Newcomers and Elmers Net: What Else can you do with a Soundcard
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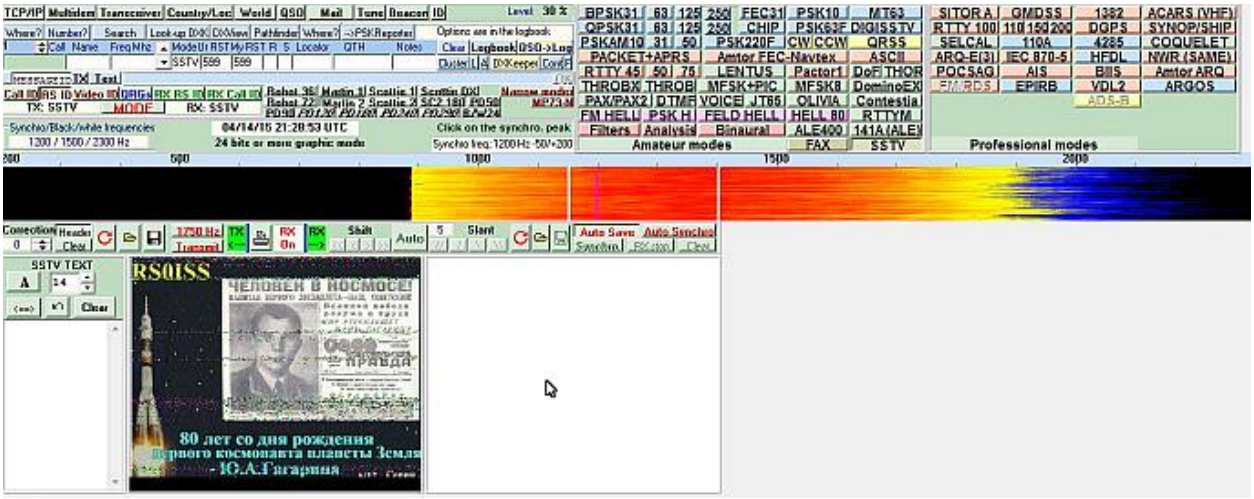
Sound card modes

Beacons (NDBs-non-directional beacons) as well as amateur radio beacons in the 475 kHz range
plane plotter – track planes based on input from an SDR dongle or UHF radio capable of 1090 MHz reception
acars – plane tracking in VHF range
HDFL- acars for HF frequencies
SECAL – selective calling
APRS – not just for hams/cars; planes, ships etc
ALE – civilian and military Automatic Link Establishment



Sample screen of Multipsk software – 64 modes and more in registered version; this is the SSTV mode with Russian ISS capture

Digital Modes

The military utilizes numerous digital modes, some of which can be decoded by software available to civilians. One of these digital modes is ALE (Automatic Link Establishment, sometimes written as MIL STD 188-144A) which can easily be decoded with commercial or freeware software. This software is used to test the radio path between two stations, and on occasion, pass simple messages. It is in essence a propagation check for the stations. ALE provides HF radios the ability to automatically link using the best frequency based on reception data given by the results of link testing.

I have included both some sample frequencies for some of the various modes, as well as some screen captures of typical reception patterns.

USAF Scope Command ALE frequencies (kHz)

2805.0 3059.0 3137.0 4721.0 5708.0
6715.0 6721.0 7632.0 8965.0 9025.0
9057.0 11226.0 11250.0 13215.0 15043.0
18003.0 20631.0 23337.0 27870.0

US Customs Over The Horizon Enforcement Net (COTHEN)

COTHEN is a network of links between agencies like the Army, Navy, U.S. Coast Guard, Drug Enforcement Administration, Border Patrol, and Joint Interagency Task Forces. Support is provided by 19 Technical Service Center (TSC) stations around the country, providing real-time on-the-air support services and communications between users. COTHEN allows for telephone patch (TRICS) services and platform tracking and location system (TRACS) services, as well as other linking functions. Decoding data requires MIL-STD 188-141A protocol (ALE), but formerly used a proprietary protocol by Rockwell Collins.

Monitoring Frequencies (kHz, USB Mode):
5732.0
5909.5
7527.0
8912.0
9106.0
10242.0
11494.0
12222.0
13312.0
13907.0
14582.0
15867.0
18594.0
20890.0
24838.5

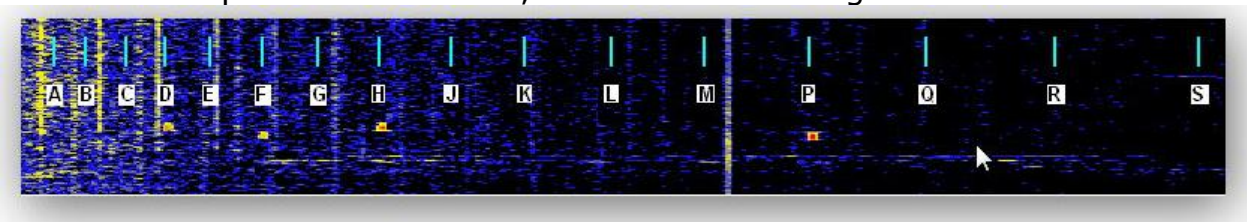
There is a wealth of information, including call signs, at http://wiki.radioreference.com/index.php/COTHEN as well as the MILCOM Monitoring Post

SELCAL
As one might imagine with HF signals traveling as far as they do some method of identifying a specific plane could be quite useful, beyond a plane's call sign. With signal distortion and atmospheric issues to deal with, a system was needed which would allow a plane to alert the pilot when a cal was intended for him. A system was developed called **SEL**ective **CAL**ling, where a two pairs of tones were assigned to each flight. It is in essence a paging system for aircraft. The use of SELCAL allows an aircraft crew to be notified of incoming communications even when the aircraft's radio has been muted. They have been in use on most long rage aircraft since the 1960s and are still in use today.

If the tones match the programmed code for the aircraft then a chime or gong will sound in the cockpit and a light will come on the radio panel to indicate which radio (HF1, HF2 etc) received the SELCAL tone. If the tones do not match the programmed ones they are ignored.

For monitoring purposes there are specialized software programs designed to decode the tones, or the Multipsk program (a great all-around utility monitoring program) can decode these by using an overlay on the waterfall with the respective letters for each tone.

Here is a sample from 8891 kHz, Gander radio calling:



The SELCAL was FP – DH, and these show up just below their respective letters on the waterfall (the D and H are just slightly higher than the F indicating the FP came first, and the DH came second, thus FP-DH).

ARINC
In frequency listings there are often entries for ARINC, which stands for Aeronautical Radio, Incorporated. They have been providing communication systems for airlines since 1929, and operate stations around the world. ARINC also developed the standards for the trays and boxes used to hold standard line-replaceable units (like radios) in aircraft. These permit electronics to be rapidly replaced without complex fasteners or test equipment.

The **ACARS** system of identification data transmission was also developed by this group, and these signals can be monitored on VHF locally (131.551) as well as HF bands.

Digital Modes for Aviation Monitoring
Digital modes play a large part in aviation monitoring since a lot of information can be passed reliably under less than favorable conditions. Beyond simple identification bursts, weather, navigational aids, and other relevant information can be passed without a lot of intervention from the pilot or controller, and the radios in the plane are designed to scan preset frequencies.

Modern aircraft also can automatically make routine engine performance observations and check systems status and then downlink the information to the operator's maintenance and dispatch facilities.

HDFL – ACARS for HF
High Frequency Data Link protocol (HFDL) is defined in ARINC specification 635-3, and it is operated by ARINC as GLOBALink service through a worldwide network of HF stations, with a standard protocol:

1. Transmissions on HF are in USB on a sub carrier of 1440 Hz with a symbol speed of 1800 baud.
2. Modulation is 2-PSK, 4-PSK or 8-PSK with effective bit rates of 300, 600, 1200 or 1800 bits/sec.
3. Several ground stations provide global network coverage and system status updates.

The HFDL network has 17 nodes (ground stations) covering aviation world-wide, and also provides a LDOC (voice network) providing phone patch services and more. Each node (or ground station) has a pool of frequencies available for use, and chooses two depending on Ionospheric conditions. ground stations transmit a status approximately every 30 seconds on the two active frequencies in order to allow aircraft to know which frequencies are in use.

The Multipsk program mentioned above can decode HFDL signals, as can PC-HFDL. Both have HFDL capability, but there are differences: PC-HFDL is a specialized program just for HFDL and requiring a licensing fee beyond a short demonstration mode, and Multipsk is free for many modes, but requires the licensed version for HFDL, VDL2, SELCAL and others. Side-by-side comparisons of the two in HFDL mode were comparable, but I prefer Multipsk for its many modes.

HDFL Node (04) for Riverhead New York

5652 Riverhead, NY, USA HDFL/USB
6661 Riverhead, NY, USA HDFL/USB
8912 Riverhead, NY, USA HDFL/USB
11387 Riverhead, NY, USA HDFL/USB
13276 Riverhead, NY, USA HDFL/USB
17919 Riverhead, NY, USA HDFL/USB
21931 Riverhead, NY, USA HDFL/USB

Sample HDFL Display Captured with Multipsk 4.28

<300 bps 1.8 sec 1439 Hz> 02/17/2015 18:37:01
MPDU CRC control: OK
MPDU (Media access control Protocol Data Unit) - Downlink
LPDU CRC control: OK

[Unnumbered Data LPDU] [Performance data HFNPDU]
UTC time: 18:36:54 UTC **Flight identifier: VS103M** Latitude: 180-00.00N Longitude: 180-00.00W
Performance version: 3 "Flight leg"': 149
Ground Station Identifier: 4 - Riverhead, NEW YORK, USA (072-38-22W 40-52-47N)
Frequency number: 3 (13276.0 KHz)
Previous frequency search count: 15
Current frequency search count: 76
Previous HF data disabled time: 0 sec
Current HF data disabled time: 0 sec
MPDUs received without error: 0 (1800 bps) / 0 (1200 bps) / 14 (600 bps) / 28 (300 bps)
MPDUs received with errors: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 5 (300 bps)
SPDUs received without error: 80
SPDUs received with errors: 1
MPDUs transmitted: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 6 (300 bps)
MPDUs delivered: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 5 (300 bps)
No frequency change since the last "performance data" HFNPDU
<End frame>

<300 bps 1.8 sec 1447 Hz> 02/17/2015 18:37:03
MPDU CRC control: OK
MPDU (Media access control Protocol Data Unit) - Downlink
LPDU CRC control: OK

[Unnumbered Data LPDU] [Performance data HFNPDU]
UTC time: 18:36:58 UTC **Flight identifier: BAW191** Latitude: 56-31.57N Longitude: 073-30.29W
Performance version: 10 "Flight leg"': 143
Ground Station Identifier: 4 - Riverhead, NEW YORK, USA (072-38-22W 40-52-47N)
Frequency number: 4 (11387.0 KHz)
Previous frequency search count: 0
Current frequency search count: 15
Previous HF data disabled time: 1102 sec
Current HF data disabled time: 8826 sec
MPDUs received without error: 0 (1800 bps) / 0 (1200 bps) / 2 (600 bps) / 17 (300 bps)
MPDUs received with errors: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 0 (300 bps)

SPDUs received without error: 36
SPDUs received with errors: 1
MPDUs transmitted: 0 (1800 bps) / 1 (1200 bps) / 0 (600 bps) / 0 (300 bps)
MPDUs delivered: 0 (1800 bps) / 1 (1200 bps) / 0 (600 bps) / 0 (300 bps)
No frequency change since the last "performance data" HFNPDU
<End frame>

Abbreviations:
BDU - Basic Data Unit
HFNPDU - High Frequency Network Protocol Data Unit
LPDU - Link Protocol Data Unit
MPDU - Media access Protocol Data Unit
SPDU - Squitter Protocol Data Unit

Sometimes there will be text messages which take some getting used to since the text runs together (I have added ellipses where I think the breaks should be, but I might be wrong in places!):

<SOH>2.C-
GHPN<NAK>A9P<STX>/ATSRVXA….TI2/CYVR…ARR…AT…ISH…13Ø6Z…CYVR…ATIS…INFO…
H13ØØZ…Ø9ØØ6KT15SMSCTØ44…BKNØ78…BKN2ØØØ6/Ø6A3Ø25….IFR…APPROACH…ISILSO
R…VISUAL…RUNWAY…Ø8…RIGHT….DEPARTURES…RUNWAY…Ø8…RIGHT….INFORM…CYVR
…ATC…ATIS…HD491<ETX><EM>S<DEL>