

SOFTWARE REQUIREMENT  
SPECIFICATION FOR  
FIELDING CHECKING SYSTEM

Submitted to: Geological Survey  
of Canada

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Software Kinetics

SOFTWARE  
REQUIREMENT SPECIFICATIONS  
FOR  
FIELD CHECKING SYSTEM

Submitted to: Geological Survey of Canada  
Experimental Airborne Operations

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## OVERVIEW

This document specifies the software requirements of the Field Checking System for the Experimental Airborne Operations of Geological Survey of Canada. The System will reside in the field laboratory during field operations.

Using a Beachcraft B80 Queenaire aircraft, sampling lines are flown to record aeromagnetic data using the Aeromagnetic Data Acquisition System, built internally at Energy Mines and Resources. This combined magnetic and navigational data is stored, during flight, on a rigid disk drive.

Magnetic data will also be collected at a Diurnal Ground Station and stored on a hard disk. The hard disk cartridges can be removed from their acquisition systems and taken to the field laboratory for data verification and transfer to magnetic tape, a permanent storage medium. An IBM-AT microcomputer will be used to verify the recorded information, to plot magnetic fields on a printer/plotter, to perform fourth difference calculations and to copy data between hard disk cartridges and magnetic tape. As well, the System will allow the creation of an edited tape, to be sent to the Booth Street Laboratories of E.M.R. for computer compilation of the resultant aeromagnetic maps.





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## OPERATIONAL REQUIREMENTS

The following subsections provide the operational requirements for the Geological Survey of Canada IBM-AT based system used to field-check the aeromagnetic data collected during flight and the diurnal data collected by the respective data acquisition systems.

### 1.0 OPERATOR INTERFACES

The Operator will provide input and control to the system entirely through the IBM-AT keyboard terminal. The AT's Video Display Monitor will create a display of twenty-five lines by eighty characters which will be used to inform and prompt the Operator.

#### 1.1 Keyboard

The IBM-AT Keyboard will be used to provide any requested inputs during operation of the system as well as providing system control. Prompts and menus will be issued on the Display to assist the Operator when commands and data are required by the System.

#### 1.2 Display

The display will contain 25 lines with 80 characters per line. However, only certain areas of the display will be available to the Operator. The screen layout is illustrated in Figure 1-2.

The largest portion of the display will be known as the Presentation Area. This zone will be 20 lines by 78 characters



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and will be enclosed by a rectangular box. Immediately below this box will be a line dedicated to displaying error and status messages. Text will be highlighted on this line using inverse video. Below this will be a line on which all Operator prompts will be printed. The bottom line of the display will be designated as the Operator input zone. All input will be made here, with the exception of screen editing explained in following subsections (prompts will inform the Operator when screen editing is in effect).



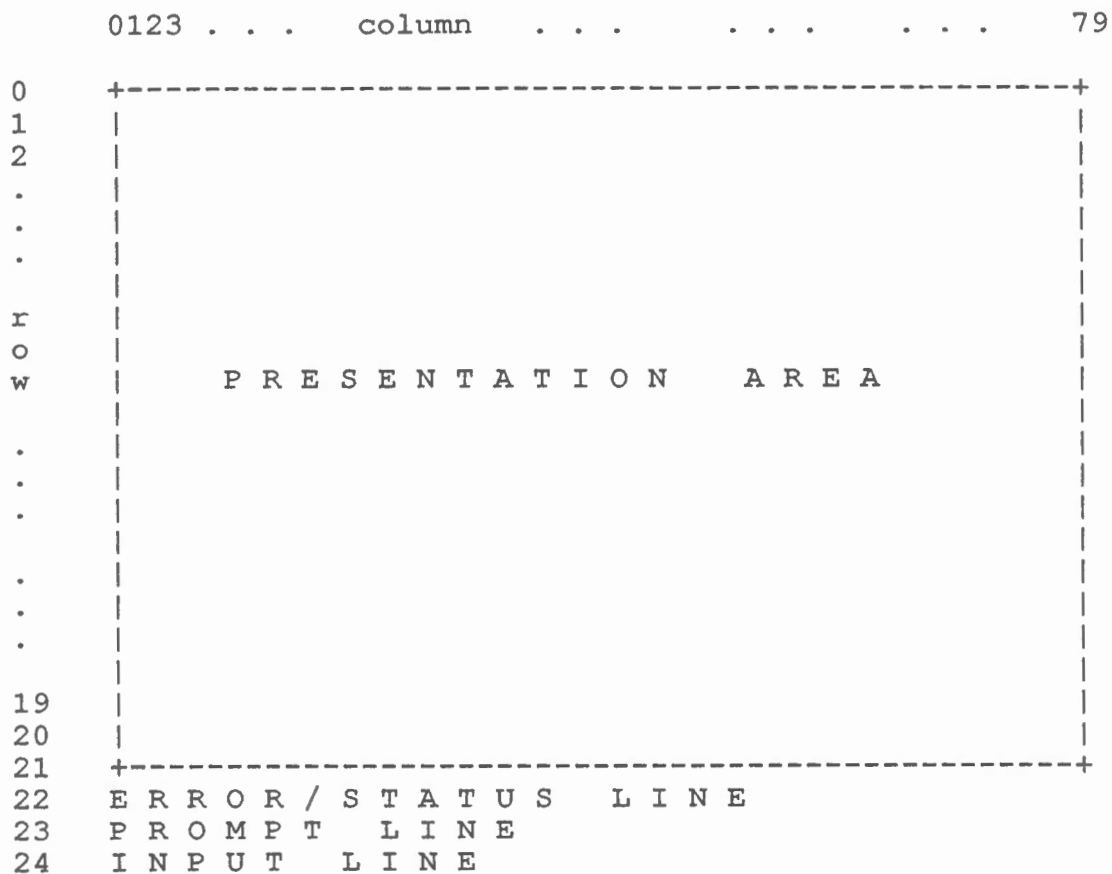


Figure 1-2 Screen Layout



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## 2.0 SYSTEM OPERATION

The System is to operate as specified in the Operational Description of this Requirements document. Details on how to use and interpret the system will be outlined in an auxiliary Operator's Manual.

The System has several functions. These will be broken down into System Specifications, Control, Block Printing, Plotting, Profiling, Parameter Creation, and Editing. Each of these functions will be outlined in following subsections.



## 2.1 SYSTEM SPECIFICATIONS

During operation of the Field Checking System it will not be necessary for the Operator to set up values for certain parameters each time the system is used. Certain parameters will have values 'assigned' to them by the system and these parameters will be referred to as System Specifications. The system specifications will be set up as a function of the Field Checking System and the following subsections describe these default parameters.

### 2.1.1 Logical Unit Numbers

The various devices attached to the Field Checking System will be referenced by Logical Unit Numbers (LUNs) rather than their device names. This will be done to make it easier for the Operator when a device must be specified and to allow more flexibility in assigning input and output devices. The LUNs will be defined as a System Specification. The IBM-AT Monitor, Star Printer, Versatec Printer, as well as the Versatec Plotter, two magnetic tape drives and two hard disks will all be assigned logical unit numbers.

### 2.1.2 Recording Parameters

The flight and ground data will be composed of strictly defined data parameters. These parameters will be defined by two character, alphabetic codes in the recorded data. The Recording Parameters Specification of the Field Checking System will provide the Operator with a means of defining these parameter codes along with several other specifications for each parameter. These will include a mnemonic, type (decimal or



hexadecimal), length (in number of digits), scale (in terms of decimal places), and units (text). These specifications will be used throughout the Field Checking System to verify recorded data blocks and for formatting during output of such things as Stacked Profiles, Plots and Block-Printing dumps.

### 2.1.3 Character Checking Sets & Headers

#### 2.1.3.1 Check-Set

When formatting data and checking for bad blocks during the Block Printing Process, a check will be done to verify that no invalid characters are found in the data. The character sets which will define these allowed characters will be entered and saved as a System Specification. The Airborne and Diurnal data will each have their own check sets.

#### 2.1.3.2 Header

Each of the two data sources (Airborne and Diurnal) will each have a specification defining the Block Header to be used during the Block Printing Process. These headers will be composed of parameter mnemonics which in turn will be used to specify which parameters will be formatted on the output of Block Printing as well as to specify the exact layout of the columns of data on the output.

#### 2.1.4 Storage Device Specifications

With variable tape lengths and inter-record gaps associated with magnetic tapes and magnetic tape units, respectively, the Operator must have a means of varying these specifications. As





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well, the hard disks contain such large amounts of data that it will also be necessary for the Operator to be able to 'partition' a hard disk to a specific area of data in order to avoid having to deal with all the data on the cartridge in question. The Storage Device Specifications will allow the Operator to do this by permitting specification of magnetic tape length, recording density, tape unit inter-record gap, and starting and ending logical addresses on the hard disks.



## 2.2 MEDIUM CONTROL

The Control functions will make up what will be referred to as the Medium Control Utility of the Field Checking System. The Operator will be able to manipulate either of the magnetic tape or disk recording mediums, as well as be able to copy the contents of one medium to the other. The procedure to perform each of these functions is outlined in the Operational Description.

### 2.2.1 Magnetic Tape Manipulation

Magnetic tape will be manipulated such that data may be skipped over in blocks or files both forward and reverse. The Tape may also be rewound to its beginning in a single command or an end-of-file marker written to it by Operator control.

### 2.2.2 Disk Manipulation

The disk will be controllable using the Medium Control Utility of the Field Checking System. Using the options available, the Operator will be able to format Iomega Cartridges at any desired interleave, clear disk directories which reside at the beginning of each Iomega Cartridge, and display disk directories on the IBM-AT Monitor.

### 2.2.3 Search/Copy Functions

The Operator will be provided with the means to search for a string in the data on both magnetic tape and hard disk. When a match is found before the end of the recording medium is reached a message will be logged on the System Message Console indicating



the sequential block number of where the match was made from the beginning of the search. If the search medium is one of the two hard disks the Logical Address (LAD) of the block containing the match will also be included in the message logged on the Console.

With the magnetic tape medium, this same search procedure may be used to position a tape to a desired location. When a match is made and the message is logged, the tape will be backed up one block to ready it for some other process. This procedure will not apply to either of the two hard disks.

The Control Utility will also allow the Operator to copy data between recording media. An option will be included to allow copying of data from disk to disk, disk to magnetic tape, magnetic tape to disk, and magnetic tape to magnetic tape. The Control Utility will inform the Operator of which operations are not possible when the hardware configuration does not include both pairs of disk and tape recording media.



## 2.3 BLOCK PRINTING

The Block Printing option of the Field Checking System will allow blocks of data from magnetic tape or hard disk to be successively printed. There will be three types of data: airborne-acquired, ground-acquired and 'other' or raw-format. For each of the three data types/formats a series of printing options will exist. Every block, every tenth block, every hundredth block, every Nth block or every bad block may be examined. The data may be printed on either the Versatec Printer, the Star Printer or sent to a null device depending upon the Operator's choice.

If every bad block is to be printed, the data blocks will be checked to ensure all recording parameters are valid, no illegal characters are present, the block is made up of the correct number of records, the block is of the correct length, and numeric data exists for each recording parameter. As well, each parameter will be checked to ensure all digits are correct. Bad Block Checking may be done for any frequency desired: the Operator will be provided with a means of enabling/disabling the checking function. When errors are detected they will be logged on either the specified printer or the Error Console, depending upon the frequency specified: if a block is to be dumped to the printer but an error is detected, it will be output in raw format regardless of the format chosen; errors detected in other blocks will be logged on the Error Console.

### 2.3.1 Formated Airborne Data

The output of the Airborne Data Acquisition System, once copied from hard disk to magnetic tape, will be available for verification using the Block Printing commands. This will allow



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the Operator to selectively check the results of the day's flight.

Figure 2-3-1 illustrates an example of Formated Airborne Data output.



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BLOCK NO.	159	LENGTH 1458	DAY 084	YEAR 87	LINE 00000109				
TIMDS	MAGU1	MAGU2	MAGU3	.01GU	STAT	LAT	LONG	HEAD	ROLL
GJ	GN	GO	GP	GZ	HH	HI	HJ	HK	HL
55066045	57062396	57061972	57061492	5706306	FECFF	n0445097	w0764164	1573	1803
55066345	57061012	57060566	57060085	5706173	FECFF	n0445097	w0764164	1574	1803
55066645	57059628	57059114	57058623	5706031	FECFF	n0445094	w0764163	1576	1805
55066945	57058165	57057596	57057116	5705886	EFDFF	n0445094	w0764163	1576	1806
55067245	57056613	57056133	57055631	5705734	EFDFF	n0445094	w0764163	1576	1806
55067545	57055073	57054604	57054102	5705585	EFDFF	n0445091	w0764157	1576	1805
55067845	57053588	57053063	57052494	5705433	EEDFF	n0445091	w0764157	1576	1805
55068145	57052036	57051523	57051009	5705277	EEDFF	n0445091	w0764157	1576	1803
55068445	57050507	57050038	57049491	5705124	EEDFF	n0445089	w0764157	1576	1802
55068745	57048955	57048475	57047995	5704974	FEDEF	n0445089	w0764152	1576	1800

PITCH	TRALT	R.ALT	AIRD	TCMPU	LCMPU	VCMPU	CSHZU
HM	JL	HN	HO	HV	HW	HX	IH
1819	+0967	FFFF	40144	+0712	+0567	+0427	1996623
1818	+0975	FFFF	60220	+0715	+0570	+0430	1996577
1817	+0975	FFFF	00003	+0717	+0570	+0425	1996527
1816	+0972	FFFF	21745	+0722	+0575	+0430	1996478
1816	+0967	FFFF	40144	+0722	+0575	+0430	1996424
1815	+0972	FFFF	60220	+0722	+0575	+0432	1996374
1815	+0972	FFFF	00003	+0722	+0577	+0430	1996320
1815	+0975	FFFF	21743	+0725	+0577	+0432	1996266
1815	+0972	FFFF	40144	+0725	+0580	+0435	1996212
1815	+0967	7FFF	60221	+0722	+0580	+0435	1996160

Figure 2-3-1 Formated Airborne Data Output

### 2.3.2 Formated Diurnal Data

The Diurnal Ground Station monitors WWVB time, Loran C, Latitude, Longitude, and the VLF Statuses and is responsible for providing the compensating data used to correct and correlate the navigational data collected during flight surveys. After the Diurnal data has been copied to magnetic tape it will be ready for checking using the Block Printing options.

Figure 2-3-2 illustrates an example of Formated Diurnal Data output.



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BLOCK NO.	57	LENGTH	668	DAY	163	YEAR	87	
TIMDS	STAT	LAT	LONG	VLFQL	VLFTL	VLFQO	VLFTO	
GJ	HH	HI	HJ	HR	HS	HT	HU	
72480015	FECFF	n0445097	w0764164	+0567	+0427	+0736	+0163	
72480301	FECFF	n0445097	w0764164	+0570	+0421	+0734	+0167	
72480607	FFCFF	n0445097	w0764164	+0570	+0419	+0732	+0171	
72480904	FFCFF	n0445097	w0764164	+0575	+0415	+0730	+0176	
72481190	FFCFF	n0445097	w0764164	+0580	+0409	+0727	+0181	
72481498	FECFF	n0445097	w0764164	+0582	+0402	+0725	+0186	
72481795	FEDFF	n0445097	w0764164	+0589	+0395	+0723	+0192	
72482083	FEDFF	n0445097	w0764164	+0595	+0387	+0721	+0198	
72482380	FFDFF	n0445097	w0764164	+0599	+0374	+0719	+0204	
72482686	FFDFF	n0445097	w0764164	+0603	+0361	+0717	+0211	

Figure 2-3-2 Formated Diurnal Data Output





### 2.3.3 Unformatted Data

In the event that it ever becomes desirable to examine data other than that collected from the airborne operations or the diurnal ground station, an option will be available to print data in an unformatted form. However, because the format of the data will be unknown, it will not be possible to search for bad blocks with this option. Every tenth block, hundredth block, etc. printing options will be applicable for unformatted data.

NOTE: Airborne and Diurnal data may be printed in an unformatted form if desired. As well, if formatted printing is being done and a bad block is encountered at the desired frequency, it will be dumped in the unformatted form. An error message will be printed beneath the Block Id indicating the error encountered.

If a bad block is encountered during formatted printing but it does not occur at the desired frequency, then a message will be logged on the System Message Console indicating the block number containing the error and text indicating the error encountered. This will be explained in more detail in the Operator's Manual.

Figure 2-3-3 illustrates an example of Unformatted (Airborne) Data with an illegal character.



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BLOCK NO. 2 LENGTH 1458  
23887GG00011620GH47278060GJ59705138GN59706925G059708544GP5970352GZ0FF0FHHn0483392HI  
0035HW+0007HX2088941IH+1112JL47278360GJ59710106GN59711714G059713244GP5970863GZ  
02HO+0190HV+0030HW+0022HX2089124IH+1117JL47278660GJ59714717GN59716146G059717586GP  
4HM0553HN21454HO+0182HV+0057HW+0027HX2089291IH+1115JL47278960GJ59718948GN59720243GO  
2HK1678HL1822HM0552HN60222HO+0187HV+0035HW+0030HX2089446IH+1112JL47279260GJ  
0882876HJ1798HK1673HL1819HM0553HN0001HO+0210HV+0052HW+0035HX2089590IH+1112JL  
Hn0483388HIw0882876HJ1794HK1670HL1818HM0553HN40147HO+0185HV+0077HW+0037HX  
2799GZ0FF0FHHn0483388HIw0882876HJ1791HK1672HL1820HM0552HN60223HO+0187HV+0060HW  
9731943GP5973037GZ0FF0FHHn0483384HIw0882876HJ1789HK1678HL1820HM0550HN21448HO  
N59732769G059733015GP5973212GZ0FF0FHHn0483384HIw0882878HJ1783HK1692HL1820HM  
0GJ59733261GN59733361G059733417GP5973320GZ0FF0FHHn0483384HIw0882878HJ1776HK  
107JL

w0882873HJ1819HK1695HL1831HM0548HN40146HO+0222HV+  
0FF0FHHn0483392HIw0882874HJ1812HK1690HL1827HM0551HN000  
5971333GZ0FF0FHHn0483392HIw0882874HJ1806HK1683HL182  
59721460GP5971767GZ0FF0FHHn0483392HIw0882874HJ180  
59722722GN59723861G059724932GP5972160GZ0FF0FHHn0483388HIw  
47279560GJ59725971GN59726964G059727868GP5972507GZ0FF0FH  
2089716IH+1112JL47279860GJ59728683GN59729487G059730246GP597  
+0042HX2089825IH+1112JL47280160GJ59730905GN59731463G05  
+0202HV+0052HW+0045HX2089913IH+1107JL47280460GJ59732412G  
0550HN40146HO+0205HV+0045HW+0030HX2089982IH+1107JL4728076  
1704HL1819HM0549HN0001HO+0227HV+0055HW+0025HX2090028IH+1

Figure 2-3-3 Unformatted Data Output



## 2.4 PLOTTING

Using the Versatec V-80 Printer/Plotter much of the airborne and diurnal data may be presented visually. To set up the necessary specifications prior to plotting, the Operator will choose the Plot option of the Main Menu. A display will be presented upon which these specifications will be defined.

### 2.4.1 Plotting Specifications

#### 2.4.1.1 Parameters

The parameters to be plotted will be identified by their recording identifiers. Under the appropriate columns, the Operator will enter the identifiers, up to a maximum of thirty-six (36).

#### 2.4.1.2 Scale

For each parameter a Scale will be required. This scale will be used to proportion the recorded data to a value suitable for plotting; it specifies the number of parameter units that corresponds to a full scale of a curve.

#### 2.4.1.3 Plot Position

The plot will be divided into vertical strips. Each of these strips will be referred to as a 'sector'. A sector will consist of 16 horizontal points with a plot composed of 132 sectors. The Plot Position will specify the leftmost and rightmost sector boundaries for a curve on the plot output.



For example, if a Plot Position of (003-008) is specified, then a curve might appear as in Figure 2-4-1-3: no point will be plotted, for the curve, outside of sectors 3 through 8 exclusively. When a curve reaches one boundary it will wrap around and continue from the opposite boundary.

For Normal Plots, the starting plot position will represent a zero value for the parameter and the ending plot position will represent a full scale. Successive Difference plots, however, will use the mid point between the start and end plot sectors as the zero reference with points to the left of centre representing negative parameter values and points to the right of centre representing positive parameter values.



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Sector

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 . . .

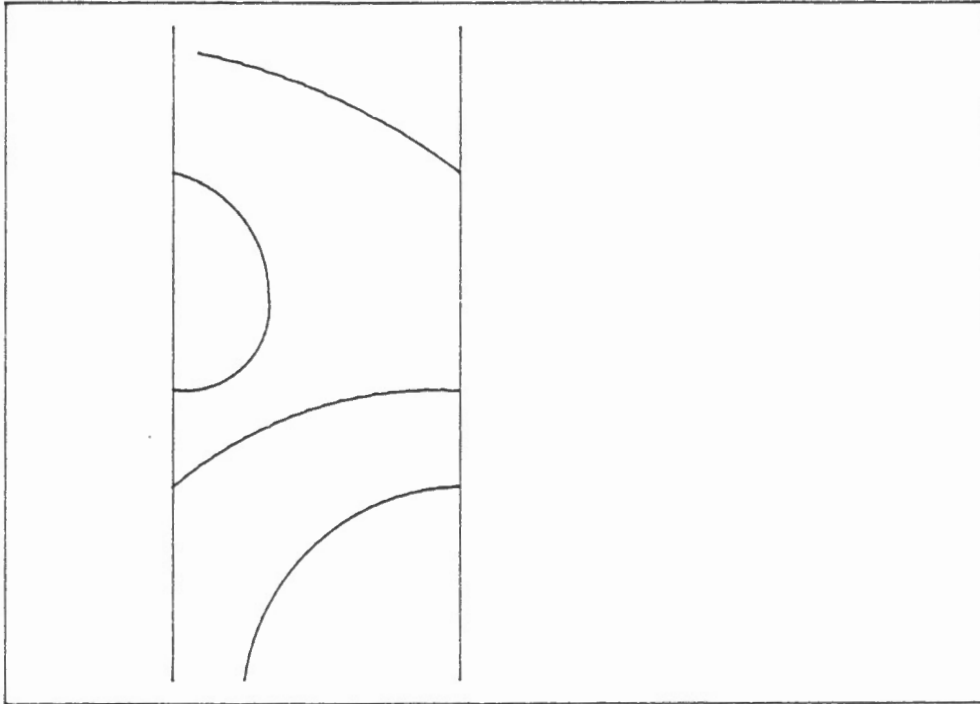


Figure 2-4-1-3 Example Plot Curve



#### 2.4.1.4 Vertical Scale

The Vertical Scale will represent the number of spaces between plot points in the vertical axis when plotting. It should be understood that a large vertical scale will stretch the profile and lead to severe distortion. The vertical scale will have a range from 0 (no spacing) to 10 (ten blank lines between each horizontal plot point).

#### 2.4.1.5 Fiducial Parameter

The Fiducial Parameter specifies that parameter upon which a marking scale for a plot is to be based. Scale lines will be marked along each edge of a plot and will consist of a short line at each graduation. This graduation will depend upon the parameter interval chosen.

#### 2.4.1.6 Fiducial Interval

The Fiducial Parameter Interval will define the change in Fiducial parameter values which will represent the difference in the scale marks along the edges of the plot. For example, if the fiducial parameter is time in day-seconds and the interval is defined as 12000 then a plot starting at time 57346285 would have a scale mark generated at time 573582285. After nine scale marks, the actual fiducial value will be printed at the left edge of the plot.

#### 2.4.1.7 Scale Lines

Scale Lines may be included which will mark the starting and ending plot sector positions for each parameter of a plot. These



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lines will mark the maximum and minimum deflections for plot parameter values.



#### 2.4.2 Successive Difference Plots

A Successive Difference Plot is useful for noise detection. Though successive differences are normally only applied to magnetometer readings, the ability to perform successive difference plots on any parameter will be possible. Up to a sixth successive difference may be performed implying that the first, up to and including the sixth differences, may also be done. A zero successive difference plot will be the actual data and this too may be included on the output.

Any number of successive differences may be plotted simultaneously. The Operator will determine which differences are to be plotted via the parameter codes specified. This will be explained in more detail in the Operator's Manual. Figure 2-4-2 illustrates a data and six successive difference curves in an attempt to show the use of successive difference plots for noise detection.





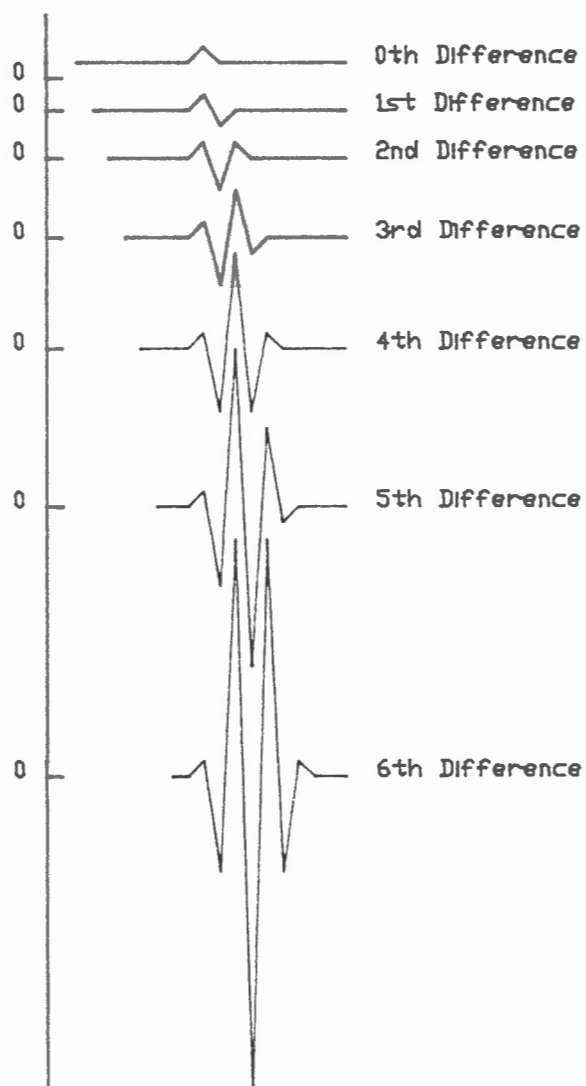


Figure 2-4-2 Successive Difference Curves



### 2.4.3 Plot Layout

For each plot generated, certain specific pieces of data and headers will be required on the plot. Figure 2-4-3 illustrates a plot of one parameter with three different sized plot windows.

The first line of any plot will contain the Julian date the data was collected and, for airborne data, the traverse line number. Beneath this line will be text indicating the vertical scale of the plot and the fiducial interval between scale marks. Immediately following the line number will be one or two characters identifying the general direction of flight. This will take the form of one of the eight principal compass directions (ie. n, ne, e, se, s, sw, w, nw).

A series of hachures under this text will indicate the plot sector locations. The mnemonic of the fiducial parameter will be printed below the sector markers with the initial fiducial value under the mnemonic.

The plot data will then be generated on the page with vertical scale lines present, if requested. Scale markers along the left and right edges of the plot will provide reference points.

A short distance down the page at the beginning of each plot parameter window will be three text lines indicating the plot parameter mnemonic, the full scale value and the full scale units.

Successive Difference plots will be identical to general plots with the exception of the text "\*\*\* SUCCESSIVE DIFFERENCE" appended to the first line in the Plot Header.



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A new plot sequence will be initiated whenever a change in the traverse line number is detected for airborne data. The plot for a new flight line will begin at the top of a new page.



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DAY 084 YEAR 87 LINE 00001111

VERTICAL SCALE = 2, FIDUCIAL INTERVAL = 18.000 SCNS

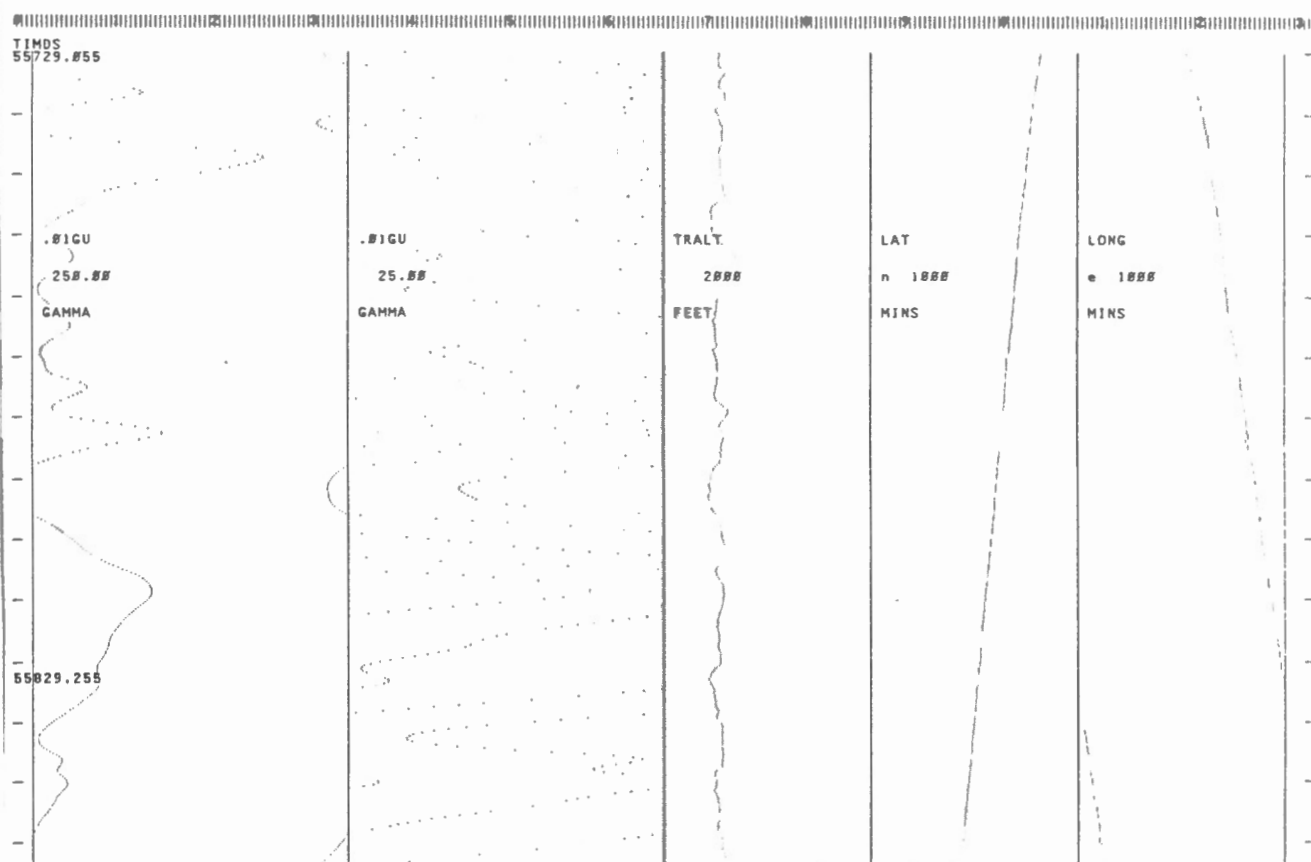


Figure 2-4-3 Example Plot Layout



## 2.5 STACKED PROFILES

Aeromagnetic data is collected by flying line strips of approximately twenty minutes in duration. When a line is completed, the aircraft is turned 180 degrees to fly the next line, separated by approximately 300 meters. A typical flight pattern might resemble that of Figure 2-5.

Referring to Figure 2-5, since data is recorded sequentially on the recording medium, electromagnetic data collected at point "A" of flight line 1507 and data of point "D" of flight line 1508 will be separated by data acquired between points "A" & "B" and "C" & "D". However, the "A"/"B" and "C"/"D" data will be stored consecutively on the recording medium. Thus, flight line data will need to be reversed in order that the data can be processed sequentially when plotting so that "A" and "D" data can be plotted side by side , and "B" and "C" data side by side.

As a means of verifying flight results for erroneous data, plots of various parameters are desirable. In the past, plots have been generated for a parameter along one line strip and then several adjacent line strip plots have been laid side by side to form a more complete picture. However, this has been found to be both time-consuming and tedious. The current Field Checking System will sort the recorded data into its adjacent lines so that a plot can be produced of all lines simultaneously. Several plot formats will be available and are outlined in the following subsections. These plots will be referred to as 'Stacked Profiles'.



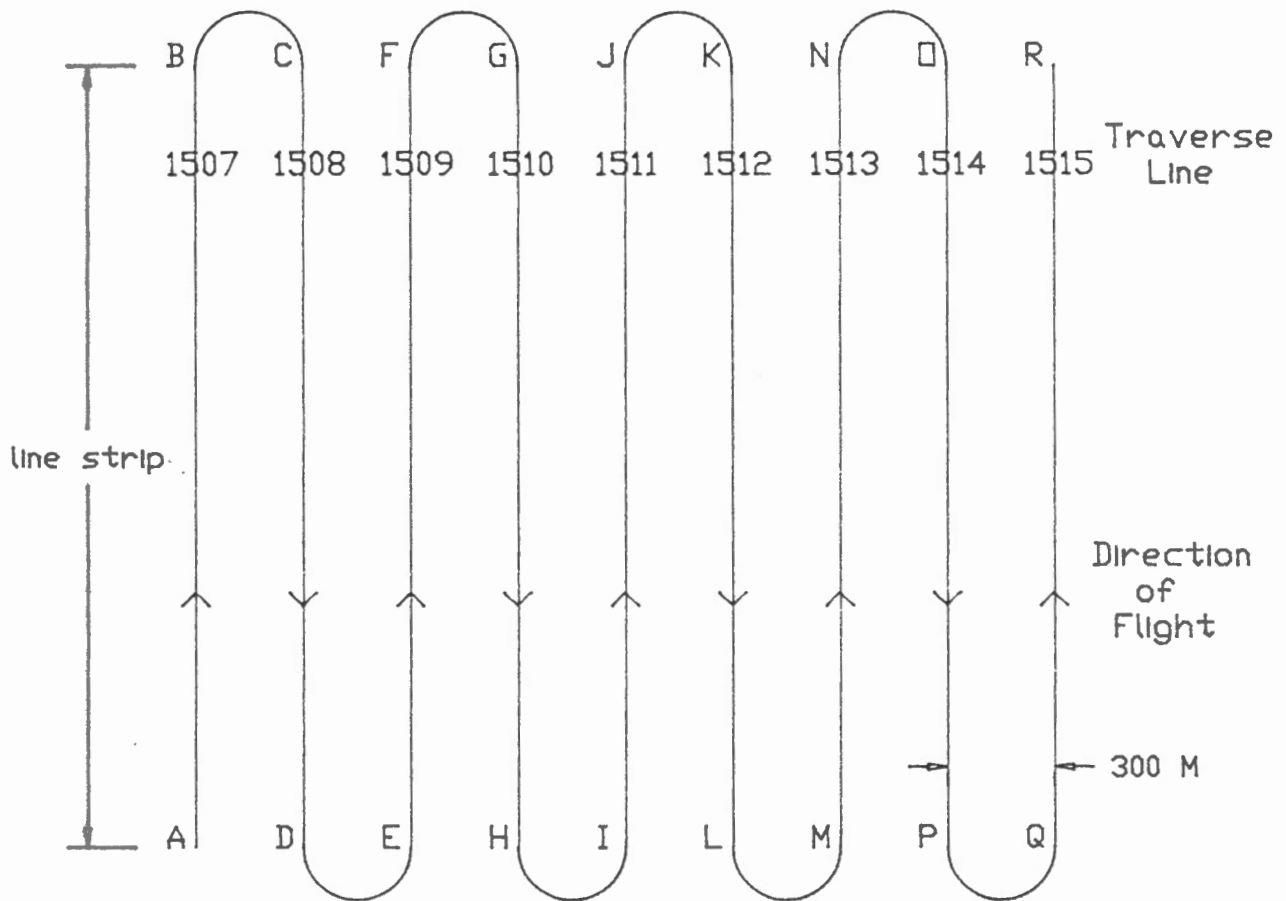


Figure 2-5 Example Flight Pattern

## 2.5.1 Profile Formats

### 2.5.1.1 Free Format Stacked Profile

A Free Format Stacked Profile of line data will be used to create a plot of adjacent lines where the top of the plot represents the start of sampling and the plot ends when all the recorded data for a line has been processed. Figure 2-5-1-1 illustrates an example of a Free Format Stacked Profile. Notice that a line's plot length may vary with this format, even when all traverse line lengths are the same. This variance might be caused by a strong tailwind while flying one direction and an equally strong headwind when flying the opposite heading. The Free Format Profile will be useful for 'first-examinations'. If this proves unsatisfactory other formats may be used for plotting.



#2100-12-001.01.0

STACKED PROFILE    FORMAT: FREE            INTERVAL = 18.888 SCNDS  
FLIGHT DATE:    DAY 248    YEAR 87  
PROFILE PARAMETER = .81GV    SCALE = 258.88 GAMMA  
VERTICAL SCALE = 8.            SEPARATION = 12 SECTORS

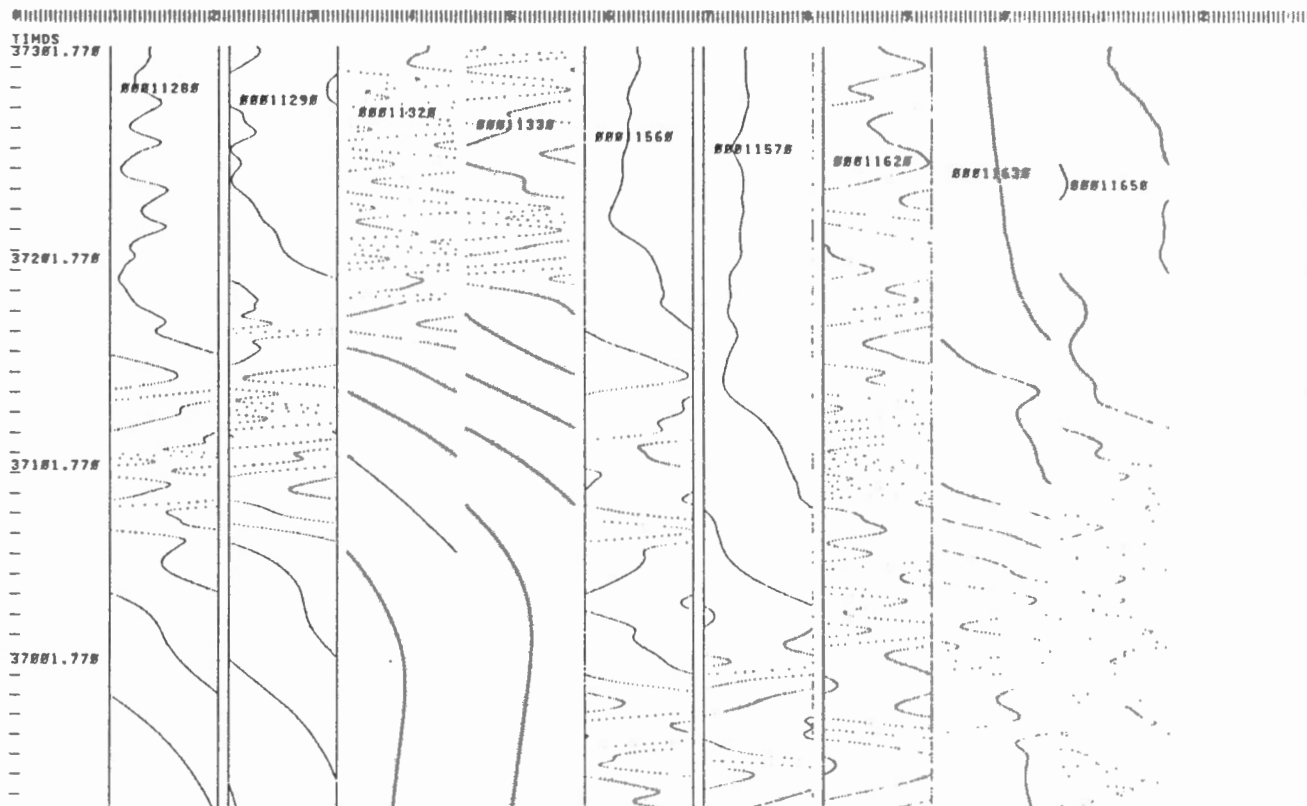


Figure 2-5-1-1 Free Format Stacked Profile





#### 2.5.1.2 Time Adjusted Stacked Profile

To compensate for the effects that wind velocity might have on the ground speed of the aircraft during data acquisition, a Time Adjusted Stacked Profile for a parameter may be created. During data extraction the data will be examined and the length of each line in units of time will be calculated. Then, when the plot is created, the plot positions for the data will be mapped against time to create a plot with all lines of equal length. Figure 2-5-1-2a and Figure 2-5-1-2b illustrate a simplified example of data and a plot of a Time Adjusted Stacked Profile.

NOTE: Traverse flight lines should be of equal length if a Time Adjusted Profile is to be created. Lines of unequal length will result in a Profile of improperly adjusted data.



#2100-12-001.01.0

Simplified Sample Flight Data:  
Strong Headwind on Day of Flight

TRAVERSE LINE #	TIME	DATA
1	0 sec	0
	1 sec	2
	2 sec	5
	3 sec	3
	4 sec	1
	5 sec	0
2	6 sec	0
	7 sec	4
	8 sec	0
3	9 sec	0
	10 sec	1
	11 sec	2
	12 sec	2
	13 sec	1
	14 sec	0
4	15 sec	0
	16 sec	5
	17 sec	0

Figure 2-5-1-2a Sample Data



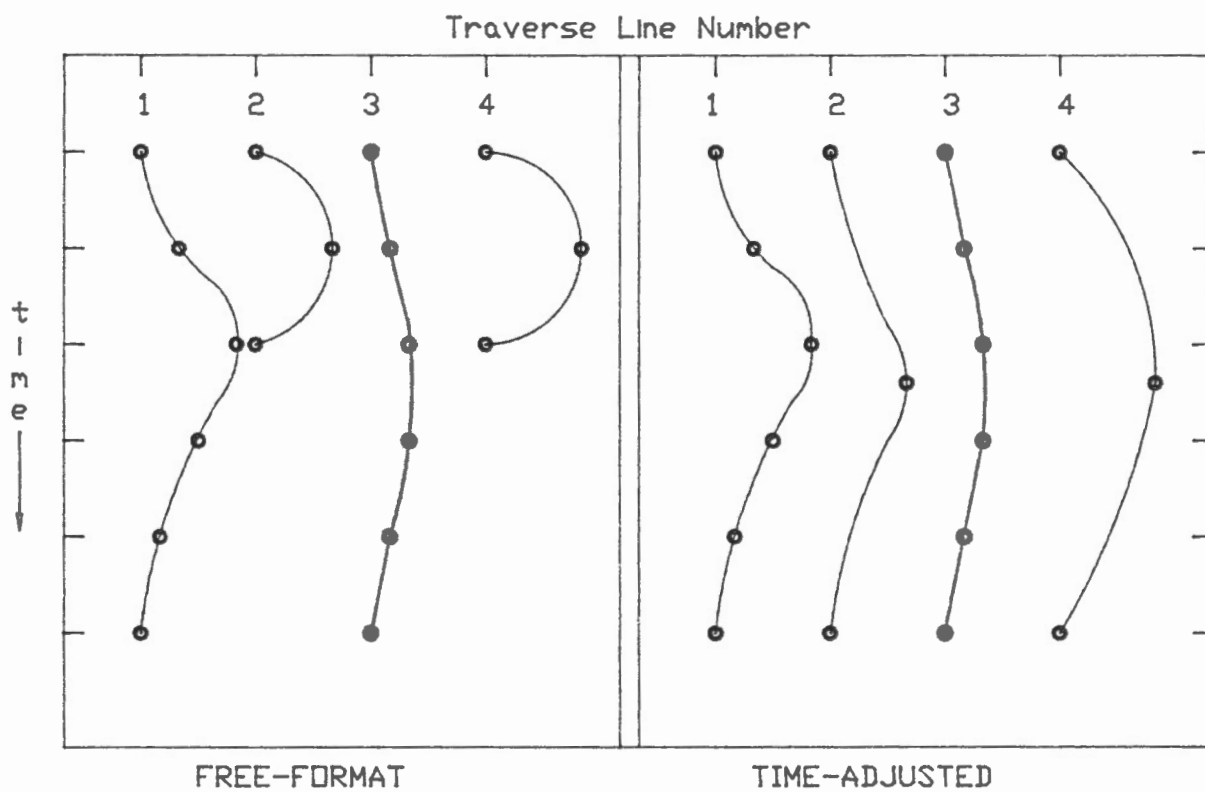


Figure 2-5-1-2b Free Format and Time-adjusted Format Profiles



### 2.5.1.3 Other Adjusting Scales

A generalization of the Time-Adjusted scale, this Stacked Profile option will allow the Operator to select any parameter on which to adjust the vertical scale of the plot. As an example, when aeromagnetic data has been collected with Loran C navigational data included, a useful plot would be to scale on either Latitude or Longitude, especially if ground speed varied with the heading during acquisition. The Operator will choose the adjusting parameter which will result in the data extraction being performed and the associated Stacked Profile being generated after the required specifications have been set up.



### 2.5.2 Profile Layout

Figure 2-5-2 shows an example of a Stacked Profile. At the top of the Profile is the text "STACKED PROFILE",; the format type consisting of either the text "FREE", "TIME-ADJUSTED" or the mnemonic of the format parameter chosen, and the format interval and units.

The second line of the header indicates the Julian date on which the data was collected. The third line shows the mnemonic of the profile parameter and the full scale and units of the profile parameter.

The fourth line lists the vertical scale and the separation between the starting plot sectors of each line. This last item will be explained in more detail in the Operator's Manual.

As with the regular plot, a series of hachures will indicate the plot sector positions across the top of the page. Similarly, the mnemonic of the format parameter and initial value will be printed on the left edge of the successive, two lines beneath the sector markers.

The traverse line number will be printed, left-justified at the starting plot sector for each flight line. These printed flight line numbers will lie by themselves on consecutive plot lines to avoid overlapping the text.

A Stacked Profile will be complete when all data has been exhausted from the source device. Thus, the length of Profiles may vary depending upon the format chosen.



## 2.6 PARAMETER CREATION

### 2.6.1 Gradient Data Parameters

The Gradient is the difference between two Magnetometer readings and is used to highlight anomalies in the magnetic field of the earth's surface. Currently, a maximum of only two magnetometers is being used in aeromagnetic data acquisition surveys though recently a configuration of three units was tested and two wing top sensors are planned for future installation. Surveys flown with two magnetometers have one upper and one lower boom instrument mounted in a vertical alignment on the tail of the aircraft as shown in figure 2-6-1a. The three-unit configuration is also mounted on the rear of the aircraft as in Figure 2-6-1b. The configuration with wing-tip sensors is shown in Figure 2-6-1c.

To allow for future testing of other configurations, the Field Checking System will permit up to twelve magnetometers to be mounted on the aircraft. This number of units will result in the creation of up to six gradient data parameters. The six parameters and their respective identifiers are listed in Figure 2-6-1d. Using the twelve possible magnetometer readings, three further data parameters may be created. Figure 2-6-1e shows how these values are calculated and their respective identifiers.

The Operator will set up the configuration by assigning the magnetometers to a grid pattern representing the various coordinates of the aircraft. This procedure will be explained in detail in the Operational Description section of this document.

As the new parameters are created, they will be added to the



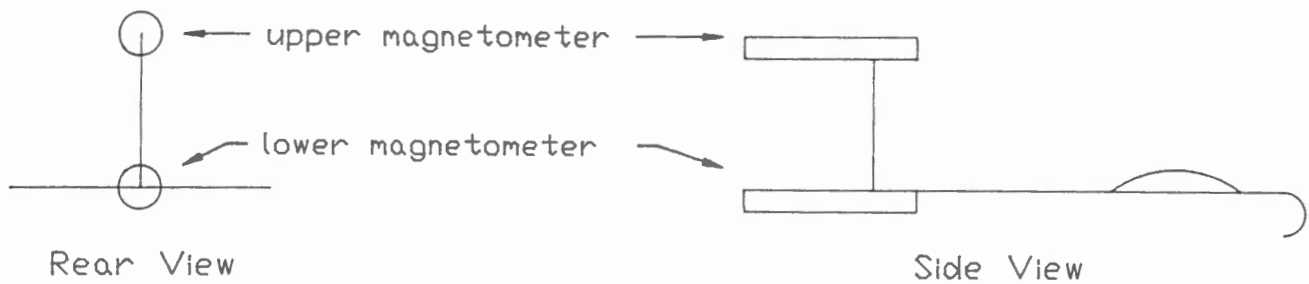
#2100-12-001.01.0

acquisition data and the new blocks will be recorded on magnetic tape or hard disk. Therefore, to create Gradient data it will be necessary that two magnetic tape drives or hard disks (or a combination of the two) be available to the Field Checking System.

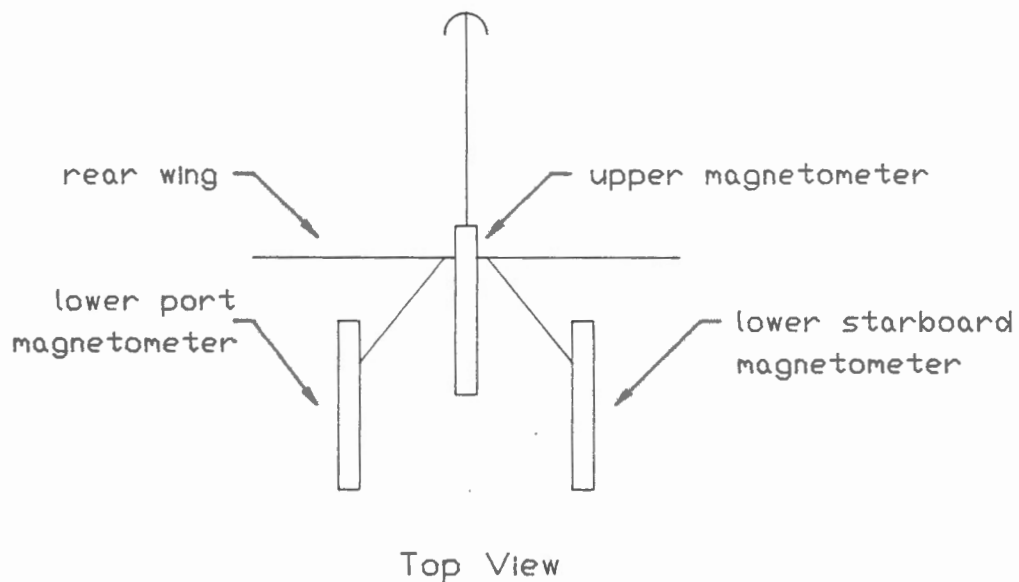
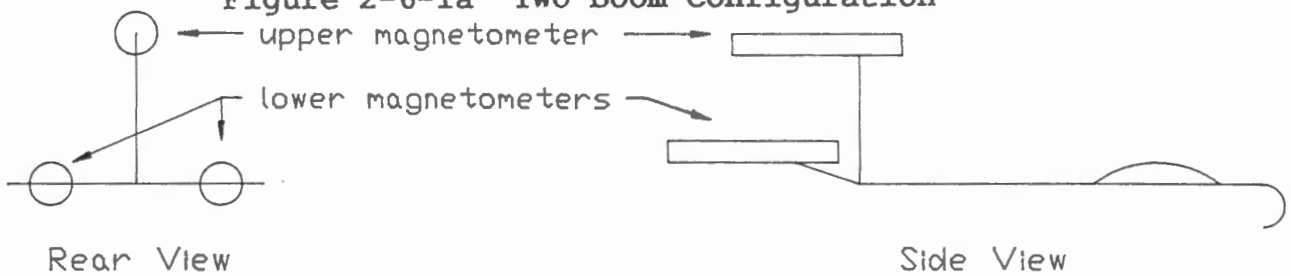
#### 2.6.2 Other Data Parameters

Other data parameters may also be created using one of the features of the Edit Function to be discussed in the next subsection.





**Figure 2-6-1a Two Boom Configuration**



**Figure 2-6-1b Three Boom Configuration**





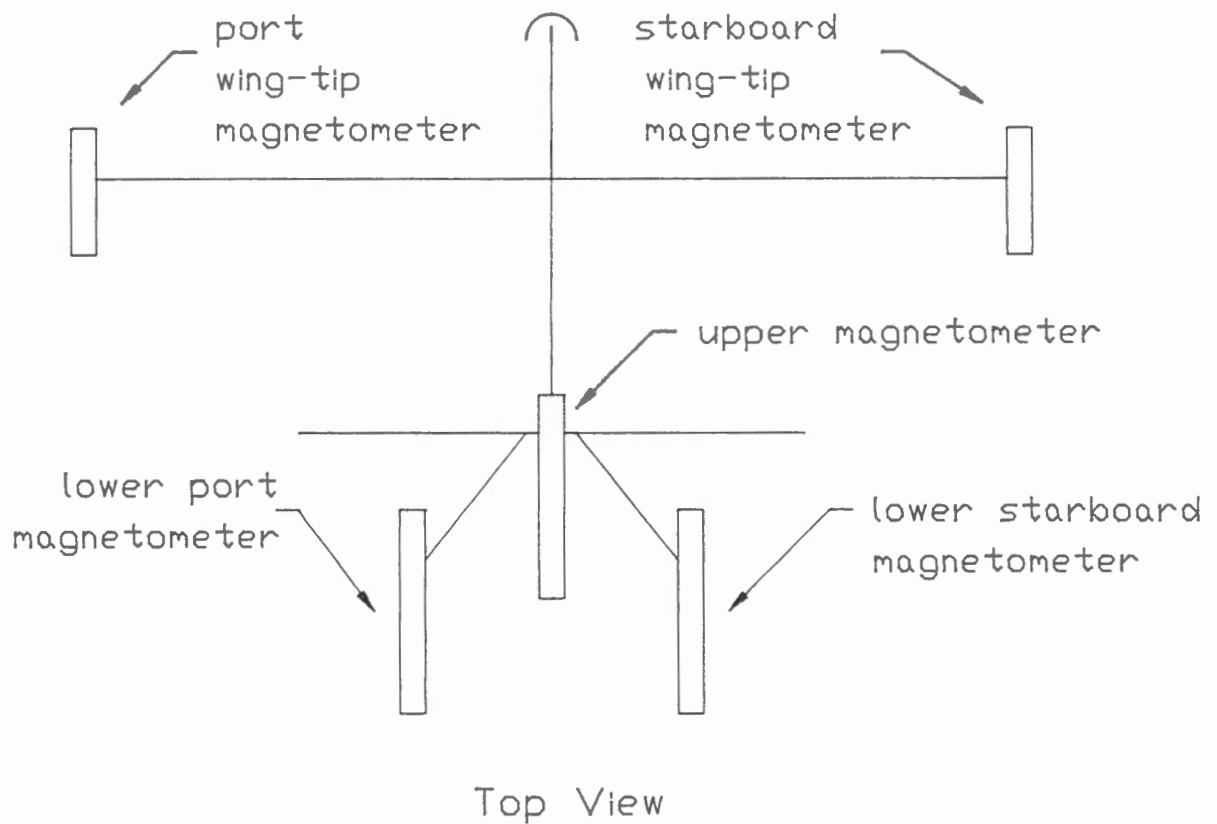


Figure 2-6-1c Five Boom Configuration



Gradient Data Parameter	Identifier
A - B	KG
C - D	KH
E - F	KI
G - H	KJ
I - J	KK
K - L	KL

Figure 2-6-1d Pair Gradient Parameters

Gradient Data Parameter	Identifier
$(A+B)/2 - (C+D)/2$	KM
$(E+F)/2 - (G+H)/2$	KN
$(I+J)/2 - (K+L)/2$	KO

Figure 2-6-1e Quad Gradient Parameters



## 2.7 EDITING

Using the Field Checking System it will be possible to create an edited version of data collected during flight or from the diurnal ground station. Various editing functions will be available and are outlined in the following subsections.

### 2.7.1 Batch Editing

To perform several changes at one time on many blocks of recorded data, Batch Editing will be available. Limits will be set and, when the desired changes have been defined, all the modifications will be done at once over the specified range.

#### 2.7.1.1 Edit Limits

The Edit Limits will define the range over which Batch changes will be permitted. Though usually based on the time parameter, the limits may be set on any parameter. For example, using time as the Edit Limit, a start limit of 40770000 and an end limit of 61800000 will imply that any block on the recording medium can be modified if the value of the time parameter is greater than or equal to 40770000 and is less than or equal to 61800000. Any block with a value for the time parameter outside these limits will not be modified.

#### 2.7.1.2 Output nnn Blocks

This function will cause 'nnn' blocks to be written directly to the output device where 'nnn' is a natural value. If 'nnn'



exceeds the number of blocks available to be written, all blocks up to the end of the source device will be written and this number will be presented to the Operator with an appropriate warning message issued on the Monitor. The block unwritten at the conclusion of the output operation will be the starting block on the source medium for the next operation.

#### 2.7.1.3 Add/Subtract To/From a Parameter

To modify the value of a given parameter the Operator will be permitted to do so by adding or subtracting a quantity from the parameter in question. The range over which the modification is to be made will be set by the Operator. As little as one block or as many as all blocks on the recording medium may be affected, depending upon the edit limits. Details of the procedure to perform the operation are outlined in the Operational Description section of this document.

#### 2.7.1.4 Replace a Parameter Value

Similar to adding/subtracting a value to/from a parameter, this function will replace a parameter's value with a new one defined by the Operator. As few as one block or as many as all blocks on the recording medium may be affected by the replacement.

#### 2.7.1.5 Delete A Parameter

Data may be removed from a final version by deleting a parameter. Using the recording identifier, the Operator will identify which parameter is to be deleted. As few as one block or as many as all blocks on the recording medium may be affected.



#### 2.7.1.6 Add A Parameter

A new data parameter may be added to the edited version. The Operator will choose an unused recording identifier to be assigned to the new parameter and will provide the calculating formula to be used to create the new parameter. The calculation will permit the four arithmetic operations of addition, subtraction, multiplication, and division to be combined with up to ten constants or existing parameter values. The resulting value followed by the recording identifier will be added to the end of each record in a block over the range specified. This range may be as little as one block or as many as all blocks on the recording medium.

#### 2.7.1.7 Change One Digit

To modify only a single digit at a time for any given parameter, this function may be used. The details of the procedure to change a digit are outlined in the Operational Description section. The range over which the modification will take affect may be as small as one block or as many as all blocks on the recording medium, depending upon the edit limits set.



#### 2.7.1.8 Check For Spike

A 'Spike' is an extraordinary change in the value of a data parameter when compared with its predecessor and successor values. Figure 2-7-1-8 shows an example of a spike. To check for such an event, which will usually point to invalid data, the parameter and the definition of the spike will be entered by the Operator. The spike definition will be a change, X, for a value compared against Y previous data values. A check for spikes may incorporate as few as one block or as many as all blocks on the recording medium. The discovery of a spike will be indicated with the spike magnitude and the block number of where the occurrence was found being printed on the System Message Console.



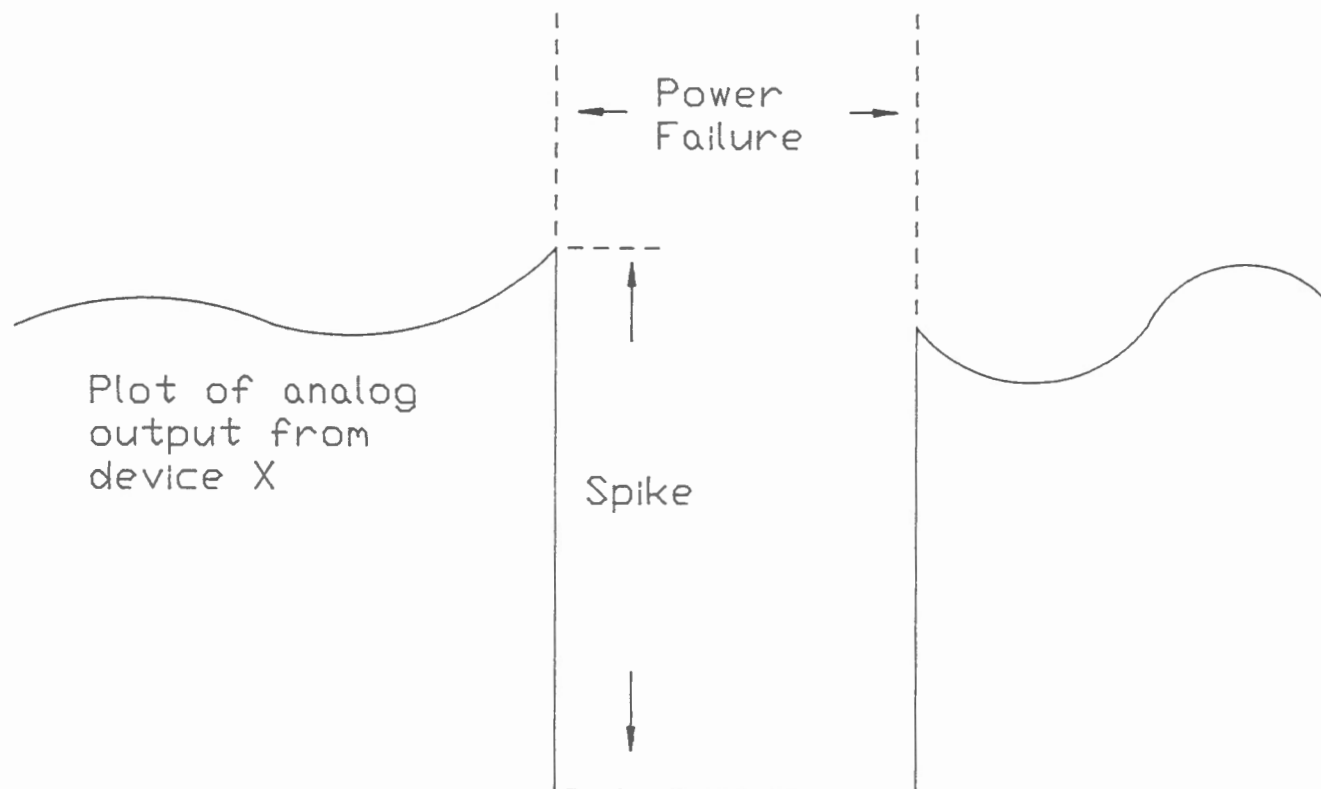


Figure 2-7-1-8 Example of a Spike During Data Acquisition



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#### 2.7.1.9 Running the Batch Editor

A simple command will allow the Operator to start the Batching Process when all desired changes have been defined and the edit limits set.

#### 2.7.2 Screen Editing

A Screen Editor will be provided to allow examination and modification of data, a block at a time. The ability to read a block from a recording medium, display the data on the IBM-AT Monitor, page through the data, delete, overwrite and insert, back up a block, check for errors, and then write the block back to another storage medium will all be included in this editor.





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**HARDWARE DESCRIPTION**

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## HARDWARE DESCRIPTION

### 1.0 IBM-AT PERSONAL COMPUTER

The Field Checking System will run on an enhanced version of the IBM-AT Personal Computer. Operating with a five Megahertz internal clock, the AT has a twenty-four bit address bus. Internally, the IBM-AT is equipped with 512 Kilobytes of Random Access Memory (RAM). Built-in storage media include a twenty Megabyte hard disk (formatted) and a 1.2 Megabyte floppy diskette drive. The IBM-AT also has two serial/parallel interface ports.

#### 1.1 Keyboard

The IBM-AT Personal Computer comes equipped with an 85-key keyboard. Special function keys, a numeric keypad, control characters and full screen cursoring are supported. The keyboard will be the sole Operator interface to the Field Checking System: all commands will be issued via the keyboard.

#### 1.2 Monitor

A Monochrome Monitor will be used by the Field Checking System to present data, issue prompts and display error messages during operation.



## 2.0 PERIPHERAL EQUIPMENT

### 2.1 Printer/Plotter

A Versatec V-80 Electrostatic Printer/Plotter will be used to obtain a hard copy of data collected during data acquisition and to produce plots of the data. The Versatec V-80 prints up to 1000 lines per minute, plots raster data at 2.54 centimetres per second and can perform both printing and plotting operations simultaneously. With a high resolution output of 6200 nibs per square centimetre, a crisp, dark image can be produced.

### 2.2 Matrix Printer

A Star NX-15 dot matrix printer will be available to obtain hard copies of Block Printing dumps and as an error/status console for the Field Checking System. At a print speed of 120 characters per second this device is not intended as the primary output device for dumping blocks. It is intended to provide a permanent record of System status messages and errors. The printer will interface to one of the two parallel I/O ports.

### 2.3 Rigid Disk Drive

Two Iomega Alpha-207 hard disks will be interfaced via a SCSI-bus to the Field Checking System. Using 21.4 megabyte, 8-inch removable cartridges as a flexible magnetic disk media, the unique design of the drives offers both Winchester-like performance and reliability as well as low cost flexible media. The Iomega Rigid Disks will be the primary data storage devices of both the airborne and ground station data acquisition systems.



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#### 2.4 Magnetic Tape Drive

Two Kennedy Model 9700 Magnetic Tape units creating IBM compatible nine-track tape may also be connected to the Field Checking System. These units will be used to create edited data versions and copies of flight data for computer compilation.



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## OPERATIONAL DESCRIPTION

### 1.0 CONVENTIONS

Several conventions will be incorporated into the Field Checking System with regard to Operator control. Menu choices will be just one character in length. When the character is entered via the keyboard the choice will be processed instantly: no carriage return (<enter>) will be required. However, when special prompts are issued on the Prompt Line, such as for strings, many characters may require keyboard entry. The <enter> key will be required in these cases to signal the end of data entry.

The Field Checking System will employ menus to move through the various operations. At any time, the Operator may backup to a previous menu using either of the CTRL Z or CTRL C key sequence (CTRL and Z/C keys depressed simultaneously). A final CTRL Z or CTRL C, when the Main Menu is displayed, will return the Operator to the VENIX Operating System environment.

Menu exits via CTRL C will cause any changes made in the Presentation area of the display to be discarded. Exits via CTRL Z will cause changes to be verified and, if valid, to be written to the IBM-AT hard disk and brought up again the next time the menu is presented.

Modifiable values in the Presentation Area of the display when a menu is first brought up will be taken as defaults to the specification they define. If no changes are made to these specifications, they will be used as shown. However, the Operator will have the option of changing any number of them before they are used. These changes, as explained above, may be





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saved as new defaults or discarded when exiting the Menu.



## 2.0 SYSTEM OPERATION

### 2.1 Start Up

After the IBM-AT is powered up and the VENIX Operating System has been installed, the Operator will call up the Field Checking System by entering one of the following command sequences (boldfaced) to the prompts issued:

```
login:  emr<cr>
```

```
emr>  fcs<cr> or fcs - p<cr>      <cr> = carriage return key
```

The difference between the two invocations is as follows: specifying the '-p' option will cause all status and error messages issued on the Error Line of the IBM-AT Monitor to be printed, also, on the Error Console (Star Printer); with no '-p' option specified, no hard copy report will be produced.

A menu similar to that of Figure 2-1 will be presented to indicate that the Field Checking System has been invoked. The Operator will enter the number of the desired choice on the keyboard. The corresponding display for the selected option will then be presented. Choosing the last option on the menu will return the Operator to the VENIX Operating System environment.



FIELD CHECKING SYSTEM	
Main Menu	
Option	Description
1	System Specifications
2	Medium Control Utility
3	Block Printing
4	Plotting
5	Stacked Profiles
6	Gradient Parameter Creation
7	Edit Functions
CTRL C/Z	Quit FIELD CHECKING SYSTEM

ENTER NUMBER OF OPTION

Figure 2-1 Main Menu



## 2.2 System Specifications

The System Specifications define, at the time of startup, the default values of important parameters. These defaults may be changed temporarily during the Field Checking System operation or permanently through the System Specifications option of the Main Menu. Choosing the later method to do so will result in the display of Figure 2-2 being presented on the IBM-AT Monitor. From this menu, the Operator will enter the number of the desired option via the keyboard. The corresponding display for the selected option will then be presented. Choosing the last option on the menu will return the Operator to the Main Menu.



FIELD CHECKING SYSTEM	
System Specifications Menu	
Option	Description
1	Logical Unit Numbers
2	Recording Parameters
3	Airborne Check-Set and Header
4	Diurnal Check-Set and Header
5	Storage Device Specifications
CTRL C/Z	Return to Main Menu

ENTER NUMBER OF OPTION

Figure 2-2 System Specifications Menu



### 2.2.1 Logical Unit Numbers

This option will present a display similar to that of Figure 2-2-1. The Operator will use the cursor keys to move to the logical unit numbers (LUNs) to be modified. Values of 0 will represent unassigned devices. To save any changes as permanent default values, the Operator will use the CTRL Z key sequence when exiting. CTRL C will return the Operator to the previous display, discarding any changes made.

NOTE: No LUN should be assigned to two or more devices.



FIELD CHECKING SYSTEM	
Logical Unit Numbers	
LUN	Device
4	Magnetic Tape Drive #0
7	Magnetic Tape Drive #1
3	Rigid Disk #0
1	Rigid Disk #1
8	Versatec Printer
5	Star Printer
6	Versatec Plotter (SPP)
2	IBM-AT Monitor

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-2-1 Logical Unit Numbers Display**



## 2.2.2 Recording Parameters

Figure 2-2-2 illustrates an example of the display used to modify the Recording Parameters. Using the cursor keys the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed. The Recording Parameter Specifications will be outlined in the Operator's Manual.

The Recording Parameter Specifications will be defined over several pages. When entered via the System Specification Menu, page number one of the Recording Parameters will be displayed. To view/modify one of the other pages the Operator will enter the desired page number via the keyboard while the cursor is at the Input Line. If no modifications have been made to the current page or modifications have been made and are all valid, then the requested page will be presented if it exists. A page cannot be exited unless it contains no errors or the Operator enters CTRL C.

To return to the System Specifications Menu, CTRL Z and CTRL C will be used as explained in Conventions. However, CTRL Z will save all changes made to all pages; CTRL C will discard all changes to all pages.





FIELD CHECKING SYSTEM	
Recording Parameters -- Page 1	
00 = :NULL :D:0:00:0:	01 = GG:DATE :D:5:00: :
02 = GH:LINE :H:8:00: :	03 = GI:TIMHS:D:8:00: :
04 = GJ:TIMDS:D:8:-3: :SCNDS	05 = GK:RWMU1:D:8:00: :GAMMA
06 = GL:RWMU2:D:8:00: :GAMMA	07 = GM:RWMU3:D:8:00: :GAMMA
08 = GN:MAGU1:D:8:00: :GAMMA	09 = GO:MAGU2:D:8:00: :GAMMA
10 = GP:MAGU3:D:8:00: :GAMMA	11 = GQ:GRAD1:D:7:00+::GAMMA
12 = GR:GRAD2:D:7:00+::GAMMA	13 = GS:GRAD3:D:7:00+::GAMMA
14 = GT:RAWM1:D:8:00: :GAMMA	15 = GU:RAWM2:D:8:00: :GAMMA
16 = GV:RAWM3:D:8:00: :GAMMA	17 = GW:MAGL1:D:8:00: :GAMMA
18 = GX:MAGL2:D:8:00: :GAMMA	19 = GY:MAGL3:D:8:00: :GAMMA
20 = GZ:.01GU:D:7:-2: :GAMMA	21 = HG:.01GL:D:7:00: :GAMMA
22 = HH:STAT :H:5:00: :	23 = HI:LAT :D:8:00:n:MINS
24 = HJ:LONG :D:8:00:e:MINS	25 = HK:HEAD :D:4:00: :DGREE
26 = HL:ROLL :D:4:00: :DGREE	27 = HM:PITCH:D:4:00: :DGREE
28 = HN:R.ALT:D:4:00: :FEET	29 = HO:AIRD :D:5:00: :

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-2-2 Recording Parameters Specifications Display**



### 2.2.3 Airborne Data Character Set & Header

Figure 2-2-3 illustrates an example of the display used to modify the Formated Airborne Data Character-Checking Set and Header. Using the cursor keys the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed. Note that 'spaces' should not be included and should be removed unless they are to be part of the character set (spaces will be included for the Header).

CTRL Z will return the Operator to the previous display, saving any modifications, if no errors are found. If errors are detected, the Operator will be informed of the error and will be expected to correct it before exiting via CTRL Z. No exit and save will be permitted as long as the Data Character Set or Header are invalid. CTRL C at any time will return the Operator to the previous Menu, discarding any changes.

Note: the NULL parameter must be used to mark the ending column of the Formated Header. If this marker is forgotten, an error message will inform the Operator of the oversight. The Operator's Manual will explain this in detail.



```
FIELD CHECKING SYSTEM

Airborne Data Character Set

V.....V
0123456789ABCDEFGHInews+-JKLMNOPQRSTUVWXYZ

-----

Airborne Block Print Header
V.....V
TIMDS   MAGU1   MAGU2   MAGU3   .01GU   STAT   LAT   LONG
HEAD ROLL PITCH TRALT R.ALT AIRD   TCMPU LCMPU VCMFU CSHZU   NUL
L
```

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-2-3 Airborne Check Set and Header Display**



#### 2.2.4 Diurnal Data Character Set & Header

Figure 2-2-4 illustrates an example of the display used to modify the Formated Diurnal Data Character-Checking Set and Header. Using the cursor keys the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed. Note that 'spaces' should not be included and should be removed unless they are to be part of the character set (spaces will be included for the Header).

CTRL Z will return the Operator to the previous display, saving any modifications, if no errors were made. If errors are detected, the Operator will be informed of the error and will be expected to correct it before exiting via CTRL Z. No exit and save will be permitted as long as the Data Character Set or Header are invalid.

CTRL C at any time will return the Operator to the previous menu, discarding any changes.



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FIELD CHECKING SYSTEM	
Diurnal Data Character Set	
V.....V	
ABCDEFGHIJKLMNOPQRSTUVWXYZ+-1234567890	
-----	
Diurnal Block Print Header	
V.....V	
TIMDS	NULL

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

Figure 2-2-4 Diurnal Check Set and Header Display



### 2.2.5 Storage Device Specifications

Figure 2-2-5 illustrates an example of the display used to modify the Storage Device Specifications. Using the cursor keys the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed.

CTRL Z will be used to return the Operator to the System Specifications Menu, saving any modifications made, provided no errors are detected. If there are errors, the Operator will be informed through the Status/Error Line window of the display and will be expected to correct the fault before exiting via CTRL Z. No exit and save will be permitted as long as the Storage Device Specifications are invalid.

CTRL C at any time will return the Operator to the System Specifications Menu, discarding any changes.



FIELD CHECKING SYSTEM			
Storage Device Specifications			
	Start LAD	End LAD	
Rigid Disk #0:	00006	001f8	
Rigid Disk #1:	00006	145ff	
	Useable Tape	Rec. Density	Interrecord gap
Mag. Tape #0:	06700	01600	00700
Mag. Tape #1:	06700	01600	00700

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-2-5 Storage Device Specifications Display**



## 2.3 CONTROL UTILITY

Choosing the Control Utility option of the Main Menu will bring up a display on the IBM-AT Monitor similar to that of Figure 2-3. The Operator will enter the number of the desired choice from the menu on the keyboard. The corresponding display for the selected option will then be presented. Choosing the last option of the menu will return the Operator to the Main Menu.





FIELD CHECKING SYSTEM	
Medium Control Utility	
Option	Function
1	Tape Control Functions
2	Disk Control Functions
3	Search/Copy Functions
CTRL C/Z	Return to Main Menu

ENTER NUMBER OF OPTION

Figure 2-3 Medium Control Menu



### 2.3.1 Tape Control Functions

Choosing this option will result in the display of Figure 2-3-1 being presented on the IBM-AT Monitor. Using the cursor keys, the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed.

When ready to perform one of the desired functions the Operator will depress the key corresponding to the option listed. The LUN specified will be verified as being assigned to a magnetic tape drive. If this is not the case, an explanatory message will be displayed in the Error Line window; otherwise the function will be performed if possible.



FIELD CHECKING SYSTEM	
Magnetic Tape Control Function	
Option	Function
1	Forward File on tape device
2	Backward File on tape device
3	Forward Block on tape device
4	Backward Block on tape device
5	Write EOF marker to tape device
6	Rewind tape device
CTRL C/Z	Return to Previous Menu
LUN = 4	

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-3-1 Tape Control Functions Menu**



#### 2.3.1.1 Forward File on Tape

If the tape unit defined is on-line, the "forward file" command will be issued and the Operator will be free to continue in the Field Checking System.

#### 2.3.1.2 Backward File on Tape

If the tape unit defined is on-line, the "backward file" command will be issued and the Operator will be free to continue in the Field Checking System.

#### 2.3.1.3 Forward Block on Tape

If the tape unit defined is on-line, the "forward block" command will be issued and the Operator will be free to continue in the Field Checking System.

#### 2.3.1.4 Backward Block on Tape

If the tape unit defined is on-line, the "backward block" command will be issued and the Operator will be free to continue in the Field Checking System.

#### 2.3.1.5 Write EOF Marker to Tape

If the tape unit defined is on-line, a prompt will be issued to verify that this option is in fact desired. If a 'y' or 'Y' is entered via the keyboard followed by the <enter> key then the "write end of file marker" command will be issued and the Operator will be free to continue in the Field Checking System; otherwise no EOF will be written to the tape.



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#### 2.3.1.6 Rewind Tape

If the tape unit defined is on-line, the "rewind tape" command will be issued and the Operator will be free to continue in the Field Checking System.

#### 2.3.1.7 Exiting Menu

CTRL Z will return the Operator to the previous menu, saving any changes if there are no errors, or flagging faults if there are invalid specifications.

CTRL C will return the Operator to the previous menu discarding any modifications made.



### 2.3.2 Disk Control Functions

Choosing this option will result in the display of Figure 2-3-2 being presented on the IBM-AT Monitor Using the cursor keys, the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed.

When ready to perform one of the desired functions the Operator will depress the key corresponding to the option listed. The LUN specified will be verified as being assigned to one of the two hard disk drives. If this is not the case, an explanatory message will be displayed in the Error Line window; otherwise the function will be performed, if possible.



FIELD CHECKING SYSTEM	
Bernoulli Disk Control Function	
Option	Function
1	Format Disk
2	Clear Disk Directory
3	Display Disk Directory
CTRL C/Z	Return to Previous Menu
LUN = 3	Cartridge Sector Interleave = 04

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-3-2 Disk Control Functions Menu**



### 2.3.2.1 Format Disk

Prior to issuing the Format Disk command the Operator will first be required to define the sector interleave to be used during the format process. This definition will be made in the Presentation Area.

If the disk drive defined is on-line and the sector interleave specified is valid then a prompt will be issued to verify that this option is in fact desired. If a 'y' or 'Y' is entered via the keyboard followed by the <enter> key then the "format disk" command will be issued and the Operator will be free to continue in the Field Checking System while the format proceeds; otherwise no format will be done.

Note: No disk accesses should be made to either drive while the format is being performed.

### 2.3.2.2 Clear Disk Directory

If the disk drive defined is on-line, a prompt will be issued to verify that this option is in fact desired. If a 'y' or 'Y' is entered via the keyboard followed by the <enter> key then a "null" directory will be written to the cartridge to clear the directory and the Operator will then be free to continue in the Field Checking System; otherwise no clearing of the disk will be attempted.

### 2.3.2.3 Display Disk Directory

If the disk drive defined is on-line, the first page of directory data will be presented on the IBM-AT Monitor. An explanation of





the data presented will be made in the Operator's Manual. Figure 2-3-2-3 shows an example page of a disk directory.

To sequentially view pages, the <PgUp> and <PgDn> keys will be used. <PgUp> will cause the next page to be displayed; <PgDn> will cause the previous page to be displayed. When the last page of the directory is displayed and <PgUp> is depressed, the first page will be returned. Similarly, if the first page of the directory is currently displayed and <PgDn> is depressed, the last page of the directory will be presented on the Monitor.

CTRL C and CTRL Z will both return the Disk Control Functions Menu. As no modifications will be possible, the CTRL Z save will be identical to the CTRL C quit.



FIELD CHECKING SYSTEM				
Disk Directory				
FLIGHT DATE	LINE NUMBER	RECS	START LAD	END LAD
23887	00011620	6	00006	014DC
23887	00011630	6	014DC	01CC8
23887	00011631	6	01CC8	02B62
23887	00011640	6	02B62	03F9C
23887	00011650	6	03F9C	054D8
23987	00011280	6	054D8	06E40
23987	00011290	6	06E40	08820
23987	00011300	6	08820	09120
23987	00011301	6	09120	0A3DA
23987	00011310	6	0A3DA	0A7FA
PAGE = 1				LUN = 3

^C = ^Z = EXIT; PgUp = PAGE FORWARD; PgDn = PAGE BACKWARD

**Figure 2-3-2-3 Disk Directory Display**



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#### 2.3.2.4 Exiting Disk Control Function Menu

CTRL Z will return the Operator to the previous menu, saving any changes if there are no errors, or flagging faults if there are invalid specifications.

CTRL C will return the Operator to the previous menu discarding any modifications made.



### 2.3.3 Search/Copy Functions

Choosing this option will result in the display of Figure 2-3-3 being presented on the IBM-AT Monitor. Using the cursor keys, the Operator will move to the Presentation Area where a change is to be made. Via the keyboard, the modification may be performed.

When ready to perform one of the desired functions, the Operator will depress the key corresponding to the option listed. The LUN's specified will be verified as being assigned to either a magnetic tape unit or a hard disk drive and both LUN's not to the same device. If this is not so, an explanatory message will be displayed in the Error Line window; otherwise the function will be performed, if possible.



FIELD CHECKING SYSTEM	
Search / Copy Utility	
Option	Function
1	Position to a String on Source LUN
2	Position to a String on Destination LUN
3	Search For a String on Source LUN
4	Search For a String on Destination LUN
5	Copy From Source LUN to Destination LUN
CTRL C/Z	Return to Previous Menu
Source LUN=3                      Destination LUN=4	
Search String = [49943050GJ                      ]	

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-3-3 Search/Copy Functions Display**



#### 2.3.3.1 Position to a String on Source LUN

Choosing this option will result in a prompt being issued, to the effect "ARE YOU SURE?". Once responded to with either 'y' or 'Y' and terminated with the <enter> key the search will commence on the source device. A message will be logged on the System Console (Star Printer) indicating the search has commenced.

The search will continue until a match is made or the end of the source device is encountered. In either case a message will be logged on the System Console indicating the block number at which the match was made or that no match was made, respectively. If the search medium is one of the hard disks, the logical address of the block containing the match will also be included in the message logged on the console.

If the string is found and the device is a magnetic tape unit, the tape will be backed up one block so that the block containing the match will be the next block read. No positioning will be done for hard disks: the Operator's Manual will outline a technique for positioning on the hard disk drives.

After a message has been logged on the System Console the Operator is free to continue in the Field Checking System.

#### 2.3.3.2 Position to a String on Destination LUN

This option is identical to Positioning To a String on the Source LUN with the exception that the procedure is carried out on the destination device.

#### 2.3.3.3 Search For a String on Source LUN



This option is identical to Positioning To a String on the Source LUN with the exception that the recording medium is not repositioned when a match is made; rather the next block read from the source device will be that following the block containing the string match.

#### 2.3.3.4 Search For a String on Destination LUN

This option is identical to Searching For a String on Source LUN with the exception that the procedure is carried out on the destination device.

#### 2.3.3.5 Copy from Source LUN to Destination LUN

This option will transfer all data from the specified source device to the specified destination device. A prompt will be issued to verify that this option is in fact desired. If a 'y' or 'Y' is entered via the keyboard followed by the <enter> key then the option will be performed; otherwise no transfer will be initiated.

A message will be issued on the Error Line window indicating that the copy is in progress. The copy will be completed when the end of the source device is encountered or a fatal error occurs. When copying data to a magnetic tape, the Operator will be prompted to change tapes when the logical end of a tape is reached. The completion of the transfer will be indicated with either an error or status message in the Error Line window of the display. The Operator will then be free to continue in the Field Checking System.



#### 2.3.4 Exiting Medium Control Menu

CTRL Z will return the Operator to the Medium Control Menu, saving any changes if there are no errors, or flagging faults if there are invalid specifications.

CTRL C will return the Operator to the previous menu discarding any modifications made.





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## 2.4 BLOCK PRINTING

### 2.4.1 Block Format

Choosing the Block Printing option of the Main Menu will result in the display of Figure 2-4-1 being presented on the IBM-AT Monitor. The Operator will enter, via the keyboard, the number of a desired choice from the menu. The corresponding display for the selected option will then be presented. Choosing the last option of the Block Printing Format Menu will return the Operator to the Main Menu.



FIELD CHECKING SYSTEM	
Block Printing Format Menu	
Option	Description
1	Print Formatted Airborne Data
2	Print Formatted Diurnal Data
3	Print Unformatted Data
CTRL C/Z	Return to Main Menu

ENTER NUMBER OF OPTION

Figure 2-4-1 Block-Print Format Menu



#### 2.4.2 Print Frequency

Figure 2-4-2 illustrates the next display in the Block Printing sequence. This menu will result regardless of the Print Format chosen.

The Print Frequency Menu will provide several choices. The "Every N'th Block" option will prompt the Operator for a positive, integer value of N terminated with an <enter>. For the other options, only the number of the desired choice will be entered.

Before a print frequency is chosen, the correct source and destination LUNs should be defined, as well as a response to whether or not error checking is to be performed on the data. If not, the "every-bad-block" frequency will not be available.

The Printing Process will be performed on input supplied by the LUN indicated at the bottom of the Presentation Area. Output will be routed to the destination LUN, also indicated at the bottom of the Presentation Area. Valid source devices are either of the magnetic tape units or the hard disks; the valid destination devices are the Versatec and Star printers for hard copies and the NULL device for ignoring output. If a LUN is not available or is invalid then an appropriate error message will be issued on the Error Line of the display when a print frequency is chosen.

If errors are detected during dumping, appropriate messages will be issued on either the destination device or the System Console. If an error is detected in a block at the specified frequency of dumping, the raw data will be printed on the



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destination device following text indicating the cause of the error; otherwise, a message will be logged on the System Console identifying the error, the logical block address, the logical disk address (if the source device is one of the two hard disks) and the first few characters of the block, primarily the block header and time parameter.



FIELD CHECKING SYSTEM	
Print Frequency Menu	
Option	Function
1	Every Block
2	Every 10th Block
3	Every 100th Block
4	Every Nth Block
5	Every Bad Block
CTRL C/Z	Return to Print Format Menu
Error Checking? [y]	
Source LUN=3	Destination LUN=0

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-4-2 Block-Print Frequency Display**



### 2.4.3 Block Printing Termination

The Block Printing Process will continue until the end of the source device or a fatal error occurs at the source device. A message will be issued on the Error Line window of the display indicating "Block Printing Complete" when the process terminates successfully.

To back up to the previous menu, the CTRL Z/C key sequences will be used. A CTRL Z exit will save the screen values provided they are valid; CTRL C will quit, discarding any screen changes. To back up out of the Block Printing Format Menu either CTRL C or CTRL Z may be used identically.



## 2.5 PLOTTING

To form a plot, specifications must be defined. The following subsections describe the Plot Specifications needed for all plots.

### 2.5.1 Plot Menu

When the Plotting option of the Main Menu is chosen, a display similar to that of Figure 2-5-1 will be presented on the Monitor. The Plot Menu will allow several plot specification versions to exist, reducing the need to change one set of specifications every time a different form of plot is to be generated.

NOTE: the only difference between the Plot Specifications options and the Successive Difference option is in the definition of the specifications: the corresponding displays are identical. The difference for Successive Difference Specifications Setup will be outlined in a later subsection.



FIELD CHECKING SYSTEM

Plot Menu

Option	Description
1	Plot Specifications #1
2	Plot Specifications #2
3	Successive Difference Specifications
CTRL C/Z	Return to Main Menu

ENTER NUMBER OF OPTION

Figure 2-5-1 Plot Menu





## 2.5.2 Plot Specifications

The display of Figure 2-5-2 will be presented when the Plot option of the Main Menu is chosen.

The Operator will use the cursor keys and keyboard to set up the Plot Specifications on the display.

### 2.5.2.1 Parameters and Full Scale

Up to a maximum of thirty-six (36) parameters may be plotted at one time. However, with the restriction of only one colour for the plot (black) it is unlikely one would ever wish to plot 36 parameters simultaneously: the overlap of the curves would make reading the plot extremely difficult.

The Parameter column will contain the recording identifier of that parameter to be plotted, along with the full scale deflection for the parameter. For regular plots the full scale must be a positive, nonzero value.



FIELD CHECKING SYSTEM					
Plot Specifications #1					
ID scale	position	ID scale	position	ID scale	position
PM1 =GZ,25000	, (002-033)	PM2 =GZ,2500	, (034-065)	PM3 =JL,2000	, (066-086)
PM4 =HI,1000	, (087-107)	PM5 =HJ,1000	, (108-128)	PM6 =	, ( )
PM7 =	, ( )	PM8 =	, ( )	PM9 =	, ( )
PM10=	, ( )	PM11=	, ( )	PM12=	, ( )
PM13=	, ( )	PM14=	, ( )	PM15=	, ( )
PM16=	, ( )	PM17=	, ( )	PM18=	, ( )
PM19=	, ( )	PM20=	, ( )	PM21=	, ( )
PM22=	, ( )	PM23=	, ( )	PM24=	, ( )
PM25=	, ( )	PM26=	, ( )	PM27=	, ( )
PM28=	, ( )	PM29=	, ( )	PM30=	, ( )
PM31=	, ( )	PM32=	, ( )	PM33=	, ( )
PM34=	, ( )	PM35=	, ( )	PM36=	, ( )
!Scale Lines?y Vert. Scale=02 Fiducial Parm & Intvl=[GJ,0010000] Source Lun=4 !					

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-5-2 Plot Specifications Display**



#### 2.5.2.2 Plot Position

The width or X-coordinate of the plot will be divided up into 'sectors'. With 2112 points across a page, it will be divided into 132 sectors of 16 points per sector. The Plot Position will mark the first and last sectors within which the plot may fall. If a scaled plot value will fall outside of either sector boundaries, then it will be plotted at the opposite side of the plot window defined by the plot position.

#### 2.5.2.3 Vertical Scale Lines

The first specification on the last line of the Presentation Area will indicate whether or not the Operator wishes vertical scale lines to be printed on the plot. These lines will mark the start and end plot position for each parameter. A "Y" (or "y") placed next to the specification on the display will be interpreted as an affirmative response for scale lines; a "N" (or "n") will suppress the lines; anything else will be interpreted as an error.

#### 2.5.2.4 Vertical Scale

The Vertical Scale will represent the number of spaces that will be left between vertical plot points. The range is from 0 (no spaces) to 10.

#### 2.5.2.5 Fiducial Parameter & Interval

The Fiducial Parameter will define the standard against which data is to be plotted (the Y-coordinate parameter). Usually it will be time, though other parameters may be used. The parameter



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will be specified by its recording identifier. The Interval will define the change in Fiducial Parameter values between markers along the left edge of the page.

#### 2.5.2.6 Data Source

The last specification to be defined will be the source LUN of the data. Verification will be done on this specification to ensure that the source device is one of the magnetic tape units or hard disk drives only.



### 2.5.3 Successive Differences

Successive Difference Plots will be generated from the Plot Specifications Display. A special set of parameter identifiers will be used to indicate the Successive Differences to be plotted. Up to six successive differences may be plotted along with the original curve (zeroth successive difference).

The first parameter to be specified on the Plot Specifications Display will be the actual parameter data source. A Scale Plot Position of zero (0) will be required for the parameter to mark the plot type as "Successive Difference". The successive difference identifiers will be specified as SG, SH, SI, SJ, SK, SL, and SM for successive differences zero through six respectively. Any number of these may be placed in the next seven parameter identifier areas of the display (only those to be calculated and plotted are specified).

The remaining plot specifications must be defined as detailed previously prior to creating the successive difference plot (ie. Scale, Plot Position, for each parameter will be required).

Figure 2-5-3 shows an example of the specification setup to do successive difference plotting.



FIELD CHECKING SYSTEM					
Successive Difference Specifications					
ID scale	position	ID scale	position	ID scale	position
PM1 =GZ,0	, ( )	PM2 =	, ( )	PM3 =	, ( )
PM4 =SG,10000	, (001-041)	PM5 =	, ( )	PM6 =	, ( )
PM7 =SJ,10000	, (043-063)	PM8 =	, ( )	PM9 =	, ( )
PM10=SK,10000	, (065-085)	PM11=	, ( )	PM12=	, ( )
PM13=SL,10000	, (087-107)	PM14=	, ( )	PM15=	, ( )
PM16=SM,10000	, (109-129)	PM17=	, ( )	PM18=	, ( )
PM19=	, ( )	PM20=	, ( )	PM21=	, ( )
PM22=	, ( )	PM23=	, ( )	PM24=	, ( )
PM25=	, ( )	PM26=	, ( )	PM27=	, ( )
PM28=	, ( )	PM29=	, ( )	PM30=	, ( )
PM31=	, ( )	PM32=	, ( )	PM33=	, ( )
PM34=	, ( )	PM35=	, ( )	PM36=	, ( )
Scale Lines?y Vert. Scale=00 Fiducial Parm & Intvl=[GJ,10000 ] Source Lun=4					

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-5-3 Successive Differences Specifications Display**



#### 2.5.4 Initiating Plot Process

When the Operator is satisfied with the Specifications defined, the cursor will be returned to the Input Line of the display and a "P" entered. This will initiate the Plot Process creating a plot similar to that illustrated in section I of this document.

#### 2.5.5 Termination

When plotting has completed, a message will be issued on the Error Line of the display to inform the Operator of this status. Another plot may be generated by repeating the above procedure to set up the Plot Specifications, with or without changes, followed by the Input Line entry of a "P". CTRL Z will return the Operator to the previous menu saving any modifications made if they are valid, issuing an error message otherwise; CTRL C will return the Plot Menu discarding any modifications.

#### 2.5.6 Exiting Plot Menu

Either a CTRL C or CTRL Z key sequence will return the Main Menu from the Plot Menu.



## 2.6 STACKED PROFILES

Data collected with the airborne acquisition system can be reordered by flight lines so that a plot of this data will create an image where all data on a horizontal axis of the plot will represent some common denominator. This type of plot is called a Stacked Profile. This plot will resemble the layout of a map, since the data of several flight lines will be plotted side-by-side.

Creation of a stacked profile will be a timely process due to the volume of data that must be handled (upwards of ten million characters). Figure 2-6 illustrates the display that will be presented when the Stacked Profile option of the Main Menu is selected. The Operator will use the cursor keys and the keyboard to set the necessary parameters required to extract the data prior to creating the profile.





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FIELD CHECKING SYSTEM	
Stacked Profile Extraction Parameters	
PARM0 =	GJ
PARM1 =	GZ
PARM2 =	HI
PARM3 =	HJ
PARM4 =	
PARM5 =	
PARM6 =	
PARM7 =	
PARM8 =	
PARM9 =	
Source LUN = 3	

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-6 Stacked Profile Extraction Display**



### 2.6.1 Data Extraction

To perform the extraction of only the necessary data required to create the Stacked Profile and place the recorded data onto the IBM-AT hard disk, the Stacked Profile Extraction Display must be completed with the appropriate specifications.

#### 2.6.1.1 Extraction Parameters

The Operator may list up to ten (10) parameters that will be extracted from the acquired data and placed onto disk to form the database for the Stacked Profile. At the time of the extraction, the data for every second flight line will be flagged as requiring reversal when processed later during the plotting sequence of the process. The Operator's Manual will detail which parameters are needed for the extraction process.

#### 2.6.1.2 Data Source

The only other specification to be defined prior to extraction will be the source LUN of the data. The Operator's Manual will provide an explanation of the various source LUNs which may be specified.

#### 2.6.1.3 Extraction Initiation and Termination

To begin the Extraction Process, the Operator will return the cursor to the Input Line on the Display and depress the "P". A message will be displayed on the Error Line indicating that the extraction is either in progress or that an error has occurred and some corrective measure is required before the extraction can commence.



When processing has completed, either by the end of the source device being reached or a fatal error occurring, a corresponding message will be issued. The Stacked Profile Inclusion Specifications display will be presented if the Extraction Process completed successfully; otherwise the Operator may make corrective modifications to the Extraction Specifications defined and try again.

CTRL Z will exit the Extraction Display, saving any modifications if valid; CTRL C will cause any modifications made to be discarded and the main Menu to be presented again.

If a successful extraction was completed, when the Operator attempts to exit the Extraction Display, a prompt will be issued asking whether or not to delete the extracted data from the IBM-AT hard disk. If a "Y" or "y" is given as a response, the data will be removed, otherwise the data will be left untouched and will be available the next time the Stacked Profile option is entered. It may be referenced on following occasions by specifying a LUN of zero for the source of the data on the Extraction Specifications Display.



## 2.6.2 Stacked Profile Inclusion Specifications

When Extraction completes, a display similar to that of Figure 2-6-2 will be presented. The Operator will then specify the lines to be included in the Stacked Profile.

### 2.6.2.1 Line Numbers

The first column of specifications will define those traverse lines to be included in the Profile. The Field Checking System will verify that any lines specified have in fact had data extracted for them.

### 2.6.2.2 Direction

When data is extracted from the source device, every second line will be flagged to indicate that the data must be reversed during plotting. If no specifications are made in this field for a line number then the extracted direction will be used. However, the Operator may change the orientation through this field: entering either a '1' or '0' will set the desired direction where these two characters are free to be interpreted by the Operator as desired. For example, lines flown in a Northerly direction may be marked by '1' and those flown in a Southerly direction would then be marked by '0'.

### 2.6.2.3 Verifying Inclusion Specifications

Typing a 'P' on the keyboard will cause the System to verify those specifications set up in the Presentation Area. If errors are detected, an appropriate error message will be issued on the Monitor. If all are okay, the specifications will be accepted



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and the Stacked Profile Plot Specifications Display will be then presented.

A Stacked Profile cannot be created until all Inclusion Specifications have been defined without error.



FIELD CHECKING SYSTEM			
Data Inclusion Specifications			
Line #	Dr	Line #	Dr
00011280	0		
00011290	1		
00011320	0		
00011330	1		
00011560	1		
00011570	0		
00011620	0		
00011630	1		
00011650	1		

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-6-2 Data Inclusion Specifications**



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### 2.6.3 Stacked Profile Plot Specifications

When Stacked Profile Inclusion has been specified correctly, a display similar to that of Figure 2-6-3 will be presented. The plot may be generated after the necessary Plot Specifications have been defined.



```

+-----+
|               F I E L D   C H E C K I N G   S Y S T E M               |
|                                                                           |
|   S t a c k e d   P r o f i l e   P l o t   S p e c i f i c a t i o n s   |
|                                                                           |
|   Profile Parameter = GZ                                               |
|   Profile Format:  Free? n    Time-Adjusted? n    Other (parm. code) = HJ |
|   Profile Interval = [1      ]                                         |
|   List Line #s? y                                                       |
|   Plot Scale = 025000                                                  |
|   First Plot Position = (010-020)          Separation =12             |
|   Vertical Scale = 00                                                  |
|   Include Scale Lines? y                                               |
|                                                                           |
|                                                                           |
|   Type:  CTRL C to quit and exit                                       |
|          CTRL Z to save and exit                                       |
|                                                                           |
+-----+

```

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-6-3 Plot Specifications Display**





#### 2.6.3.1 Profile Parameter

Next to this specification, the Operator will enter the recording identifier of the parameter to be profiled. Only one parameter may be profiled at a time.

#### 2.6.3.2 Profile Format

The next Specification to be defined will be the Profile Format. Three columns will be available for the Operator to enter a desired choice.

##### 2.6.3.2.1 Free-Format

A 'Y' (or 'y') in the first column will indicate that a 'Free Format' profile is to be generated. A Free Format Profile will simply use increments of time as a fiducial parameter.

##### 2.6.3.2.2 Time-Adjusted Format

A 'Y' (or 'y') placed in the 'TIME-ADJUSTED?' field will indicate that this form of profile is to be created. A Time-Adjusted Format Profile will attempt to 'fit' the data and create an equal-length plot even though the time taken to fly equal-length survey lines differed.

##### 2.6.3.2.3 Other Format

If neither of the above two formats is desired, the Operator may specify another format by entering the recording identifier of the parameter upon which the format is to be based in the third column next to the text 'OTHER'. Data will be plotted against



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this parameter.

Note: The format parameter must have been extracted if a plot is to be generated. Verification that data is available for the format parameter will be made prior to plotting. In the case of free and time adjusted formats, the TIMDS parameter must exist in the extracted data.

#### 2.6.3.3 Profile Interval

The full scale deflection for each line of profile data plotted must be specified. This number must be a positive, integer value.

#### 2.6.3.4 List Line Numbers

The Operator will inform the system as to whether or not line numbers will be printed across each curve on the plot. Either "Y" (or "y") or "N" (or "n") will be placed next to the "LIST LINE NUMBERS?" text on the display to respond affirmatively or negatively, respectively.

#### 2.6.3.5 Plot Scale

The next specification to be defined for the parameter will be the Plot Scale. This Full Scale value will be used to map the data to a numerical value which can be plotted within the Plot Position specified.

#### 2.6.3.6 First Plot Position

The first plot position will mark the sector boundaries within



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which the first flight line curve will fall. The width of this boundary will be applied to the other curves, as well.

#### 2.6.3.7 Separation

This parameter will specify the number of sectors to be used to space each plotted flight line curve. Combined with the First Plot Position, this value will be used to determine the sector locations of the other flight line curves on the profile.

#### 2.6.3.8 Vertical Scale

The Vertical Scale will represent the number of spaces that will be left between vertical plot points. The range is from 0 (no spaces) to 10.

#### 2.6.3.9 Include Scale Lines

The Operator will inform the System as to whether or not scale lines marking plot boundaries are to be included in the Profile, identical to that discussed for regular and successive difference plots.



#### 2.6.4 Initiation

When the Operator is satisfied with the Specifications defined, the cursor will be returned to the Input Line of the display and a "P" will be entered. This will initiate the Profiling Process which will create a Stacked Profile similar to that illustrated in Section I of this document. Depending upon the defined specifications, the flight line numbers may or may not also appear at the top of the profile, overlapping their respective curves.



### 2.6.5 Termination

Profiling will continue until all of the extracted data has been plotted.

When profiling completes, a message will be issued on the Error Line of the display to inform the Operator. Another profile may be generated by repeating the above procedure to set up the Stacked Profile Specifications with or without any modifications. A new extraction may be performed by changing the extraction parameters of a previous display. Exit to the Extraction Parameters Display is via CTRL Z or CTRL C, twice. Valid modifications will be saved when a CTRL Z exit is made; any changes will be discarded if CTRL C is used to return to a previous display.



## 2.7 GRADIENT PARAMETER CREATION

Up to six (6) gradient parameters may be created from a data source by choosing the Gradient Creation option of the Main Menu. When this choice is made, a display similar to that of Figure 2-7 is presented.

The cube in the display is only meant to serve as a guide for the Operator to picture the gradiometer orientation about the six planes or twelve sides. The Operator should keep in mind that any of the points may be moved to any position along the line on which they are oriented.

Beside the cube are the twelve characters which define points on the cube. The Operator will use the cursor keys and keyboard to move to these characters and set up the parameters on which the gradients will be calculated as listed at the bottom of the Presentation Area. The recording identifiers of existing data will be used to assign the parameters.

The Operator will update the LUN of the source and destination devices before cursoring back to the Input Line and depressing 'P' followed by the carriage return. This will commence the creation of the gradient parameters, if valid devices have been assigned; otherwise an appropriate message will be displayed on the Error Line.

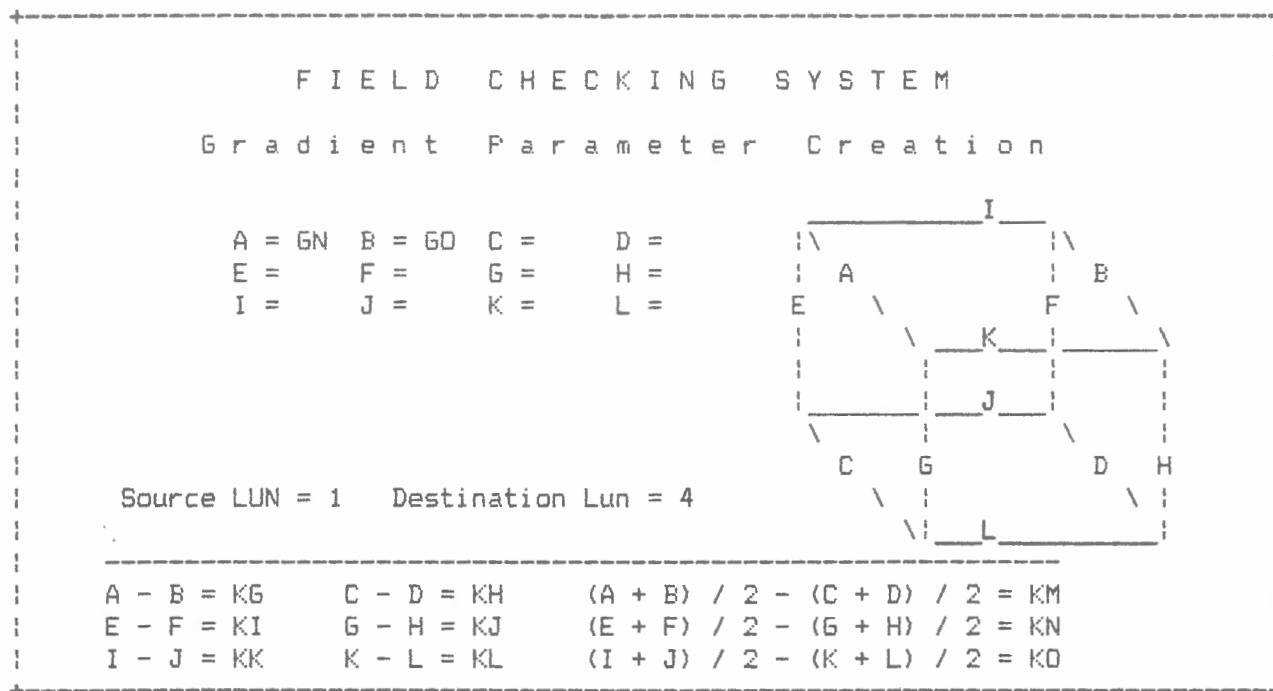
As the parameter data is created, it will be inserted into each record of each block before the data is written to the output device. The process will continue until the end of the source device is encountered. When completed, the process may be repeated by redefining the specifications on the display; or the



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Operator may return to the Main Menu via CTRL Z to save the display values as defaults; or CTRL C to discard any modifications.





USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-7 Gradient Parameter Display**





## 2.8 EDIT FUNCTION

To create an edited version of acquired data, the Operator may do so by choosing the Edit Function option of the Main Menu. The display of Figure 2-8 will be presented when this choice is made. At the bottom of the Edit Function Menu is an area where the source and destination devices for the data must be defined. The Operator will use the cursor keys and keyboard to set the logical unit numbers for these devices before any editing is done.

The Operator may now enter the number of a desired option at the keyboard to invoke a function. Note that two forms of editing are possible: (1) Batch, which will allow several edit functions to be performed simultaneously, automatically and over several blocks of data and, (2) Screen, which will allow blocks of data to be edited individually. All but the last two commands of the Menu apply to batch editing; the second last command will bring up the Screen Editor and the last command will return the Operator to the Main Menu. A message on the Error Line will inform the Operator if either of the source or destination LUNs are invalid prior to an option being invoked. Once the LUNs have been set, the cursor should be returned to the Input Line.

CTRL Z will exit the Editor Menu saving any modified specifications; CTRL C will return the Main Menu with any modifications being discarded.



FIELD CHECKING SYSTEM	
Edit Function Menu	
Option	Description
Batch Editing:	
1	Set Start/Stop Edit Limits
2	Output NNN Blocks
3	Add to/Subtract from a Parameter
4	Replace a Parameter Value
5	Delete/Add Parameters
6	Change One Digit
7	Check For Spike
8	Perform Edit Changes
9	Screen Editor
CTRL C/Z	Return to Main Menu
Source LUN = 4	Destination LUN = 0

ENTER NUMBER OF OPTION

Figure 2-8 Edit Function Menu



## 2.8.1 Batch Editing

### 2.8.1.1 Set Start/Stop Edit Limits

The Display of Figure 2-8-1-1 will be presented with the Set Edit Limits option. These limits must be set before a batch edit may be performed. Using the cursor keys and the keyboard, the Operator will set the two limits and the parameter upon which these limits will be based. Once the specifications are set, the cursor should be returned to the Input Line of the display.

CTRL Z exit will verify any modifications and save them, if okay, or flag any errors if not; CTRL C will return the Edit Menu, discarding any modifications.



FIELD CHECKING SYSTEM	
Set Start / Stop Edit Limits	
Basis Parameter	= GZ
Start Limit	= 52480015
Stop Limit	= 52480015
CTRL C/Z      Return to Edit Menu	

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-8-1-1 Batch Edit Limits Display**



### 2.8.1.2 Output nnn Blocks

When this option is taken, a prompt will be issued for the number of blocks to be dumped. To this, the Operator will enter a positive, integer value. This number of blocks will be immediately transferred from the source device to the destination device, provided the end of the source device is not encountered. Whether the copy completes successfully or not, a message will be logged on the System Console indicating the number of blocks output to the destination device.

### 2.8.1.3 Add/Subtract Value to Parameter

When this option is chosen, the display of Figure 2-8-1-3 will be shown on the Monitor. In the Presentation Area of this display, the Operator will specify the recording identifiers of the parameters to be modified and the values to be used to do so. Up to ten parameters may be modified, in this way, per batch edit.

After the display has been set up, the cursor will be returned to the Input Line and CTRL Z or CTRL C depressed to return the Operator to the Edit Function Menu. Errors will be flagged if CTRL Z is used to exit.

NOTE: Only addition may be performed on the parameter: to subtract a value, it is inverted by preceding it with a minus ('-') sign. This will create the same result by addition as would have been accomplished by subtraction of a positive value. The Operator should be aware, then, that hexadecimal numbers may be entered as signed numbers. For example, -12 is normally represented in hex as >FFF4 and +12 is >000C. However, here, -12 will be entered, in hex, as "-C" and +12 will be entered as "C"



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(no plus ('+') sign).



FIELD CHECKING SYSTEM		
Add A Value To A Parameter		
Parameter	Value (signed)	
PARAM1 = GJ	VALUE =	10000000
PARAM2 =	VALUE =	
PARAM3 = HI	VALUE =	-00000005
PARAM4 =	VALUE =	
PARAM5 =	VALUE =	
PARAM6 =	VALUE =	
PARAM7 =	VALUE =	
PARAM8 = GJ	VALUE =	-5
PARAM9 =	VALUE =	
PARAM10=	VALUE =	

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-8-1-3 Add/Subtract Value To Parameter Display**



#### 2.8.1.4 Replace a Parameter Value

The value of a parameter may be set to a constant using this option. When this option is chosen, a display similar to that of Figure 2-8-1-4 will be placed on the screen. The Operator will use the cursor keys to set up the recording identifiers and constants for up to ten parameters to be modified.

Returning the cursor to the Input Line, the Operator will return to the Edit Function Menu, either by depressing CTRL C or CTRL Z. CTRL Z will verify any modifications prior to exiting; CTRL C will discard any changes.





FIELD CHECKING SYSTEM	
Replace A Parameter Value	
Parameter	Value
PARAM1 = HI	VALUE = s00000001
PARAM2 = HJ	VALUE = e00000002
PARAM3 =	VALUE =
PARAM4 =	VALUE =
PARAM5 =	VALUE =
PARAM6 =	VALUE =
PARAM7 =	VALUE =
PARAM8 =	VALUE =
PARAM9 =	VALUE =
PARAM10 =	VALUE =

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-8-1-4 Replace a Parameter Value Display**



#### 2.8.1.5 Delete/Add Parameters

Invocation of this option will bring up the display of Figure 2-8-1-5. The Operator will use the cursor keys and keyboard to move to the desired areas of the Presentation Area to effect changes. When these changes are complete, the Operator will return to the previous display by cursoring to the Input Line and depressing either of the CTRL C or CTRL Z keys. Verification will be performed on any modifications prior to a CTRL Z exit. CTRL C will discard any modifications.

##### 2.8.1.5.1 Deletion

To delete a parameter or parameters, the Operator will cursor to the top portion of the display and, in the corresponding columns, list those recording identifiers marking the data to be removed. Up to five (5) deletions may be performed at once.

##### 2.8.1.5.2 Addition

The Operator will enter the new recording identifier for the parameter and, along with this, the formula for calculating the value in the CALCULATION column. A calculation will consist of the '+' (addition), '-' (subtraction), '\*' (multiplication) and '/' (division) operators with up to ten (10) recording parameters or numeric symbols making up the operands. Up to five (5) additions may be made at one time.



FIELD CHECKING SYSTEM				
Delete A Parameter				
PARM1 = KG	PARM2 =	PARM3 =	PARM4 =	PARM5 =
-----				
Insert A Parameter				
PARM1:	=			
PARM2:	=			
PARM3:	=			
PARM4:	=			
PARM5:	=			

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-8-1-5 Delete/Add Parameters Display**



#### 2.8.1.6 Change One Digit

A single digit within a parameter value may be changed using the Change One Digit option. The Operator will, by choosing this option, bring up the display of Figure 2-8-1-6 upon which the recording identifier of the parameters to be changed, digits to be changed, and new digits will be entered using the cursor keys and keyboard. Up to ten changes may be made per batch edit.

To return to the Edit Function Menu, the cursor will be returned to the Input Line and a CTRL C used to quit, discarding any modifications, or CTRL Z to exit following successful verification of any changes.



FIELD CHECKING SYSTEM		
Change One Parameter Digit		
Parameter	Digit	
PARM1 = GZ	POSITION = 7	VALUE = 1
PARM2 =	POSITION =	VALUE =
PARM3 =	POSITION =	VALUE =
PARM4 =	POSITION =	VALUE =
PARM5 =	POSITION =	VALUE =
PARM6 =	POSITION =	VALUE =
PARM7 =	POSITION =	VALUE =
PARM8 =	POSITION =	VALUE =
PARM9 =	POSITION =	VALUE =
PARM10 =	POSITION =	VALUE =

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-8 Change One Digit Display**



#### 2.8.1.7 Check For Spike

A 'spike' is a sudden change in magnitude of parameter data over a short period of time. To check for this phenomenon, the Operator will choose the Spike option of the Edit Function Menu. The display of Figure 2-8-1-7 will be brought up. In the Presentation Area, the recording identifier of up to ten parameters, and the magnitude definition of the spike for each will be entered. This definition will consist of two components: (1) an absolute change in a parameter's value over, (2) a range of samples.

Returning the cursor to the Input Line and hitting either CTRL C or CTRL Z after the spike information has been set up will return the Edit Function Menu (provided no errors are detected for a CTRL Z exit).



FIELD CHECKING SYSTEM		
Check For Spike		
Parameter	Spike Definition	
PARM1 = GZ	CHANGE = 20000	RANGE = 01
PARM2 =	CHANGE =	RANGE =
PARM3 =	CHANGE =	RANGE =
PARM4 =	CHANGE =	RANGE =
PARM5 =	CHANGE =	RANGE =
PARM6 =	CHANGE =	RANGE =
PARM7 =	CHANGE =	RANGE =
PARM8 =	CHANGE =	RANGE =
PARM9 =	CHANGE =	RANGE =
PARM10 =	CHANGE =	RANGE =

USE CURSOR KEYS AND KEYBOARD TO SET UP SPECIFICATIONS

**Figure 2-8-1-7 Check For Spike Display**



#### 2.8.1.8 Perform Edit Changes

This command will initiate the Field Checking System to carry out the edit changes previously set up using the other options of the Edit Function. The changes will be made for data on the source device, within the edit limits, also previously set. If no edit changes have been set up, no changes will be made.

When this option is chosen, a prompt will be issued to ensure that this is in fact what the Operator desires. Entering either a 'Y' or 'y' will cause the batch edit to take place; any other response will abort the edit.

When batch editing commences, the Operator will be informed, as well as when it completes. Successful completion will occur when a data block is read from the source device which is beyond the ending edit limit.

During Batch Editing, if Spike-Checking is being done, occurrences of spikes will be logged on the System Console.





## 2.8.2 Screen Editor

Single blocks may be read from a source device, displayed on the IBM-AT Monitor, edited using the keyboard and cursor keys, and then written to a destination device. To perform this option, the Operator will call up the Screen Editor. A blank display will be shown when the option is first invoked.

### 2.8.2.1 Reading a Block

<CTRL R> will read a block of data from the source device and display as much of it as possible on the Monitor.

### 2.8.2.2 Paging

Using the <PgUp> and <PgDn> keys, the Operator may move the display window Up and Down respectively, a page at a time.

### 2.8.2.3 Changes

Changes may be made by cursoring to the character to be replaced, and overwriting it via the keyboard.

### 2.8.2.4 Insertion

Insertion will be accomplished by depressing the <Ins> key, cursoring to the desired area on the display and then typing the text to be inserted. Insertion will be a character at a time. To terminate insertion, <Ins> will be depressed a second time.

### 2.8.2.5 Deletion



Deletion will be accomplished by depressing the <Home> key, cursoring to the desired area on the display, and then typing the <Del> key on the IBM-AT Keyboard. Deletion will be a character at a time.

#### 2.8.2.6 Backward One Block

<CTRL B> will back the source device up by one block, regardless of whether the device is a magnetic tape unit or hard disk. Backing up beyond the start of the device will not be permitted.

#### 2.8.2.7 Error Checking

<CTRL E> will be used to check blocks of data for errors, including block lengths, character composition, parameters existing and parameter values correct. The assumption will be that the data block was acquired via the airborne data acquisition system and that the Block Header and Character Check Set of the System Specifications will define the format of a data block to be checked.

Any errors detected will be highlighted in the Presentation Area in the upper, left corner using inverse video. Appropriate error messages will also be issued on the Error Line window of the IBM-AT Monitor if errors are found.

Only one error will be indicated at a time. Therefore, to verify that a data block is error free, <CTRL E> must be used until no errors are shown on the display.

#### 2.8.2.8 Writing A Block



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<CTRL W> will write the block currently displayed in the Presentation Area of the editor to the destination device.

#### 2.8.2.9 Exiting Editor

<CTRL Z> or <CTRL C> will return the Operator to the Edit Function Menu, out of the Screen Editor.



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## 2.9 EXITING FIELD CHECKING SYSTEM

Entering <CTRL Z> or <CTRL C> while the Main Menu is displayed on the Monitor will place the Operator in the VENIX Operating System environment, outside of the Field Checking System.



**SECTION IV  
DEVELOPMENT**

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## DEVELOPMENT

### 1.0 DEVELOPMENT SYSTEM

The development of the software for the Field Checking System will be carried out on the actual target system. This target is an IBM-AT Personal Computer.

The IBM-AT is equipped with 512 bytes of internal RAM memory, a 20 megabyte hard disk, a high density floppy drive, and a monochrome monitor. A 132 column printer will be available for obtaining hard copy listings of software source code.

The IBM-AT will run under the VENIX Operating System. A derivative of UNIX, the VENIX system was chosen because of its design, good support and excellent utility functions.



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## 2.0 SOFTWARE

The software for the Field Checking System will be written in the 'C' programming language. This language has been chosen because of its high-level yet flexible bit manipulation operations associated with an assembly language.

The source code will include sufficient documentation throughout and, for each procedure and subroutine, documentation detailing their inputs, outputs and actions will be included.



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### 3.0 TESTING

The developed software will be thoroughly tested on the target system including its input and output.





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#### 4.0 DOCUMENTATION

Aside from this Requirements Document, a detailed Design Document, and an Operator's Manual will be produced. The detailed Design Document will be produced prior to any software being developed. All documentation is to be prepared and kept up to date as development proceeds, including the Operator's Manual.

