

**DN 6000377
USERS MANUAL
MODEL 515VAA
VIDEO DOPPLER PROCESSOR**

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FEBRUARY 14, 2002

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ACROAMATICS DOCUMENT HISTORY

The following table indicates major changes made to

User's Manual - Model 515VA Video Doppler Processor, Acroamatics Document Number 6000377, released on February 14, 2002, and contains a record of all revisions made since that date.

DN6000377 CHANGE HISTORY			
Rev	Date	Action	Name
	02-14-02	Original Issue	DJM

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USERS MANUAL
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CHAPTER 1 PROGRAMMING THE VIDEO DOPPLER PROCESSOR

INTRODUCTION

This user manual describes the Host program setup instructions for the *515VA Video Doppler Processor*. The host program, **vdop**, is used for communicating setup commands to the doppler card. The Doppler card is designed to produce a Doppler display with annotated time bars and up to eight TM channel strip charts in real time during flight data acquisition, and at the same time archive the data. Its second function, playback, is to display the archived Doppler and strip chart data for post flight analysis.

The 515VA has a SCSI hard disk which it uses for storing doppler and TM data during a real time acquisition, and for retrieving doppler and TM data during a playback. The 515VA supports a file system which allows for up to 8 flights to be stored on this disk. For more permanent storage of flight data, the 515VA allows the user to upload a file from the doppler's disk to the host's disk, and also to replace a doppler file from the host's disk to the doppler's disk using a download feature.

Note that older versions of the 515VA firmware only supported one file, and therefore had a different file structure on the Doppler's disk. This makes a disk from a single file Doppler system non-interchangeable with the disk from multiple file Doppler system, and vice versa. Since both the single file firmware and the multiple file firmware on the Doppler card will format an unrecognized file system to its native file system, **interchanging the Doppler disk of a single file Doppler system and a multiple file Doppler system, or vice versa, will result in the loss of any data previously on the disk.** If the version of vdop.exe is 3.1 or later, then the Doppler system is a multiple file type. Otherwise, the system is a single file type. This document describes vdop version 3.1 which programs the multiple file type Doppler system.

STARTUP

The program **vdop** is invoked at the command prompt with the following syntax:

```
vdop [DopNumber] [SetupFile] [-h] [-px]
```

DopNumber is the card number of the doppler card you wish to set up, either **1** or **2**. If not specified, **vdop** defaults to card 1. *SetupFile* is the name of a file containing **vdop** setup commands. If *SetupFile* is given, **vdop** will execute the commands in the file and then exit. If not given, then **vdop** will accept commands interactively. The **-h** switch causes **vdop** to print a help message about its command line parameters, and then exit without doing any other processing. The **-px** switch causes **vdop** to prompt for a keypress before exiting. This switch was added so that when **vdop** is run non-interactively from within the Windows Doppler GUI, its console window would stay open until the user finished reading its output and dismissed it.

SOFTWARE DESCRIPTION

The setup for a Doppler run is divided into six sections: *Disk*, *Realtime*, *Archive*, *Playback*, *Plot*, and *Run*. The *Disk* section of commands is used for formatting the doppler's disk, creating and deleting files, selecting the active file, uploading files from the doppler's disk to the host, and downloading files from the host's disk to the doppler. In a *Realtime* run, the system will acquire Doppler data and digital TM data with time to produce a plot, and archive all of the data to a user selected file on the Doppler system's disk. The *Realtime* section of the setup is used to define the type of Doppler data and how it is processed. *Archive* has the commands that determine what data is used for the real time plot and saved for playback. Data can be archived that is not used for the real time plot. Entering *Playback* instructs the Doppler system to use the archived data from a user selected file on the Doppler system's disk for post flight plots. The *Plot* setup determines how the data is presented for a Realtime run or a Playback, and *Run* commands communicate with the Doppler system.

In order for any doppler data to be saved, you must first format the Doppler system's disk into up to eight partitions. Each partition may contain one named file, and that file may span any fraction of its partition but may not go beyond its partition boundary. Once the disk is formatted into partitions and at least 1 file is created, then you may use the doppler card to acquire doppler data and save it to the doppler's disk in the specified file name. Doppler data which has been saved on the disk may be played back for post flight plots.

To Acquire data, you must enter *Realtime*. In a real time setup, you define the type of Doppler data and how it is processed. Then you must enter *Archive* to describe the digital data to be used for plotting and recording, and you must enter a *Plot* setup to specify what data to display and how to display it. All data to be plotted must be Archived, but not all archived data must be plotted.

Any data that has been recorded on the Doppler system's disk may be played back. For playback plots, first specify the file to be played back, and then enter *Playback*. The Doppler system will then set itself up to the same parameters as when the data was recorded. Then you can enter *Plot* to change any of the display specifications.

Run commands communicate with the Doppler card for set up, starting and stopping the system, and producing a leader on the plot.

The set up of the Doppler processor is through an image of the setup variables. Each time you enter *vdop*, it reads the setup from the Doppler card. Therefore, changes are made from the working setup. On power up, the setup image on the Doppler card is cleared to zero. The setup is organized into sections, and most commands are unique to a section. The section is determined either by entering one of the section keywords **Disk**, **Realtime**, **Archive**, **Playback**, **Plot**, or **Run**, or by entering a command that is a subcommand of one of the sections. The commands **Clear** and **TM1-TM8** are common to two sections and should be preceded by a **Archive** or **Plot** command. The commands may be entered in any order. They are case indifferent and usually matched to the first three characters. Separators are spaces, tabs, blanks, and equals. Multiple commands may be on a single line; there is no provision for comments. At any time you may enter ? for help or the command **See** to see the current state of the setup. Any values in the setup memory which are not relevant to the type of run being executed are ignored by the Doppler system.

DISK

The **Disk** setup is used for setting up the the Doppler system's disk. These commands are relevant for both acquisition and playback of doppler data. The disk setup is used to specify the file to record the data to during a *Realtime* acquisition and the file to read the data from during a *Playback*. The disk setup also provides commands for formatting the disk, creating and deleting files, seeing the directory of the disk, uploading a file from the Doppler system's disk to the host's disk, and downloading a file from the host's disk to the Doppler system's disk.

The file system on the Doppler system's disk is as follows. The disk is divided up into *segments* that are each one-eighth of the total disk storage. A *segment* defines the finest resolution at which the disk may be partitioned. A *partition* is defined as one more contiguous segments to which a file may be written. A *partition* may contain only 1 file, and the file can span any fraction of the partition, but it cannot go beyond the partition boundary. If during a realtime acquisition a file grows until it has filled up its partition, the recording of the data to disk will stop so that no other files on the disk will be destroyed. The following gives an example of a disk setup:

```
format 1 4 2
create dop0.dat 0
create dop1.dat 1
create dop2.dat 2
file=dop1.dat
```

The example first reformats the disk into 3 partitions of lengths 1,4, and 2 segments. Any data that was previously on the disk is lost. Next, a file is created on each of the newly created partitions (note that the partitions are numbered starting with 0), and finally the file "dop1.dat" is chosen as the active file, which means it will be used for the next *Realtime* or *Playback*.

Note that the doppler card ignores disk commands while it is in run. The following describes all of the disk commands in detail.

File

The **File** specifier tells the doppler card which file to use for a *Realtime* acquisition or *Playback*. The syntax to specify the file is

file=DopFile

where *DopFile* is the name of the file on the doppler disk. **If for a Realtime** acquisition, **File** is set to a nonexistent file name, the doppler card will acquire data without archiving it on the doppler's disk.

Directory

Directory lists the partitions on the disk, as well as the name of the file on each partition, the partition size (given in *segments*), and the file size (given in disk blocks). Preceding the list of files on the disk is information about the disk and file system.

Create

Create creates a file name for an unused partition on the Doppler system's disk. The syntax is

create fname pnum

where *fname* is the name of the file to create, and *pnum* is the partition number where the file is to be created. Note that partitions are numbered starting at zero.

Delete

Delete deletes a file from the Doppler system's disk leaving an empty partition. The syntax is

delete fname

where *fname* is the name of the file to delete.

Format

Format reformats the Doppler system's disk to have the specified number of partitions with the specified partition sizes. All data stored on the disk prior to issuing the format command will be lost. The syntax is

format nseg0 nseg1 ... nsegN

where *nseg0* is the number of *segments* to allocate for the first partition, *nseg1* is the number of *segments* to allocate for the second partition, and so on. An *nseg* argument should be given for each partition to be created, and the sum of the *nseg* arguments must be eighth (the total number of segments on the disk).

For example, the command

```
format 1 2 3 2
```

would create 4 partitions of sizes 1,2,3,and 2 segments respectively, and $1+2+3+2=8$ which means that all of the segments on the disk have been allocated to a partition making this a legal partitioning of the disk.

Upload

The **Upload** command uploads a file from the doppler's disk to the host's disk. The syntax is

```
upload HostDest DopSrc [StartTime [ StopTime]]
```

where *HostDest* gives the name of the destination file on the host, *DopSrc* gives the name of the source file on the doppler disk. The optional parameters *StartTime* and *StopTime* give the start time and stop time of the doppler data to upload. If only *StartTime* is specified, then the upload begins at the specified time and ends at the end of the file. If neither *StartTime* nor *StopTime* is given, then the entire file is uploaded. There is no way to specify just the *StopTime*. The maximum file size that can be uploaded is 2GB.

If the given *HostDest* file already exists on the host, and you are running vdop interactively, then vdop will prompt you before it allows you to overwrite a host data file. If you are running vdop non-interactively (eg. with a setup file), then vdop will not interrupt the setup file to prompt you.

Download

The **Download** command downloads a file from the host's disk to the doppler's disk. The syntax is

```
download HostSrc DopDest [StartTime [ StopTime]]
```

where *HostSrc* gives the name of the source file on the host, *DopDest* gives the name of the destination file on the doppler disk. The optional parameters *StartTime* and *StopTime* give the start time and stop time of the doppler data to download. If only *StartTime* is specified, then the download begins at the specified time and ends at the end of the file. If neither *StartTime* nor *StopTime* is given, then the entire file is downloaded. There is no way to specify just the *StopTime*. The maximum file size that can be downloaded is 2GB.

If the given *DopDest* file already contains data and you are running vdop interactively, then vdop will prompt you before it allows you to overwrite a doppler data file. If you are running vdop non-interactively (eg. with a setup file), then vdop will not interrupt the setup file to prompt you.

HTimes

The **HTimes** command is used to get the start and stop time of a given doppler file that exists on the host's disk. This information can be helpful in choosing the start and stop times for a download of the file to the doppler disk. The syntax is

htimes *HostName*

where *HostName* gives the name of the hostfile that you want the start and stop times from.

DTimes

The **DTimes** command is used to get the start and stop time of a given doppler file that exists on the doppler's disk. This information can be helpful in choosing the start and stop times for an upload of the file from doppler disk, or for choosing the start and stop times for a windowed playback. The syntax is

dtimes *DopplerName*

where *DopplerName* gives the name of the doppler file that you want the start and stop times from.

REAL-TIME

A real-time setup must include specification of the type of Doppler data, the Power Spectral Density (PSD) array size for the Fast Fourier Transformation, and the input frequency range or sampling rate. When the run type is *Realtime*, the *Archive* and *Plot* options must be set up. Further, you must configure the Doppler system's disk and set the "**File=**" **Disk** parameter in order for the real-time data to be properly saved. The following paragraphs discuss the commands that are used for a real time setup. The command **Realtime** may be entered, or just enter the real time commands. Below are examples of a real time Doppler setup line.

```
Realtime Analog PSD_array_size=1024 Frequency_range=200
Translated_Analog PSD_array_size=512 Frequency_range=300 HiPass_CutOff=50
Realtime Digital PSD_array_size=512 Rate=600 Decimate=0
```

Realtime Doppler Data Type

Setup commands for specifying the type of Doppler data are **Analog**, **Translated_Analog**, and **Digital**. **Translated_Analog** is used when the Doppler data is merged with other data and the Doppler data is upshifted in frequency range (upconverted) by 200 kHz. For **Analog** Doppler set the *PSD_array_size* and the *Frequency_range*. For **Translated_Analog** Doppler define the *PSD_array_size*, *Frequency_range*, and the *HiPass_CutOff_frequency*. For **Digital** Doppler define the *PSD_array_size*, *Rate*, and the *Decimation*.

PSD_array_size

The Doppler data is arranged into digital arrays and transformed into PSD time slices by a Fast Fourier Transformation. The number of words in an array determines the number of frequencies in the PSD time slice. For instance, a 1024 word array produces 512 frequency components. You must specify the **PSD_array_size** to determine the number of Doppler data samples to be input to the DSP memory for FFT conversion. The options are **256**, **512**, and **1024** samples.

Frequency_range

For *Analog* and *Translated_Analog*, define the input frequency range with **Frequency_range**. The range is expressed in kHz and the following are available, **12.5**, **25**, **37.5**, **50**, **62.5**, **75**, **100**, **125**, **150**, **180**, **200**, **225**, **250**, **300**, and **400** kHz.

HiPass_CutOff_frequency

Define the **HiPass_CutOff_frequency** when you use *Translated_Analog*. The 515VA contains a 200kHz down-shift detranslator for frequency-shifted input signals. Translated signals pass through a fourth order high-pass filter (HPF) to remove the low frequency component from the translated Doppler. The translated input may be received at one of four frequencies, as specified by the tape playback ratio. At a 1:1 playback ratio the translation frequency is 200kHz, and the HPF cutoff frequency is set to 200k. Tape playback ratios of 1:2, 1:4, and 1:8 reduce the input frequency by that ratio, and the HPF cutoff frequency is reduced correspondingly. The **HiPass_CutOff_frequency** is the kHz cutoff for the high-pass filter. The choices are **200**, **100**, **50**, or **25** kHz.

Rate

For *Digital Doppler*, **Rate** is used to set the sample rate in kHz. The maximum rate is 600 kHz. The highest frequency in the PSD time slice is one half of the digital sampling rate, so the maximum of 600 kHz allows a maximum frequency of 300 kHz.

Decimation

For *Digital Doppler* input, the samples are decimated by the digital filter to produce a sample rate that is twice the input frequency. Use **Decimate** to define the decimation to determine the digital filter setting to produce the correct cutoff frequency. Set the decimation to **zero** to bypass the filter, or to **1** for no decimation but with the filter on. Or select a decimation of **2** through **15**. The table below, given as an example, shows the different digital filter settings supported by each decimation for a sample rate of 600kHz.

Input Freq	Input Sample	Decimate	Output Sample	Cutoff Freq	Filter
300 kHz	600 kHz	0	600 kHz	300 kHz	Off
300 kHz	600 kHz	1	600 kHz	300 kHz	On
300 kHz	600 kHz	2	300 kHz	150 kHz	On
300 kHz	600 kHz	3	200 kHz	100 kHz	On
300 kHz	600 kHz	4	150 kHz	75 kHz	On
300 kHz	600 kHz	5	120 kHz	60 kHz	On
300 kHz	600 kHz	6	100 kHz	50 kHz	On
300 kHz	600 kHz	7	85.71 kHz	42.86 kHz	On
300 kHz	600 kHz	8	75 kHz	37.25 kHz	On
300 kHz	600 kHz	9	66.67 kHz	33.33 kHz	On
300 kHz	600 kHz	10	60 kHz	30 kHz	On
300 kHz	600 kHz	11	54.55 kHz	27.27 kHz	On
300 kHz	600 kHz	12	50 kHz	25 kHz	On
300 kHz	600 kHz	13	46.15 kHz	23.07 kHz	On
300 kHz	600 kHz	14	42.86 kHz	21.43 kHz	On
300 kHz	600 kHz	15	40 kHz	20 kHz	On

ARCHIVE

Archiving of the data is active only during *Realtime* acquisition of data. Archive commands describe where to get the data and what each digital input word looks like. Defining a word enables its archiving. All digital data to be presented on the real time display must be archived; however you may archive data which is not plotted on the real time display. You must archive *Time* which must be present for the Doppler system to start. You may archive up to eight *TM channels* for strip chart display, four different *Digital Doppler* input words, and two words of data for stop and start *Events*.

Each of the digital data words listed below (TM, Time, Events, and Digital Doppler) must be specified by ID. An ID must be a 16-bit non-varying ID, which means that output formats which insert time into part of the 16-bit ID field cannot be used for Doppler input. Each of the IDs must be unique, you may not use the same ID for an Event and a TM channel. The ID must immediately follow the keyword and is decimal or, if preceded by a slash, hexadecimal. Following the ID, specify **MSW** (for most significant word of 32-bit data) or **LSW** (for least significant word of 32-bit data), **MSB** (most significant bit) or **LSB** (least significant bit) data justification, and **2CM** (two's complement) or **OBN** (offset binary) format.

To enter Archive setup, type **Archive**. A typical **Archive** line follows.

Archive DV2 Clear

DV2 specifies the output device and *Clear* disables any already enabled archive words. Follow the Archive line with lines listing the digital data words to be archived.

Output Device Select

The output device from which all of the digital data is used should be specified as **DV1**, **DV2**, **DV3**, or **DV4**. DV1 through DV4 are reserved for data output to a host computer interface. See

Programming Manual for the VMEbus Telemetry Data Processors Floating Point Data Distribution System, Acroamatics Document Number 6000265, for a discussion on the Output Device.

Clear_Input_Channel_Enables

Clear_Input_Channel_Enables disables all of the archive words except for *Time* since time is necessary to start. Clear does not clear any of the specifications for that word. To re-enable archiving of a function that has previously been defined, enter only the three character code for the word.

Time

Time must be archived for the Doppler system to start. The Time ID must be 16 bits of non-varying ID, the output format must not be one that has 12 bits of ID and include time as part of the ID word. If the output format is for 16-bit data, use the ID of the microsecond word for the archive time ID, and include the specifier Short. The example below is for OUTALG_DV1=9, first the distribution setup then the Doppler archive setup for time.

```
dm          |Distribution setup
/1ffe: sav
/1fff: sav
           oty
end
```

Archive DV1 Time=/1fff Short

For a distribution output format for 32-bit data use the specifier Long, as seen in the example below for OUTALG_DV1=11.

```
dm          |Distribution setup
long
/1fff: pas long
end
```

Archive DV1 Time=/1fff Long

If you need a time format with an ID of less than 16 bits and embedded time for your recorded acquisition, designate a different device for the Doppler data, including time, and use the *RAW* algorithm to bypass the format conversion. An example for the distribution setup followed by Doppler setup for changing devices follows. Note that any data to be used by the Doppler system must be output to the alternate device.

```

dm          | Distribution setup
out dv2
1: rawo     | data for Doppler
out dv1
  pas      | data for recording
end
time
out dv1
dh: ms: sav
tms0: tim #/fff      | time for recording
out dv2
long
  rawlo    | time for Doppler
end

```

Archive DV2 Time=/1fff Long

Output formats are discussed in

Programming Manual for the VMEbus Telemetry Data Processors Floating Point Data Distribution System, Acroamatics Document Number 6000265.

TM data for Strip Chart

Up to eight separate TM strip charts may be displayed on the Doppler plot. To include TM strip chart display on the Doppler plot, you must enable the archiving and the plotting of each of the channels. For any data to be included on a plot it must be archived. You may archive data which is not enabled for real time plotting to use it for playback only. The Plot enables, described in the Plot setup section, determine what is plotted. To activate archiving each of the eight channels of TM data that would be used for a strip chart display use **TM1**, **TM2**, **TM3**, **TM4**, **TM5**, **TM6**, **TM7**, and **TM8**. Specifications for word length, data justification, and format apply to TM1-TM8, as shown below.

```

TM5=4 MSB 2CM
TM1=1 LSB 2CM LSW
TM2=/12de MSB OBN MSW

```

Digital Doppler

Digital Doppler words can be identified for archiving, but the Doppler system will ignore them unless the type of Doppler data is specified as *Realtime Digital*. Digital Doppler can be extracted from one or more input words. The bits within the input words and the samples taken from them must be described by the syntax below. **D1A** is what we call the first 16 bit Digital Doppler word. In this word, 16 or fewer bits are specified as *Doppler bits*. The *Doppler bits* may represent one or more Doppler samples. If the sample size is not an even multiple of the *Doppler bits*, use **D1B** as the name for specifying successive words to complete the samples. The D1A word is used as a synchronization ID to start sampling; D1B words are used to complete the assembly of samples until the least common multiple number of bits of the sample bits and *Doppler bits* have been assembled. If any trailing data words are encountered with a D1B tag after a

complete sample assembly has been accumulated, they are simply discarded. D1A words are never discarded, they always reinitialize the sampling.

D2A and **D2B** are available for Doppler data when there is a format change. They perform the same function as D1A and D1B, but allow different IDs to be used after the change.

To set up Digital Doppler start with D1A, then if the input size (the number of *Doppler bits*) is not an even multiple of the sample size, use D1B. After assigning the ID for the input word, and MSW or LSW half of a longword, define the number of *Doppler bits* in the input word by **Input_size**, which ranges from **1** to **16** bits. MSB or LSB data justification determines where the Doppler data bits are located in the word. For an example, using a word of bits labeled fedcba9876543210 and Input_size=9, for MSB justification the bits used are fedcba987xxxxxxx, for LSB justification the bits used are xxxxxxxx876543210.

The size in bits of the Doppler sample within the *Doppler bits* is defined by **Sample_size**, ranging from **1** to **12** bits. The Sample_size must be less than or equal to the Input_size. The Sample_size of D1B, the continuation word, usually will be the same as the Sample_size of D1A. The sample orientation, **S_MSB** (sample most significant bits) or **S_LSB** (sample least significant bits) is used to specify the sampling direction. 2CM or OBN format for the input sample should be specified. The conversion to 2CM data will be applied to each sample as it is taken from the input word. For the example input word of fedcba9876543210 and the following setup for D1A

D1A=/105 Input_size=9 MSB Sample_size=3 S_LSB 2CM

the Digital Doppler samples would be 987, cba, fed. If S_MSB is used instead, the Digital Doppler samples would be fed, cba, 987.

An example for using D1A and D1B follows.

D1A=/102 MSB 2CM Input_size=8 Sample_size=3 S_LSB
D1B=/103 LSB 2CM Input_size=8 Sample_size=3 S_LSB

Using the above setup for ID /102, a 16 bit data word with the bits labeled fedcba98xxxxxxx, followed by ID /103, a 16 bit data word with the bits labeled xxxxxxxx76543210 followed by ID /103, a 16 bit data word with the bits labeled xxxxxxxxnnnnnnnn, the samples would be a98, dcb, 0fe, 321, 654, nn7, nnn, nnn. For the same data, but with the setup modified for S_MSB instead of S_LSB, the samples would be fed, cba, 987, 654, 321, 0nn, nnn, nnn.

In the example above, any more words of ID /103 will be discarded until an ID of /102 initiates the sampling again. Using the last setup, if the data stream has ID /102, a 16 bit data word with the bits labeled fedcba98xxxxxxx, followed by another ID /102 and no ID /103, the samples would be a98 and dcb, with the rest of the data lost when a D1A ID is encountered.

Events

To be able to start or stop the Doppler system using a trigger event in the data stream, enable the archiving of the trigger word using **EV1** and **EV2** (events 1 and 2) to specify the IDs for these events. Either event can be used for a start or a stop, or one event can be used for both functions. The events can be archived but not enabled for use. To enable the use of an event for starting or stopping the Doppler system see the *Run* section. A single bit of the event data word is used for the triggering. The most significant bit of any byte of the data can be used for the triggering bit. Specify which bit by using the bit number **Bit_7** or **Bit_15**, and additionally for 32-bit data words **Bit_23** or **Bit_31**. When used as a *Start Event* the trigger is true when **EV1 is 1** or **EV2 is 0**. Used as a *Stop Event* the trigger is true when **EV1 is 0** or **EV2 is 1**. As an example, to use the most significant bit of a 32 bit number enter

EV1= /512 Bit_31

No other specifiers should be entered for events. Raw data from the event word is used, so 2CM and OBN do not apply.

PLAYBACK

Running the Doppler in *Playback* requires minimal setup since the run is from archived data. When you enter **Playback** in the Host setup program, the Doppler system is instructed to find the archived file as specified by the **File=** command, and restore the setup memory to the settings that were used for the archive. Those settings are then displayed for playback by the Host program. To see the Archive setup, enter *Realtime See*. Reenter Playback and change any of the Plot settings and control the expansion of the plot with the *Reconstruct_Timebase*. In Playback, *Paper_Speed* determines only how fast the plot is produced. Note that entering **Playback** will override any settings you have entered in the Host program. If you set the *Reconstruct_Timebase* before your real time acquisition, you can run a playback without any more setup.

PLOT

The plot commands determine what is plotted and how to plot it. The plot parameters should be set for *Realtime* and *Playback*. For *Realtime* specify the plot destination and any TM channels to be included. A Doppler plot with grid lines and time bars with annotation are displayed in every plot. Leader characters are generated for each grid line. For *Playback*, the plot parameters are reset to the real time recording values, so you need only to define the *Reconstruct_Timebase*, but you may change any of the plot parameters. To enter a plot setup, type **PLOT**. A typical plot line follows.

Plot Gould Paper_Speed=5 Bar_Interval=25 Grid_Interval=0 TMPlot_Size=8 Reconstruct=200

Plot Destination

Mutually exclusive commands for specifying the Plot destination are **Host**, **Astromed**, or **Gould**. Astromed users should read Talk488 and UnTalk488 descriptions for the GPIB functions.

Paper Speed

Paper_Speed is given in millimeters per second. Choices include **1, 2.5, 5, 10, 25, 50, 100, 200**. In Realtime, *Paper_Speed* controls the expansion or contraction of the data, but in Playback, *Reconstruct_timebase* serves this function. In Playback, *Paper_Speed* determines only how fast the plot is produced. The Astromed cannot handle a paper speed greater than 10.

Reconstruct Timebase

For Playback, **Reconstruct_Timebase** controls the X-axis expansion of the plot by providing the number of milliseconds of data that are to be plotted on 25 mm of paper. The range is **1** to **4095** milliseconds.

Time Bar Interval

Time bars with time annotation are always present on the plot. **Bar_Interval** defines the millimeters of chart paper between time bars. Should the interval be shorter than the time annotation, time bars will appear without new time annotation until an annotation is finished. The size of the time annotation is 30 mm. The maximum interval is **32000** mm.

Legend

The **Legend** is continually printed at the bottom of the plot. Legend may be left blank or is a maximum length of 120 ASCII characters. The first 120 characters following the first break character after **Legend** are used. The ASCII character set is the upper case letters, numbers, and most special characters. Specifically all characters with the values 20_{hex} through 60_{hex} . Lower case letters are converted to upper case. The legend repeats as soon as the character string is finished, it does not blank fill to 120 characters. You may trail the legend with blank characters. Legend causes the rest of the line to NOT be searched for keywords. Example.

Legend ACROAMATICS TELEMETRY SYSTEMS - 515VA DOPPLER SYSTEM

TM Strip Chart Channels

The TM strip chart channels **TM1**, **TM2**, **TM3**, **TM4**, **TM5**, **TM6**, **TM7**, and **TM8**, select the TM channels for inclusion in the plot. The selected TM channels must be Archived. The minimum and maximum data value of each selected channel is calculated for each paper step. Following each TM channel you may specify up to eight ASCII characters to be used as the leader for that channel, or leave the leader blank. The ASCII character set is all characters with the values 20_{hex} through 60_{hex} . Lower case letters are converted to upper case. Please note that the first eight characters following the break character(s) are used for leader, the rest of the line is ignored. TM keywords cause the rest of the line to NOT be searched for keywords. An example follows.

```
tm1=FUSE 1
tm8=SIN WAVE
tm2
```

Clear TM Plot Enables

Clear_TM_Plot_enables disables for plotting all of the eight strip chart channels. There is no individual disable for the channels.

TM Plot Size

The TM strip chart display is located at the top of the plot paper. Depending on the number of channels to display and the Doppler display size, the TM plots can overlap the Doppler display. The Doppler display size is determined by the *PSD_Array_Size*. The display is 256 mm for a PSD array size of 1024 samples, 128 mm for 512 samples, and a 64 mm plot for a 256 sample PSD array. **TMPlot_Size** determines the size of each output channel expressed as full scale deflection in millimeters. The choices are **8**, **16**, or **32** mm.

Doppler Display Size

Large_PSD_Display forces the Doppler display to 256 mm. Without using this option, the display is 256 mm (10.25 inches) for a PSD array size of 1024. A PSD array size of 512 will generate a 128 mm (5.125 inch) plot, and a array size of 256 will produce a 64 mm (2.56 inch) plot.

Doppler Display Shades

Linear_PSD and **Log_PSD** set the mode of the PSD intensity of shades for the Doppler display. To set up a linear display, for example, you would use the command

```
Linear_PSD Min_decibels= 15 Max_decibels= 40 Ref_decibels= 0
```

The parameters **Ref_decibels**, **Min_decibels**, and **Max_decibels**, determine the shades for the decibel levels for the Doppler plot. The **Ref_decibels** parameter is expressed as a positive integer that represents a reference level *below* an arbitrary maximum amplitude of the PSD. The **Min_decibels**, parameter is

expressed as a positive integer that represents a *minimum* offset *below* the reference. An amplitude **greater** than the minimum offset is represented in the display as black. The **Max_decibels**, parameter is expressed as a positive integer that represents a *maximum* offset *below* the reference. An amplitude **less than** the maximum offset is represented in the display as white. The region between **Max_decibels**, (the lower limit), and **Min_decibels**, (the upper limit), is divided into eight shades of grey. The divisions are equally spaced for a linear display, and logarithmically spaced for a log display.

Doppler Grid Interval

Grid lines are always present on the Doppler plot. **Grid_interval** defines in kHz the spacing between the grid lines for the Doppler plot. Grid lines are placed on the Doppler display from zero to the highest frequency of the PSD time slice, and leader characters are generated for each grid line. A grid interval of **1** through **255** kHz is acceptable. Enter **zero** to default to eight equally spaced grid lines.

RUN

Run commands send the setup and an interrupt to the Doppler system. The Doppler system always returns to an Idle state when a Host interrupt occurs, then it executes the command that caused the interrupt. For this reason, any Stop condition, other than Stop Immediate, should be set previous to a Start command. At the Start command, the Doppler microprocessor reads the stop condition from setup memory and sends it to the hardware, unless it is Stop Immediate. After a Start command, even if the start condition has not been found, and the system is not in Run, any interrupt (Leader, Setup, Start, or Stop) causes the Doppler system to stop the run.

Setup

Setup writes the Host's copy of the setup to a memory shared by the Host and the Doppler system and tells the Doppler system to configure the hardware for the type run specified. Usually you will not use this command because it does not cause the Doppler system to initiate any action and because the setup is done with every Run command you use. It is available to send a setup to assure you have no errors such as the plot is to be sent to the Gould, but the Gould is off. It can also be used to transfer a setup from a setup file to the Doppler system.

Leader

Leader writes the setup to shared memory and tells the Doppler processor to produce a leader on the plotter. The Doppler display has leader characters generated for each grid line as specified by the *Grid_interval*. For enabled TM channel plots, the eight character leader specified is used.

Start

Start is used to set the condition for the Doppler system to go into run and start processing data. Start sends the setup to the Doppler system and instructs it to look for the start condition. When the start condition is found, the system goes into Run. There are three ways to start the system, **Immediate**, when **Ev1_is_1**, or **Ev2_is_0**, or by setting a **Time**. If the start condition is an event, Ev1 or Ev2, the event must be archived. See the Archive section on defining an event. Time setting are of the form ddD:HHMM:SS.sss, where the lower case letters need not be specified. For the time compare for start, the days part of time must be the same as the days in the data stream. The Doppler system will not start with data stream days that are past the start time days.

If you are using vdop interactively, vdop will prompt you before it allows you to overwrite a data file, or, will warn you if you have chosen a non-existent file to which to record. If you run vdop non-interactively (eg. with a setup file), then vdop will not interrupt the setup file to prompt you.

Although there is no specific order you must enter the commands, remember that setting the Start condition actually sends the Start command to the Doppler system. If the Doppler system has been sent a Start command and is waiting for a Start condition to go into Run, any other Run command that sends an interrupt will stop the system and it will no longer be looking for the start condition. Examples of each type of Start condition follow.

```
Start Time=93:1030:00.0
Start Ev1_is_1
Start=Immediate
```

Stop

Stop is used to set the condition for the Doppler system to terminates a run and return to Idle. Stop Immediate causes an interrupt to the Doppler system; the other Stop conditions are written to Host's copy of setup memory and do not cause an interrupt. The Stop condition, with the exception of Stop Immediate, should be set previous to a *Start* command. **Stop** conditions are **Immediate**, when **Ev1_is_0**, or **Ev2_is_1**, or a set **Time**. If the stop condition is an event Ev1 or Ev2, the event must be archived. Refer to the Archive section to define an event. Time setting are of the form DDD:HHMM:SS.sss. *Playback* has an additional way to stop, a *Playback* will stop when the archived data is depleted.

Stop or Start can be initiated by typing a period instead of a specifier. This will cause the set condition to be used. This also works for changing the specifier back to Time to use a previously set time, instead of re-entering the time, enter a period. The example below shows how to set the Stop condition to use a time entered previous to changing the Stop to an Event or Immediate.

Stop Time .

If you want to check the set condition, type **See**.

If the Start and Stop are both Events, and the Events are imperceptibly separated, the Stop to the Doppler system may be missed. The TM strip chart display will cease, but the Doppler plot will continue. A Stop Immediate will stop the system.

HOST COMMANDS

Host commands that do not communicate with the Doppler system are **See**, **Check**, **Monitor**, **Talk488**, **UnTalk488**, and **End**.

See

See displays the settings that are relevant to the type of Doppler run you have set. After entering the Host program, typing **See** will display your setup. After entering *Playback*, to see the Archive setup, enter *Realtime See*, then re-enter *Playback*.

Check

Check does a minor check of your setup, and might tell you something important. Check will also report what the Doppler GPIB address is if the Astromed plotter is selected.

Monitor

Monitor displays the running status of the Doppler system, and any messages which are being reported. It is recommended that vdop be placed in this mode while a realtime acquisition or playback is taking place. It will display any change in status or message until the next keystroke. A portion of setup memory is reserved for Doppler status and message. This is the Doppler system's communication to the Host. Status includes *IDLE*, *Setup*, *Leader*, *Start* (a Start time or event has been set), *Run* (the Start condition has been found), *Recall* (at playback setup memory is restored to what it was for the real time record), and *SCSIXfer* (a file is being up/download from/to the doppler card).

End

End exits the program. If the setup has been changed but not sent to the Doppler system, the changes will be lost.

GPIB Setup

For Astromed GPIB users, when the Host program starts executing, it reads the setup memory, and checks the plotter specified. If no plotter has been specified, the environment and the file *tdpc.cfg* are checked for **DOPPLER1** or **DOPPLER2** to find a GPIB address for the first or second Doppler system. If neither is found in the environment, the plotter is set for Gould. If a Doppler GPIB address is found, it is set in setup memory along with the choice of Astromed for plotter, and a setup interrupt is sent to the Doppler system to set its GPIB address. If a plotter is specified in the setup memory when it is read, nothing is done. An example of a *tdpc.cfg* line to set the first Doppler systems GPIB address to 9 follows.

```
DOPPLER1=9
```

Talk488

Talk488 addresses the National Instruments controller card. It checks the environment and the file *tdpc.cfg* for **ASTRODOP1** for VDOP1 or **ASTRODOP2** for VDOP2 and if not successful then **ASTROMED** for a GPIB address in case multiple Astromeds are online and are used for different purposes. If it cannot find an address, it errors out. Otherwise, the GPIB controller addresses the Doppler system to talk, the Astromed to listen, sends a clear to the Astromed, and goes to standby. If the Astromed is not responding, the Doppler system sets an error message. If at any time when the Doppler system is trying to send data to the Astromed, and the Astromed is not taking it, the Doppler system sets a message which may be read by the monitor command of the Host program.

UnTalk488

UnTalk488 has the controller take charge again, unlistens the Astromed, and untalks the Doppler system.

EXAMPLES

The following are examples of how one might set up the doppler card. The first example shows a **Disk** setup. All subsequent examples assume that the **Disk has been set up as in the first example.**

Disk Setup

Please note that the **format command in this example will render any previous data on the disk inaccessible. Be sure to upload** to the host's disk any data on the Doppler system's disk that you wish to save before doing this example.

```
format 4 4
create analog.dat 0
create digital.dat 1
```

Realtime Analog Setup

```
Realtime Analog PSD_array_size= 1024 Frequency_range= 200
Archive DV1 Clear
Time=/lfff Short
TM1=1 LSB, 2CM
TM2=0 MSB, 2CM
TM5=4 MSB, 2CM
EV2=/112 Bit_7
Plot Gould Paper_Speed=10 Bar_Interval=30mm Grid_interval=20kHz
Log_PSD, Min_decibels= 20, Max_decibels= 40, Ref_decibels= 0
TMPlot_Size= 32mm
TM1=RAMP
TM2=SIN WAVE
TM5=RANDOM
Legend=A Realtime Analog Setup
Reconstruct_timebase=3000
Stop EV2
file=analog.dat
Start Time=93:1030:00.0
Monitor
```

Realtime Digital Setup

```
Realtime Digital PSD_array_size= 512 Rate= 600 Decimate= 0
Archive DV1
clear
D1A=/0105 MSB 2CM LSW Input_size= 9 Sample_size= 3 s_lsb
D2A=/0106 MSB 2CM LSW Input_size=1 Sample_size=1 s_lsb
Time=/lfff Long
tm1=/101 MSB 2CM LSW
tm2=/102 MSB 2CM LSW
tm3=/103 MSB 2CM LSW
Plot Gould Paper_Speed=5 Bar_Interval=25 Grid_interval=10 TMPlot_size=32
clear
tm1=FUUSE 1
tm2=FUUSE 2
tm3=FUUSE 3
Linear_PSD Min_decibels= 15 Max_decibels= 40 Ref_decibels= 0
Legend=Digital Doppler from file ONE 2/21/97
file=digital.dat
Run leader
start imm
Monitor
```

Playback Setup

```
file=analog.dat  
PLAYBACK  
Plot clear  
Large_PSD_Display  
Reconstruct_Timebase=3000  
LEGEND DOPPLER WITHOUT STRIP CHARTS  
leader  
start immediate  
end
```

CHAPTER 2

PROGRAMMING THE VDOP GRAPHICAL USER INTERFACE

INTRODUCTION

The VDopGUI is a user-friendly program designed to follow the normal input sequence you use when you program the Video Doppler card. VDopGUI has similarities to the original vdog program, and there are several references to Appendix A above.

MAIN MENU

When you start the program you see a form called the Main Menu. Across the top is the Main Menu Bar containing File, Mode, Realtime, Playback, Plot Leader, and Help. Darkened values are enabled and you can select from these. Initially, these are the File, Plot Leader and Help. The Help talks about the various elements and controls of the program, and is a good place to start. You can invoke Help any time by pressing the F1 key or selecting Help with the mouse.

To start, select a File and then choose from the selections in the drop down menu that appears under the File. As in most Windows applications, placing the mouse icon over the item and clicking the left mouse button once or twice makes selections. Note that any item in the menu that is gray or lighter has been disabled. For example, if there are no empty partitions on the SCSI hard drive, the *New* selection is not enabled, but the *Open* and *ReConfig* selections are.

File menu selections perform the following:

- New - Assigns a new file name to an empty partition.
- Open - Opens an existing file and restores the setup controls to the forms.
- ReConfig - Re-formats the SCSI hard drive by assigning user-designated partitions and segments.
- DownLoad - Transfers a data file from the Host to the SCSI.
- UpLoad - Transfers a data file from the SCSI to the Host.
- Exit - Ends the execution of the VDopGUI.

Selection of any of the above opens the *File Status* display, which has a different set of controls and listings. The listing boxes contain the file names associated with the partition and the percentage of used blocks. The control buttons are as follows.

- New - If enabled, permits you to input a new file name including extension. This is limited to 31 characters.
- Delete - Once a file is selected, you can delete the file from the SCSI hard drive and zero out the used blocks. Use this function with caution, as all data is destroyed.
- Cancel - This permits you to change your mind (if the Done button was not pressed previously) regarding changes to the SCSI.
- Done - Use this to exit the program and save all your selections.

Once a file is open the setup data is retrieved by the system and other menu items become enabled, usually Mode and either Realtime or Playback. These function as follows.

Mode Menu:

1. Realtime - (default) Operations will be Realtime.
2. Playback - Operations will be Playback, enabled only if the file has data.

Realtime Menu

1. Realtime Setup - Sets the Realtime settings as Appendix A-2.1. This includes Realtime Doppler Data Type, PSD array size, Frequency range, HighPass Cutoff Frequency, Rate, and Decimation. The selections are dependent on the Data Type. Selecting the Done button saves the data and exits the form.
2. Archive Setup - Sets the Archive-related settings per Appendix A-2.2. This form has two or three tabs, depending on the Data Type. If there is no Digital data then the third tab is disabled. The first tab contains the TM channel data for all eight channels, and if selected, the TM legend. Additional data is requested when you enter an ID. The second tab is for the Time and Event data, and you must enter the Time ID for the Video Doppler card to work at all. The third tab, when enabled, is for the Digital Data. Selecting the Done button saves the data and exits the form.
3. Plotter Setup - Sets the Plotter-related settings per Appendix A-2.4. Here again, depending on the operation and selections, the available items can change. For example, selecting the Gould Plotter permits the display of all paper speeds, while selecting Astromed will restrict this selection to paper speeds no greater than 10. Also, in the boxes where you have to type in a value, there are checks performed on the acceptable limits. Selecting the Done button saves the data and exits the form.
4. Write Setup - This does the actual write to the A32 memory area the Video Doppler card will use.
5. Save a Setup - This permits you to save the current setup configuration. Selecting this opens another form where you select the place and name of the setup file to be saved. Be careful not to add an extension, as the program will do this for you.
6. Get a Setup - This enables you to grab a previously saved setup and load it into the current forms, thus saving time when you only want to change a few items.

Note: In the Summary display shown in the Main Menu during normal operations, there is a Configure button which permits you to display the current A32

memory settings as read back from the Video Doppler card. These setting only get updated when you select 'Write Setup'.

Playback Menu

1. Plotter Setup - Sets the Plotter-related settings per Appendix A-2.4. Here again, the available items can change depending on the operation and selections. For example, selecting the Gould Plotter permits all paper speeds to be shown, while selecting Astromed restricts this selection to speeds no greater than 10. Also in the boxes where you must type in a value, there are checks performed on the acceptable limits. Selecting the Done button saves the data and exits the form.
2. View Archive Settings - Sets the Archive-related settings as per Appendix A-2.2. This form has two or three tabs, depending on the Data Type. If there is no Digital then the third tab is disabled. The first tab contains the TM channel data for all eight channels and, if selected, the TM legend. Additional data is requested when you enter an ID. The second tab is for the Time and Event data, and you must enter the Time ID for the Video Doppler card to work at all. The third tab, when enabled, is for the Digital Data. Selecting the Done button saves the data and exits the form.
3. Write Setup - This does the actual write to the A32 memory area that the Video Doppler card will use.

EXAMPLES

Example 1. Using an existing file.

Caution: Opening and running the selected file in Realtime mode will overwrite the current data on the SCSI. If you want to display the recorded data, be sure to place the Mode to Playback.

1. Select File, and open the file of choice by clicking on the file name, then press Done.
2. Select the Mode, default to Realtime unless the file has data, which indicates a Playback.
3. Select Realtime, and select Realtime Setup for review or change. Remember to select Done to save settings.
4. Select Archive or Plot as required to modify.
5. Select Write Setup to transfer to the A32 memory. This must be done whether or not any changes have been made.
6. Enable the Run/Activate button on the Main Menu. Select this button to start a Realtime recording.
7. Use the Stop button to stop recording at any time.

Note: The only difference between this type of Realtime and a Playback is in step 2, where you must select the Playback mode. Then open either the Plotter setup, which would now contain the Reconstruct Timebase setting, along with what was originally done.

Example 2. Using a new file.

1. Select File, then New when enabled. The first blank file is indicated. Select the blank file and the New command button is enabled.
 2. Press the New button to open the File Name form and enter a file name followed by Done, which closes the new file form.
 3. When the new filename is selected, the Done button becomes enabled.
 4. The Mode will default to Realtime.
 5. At this point you can port in a previous setup or start opening up the forms and entering the desired settings. The forms will have 'zero' settings initially if no setup was loaded.
 6. Select Realtime, and select Realtime Setup for review or change. Remember to select Done to save settings.
 7. Repeat with Archive or Plot as required to modify, then select Done to complete the operation.
 8. You can save the Setup to a file by selecting Save Setup under the Realtime Menu.
 9. Select Write Setup to transfer to the A32 memory. This must be done whether or not any changes have been made.
 10. You can view your settings by selecting the Configure Button in the Summary display.
 11. Enable the Run/Activate button on the Main Menu. Select this button to start a Realtime recording.
 12. Use the Stop button to stop recording at any time.
- Note: The progress bar will indicate the percentage of blocks used as the Realtime is running.

Example 3: Re-Configuring from the File menu;

This will destroy all data on the SCSI if carried through to completion. It is used to partition the SCSI hard drive and assign the number of segments to each partition. The number of segments must always total eight.

1. Under the File menu, select ReConfig and the File Status display will come up.
2. All the filenames in the File Listing will be cleared, and the Partition will default to a single eight segment partition.
3. Select the number of desired partitions, and this will open the selections for the number of segments to be assigned, which is the next selection. The display will reflect these settings.
4. Once the desired configuration is reached, select a blank file and enter a file name. (See Example 2)
5. You can now assign all the filenames to all the partitions or only those desired.
6. The Partitions and filename will be formatted to the SCSI.
7. You must now select a file and repeat the steps in example 2.

These elements are the basics of the VDopGUI program. Not covered here are all the individual controls and inputs, and the hundreds of combinations which you can implement. For the most part, the program will tell you when something is not acceptable or outside a required limit.

