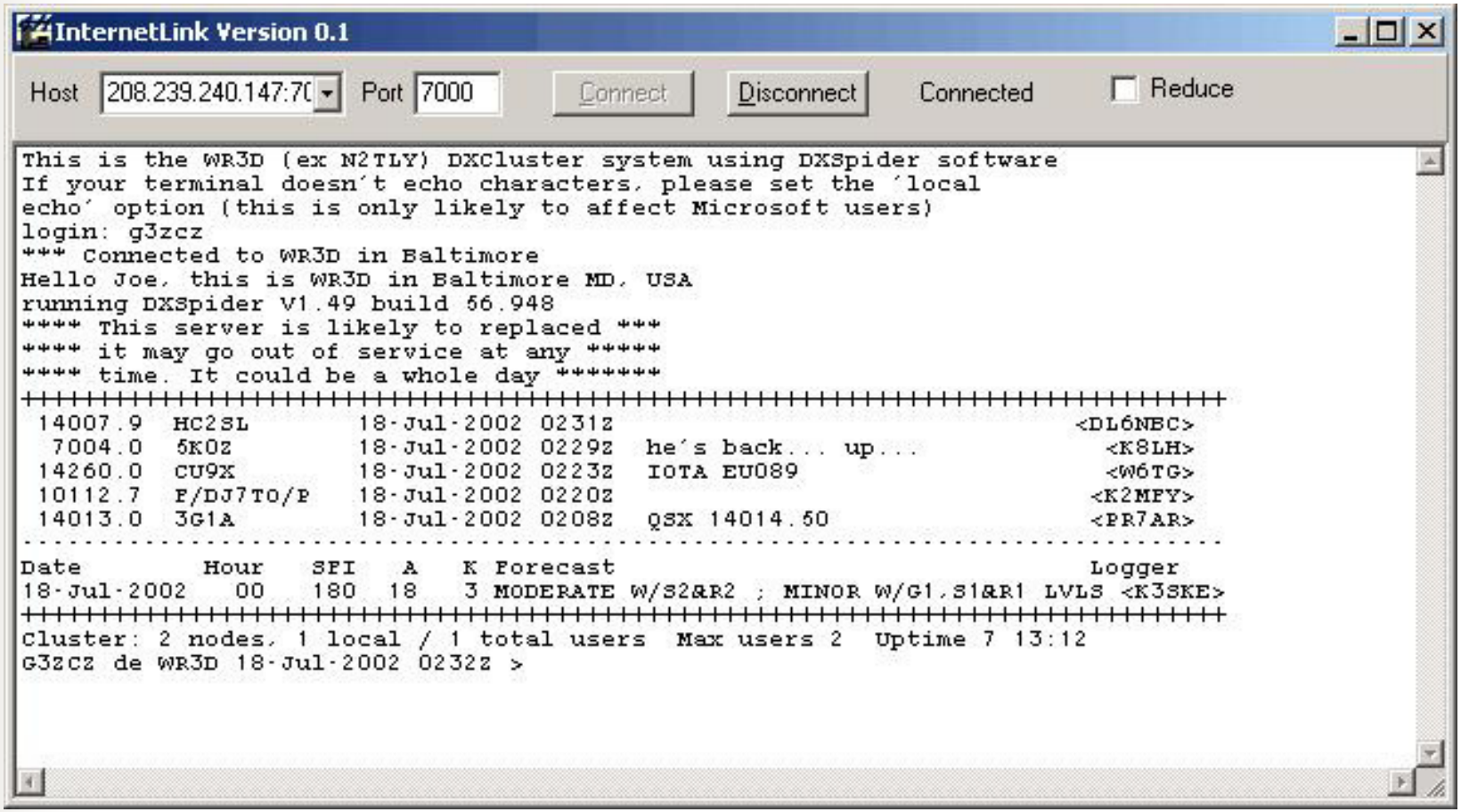
The Internet

- Provided “wormholes”
- **Replaced message aspects of packet radio**
- **Providing new ‘voice bands’**
  - **IRLP**
  - **Echolink**
- **Provides video and audio QSOs**
- **Providing experiment features via remote receivers**
  - **W4MQ and W7DXX**
- **Low cost**

IRC chat sample



InternetLink



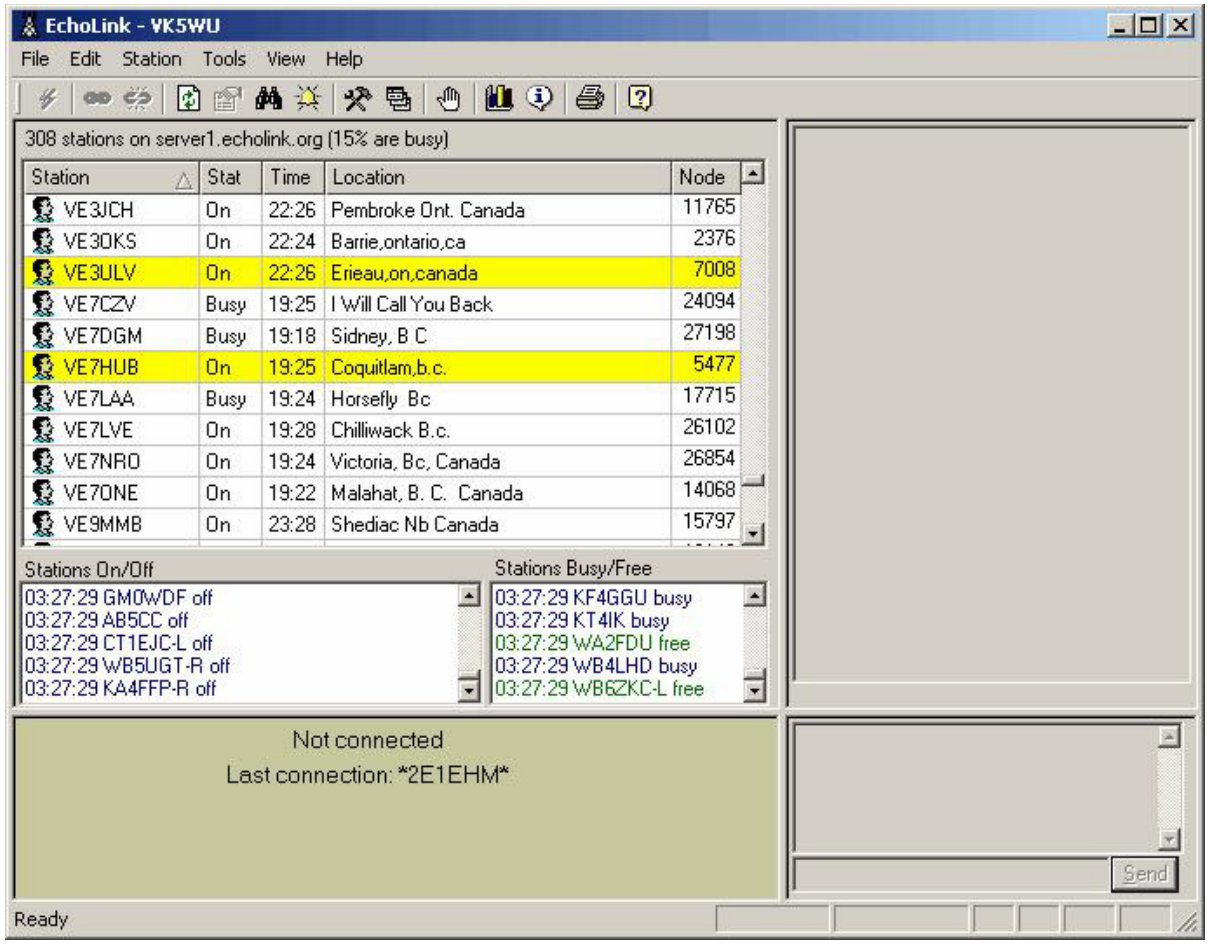
Iphone

- Vocaltec
- Audio and video QSOs
- Audio repeater wormholes
- Small screen
- No longer supported
- Use Microsoft's Netmeeting for the same functions
  - Need IP address

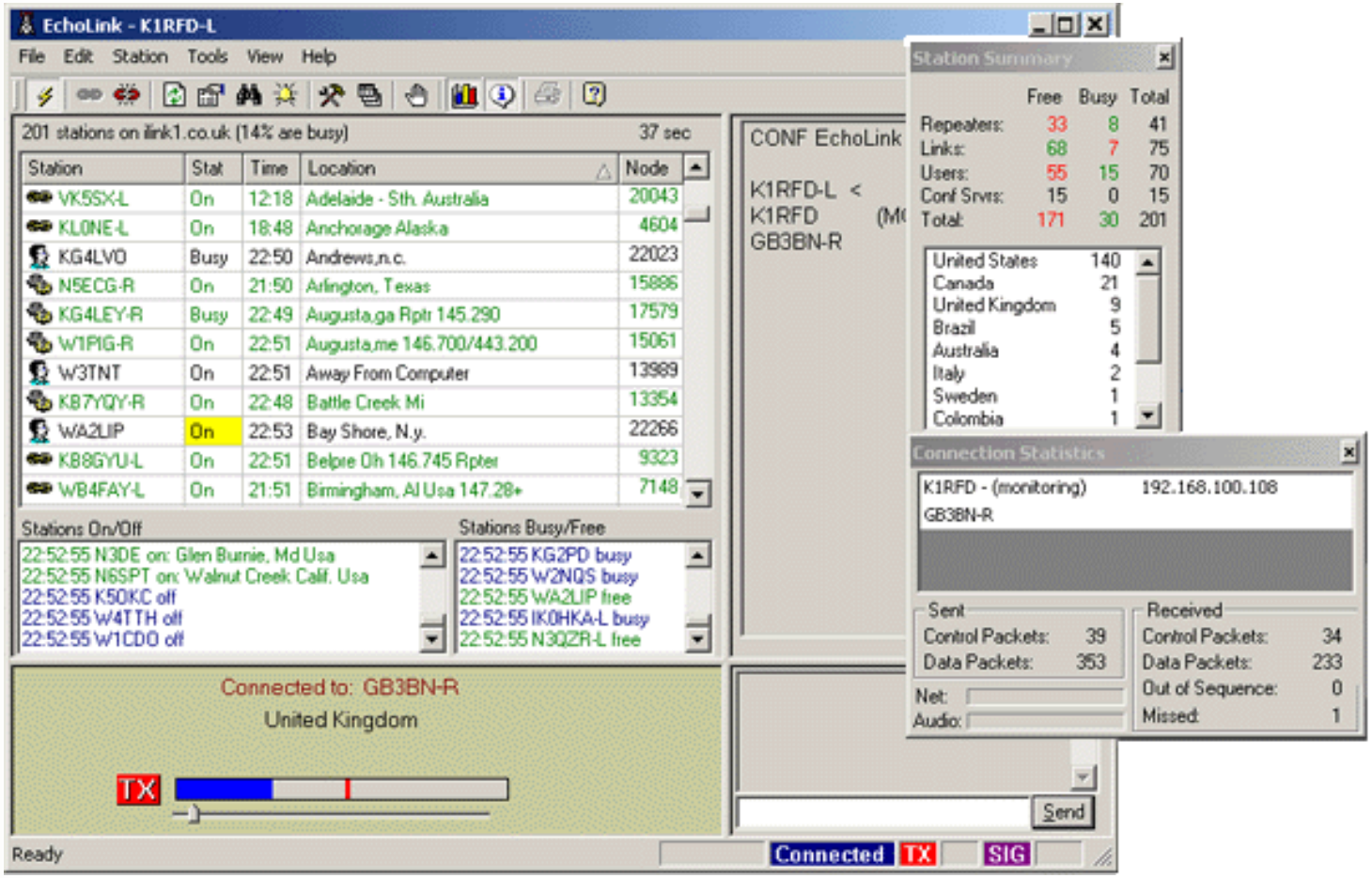
IRLP

- http://www.irlp.net/
- Internet Radio Linking Project.
- Voice over IP
- Links > 700 vhf/uhf repeaters worldwide
- Dial-up tone control access
- VK5 Node 650

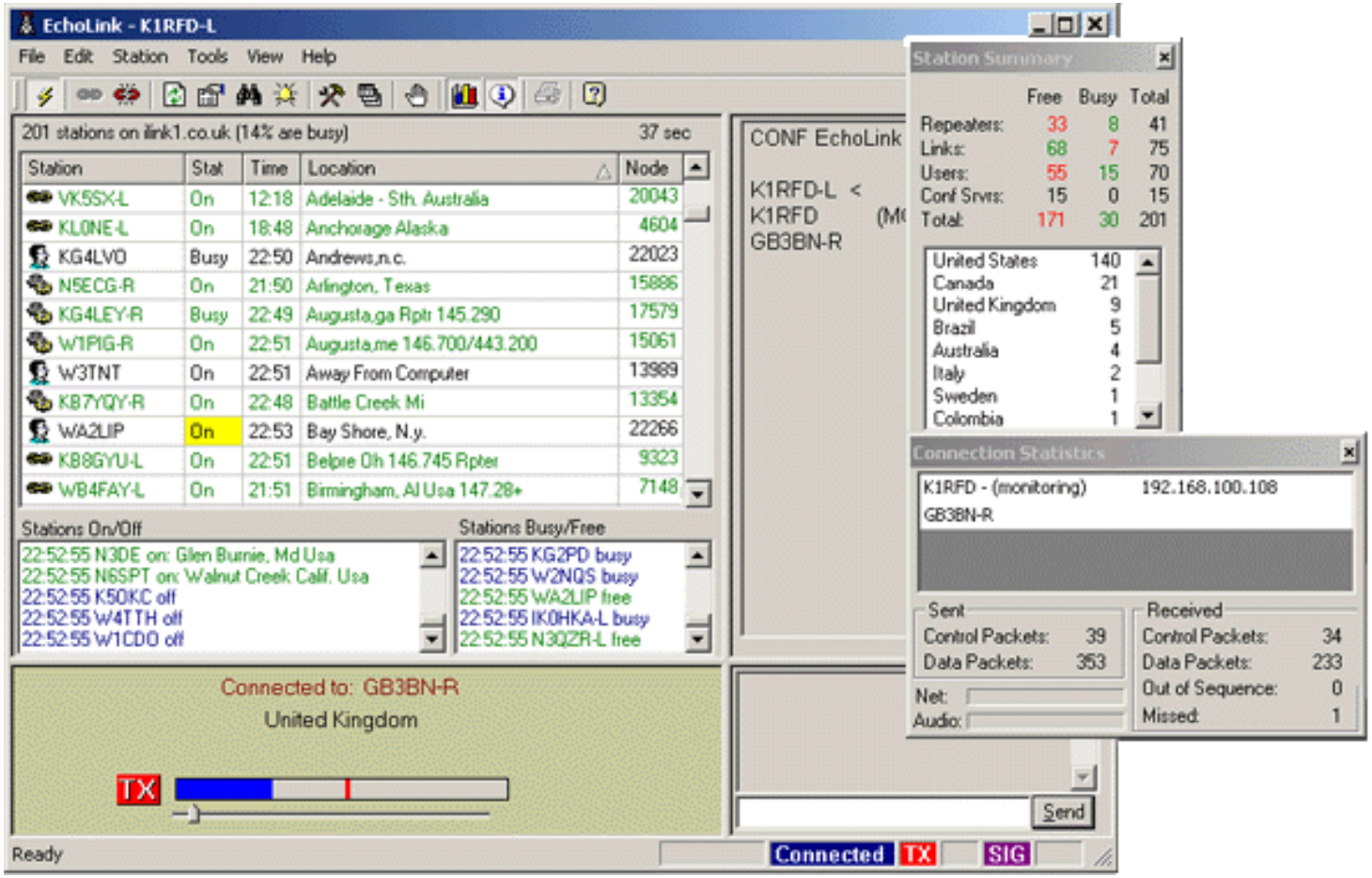
Echolink



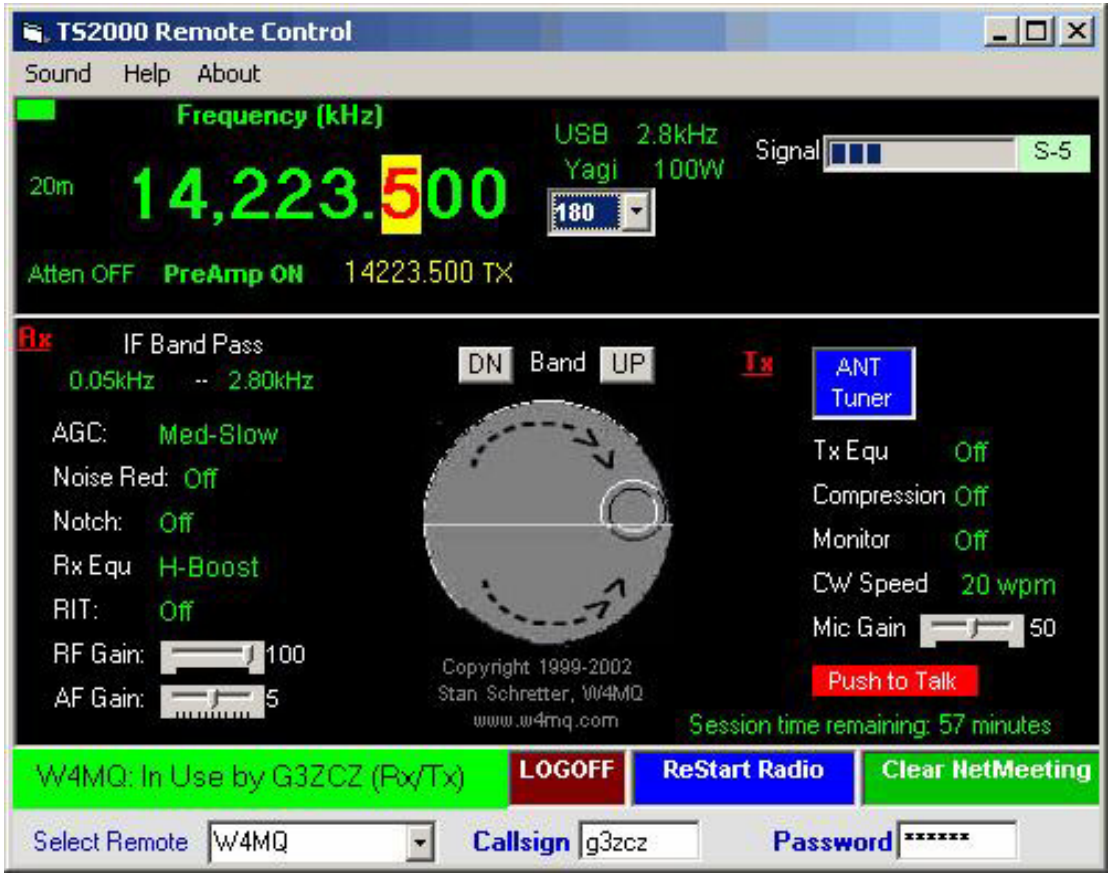
More Echolink



More Echolink

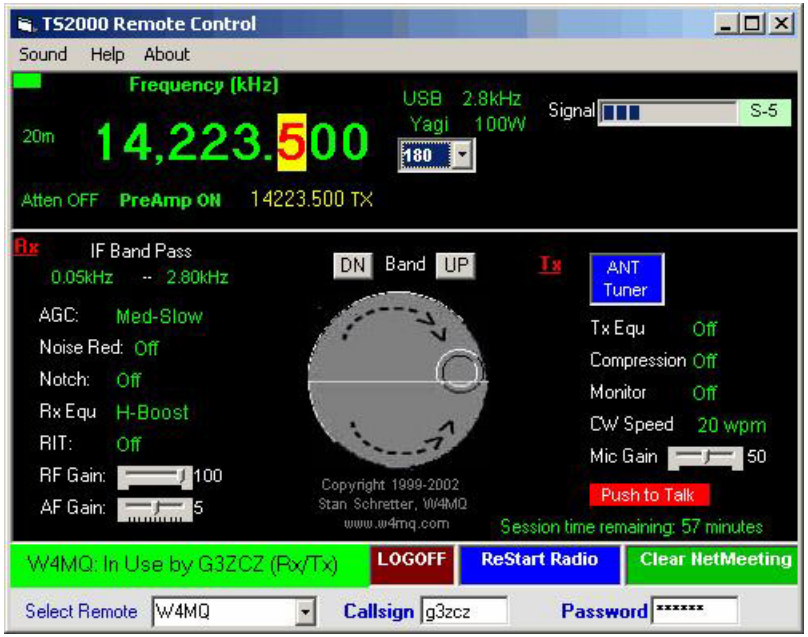


VK3UR, W4MQ and W7DXX/1



W4MQ and W7DXX/1

- Regular QSOs
  - Internet delays
- Sweepstakes contest
  - QST July 2002, p94.
- Thunderstorm at G3IOR
- Work yourself in many places?



Topics

- Conventional amateur radio
- Introduction of computers
- OSCAR
- Digital communications
- Automating Communications
- The Internet
- **The future?**
- Concerns
- Discussion

The future?

- Electronic QSLs
  - Text emails?
    - letters
  - Pictures via email?
    - QSL cards

The future?

- Electronic QSLs

The future?

- Electronic QSLs
- **Interplanetary communications**

[young] G3ZCZ at Comsat Labs, with OSCAR 7 Mode B Communications Terminal, donated by Comsat to World Boy Scouts HQ, Geneva

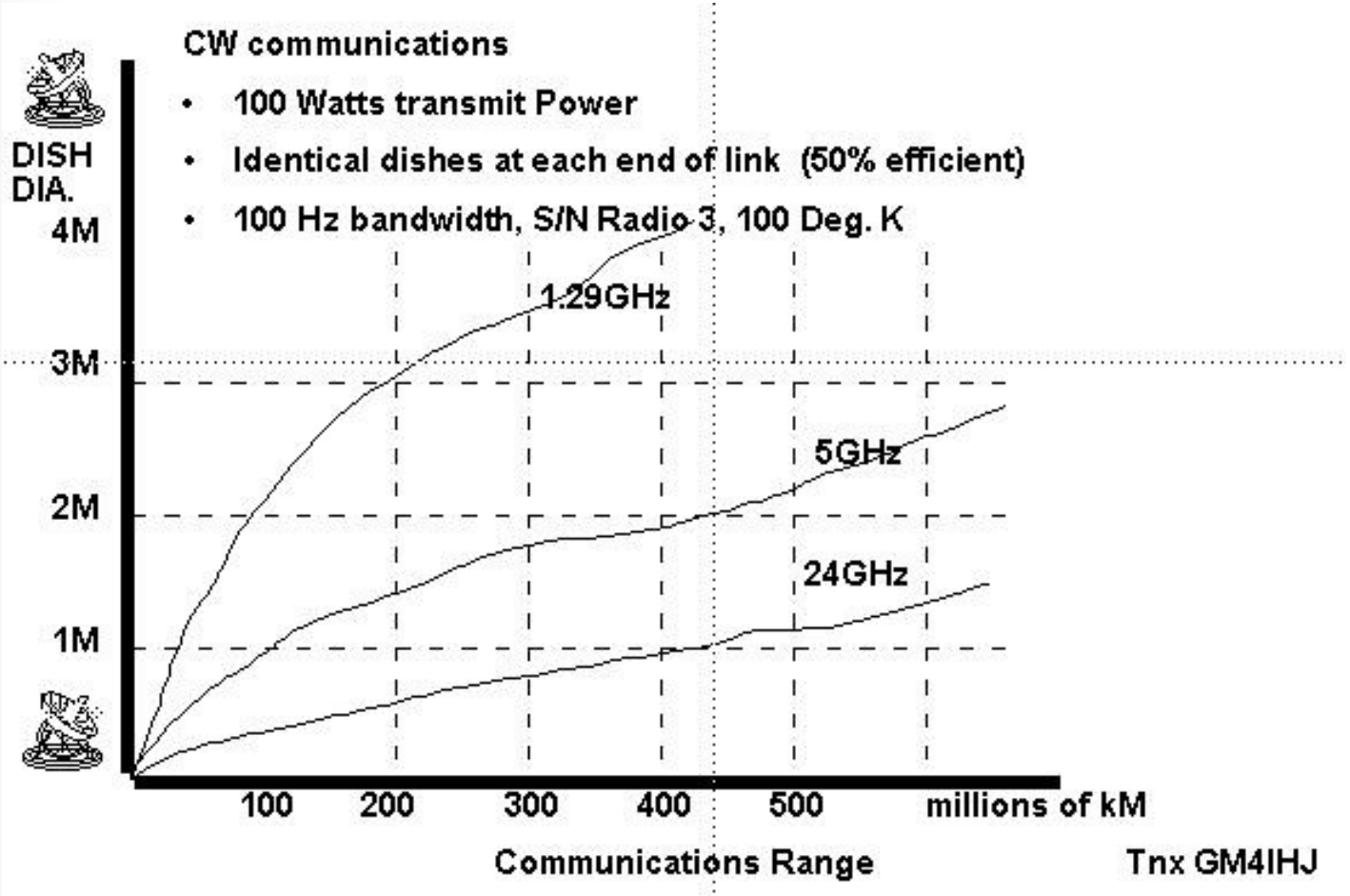
GATEWAYS TO THE 21ST CENTURY

JOE KASSER, G3ZCZ

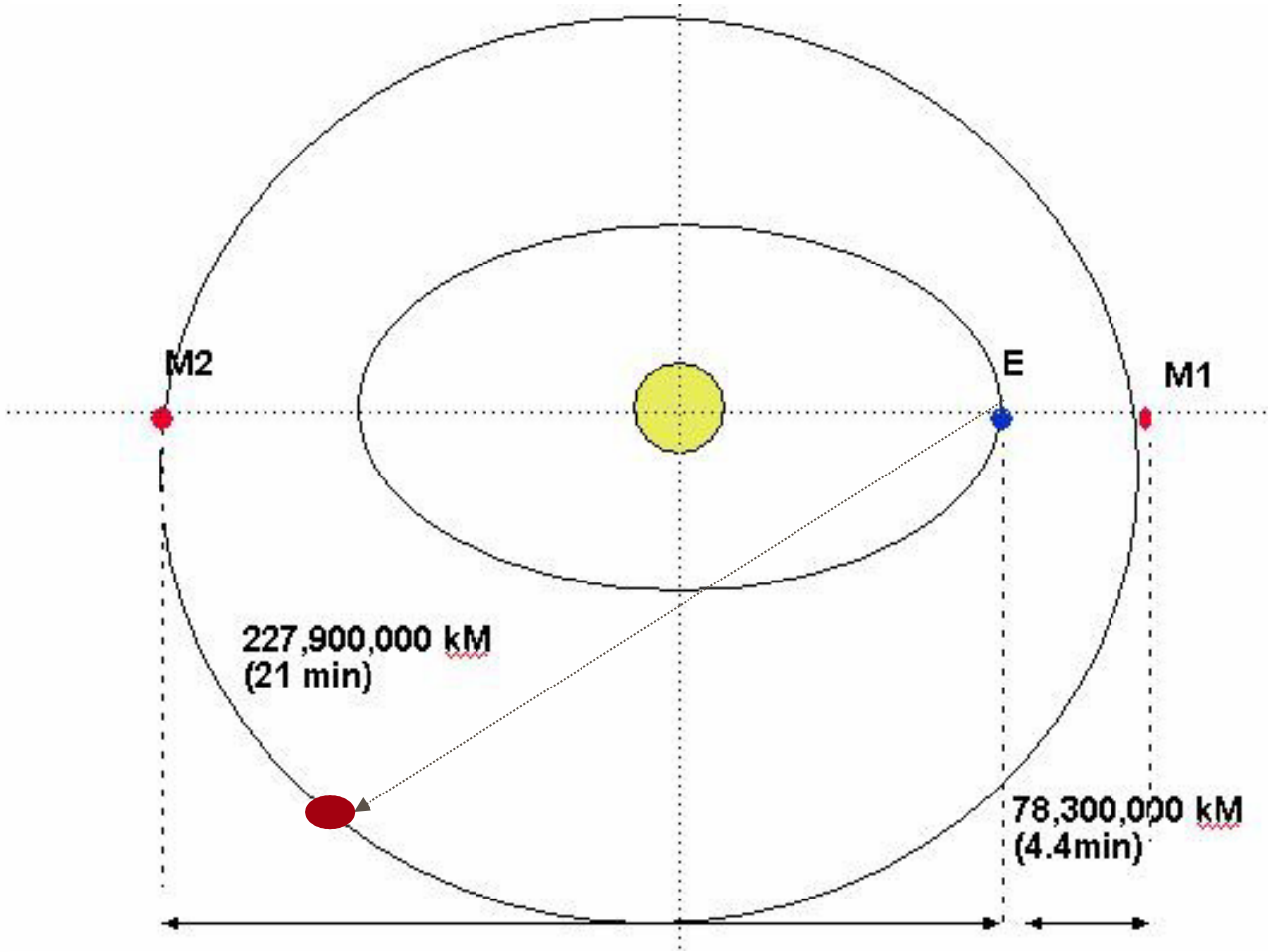
AMSAT-NA SPACE SYMPOSIUM

NOVEMBER 1991

Microwave ranges

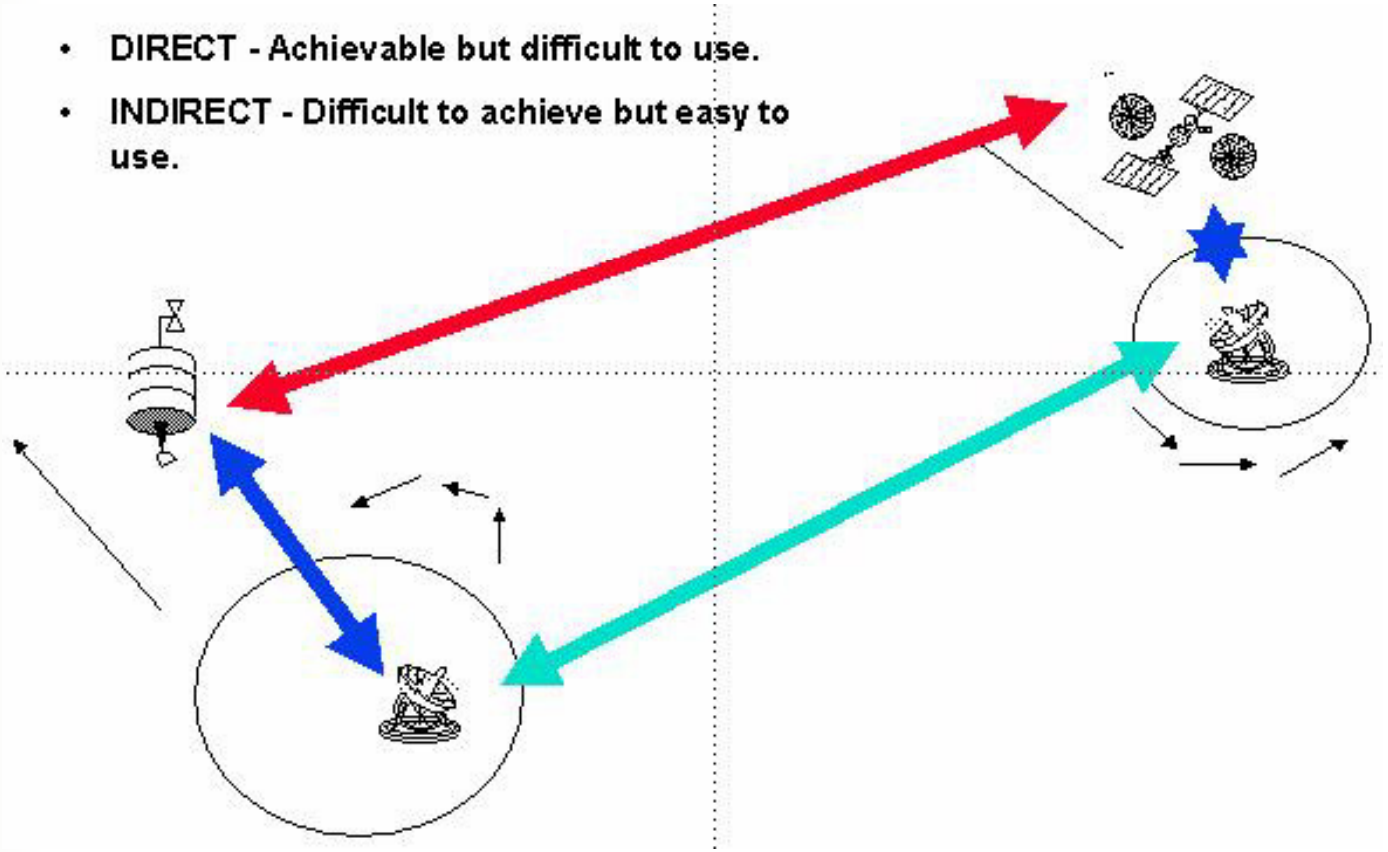


Earth – Mars links

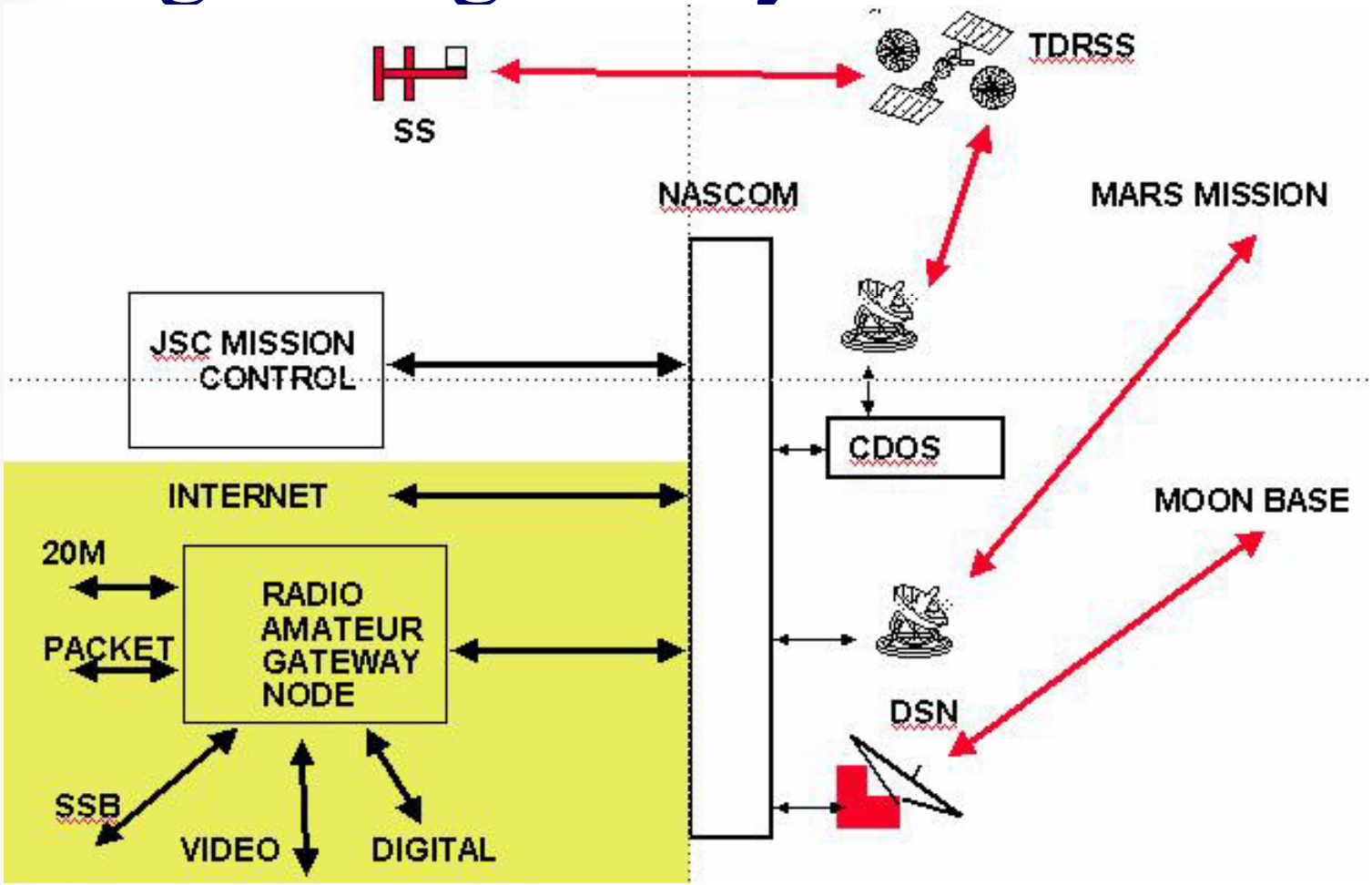


Interplanetary communications

- DIRECT - Achievable but difficult to use.
- INDIRECT - Difficult to achieve but easy to use.



Integrated gateways



The future?

- Electronic QSLs
- Interplanetary communications
- **Hybrid Internet-Radio links**
  - IRLP, W4MQ, new types
- **Need new cost-effective applications**
  - 20th Century
    - Communications
  - 21st Century
    - Something different
      - Experimentation and education?

Concerns-1

- Before about 1980 amateur radio led the way
  - Short wave propagation
  - Emergency communications capability
  - ELT for downed aircraft
  - Capabilities of LEO communications satellites
  - Etc.

Concerns-2

- Post 1980 amateur radio seems to be following
  - Packet radio introduced and provided Internet capability to radio hams, but was overtaken by the growth of the Internet
  - Current spread spectrum experiments in USA
  - HF modes of communications
    - PSK-31, MFSK

Concerns-3

- **Need new services [for microwave bands] that do not try to duplicate Internet capability nor try to duplicate hf/vhf functionality**
- Need to focus on non-communications functions of amateur radio
  - Experimentation
  - Spacecraft telemetry
  - Education
  - Etc.

Microwave bands

- Amateur vhf/uhf/microwave spectrum is shrinking
  - Personal communications are absorbing spectrum
  - Amateur hf spectrum is growing slightly
    - Professionals move to vhf/uhf/microwave
- Microwaves are not conducive to multi-point QSOs
- QSOs are local
  - even with repeaters, except via OSCAR
- Cable losses are high compared to hf

Comparisons for communications

- Radio links
  - RF equipment
  - Antennas
  - Purchase price
  - Audio - World-wide
  - Local video - uhf/microwave
  - QRM
- Internet
  - No RF equipment
  - No antennas
  - Monthly ISP costs
  - Audio and video - World-wide
  -
  - No QRM

Cellular telephones provide local service for simplex single QSOs

Experimentation

- Layered software
  - Well defined interfaces
- Application layer
  - LanLink
    - traditional communications and databases
- Communications layer
  - Voice card modems
    - psk31 etc.

Modular approach to developers

- Think about why new modes catch on
- Instead of developing one aspect well and others in mediocre manner because the users want them
- Focus on what you can do well
  - Eg. AE4JY's PSK31CORE.DLL
- Leave other aspects to those who do them well
- User can plug and play

Summary

- Conventional amateur radio
- Introduction of computers
- OSCAR
- Digital communications
- Automating Communications
- The Internet
- The future?
- Concerns

Software for Amateur Radio 2001

Discussion

- http://therightrequirement,com
- http://www.w4mq.com
- http://www.echolink.org
- http://www.eqsl.org
- http://www.satscape.co.uk
- http://www.irlp.net/
- http://www.taborsoft.com/abw/
- http://www.qsl.net/mmhamsof/
- http://www.qsl.net/g4ilo
- http://www.arrl.org
- http://www.rsgb.org
- http://www.wia.org.au