2.5 How the Profiler Software Works Con't

Radar Computer Software Module Con't

POP4.BAT sequences communications and POP4X.EXE error-handling. POP4.BAT, during a normal autostart routine, runs AUTOSTAR.EXE, which sets specific parameters in RADAR.PAR so that POP4X.EXE can run without the user being present. AUTOSTAR.EXE then returns control to POP4.BAT, and POP4.BAT executes POP4X.EXE. POP4X.EXE reads C:\RADAR\RADAR.PAR and sets the run time parameters accordingly. Then POP4X.EXE configures the radar data processing and control functions and begins to take data.

If the user interrupts radar operation, control returns to POP4.BAT, which, based on various return codes from POP4X.EXE, determines whether to exit to DOS, restart POP4X.EXE, or pass control to LAP.BAT. LAP.BAT starts Windows, another commercially produced software, and LAP2.EXE. LAP2.EXE is a "windowed" user interface that allows the user to create and edit parameter files. When the user has completed creating and/or editing the parameter file, the user then has the option to load the parameter file. Loading the parameter file is performed by selecting from the list of uniquely named parameter files that were created by the user. LAP2.EXE then takes the selected parameter file and copies it to the C:\RADAR directory as RADAR.PAR. When the user has finished with LAP2.EXE, selection is made to exit to DOS or to start the profiler. LAP2.EXE then passes control back to LAP.BAT, where the system either exits to a DOS prompt or returns control to POP4.BAT for continuing operation of the profiler.

Input/Output Formats

The Radar Computer Software Module creates three types of files - consensus files, moment files, and spectral files. Their formats are described below.

Consensus File Format

Data from each consensus average is appended to an ASCII file in *\radar\data* with the name *xyyddd*.**cns** where *x* is **w** or **t** for winds or temperature, *yy* is the year, and *ddd* is the day of year. These data can also be sent out on a serial port. The format of the file for both winds and temperature are listed on the following page.

2.5 How the Profiler Software Works Con't

Input/output Formats Con't

- **Winds Format**

Line 0:	Winds Files. (Only sent over serial port for YMODEM, not in file.) Format: wyyddd.cns where: w = wind data yy = 2 digit year ddd = 3 digit day of the year cns = consensus
Line 1:	Station name.
Line 2:	"WINDS rev 4.1" (rev number will change if file format changes).
Line 3:	N Latitude, W Longitude, and site elevation (m).
Line 4:	Date and begin time of consensus: yy mm dd hh mm ss plus # minutes to add to get UT.
Line 5:	Consensus averaging time (minutes); number of beams; number of range gates.
Line 6:	For each beam, number of records required to make consensus (num); total number of records (tot); consensus window size (m/s); in the format: num:tot (window).
Line 7:	no. of coded cells, no. of spec, pulse width (ns), and inter-pulse period (μs), each with a pair of values: first value is for oblique beams, second for vertical.
Line 8:	Full scale Doppler velocity (m/s), oblique and vertical; Vertical correction applied to obliques? (0 = no, 1 = yes); Delay to first gate (ns), oblique and vertical; Number of gates, oblique and vertical; Spacing of gates (ns), oblique and vertical.
Line 9:	Azimuth and elevation of each beam (999 for missing beams).
Line 10:	Labels for columns that follow.
Line 11 etc.:	Height above ground (km); Wind speed and direction (m/s and deg E of N from); Radial velocities for each beam (m/s) in order given in azimuth and elevation line (positive toward radar; 9999. for missing data); Number of records that made consensus (in same order); Average SNR (dB) of records in consensus (in same order).
Last line:	A single '$' character.

2.5 How the Profiler Software Works Con't

Radar Computer Software Module Con't

- **Temperatures Format**

Line 0:	RASS Files. (Only sent over serial port for YMODEM, not in file.) Format: tyyddd.cns, where t = temperature data, yy = 2 digit year, ddd = 3 digit day of year, cns = consensus
Line 1:	Station name.
Line 2:	"RASS rev 4.1"
Line 3:	N latitude, W longitude, and site elevation (m).
Line 4:	Date and begin time of consensus: yy mm dd hh mm ss plus # minutes to add to get UT.
Line 5:	Consensus averaging time (minutes; number of beams; number of range gates).
Line 6:	Number of records required to make consensus (num); total number of records (tot); and the consensus window size (m/s); in the format: num:tot (window).
Line 7:	no. of coded cells, no. of spec, pulse width (ns), and inter-pulse period (μs).
Line 8:	Full scale Doppler value (m/s); Delay to first gate (ns); Number of gates; Spacing of gates (ns).
Line 9:	Azimuth and elevation.
Line 10:	Labels for columns that follow.
Line 11 etc.,	Height above ground (km); Uncorrected RASS temperature consensus (deg C); Corrected RASS temperature consensus; Vertical wind consensus (w-component, positive upward, m/s); Number of records that made consensus (for the 3 values in same order); Average SNR (dB) of records in consensus (in same order).
Last line:	A single '$' character.

2.5 How the Profiler Software Works Con't

Input/Output Formats Con't **Header File Format for the Spectral and Moment Files**

The profiler uses three file formats for two kinds of data, moments and spectra. Each spectral and moment data file has a corresponding header file containing the operational parameters of the profiler at the time the data file is created. The three file formats - header, moments, and spectra - use the same file naming convention, which is:

CYYJJJS.TTT

Where: C	-	File contents (D for data or H for header).
YY	-	Last two digits of the year.
JJJ	-	Julian day.
S	-	File sequence letter. A-Z
TTT	-	File type (MOM for moments or SPC for spectral data).

Both the moment and spectral data files and the header files are binary files. These files are created once a day. Header files are appended to whenever the operational parameters of the profiler are changed. The data files are appended to at the end of each spectral averaging period.

When writing to a removable media magneto-optical disk, the header and data files can be any size. When any other data storage medium is used, the file sizes are limited to 1 Mbyte. This limitation means that a new file is created once the file size reaches 1 Mbyte. The sequence letter increments by one to represent the new file. Example:

File Name	Size
D92164A.MOM	1,000,000 bytes
D92164B.MOM	54,000 bytes

- **The Header File Format**

Every moments file and spectra file has an accompanying header file. Header files are created once a day and are appended to every time the operational parameters are changed. Consequently, the header files are comprised of one or more header records. Every time the operational parameters are changed, a new header record is created.

2.5 How the Profiler Software Works Con't

Radar Computer Software Module Con't

- **Header Records**

Header records are 580+(2*M) bytes long, where M = the number of instruments. M is currently 0 for all systems, making all header records 580 bytes in length. The header record begins with a description of the contents in the header record and is followed with the operational parameters inside the brackets []. Within these brackets are parameter subsets, inside parentheses (), with text to explain the header record format below. In the format, *Char* stands for character, *Int* stands for integer, and *Float* stands for floating point.

No. of Bytes	Description
Int x 2	Revision Level = 103
Int x 2	Number of bytes in Header Record
Int x 2	Number (M) of additional instrument readings in data file.
Int x 2	Maximum number of radars (MAXRAD=1)
Int x 2	Maximum number of beam parameter sets (MAXBMPAR=4).
Int x 2	Maximum number of beams (MAXBM=10).
Int x 2	Maximum number of beam directions (MAXDIR=9).
Int x 2	Maximum number of bandwidths on Rx. (MAXBW=4).
	Radar Operational Parameters
[Char x 32	Station Name
Int x 2	Latitude (North is positive degrees x 100)
Int x 2	Longitude (East is positive degrees x 100)
Int x 2	Minutes added to the system time to get CUT (Coordinated Universal Time)
Int x 2	Site altitude above sea level in meters.
Int x 2	Number of Radars at this station.
Char x 32	Radar name.
Int x 2	Identification number of radar.
Int x 4	Tx Frequency in MHz x 100.
Float x 4	Maximum duty Cycle (floating point percentage).
Int x 2	Maximum Tx pulse length in μs.
Int x 2	Tx pulse on or off. On=1,Off=0.
Int x 2	Number of allowable directions. (Based on antenna type.)
Int x 2	Number of beam positions selected during set-up.
Int x 2	Number of beam parameter sets selected during set-up.
MAXBMPAR x	(Subset value called "Sampling Parameters"
Int x 4	Inter-pulse period in ns.
Int x 4	Pulsewidth in nanosec.
Int x 4	Delay from pulse to first gate in ns.
Int x 4	Spacing between gates in ns.
Int x 2	Number of gate heights.
Int x 2	Number of coherent integrations.
Int x 2	Number of spectra to be averaged.
Int x 2	Number of points in FFT.
Int x 2	Delay through Rx in ns.

2.5 How the Profiler Software Works Con't

Input/Output Formats Con't

```
Int x 2          Rx bandwidth switch code.
Int x 2          Reserved for future use. Number of attenuated range gates.
Int x 2          Number of Pulse code bits.
        )End of MAXBMPAR

MAXBM x (Subset value called "Beam Control Parameters"
Int x 2          Direction index (0 to NUMDIR-1).
Int x 2          Parameter set index (0 to NUMPAR-1).
Int x 2          Number of repetitions at this direction.
        )End of MAXBM

Int x 4          Pre T/R delay in ns.
Int x 4          Post T/R delay in ns.
Int x 4          Synchronizing pulse in ns.
Int x 4          Pre-blanking delay in ns.
Int x 4          Post-blanking delay in ns.
MAXDIR x (Subset value called "Beam Configuration Parameters"
Char x 12        Direction label name.
Int x 2          Beam azimuth angle in degrees from north.
Int x 2          Beam elevation angle in degrees from horizontal.
Int x 2          Beam direction code for steering.
        )End of MAXDIR

MAXBW x ( Int x 2  Pulsewidth in ns)
MAXBW x ( Int x 2  Rx delay in ns)

Int x 2          DC filtering. On=1,Off=0
Int x 2          Windowing. On=1,Off=0
Int x 2          Number of points omitted around DC.
Int x 2          Number of heights to apply DC omit.
Int x 2          First wind spectral bin.
Int x 2          Number of wind spectral bins.
Int x 2          First RASS spectral bin.
Int x 2          Number of RASS spectral bins.
Int x 2          RASS on or off. On=1,Off=0
Int x 2          Lower Rass source frequency in Hz.
Int x 2          Upper Rass source frequency in Hz.
Int x 2          RASS Step size in Hz.
Int x 2          RASS Dwell time in µs.
Int x 2          RASS signal. Pseudorandom=0,Sweep=1
Int x 2          Maximum height for clutter removal.
Int x 2          Spec. Avg Mode (1 = ICRA, <1 = mean)
Int x 2          No.of multiplexed interferometer receivers (=1)
Int x 2          No. of aux met instruments in use (=0)
Char x 44        Reserved for future use.
        ] End of Radar Operational Parameters

Int x 4          Start byte number in data file for data with this structure.
Int x 2 x M      Code for each of the M instrument types.
```

2.5 How the Profiler Software Works Con't

Radar Computer Software Module Con't

- **The Moments File Format**

Moment files are actually contained in two files, a header and a data file. The header files are made up of binary data records that contain information about the operational parameters of the profiler. Data files are also composed of binary data records but contain the moments data records collected by the profiler. The moments data include the Doppler velocity, the spectral width, the signal-to-noise ratio of the peak, and the noise level.

- **Moment Data Records**

Moments data files are comprised of one or more data records. A data file can contain moments for winds only or moments for winds and RASS.
Moment records when not running RASS are:

28+(4*M)+8*(Number of heights) in length

where M is the number of instruments.

Moment records when running RASS are:

28+(4*M)+16*(Number of heights).

For a profiler configured with 24 range gates, the moment record contains 220 bytes for winds and 412 bytes for RASS. At the end of each spectral average the data record is written in the following format. In this format, *Char* stands for character, *Int* stands for integer, and *Float* stands for floating point.

No. of Bytes	Description
Int x 2	Record type for data file. 3115 = Winds moments records. 3116 = RASS moments records.
Int x 4	Total number of bytes in this record.
Int x 2	Spectral data in file. Spectral data in file=1, Moments data only=0.
Int x 4	Start byte number for corresponding record in header file.
Int x 4	System time (long integer seconds).
Int x 2	C_rad (index for radar and in sp_).
Int x 2	C_bm (index for beam arrays in sp_).

2.5 How the Profiler Software Works Con't

Input/Output Formats Con't

Int x 2	Number of Coherent Integrations.
Int x 2	Number of Spectra in average.
NHTS x (FOR WINDS AND RASS	
Int x 2	Mean Doppler value = (mean Doppler velocity / full scale velocity) x 1e4.
Int x 2	Spectral width value = (spectral width (vel)/ full scale velocity) x 1e4.
Int x 2	Signal-to-noise ratio in dB x 100.
Int x 2	Noise = 1000 $\log_{10}$ (noise value)
) End of Winds Moments	
NHTS x (RASS ONLY	
Int x 2	(second) Mean Doppler value = (mean Doppler velocity / full scale velocity) x 1e4.
Int x 2	(second) Spectral width value = (spectral width (vel) / full scale velocity) x 1e4.
Int x 2	(second) Signal-to-Noise Ratio = dB x 100
Int x 2	RASS Temperature. Degrees C x 10 (default = -9999)
)End of RASS Moments (RASS Moments = Winds + RASS)	
Float x 4 x M	Other instrument readings (M given in header)
Int x 4	Total number of bytes for record.

- **The Spectral File Format**

Spectra files are actually contained in two files, a header and a data file. The header files are made up of binary data records that contain information about the operational parameters of the profiler. Data files are also composed of binary data records but contain the moments and spectra data records collected by the profiler. A spectrum is a display of amplitude with respect to the frequency. The spectra file includes spectral values for each spectral bin for every range gate and the derived moments data.

- **Spectral Data Records**

Spectral data records when not running RASS are:

28+(4*M)+(8*No. of Heights)+(4*No. of Heights*
(No. of interval points for winds + No. of interval points for RASS))

where M is the number of instruments.

2.5 How the Profiler Software Works Con't

Radar Computer Software Module Con't

Spectral data records when RASS is running are:

28+(4*M)+(16 * No. of Heights)+(4*No. of Heights
* (No. of interval points for winds + No. of interval points for RASS)).

A profiler configured with 24 range gates and 64 spectral points where M is 0 for all systems and "Number of interval points for RASS" is 0, uses 6,364 bytes for wind spectral records.

At the end of each spectral average, the data record is written using the following format if the *Write To Disk Option* is set and the file type to save is *Spectral data.* In this format, *Char* stands for character, *Int* stands for integer, and *Float* stands for floating point.

No. of Bytes	Description
Int x 2	Record type for data file. 3115 = Winds spectral record. 3117 = RASS spectral record.
Int x 4	Total number of bytes in this record.
Int x 2	Spectral data in file. Spectral data in file=1, Moments data only=0.
Int x 4	Start byte number for corresponding record in header file.
Int x 4	System time (long integer seconds).
Int x 2	C_rad (index for radar in sp_).
Int x 2	C_bm (index for beam arrays in sp_).
Int x 2	Number of Coherent Integrations.
Int x 2	Number of Spectra in average.
NHTS x (Winds and RASS	
Int x 2	Mean Doppler value = (mean Doppler velocity / full scale velocity) x 1e4.
Int x 2	Spectral width value = (spectral width (vel) / full scale velocity) x 1e4.
Int x 2	Signal-to-Noise Ratio = dB x 100
Int x 2	Noise = 1000 $\log_{10}$ (noise value)
)End of Winds Moments	
NHTS x (RASS data only.	
Int x 2	(second) Mean Doppler value = (mean Doppler velocity / full scale velocity) x 1e4.
Int x 2	(second) Spectral width value = (spectral width (vel) / full scale velocity) x 1e4.
Int x 2	(second) Signal-to-Noise Ratio = dB x 100
Int x 2	RASS Temperature. Degrees C x 10 (default -9999)
)End of RASS Moments	

2.5 How the Profiler Software Works Con't

Float x 4 x M	Other instrument readings (M given in header)
Float x 4 x NHTS x (No. of wind spectral bins + No. of RASS spectral bins)	The power spectral data = variance x 2^{18} (When taking wind data, the FFT length is = no. of wind spectral bins. The no. of RASS spectral bins = 0.)
Int x 4	Total number of bytes for record.

Hardware Connection

The Radar Computer Software Module communicates with the gateway computer through a thin-wire Ethernet cable. This connection is controlled by the LANtastic local area network operating system and uses the IEEE 802.3 10BASE2 bus network that can transmit data at 10 Mbs for a maximum distance of 185 meters with a maximum of 30 nodes per segment. The following cables are supported for this thin coaxial (10BASE2) type of network.

- RG58A/U
- RG58C/U
- Belden 9907
- Belden 89907 (plenum)

Gateway Computer Software Module

The information below describes the Gateway Computer Software Module, as shown in the block diagram in Figure II-N.

Location

The Gateway Computer Software Module is located on the gateway computer, which is an ISA-compatible personal computer located next to the LAP®-3000 radar computer, and the hub computer, located at a remote site. The gateway computer is connected to the radar computer via an Ethernet local area network (LAN). On the gateway computer, the LAPCOMM submodule is located in the C:\GATEWAY directory. The LAPCDF module is in the C:\LAPCDF directory. Daily CDF data files are stored in the C:\GATEWAY\DATA\DAILY directory. Hourly CDF data files are stored in the C:\GATEWAY\DATA\HOURLY directory. Since there are two kinds of data, wind and temperature, the HOURLY and DAILY sub-directories are further divided into \WIND and \TV sub-directories.