Hanford Meteorological Station Computer Codes Volume 6 - The SFC Computer Code

**G. L. Andrews
J. W. Buck**

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HANFORD METEOROLOGICAL STATION
COMPUTER CODES

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Richland, Washington 99352

PREFACE

This volume is the sixth in a series of volumes that describe computer programs routinely used at the Hanford Meteorological Station (HMS) (e.g., data entry programs). Each volume, which documents one computer code, consists of a program overview, user's guide, description of input, a detailed program description and flowchart, and a source listing of the code.

The first seven volumes present the data entry programs used at the HMS for archiving and checking various types of data. All of these programs use a data entry form to facilitate data input, and each code calls the same series of subroutines that control and display the data entry form at the user's terminal. The subroutines were generated from the program FORMEDIT, which was developed by John Wiberg of the Computer Science staff in the Engineering Physics Department at Pacific Northwest Laboratory. An informal user's guide to the FORMEDIT program that describes how to create, modify, and eliminate data entry forms is available from the HMS system manager.

SUMMARY

Each hour the Hanford Meteorological Station (HMS), operated by Pacific Northwest Laboratory, records and archives weather observations. Hourly surface weather observations consist of weather phenomena such as cloud type and coverage; dry bulb, wet bulb, and dew point temperatures; relative humidity; atmospheric pressure; and wind speed and direction. The SFC computer code is used to archive those weather observations and apply quality assurance checks to the data. This code accesses an input file, which contains the previous archive's date and hour and an output file, which contains surface observations for the current day. As part of the program, a data entry form consisting of 24 fields must be filled in. The information on the form is appended to the daily file, which provides an archive for the hourly surface observations.

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INTRODUCTION

The Hanford Meteorological Station (HMS) was established in 1944 on the Hanford Site to collect and archive meteorological data and to provide weather forecasts and related services for Hanford project activities. The HMS is located in the northwest quadrant of the Hanford Site and is operated by the Pacific Northwest Laboratory (PNL).

Surface weather observations are recorded and archived each hour throughout the year at the HMS. These observations, hereafter referred to as the hourly surface observations, consist of weather phenomena such as cloud type and coverage; dry bulb, wet bulb, and dew point temperatures; relative humidity; atmospheric pressure; and wind speed and direction. Forecasters use the SFC computer code to archive and apply quality assurance checks to the hourly surface observations. The archive is maintained in disk files on the HMS computer system (DEC VAX 11/750).

The U.S. Department of Commerce (1982) provides a guide to the method used for coding the surface observations. This guide is kept in the forecast room at the HMS.

The following sections in the volume describe the implementation and operation of the SFC computer code. Appendix A contains a description and flowchart of the SFC computer code and Appendix B contains a source listing of the code.

THE SFC COMPUTER CODE

The SFC computer code is the primary method for archiving data obtained from hourly surface observations. The code has replaced manual entry of data via computer cards and a keypunch. The SFC code was written, compiled, and linked on the DEC VAX 11/750 at the HMS and is executed once an hour.

PROGRAM OVERVIEW

The SFC computer code accesses one input file and one output file. The input file contains the previous archive's date and hour, and the output file consists of hourly surface observations for the current day (Refer to Appendix A for more information about input/output operations.)

The program begins by displaying a data entry form on the terminal screen (Figure 1). The length of each field is indicated by the number of X's adjacent to the field name. The program fills in the date and hour fields by accessing an input file to obtain the previous archive's date and hour. You are then prompted to enter data for the remaining input fields. You can exit the data entry form after filling in all the input fields. The screen clears, and a prompt to make any needed corrections appears on the screen. Once all the input values are correct, you can exit the program and the hourly surface observation is appended to the current daily surface observation file. During the graveyard shift the next day, the daily surface observation file is appended to the current monthly surface observation file. (For example, hourly surface observation data for September 5 is archived to the September monthly surface observation file during the September 6 graveyard shift.) Volume 7 of this series (The RIVER Computer Code) further describes how the daily surface observation file is appended to the monthly surface observation file.

USER'S GUIDE FOR THE SFC COMPUTER CODE

This section describes how the SFC computer code is invoked on the HMS DEC VAX 11/750 computer and how to respond to the various prompts associated with the code. We assume that you know how to access the FCST account on the HMS computer, and that you have a basic working knowledge of the VAX

HMS SURFACE OBSERVATION INPUT FORM			
CLOUDS: xxxxx	DATE: xxxxxx	HOUR: xx	CEILING HT: xxx
SKY COND: xxxx	VISIBILITY: xxx	THDR&TOR: x	LQ PRECIP: xx
FR PRECIP: xxx	OBSTRCTNS: xx	SEA PRESS: xxxx	DEW POINT: xxx
WIND DIR: xx	WIND SPD: xx	STN PRESS: xxxx	DRY BULB: xxx
WET BULB: xxx	REL HUM: xxx	SKY COVER: xx	RAIN: xx
SNOW EQ: xx	SNOW UN: xx	WX INDCTR: x	SOLRAD: xxx

FIGURE 1. Example of the Data Entry Form Used by the SFC Computer Code

operating system. The terminal must be in the DEC VT100 terminal mode to use the data entry form. Currently, the HMS is equipped with several Tektronix 4107 terminals that can emulate the VT100 terminal. To determine the terminal status, simply type SHOW TERMINAL and depress the RETURN key. A list of terminal characteristics appears on the screen. Check to make sure the terminal type is set to VT100. If it is not, type SET TERMINAL/VT100 and depress the RETURN key.

Basically, there are six steps to executing the SFC computer code, filling in the data entry form, and terminating the program. These steps are listed below, and each step is discussed in detail in the following paragraphs:

- log in to the HMS computer (need the FCST password)
- type RUN SFC, then depress the RETURN key
- fill in the data entry form
- exit the form
- answer "yes" or "no" to "need corrections" prompt
- terminate program.

To log in, depress the RETURN key a couple of times. The computer responds with the prompt USERNAME:. Enter FCST and depress the RETURN key. The computer then responds with the prompt PASSWORD:. You must know the password to the

FCST account before logging in to the HMS computer. Enter the correct password. If you fail to answer either of these prompts correctly, the computer repeats the appropriate prompt. You are given three chances to enter the correct response. When you successfully log into the FCST account, you are placed in the [FCST] directory and can immediately invoke the SFC computer code.

The SFC code is invoked by typing RUN SFC and depressing the RETURN key. When this is done, the screen clears and the data entry form appears on the terminal. You can now begin data entry. If problems occur when executing the code, refer to the "Trouble-Shooting" section for help.

The data entry form appears on the screen as shown in Figure 1 with the cursor in field one (CLOUDS). The date and hour fields (second and third fields, respectively) are filled in by the program. When the cursor is moved to a new field, a prompt for the field appears on the screen below the data entry form. Included with each prompt is a default value and a valid range or list of matching values from which the input must be selected. To enter data into a field, simply type in the requested data and depress the RETURN key. Integers are used for all input. The default value may be entered by depressing the ENTER key or the SELECT DEFAULT key, which is found on some Tektronix terminals. The input value appears in the field (assuming a valid value or default value was entered) while the cursor moves from left to right into the next field. After data are entered in the rightmost field, the cursor moves down one line to the leftmost field. When values have been entered in all the fields, you should check the fields for mistakes. If corrections are needed use the up, down, right, and left arrow keys (↑,↓,→,←) located at the top of the keyboard to move within the form. Once you are satisfied the entered values are correct, depress the EXIT key to exit the form. You may exit the data entry form from any field.

The SFC program provides for two phases of quality assurance to the input data. The first phase is applied as you enter the input data for each field. An error message appears at the bottom of the form if the input value is not within the valid range or valid list of matching numbers. If the input value is not in the acceptable range, you are given the opportunity to enter another value for that field. The second phase occurs when you exit the form and the

"need corrections" prompt appears below the information entered in the form. You can check the input values for validity and make necessary corrections.

After exiting the form, the program displays the information entered into the data entry form on the terminal in the format in which it is appended to the daily file. A prompt appears just below the information asking if you would care to make any corrections. If no corrections are needed, enter an N or n and the program appends the data to the daily file. If corrections are needed, enter a Y or y and the program returns to the data entry form mode. This time, the previously entered values appear in their respective fields. Incorrect value(s) can be corrected by using the arrow keys to move the cursor to the appropriate field(s) and revising the incorrect entry. When all corrections have been made, you can exit the form by depressing the EXIT key. You may exit the data entry form from any field; it is not necessary to move to the last field.

The SFC program is terminated by answering n or N to the "need corrections" prompt. The entered data are appended to the daily file and the program terminates with a FORTRAN STOP message written to your terminal. The data file DAILYSFCSOBS.DAT is located in the [FCST.DAT] directory. This file contains the hourly surface observations for the current day.

DESCRIPTION OF INPUT

The data entry form consists of 24 fields. You must provide integer values for 22 of these fields. The program provides the value for the second and third fields, which are the date and hour fields. When you move the cursor to one of the other 22 input fields, the code provides a prompt related to the required input. The prompt consists of a brief description of the field, the valid range or list of matching numbers from which the input value must be selected, and a default value (refer to the "User's Guide" section for information on how to input the default value). Table 1 describes each of the input fields.

TABLE 1. Reference Guide to Input Fields

<u>Input Field</u>	<u>Description</u>	<u>Range or List</u>
CLOUDS	code	0 - 99900 / 0
DATE	YYMMDD	860101-990101 / 999999
HOUR	hour of day	1 - 24 / 99
CEILING HT	height of cloud base ^(a)	0 - 300 / 0
SKY COND	code	0-9800 & 9998-9999 / 0
VISIBILITY	miles and fraction of miles	0 - 150 / 150
THDR&TOR	code	0 - 5 / 0
LQ PRECIP	code	4 - 99 / 0
FR PRECIP	code	1 - 999 / 0
OBSTRCTNS	code	1 - 55 / 0
SEA PRESS	millibars	9700-9999 & 0-538 / 9999
DEW POINT	°F	-30 - 90 / 999
WIND DIR	tens of degrees	0 - 37 / 99
WIND SPD	miles per hour	0 - 55 / 99
STN PRESS	inches of mercury	2810 - 3023/ 9999
DRY BULB	°F	-37 - 125 / 999
WET BULB	°F	-37 - 125 / 999
REL HUM	percent	1 - 100 / 999
SKY COVER	tenths	0 - 10 / 0
RAIN	hundredths of inches	0-37 & 49-50 / 0
SNOW EQ	hundredths of inches	0-50 & 49-50 / 0
SNOW UN	tenths of inches	0-30 & 49-50 / 0
WX INDCTR	code	0 or 9 / 0
SOLRAD	hundredths of langleys/min	0-200 & 500 / 0

^(a) 100's of ft.

The following list describes each input field, the associated range or list of matching values from which the input must be selected, and the default value. Surface observations are normally recorded 10 minutes before the hour.

- 1) CLOUDS - The input value for this field is the type of cloud at the time of observation. Cloud type observations are recorded every 3 hours. Up to five cloud types can be entered, although it is unusual to enter more than three types. Cloud types are ordered by height. The lowest cloud type is recorded in the first column, the next layer is recorded in the second column, etc. The value entered is a code, as indicated in Table 2. The range of possible codes is from 00000 through 99900, with a default value of 00000. The default value indicates no clouds were observed.
- 2) DATE OF FORECAST - The date format is YYMMDD: where YY is the last two digits of the current year (e.g., 87 for 1987), MM is the numerical equivalent of the month (e.g., 04 represents April), and DD is the day of the month. An example of a date is 870421, which is April 21, 1987. The range of the date is 860101 (i.e., January 1, 1986) through 990101 (i.e., January 1, 1999). The default value for the date (refer to the User's Guide Section for details on entering default values) is 999999. This value indicates that the date is missing for the hourly surface observation.
- 3) HOUR - The input value for this field is the hour (always Pacific Standard Time) of the day. The range is 1 through 24, with a default of 99. The value 15 represents the hour 1500 on a 24-hour clock, or 3:00 p.m. using the normal convention. The default value indicates the hour was missing for that observation.
- 4) CEILING HT - The input value for this field is the height of the lowest cloud base that is either broken (.6 through .9 of sky covered) or overcast. The value 250 indicates a cloud height of 25,000 ft (values are recorded in hundreds of feet). The range is 000 through 300, with a default value of 000. The default value indicates no cloud ceiling.

TABLE 2. Cloud Type Codes

<u>Code</u>	<u>Cloud Type</u>
1	Fog
2	Status
3	Stratocumulus
4	Cumulus
5	Cumulonimbus
6	Altostratus
7	Alto cumulus
8	Cirrus
9	Cirrostratus

- 5) SKY COND - The input value for this field is a code or codes for each layer of cloud in the sky. Sky conditions are categorized into six general conditions and up to four conditions can be entered:

- clear
- scattered (.1 through .5 sky covered)
- broken (.6 through .9 sky covered)
- overcast
- total obscuration
- partial obscuration (.1 through .9 sky covered)

See U.S. Department of Commerce (1982) for details on coding sky conditions. The input value is a code that describes the sky condition of each cloud layer in the sky at the time of observation. The first digit in the entry indicates the sky condition of the lowest cloud layer, the second digit indicates the sky condition for the next highest cloud layer plus the lower layer, and so on. An input value of 2580 describes the following sky condition: 2 indicates scattered sky conditions for the lowest cloud layer, 5 indicates broken sky conditions for the next highest cloud layer plus the lower layer, 8 indicates overcast sky conditions for the next highest cloud layer plus the two lower layers, and 0 indicates there is no fourth cloud layer or the sky is fully covered by the

lower layers. Clear skies are coded as 0000. Table 3 describes each sky condition code. The code 9 is used to describe two types of sky conditions. See U.S. Department of Commerce (1956) for a more thorough description of code 9 and other sky condition codes. (A copy of this manual is in the weather forecasting room at the HMS.) The two ranges for this field are 0000 through 9800 and 9998 through 9999. The default value is 0000, which indicates clear sky conditions.

TABLE 3. Sky Condition Codes

<u>Code</u>	<u>Description</u>	<u>Example</u>
1	Thin scattered	Patches of thin cirrus; no ceiling
2	Scattered	A few cumulus clouds; no ceiling
3	Heavy scattered	Dark cumulus clouds; no ceiling
4	Thin broken	Large patches of cirrus; no ceiling
5	Broken	Large patches of altostratus; ceiling
6	Heavy broken	Thick large patches of altostratus; ceiling
7	Thin overcast	Cirrostratus covering entire sky; no ceiling
8	Overcast	Altostratus covering entire sky; ceiling
9	Heavy overcast	Nimbostratus covering sky; ceiling
9000	Partial obscuration	Ground fog
9999	Total obscuration	Fog enclosing station

- 6) VISIBILITY - The input value for this field is the horizontal visibility in miles when the visibility is equal to or greater than 3 miles. For example, 050 indicates a horizontal visibility of 5.0 miles. The visibility is never greater than 15 miles because of surrounding mountain ranges. Visibility of less than 3 miles is recorded in miles and fractions of miles. Table 4 lists the codes for visibilities less than 3 miles. For example, the code 005 indicates a horizontal visibility of 5/16 of a mile. The code 001 indicates a visibility of 1/16 of a mile. The range is 0 through 150 with a default value of 150. The default value indicates a horizontal visibility of 15.0 miles.

TABLE 4. Codes for Visibilities Less Than Three Miles

<u>Code</u>	<u>Visibility (mi)</u>
001	1/16
002	1/8
003	3/16
004	1/4
005	5/16
006	3/8
007	1/2
008	5/8
009	3/4

- 7) THDR&TOR - The input value for this field is a code that indicates whether thunder was heard or a tornado was sighted. Table 5 describes the codes. The codes range from 0 through 5. The default value is 0, which indicates no thunder was heard or no tornado was sighted at the time of observation.
- 8) LQ PRECIP - The input value for this field is a code that indicates the type of liquid precipitation at the time of observation. Table 6 describes each code.

TABLE 5. Codes for THDR&TOR Field

<u>Code</u>	<u>Description</u>
1	Distance thunder
2	Loud thunder (overhead)
3	Tornado sighted
4	Not used
5	Squall

TABLE 6. Liquid Precipitation Codes

<u>Code</u>	<u>Type of Precipitation</u>
01	Not used
02	Not used
03	Not used
04	Light drizzle
05	Moderate drizzle
06	Heavy drizzle
07	Light freezing drizzle
08	Moderate freezing drizzle
09	Heavy freezing drizzle
10	Light rain
20	Moderate rain
30	Heavy rain
40	Light rain shower
50	Moderate rain shower
60	Heavy rain shower
70	Light freezing rain
80	Moderate freezing rain
90	Heavy freezing rain

Two kinds of precipitation may be recorded at the time of observation, such as light rain and heavy drizzle. These types are indicated by an input value of 16. The range of possible codes is 04 through 99, with a default value of 00. The default value indicates no liquid precipitation at the time of observation. The U.S. Department of Commerce (1982) provides the definitions of light, moderate, and heavy liquid precipitation.

- 9) FR PRECIP - The input value for this field is a code that indicates the type of frozen precipitation at the time of observation. Table 7 describes each code. Two types of precipitation may be recorded at the time of observation, such as light snow and light snow grains. These types are indicated by an input value of 170. The range of possible codes is 001 through 999, with a default value of 000. The default value indicates no frozen precipitation at the time of observation. The U.S. Department of Commerce (1982) provides the definitions of light, moderate, and heavy frozen precipitation.
- 10) OBSTRCTNS - The input value for this field is a code that indicates the type of obstruction to vision (e.g., smoke, haze, dust) at the time of observation. Table 8 describes each code. Two types of obstructions may be recorded at the time of observation, such as fog and blowing snow. These obstructions are indicated by an input value of 15. The range of possible codes is 01 through 55, with a default value of 0. The default value indicates no obstruction at the time of observation.
- 11) SEA PRESS - The input value for this field is the sea level pressure in tenths of millibars (mb) at the time of observation. When the sea level pressure is greater than or equal to 1000 mb the 10 is assumed. For example, a sea level pressure of 1023.6 mb is recorded as 236. When the pressure is below 1000 mb the entire pressure is recorded; for example, 993.6 mb is recorded as 9936. The range is 9700 through 9999 and 0000 through 538, with a default value of 7777. The default value indicates a rising sea level pressure.

TABLE 7. Frozen Precipitation Codes

<u>Code</u>	<u>Type of Precipitation</u>
001	Light sleet
002	Moderate sleet
003	Heavy sleet
004	Not used
005	Moderate hail
006	Not used
007	Not used
008	Not used
009	Not used
010	Light snow showers
020	Moderate snow showers
030	Heavy snow showers
040	Not used
050	Not used
060	Not used
070	Light snow grains
080	Moderate snow grains
090	Heavy snow grains
100	Light snow
200	Moderate snow
300	Heavy snow
400	Light snow pellets
500	Moderate snow pellets
600	Heavy snow pellets
700	Light ice crystals
800	Moderate ice crystals
900	Heavy ice crystals

TABLE 8. Obstruction Codes

<u>Code</u>	<u>Description</u>
01	Smoke
02	Haze
03	Smoke/Haze
04	Dust
05	Blowing Snow
10	Fog
20	Ice Fog
30	Ground Fog
40	Blowing Dust
50	Blowing Sand

- 12) DEW POINT - The input value for this field is the dew point temperature in whole °F at the time of observation. The temperature 36°F is recorded as 036. Negative values are represented with a minus sign. The temperature -10°F is recorded as -10. The range of possible values is -30 through 090, with a default value of 999. The default value indicates a missing dew point temperature.
- 13) WIND DIR - The input value for this field is a 5-minute average of the wind direction in tens of degrees at the time of observation. For example, a north wind direction would be recorded as 36. Calm conditions are recorded as 00. Variable wind directions are recorded as 37. The range of possible values is 0 through 37, with a default value of 99. The default value represents a missing wind direction.
- 14) WIND SPD - The input value for this field is a 5-minute average of the wind speed in whole miles per hour (mi/hr) at the time of observation. Calm conditions are recorded as 00. The range of possible values is 0 through 55, with a default value of 99. The default value indicates a missing wind speed.
- 15) STN PRESS - The input value for this field is the station pressure in hundredths of inches-of-mercury (in./Hg) at the time of

observation. A station pressure of 30.00 is recorded as 3000. The range of possible values is 2810 through 3023, with a default value of 9999. The default value indicates a missing station pressure.

- 16) DRY BULB - The input value for this field is the dry bulb temperature in whole °F at the time of observation. A dry bulb temperature of 75°F is recorded as 75, while a temperature of 110°F is recorded as 110. Negative dry bulb temperatures are recorded with a minus sign. A temperature of -13°F is recorded as -13. The range of possible values is -37 through 125, with a default value of 999. The default value indicates a missing dry bulb temperature.
- 17) WET BULB - The input value for this field is the wet bulb temperature in whole °F at the time of observation. A wet bulb temperature of 75°F is recorded as 75, while a temperature of 110°F is recorded as 110. Negative wet bulb temperatures are recorded with a minus sign. A temperature of -13°F is recorded as -13. The range of possible values is -37 through 125, with a default value of 999. The default value indicates a missing wet bulb temperature.
- 18) REL HUM - The input value for this field is the relative humidity in whole percent at the time of observation. The range of possible values is 1 through 100, with a default value of 999. The default value indicates a missing relative humidity.
- 19) SKY COVER - The input value for this field is the sky cover in tenths at the time of observation. For example, a value of 05 indicates that one half of the sky is covered. The range of possible values is 0 through 10, with a default value of 0. The default value indicates clear sky conditions.
- 20) RAIN - The input value for this field is the amount of liquid precipitation in hundredths of an inch recorded during the hour. A value of 04 indicates that four-hundredths of an inch of rain fell during the hour. A trace of liquid precipitation is recorded as 50. The range of possible values is 00 through 37 and 49 through 50, with a default value of 00. The default value indicates no liquid precipitation was recorded during the hour.

- 21) SNOW EQ - The input value for this field is the amount of frozen precipitation in water equivalent form that accumulated during the hour. The units are in hundredths of an inch. An input value of 04 indicates that four-hundredths of an inch (water equivalent) of snow fell during the hour. A trace of frozen precipitation is recorded as 50. The range of possible values is 00 through 50 and 49 through 50, with a default value of 00. The default value indicates no frozen precipitation was recorded during the hour.
- 22) SNOW UN - The input value for this field is the amount of unmelted snow in tenths of inches that fell during the hour. An input value of 04 indicates that .4 inch of snow fell during the hour. A trace of snow is recorded as 50. The range of possible values is 0 through 30 and 49 through 50, with a default value of 0. The default value indicates no snow fell during the hour.
- 23) WX INDCTR - The input value for this field is a code indicating if a weather event (all precipitation and obstruction events) ended during the hour. The code is 9. The list of matching values is 0 or 9, with a default value of 0. The default value indicates a weather event did not end during the hour.
- 24) SOLRAD - The input value for this field is a 1-hour average of the solar radiation in hundredths of langley-per-minute (ly/min). An hourly average of 1.0 ly/min is recorded as 100. A trace of solar radiation is recorded as 500. The range is 000 through 200, with a default value of 000.

TROUBLE-SHOOTING THE SFC COMPUTER CODE

This section provides information that may help resolve problems that occur when operating the SFC computer code. We assume that you are familiar with the VAX EDT editor and the VAX operating system commands. Basically, there are three types of failure or problem areas: terminal (i.e., CRT), system, and/or program. The following sections will discuss problems or failures that may occur when using the SFC computer code and the suggested recovery procedures. If a series of recovery actions are suggested, you should try them in sequence until the problems or failure are resolved. Remember the date and hour are incremented each time you execute the SFC program. Therefore, you may need to edit the [FCST.PREVIOUS_DATE]SFCOBS_DATE.DAT file to reflect the desired date and hour after you have tried the recovery procedures.

TERMINAL PROBLEMS/FAILURES

Problem: Terminal does not respond.

Recovery: Determine if terminal is on. On Tektronix terminals the on/off switch is located in the front and to the right.

Determine if the dimmer switch is turned all the way down. On Tektronix terminals the dimmer switch is located in the front and to the right. Turn the switch clockwise to increase the light intensity on the screen.

If the above actions fail to get a response from the terminal, ask the instrument specialist (the HMS Room 125) to check the terminal.

SYSTEM PROBLEMS/FAILURES

Problem: System does not respond to operating system commands or carriage returns.

Recovery: Check with the Emergency Meteorological System (EMS) computer manager (Eric Stephan, 376-1107, or Ora Gifford, 373-3216) to see if the HMS computer system is down for maintenance or repair.

If the EMS computer manager indicates the HMS computer system is operating, turn the terminal off, wait approximately 15 to 20 seconds, and turn the terminal back on. Depress the RETURN key several times to get the attention of the computer system.

If the above actions fail ask an instrument specialist to examine the computer and notify the EMS computer manager.

PROGRAM PROBLEMS/FAILURES

Problem: Terminal not correctly displaying data entry form.

Recovery: Depress the CTRL key and the Y key simultaneously to get to the dollar sign prompt. Type SET TERMINAL/VT100 and depress RETURN. Try running the program again.

Depress the SETUP key at the top of the keyboard. The terminal should respond with an asterisk. Type CODE ANSI and depress RETURN, then depress the SETUP key. Try running the program again.

Problem: Terminal displaying garbled data.

Recovery: Depress the SETUP key at the top of the keyboard. The terminal should respond with an asterisk. Type CODE ANSI, depress RETURN, then depress the SETUP key.

Problem: Program SFC.EXE cannot be found or program has been "trashed" in some way.

Recovery: Copy backup version to the FCST directory. Type COPY [FCST.DATA_ENTRY]SFC.EXE [FCST]SFC.EXE. Try program again.

Problem: Input file ([FCST.PREVIOUS_DATE]SFCOBS_DATE.DAT) or output file ([FCST.DAT]DAILYSFCOBS.DAT) cannot be found.

Recovery: Check the [FCST.PREVIOUS_DATE] directory for the input file or the [FCST.DAT] directory for the output file. If the file(s) is intact, try copying the backup version of SFC.EXE to the [FCST] directory (see above for directions). Try running the code again.

REFERENCES

- U.S. Department of Commerce. 1956. Manual of Card Punching. 6th ed. U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia.
- U.S. Department of Commerce. 1982. Federal Meteorological Handbook No. 1 - Surface Observations. U.S. Department of Commerce, U.S. Department of Defense, and U.S. Department of Transportation, National Technical Information Service, Springfield, Virginia.

APPENDIX A

PROGRAM DESCRIPTION AND FLOWCHART

APPENDIX A

PROGRAM DESCRIPTION AND FLOWCHART

This discussion describes, in detail, the operations and logical flow of the SFC computer code. A flowchart indicating the general operations and logical sequence of the SFC code is shown at the end of this appendix. The flowchart is divided into three sections by two dashed lines. The top and bottom sections are transparent and do not require your input. The middle section involves the data entry form that requires your input. The following three paragraphs describe the operations within each section. For a more in-depth review of the operations and logical sequence of the program, refer to the source listing in Appendix B.

The program begins by opening and reading the data in the file SFCOBS_DATE.DAT, which contains one record with the date and hour of the previous archive. The program then reads the data. The SFCOBS_DATE.DAT file resides in the [FCST.PREVIOUS_DATE] sub-directory. Next the program opens the output file DAILYSFCOBS.DAT, which contains the hourly surface observation data for the current day. The DAILYSFCOBS.DAT file resides in the [FCST.DAT] sub-directory. The date and hour are then incremented and entered back into the SFCOBS_DATE.DAT file. At this point the code calls several subroutines that control and display a data entry form at your terminal.

The SFC code uses a data entry form to facilitate data entry. The form consists of several input fields (see Fig. 1 in the main text), each of which represents a surface observation variable. Each field is displayed in reverse video to highlight the field length. The fields are initially blank. You are prompted from the bottom of the form for an input value. The prompt consists of a brief description of the field, the valid range or list of numbers from which input must be selected, and a default value. A valid entry must be made before the cursor moves to the next field. If the numeric value is valid, the number is displayed in the appropriate field and the cursor moves to the next field when the ENTER key is depressed. If the input value is not valid, an error message occurs at the bottom of the form while the cursor remains in that field. When this occurs, the prompt reappears.

After entering all the input data, you can terminate the data entry process by depressing the EXIT key on the Tektronix 4107 terminal. The screen then clears and the input data are displayed at the terminal in the data format it will be appended to in the DAILYSF COBS.DAT file. You are then asked if any corrections are needed before the record is appended to the current daily file. If no corrections are needed, enter an N or n and the surface observation data are appended to the DAILYSF COBS.DAT file, and a message is displayed on the screen indicating the hourly surface observation data has been appended to the current daily file. The program terminates when the message FORTRAN STOP appears on the terminal. If corrections are needed, enter a Y or y and the code returns to the data entry form with the input values you displayed. You can move to the appropriate input field(s) (refer to the "User's Guide" section for information on how to move the cursor within the form) and change the value(s). Once all the value(s) are corrected, the data record is again displayed on the screen and you are given an opportunity to correct any mistakes.

The DAILYSF COBS.DAT files are used to archive the hourly surface observation data for the current day. At the end of each day (graveyard shift the next day), the RIVER program (see Vol. 7) is run to append hourly river data to the current day's hourly surface observation data contained in DAILYSF COBS.DAT. The RIVER program writes the appended data to the end of the monthly surface observations file (e.g., SFCOBSxxx.DAT). See Volume 7 of this series for further details.

APPENDIX B

SFC SOURCE CODE LISTING


```

0001 C *****
0004 C      PROGRAM: SFCOBS.FOR
0005 C
0006 C      PROGRAMMER: GREGG ANDREWS
0007 C
0008 C      FUNCTION: THIS PROGRAM WAS DEVELOPED TO FACILITATE THE
0009 C                  ARCHIVING OF THE HMS SURFACE OBSERVATION DATA.
0010 C                  THE PROGRAM ACCESSES A SCRATCH FILE
0011 C                  (SFCOBS_DATE.DAT) TO DETERMINE DATE AND HOUR OF
0012 C                  LAST DATA ENTRY. PROGRAM THEN INCREMENTS THE DATE
0013 C                  AND HOUR THROUGH SOFTWARE. AFTER THE DATE AND HOUR
0014 C                  OF THE NEXT ENTRY IS DETERMINED IT MAKES CALLS TO
0015 C                  SUBROUTINES THAT CONTROL THE INPUT FORM. AT THIS
0016 C                  POINT THE FORECASTER ENTERS THE DATA. GROSS ERROR
0017 C                  CHECKS ARE MADE AND DEFAULT VALUES ARE AVAILABLE
0018 C                  IF NEEDED. ONCE THE DATA IS ENTERED THE FORECASTER
0019 C                  HITS THE EXIT KEY ON THE TEX 4107. THE DATA WILL
0020 C                  APPEAR AS IT WILL BE WRITTEN TO THE OUTPUT FILE
0021 C                  (MONTHLY) AND ASKS IF THE DATA IS CORRECT;
0022 C                  IF NOT THE PROGRAM GOES BACK TO THE FORM MODE AND THE
0023 C                  FORECASTER IS GIVEN THE OPPORTUNITY TO MAKE THE
0024 C                  DESIRED CORRECTIONS.
0025 C
0026 C      CREATED: 1.0 12/85 GL ANDREWS
0027 C
0028 C *****
0029
0030
0031      INCLUDE 'ERDS$INCLUDE:FORMFLAGS.INC'
0069      Byte      Form_Interface_Record( 96)
0070      Integer*4   Iflags( 24)      ! Form flags
0071 C
0072 C      Type      Name      Field Prompt String
0073 C
0074      Integer*4   I_VAR001      ! CLOUDS (00000 - 99990) / DEFAULT
0075      Integer*4   I_VAR002      ! DATE (850101 - 990101) / DEFAULT
0076      Integer*4   I_VAR003      ! HOUR (1 - 24) / DEFAULT =
0077      Integer*4   I_VAR004      ! CLOUD CEILING HT (000 - 300) / D
0078      Integer*4   I_VAR005      ! SKY COND (0-9800 & 9998-9999) /
0079      Integer*4   I_VAR006      ! VISIBILITY (0 - 150) / DEFAULT =
0080      Integer*4   I_VAR007      ! THUNDE AND/OR TORNADO (0 - 5) /
0081      Integer*4   I_VAR008      ! LIQUID PRECIP (10 - 99) / DEFAULT
0082      Integer*4   I_VAR009      ! FROZEN PRECIP (100 - 999) / DEFA
0083      Integer*4   I_VAR010      ! OBSTRUCTION (1 - 55) / DEFAULT
0084      Integer*4   I_VAR011      ! SEA LVL PRESS (9700-9999 & 0-540
0085      Integer*4   I_VAR012      ! DEW POINT (-30 - +90) / DEFAULT
0086      Integer*4   I_VAR013      ! WIND DIRECTION (00 -37) / DEFAULT
0087      Integer*4   I_VAR014      ! WIND SPEED (00 - 55) / DEFAULT =
0088      Integer*4   I_VAR015      ! STATION PRESS (2810 - 3023) / DE
0089      Integer*4   I_VAR016      ! DRY BULB TEMP (-030 - +115) / DE
0090      Integer*4   I_VAR017      ! WET BULB TEMP (-030 - +115) / DE

```

```

0091      Integer*4      I_VAR018      ! RELATIVE HUMIDITY (1 - 100) / DE
0092      Integer*4      I_VAR019      ! TOTAL SKY COVER (00 - 10) / DEFA
0093      Integer*4      I_VAR020      ! RAIN (00 - 40) / DEFAULT =
0094      Integer*4      I_VAR021      ! SNOW H2O EQUIV. (00 - 50) / DEFA
0095      Integer*4      I_VAR022      ! SNOW UNMELTED (0 - 5) / DEFAULT
0096      Integer*4      I_VAR023      ! WEATHER INDICATOR (0 or 9) / DEF
0097      Integer*4      I_VAR024      ! SOLAR RADIATION (000-200 or 500)
0098
0099      INTEGER*4  YEAR, MONTH, DAY, HOUR, DAYS_IN_MONTH(12),
0100  +            DAYS_IN_MONTH_LY(12), HR
0101
0102      CHARACTER*1  SELECT
0103
0104      Equivalence  (Form_Interface_Record, I_VAR001)
0105
0106      Common /Form_Record/ I_VAR001, I_VAR002, I_VAR003, I_VAR004,
0107      .                I_VAR005, I_VAR006, I_VAR007, I_VAR008,
0108      .                I_VAR009, I_VAR010, I_VAR011, I_VAR012,
0109      .                I_VAR013, I_VAR014, I_VAR015, I_VAR016,
0110      .                I_VAR017, I_VAR018, I_VAR019, I_VAR020,
0111      .                I_VAR021, I_VAR022, I_VAR023, I_VAR024
0112
0113      DATA DAYS_IN_MONTH/31, 28, 31, 30, 31, 30, 31, 31, 30, 31,
0114  +            30, 31/
0115
0116      DATA DAYS_IN_MONTH_LY/31, 29, 31, 30, 31, 30, 31, 31, 30,
0117  +            31, 30, 31/
0118
0119
0120      OPEN(UNIT=11, FILE='[FCST.PREVIOUS_DATE]SFCOBS_DATE.DAT',
0121  +      STATUS='OLD', IOSTAT=IER)
0122      IF(IER.NE. 0) WRITE(*,20) IER
0123  20  FORMAT(/SX,'Error Opening [FCST.PREVIOUS_DATE]SFCOBS_DATE',
0124  +      '.DAT Code - ',I4)
0125
0126      OPEN(UNIT=12, FILE='[FCST.DAT]DAILY_SFCOBS.DAT', STATUS='OLD',
0127  +      ACCESS='APPEND', CARRIAGECONTROL='LIST', IOSTAT=IER)
0128      IF(IER.NE. 0) WRITE(*,30) IER
0129  30  FORMAT(/SX,'Error Opening [FCST.DAT]DAILY_SFCOBS.DAT Code - ',
0130  +      I4)
0131
0132
0133  C..... READ PREVIOUS DATE AND HOUR FROM SFCOBS DATE FILE
0134
0135
0136      READ(11,'(4I2)') YEAR, MONTH, DAY, HOUR
0137
0138
0139  C..... INCREMENT DATE AND HOUR WHERE NEEDED
0140
0141
0142  200  IF(HOUR.EQ.24 .AND. DAY.EQ.31 .AND. MONTH.EQ.12) THEN      ! check for end of year
0143
0144      YEAR = YEAR + 1

```

```

0145         MONTH = 1
0146         DAY = 1
0147         HOUR = 1
0148
0149     ELSE
0150
0151         IF(MOD(YEAR,4) .EQ. 0) THEN           ! check for leap year
0152
0153             IF(DAY.EQ.DAYS_IN_MONTH_LY(MONTH) .AND. HOUR.EQ.24) THEN
0154
0155                 MONTH = MONTH + 1
0156                 DAY = 1
0157                 HOUR = 1
0158
0159             ELSE
0160
0161                 IF(HOUR.EQ.24) THEN
0162                     DAY = DAY + 1
0163                     HOUR = 1
0164                 ELSE
0165                     HOUR = HOUR + 1
0166                 ENDIF
0167             ENDIF
0168         ENDIF
0169     ELSE
0170
0171         IF(DAY.EQ.DAYS_IN_MONTH(MONTH) .AND. HOUR.EQ.24) THEN
0172
0173             MONTH = MONTH + 1
0174             DAY = 1
0175             HOUR = 1
0176
0177         ELSE
0178
0179             IF(HOUR.EQ.24) THEN
0180                 DAY = DAY + 1
0181                 HOUR = 1
0182             ELSE
0183                 HOUR = HOUR + 1
0184             ENDIF
0185         ENDIF
0186     ENDIF
0187 ENDIF
0188
0189 ENDIF
0190
0191 ENDIF
0192
0193
0194 C..... WRITE NEW DATE AND HOUR TO PREVIOUS DATE FILE
0195
0196     HR=HOUR
0197
0198     BACKSPACE (UNIT=11,IQSTAT=IER)

```

```

0199      IF(IER.NE.0) WRITE(*,60) IER
0200 60      FORMAT(//5X,' Error During Backspace Code - ',I4/
0201 +        5X,' Check [FCST.PREVIOUS_DATE]SFCOBS_DATE.DAT File')
0202      WRITE(11,'(4I2)') YEAR, MONTH, DAY, HOUR
0203
0204
0205 C..... FIX DATE AND HOUR TO THE VARIABLES I_VAR002 AND I_VAR003
0206
0207
0208      I_VAR002 = (YEAR*10000) + (MONTH*100) + DAY
0209      I_VAR003 = HOUR
0210
0211
0212 C..... PREVENT USER FROM ENTER DATA FOR DATE AND HOUR AND FORCE
0213 C..... CURSOR TO START AT FIRST VARIABLE
0214
0215
0216      IFLAGS(2) = FM$ _NO_WRITE
0217      IFLAGS(3) = FM$ _NO_WRITE
0218      IFLAGS(1) = FM$ _FORCE_START
0219
0220 C..... CALL SUBROUTINES TO CREATE INPUT FORM
0221
0222
0223 100     CALL SUBPROCESS_OPEN_IO
0224         CALL SELECT_ANSI          ! put terminal in ANSI mode
0225         Call FM_Form_Open (15, 'HMSFORMS.FRM', IError)
0226         Call FM_Form_Input ('SURFACE', Form_Interface_Record,
0227                             Iflags, Ierror, User_Check, *990)
0228         Call FM_Form_Close (IError)
0229         CALL SUBPROCESS_CLOSE_IO
0230
0231
0232 C..... WRITE DATA TO SCREEN AS WILL BE WRITTEN TO FILE AND
0233 C..... PROMPT FOR CORRECTION
0234
0235
0236         TYPE *, ' '
0237         TYPE *, ' '
0238         TYPE *, ' '
0239         TYPE *, ' The Following Data Record Will be Appended to ',
0240 +         'Daily Surface Obs. File : '
0241
0242         WRITE(*,90)
0243 90      FORMAT(//1X,'123456789 123456789 123456789 123456789 ',
0244 +        '123456789 123456789 123456789')
0245         WRITE(*,70) I_VAR001, I_VAR002, I_VAR003, I_VAR004,
0246 +         I_VAR005, I_VAR006, I_VAR007, I_VAR008,
0247 +         I_VAR009, I_VAR010, I_VAR011, I_VAR012,
0248 +         I_VAR013, I_VAR014, I_VAR015, I_VAR016,
0249 +         I_VAR017, I_VAR018, I_VAR019, I_VAR020,
0250 +         I_VAR021, I_VAR022, I_VAR023, I_VAR024
0251 70      FORMAT(/,1X,I5,I6,I2,I3,I4,I3,I1,I2,I3,I2,I4,I3,2I2,I4,3I3,
0252 +        4I2,I1,I3,/)

```

```

0253
0254      SELECT = 'N'
0255
0256      TYPE *, ' Do You Need To Make Any Corrections ?'
0257      TYPE *, ' Enter N or Y'
0258      READ(*, '(A)') SELECT
0259
0260      IF(SELECT.EQ.'Y' .OR. SELECT.EQ.'y') GOTO 100
0261
0262
0263      C..... WRITE DATA TO DAILY FILE
0264
0265
0266      WRITE(12, 80) I_VAR001, I_VAR002, I_VAR003, I_VAR004,
0267      +             I_VAR005, I_VAR006, I_VAR007, I_VAR008,
0268      +             I_VAR009, I_VAR010, I_VAR011, I_VAR012,
0269      +             I_VAR013, I_VAR014, I_VAR015, I_VAR016,
0270      +             I_VAR017, I_VAR018, I_VAR019, I_VAR020,
0271      +             I_VAR021, I_VAR022, I_VAR023, I_VAR024
0272      80  FORMAT(I6,I8,I2,I3,I4,I3,I1,I2,I3,I2,I4,I3,2I2,I4,3I3,
0273      +          4I2,I1,I3)
0274
0275
0276      TYPE *, ' '
0277      TYPE *, ' '
0278      TYPE *, ' Data Appended to: [FCST.DAT]DAILYFCOBS.DAT File.'
0279      TYPE *, ' '
0280      TYPE *, ' '
0281      IF(HR.EQ.24) TYPE *, 'REMEMBER TO ENTER RIVER
0282      *D A T A'
0283      IF(HR.EQ.24) TYPE *, ' '
0284      IF(HR.EQ.24) TYPE *, ' '
0285      IF(HR.EQ.24) GOTO 300
0286      TYPE *, ' Do You Want to Enter Data for Another Hour ?'
0287      TYPE *, ' Enter Y or N'
0288      READ(*, '(A)') SELECT
0289      IF(SELECT.EQ.'Y' .OR. SELECT.EQ.'y') GOTO 200
0290
0291      GOTO 300
0292
0293      990  TYPE *, ' Error During Form Input - Call Gregg A.'
0294      TYPE *, ' Home 946-5482   Work 378-0138'
0295      300  CALL EXIT
0296      END

```

PROGRAM SECTIONS

Name Bytes Attributes

0 \$CODE	1727	PIC CON REL LCL	SHR	EXE	RD NOWRT LONG
1 \$PODATA	832	PIC CON REL LCL	SHR	NOEXE	RD NOWRT LONG
2 \$LOCAL	478	PIC CON REL LCL	NOSHR	NOEXE	RD WRT LONG
3 FORM_RECORD	96	PIC OVR REL GBL	SHR	NOEXE	RD WRT LONG

Total Space Allocated 3131

ENTRY POINTS

Address	Type	Name	References
0-00000000		SFC\$MAIN	

VARIABLES

Address	Type	Name	Attributes	References
2-000000CC	I*4	DAY		99 136= 142 146= 153
156=		182(2)=	172 175= 181(2)= 202 208	
2-000000D0	I*4	HOURL		99 136= 142 147= 153
157=		181	163= 165(2)= 172 176= 180	
		182=	184(2)= 196 202 209	
**	I*4	HR		99 196= 281 283 284
285				
2-000000D4	I*4	IER		120=A 122(2) 126=A 128(2) 196=
199(2)				
2-000000DC	I*4	IERROR		228A
2-000000D8	I*4	IOERROR		225A 228A
3-00000000	I*4	I_VAR001	COMM EQUIV	74 104 106 245 266
3-00000004	I*4	I_VAR002	COMM EQUIV	75 106 208= 245 266
3-00000008	I*4	I_VAR003	COMM EQUIV	76 106 209= 245 266
3-0000000C	I*4	I_VAR004	COMM EQUIV	77 106 245 266
3-00000010	I*4	I_VAR005	COMM EQUIV	78 106 245 266
3-00000014	I*4	I_VAR006	COMM EQUIV	79 106 245 266
3-00000018	I*4	I_VAR007	COMM EQUIV	80 106 245 266
3-0000001C	I*4	I_VAR008	COMM EQUIV	81 106 245 266
3-00000020	I*4	I_VAR009	COMM EQUIV	82 106 245 266
3-00000024	I*4	I_VAR010	COMM EQUIV	83 106 245 266
3-00000028	I*4	I_VAR011	COMM EQUIV	84 106 245 266
3-0000002C	I*4	I_VAR012	COMM EQUIV	85 106 245 266
3-00000030	I*4	I_VAR013	COMM EQUIV	86 106 245 266
3-00000034	I*4	I_VAR014	COMM EQUIV	87 106 245 266
3-00000038	I*4	I_VAR015	COMM EQUIV	88 106 245 266
3-0000003C	I*4	I_VAR016	COMM EQUIV	89 106 245 266
3-00000040	I*4	I_VAR017	COMM EQUIV	90 106 245 266
3-00000044	I*4	I_VAR018	COMM EQUIV	91 106 245 266
3-00000048	I*4	I_VAR019	COMM EQUIV	92 106 245 266

3-0000004C	I*4	I_VAR020	COMM EQUIV	93	106	245	268
3-00000050	I*4	I_VAR021	COMM EQUIV	94	106	245	268
3-00000054	I*4	I_VAR022	COMM EQUIV	95	106	245	268
3-00000058	I*4	I_VAR023	COMM EQUIV	96	106	245	268
3-0000005C	I*4	I_VAR024	COMM EQUIV	97	106	245	268
2-000000C8	I*4	MONTH		99	136=	142	145= 153
155(2)=							
172		174(2)= 202					208
2-000000C0	CHAR	SELECT		102	254=	258=	260(2) 268=
269(2)							
2-000000E0	R*4	USER_CHECK		228A			
2-000000C4	I*4	YEAR		99	136=	144(2)=	151 202
208							

ARRAYS

Address	Type	Name	Attributes	Bytes	Dimensions	References
2-00000080	I*4	DAYS_IN_MONTH		48	(12)	99 113D
172						
2-00000090	I*4	DAYS_IN_MONTH_LY		48	(12)	99 116D
153						
3-00000000	L*1	FORM_INTERFACE_RECORD	COMM EQUIV	96	(96)	69 104
228A						
2-00000000	I*4	IFLAGS		96	(24)	70 216=
217=						
218=		228A				

PARAMETER CONSTANTS

Type	Name	References
I*4	FM\$ FIELD_BOLD	55 59#
I*4	FM\$ FIELD_UNDERLINE	55 59#
I*4	FM\$ FORCE_START	55 59# 218
I*4	FM\$ NO_ECHO	55 59#
I*4	FM\$ NO_SEE	55 59#
I*4	FM\$ NO_WRITE	55 59# 218 217
I*4	FM\$ SET_ERROR	55 59#
I*4	FM\$ SET_EXCEPTION	55 59#
I*4	FM\$ USER_CHECK	55 59#

LABELS

Address	Label	References
1-000001BA	20'	122 123#

1-000001FD 30'	128	129#	
1-00000239 60'	199	200#	
1-000002E3 70'	245	251#	
1-00000315 80'	266	272#	
1-00000295 90'	242	243#	
0-00000104 100	223#	260	
0-000000B8 200	142#	289	
0-000000B8 300	285	291	295#
0-000000B8 990	226A	293#	

FUNCTIONS AND SUBROUTINES REFERENCED

Type	Name	References
	FW_FORM_CLOSE	228
	FW_FORM_INPUT	228
	FW_FORM_OPEN	225
	FOR\$EXIT	295
	FOR\$OPEN	120 126
	SELECT_ANSI	224
	SUBPROCESS_CLOSE_IO	229
	SUBPROCESS_OPEN_IO	223

```

-----
|           KEY TO REFERENCE FLAGS           |
|  =  - Value Modified                       |
|  #  - Defining Reference                   |
|  A  - Actual Argument, possibly modified  |
|  D  - Data Initialization                  |
|  (n) - Number of occurrences on line      |
-----

```

COMMAND QUALIFIERS

```

FOR/LIS/CROSS/CHECK=ALL SFC

/CHECK=(BOUNDS,OVERFLOW,UNDERFLOW)
/DEBUG=(NOSYMBOLS,TRACEBACK)
/STANDARD=(NOSYNTAX,NOSOURCE_FORM)
/SHOW=(NOPREPROCESSOR,NOINCLUDE,MAP,NODICTIONARY,SINGLE)
/WARNINGS=(GENERAL,NODECLARATIONS,NOULTRIX)
/CONTINUATIONS=19 /CROSS_REFERENCE /NOO_LINES /NOEXTEND_SOURCE /F77
/NOG_FLOATING /I4 /NOMACHINE_CODE /OPTIMIZE

```

COMPILATION STATISTICS

Run Time: 8.29 seconds

Elapsed Time: 11.87 seconds
Page Faults: 755
Dynamic Memory: 428 pages

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