Automatic Radio Direction Finding Using MacAPRS™ & WinAPRS™
Automatic Position Reporting System

Keith Sproul, WU2Z
ksproul@noc.rutgers.edu
http://aprs.rutgers.edu/APRS/

Abstract

Radio Direction Finding has been around for almost as long as radio itself. Doppler-based RDF systems have been around for quite awhile too. In the recent past, people have developed computer interfaces to Doppler-based RDF systems. APRS has the ability to display the RDF information on maps, giving the user a graphical way to view the RDF patterns.

Over the last few years, the call sign databases available on CD-ROM from several companies have become more and more sophisticated. There are also databases of commercial frequencies and locations available.

Most of us involved in Amateur Radio have experienced situations where we need to track down the cause of an unwanted radio signal, i.e. stuck microphone, improperly tuned equipment, or even a jammer.

With all of the available technology, we should be able to develop a system that zeros in on a location and automatically shows us the possible transmitters in the area.

Computerized Radio Direction Finding

Doppler RDF units have been around for many years. Several years ago, people started trying to get the output of these RDF units to feed directly into a computer. One of the early versions of this was simply a method for reading the status of the LEDs on the RDF unit via a computer interface. Later on, these interfaces became more sophisticated. The current RDF units have serial ports that report not only the direction, but also signal strength indicators. The direction vectors are also reported in much higher accuracy resolution.

This year at the Dayton Hamfest, Agrelo Engineering introduced the DFjr. This unit is a complete computerized RDF unit. During the development of this unit, Agrelo worked with the developers of APRS to ensure smooth operation of their unit and the APRS software.

The 'normal' mode of operation of the DFjr is to have it in a car for doing RDF work. However, this unit also can be configured to be hooked up to a TNC so that each time

it hears a signal on the frequency it is monitoring, it will transmit the RDF information over Packet, using APRS protocols.
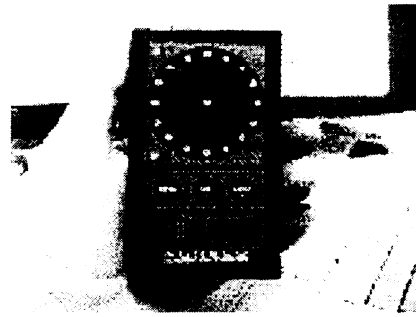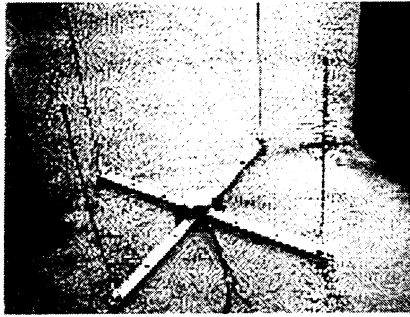
Agrelo DFjr, Computerized Doppler RDF Unit

Computerized RDF and APRS

APRS will take the output of the RDF units and display the information on any of the APRS maps. This gives you a geographical representation of the RDF data. If you have more than one RDF/APRS station participating, then you can get real-time intercept vectors. The first picture below shows WinAPRS and the vectors from a DFjr. The second picture below shows MacAPRS and two stations reporting RDF vectors.
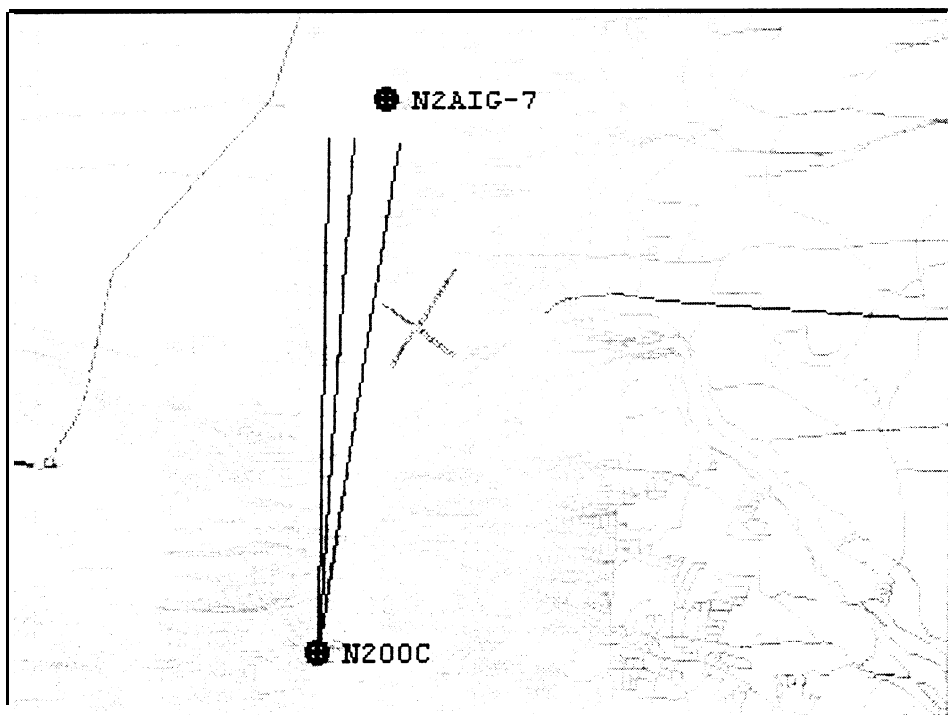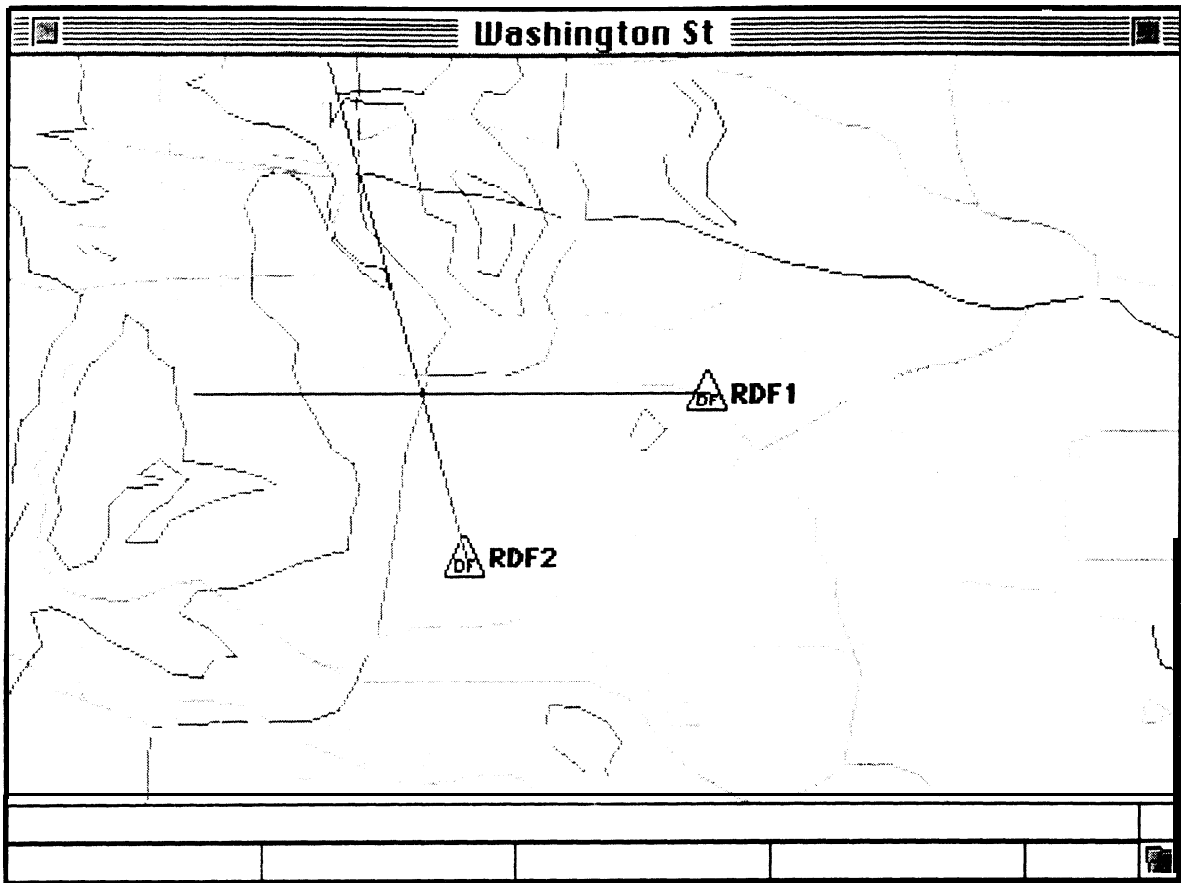
Combining RDF and Call-sign Databases

Once the RDF information lets you know the area of interest, you can find all of the stations in the area with the help of the call-sign databases on CD-ROM. **MacAPRS** and **WinAPRS** can search through the database and show you all of the stations located in that general area. This is done via a database containing the latitude / longitude of all of the post offices in the US. Some of the CD-ROMs are starting to add the Zip+4 lat/lon to their databases. The Buckmaster CD was the first to do this. (This, alone, makes their CD one of the best available for this type of use).

The user can then search for all of the call signs reported to be in this area. The user can select how big of an area to search. The initial search is done on the lat/lon of the zipcode. This is done for speed. Then, once this group of data has been selected, it is further enhanced using the Zip+4 data, if available. The chart below shows the information obtained from the Buckmaster Hamcall CD.

The table below shows one page of approximately 110 people found within a 1 mile radius of the intersection point shown above. Realize that this is the FIRST pass based on the 5-digit zipcode. The table shows the actual distance from the intersection of the RDF vectors to each station based on the its zip+4 lat/lon. If the CD-ROM database you are using has the Zip+4 location data, you can double click on each one of the

stations in the list and it will show you exactly where that person lives on the map. (Within the accuracy of the Zip+4 system which is generally about 1/2 block).

Call	LC	First Name	Last Name	Street	City	St	Zip	DOB	Lic Issue	Lic Expire	Area	County	Other	Dist
KB7OAT	N	Jeffrey L	Pullen	4602 S 170th	Seattle	WA	98 188-3254	1954 10 17	199 10820	20010820	206	King	I	0.2
KB7OHL	P	Eric M	Emry	5565 S 152nd Apt 34	Tukwila	WA	98 188-78 15	19690708	19930928	20030928	206	King	I	1.3
KB7OTF	P	James L	Quinton	3705 S 172nd	Sea Tac	WA	38 188-3628	1949072 1	19920602	20020602	206	King	I	0.4
KB7RJA	T	Steve P	Olson	3749 S 194th	Sea tac	WA	98 188-5360	197407 15	1992 1229	20021229	206	King	I	1.5
KB7RYJ	P	Howard T	Mayhew Jr	15325 Sunwood Blvd	Tukwila	WA	98 188-5726	194 10929	199407 16	20030119	206	King	I	0.3
KB7SAQ	T	Theresa A	Kennedy	3714 S 152nd 27	Tukwila	WA	98188	19580706	19930119	20030119	206	King	I	0.1
KB7TTM	T	Vaughan F	Philpot	4011 s 152 St	Tukwila	WA	98 188-223 1	192409 13	199304 13	200304 13	206	King	I	1.1 0.4
KB7UFM	T	Zita Joan	Hal lstrom	17047 35th Ave S	Sea tac	WA	98 188-3608	19330820	19930504	20030504	206	King	I	0.3
KB7YTQ	N	Gregory S	Berg lund	3754 S 172nd	Sea tac	WA	98 188-3627	1964050 1	1993092 1	2003092 1	206	King	I	0.1
KC7AHT	G	Nancy B	Schimmelman	645 S Center 260	Seattle	WA	98188	195202 15	19940 104	20040 104	206	King	I	0.5
KC7AUZ	T	Jason E	Parvu	3738 S 164th	Sea Tac	WA	98 188-3040	197802 12	199402 15	200402 15	206	King	I	0.7
KC7AZX	T	Margaret K	Thomasson	16432 32nd Ave S	Sea tac	WA	98188-3021	19570805	19940222	20040222	206	King	I	0.1
KC7AZY	T	Norma H	Thomasson	16432 32nd St	Sea tac	WA	98188	19310214	19940222	20040222	206	King	I	0.3
KC7BNS	T	Danice M	Fisher	17343 Military Rd S	Sea tac	WA	98 188-365 1	19590727	19940329	20040329	206	King	I	0.5
KC7CUS	T	Sidney W	Anderson	3408 S 175th	Seattle	WA	98 188-3662	1928 1125	1994053 1	2004058 1	206	King	I	0.1
KC7DBN	P	Douglas W	Hans	16037 45 Th Ave S	Tukwila	WA	98188	19470825	19940705	20040705	206	King	I	0.2
KC7FBP	T	James E	Mitchell	17230 Military Rd S	Seattle	WA	98 188-3648	197 103 18	19950505	200408 17	206	King	I	1.4
KC7HPM	T	Todd J	Rogers	3054 S 150th	Seattle	WA	98 188-2 107	19830509	19941221	2004 122 1	206	King	I	1.1 0.7
KC7HUZ	P	Lloyd L	Crab tree	18625 39 th Ave S	Sea tac	WA	98 188-5007	1935 1112	19950906	2004 1229	206	King	I	0.6
KC7IGO	T	Diosdado A	Alejo	3511 S 160th St B1	Seattle	WA	98 188-2634	19740 127	19950 117	20050 117	206	King	I	
KC7IGR	P	Tina M	Pat ton	1734 1 32 Ave S A 102	Sea tac	WA	98 188-4436	1958 1029	1995020 1	20050 117	206	King	I	0.7
KC7IVC	T	Michael S	Ward	3200 S 176th St 408	Seattle	WA	98 188-4072	196703 19	19950209	20050209	206	King	I	0.5
KC7KLW	T	Binyamin Y	Lev ine	1680 1 33rd Ave	Sea Tac	WA	98 188-3 132	1946 1105	1995042s	20050425	206	King	I	0.1
KC7LDN	T	Diane L	De tleerleer	4024 F S 158th	Seattle	WA	98188	19480202	19950522	20050522	206	King	I	0.7
KC7MFC	T	Quentin W	Rapp	3806 S 179th St	Seattle	WA	98 188-4 167	1930 10 15	199507 14	200507 14	206	King	I	0.7
KC7MUG	T	Jana E	Ward	3200 S 176th St 408	Seattle	WA	98 188-4072	1970 1208	199508 19	20050819	206	King	I	

Conclusion

This kind of Geographical information System has many potential uses within the ham-radio community. This type of search is not limited to ham-radio databases only. There are databases available that contain similar information about commercial transmitters. These databases not only include latitude and longitude, but also actual frequencies etc. Over a year ago, when I started doing demonstrations of this type of capability, many people wanted to have it immediately. However, at that time, the computerized RDF units where either done as build-it-yourself kits, or for the most part, were just not available. Now, with the DFjr from Agrelo Engineering, this type of automatic RDF Unit is easily available and affordable. This type of technology will allow us to do semi-automatic Radio Direction Finding for such things as tracking down interference problems etc.

References

[1]   *MacAPRS, Automatic Position Reporting System, A Macintosh version of APRS,*
Keith Sproul, WU2Z and Mark Sproul, KB2ICI
American Radio Relay League, Digital Communications Conference, Bloomington, Minnesota, August 19-21, 1994. pp 133-145

[2]   *Graphical Information Systems and Ham Radio*
(The Future of A. P. R.S. Technologies)
Keith Sproul, WU2Z and Mark Sproul, KB2ICI
American Radio Relay League, 14th Digital Communications Conference, Arlington, Texas, September 8-10, 1995. pp 108-I 17

Internet Resources

Web sites with APRS Information

http://aprs.rutgers.edu/APRS/
http://www.tapr.org/tapr/html/sigs.html

Aarelo DFjr

http://home.navisoft.com/agrelo/ae.htm