CODAR Radial
File Format Review

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OVERVIEW
This report is part of a continuing effort to document CODAR radial file format
variations so that information can be extracted from files in a consistent and controlled
manner. Radial file format variations from approximately 269,000 files produced by 35
CODAR SeaSonde systems from 8 institutions located throughout the United States are
summarized.

Variations in file formats ultimately arise from different versions of the SeaSonde
software package which produce the radial files. Three versions of the SeaSonde
software are represented by the files considered:

> SeaSonde 4.3
> SeaSonde 4.4
> SeaSonde 10

Until the introduction of SeaSonde 10, radial data was reported in a range-bin format
with modifications only to the header and trailer of the file. However, because the range-
bin format presents difficulties due to additional processing needed to convert data to a
conventional latitude, longitude, u & v (LLUV) reference frame, CODAR now provides
output in a LLUV format with the introduction of SeaSonde 10. Although data can still
be output in range-bin format and tools are available for converting between range-bin
and LLUV file formats, CODAR no longer supports the range-bin format.

CODAR provides detailed documentation for the LLUV file format and overarching
CODAR Table Format (CTF). To date, only range-bin files have been analyzed for
variations in formatting. However, although this document focuses on variations
observed in the range-bin format, any deviations from file format specifications provided
by CODAR in LLUV formats will be reported in this document.

CODAR RANGE-BIN FORMAT RADIAL FILES
As mentioned above, the range-bin format has only changed in the way metadata is
reported in the header and trailer of the file. The following is the radial file format
documentation from CODAR:

> **Radial Vector Description:**
> Each radial vector describes the measurable portion of a current vector in relation to the
> SeaSonde site.
>
> The *radial velocity* is measurable portion of the current velocity moving towards or away
> from the SeaSonde. Current velocities, which run perpendicular to the SeaSonde, will
> have a zero radial vector component, while current velocities, which run directly towards
> or away from the SeaSonde, will have a 100 percent radial vector component. A positive
> radial velocity is moving towards the SeaSonde, while a negative radial velocity is moving
> away from the SeaSonde.
>
> The *radial bearing angle* indicates the direction out from the SeaSonde to where the
> radial vector is located.

The *radial range cell* minus one multiplied by the distance between range cells plus the first range cell distance indicates how far away the radial vector is located.

Values may be in Exponent format where 'E+n' means 10 to the nTH. Example 1.2E+3 is 1200

File Contents:
Line 1: First 48 characters: Long Textual Date of Radial
Line 1: After 48th character: Seconds from year 1904 after adding 2^32.
Line 2: Site Latitude and Longitude formatted as 00°00.000N,000°00.000E
Line 3: Parameter 1: Distance in kilometers to first range cell
Line 3: Parameter 2: Distance in kilometers between range cells
Line 3: Parameter 3: *Reference Angle* degrees counter-clockwise from East. Typically, this will be 90.0 degrees, which is North.
Line 3: Parameter 4: Time Coverage in hours of Radial Data
Line 4: *Number of Range Cells*
> **Repeat** for *Number of Range Cells*
>> **Line N: Parameter 1:** *Number of Vectors* for this Range cell
>> **Line N: Parameter 2:** Current Range Cell Index
>> -- *Bearings* in degrees counter clockwise from *Reference angle*
>> **Repeat** for *Number of Vectors*
>> **Line N:** Bearing values in degrees up to 7 per line
>> **End Repeat**
>> -- *Velocities* in cm/s.
>> **Repeat** for *Number of Vectors*
>> **Line N:** Velocity values in cm/s up to 7 per line
>> **End Repeat**
>> -- *Uncertainties*
>> **Repeat** for *Number of Vectors*
>> **Line N:** Standard Deviation values in cm/s up to 7 per line
>> **End Repeat**
> **End Repeat**
End File

There has been one anomaly observed in the way standard deviation values may be reported. Normally, data is reported in scientific notation. However, for standard deviation data produced from Macintosh OS's prior to 9.22 and SeaSonde software prior to 4.4f6, occasionally data will be reported as NAN(001).

There appears to be no documentation for the way in which the header has been modified over different versions of SeaSonde software and there is no documentation at all on the trailer. The following notes on variations in the formats are from direct comparison of files.

General Variations
End-of-Line indicators
> SeaSonde <10   ASCII 13 (return)
> SeaSonde 10[*]   ASCII 10 (linefeed)

[*]Unless the file has been converted for processing on an OS9 central site, in which case the line ending will be ASCII 13.

Number format
       Previous to SeaSonde 10 Release 4, numbers were reported in scientific format
(ie. 1.00 E+01) and have since been reported without scientific format (ie. 10).

Header Variations
Line 1 Time formats
       Files from Rutgers, UCSB & SIO indicate that there are two variations in the time
       format;

```
2:00 PM   Friday,   October  8, 2004  GMT          -1114878496
13:00:00 Saturday, September 25, 2004 GMT          -1116005296
```

       And that the variations are correlated with SeaSonde versions as follows;
       SeaSonde 4.3/ 4.4   military time   (HH:MM:SS)
       SeaSonde 10   civilian time   (HH:MM AM/PM)

       However, Mike Cook notes that there can be any combination of the following
       (from codar2HFR.m in the MATLAB HFRadarmap toolbox);
       hh:mm:ss   or   hh:mm
       Civilian time or   Military time
       No Time zone or   Time Zone reported (not always GMT)

       GMT has also been observed after the time (as well as after the year) for data
       collected at CSTM, a UMaine site, from 2004/01/30 17:00;

```
17:00:00 GMT Friday, January 30, 2004 GMT          -1136640496
```

       In some recent files, such as this one from SIO site SDBP on 2006/01/11 11:00,
       the timezone is repeated after the year;

```
11:00:00 AM Wednesday, January 11, 2006 GMT   GMT     -1075145296
```

Line 2 Latitude and Longitude formatting – below are a list of examples of variations
       seen in the latitude and longitude formatting:

```
32¡24.844'N,117¡14.624'W      ASCII 161
40°33.701'N,73°52.959'W       ASCII 176
36û56.953'N,122¡03.966'W      ASCII 251
40°33.701'N,73°52.959'W       Comma but no space after Lat
40°25.992'N 073°59.026'W      No comma between Lat & Lon
34 25.221¡N,119 36.231¡W      No degree/minute separator (SMR1)
34.4612¡N,120.0767¡W          Decimal degrees reported (RGF1)
34.4612Â¡N,120.0767Â¡W        ASCII 194 inserted
40Â¡33.701'N,073Â¡52.959'W    ASCII 194 inserted
```

Variations in the header are not correlated with versions of SeaSonde software. This is
due to the fact that line 1 is dependent upon the operating system and line 2 comes from
unformatted user input into the header file. ASCII variations also result from alteration
as files are transferred via FTP or moved to different OS platforms.

Trailer Variations
The trailer varies in the fields included as well as their order of appearance. For the
majority of fields, data appears to be reported in the same format across all files. One

observed variation is in the RadSmoothing field which was reported as '0 None' until SeaSonde 10 Release 4 when only '0' is reported. Fields observed by format are summarized below:

Trailer Fields	SeaSonde 4.3/4.4	SeaSonde 10	SeaSonde 10 Release 4	SeaSonde 10 Release 4 Update 1
RadialMerger		X	X	X
RadSmoothing		X	X	X
MinRadVectorPts		X	X	X
SpectraToRadial		X	X	X
Currents	X			
NumMergeRads	X	X	X	X
CenterFreqMHz	X	X	X	X
DopplerFreqHz	X	X	X	X
LimitMaxCurrent	X	X	X	X
AverFirmssPts	X	X	X	X
FactorDownPeakLimit	X	X	X	X
UseSecondOrder	X	X	X	X
FactorDownPeakNull	X	X	X	X
FactorAboveNoise	X	X	X	X
AmpAdjustFactors	X	X	X	X
MusicParams	X	X	X	X
AmpCalculated			X	X
PhaseAdjustFactors			X	X
PhaseCalculated			X	X
RadialSlider			X	X
FirstOrderCalc				X

Documentation covering the meaning of these fields is covered in the SeaSonde 10 LonLatUV (LLUV) file format and CODAR Table Format File Format Specification published by CODAR.