

CRES

1. Report No. NASA CR-144992	2. Government Access	ion No.	3. Recipient's Catalog	No.
4. Title and Subtitle AAFE RADSCAT Data Reduction	Programs		5. Report Date	
User's Guide			6. Performing Organiz	ation Code
7. Author(s)			8: Performing Organiz	ation Report No.
John P. Claassen			Technical Rep	ort 186-9
9. Performing Organization Name and Address	D 1 T		10. Work Unit No.	
University of Kansas Center for Space Technology Center, 2291		l – Campus West	11. Contract or Grant	No,
Lawrence, Kansas 66044	Ū		NAS 1-10048	
12. Sponsoring Agency Name and Address			13. Type of Report an	nd Period Coverea
National Aeronautics and Space Langley Research Center	e Administration	+	14. Sponsoring Agency	· Code
Hampton , Virginia 23365				
15. Supplementary Notes				
16. Abstract	_ <u></u>	. <u></u>		
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both the experimenter and the p				a to serve
17. Key Words (Suggested by Author(s))		18. Distribution Statement		
Data Reduction	1			
Radiometer Measurements Scatterometer Measurements		Unclassified	-Unlimited	
Remote Sensing.		· ·	omanieu	
Earth Resources				
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (o UNCLASSIFI		21. No. of Pages	22. Price*
	- UNCLASSIFI		144]

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THE UNIVERSITY OF KANSAS SPACE TECHNOLOGY LABORATORIES



2291 Irving Hill Dr.— Campus West

Lawrence, Kansas 66044

Telephone:

AAFE RADSCAT DATA REDUCTION PROGRAMS

USER'S GUIDE

CRES Technical Report 186-9

John P. Claassen

Supported by:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Langley Research Center Hampton, Virginia CONTRACT NAS 1–10048

FOREWORD

The value of microwave scatterometers and radiometers as remote sea wind sensors has been independently demonstrated by a number of investigators. However, near-simultaneous observations by a composite radiometer and scatterometer (RADSCAT) instrument have been proposed as a method of making improved wind estimates. The improvement is derived from the complementary as well as supplementary features of the sensors. To demonstrate this potential a joint effort among New York University, General Electric Space Division, the University of Kansas and NASA Langley Research Center was undertaken through the Advanced Application Flight Experiment program of NASA. This document is submitted in support of these efforts.

Specifically, this document was prepared by the Remote Sensing Laboratory of the University of Kansas Center For Research, Inc. under NASA Contract NAS 1-10048. The principal investigator under the contract is Dr. R. K. Moore and project engineer is Dr. A. K. Fung. Several individuals rendered valuable assistance in the development of the computer programs. The control and integration of the routines were partially achieved by Glen E. Elliott of the University of Kansas. John L. Mitchell of LTV operated the programs repeatedly on the CDC-6600 while they were under final scrutiny by The author.

ABSTRACT

The theory, design and operation of the computer programs which automate the reduction of joint radiometer and scatterometer observations conducted by the AAFE RADSCAT instrument is presented. The programs reduce scatterometer measurements to the normalized scattering coefficient; whereas the radiometer measurements are converted into antenna temperatures. The programs are both investigator and user oriented. Supplementary parameters are provided to aid in the interpretation of the observations. A hierarchy of diagnostics is available to evaluate the operation of the instrument, the conduct of the experiments and the quality of the records.

General description of the programs and their data products are also presented. This document therefore serves as a user's guide to the programs and is therefore intended to serve both the experimenter and the program operator.

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I. INTRODUCTION

The AAFE RADSCAT* Data Reduction Package, as prepared by the University of Kansas, is a family of computer programs** which together form a basis for automated reduction and presentation of scatterometer and radiometer measurements taken by the RADSCAT instrument. The primary member in the family validates the raw RADSCAT data records and uses instrument and aircraft parameters to yield emission and scattering characteristics of the scene represented by the data. The scatterometer data is reduced to the normalized scattering coefficient whereas the radiometer data is reduced to the antenna temperature. Other programs in the family are employed to maintain a file of instrument characteristics, list the output (reduced data), and prepare duplicate output tapes for use on other computing machines. Two engineering routines are also provided to compute certain antenna parameters essential to the reduction of the microwave data; these routines are not employed regularly. The programs were written in FORTRAN IV, developed on a HW 635 system and then modified and demonstrated on a CDC-6600.

The program outputs provide a comprehensive basis from which to interpret the results of RADSCAT experiments. The basic output parameters have been augmented with others to reconstruct the influence of the aircraft attitude on the experiment, to validate the measurements, and to reflect the status of the RADSCAT instrument. Full evaluation of the data is accomplished by examining contents of an activity report as well as the output records. A fuller data base from which to analyze RADSCAT data is only provided when these outputs are augmented with seq/ ground truth and certain aircraft parameters available from other sources. The programs are therefore largely experimenter oriented.

Attempts have been made to generalize the reduction algorithms so as to easily adapt the programs for changes in the character or operation of the instrument. In doing so the user is expected to provide many more of the calibration and

A composite radiometer and scatterometer sensor.

The family of programs does not include a merge and edit routine which prepares the raw input data. This routine was developed by the Flight Instrumentation Division of NASA Langley Research Center.

data parameters than would otherwise by required. For this reason a historical file is maintained on the instrument parameters. It is also provided to trace the development, modifications and aging of the instrument.

No attempts have been made to develop efficient coding; rather extensive efforts have been made to develop programs which will, to some degree, document themselves. Self documentation is provided by a liberal insertion of comment cards. This approach had been instituted with the full realization that the programs are likely to undergo changes as experience or changes in the instrument dictate them. It is hopeful that this approach together with this document will ease the insertion of program modifications. However, the authors can assume no responsibility for changes made without their knowledge. It is strongly recommended that changes to the reduction algorithms be made only with the approval of an engineer who is thoroughly familiar with the operation of the instrument, the theory behind the algorithms and the needs of the investigators.

Some strides have been made to design production type programs. External directives give the users the ability to select the files to be processed or the service function to be executed. Unrecognized directives will halt the execution of the program. Data entries are also validated and when too many bad files are encountered the job is aborted. Activity reports and termination statements are provided so that the user can trace the progress of the job.

The details on the use, theory and design of these programs are presented in the remainder of this document. To place these programs in context with RADSCAT experiments the technical background is briefly described in Section II. The experimenter and programmer will find Section III helpful in understanding the general features and data products of the programs. He may wish to refer to Section IV and the Appendices for more specific information. The program operator will find Section IV essential to the operation of the programs. Again he may wish to consult the appendices for specific help. The cognizant engineer will want to become familiar with all aspects of this document to develop a thorough understanding of the program content. To a large extent this document assumes some knowledge of the operation of the RADSCAT instrument*. The programmer and cognizant

[&]quot;A description of the instrument may be found in "Field Service Procedure Handbook," vol. 1, prepared by General Electric Space Division, Philadelphia, Pennsylvania under NASA Contract NAS 1–10161.

engineer will also want to consult the document which describes the merge and edit routine which prepares the raw data records. This document is in preparation at NASA Langley Research Center. Those wishing to learn the details on the theory and design of the various routines in the family of programs will find the appendices helpful.

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II. TECHNICAL BACKGROUND

A. Introduction

This section is primarily written for the investigator or programmer not familiar with scatterometric or radiometric measurements. The motivation for joint measurements is presented and the elementary theory behind the measurements is discussed. The instrument and its relation to the C-130 aircraft is also briefly described. It is hoped that this section will place the AAFE RADSCAT Data Reduction Programs in context of experiments.

B. Motivation for Joint Measurements

In recent years a strong interest has developed in interpreting the microwave signatures of natural surfaces. In these efforts a number of potential earth resources and scientific applications have been demonstrated by measuring the emission or scattering properties of various scenes. The scatterometer is employed to measure the scattering characteristic whereas the radiometer is used to measure the emission properties. To date the investigations have been largely conducted with one instrument or the other. However, several investigators have proposed that joint scattering and emission measurements would form a stronger interpretational basis, because each sensor measures a different aspect of the bi-static scattering characteristic of the surface. From an entirely different viewpoint the sensors are complementary in nature. It is known that the radiometer is very sensitive to clouds and rain whereas the scatterometer is relatively insensitive to clouds and rain. Over the ocean this property has potential in correcting the scatterometer measurements for small attenuations caused by clouds.

C. Description of the RADSCAT Sensor

The AAFE RADSCAT instrument is a composite sensor consisting of a pencilbeam microwave scatterometer and radiometer. It was designed to conduct measurements from an aircraft and is capable of operating at either of two frequencies, 9.3 GHz or 13.9 GHz. In three of its four modes of operation it makes scatterometer and radiometer measurements on a near-simultaneous basis. In the fourth mode it makes radiometer measurements only. Observations can be conducted at any one of six adjustable angles covering the sector between nadir and 60 degrees. The AAFE RADSCAT instrument was primarily designed to perform experiments over the ocean to verify the remote anemometric capability of the composite sensor. Although primarily designed for oceanographic work, the extension to observations of agrarian or urban scenes is straightforward. The instrument is capable of conducting experiments at one of four altitudes, viz, 2000, 5000, 10,000 and 20,000 feet.* The wide range of altitudes is provided to study atmospheric effects such as humidity, temperature, clouds and rains. To avoid difficulties introduced by operating from behind a radome, the RADSCAT instrument mounts on the tail gate of the NASA/MSC C-130 aircraft. The Litton Navigator LTN-51 aboard the C-130 aircraft is extremely useful to the interpretation and reduction of the RADSCAT observations. It provides aircraft attitude and location information from which the point of observation on the surface may be established. The attitude parameters are especially useful when measurements are performed from a roll maneuver, since these parameters enable one to compute the incident angle. The radar altimeter information provided by the aircraft is essential to the inversion of the scatterometer measurements.

D. Estimating the Scattering and Emission Properties from Measurements

The scatterometer is a radar which is capable of accurately measuring the backscatter properties of a rough surface. The backscatter ability of the surface is denoted by the normalized scattering coefficient σ° which is given in terms of the scattering cross-section per unit area. In general it is dependent upon the point of observation, the incident angle, frequency, polarization, etc. It is well known that the radar return is predicted by (see Figure 1).

$$P_{r} = \frac{\lambda^{2}}{(4\pi)^{3}} P_{t} \iint_{4\pi} \frac{9^{2}(\theta, \phi) \sigma^{\circ}(\theta', \phi')}{R^{4}} dA \qquad (1)$$

where

- $P_r = received power$
- P_{+} = transmitted power
- $\lambda = wavelength$
- g = antenna gain function
- R = radar range to elemental area dA

 σ^{o} = normalized scattering coefficient

^{*}The radiometer by itself can operate at any altitude.

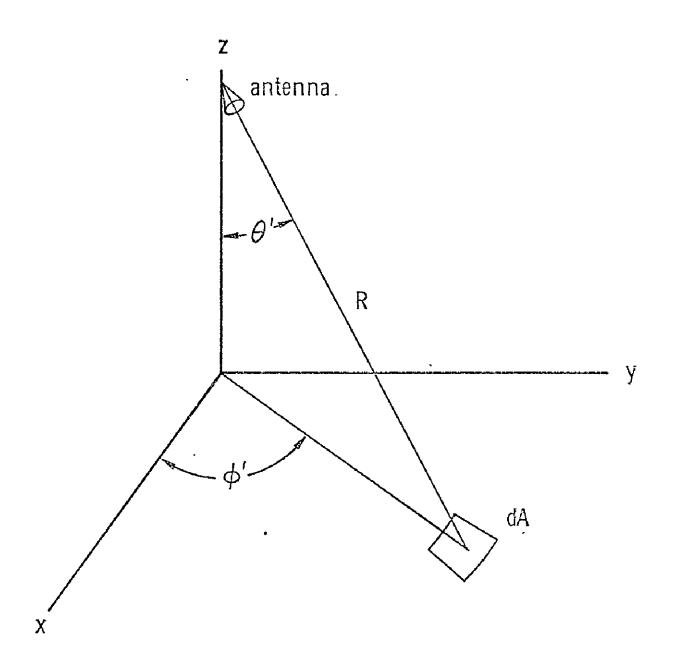


FIGURE 1. RADAR GEOMETRY

For narrow (or equivalently narrow) beam scatterometers the above integral expression may be inverted rather simply for σ° . As a consequence the problem of accurately determining σ° reduces to the problem of accurately measuring the transmitted and receiver powers, the pattern function, look angle, and radar range. The area of illumination may be shown to be related to the pattern function, look angle, and radar range. The scatterometer provides outputs which are measures of P_r and P_t . The power transfer function of scatterometer completes the association between the outputs to yield P_r and P_t^* . A member of the family of programs actually employs the scatterometer transfer function and an algebraic approximation of equation (1) to estimate σ° .

The radiometer, on the other hand, is a very sensitive receiver capable of measuring very low level emissions which emanate naturally from objects. In the microwave region the natural emission is governed by the Jeans-Rayleigh law which states that the power emitted is proportional to the physical temperature T of the body. In actuality, however, different objects at different temperatures emit different powers depending until their relative ability to absorb energy. Better absorbers emit more efficiently than poor ones. The relative ability to emit is described in terms of a parameter called emissivity ϵ . The emitted power per unit bandwidth in direction θ is given by

$$P(\theta) = \frac{4\pi k \epsilon(\theta) T}{\lambda^2}$$
(2)

where k is Boltzmann's constant.

We may now suppose that the surface emits in accord with this relation. Then a radiometer whose antenna gain function is given by $g(\theta, \phi)$ will measure (ignoring atmospheric contributions) a total power per unit bandwidth given by

$$P_{\alpha} = \frac{1}{\Omega} \iint_{4\pi} \vartheta(\theta, \phi) k T_{B}(\theta) d\Omega \qquad (3)$$

Actually only the ratio P_{1}/P_{1} is needed.

** For one polarization.

This relation is only representative of the nature of the problem. See Claassen, J. P. and A. K. Fung, "An Efficient Method for Inverting Antenna Temperatures for the Apparent Temperature Distribution" University of Kansas Center For Research, Inc., TR 186-8, January 1973, for a precise relationship. where

$$\Omega = \iint_{4\pi} g(\theta, \phi) d\Omega \qquad (4)$$

and

$$T_{\mathbf{B}} = \epsilon(\theta) T \tag{5}$$

The antenna power may be related to antenna temperature by $P_a = kT_a$. For narrow beam efficient antennas the antenna temperature is an approximate measure of the brightness temperature T_B in the look direction. The radiometer therefore must accurately measure the antenna power. The RADSCAT data reduction programs use the calibration data and radiometer transfer function to estimate T_a for each polarization.

III. GENERAL DESCRIPTION

A. Introduction

This section is primarily written to familiarize the investigator or programmer with the family of RADSCAT data reduction programs. The functions of the particular programs and the relationships between the programs are presented. Input and output data products are described to various degrees.

B. Summary of Programs

The AAFE RADSCAT Data Reduction Package consists of a family of six programs:

- 1. Conversion Program (CONVERT)
- 2. Output Program (OUTPUT)
- Program for the Storage and Retrieval of Instrument Characteristics (ICHAR)
- 4. Output Translation and Duplication Program (TDUPE)
- 5. Equivalent Beamwidth Program (WIDTH)
- 6. Antenna Gain and Efficiency Program (GAIN)

The actual reduction of data is accomplished in CONVERT. The input data for CONVERT is prepared by an edit and merge routine developed by NASA Langley Research Center. The merged tape consists of RADSCAT and aircraft data. To assist in the computations, program ICHAR prepares a historical file of instrument characteristics. CONVERT selects a particular set of characteristics from the file and applies them to the input data. The computed results are stored on an output tape. Program OUTPUT will list the contents of the output tape. To prepare duplicate output tapes for use on other computing machines program TDUPE may be employed.

WIDTH and GAIN are special routines which compute several antenna parameters. The parameters are employed as elements of the instrument characteristics. Both programs require antenna pattern information to compute the parameters. Their use will seldom be required unless the antenna pattern changes.

Of the six programs the initial four programs are production types and the last two are engineering application programs.

C. Conversion Program

The reduction of RADSCAT data is performed entirely in CONVERT. By means of external directives, physical files of a specified type are processed with a designated set of instrument characteristics withdrawn from a separate file source. External directives permit the user to initiate processing of input files by type or sequentially regardless of type. The files are organized by flight runs and are labeled in accord with a procedure instituted by the Flight Operations Division of NASA/MSC.

Directive options are given by MISFLT, FLTLIN, SPECIF, or ALL. When the first directive is appended with mission and flight numbers, all files from that mission and flight are processed in the order that they appear on the tape. Mission, flight and line numbers must appear with the second directive option. Files of the designated line type will thus be processed. Consecutive directives which exhaust the line types will order the output files by line type. This feature is helpful to the interpreter who often associates an experiment condition with a line type. The third directive is employed when a specific file designated by mission, flight, line and run is to be processed. This directive is appropriate for a quick or selective look at the experiment results. The last directive (ALL) will initiate processing of all files regardless of type. Combinations of directives may be employed; however, indiscriminant use of the processing types is cautioned against since duplicate processing of files may occur. For each directive the file search is effectively conducted from the beginning of the tape.

Each of the above directives must include a designator which selects a set of instrument characteristics from a historical file of characteristics or which permits them to be read from cards. It is likely that the most current characteristics will be chosen; however, any set on the file may be selected. Alternatively, characteristics may be entered from the card reader. However, operation under this latter option is restricted to one data file per directive. Entry through the card reader is mainly reserved for testing a set of instrument characteristics before storage on the historical file. Also as a part of the same directive the number of files to be processed of the indicated type and the line density of the activity report must be designated on the control card. The latter parameter can be used to limit the number of data records on which reports are given. During processing CONVERT generates a conversion report. The report routinely issues statements on the calibration parameters and critical receiver temperatures as they are computed from the input file. It will also routinely state that a record had been reduced. The reports are appended with record numbers. Other special statements are generated whenever critical situations are encountered in the records. When these special situations occur, the record is normally processed regardless; however, that record is flagged by an interpretational code which becomes a part of the output record. In some cases, such as invalid data, the record is bypassed and an appropriate error message is generated. When an excessive number of bad records is encountered, the file is bypassed and an appropriate message printed. These messages are primarily intended to reflect the status of the processing, the condition of the instrument, the conduct of the experiment, and the quality of the data. A sample listing of the conversion report is illustrated in Figure 2.

As processing progresses output records are accumulated in blocks (arrays) and the blocks are written to the output tape. A description of the contents of the output tape appears in the following subsection.

D. Output Program

Program OUTPUT will list the processed records produced in the conversion program. External directives similar to those in CONVERT permit listing files of designated types or all files regardless of type. Again general directives are given by MISFLT, FLTLIN, SPECIF or ALL. The appropriate mission, flight, line and run designators must accompany the directives.

A sample listing produced by OUTPUT is shown in Figure 3. A double page of output consists of the file label, column headings, 80 records and a key. The set of instrument characteristics which produced the results is identified by set number and date in the last entry of the file label. Each measurement record occupies one line on the listing. A record number is appended to each line and should agree with the number assigned in the conversion report. The time of measurement in mean Greenwich time is presented in the second column. It is to be read in hours, minutes, seconds and 1/10th seconds. The measurement can therefore be associated with data from other sources. The mode from which the instrument conducted the measurement is reflected in column 3. The incident and cross-tracks angles appear in the next two columns. They were computed from aircraft attitude parameters and the RADSCAT view angle with respect to the aircraft platform. The cross-track angle is that angle

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CONVERSION REPORT

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MISSIUN-207 FLIGHT- 12 DATE-	7 25 1972	FLT LINE-	2 RUL- 3	FREQUENCY- 13.9	FEED- WG S	W {PAR= L 2 L 73

•	•	••••			
FECOPO /	¥0.+	HESSACE	•	PARAMETEKS	
	•	CALIBRATION DATA	•	CHAN 1270 CHAN 2410 CHAN 3- 1.190 CHAN 4- 1.285	
1		RECVE TEMP NOT WITHIN OPERATING		RCAL= 2.400 RUASE= .100 NCAL= 6 NUCAL= 6	
ī	•	CRITICAL TEMPERATURES	KANJE *	LGCATION NO. 1 TEMPERATURE +337.8 KELVIN HARM= 311.8 HCT= 415.0 GMT= 312.1 Sh= 311.3 AIR= 288.0 GDT= 312.7	
1		EXCESSIVE DEPCLARIZATION	•	LEPAL 021	
<u>+</u> -		COMPLETED RECORD COMPUTATION	NS	ANTEGNA TEMP# 246.6 SCATTERING CUEF=7.720364E+00 CHANNEL# 2 DUP BAND# 7	
2		RECVR TEMP NUT WITHIN UPERATING URITIGAL TEMPERATURES	RANGE .	LOLATION NO. I TEMPERATURE =337.8 KELVIN	
ž			NS	%ARH= 311,8 HCT= 415.0 LKT= 312.1 Sh= 311.3 A1R= 200.0 GDE= 312.7 ANTENNA TEMP= 248.6 SCATTERING LOEF=6.311449€+00 CHANNEL= 2 UQP BAND= 7	
3	*	RECVR TEMP OUT WITHIN OPERATING	RANGE +	LUCATION NO. 1 TEMPERATURE =337.8 KELVIN	
3	•	CRITICAL TEMPERATURES	•	NARM= 311.8 HGT= 415.0 UHT= 312.1 Sh= 311.3 AIR= 288.0 GDE= 312.7	
3		CUMPLETED RECERD COMPLETATION	NS ##	ANTENNA TEMP= 248.4 SCATTERING COEF=5.924877E+00 CHANNEL=2 QOP BAND= 7	
1		RECVE TEMP NOT WITHIN OPERATING CRITICAL TEMPERATURES	RANGE *	LOCATION NO. 1 TEMPERATORE =337. E KELVIN	
			NS .	WARH= 311.0 HCT= 415.0 OHT= 312.1 SN= 311.3 AIR= 208.0 GDE= 312.7 ANTEHNA TEMP= 245.8 SCATTERING COEF=7.0201955+00 CHANNEL= 2 DOP BAND= 7	
5	*	RELVE TEMP NOT HITHIN OPERATING		LOCATION NU. 1 TEMPERATURE =337.8 KELVIN	
2	. *	CRITICAL TEMPERATURES		NARN= 311.8 HUT= 415.0 ONT= 312.1 Sh= 311.3 AIR= 287.9 GDE= 312.7	
- 2		EXCESSIVE DEPCLARIZATION		DEFUL .021	
7		COMPLETED RECORD COMPUTATION RECVR TEMP NOT WITHIN OPERATING	NS ##	ANTENNA TEMP= 249.4 SCATTERING COEF=6.206822E+00 CHANNEL= 2 DUP BAND= 7 LCCATIUN NU. 1 TEMPERATURE =337.8 KELVIN	
ŏ		CRITICAL TENPERATURES	K # 50 E	LCCATIUN ND. 1 TEHPERATURE =337.8 KELVIN WARM= J11.8 HGT= 415.0 GMT= 312.1 SW= 311.3 AIR= 287.6 GDE= 312.7	
6		EXCESSIVE DEPCLARIZATION	÷.	DEPOL	
6	**			ANTENNA TEXP: 249.1 SCATTERING COEF=5.944944E+00 CHANNEL= 2 DOP BAND= 7	
<u>!</u>		RECYK TEHP NOT #ITHIN UPERATING		LUCATION NO. 1 TEMPERATURE #337.8 KELVIN	
4		CRITICAL TEMPERATURES EXCESSIVE DEPLIARIZATION	:	WARM = 311.8 HGT= 415.0 OHT= 312.2 Sh= 311.3 AIR= 287.9 GDE= 312.7	
7			NS	DEFOL= .020 ANTENNA TEMP= 248.2 SCATTERING COEF=7.507535E+00 CHANNEL= 2 DOP BAND= 7	
8		RECVE TEMP NOT ALTHIN OPERATING		LCCATION NO. 1 TENPERATURE >337.8 KELVIN	
8		CRITICAL TENPERATURES	*	MARN= 311.4 HCT= 415.0 UMT= 312.2 Sh= 311.3 AIR= 288.0 GDE= 312.7	
B B		COMPLETED RECORD COMPLETED		ANTENNA TENP= 249+0 SCATTERING COEF=7+141555E+00 CHANNEL= 2 DOP BAND= 7	
4		RECYR TEMP NUT WITHIN OPERATING CRITICAL TEMPERATURES	KANJE T	LOCATION NO. 1 TEMPERATURE #337.8 KELVIN	
4			NS ##	WARM= 311.0 HGT= 415.0 UMT= 312.1 SK= 311.3 AIR= 288.0 GDE= 312.7 Antenna Texp= 245.2 Scattering Cuef=8.071541E+00 Channel= 2 DOP Band= 7	
10	+	RECVR TEMP NOT WITHIN UPERATING	RANGE +	LOCATION NO. 1 TERPERATURE =337. h KELVIN	
10		CRITICAL TEMPERATURES	*	NAK4= 311.8 HCT = 415.0 CMT= 312.1 SN= 211.3 AIR= 288.0 GDF= 312.7	
10 .		CUMPLETED RECCED COMPUTATION DECKED TEMP NOT STITUTE OUCSATING		ANTENNA TEMP* 248.6 SCATTERING COEF=7.1d5143E+00 CHANNEL= 2 DDP GAND= 7	
11 11		RECYR TEMP NOT WITHIN OPERATING CRITICAL TEMFERATURES	RANGE #	LDCATION NU. 1 TENFERATURE #338.0 KELVIN WARM# 311.0 HGT# 415.0 CMT# 312.1 SN# 311.3 AIR# 280.1 GDE# 312.9	
ii				ANTENNA TEMP= 243.5 SCATTERING CUEF=5.522655E+00 CHARNEL= 2 DOP BAND= 7	
			-	Change 2 DUP BANDA /	

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FIGURE 2. SAMPLE OF THE CONVERSION REPORT

							MIGR	LNAVE LATA						
*15510	N-20/ FL	168f- 1	2 CATE	- 125	1572	FLT	LINE-	2 RUN- 3	FRECU	ENCY- 13.4	+ttc-	×6 S₩	IPAR= 1	2 1 73
FECORU NO.	TINE	HJCE	INCIC Angle (Deg)	CFCSS Angle (Ceg)	XHIT PCL	REC POL	S INT TIME (SEC)	SCAT	SCAT CB	RAD (DEG K)	UEPUL Factur	S/R CCDE	ALTITUDE (FEET)	FLT DIRECT {CEG}
	151746.7	F.A.	12.7	-11.4	н	н	.555	7.7204E+00	8*8	246.8	.021	110000	9966	2.5
23	151748.2	F.A. F.A.	6.El 8.El	-10.3	н	н	.595	6.J114E+00	8.0	248.6	0.000	100000	9959	2.7
4	151751.1	F.A.	13.7	-9.9	1	11 11	• 595 • 595	5.9249E+00 7.0282E+00	7.1	240.4	0.000	100000	9957 9956	2.6
5	151751.9	F.A.	13-6	-10.7	н	н	. 555	6+2068E+00	6.5 7.9	249.8 249.4	.021	110000	5556	2.0
5	151752.6	F.A.	13.0	-10.8 -16.5	н Н	н	- 595	>.\$449E+00	7.7	249.1	.02Z	110000	9959 5958	1.9 1.8
8	151754.1	F.A.	13.5	- 4.7	н	н	• 555 • 555	7.5075E+00 7.1420E+00	8.8 8.5	248.2 249.0	.020 0.000	110000	9955	1.8
10	151754.8 151756.3	F.A.	13.3	-6.9	н	н	• 595	4.0719E+00	9.1	249.2	0.000	100000	5553	1.8
11	151757.8	F.A. F.A.	13.4	-8.6	H	н V	+555	7.1891E+00	£-6	Z 8.6	0.000	100000	5956 9956	1.6 1.3
12	151758.5	F.A.	13.0	-9.3	v	v	- 555	5.5229E+00 5.5486E+00	7.4	243.5 244.0	0.000	100000	9954	1.2
13_ 14	151759.2	F.A. F.A.	13.5	-6.9	v	Y	. 555	5.3070E+00	7.3	242.9	0.000	100000	5955	1.2
15	151800./	F.A.	13.4	-8.2 -7.4	v	v	• 555	5.6805E+00 5.7777E+00	7.5	244.C 243.E	0.000	100000 100000	9955 9955	1.1
16	151802.2	F.A.	13.3	-7.2	v	Ŷ	.595	5.7537E+00	7.6 7.6	243.2	0.000	100000	9953	.9
17	151804.4	F.A. F.A.	13.3	-7.8 -7.6	N.	¥.	- 555	7.14116+00	8.5	244.4	0.000	100000	9952 9952	•6
19	151805.9	F.A.	13.3	-7.1	v	v	•595 •595	5.3751E+00 7.2444E+00	7.3 8.6	242.7 243.7	0.000 0.000	100000	9956	.6 .6
20 21	151806.6	F.A.	13.2	-0.7	Ý	Ŷ	- 595	7.64158+00	8.8	244.4	0.000	100000	9956	•6
22	151816.7	F.A. F.A.	43.0 43.0	-2.5	v	v	-555 -802	3,2273E-01	-4.9	250.1 250.1	0.000	100000	9951 9953	1 C3.4 3 59.8
Z3	151318.6	F. A.	42.9	-2+6	v	, v	.802	2.4405E-01 2.4335E-01	-6.1 -6.1	250.4	0.000	100000	9952	359.9
24 25	151820.5	≁•▲• F•A•	42.7 42.8	-2.2	v	Ý	-802	2.4358E-01	-6-1	245.7	0.000	100000	9952 \$953	359.8 359.7
26	151822.4	F.A.	42.3	-2.4	v	v	.802 .802	2.43478-01 2.0856E-01	-6.1 -6.8	249.3 250.5	0.000	100000 100000	9952	3 59 . 7
27	151823.3	F. A.	42.8	-2+5	ÿ	v	-802	2.0911E-01	-6-8	250.5	0.000	100000	5953	359.6
28 29	151824.3	⊦.Å. F.Å.	42.7 42.d	-2.5	v	Ŷ	- 802	2.0958E-01	-6-8	250.1	0.000	100000	9957 5957	359.6 359.7
30	151827-1	F.A.	44.7	-1.9	v	v	-802 -802	2.0990E-01 2.0854E-01	-6-8	250.1 249.3	0.000	100000	9961	359.6
31	151828.0	F.A.	42.5	-1,5	Ŷ	Ŷ	-805	2,0997E-01	-6.8	249.5	0.000	100000	9960	359.6
32 33	151829.9 151830.9	F.A. F.A.	43.) 43.0	-1.9 -2.0	v	v	- 203 - 802	2.4451E-01 2.4449E-01	-6.1 -6.1	249.3 249.3	0.000	100000	5963 5963	359.4
34	151831.8	F.A.	43.0	-1.9	v	Ŷ	- 802	2.4402E-01	-6.1	250.1	0.000	100000	9961	359.4
35 36	151632.8 151333.7	f.A.	42.9	-1.8	¥	V.	- 602	2.4336E-01	-6.1	250.5	0.000	100000	596 Z	359.5
.37_	151835.6	F.A. F.A.	42.9 42.0	-1.0	У Н	V Н	-802 -802	2.4434E-01	-6.1 -30.9	249.7 247.0	0.000 0.000	100000	9958 5959.	359.5 359.4
38	151836.5	F.A.	42.6	-1,2	н	H	- £02	7.5444E-04	-31-0	246.0	0.000	100000	9957	359.3
39 40	151837.5	F.A. F.A.	42.8 42.8	-1.3	н н	H	. 02 . 802	7.4506E-04	-31.3	246.5	0.000	100000	9960 9960	359.3
41	151839.4	F.A.	44.0	1.4	ĥ	н	.602	6.5443E-04 7.7676E-04	-31.8 -31.1	246.2 246.4	0.000	100000	5960	359.3 359.4
42 43	151640.3 151842.2	F.A.	-2-7	-1.3	н	ห	• 802	7.2553E-04	-31.4	245-0	0.000	100000	9960	359-5
44	151844+1	F.A. F.A.	42.4 42.3	-1.0	н	- H - H	-802 -802	8.5995E-04 6.8271E-04	-30.7 -31.7	246.0 247.0	0.000	100000	9960 9960	359.4 359.4
45	151840+0	F.A.	42.9	-1,3	н	н	. 80Z	6.8509E-04	-31.6	245+2	0.000	100000	\$963	359.4
46	151847.9 151848.8	. .	42.9 43.0	-1.1 -1.0	н н	н. Н	- 503 -	7.5142E-04 7.4572E-04	-21.2	247+2	0.000	100000	9966	359.6
48	151657+8	F.4.	13.3	-2.2	н		595	5.6747E+00	-31-3 7-5	247.8 247.6	0.000	100000	9964 9960	359.5 359.7
49 50	151658.5	F.A.	14.1	-2.3	н	н	.595	5.5253E+00	7-4	248.3	0.000	100300	9960	359.7
51	151859.3	F.A. F.A.	13.1 13.2	-2.1 -1.5	н	н н	• 595 • 595	7.4056E+00 6.7056E+00	8.7 8.3	249.1 248.9	0.000	100000	9962 9959	359.8
	151901.5	. F . A.	13.3	-1.1	н	н	- 595	5.6748E+00	7.5	245.7	0.000	100000	9961	359.8
53	151902.2	F.A. F.A.	13.3 13.3	-1.0	н н	н н	- 595 - 555	6.4946E+00	8.1	248.5	0.000	100000	5961	``359+9'
55	151904.4	F.A.	13.2	-1.4 -1.4	н	- H	.595	5.5778E+00 6.0552E+00	7.5 7.8	248.2 249.5	0.000	100000	9960 9961	359.8 359.8
56	151905.2	F.A.	13.3	-1.5	н	н	. 595	6.0606E+00	7.8	249.3	0.000	100000	9961	359.9
57	151906.6	F.A. _ F.A.	13.2	-1.5 -1.4	н н	н н	•5\$5 •5\$5	5.4558E+00 5.8421E+00	7.4 . 7.7	247.£ 248.4	0.000	100000	9959	360.0
59	151908.1	F. A.	13.2	-1.3	н	н	- 595	5.43C4E+00	7.3	248.4	0.000	100000	9960 9960	360.0 213.1
60 61	151909.6	F.A. F.A.	13.3 13.2	-1.1 -1.2	н Н	н Н	•595 •595	6.9278E+00 5.7202E+00	£.4	248.5 249.3	0.000	100000	9960	+1
62	151911.8	F.A.	13.2	-1.2	н	н н	. 195	6.7520E+00	7.6 E.3	249.3	0.000	100000	9959 9957	+1
63	151912.5	F.A.	13.2	-1.3	۷	v	.595	5.9210E+00	7.7	244.2	0.000	100000	9958	-1 -2
- 64	151913.3 151914.0	F.A. F.A.	12.2 د.13	-1.2 -1.2	v	v v	+ 595	4.7140E+00 4.8754E+00	6.7 6.9	244.4 244.6	0.000	100000 100000	9956	.3
60	151915.5	F.A.	12.3	-1.1	v	v	.595	4-\$261E+00	6.9	243.4	0.000	100000	9954 9954	• 3
67	151916.2	F.A.	13.2	-1.2	v	¥	- 595	5.9873E+00	7.8	244.4	0.000	100000	9954	•5
68 69	151717.7	F.A. F.A.	13.J 13.2	-1.3 -1.3	, ¥	v	- 595 - 595	4.4515E+00 5.3231E+00	6.5 7.3	245.0 243.4	0.000	100000	9951 9950	- 4
70	151919.2	۲.۸.	13.2	-1.3	v	Ý	\$95	5.7957E+00	7.6	243.6	0.000	100000	9951	•4 •5
71	151520.6	F.A.	13.3	-1.0	v	V	* 27 2	5.55958+00	7.5	244.2	0.000	100000	9950	-6
72 73	151921-4 151922-1	F.A.	13.3 12.2	4	v	v	•595 •595	5.2076E+00 5.0653E+00	7.2	244.0 245.0	0.000	100000	9951 9952	• 8 • 9
74	151-23.6	F.A.	15.2	4	v	Ý	. 555	4.7133E+00	a.7	244-0	0.000	100000	9955	.9
76	151924.3 151925.1	F.A. F.A.	13.3	7 -1.1	v	v v	-595 -555	4-5975E+00 6+0345E+00	7.0 7.8	243.6 244.2	0.000	100000	9954	+9
27	151925.8	- F.A.	12.2	-1.4	v	v	• 555	5.5154E+00	7.7	243.6	0.000	100000	9954 9953	.9
78	151926.5	F.4.	12.2	-1.4	V.	V.	- 595	5.1604E+00	7-1	244.2	0.000	100000	9954	1.1
79 50	151927.3	F.A. F.A.	13-1	-1.5	v	V V	•595 •555	5.3982E+00 4.6699E+00	7.3	243.3 244.2	01000 0.000	100000	9958 9961	1.1
				4	•	•						100000	7701	1.2

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KEY TO CODES-

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O NE FLAG 1 FESSIBLY OUTSIDE RANGE GATE 1 FESSIBLY OUTSIDE RANGE GATE 100000 RECESSIVE OPPOLL 10 EXCESSIVE OPPLER 1000000 REC TEPP AUNCRHAL 100 EXCESSIVE OUPPLER 10000000 WARN LUAD TEPP ESTIMATED CLPBINATILNS OF FLAUS CAN CCCUR.

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FIGURE 3. SAMPLE LISTING OF OUTPUT RECORDS

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between the "negative" flight direction and the azimuthal look direction. The positive cross-track angle is defined to the right of the aircraft when looking aft. It is induced by aircraft roll and drift angle. The incident and cross-track angles are precisely computed for any aircraft attitude. The angles enable the investigator to locate the illumination area. The scatterometer transmit polarization and the scatterometer and radiometer receive polarization are presented in the next two columns, respectively. The scatterometer integration time is indicated in the following column. The radiometer integration time is not listed since it is constant (128 milliseconds) regardless of mode or angle. The normalized scattering coefficient (m^2/m^2) is shown in decimal as well as dB units. The radiometer antenna temperature is shown in column 11.

A depolarization factor appears in column 12. The depolarization factor when expressed as a percentage indicates the percent power transmitted at the opposite surface polarization. Whenever DEPOL exceeds 50 per cent a polarization reversal flag is generated under the S/R validation code (column 13) and the complementary depolarization factor (1-DEPOL) is posted in column 12. If a reversal is indicated and the (complementary) depolarization factor is small, the polarization designators in columns 6 and 7 may indeed be regarded in the opposite state. Polarization reversals will frequently occur when observations are conducted from an aircraft roll condition. When DEPOL exceeds 2 per cent a flag in the S/R code is raised.

Other flag conditions can occur under the S/R code. The flags are used as a quick indicator of an abnormal condition. The interpretations of flags are given in a key at the bottom of every double page. The range gate flag is specifically set whenever the aircraft is not within <u>+</u> 300 feet of the range gate setting. On some occasions this condition may be purposely generated to check the scatterometer zeros. A dynamic range flag is set whenever the scatterometer return is above or below the dynamic capability of the scatterometer receiver. If any of the receiver temperatures are not within the proper operating range a flag is set. Whenever the receiver temperature data is missing for long periods of time (data drop out), the receiver temperatures are estimated and a flag is generated. The other keys are self-explanatory. For additional assistance in diagnosing the flagged condition the conversion report may be consulted.

The latter two columns denote aircraft radar altitude and flight direction. Other aircraft parameters are available from the listings of the aircraft mission tape. Not listed but present on the tape is the ambient air temperature at altitude. This latter parameter is available should the investigator wish to use it to estimate the apparent temperature distribution*.

E. Program ICHAR

Program ICHAR maintains a historical tape file of RADSCAT instrument characteristics. The historical file will (eventually) consist of many sets of instrument parameters which have been entered chronologically and labeled numerically. The historical file is maintained to chart the changes in the instrument parameters as may occur through updating, instrument modifications or simply aging. The Conversion Program withdraws an appropriate set of parameters from the historical file and applies the withdrawn parameters to reduce the measurements.

ICHAR performs several useful functions. It will initially establish the file. Once the file has been established it will permit the user to append new sets of characteristics. To assist in the maintenance of the file, ICHAR may be used to print and punch old sets of characteristics. The punched sets may be modified, for example, and submitted to ICHAR as a new set to be appended to file.

F. Program TDUPE

Program TDUPE provides a master duplicate tape of the output tape formed by the Conversion Program for use on other computing machines. The bit conversion problem between machines is avoided by scaling and integerizing all the numerical data before transferring the output data to the duplicate tape. This technique has been successfully applied to tapes prepared by a CDC-6600 and read on a Honeywell 635. The CDC 6600 is a 60 bit machine which performs "ones complement" arithmetic whereas the Honeywell is a 36 bit machine which performs "twos complement" arithmetic. The scale factors may be withdrawn from the listing of TDUPE shown in Figure D-2. Each output file consists of a header label (a flight run), the instrument characteristics applied to the data, and the output data records.

^{*}See for example, Claassen, J. P. and A. K. Fung, "An Efficient Technique for Estimating the Apparent Temperature Distribution," University of Kansas Center for Research, Inc., Technical Report 186–8 , January 1973.

Additional integerized tapes may be prepared from the master duplicate tape by using system utility programs.

G. Special Programs

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In addition to the above production type programs two engineering routines WIDTH and GAIN are included in the reduction package. Program WIDTH computes the equivalent beamwidth when it is presented with the mainbeam antenna pattern. The equivalent beamwidth parameter is essential to the inversion of the scatterometer data. The program GAIN computes the beam solid angle and directivity. The initial factor is important to the inversion of the radiometer measurements whereas the second is required in the inversion of the scatterometer measurements.

Functional representations of the antenna pattern are required by both programs.

IV. OPERATING INSTRUCTIONS

A. Introduction

General operating requirements, preparation of data input files, construction of the job deck, descriptions of the data products, flags and aborts, etc., are treated in this section. It is primarily written for the user having little or no knowledge of the theory and design of the programs. The reader will find that Section II and Section III will be helpful in understanding the contents of this section. Supplementary as well as detailed information on these programs may be found in the Appendices. Sufficient information is intended to permit the user to operate the primary programs CONVERT, OUTPUT, ICHAR and TDUPE. The remaining programs WIDTH and GAIN are engineering routines and should be handled by an engineer (or equivalent) familiar with the RADSCAT antenna. However, it is also strongly advised that a competent engineer, thoroughly familiar with the RADSCAT instrument, be involved in the preparation of the data and in the operation of the primary programs.

System control cards are not specified. It is presumed that this section together with sufficient knowledge of the operating system will dictate the necessary system control cards.

B. Conversion Program (CONVERT)

1. General

This program reduces 50 word input records to 20 word output records. Various computational algorithms described in detail in the Appendices are applied to the input records to yield data products of interest to the investigator. The input records are members of a file having an indefinite number of records. The files are elements of a multi-file tape. Each file is labeled with the entries shown in Table 1. The files are footed with an "end of file" mark. It is anticipated that files (flight runs) from several missions can be stored on a single tape. Tapes of this type are designated Raw Data Tapes.

To initiate processing of any of the files or all of them, <u>processing</u> directives are employed. The directives permit seeking files of certain types and must appear as data cards in the job deck. Each processing directive must be accompanied with a file referral argument to select a set of instrument parameters from the Instrument Characteristics Tape* on which sets of instrument parameters are indexed numerically (and presumably stored chronologically). A set of these parameters is employed by CONVERT to reduce the raw data records. Alternatively, the instrument parameters can be entered from the card reader should the file index be set at zero. Files processed under a particular directive are transferred to the Output Tape. Various processing directives may be applied successively. In each instance the file search is effectively initiated from the beginning of the tape. Processing continues until all directives have been exhausted.

Other types of directives perform <u>service</u> functions. The directive POST permits newly processed files to be appended to an old Output Tape. This directive, when used, must precede all processing directives. The PRINT and PUNCH commands will list and punch, respectively, a set or several consecutive sets of instruments parameters from the Instrument Characteristics Tape. When the PUNCH command is employed, a listing of the set is also generated.

The composition of a CONVERT job deck is illustrated in Figure 4.

2. Preparation of the Raw Data Tape

As mentioned above each file is identified by a header label. The first seven items in the label (Table 1) are integer variables. The integer variables must be right justified. Note that the date requires three words. The sixth and seventh items are appended to the label to assist in selecting the proper <u>subset</u> of instrument characteristics from the set index designated on the processing directive card. See Section IV D for a description of the instrument characteristic files. The frequency is specified in GHz. The feed type is declared in the seventh word and is an alphanumeric word.

Presently two feed types are employed by the RADSCAT instrument. One feed uses a mechanical waveguide switch and the other a ferrite circulator. The abbreviations WG SW and CIRC are recommended as designators. To establish a convention, they should be left justified. The label must be created with an unformatted WRITE statement.

Beneath the header label are a sequence of raw data records each a mixture of real and integer words. The records are blocked by groups of 10 records. The blocks

This tape is physically separate from the Raw Data Tape.

	\wedge	SYSTEM CARDS	
į	M	INSTRUMENT CHARACTERISTICS	
	/	SPECIF	
		FLTLIN	
		PRINT.]
		POST	7
		SYSTEM CARDS	
4		SOURCE OR OBJECT DECK	
Ц 			
		SYSTEM CARDS	
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FIGURE 4. JOB DECK FOR PROGRAM CONVERT

Position	Name	Entry
1	Mission	207
2	Flight	-11
3	Month	7
4	Day	21
5	Year	1972
6	Line	4
7	Run	9
8	Frequency	13.9
9	Feed	WG SW

Table 1 . File Label Entries Illustrated

must be created by unformatted WRITE statements. When insufficient records exist to fill the last block on a file, the remaining records must be filled with 99999.0 (floating point). These entries are used to flag the end of the records (file). In addition an EOF is appended to the foot of the file. As many files as practical may be created on the tape. The end of the files must be flagged with the label END OF REEL which fills the beginning of a nine word array and in effect is another file label.

The files are composed of three record types:

- 1. Normal Calibration
- 2. Baseline Calibration
- 3. Measurements

Calibration records may appear anywhere in the file and as frequently as desired. In a properly constructed file both types of calibrations should appear in the first records. However, should one (or both) type(s) of calibration be missing from the top of the file, the program will search for calibration records deeper in the file. Records bypassed in the search are transferred to a scratch unit for subsequent processing. Once found, the calibration information is extracted and applied to the bypassed records. Records following the calibration records are also treated with the same parameters until new calibration records are encountered. When the calibration information is totally missing or incomplete, the file is bypassed and an appropriate error message is printed.

The entries in the records are shown in Table II. Type and units of the variables are indicated. Parenthetical designators behind some of the entry names describe the computed results stored in those positions during processing. The integer

TABLE II RAW DATA VECTOR

NAME : DATA

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POSITION	ENTRY	TYPE	UNITS
ĩ	TIME	R	HR MIN SEC
2	FREQUENCY INDICATOR	·I	_
3	MODE INDICATOR	Ι	_
4	DATA TYPE INDICATOR	I	
5	ANGLE DESIGNATOR	I	
6	TRANS POL INDICATOR	I	
7	REC POL INDICATOR	I	-
8	SCAT I (OR CONVERTED SCAT)	R	VOLTS
9	SCAT 2	11	11
10	SCAT 3	31	п.
11	SCAT 4	11	u
12	RAD POL INDICATOR	I	
13	RAD (OR CONVERTED RAD)	R	VOLTS
14	SCAT ¹ ANGLE (OR INCID ANGLE)	R	I
15	RAD ANGLE (OR X-TRACK ANGLE)	Ŕ	11
16	RANGE GATE INDICATOR	Ι	-
17	T ₁ , 9.3 DICKE SWITCH	R	VOLTS
18	T ₂ , TRIPLEXER	R	11
19	T_3 , T/R CIRCULATOR	R	11
20	T_{4} , 13.9 DICKE SWITCH	R	n
21	T ₅ , 9.3 TDA	R	n
22	T ₆ , 9.3 WARM LOAD	R	li -
23	T ₇ , 9.3 LIMITER	R	12
24	T ₈ , BRACKET	R	12
25	T ₉ , COMMON T/R GUIDE	R	11
26	T ₁₀ , 11.7 DICKE SWITCH	R	п
27	T11, 13.9 WARM LOAD	R	п
28	T ₁₂ , POLAR SWITCH OR CIRC.	R	11
29	T ₁₃ , SCAT CALIB SWITCH	R	и
30	T 14, 9.3 IMAGE REJECTION FILTER	R	13

TABLE II RAW DATA VECTOR (continued)

NAME : DATA

POSITION	ENTRY	TYPE	UNITS
31	T ₁₅ , BASEPLATE	R	VOLTS
32	T ₁₆ , OMT	R	11
33	T ₁₇ , HOT LOAD	R	VOLTS
34		R	VOLTS
35	V supply FLAC (T MISSING)	R	11
36	FLAG (T ₁₁ MISSING)	1	
37	EMPTY		
38	t1		
39	IL		
40	11		
41	RADAR ALTITUDE	R	` FEET
42	GRD SPEED	R	FT/SEC
43	PITCH	R	DEGREES
44	DRIFT	R	DEGREES
45	ROLL	R	DEGREES
46	AMBIENT AIR TEMP	R	°C
47	FLIGHT DIRECTION	R	DEGREES
48	EMPTY		
49			
50			

indicator variables are defined in Table III. These indicators are employed to cue certain program actions or to index variables and must be right justified. Items 2 through 13 and 16 are extracted from the RADSCAT microwave data channel. Items 17 through 32 are retrieved from the RADSCAT ATM channel. Item 33 is presently entered by hand but may eventually appear on the ATM channel. Items 34 and 35 are presently ignored but may also eventually appear on the ATM channel. Item 36 is presently entered by hand and is used to flag missing temperature data (DATA(17) – DATA(32)). Items 41 to 45 and 47 are provided by the Litton Navigator LTN-51 aboard the C-130. Item 46 is provided by an external sensor aboard the aircraft.

The measurement records must be completed as shown in Table II. However, the calibration records may be abbreviated to include only the data type indicator (DATA(4)) and the calibration entries in the appropriate SCAT and/or in the RAD position. The normal calibration records must be ordered by SCAT channels (one through four) with the normal RAD calibration occurring in the fourth record (containing the SCAT channel 4 calibration). The routine which extracts calibration data will orient itself on the calibration record for SCAT channel 1 in an attempt to meet contingencies where calibration record drop-outs occur. Any number of normal calibration sequences (calibrations on channels one through four in each sequence) may occur successively. All will be averaged. Typically the instrument produces three sequences of normal calibrations. The baseline calibration record simply requires the appropriate RAD baseline calibration in the DATA(13) position (as well as the type indicator in DATA(4)) and may occur anywhere in the file except within a sequence of normal calibrations. It is essential that the baseline and normal calibrations be grouped by three or more consecutive records to assure that a statistically significant average will be established. The program will average consecutive baseline records, even if they are interspersed with sets of normal calibrations. The normal calibrations will also be averaged in this circumstance.

A routine prepared by Langley Research Center actually merges data from several sources to meet the above specifications.

3. Preparation and Use of the Control Cards

There are four types of processing directives and three service directives. The directives consist of a control word and some arguments. All control words are left justified; the arguments are right justified. Sample directives and their formats are defined in Table IV.

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TABLE III. DEFINITION OF INTEGER INDICATOR VARIABLES

•	r	00	1	2	3	4	5	6	
	Frequency Indicator		9.3 GHz	11.4*GHz	13.9 GHz			-	
24	Dete Type	Measurement	Normal Colibration	Base Calibration	<u>ر</u>				
	Angle Designator		· ×	Х .	X	×	×	X	
	Polarization Indicator	Horizontal	Vertical						
	Range Gate	2000 fr.	5000 ft.	10,000 ft.	20,000 ft.				
	Mode Indicator**	R.O.	5.5.	F.A.	A.A.				

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NOT OPERATIONAL

*"R.O. = RADIOMETER ONLY

S.S. = SHORT SCAT

F.A. = FIXED ANGLE

A.A. = ALTERNATING ANGLE

	ARGUMENTS							
CONTROL WORD	MISSION	FLIGHT	LINE	RUN	LINE PRINT MODULUS	ICHAR SET NO.	FILES TO BE PROCESSED	
A6,4X	15	15	15	15	15	15	15	
SPECIF	207	12	2	3	ĩ	2	1	
	208 ·				١			
FLTLIN	208	1	4		5	3	81	
MISFLT	209	4			10	3	10	
ALL					10	2	999	
POST							·	
PRINT						2	ż	
PUNCH						I	ĩ	

TABLE IV. CONTROL CARD OPTIONS ILLUSTRATED

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The control word for the processing directives designates the classification of the file search to be conducted. The search is conducted by comparing the arguments, mission, flight, line and run on the directive with the file labels on the Raw Data Tape. The depth of comparison in the label will depend on the type of processing directive. ALL will process all files on the tape, MISFLT will process all lines and runs under the designated mission and flight, FLTLIN will process all runs from the specified mission, flight, and line. SPECIF will process only a particular file labeled by the specified mission, flight, line and run. When consecutive processing directives are employed, the file search is effectively conducted from the beginning of the tape.

Arguments other than the mission, flight, line and run must also be provided. The sixth word LNPMOD controls the density of records on which reports will be made in the activity report. The use of this parameter will limit the amount of print out acquired during the reduction of records. It will not affect the density of output records.

The set of instrument characteristics (ICU) to be applied to the specified files is designated in the seventh word. The entry specifies the file position on a master tape of characteristics. If a zero is entered, the program will expect instrument parameters to be read from cards appended behind the program control card. When characteristics are read from the card reader, processing is limited to one physical file regardless of the directive. This control option is primarily reserved to test a set of instrument characteristics. See Section IV D for a description of the format required for the instrument characteristics. If 999 is specified, the last set of characteristics on the master (historical) tape will be used.

The last (eighth) entry NFP on the control card specifies the number of files to be processed under the directive. To process all files under the directive simply make NFP sufficiently large.

The special service command POST may be used to position a previously produced output tape to a point behind the last file on the tape. The use of this command will, therefore, permit new files to be appended to an old output tape. This command, when used, must appear before any processing directives. There are no arguments with this directive.

The two service directives PRINT and PUNCH are provided to list and list and punch a designated set of instrument characteristics, respectively. The desired set number is entered in columns 36 through 40 of the directive card. If n-1 sets behind the designated set are to be listed or punched also, NFP should be set to n; otherwise it is set equal to one. NFP appears in column 41 through 45 of the directive card.

4. Peripheral and Memory Requirement

The input and output unit requirements are illustrated in Figure 5. Under a processing directive units 01, 02, 04, 06, 08 are required; under the service directives PRINT or PUNCH units 04, 06, and 43 are required. Unit 08 is a scratch unit, either disc or tape, perferably disc. It is used to temporarily store bypassed records when it is necessary to search for calibration data.

Approximately 17000 decimal words of memory were required to load this program on a CDC-6600 to include buffer space and system routines.

5. Flags and Aborts

The activity report produced by the program conveys various messages to indicate the status of the processing. It is normal for the program to echo check the directives, to list the progress on the processing, and to indicate a normal termination. The Conversion Report will also make regular statements reflecting the progress of the processing and the quality of the measurements. A sample listing of the Conversion Report is shown in Figure 2 of Section III. In some instances however, improper use of the program or construction of the data will result in an error message or an abort.

When an abort condition is encountered, an error message is generated, an abort code is given, an end of file mark is appended to the output tape on unit 02, an END OF REEL statement is appended, and control is yielded to the system. Table V defines the various abort conditions. When invalid data records are encountered, an error message will identify the improper element and the entire record will be dumped in octal. The message will appear within the Conversion Report. When more than 10 bad records are encountered in a file, the remaining records in the file are bypassed and processing is directed to the next internal activity. When more than three bad files are encountered the processing is aborted.

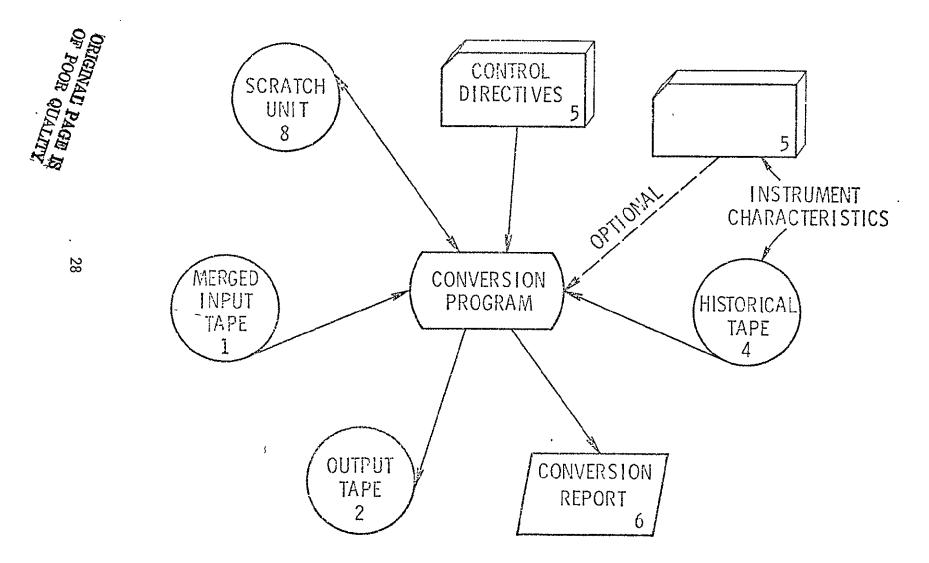


FIGURE 5. PERIPHERAL REQUIREMENTS FOR THE PROGRAM CONVERT

	Table V. Definition of Abort Codes
UD	= Unrecognized Directive
IC	= Instrument Characteristic Missing
MF	= <u>M</u> issing Raw Data <u>F</u> ile
FF	= Unable to Find Instrument Characteristics
	with the Feed and Frequency Designated
ER	= Too Many File <u>Err</u> ors
NFP	= NFP less than 1

6. Description of the Data Products

Normally two data products are generated by CONVERT, an activity report and an output tape. When the PUNCH option is employed a set or sets of punched instrument parameters can also occur. The character of the punched output is identical to that described in Section III D. The activity report reflects the program progress and largely contains items in the Conversion Report. See Figure 2 of Section III for an illustration of the Conversion Report. The Output Tape, however, will be described.

The output file structure is similar to that of the input raw data files. The file consists of the file label and blocks of output records. However, occurring between the label and output record blocks is the set of instrument parameters that had been used to process the input records. The entries in the file label are the same as that for the input files shown in Table I. The label and instrument parameters are created with separate unformatted WRITE statements. The entries in the instrument characteristics are described in Section III D. The output records occurring beneath the instrument parameters are blocked in 20 records groups. Each block is created with a binary WRITE statement. The elements in the output records consist of mixed integer and floating point entries. The entries are defined in Table VI. When insufficient records exist to fill the the last block in the file, the remaining entries are filled with integer zeros. An "end of file" mark is created after the last block in the file.

When all directives have been exhausted or the program aborted an "end of reel" statement is appended behind the last output file.

TABLE VI OUTPUT DATA VECTOR

POSITION	ENTRY	TYPE	UNITS
1.	TIME	R	HR, MIN, SEC
2.	MODE	Ι	
3.	INCIDENCE ANGLE	R	DEGREES
4.	CROSS TRACK ANGLE	R	DEGREES
5.	TRANSMIT POLARIZATION	I	
6.	RECEIVE POLARIZATION	I	—
7.	SCAT INTEGRATION TIME	۲R	SECONDS
8.	NORMALIZE SCATTERING COEF.	R	M^2/M^2
9.	NORMALIZE SCATTERING COEF.	R	dB
10.	ANTENNA TEMPERATURE	R	DEGREES KELVIN
11.	DEPOLARIZATION FACTOR	R	-
12.	DATA VALIDATION CODE	Ι	
13.	ALTITUDE		FEET
14.	FLIGHT DIRECTION		DEGREES wrf TRUE NORTH
15.	AMBIENT AIR TEMP		DEGREES KELVIN
16-20.	EMPTY		

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C. Output Program

1. General

The Output Program simply lists the output records prepared by program CONVERT. The output listings are organized by files which are selected by external directives similar to those described for the Conversion Program. A sample of a listing is illustrated in Figure 3 of Section III. The file heading together with instrument characteristic identifiers compose the page heading. Beneath the heading are listed 80 record images; each image consists of the first fourteen entries in an output record as defined in Table VI. The fifteenth entry is not printed but is available on tape should the investigator choose to use it to further reduce the radiometer data. Each line of print-out is appended with the record number. The record number corresponds to those used in the Conversion Report. The 80 records are intended to fill two consecutive pages of print-out where the page size is 8-1/2" by 15". Appended to the foot of each double page is a key defining the S/R validation code in column 13.

The instrument characteristics although present on the output tape are not listed. The set which has produced the data is identified in the heading on the right by the set number and date. No option is provided to print the characteristics.

The job deck for the program OUTPUT is organized identically to the conversion program (however, no instrument characteristics must appear in the data deck). File types are selected from the output by proper use of the directives:

- 1. ALL
- 2. MISFLT
- 3. FLTLIN
- 4. SPECIF

The meaning and use of these directives have been presented in Sections III B.1 and III B.2. The format of these control cards is identical to those described above. In the argument field of the control card the appropriate file identifiers must be present. No provision is made to limit the number of files to be processed, nor can the record density be controlled through a line print modulus. It is, of course, meaningless to specify the instrument characteristics ICU.

2. Program Messages

In addition to listing the output file, OUTPUT will keep the user posted on its internal activity as it searches for the specified files. The directive is initially echo checked, bypassed files are identified and the user is notified when the reel is encountered. Unrecognized directives will terminate the processing.

3. Peripheral and Memory Requirement

Peripheral requirements are illustrated in Figure 6. The program required approximately 7000 decimal words of memory on a CDC 6600 to include buffer space and system routines.

D. Program ICHAR

1. General

The primary purpose of program ICHAR is to maintain a file of instrument characteristics. The file is maintained not only to serve as a source of parameters to reduce raw data records but also to serve as a history of the changes undergone by the RADSCAT instrument. The file can consist of many sets of instrument parameters which are appended to the file numerically. The user may also identify the set by a date which is entered with the parameters.

Each set of instrument characteristics can consist of four subsets. The four subsets permit characterizing the instrument for a combination of two feeds and two frequencies. Each subset is composed of a set of radiometer parameters and a set of scatterometer parameters. The subsets are identified by feed and frequency. These identifiers are used by the Conversion Program to select the appropriate subset of characteristics.

This file maintenance program is operated by means of external control cards. Four directive (processing) options are offered:

- 1. INITIALIZE
- 2. APPEND
- 3. PRINT
- 4. PUNCH

They must be left justified and occupy columns 1 through 10 of the control card. INITIALIZE will create the historical file by storing the first set of characteristics on the tape. The set must appear behind the control card. APPEND will permit other sets to be added to the existing historical file. The characteristics set to be appended must appear behind the APPEND command card. When several sets are added at one operation, each set must be led by an APPEND card and intervening PRINT or PUNCH commands are not permitted. When sets are appended to the file, the old sets are transferred from the old tape to a new tape and the new sets are then

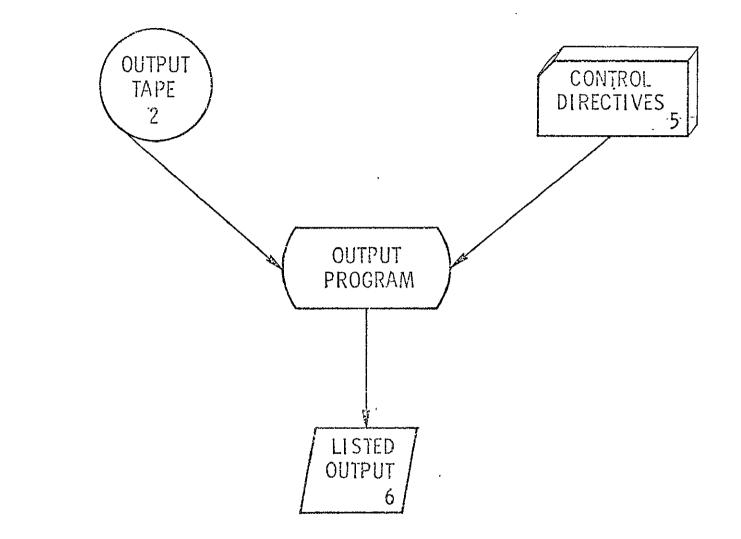


FIGURE 6. PERIPHERAL REQUIREMENTS FOR THE PROGRAM OUTPUT

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added to the new tape. Before appending a new set of characteristics, it is advisable to have tested them in the Conversion Program by entering them from the card reader.

The PRINT and PUNCH commands perform the same service as they do in the Conversion Program. However, one command must be used for each set to be printed or punched. The set to be printed or punched must be specified on the control card' in columns 11 through 15. The set number must be right justified. A listing accompanies the punched output. The PRINT or PUNCH may preceed or follow a set of APPEND commands but must not intermingle with them. These commands are provided so that new sets may be formed easily from old sets of characteristics.

A sample deck is illustrated in Figure 7.

2. Preparation of the Instrument Characteristics

The instrument parameters cards must be prepared in groups of four subsets. When insufficient data exists to complete one of the subsets, a complete subset may be repeated an appropriate number of times to fill the requirement. A sample subset is shown in Figure 8.' The lines actually represent card images (except for the word SET). The entries in the upper half are radiometer parameters whereas the entries in the lower half are scatterometer parameters. This subset would be used for measurements taken at 13.9 GHz with a waveguide switch (WG SW) as the polarization switch. The radiometer and scatterometer parameters are identified with the set number of which it is a member and with a date of entry (origin). The first line of radiometer or scatterometer parameters must be punched with the format 415, 10X, E10.3, A10, E10.3 whereas the remaining lines must be punched according to the format 7E10.3. Excluding the set number and date, the radiometer parameters array consist of 75 words and the scatterometer parameter array consists of 85 words. Not all words are necessarily filled.

The entries in the radiometer and scatterometer arrays are defined in Tables VII and VIII, respectively. Many of the entries can be clarified by referring to a description of the reduction algorithms in the Appendices. These algorithms have been developed from the transfer and calibration characteristics of the RADSCAT instrument. As a consequence the entries may change (and perhaps the program algorithms) when the instrument is modified. Many of the entries must be based on special calibrations and measurements. Explanations are required for some of the

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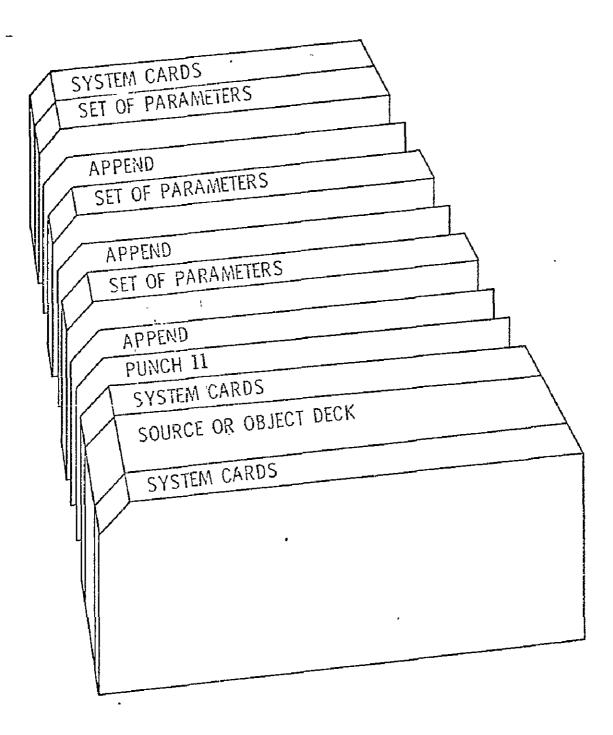


FIGURE 7. JOB DECK FOR PROGRAM ICHAR

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SET 1 DATE	10 23 72	1.3900E+10	WG SW	0.		
Û.	3.9900E+02	1.05406+00	1.99506+02	4.0000E-01	8.00006-02	9.0000L-02
1.0200E-02	1.0150E-02	6.0000E-02	6.00000-02	0_	0.	-0.
-0.	1.2800E-01	1.0000E-01	3.2500E+02	3.0500F+02	-A./800F+00	7.9924E+0]
-8.78005.00	7.9871E+01	-8.7800E+00	7.9169E+01	-8.7800E+00	7.88/9F+01	-8,7800E+U0
7.9476E+01	-8.7800E+00	7.8730E+01	-8.7800F+00	7.9415E+01	-8.78001+00	7.9704E+01
-8.7800E+00	7.9388E+01	-8.7800E+00	7.9889E+01	-8,7800E+00	8.0178F+01	-8,7800E+00
7.8826E+01	-8.7800E+00	7.9757E+01	-8.7800E+00	7.9309E+01	-8.7800E+00	7.9573E+01
-3.7800E+00	7.93796+01	1.0000F+00	-2.7318E+02	-0.	-0.	-0. ,
-0.	-0.	-0.	-0.	-0	-0.	~ 0 .
-0.	-0.	-0.	-0.	-0.	-0.	-0.
-0.	-0.					
SET 1 DATE	10 23 72	1.3900E+10	¥G SW	1.0000E-01	•	
5.8000E-01	5.9500E-01	6.3700E-01	7.0700E-01	8.0200E-01	9.2400E-01	3.0000E-01
3.7568F-01	3.7916E-01	0.	0.	4,9753E-01	5.02136-01	2.0893E-07
1.0000£+00	1.0000E-02	3,1623E-04	3.1623E-05	-A.0000E+03	3.>000F+03	2.50008+02
1.4125E+04	1.4125E+04	1.4000E+00	1.0500E+01	1.4000E-01	-6.3400F+00	5.0000E+01
2.2514E-01	2.25146-02	0.	0.	4.6000E-02	7.1000F-02	9.6000E-02
1.3000E-01	1.6500E-01	2.1300E-01	2.6200E-01	2.9600E-01	3.U000E-01	6.4200E-Ul
5.15002-01	6.0000E-01	7.6900E-01	8.8500E-01	1.0000E+00	1.1730E+00	1.3460E+U0
1.3460F+00	1.3460E+00	1,2500E+00	1.1540E+00	1.0960E+00	1*0390E+00	1.01906+00
1-00006+00	1.0560£+00	1.1120E+00	1-2170E+00	1.3230E+00	1.3730E+00	1.4230E+00
1.4950£+00	1.5380E+00	1.4420E+00	1.3460E+00	1.1570E+00	9.09006-01	7.6000E-V1
5.50002-01	4.2)00E-01	2.9200E-01	2-3300E-01	1.7300E-01	1.++400E-01	1.1500E-01
1.0000E-01	8.5000E-02	-0.	-0.	-0.		

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FIGURE 8. SAMPLE OF INSTRUMENT CHARACTERISTICS

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TABLE VII RADIOMETER PARAMETERS

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VARIABLE NAME : RPAR

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POSITION	ENTRY			TYPE	UNITS
1	FREQUENCY			R	GHZ
2	FEED (WG SW OR CIRC)			А	UNITLESS
3	CROSS FEED CONSTANT		^ξ HV	R	
4	17 U		ξ _{VH}	R	п
5	HOT LOAD REFERENCE CON	ST	σ	R	°К
6	WARM LOAD REFERENCE CO	NST	σ ₂	R	11
7	HOT LOAD BIAS FACTOR		σ	R	13
8	WARM LOAD BIAS FACTOR		σ ₄	R	UNITLESS
9	SWITCH COMPENSATION FA	CTOR	^р ін	R	UNITLESS
10	n n	15	ρ IV	R	II
11	OMT "	11	^р 2Н	R	11
12	, ¹⁸ ,	11	^ρ 2∨	R	11
13	CUTLER FEED ''	n ,	^р 3Н	R	21
14	31 3L	18	^ρ 3V	R	11
15 `	INPUT GUIDE "	- £1	^р 4Н	R	21
16		•	ρ _{4V}	R	11
17	RESIDUAL	11	ρ _{5Η}	R	
18	и ,		₽ ₅ ∨	R	
19	MEASUREMENT PERIOD		τ	R	SEC
20	CALIBRATION PERIOD		τC	R	SEC
21	UPPER TEMP LIMIT		UP	R	°K
22	LOWER TEMP LIMIT		LOW	R	°K
23	THERMISTOR CONVERSION	FACTOR	α	R	°C/VOLT
24	\$1 BT	11	q ۲	R	°C
25	11 IL -	17	α' 2	R	°C/VOLT
26	16 21	12	β2	R	°C
27	11 23	£1	α	R	°C/VOLT ·
28	13 ' 21	IC	β ₃	R	о́С
29	lt II	31	β α β β β α 4 β 4	R	°C °C/VOLT °C
30	11 II	11	β	R	°C
	37		- 1		

TABLE VII RADIOMETER PARAMETERS (continued)

	- -
POSITION ENTRY	TYPE UNITS
31 THERMISTOR CONVERSION FACT	$COR \simeq_5 F6.2 °C/VOLT$
32 ⁿ " "	β ₅ " °C
33 u u'u	α ₆ " ^o C/VOLT
34 , " , " "	
35	α <mark>7</mark> " [°] C/VOLT
· 36 II II II II	β ₇ " [°] C
37 ม ม ม	α ₈ " [°] C/VOLT
38 ม เร ม	β ₈ " [°] C [°]
39 и и в	α ₉ " [°] C/VOLT
40 " " "	β ₉ " ^ο C ⁽
4] n n n·	α ₁₀ " °C/VOLT
42 " " "	^β 10 ^β C
43 ^{II} ^{II} ^{II}	α ₁₁ " °C/VOLT
44 u u u	β ₁₁ " °C
45 ¹¹ ¹¹ ¹¹	
46 u n u	β ₁₂ ". °C
47 n n	α_{13}^{α} " °C/VOLT
48	^β 13 [°] C
49 u u u	α ₁₄ " °C/VOLT
50 ", "	β ₁₄ " °C
51 " " "	^{.α} .15 " °C/VOLŢ
52 u u u	ві <u>я</u> " °С [*]
53 u ii ii	α ₁₆ " °C/VOLT
54 ⁻ u u u	β ¹⁰ " ^ο C
55 ¹¹ 11 11	α ₁₇ " [°] C/VOLT
56 u u u	^α 16 " [°] C/VOLT ^β 16 " [°] C ^α 17 " [°] C/VOLT ^β 17 [°] C
57 EMPTY	, 17
• •	

75 EMPTY

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38

TABLE VIII SCATTEROMETER PARAMETERS

.

POSITION	ENTRY		TYPE	UNITS
1	FREQ		R	' HZ
2	FEED (WG SW OR CIRC)		А	
3	CALIBRATION PERIOD	С	R	SEC
4	INT. TIME #1	1	R	п
5	INT. TIME #2	2	R	n
6	INT. TIME #3	3	R	11
7	INT. TIME #4	4	R	81.
8	INT. TIME #5	5	R	11
9	INT. TIME #6	6	R	ri
10	SHORT SCAT INT TIME	7	R	13
11	TRANSFER FUNCTION	G _{HT}	R	
12	11 11	G _{VT}	R	
13	n n	G _{VHT}	R	
14	11 18	G _{H∨T}	R	-
15	16 11	G _{HR}	R.	-
16	<u>.</u> 11 14	G _{VR}	R	
17	11 11	G _C	R	
18	CAL ATTN CHAN 1	A	R	
19	ⁿ ⁿ 2	A _ż	R	—
20	" " 3 ·	A ₁ A ₂ A ₃ A ₄	R	
21	¹¹ ¹¹ 4	A_4	R	
22	FILTER LOWER LIMIT (NEG)		R	HZ
23	FILTER UPPER LIMIT (POS)		R	HZ
24	FILTER RESOLUTION		R	HZ
25	ANT GAIN H	Г _Н	R	
26	ANT GAIN V	r,	R	—
27	CHAN #1 SATURATION LEVEL	v	R	VOLTS
28	EMPTY			
29	MINIMUM SQUARE LAW LEVEL FOR ALL CHANNELS		R	VOLTS
30	ANGLE CONVERSION FACTOR		Ř	DEG/VOLT

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TABLE VIII SCATTEROMETER PARAMETERS (continued)

POSITION	ENTRY		TYPE	UNITS
31	ANGLE CORRECTION FAC	CTOR*	R	DEG.
32	EQUIVALENT BEAMWIDTH	Η θeq	R	radians
33	EQUIVALENT BEAMWIDTH	V θeq	R	11
34	EMPTY	·		
35	II			—
36	11			
37	11			lainann
38	RELATIVE FILTER GAIN,	f= 3000	R	—
39	11	f= 2750	R	
40	и	f= 2500	R	_
41	11	f= 2250	R	
42	11	f= 2000	R	
43	н	f= 1750	R .	
44	31	f= 1500	R	
45	11	f= 1250	R	
46	12	f= 1000	R	—
47	31	f= 750	R	
48	11	f= 500	R	
49	11	f= 250 .	R	
50	*	f= 0	R	
51	17	f= -250	R	
52	81	f= - 500	R	·
53	н	f= - 750	R	
54	17	f=-1000	R	
55	н .	f=-1250	R	
56	11	f=-1500	R	
57	н	f=-1750	R	>
58	11	f=-2000	R	
59	11	f=-2250	R	-
60	11	f=-2500	R	
				-

*Includes relative pitch between aircraft frame and antenna gimbal.

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TABLE VIII SCATTEROMETER PARAMETERS (continued)

POSITION	ENTRY		TYPE	UNITS
		6 0750	0	
61	RELATIVE FILTER GAIN,	f⊐-2750	R	
62 `	,II	f=-3000	Ŕ	
63	17	f=-3250	R	
64	n	f≕-3500	R	
65	π	f=-3750	R	
66	11	f=-4000	R	
67	11	f=-4250	R	
68	11	f=-4500	R	
69	н	f=-4750	R	 -
70	\$1	f=-5000	R	
71	n	f=-5250	R	
72	ti	f=-5500	R	—
73	н	f=-5750	R	. —
74	И	f=-6000	R	
75	11 .	f=-6250	R	
76	п	f=-6500	R	
77	н ,	f= - 6750	R	
78	н	f=-7000	' R	
79	н	f=-7250	R	
80	11 ,	f=-7500	R	
[.] 81	u	f=-7750	R	
82	11	f=-8000	R	-
83	`EMPTY			
84	11			

85 "

41

.

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entries. The thermistor conversion factors in RPAR(23) through RPAR(56) convert the thermistor voltages in DATA(17) through DATA(33) to temperature in centigrade (see Table II). A sampled representation of the scatterometer doppler filter frequency characteristic appears in SPAR(34) through SPAR(85). The sample frequency interval is designated in SPAR(24) and the frequency domain of the doppler filter is specified in SPAR(22) and SPAR(23).

3. Peripheral and Memory Requirements

The peripheral requirements are illustrated in Figure 9. To load the program required approximately 10,000 decimal words of memory on a CDC-6600 to include buffer space and system routines.

E. Program TDUPE

Program TDUPE scales and integerizes output files prepared by program CONVERT and transfers the result to another tape. The resulting tape serves as a master tape which may be duplicated and sent to the investigator for use on another type of computing machine.

The scaling and transferring of an output tape is implemented by an external control card appended to the source or object deck. The card simply states the files by mission and flight which are to be transferred. The control card requires a 2110 format. The input files must be located on tape unit 01. The specified file types are transferred to a tape on unit 02. An activity report, stating the status on the transfers, is generated. The program requires approximately 8000 decimal words on a CDC-6600. The peripheral requirements are illustrated in Figure 10.

F.- Special Programs

Several engineering application programs are provided to compute and/or verify certain antenna parameters employed in the instrument parameters. Program WIDTH computes the equivalent pencil beamwidth, an important parameter to the inversion of the scatterometer data (SPAR(32) and SPAR(33)). The program GAIN computes the antenna gains SPAR(25) and SPAR(26) and the beam solid angle.

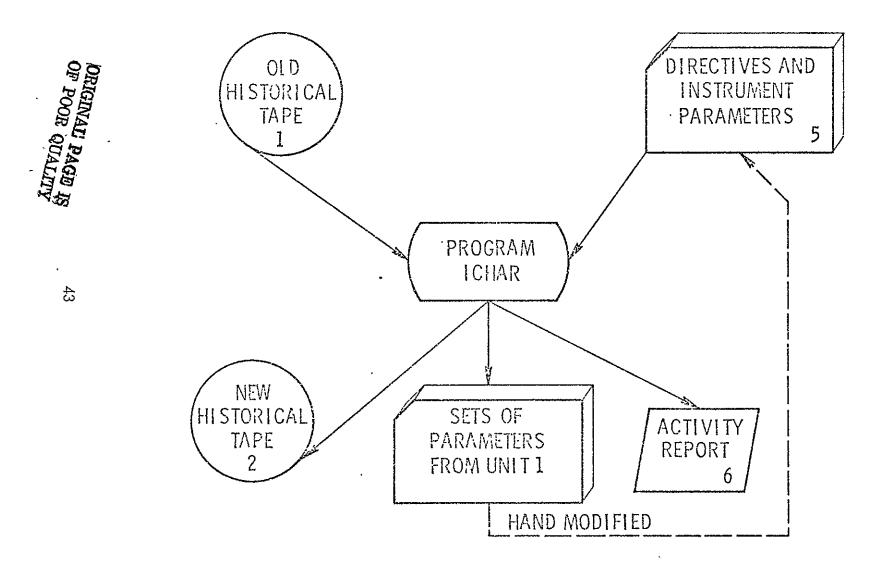


FIGURE 9. PERIPHERAL REQUIREMENTS FOR PROGRAM ICHAR

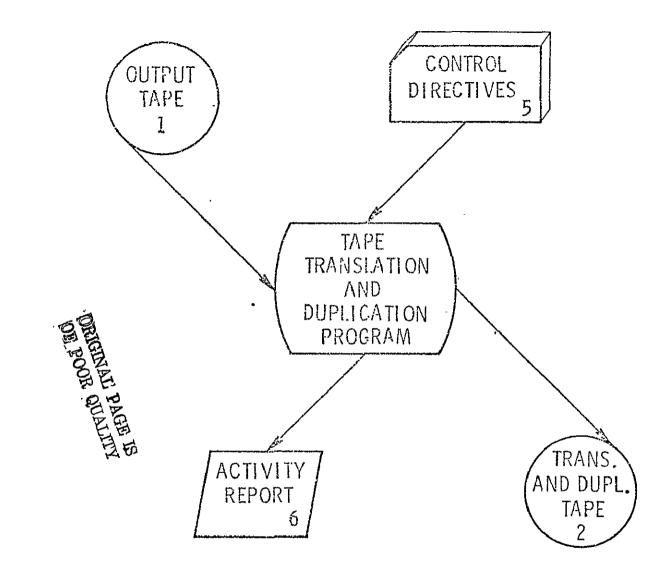


FIGURE 10. PERIPHERAL REQUIREMENTS FOR PROGRAM TDUPE

Program WIDTH is self sufficient when antenna pattern information is provided in the FUNCTION subroutine FUN. Presently functional representations of the main beam out to 6 degrees from boresight are provided. This routine may be replaced by a sampled version of the main beam. However, interpolation between sampled values must be provided since a double integration routine requires values dictated by the Gaussian Legendre quadrature technique.

Program GAIN requires both polarized and cross polarized power patterns. Functional representations of the polarized pattern is now given in FUN1 and the cross polarized pattern in FUN2. These may be replaced with sampled valued representation, if desired. Again, interpolation will be required.

For more specific information see Appendix E.

APPENDICES

APPENDIX A

CONVERSION PROGRAM

I. INTRODUCTION

The conversion program (CONVERT) applies many reduction algorithms to the raw RADSCAT data to provide the investigator with a set of comprehensive data products with which to interpret the scattering and emission characteristics of the scene represented by the data. CONVERT consists of the Control Section and the following subroutines:

IREAD	7.	CALIB
READI	8.	RCONV
WRITE2	9.	ANGLE
ABORT	10.	DOPCHK
SEARCH	11.	SCONV
CRUNCH	12.	THERMO
	IREAD READ 1 WRITE2 ABORT SEARCH CRUNCH	READ1 8. WRITE2 9. ABORT 10. SEARCH 11.

The theory and design of these routines are treated in this appendix.

II. GENERAL OVERVIEW

The Control Section reads and interprets external directives. On the basis of the directive, the appropriate files are retrieved and presented to the processing subroutines. Subroutine SEARCH executes entry into the data records of the file in search of the appropriate calibration records. When found, the calibration information is extracted and averaged in subroutine CALIB. When sufficient calibration data cannot be found, the file is bypassed. The actual processing is performed by subroutine CRUNCH which applies various algorithms and calibration information to reduce the data. Many of the algorithms are embodied in subroutines, bearing descriptive names, which are called from CRUNCH.

Subroutine ANGLE computes the incident and cross-track angles using aircraft attitude and look angle information. Subroutine THERMO checks internal

receiver temperatures. The antenna temperature is computed in RCONV using the transfer function of the RADSCAT radiometer, the temperatures developed in THERMO and RAD calibration parameters. When scatterometer data is present, the maximum on-scale measurement is selected from the four SCAT channels with an in-line routine in CRUNCH. Using aircraft ground speed, DOPCHK computes the doppler shift in the scatterometer signal. The doppler filter gain is chosen accordingly. The scatterometer normalized input power. An in-line routine in CRUNCH applies antenna inversion parameters to the input power to compute the normalized scattering coefficient.

When additional calibration records are encountered, the old calibration information is replaced by the new calibration information by subroutine CALIB.

Subroutine IREAD and READ1 perform the file read functions, whereas subroutine WRITE2 performs the write functions.

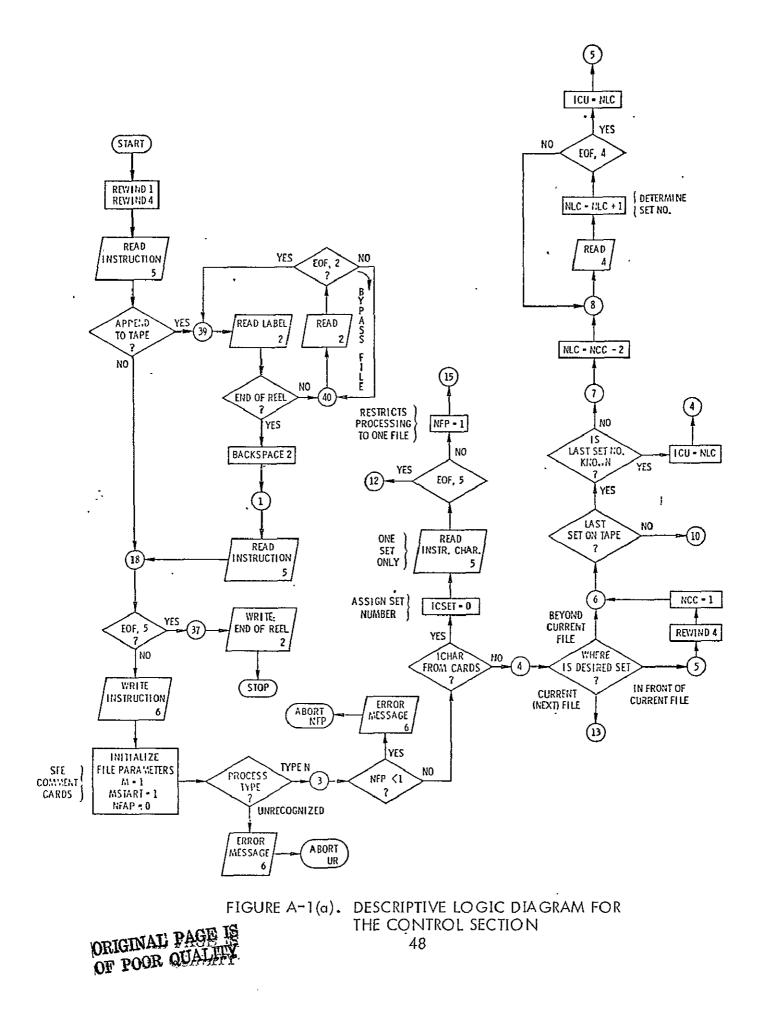
Subroutine ABORT is employed by the CONTROL Section to abort the job when an abnormal condition is encountered.

III. CONTROL SECTION

A. Theory and Design

The control section was developed to give the user a large amount of flexibility in the choice of the instruments characteristics and the files to be processed. As many or as few files of a particular type can be processed. Some files can be treated with one set of instrument characteristics and others with another. These features permit the user to (1) test a set instrument parameters, (2) group the files by type, (3) process different types of files with different instrument parameters, (4) etc. The flexibility in the choice of parameters was incorporated with the full realization that the instrument would undergo modifications.

Control of the program is executed by the choice of appropriate directives entered as data cards. The types of controls have already been discussed in Section II and III of the text and will not be treated here again. The method by which control cards are read and files are retrieved is shown in the logic diagram of Figure A-1.



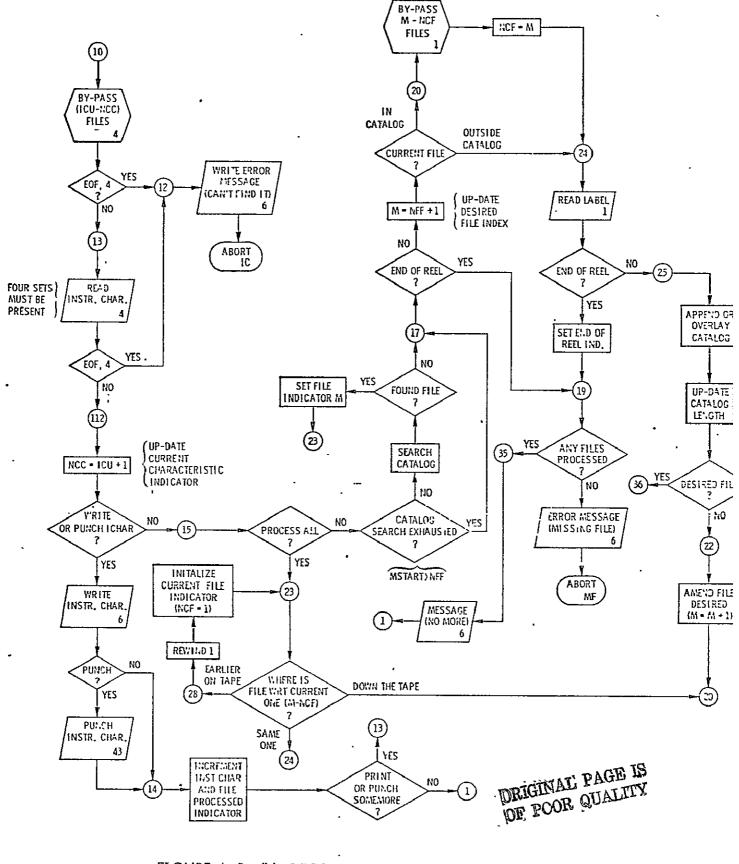


FIGURE A-1. (b) DESCRIPTIVE LOGIC DIAGRAM FOR FOR THE CONTROL SECTION

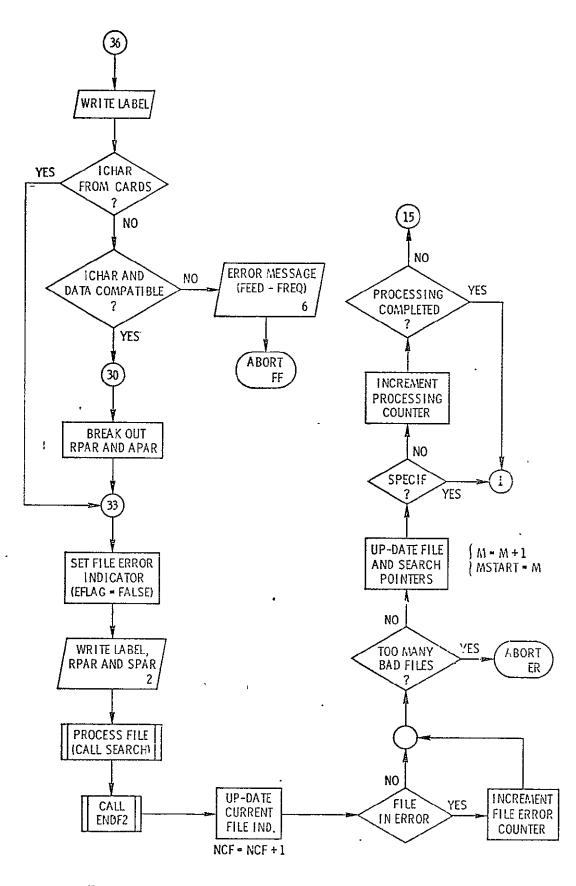


FIGURE A-1. (c) DESCRIPTIVE LOGIC DIAGRAM FOR THE CONTROL SECTION

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ORIGINAL PAGE IN OF POOR QUALITY

The numbers on the connecting points coincide with the statement numbers of the text shown in Figure A-2.

An instruction is read from the card reader. If it is POST, the files on an old output tape are bypassed in statements between 39 and 1 of the diagram. Another instruction is then read. The instruction is echo checked, file parameters are initialized and in the subsequent blocks of Figure A-1, the processing type is identified. Thereafter the specified instrument characteristic is read from unit 04 or 05. If the last set of characteristics on a file code 04 is desired and its file number is not known (ICU=999), the last file number is determined in statements between 6 and 5. If, on the other hand, they are to be read from cards (ICU=0), the appropriate action is taken and control is advanced to statement 15. If a specific file is designated, an appropriate number of files is bypassed until tape unit 04 is positioned on the correct file (see steps between statements 10 and 13).

If the set is to be punched or printed, the appropriate action is taken in steps preceeding statement 14. If NFP>1, NFP-1 subsequent sets are also punched or printed. (See steps between 112 and 13). When completed, the next control card is read.

When the control card is a processing directive, the instrument characteristic tape will have been positioned to the correct file (set of parameters) or the set will have been entered from cards. Steps following 15 search for the appropriate data file. The search is governed by the type of directive. Bypassed files are cataloged in steps between 25 and 22. If the desired file is in the catalog and the current file is strictly in the catalog, the appropriate number of files are bypassed in steps between 22 and 24. If the file is beyond the catalog, the catalog'is updated as the program advances the tape in search of the file.

Once found, the file label is listed and the appropriate subset of instrument parameters is withdrawn from tape if they weren't entered from the reader. SEARCH is then called to find the calibration data. SEARCH in turn calls CRUNCH to process the measurement records. Once completed control returns to the Control Section where additional files are sought or another directive is read.

B. Program Listing

The Control Section Listing is shown in Figures A-2(a) through A-2(e). The variables are defined in the listing.

* 6665	TAPE5=	CCNVERT (INPUT,OUTPUT,PUNCH, TAFE1,TAPE2,TAPE4,TAPE8, INPUT,TAPEG=OUTPUT,TAPE43=PUNCH) CCNVERSICN CENTROL SECTION	00000004 00000004
C C		THIS PREGRAM WAS PREPAKED BY	CC000010 0C000011
č			C0000012
C		JCHN P. CLAASSEN	00000013
C C		GLEN E. ELLIOTT	00000014 00000015
C,		UNIVERSITY OF KANSAS CENTER FOR RESEARCH	CC000016
C			0000017
C C		PROGRAM DESCRIPTION.	00000028
č			00000030
ç			((000031
C C		01 INPLT RAW DATA. 02 LUTPUT PROCESSED DATA.	06000032
C		04 INPUT INSTRUMENT CHARACTERISTICS FILE.	00000034
с с		05 SYSTEM INPUT - DIRECTIVE CARDS.	00000035
Č		OF SYSTEM CUTPUT - PRINT LINES. " OB SCRATCH FILE - USED BY CCHPUTATION SECTION.	00000037
C		43 SYSTEM GUTPUT - PUNCHED CARDS.	0000038
с с		VARIABLE NAMES LSED.	CC0000039 CC00C040
č			C0000041
c	ԼՅԼТԵԼ	*LABEL TABLE*. TABLE CONTAINING	CC060042 C0000043
C C		LABEL INFORMATION (MISSION, FLIGHT, LINE, RUN) FOR ALL LATA FILES BYPASSED SO FAR.	00000044
Ċ Ĩ			0000045
C C	NWPST	≠NEW POSITION.≠ ARRAY CONTAINING LAUEL INFO (M,F,L,R) OF NEXT FILE TO BE PROCESSEC.	00000046 CG000047
c		or NEXT FILE TO DE PROCESSED.	0000048
<u>č</u>	NCF	≠NUMBER OF CURRENT FILS.≠ POSITICN POINTER FOR	C0000049
с с		FILE CODE Q1.	00000050 C0000051
č.	NFF	≠NUMBER OF FINAL FILE.≠ INDEX OF LAST ENTRY IN	CC000052
C C		≠LBLT0L≠ TABLE.	00000053 CC000054
c	NSTART	STARTING POINT FOR SEARCH IN #LBLTBL# TABLE.	00000055
С	•		CC00C056
		INPUT FILE TO LSE. RELATIVE POSITIION ON FILE CODE 01.	CC000057
, c' c , c , c	EOKI	#END OF REEL INDICATOR.# LOGICAL VARIABLE, SET TRUE WHEN END OF REEL ON FILE CODE OI IS DETECTED, INCICATING #LBLTBL# MABLE#IS COMPLETE.'	CC000059 CC0C0000 C0000061 (CC0C062
С	I EOR	INTEGER ARRAY CONTAINING WORDS FEND OF REELF.	00000063
C C	IPTYPE	INTEGER #PROCESSING TYPE# ARRAY, CONTAINING RECOGNIZED	CCO000064 CO000065
Ç		PROCESSING TYPES.	0000066
C C	JPTYPE	INPUT DESIRED PROCESSING TYPE.	CC000067 C000068
с,			6900003
C C	N	INCEX OF POSITION OF ≠JPTYPE≠ IN ≠IPTYPE≠.	COOR0070 COC00071
č	ICu	≠INSTRUMENT CHARACTERISTICS TO USE¥. NJMBER UF THE I.C.	
с с		SET TO BE USED. REFLECTS THE POSITION OF THE SET ON	CC000073 C000C074
Č	•	FILE CCCE 04. O INDICATES I.C. TO BE READ FRCM CARDS (FC=05);	CC0000075
c		559 MEANS USE THE LAST SET ON FILE 04.	{CGOCC76
C C	NCC	≠NUMBER OF CURRENT CHARACTERISTICS≠. REFLECTS POSITION (CC00C077 CCC00C078
С		FILE CODE 04.	CCCC0079
C C	NLC	#NUMBER OF LAST CHARACTERISTIC#. USED WHEN ICU=559.	00000080
c		NLC=0 INDICATES THIS VALUE IS YET UNKNOWN.	00000082
C C	RPAR	#RACICMETER PARAMETERS≠ .	COOOOO63 COOOO084
C C	SPAR	≠SLATERCMETER PARAMETERS≠.	C0000085
C		≠PARAMETERS≠ ARRAY CONTAINING UP TP 4 SETS OF RACSCAT	0000086
	_PAK	INSTR PARAMETERS READ FRCH FILE CCCE 04 OR 05. RAC	CC000087 (C0C0C68
C		PARAMETERS COMPOSE THE FIRST 75 ENTRIES OF PAR AND SCAT	00000089
C C		PARAMETERS OCCUPY THE NEXT 85 ENTRIES IN EACH SUBSET. THE APPROPRIATE SUBSET OF PARAMETERS IS SELECTED ON THE	CCOCCO90 00000091
C ´		BASIS OF FREQUENCY AND FEED.	C0000092
· · · · · · · · · · · · · · · · · · ·		#NUMBER OF FILES TO PROCESS# USING THE PROCESSING TYPE	00000093
ι C	NFP	LIVEN BY #JPTYPE# AND DESCRIPTION IN #N#PST#.	00000094 00000095
С		NFP IS IGNORED IF JTYPE = SPECIF. IF ICU = 0,	00000096
C C		NEP IS SET TO 1.	CC000057 CC000048
C	NFAP	#NUMBER OF FILES ALREADY PRUCESSED.# COMPARED TO #NFP#	0000099
C C		TO CHECK FOR TERMINATE CONCITICA.	C0000100 CC000101

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DRIGINAL PAGE IS OF POOR QUALITY FIGURE A-2. (a) LISTING OF CONTROL SECTION 52

	c	LIPMOD - #LINE PRINTING MCDULUS#. USED TO REDUCE OUTPUT	CG000102
	C	FREM CEMPLIATION SECTION. O IS TAKEN AS 1.	CCCCC103
	Ċ		00000104 CC000105
	с с	NERR #AUMBER OF ERKORS#. NUMBER OF TIMES COMPUTATION SECTION RETURNED ERROR CONDITION. NERR = 4 CAUSES ABORT.	0000106
	C		
	ç	ERRFLG BAC FILE ERRCR FLAG.	00000157
	с с	•	C00001C7
	č	DIRECTIVE CARD LSAGE	C0000109
	C		C0000110
	c	PRUCESSING PEANING	CC000111
	C	TYPE ALL START FRCM FIRST OF INPUT FIL'E AND PROCESS WITHOUT	00000112 C0000113
	с. с.	REGARD TO LABEL INFURMATION.	C0000114
	с		CC000115
	ç	HISFLT CHECK LABEL ONLY FOR CORRECT MISSION AND FLIGHT.	00000116 00000117
	ς c ι	FLTLIN CHECK FCR CORRECT MISSION, FLIGHT, AND FLIGHT LINE.	C(000118
	C		0000119
	C C	SPECIF CHECK FOR MISSION, FLIGHT, FLT. LINE, AND RUN.	C0000120 C0000121
	č	PRINT PRINT CUT VALUES OF INSTRUMENT, CHARACTERISTICS.	CU000122
	С		00000123
	۲ د	PUNCH PRINT AND PUNCH I.C.#S.	COOCC124 COOOC125
	с с	PUST MAY BE LSEL AS THE FIRST PRCCESSING TYPE. IF SO.	C0000138
	Ċ.	THE PECGRAM WILL SPACE DUWN THE CUTPUT TAPE SEARCHING	0000139
	C _	FOR THE ENU OF REEL. POST IS ILLEGAL EXCEPT ON THE	00000140
	C C	FIRST LIRECTIVE CARD.	CC000141
	č	CIRECTIVE CARD FORMAT.	C0000126
	c c		0000127
	C	JPTAPE MISS FLT LINE RUN LNPM ICJ NFP	00000128
•	ć	A6 4X 15 15 15 15 15 15 15	COOOO129 COOOO130
	C C	ALL * * * * 1 3 6	00000131
	С	HISFLT 207 12 * * 5 3 2	60000132
	C	FLTL1N 207 12 1 + 10 3 5	0000133
	с с	SPECIF 207 12 1 2 1 3 1 PUNCH * * * * * 4 6	CO000134
-	c	PRINT * * * * * 5 7	
	Ū.	PUST * * * * * *	
			C0000125
	ç	* INCIGATES FIGED IS GUIDED BY PROGRAM.	COOU0135 CCC00136
	C C C	* INCICATES FIELD IS IGNURED BY PROGRAM.	COON0135 CCCO0136 CCC00137
	ů.		CCC00136 CCC00137 C0000142
CC0003	ເ ເ ເ	DIMENSION AMPST(4), LOLTBL(4,300), IEGR(2), RPAR(75), SPAR(85),	CCC00136 CCC00137 C0000142 CCC0C018
CC0003	с С	DIMENSION AMPST(4), LOLTBL(4,300), IEGR(2), RPAR(75), SPAR(85),	CCC00136 CCC00137 C0000142
CC0003 C00003	ເ ເ ເ	DIMENSIUN NWPST(4)+ LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4)+ IPTYPE(6), IDAT(3) DIMENSICH LdL(9) Equivalence (L8L(8),FREq),(L8L(9),FEEC)	CCC00136 CCC00137 C0000142 CCC0C018 00000019 CC00C020 C00C020
CC0003 C00003 C00003	ເ ເ ເ	DIMENSIUN NNPST(4), LOLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) DIMENSIGN LOL(9) Equivalence (101,60),FREq),(LOL(9),FEEC) FQJIVALENCE (104T(1),101),(ICAT(2),102),(ICAT(3),103)	CCC00136 CCC00137 C0000142 CC000019 CC000019 CC000020 C0000021 CC000022
CC0003 C00003 C00003 C000C3	ເ ເ ເ	DIMENSIUN NWPST(+), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) UMFNSICN LdL(9) EQUIVALENCE (LØL(8),FREU),(LBL(9),FEEC) FQJIVALENCE (IDAT(1),ID1),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG	CCC00136 CCC00137 C0000142 CCC0C018 00000019 CC00C020 C0000021 CC00C022 C0000023
CC0003 C00003 C00003	ເ ເ ເ	DIMENSIUN NNPST(4), LOLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) DIMENSIGN LOL(9) Equivalence (101,60),FREq),(LOL(9),FEEC) FQJIVALENCE (104T(1),101),(ICAT(2),102),(ICAT(3),103)	CCC00136 CCC00137 C0000142 CC000019 CC000019 CC000020 C0000021 CC000022
CC0003 C00003 C00003 C00003 C00003 C00003 C00003	ເ ເ ເ	DIMENSIUN AMPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) UMAENSICN LdL(9) EQUIVALENCE (LØL(8),FREQ),(LØL(9),FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLR /IDFENC OF REE,IML/ DATA IPTYPE/6HFLTLIN,6HNISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ CATA IPUST/4HPOST/	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC000020 C0000021 CC000022 C0000023 C0000024 CC000025 C0000026
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003	ເ ເ ເ	DIMENSIUN NAPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IUAT(3) UMFNSICN LdL(9) EQUIVALENCE (L0A(1),ID1),(ICAY(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICGR /IOFENC OF REE,IHL/ DATA IPTYPE/6HFLTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ GATA IPUST/4HPOST/ LATA EGRI/.FALSE./, NLC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 CC000024 CC000025 C0000026 CCCC0027
CC0003 C00003 C00003 C00003 C00003 C00003 C00003	ເ ເ ເ	DIMENSIUN AMPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) UMAENSICN LdL(9) EQUIVALENCE (LØL(8),FREQ),(LØL(9),FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLR /IDFENC OF REE,IML/ DATA IPTYPE/6HFLTLIN,6HNISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ CATA IPUST/4HPOST/	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC000020 C0000021 CC000022 C0000023 C0000024 CC000025 C0000026
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 CC0005 CC0005	ເ ເ ເ	DIMENSIUN AMPST(+), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) UMFNSICN LdL(9) EQUIVALENCE (LØL(8),FREU),(LBL(9),FEEC) EQUIVALENCE (IDAT(1),ID1),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLK /IOFENC OF REE,IML/ DATA IPTYPE/GHFLTLIN,GHMISFLT,GHSPECIF,3MALL,SMPRINT,5hPUNCH/ CATA IPUST/4MPOST/ LATA EGRI/.FALSE./, NLC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 REWIND 4	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 C0000024 CC000025 C0000026 CCCC0027 C0000143 C0000144
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C00005 C00007 C00025	ι [] [] []	DIMENSIUN NAPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IUAT(3) UMFNSIGN LdL(9) EQUIVALENCE (L0AT(1),ID1),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICGR /IOFENC OF REE,IHL/ DATA IPTYPE/GHELTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ CATA IPUST/4HPOST/ LATA ECRI/.FALSE./, NUC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/ PEGIND 1 REM IND 4 REAU(0.500G) JPTYPE, NMPST, LNPMOD, ICU, NFP IF(JPTYPE.NE.IPCST) GO TO 18	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC000022 C0000023 CC000024 CC000025 C0000024 CC000026 CCCC0027 0000143 C0000146
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027	ເ ເ ເ	DIMENSIUN AMPST(4). LBLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENSICN LdL(9) EQUIVALENCE (LBL(8),FREQ).(LBL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IDFENC OF REE.IHL/ DATA IPTYPE/AHLTLIN.6HMISFLT.6HSPECIF.3HALL.5HPRINT.5hPUNCH/ GATA IPUST/4HPOST/ LATA ECRI.FALSE./. NLC.NCC/0.I/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REWIND 4 REWIND 4 REAU(5.50C) JPTYPE, NMPST, LNPMOD, ICU, NFP IF(JPTYPL.NE.IPCST) GO TO 18 READ(2) LB1.LB2	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 C0000024 CC000025 C0000026 CCCC0027 C0000143 C0000144
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C00005 C00007 C00025	ι [] [] []	DIMENSIUN NAPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IUAT(3) UMFNSIGN LdL(9) EQUIVALENCE (L0AT(1),ID1),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICGR /IOFENC OF REE,IHL/ DATA IPTYPE/GHELTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ CATA IPUST/4HPOST/ LATA ECRI/.FALSE./, NUC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/ PEGIND 1 REM IND 4 REAU(0.500G) JPTYPE, NMPST, LNPMOD, ICU, NFP IF(JPTYPE.NE.IPCST) GO TO 18	CCC00136 CCC00137 C0000142 CC000018 CC000021 CC000022 C0000023 CC000023 CC000025 C0000025 C0000025 C0000026 CCCC0027 C0000143 C0000145 C0000145
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 000025 C00027 000036 C00042	ι [] [] []	DIMENSIUN AMPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) UMAENSIGN LOL(9) EQUIVALENCE (LØL(8),FREQ),(LØL(9),FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERREG LATA ICTAR /IOFENC OF REE,IHL/ DATA IPTYPE/GHELTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ GATA IPUST/4HPOST/ LATA EGRI/.FALSE./, NLC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 READ(2),5CGJ JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JFYPE.NE.IFCST) GO TO 18 READ(2) LB1,LB2 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB2.NE.IECR(22)) GO TC 40 UACKSPACE 2	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 CC000024 CC000025 C0000024 CC0000143 C0000144 C0000145 C0000146 CC000148 C0000148 C0000149 C0000149
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 C00025 C00040 C00040 C00044	ن (((((((DIMENSIUN AMPST(4). LBLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENCE (LBL(8).FREU).(LBL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IOFENC OF REE.IHL/ DATA IPTYPE/GHLTLIN.6HMISFLT.6HSPECIF.3HALL.5HPRINT.5hPUNCH/ GATA IPUST/4HPOST/ LATA ECRI.FALSE./. NLC.NCC/0.I/. NCF.NFF/1.0/. NERR/0/ PEAIND 1 REWIND 4 REAU(0.50CG) JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JPTYPELNE.IPCST) GO TO 18 READ(2).LB1.LB2 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB2.ALE.IECR(2)) GO TC 40 BACKSPACE 2 GC TO 1	CCC00136 CCC00137 C0000142 CC000019 CC000021 CC000022 C0000023 CC000024 CC000025 CC000025 CC000025 CC0000143 C0000144 0000145 C0000148 C0000148 C0000148 C0000149 C000150 CC000150
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 000025 C00027 000036 C00042	ι [] [] []	DIMENSIUN AMPST(4), LØLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4), IPTYPE(6), IDAT(3) UMAENSIGN LOL(9) EQUIVALENCE (LØL(8),FREQ),(LØL(9),FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERREG LATA ICTAR /IOFENC OF REE,IHL/ DATA IPTYPE/GHELTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ GATA IPUST/4HPOST/ LATA EGRI/.FALSE./, NLC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 READ(2),5CGJ JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JFYPE.NE.IFCST) GO TO 18 READ(2) LB1,LB2 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB2.NE.IECR(22)) GO TC 40 UACKSPACE 2	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 CC000024 CC000025 C0000024 CC0000143 C0000144 C0000145 C0000146 CC000148 C0000148 C0000149 C0000149
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 CC0005 CC0007 C00025 C00027 C00025 C00027 C00024 C00042 C00042 C00044 C00045	ι C C × 40 C	DIMENSIUN AMPST(4). LBLTBL(4,300). IEGR(2). RPAR(75), SPAR(85). PAR(160,4). IPTYPE(6), IDAT(3) UMAENCE (LBL(8),FREQ),(LBL(9).FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLR /IOFENC OF REE,IHL/ DATA IPTYPE/AFLTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ GATA IPUST/4HPOST/ LATA ECRI.FALSE./, NUC.NCC/0,I/. NCF.NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 REWIND 4 REAJ(5,50C] JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JFTYPL.NE.IPCST) GO TO 18 REAJ(2) LB1.KE2 IF(LB1.KE.IEUR(1)) GO TO 40 IF(LB2.KE.IECK12)) GO TC 40 WACKSPACF 2 GC TO 1 REAL(2) IF(CUF,2) 39, 40	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC000022 C0000023 C0000024 CC000025 C0000024 CCC000143 C0000145 C0000145 C0000146 CC000147 C0000148 0000149 C0000150 CC000153 C0000154
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 CC0005 CC0007 C00025 C00027 C00025 C00027 C00024 C00042 C00042 C00044 C00045	ι C C - * 40 C C C	DI MENSIUN AMPST(+) + LBLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4) + IPTYPE(6), IDAT(3) UIMFNSICN LdL(9) EQUIVALENCE (LBL(8),FREU),(LBL(9),FEEC) EQUIVALENCE (IDAT(1),ID1),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLR /IOFENC OF REE,IHL/ DATA IPTYPE/6HFLTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ CATA IPUST/4HPOST/ LATA EGRI/.FALSE./, NLC,NCC/0,I/, NCF,NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 READ(5,50C) JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JPTYPE.NE.IPCST) GO TO 18 READ(2) LB1,LB2 IF(LB1.KE.IEUR(1)) GD TO 40 IF(LB2.KE.IECR(2)) GO TC 40 UACKSPACF 2 GC TO 1 REAL(2)	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 CC000024 CC000025 C0000145 C0000145 C0000147 C0000149 C00C0150 CC0C0151 CC000155
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 CC0005 CC0007 C00025 C00027 C00025 C00027 C00024 C00042 C00042 C00044 C00045	ι C C 2 * 40 C	DIMENSIUN AMPST(4). LBLTBL(4,300). IEGR(2). RPAR(75), SPAR(85). PAR(160,4). IPTYPE(6), IDAT(3) UMAENCE (LBL(8),FREQ),(LBL(9).FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLR /IOFENC OF REE,IHL/ DATA IPTYPE/AFLTLIN,6HMISFLT,6HSPECIF,3HALL,5HPRINT,5hPUNCH/ GATA IPUST/4HPOST/ LATA ECRI.FALSE./, NUC.NCC/0,I/. NCF.NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 REWIND 4 REAJ(5,50C] JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JFTYPL.NE.IPCST) GO TO 18 REAJ(2) LB1.KE2 IF(LB1.KE.IEUR(1)) GO TO 40 IF(LB2.KE.IECK12)) GO TC 40 WACKSPACF 2 GC TO 1 REAL(2) IF(CUF,2) 39, 40	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC000022 C0000023 C0000024 CC000025 C0000024 CCC000143 C0000145 C0000145 C0000146 CC000147 C0000148 0000149 C0000150 CC000153 C0000154
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00025 C00027 C00025 C00040 C00042 C00044 C00044 C00045 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DIMENSIUN AMPST(4). LBLTBL[4,300]. IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMMENSICN LdL(9) EQUIVALENCE (LBL(8).FREQ).(LBL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICUR /IOFENC OF REE.IHL/ DATA ICUST/AMPOST/ CATA ECRI.FALSE./. NUC.NCC/0.I/. NCF.NFF/1.0/. NERR/0/ PEAIND 1 REWIND 4 READ(5.50G) JPTYPE, NMPST, LNPHOD, ICU, NFP IF(LB1.NE.IECR(2)) GO TC 40 BACKSPACE 2 GC TO 1 READ LIRECTIVES READ(5.50A) JPTYPE, NMPST, LNPHOD, ICU, NFP FORMAT(Ac.4X.715)	CCC00136 CCC00137 C0000142 CC000020 C0000021 C000022 C0000023 C000023 C000025 C000025 C0000143 C0000143 C0000144 0000145 C0000148 0000149 C0000150 CC000153 C0000154 C0000157 C0000154 C0000157 C0000158
CC0003 C0003 C0003 C0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 C00025 C00040 C00042 C00044 C00045 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSIUN AMPST(+). LBLTBL(4,300), IEGR(2), RPAR(75), SPAR(85), PAR(160,4). IPTYPE(6), IDAT(3) UMFANSION LdL(9) EQUIVALENCE (LBL(8),FREU),(LBL(9).FEEC) EQUIVALENCE (IDAT(1),IDI),(ICAT(2),ID2),(ICAT(3),ID3) LUGICAL EGRI, ERRFLG LATA ICLR /IOFENC OF REE,IHL/ DATA IPTYPE/GHFLTLIN,GHMISFLT,GHSPECIF,3HALL,SHPRINT,5hPUNCH/ CATA IPUST/AMPOST/ LATA EGRI/.FALSE./, NUC,NCC/0,I/, NCF.NFF/1,0/, NERR/0/ PEAIND 1 REWIND 4 READ(1),SOCJ JPTYPE, NMPST, LNPHOD, ICU, NFP IF(JPTYPE.NE.IPCST) GO TO 18 READ(2) LB1.LB2 IF(LB1.KE.IEUR(1)) GU TO 40 IF(LB2.KE.IECR(2)) GO TC 40 UACKSPACF 2 GC TO 1 READ LIRECTIVES READ(5,500) JPTYPE, NMPST, LNPHOD, ICU, NFP FORMAT(AC.4X,715) IF(FUF,5) 37.41	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 CC000024 CC000025 C0000144 0000145 C0000145 C0000146 C0000146 C0000146 C0000146 C0000147 C0000148 C0000148 C0000155 C0000155 C0000155 C0000157 C0000157 C0000159
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C00025 C00027 000036 C00042 C00044 C00045 000050 C00050 C00050	c c c c c c c c c c c c c c c c c c c	DIMENSIUN AMPST(4). LØLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENSICN LOL(9) EQUIVALENCE (LØL(8).FREQ).(LBL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IOPENC OF REE.IHL/ DATA IPTYPE/GHFLTLIN.6HMISFLT.6HSPECIF.3HALL.5HPRINT.5hPUNCH/ CATA IPUST/4HPOST/ LATA ECRI.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).SOCJ JPTYPE, NWPST, LNPHOD, ICU, NFP IF(JFTYPE.NE.IPCST) GO TO 18 READ(2) LB1.62 IF(LB1.NE.IECR(2)) GO TC 40 UACKSPACF 2 GC TO 1 READ LIRECTIVES READ(5.500) JPTYPE, NWPST, LNPHOD, ICU, NFP FORMAT(Ac.4X.715) IF(EUF,2) 37.41 WR ITE(6.000) JFTYPE, NWPST, LNPHOD, ICU, NFP	CCC00136 CCC00137 C0000142 CC000020 C0000021 C000022 C0000023 C000023 C000025 C000025 C0000143 C0000143 C0000144 0000145 C0000148 0000149 C0000150 CC000153 C0000154 C0000157 C0000154 C0000157 C0000158
CC0003 C0003 C0003 C0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 C00025 C00040 C00042 C00044 C00045 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DIMENSIUN AMPST(4). LBLTBL[4,300]. IEGR(2). RPAR(75), SPAR(85). PAR(160,4). IPTYPE(6), IDAT(3) UMMENSICN LdL(9) EQUIVALENCE (LBL(8),FREQ),(LBL(9).FEEC) EQUIVALENCE (IDAT(1),IDI).(ICAY(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLM /IDFENC OF REE.IHL/ DATA IPTYPE/OHLTLIN.6HMISFLT.6HSPECIF.3HALL, SHPRINT, ShPUNCH/ GATA IPUST/4HPOST/ LATA ECRI.FALSE./, NUC.NCC/0.I/. NCF.NFF/1.0/, NERR/0/ PEAIND 1 REWIND 4 READ(5.50C] JPTYPE, NMPST, LNPHOD, ICU, NFP IF(LB1.NE.IEDR(1)) GD TO 40 IF(LB2.AL.IECR(2)) GO TC 40 BACASPACE 2 GC TO 1 READ LIRECTIVES READ(5.500) JPTYPE, NMPST, LNPHOD, ICU, NFP FORMAT(Ac.4X,715) IF(EUF,2) 37.41 WRITE(6.600) JFTYPE, NMPST, LNPHOD, ICU, NFP FORMAT(AL1,/10X,17H CCNTRCL CARD IS ,	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 C0000023 C0000024 CC000025 C0000024 CC000025 C0000143 C0000143 C0000145 C0000145 C0000145 C0000145 C0000153 C0000155 C0000157 C0000157 C0000157 C0000159 C0000159
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C00025 C00027 000036 C00042 C00044 C00045 000050 C00050 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSILN ANPST(4). LØLTBL(4,300). IEGR(2). RPAR(75), SPAR(85). PAR(160,4). IPTYPE(6), IDAT(3) UMAENSICN LOL(9) EQUIVALENCE (LØL(8),FREQ),(LBL(9).FEEC) EQUIVALENCE (IDAT(1),IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IOPENC OF REE.IHL/ DATA IPTYPE/GHFLTLIN, GHMISFLT.GHSPECIF.3HALL.SHPRINT.ShPUNCH/ CATA IPUST/4HPOST/ LATA ECRI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).LB1.CB3 GO TO 18 READ(2).LB1.CB3 GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LC1.NE.IEUR(1)) GO TO 40 READ LIRECTIVES READ LIRECTIVES READ(5,500) JPTYPE, NMPST, LNPHOD, ICU, NFP FORMAT(42.4X,715) IF(EUF,2) 37.41 WR ITE(6.000) JFTYPE, NMPST, LNPHOD, ICU, NFP FORMAT(411.//10X,17H CCNTRCL CARU IS . A644X,715)	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC000022 C0000023 CC000024 CC000025 C0000143 C0000144 C0000144 C0000144 C0000144 C0000148 C0000148 C0000148 C0000148 C0000155 CC000155 CC000155 CC000155 C00
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C00025 C00027 000036 C00042 C00044 C00045 000050 C00050 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSILN AMPST(4). LØLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENCE (LØL(9) EQUIVALENCE (LØL(8),FREQ).(LBL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IOFENC OF REE.IHL/ DATA IPTYPE/GHFLTLIN.GHMISFLT.GHSPECIF.3HALL.SHPRINT.ShPUNCH/ CATA IPUST/4HPOST/ LATA ECRI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).SOCJ JPTYPE, NWPST, LNPHOD, ICU, NFP IF(JJTYPE.NE.IFCST) GO TO 18 READ(2) LB1.62 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB2.NE.IECR(2)) GO TC 40 UACKSPACF 2 GC TO 1 READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ(5.500) JPTYPE, NWPST, LNPHOD, ICU, NFP FORMAT(42.4X,715) IF(EU.4X,715) IF(EU.4X,715) IF(H1,7/10X,17H CCNTRCL CARU IS. A644X,715) WHAT PANNER TU PROCESS	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C000021 CC000023 C0000024 CC000025 C000025 C000025 C0000143 C0000143 C0000145 C0000145 C0000145 C0000145 C0000145 C0000145 C0000155 C0000155 C0000157 C00005
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C00025 C00027 000036 C00042 C00044 C00045 000050 C00050 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSILN AMPST(4). LØLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENCE (LØL(9) EQUIVALENCE (LØL(8).FREQ).(LØL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IDFENC OF REE.HL/ DATA IPTYPE/GAFTLTLIN.GHMISFLT.GHSPECIF.3HALL.SHPRINT.ShPUNCH/ CATA IPUST/AHPOST/ LATA ECRI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).LB1.CB21 GO TO 18 READ(2).LB1.CB21 GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ(5.500) JPTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(46.4X,715) IF(E0.000) JFTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(411,//10X,17H CCNTRCL CARD IS. A644X,715) MEAT PANNER TO PROCESS MEL ORICITATAME	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C0000021 CC00C022 C0000023 C0000024 CC000025 C0000145 C0000145 C0000145 C0000145 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000147 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000159 C0000164 CC000163 C0000164 CC000163 C0000164
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00025 C00027 C00025 C00025 C00040 C00040 C00042 C00044 C00044 C00045 C00050 C00050	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSILN AMPST(4). LØLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENCE (LØL(9) EQUIVALENCE (LØL(8).FREQ).(LØL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IDFENC OF REE.HL/ DATA IPTYPE/GAFTLTLIN.GHMISFLT.GHSPECIF.3HALL.SHPRINT.ShPUNCH/ CATA IPUST/AHPOST/ LATA ECRI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).LB1.CB21 GO TO 18 READ(2).LB1.CB21 GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ(5.500) JPTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(46.4X,715) IF(E0.000) JFTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(411,//10X,17H CCNTRCL CARD IS. A644X,715) MEAT PANNER TO PROCESS MEL ORICITATAME	CCC00136 CCC00137 C0000142 CC00C018 00000019 CC00C020 C000021 CC000023 C0000024 CC000025 C000025 C0000125 C0000145 C0000145 C0000145 C0000145 C0000145 C0000145 C0000155 C0000157 C0000160 CC000161 C0000163 C0000164
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 000036 C00042 C00042 C00044 C00045 000050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00003 C00005 C00005 C00007 C0005 C00007 C0005 C00007 C0005 C00007 C0005 C00007 C0005 C0007 C0005 C0007 C00	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSILN AMPST(4). LØLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENCE (LØL(9) EQUIVALENCE (LØL(8).FREQ).(LØL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IDFENC OF REE.HL/ DATA IPTYPE/GAFTLTLIN.GHMISFLT.GHSPECIF.3HALL.SHPRINT.ShPUNCH/ CATA IPUST/AHPOST/ LATA ECRI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).LB1.CB21 GO TO 18 READ(2).LB1.CB21 GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ(5.500) JPTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(46.4X,715) IF(E0.000) JFTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(411,//10X,17H CCNTRCL CARD IS. A644X,715) MEAT PANNER TO PROCESS MEL ORICITATAME	CCC00136 CCC00137 C0000142 CC00C020 C0000021 C000022 C0000023 C0000024 C000025 C0000025 C0000025 C0000145 C0000145 C0000145 C0000145 C0000145 C0000155 C0000154 C0000155 C0000155 C0000155 C0000157 C0000155 C0000157 C0000155 C0000156 C0000160 CC000161 CC000161 CC000163 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 C00025 C00027 C00025 C00040 C00042 C00042 C00045 000050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00003 C000003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00005 C005 C00	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DI MENSILN AMPST(4). LØLTBL(4,300). IEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMAENCE (LØL(9) EQUIVALENCE (LØL(8).FREQ).(LØL(9).FEEC) EQUIVALENCE (IDAT(1).IDI).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL EGRI. ERRFLG LATA ICLR /IDFENC OF REE.HL/ DATA IPTYPE/GAFTLTLIN.GHMISFLT.GHSPECIF.3HALL.SHPRINT.ShPUNCH/ CATA IPUST/AHPOST/ LATA ECRI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEGIND 1 REW IND 4 READ(2).LB1.CB21 GO TO 18 READ(2).LB1.CB21 GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB1.NE.IEUR(1)) GO TO 40 READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ LIRECTIVES READ(5.500) JPTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(46.4X,715) IF(E0.000) JFTYPE. NMPST, LNPHOD. ICU, NFP FORMAT(411,//10X,17H CCNTRCL CARD IS. A644X,715) MEAT PANNER TO PROCESS MEL ORICITATAME	CCC00136 CCC00137 C0000142 CC00C020 C0000021 CC00C022 C0000023 C0000024 CC000025 C0000142 CC000025 C0000143 C0000144 C0000145 C0000145 C0000146 C0000146 C0000147 C0000148 C0000145 C0000145 C0000155 C0000155 C0000157 C00000000000
CC0003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C00003 C000025 C00027 000036 C00042 C00042 C00044 C00045 000050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00050 C00003 C00005 C00005 C00007 C0005 C00007 C0005 C00007 C0005 C00007 C0005 C00007 C0005 C0007 C0005 C0007 C00	υ υ υ υ υ υ υ υ υ υ υ υ υ υ	DIMENSILA AMPST(4). LOLTBL(4,300). HEGR(2). RPAR(75). SPAR(85). PAR(160,4). IPTYPE(6). IDAT(3) UMENSIGN LdL(9) EQUIVALENCE (LOL(8).FREU).(LOL(9).FEEC) EQUIVALENCE (IDAT(1).ID1).(ICAT(2).ID2).(ICAT(3).ID3) LUGICAL ECRI. ERRFLG LATA ICLR /IOFENE OF REE.HL/ DATA IPTYPE/ONFLTLIN.GHMISFLT.GHSPECIF.SHALL.SHPRINT.SHPUNCH/ CATA EDKI/.FALSE./. NUC.NCC/0.1/. NCF.NFF/1.0/. NERR/0/ PEAIND 1 REMIND 4 READ(5.500) JPTYPE, NHPST, LNPHOD, ICU. NFP IF(JPTYPL.NE.IFCST) GO TO 18 READ(2) Ld1.LB2 IF(LB1.NE.IEUR(1)) GO TO 40 IF(LB2.AL.IECR(2)) GO TC 40 WACASPACE 2 GC TO 1 READ LIRECTIVES READ(5.500) JPTYPE, NHPST, LNPHOD. ICU. NFP FORMAT(Ac.4X,715) IF(EUF.5) 37.41 WR ITE(0.000) JFTYPE, NHPST, LNPHOD. ICU. NFP FORMAT(Ac.4X,715) IF(EUF.5) 37.41 WR ITE(0.001) JFTYPE, NHPST, LNPHOD. ICU. NFP FORMAT(Ac.4X,715) IF(FORMAT(Ac.4X,715) IF(FORMAT(AC.4X,715) IF(FORMACAC.4X,	CCC00136 CCC00137 C0000142 CC00C020 C0000021 C000022 C0000023 C0000024 C000025 C0000025 C0000025 C0000145 C0000145 C0000145 C0000145 C0000145 C0000155 C0000154 C0000155 C0000155 C0000155 C0000157 C0000155 C0000157 C0000155 C0000156 C0000160 CC000161 CC000161 CC000163 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000164 CC000165 C0000

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FIGURE A-2. (b) LISTING OF CONTROL SECTION

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000126	601	FUR BATTLERA, 30HL INCOLONIZED PROCESSING FUBBATTI	51100000
000126		LALL ABLAI(2NLA)	0000173
COO130	٤	HENEP-GE-11 GUITE 59	CC000174
000133		nRITELO, CLUI NFP	
000140	610	FURMAT(//104,*NEP LT 1*,5X,*NEP = *,15//)	
COO140		LALL ABLAT (SHAFP)	
	с		CCCPC175
	C	FIND INSTRUMENT CHAR.	00000176
	c		CC000177
000142	55	LF(1CL-NE+0) GC TC 4	COOO0178
	C	READ FROM CARUS	CC000179
COO143		ILSET=0	CC0C0180
0001,44		REAU(5,4303) NUMBER,101,162,103,RPAR(11,RPAR(21,RPAR(3)	00000181
000166		IF(ECF, 5) 12, (0	0000182
000171	00	wkîte(6%CO3) ICSET,ID1,ID2,ID3,RPAR(1),RPAR(2),RPAR(3)	00000183
CO0213	1	DO 61 J=4+75+74	CC000184
000215	2	L=J+6	CC000165
000217		1F(L.Gt.75) L=75	C0000186
000222		READ(5,4304)(RPAR(K),K=J,L)	0000187
000235		IF(E0F+5) 12+ 61	60000188
C00240	61	KRITE(0+004)(KPAR(K),K=J,L)	0000185
000255		READ(5,4303) NLPBER, ID1, IC2, ID3, SPAR(1), SPAR(2), SPAR(3)	00000190
C00277	. 5	IF(EUF)51 12, 62	CC00C151
C00302	ψŽ	RITEL0+CO31 ICSET+101+1C2+103+SPAR(1)+SPAR(2)+SPAR(3)	COCOC123
000324		00 03 J=4,85,7	
000326			CCOCC154 CCOO0155
0د003 دد003		It(L.GT.+5) L={5	CC000196
		REAC(5+4JG4)(SPAR(K),K=J,L)	00000157
000346 C00351	63	1F(E0++5) 12+ 63	00000198
C00351	60	NRITL(6+604)(SPAR(K)+K=J+L)	0000199
C00367 '		NFP=1 GU TO 15	00000200
CG0370	4	IF(ICU-NCC) 5,13,6	00000201
000373	5	REWIND 4	6000202
C00375	2	NCL = 1	0000203
000376	6	IF(ICU.NE.997) GC TO 10	CC000204
000010	ເັ	FIND LAST SET ON FILE.	CGC002C5
C00400	C	15(NEC-50-0) 66 TO 7	00000206
(00401	+2		00207
000403		60 TU 4	00000208
C00403	1	NLC=NCC-2	00000209
00405	a	KEAU(4)	CO000210
000410	-	NLC=NLC+1	CG000211
000412		1F(EUF,4) 45, 0	C0000212
000415	42	ICU=NLC	00000213
000417		GU TU 5	C0000214
	ĉ	POSITION TO THE SET	C0000215
CO0417	10	NCL=NCC+1	CC000216
000421		UU 11 1=NC1:ICU	C0000217
000422		READ(4)	.0000218
COC425		1F(EUF,4) 12,11	00000219
000430	11	CONTINUE	0000220
000433			
000433	12	wRITE(6,002)	00000221
000437	692	FCRMAT(10X, 34HNO SUCH INSTRUMENT CHARACTERISTICS)	CC000222 C0000223
000437	~	CALL ABORT(2HIC) • READ THEM	(0000224
	C,		0000225
000441	13	READ(4) ICSET,IL1,ID2,IC3,PAR IF(E0F,4) 12,112	CC00C225
000456	112	1F(EOF,4) 12,112 NCC=1CU+1	00000227
000461 000463	. 112	IF(N.LT.5) GO TO 15	00000228
000400	c		CC000229
	č	WRITE (AND PUNCH) INST. CHAR.	06200000
	č		CG000231
C00466	-	DU 55 [=1,4	00000232
000467		wR1 FE (0+603) ICU, ID1, IC2, ID3, PAR (1, I), PAR (2, I), PAR (3+I)	CC000233
000515	603	FOR MATI//# SEI#,15,# DATE#,315,E15.4,5X,A10,E15.4)	CC000234
000515		00 54 J=4,75,7	C0000235
C00517		L=J+6	C0000236
000521		IF(L.GT.75) L=75	CO000237
C00524	54	<pre>wRITE(0,604)(FAR(K,1),K=J,L)</pre>	C0000238
000543	604	FURMAT(7E15.4)	00000235
000543		WRITE(6,C03) ICU,IC1,ID2,ID3,PAR(76,I),FAR(77,1),PAR(78,I)	CC00C240
C00572		DU 59 J=75,10C,7	00000241
C00574			00000242
000576	. .	IF(L.GJ.160) L=160	00000243
000601	55	WRITE(0:004)(FAP(K:1);K=J:L)	C0000244
		1F(N.NE+6)_60_1C_14	0000245
C00622.			
000624		DU 57 I=1+4	00000246
000624 000626		tt=!	CC000247
000624		LL=1 %R(TE(43,4303) ICU,ID1,ID2,IU3,PAR(1,I),PAR(2,1),PAR(3,I),	CC000247 C0000248
000624 000626 000627	-	LL=1 WRITE(43,4303) ICU,ID1,ID2,ID3,PAR(1,I),PAR(2,1),PAR(3,1), * ICU,I,LL	CC000247 C0000248 C0000249
000624 000626 000627 000644	4303	LL=1 WRITE(43,4303) ICU,ID1,1D2,ID3,PAR(1,I),PAR(2,1),PAR(3,1), * ICU,I,L4 FORMAT(415,10x,E10.3,A10,E10.3,12x,12,11,15)	CC000247 C0000248 C0000249 CC000250
000624 000626 000627 000664 000664	4303	LL=1 wR[T[{43,4303} ICU,ID1,ID2,IU3,PAR(1,I],PAR(2,I),PAR(3,I), * ICU,I,LL FORMAT(415,IOX,E10-3,A10,E10-3,I2X,I2,I1,I5) UD 50 J=4,75,7	CC000247 C0000248 C0000249 CC000250 00000251
000624 000626 000627 000664 000664 000666	4303	LL=1 WRITE(43,4303) ICU,ID1,ID2,ID3,PAR(1,I],PAR(2,1),PAR(3,I), * ICU,I,LL FOR MAT(415,I0X,E10.3,AL0,E10.3,I2X,I2,I1,I5) U0 50 J=4,75,7 LL=LL+1	CC000247 C0000248 C0000249 CC000250 00000251 CC000252
000624 000626 000627 000664 000664	4303	LL=1 wR[T[{43,4303} ICU,ID1,ID2,IU3,PAR(1,I],PAR(2,I),PAR(3,I), * ICU,I,LL FORMAT(415,IOX,E10-3,A10,E10-3,I2X,I2,I1,I5) UD 50 J=4,75,7	CC000247 C0000248 C0000249 CC000250 00000251

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FIGURE A-2. (c) LISTING OF CONTROL SECTION

(0061Z	56	nR[11(43,4304)(FAR(K,1)=K*J,L]+ICU+1+LL	00000254
C00715	4304	FORMAT(/E10+3+2X+12+11+15)	00000255
000715		LL=LL+1	66066256
CC0717		WRITE(43,4303) ICU,ICAT,PAR(16,11,PAR(73,11,PAR(70,11))	C0060257
	-		C0000258
0007/7	•		60000259
000747		00 57 J=75,100,7	00000260
000751			C0000261
C00753		Ladto	00000262
000755	57	nRITE(43,4304)(PAR(K,I),K=J,L),ICU,I,LL	
CO1002	14	1CU=1CU+1	00000263
CO1004	•	_ NFAP=NFAF+1	0000264
CO1005		IF(NFAP.LT.NFP) GO TO 13	00000265
CO1 0 C 7		<u>συ το ι</u>	60000266
	C		C0000267
	c	FIND THE DATA RECORD.	C0000268
	ċ		CC000269
001010	15	(F(N.EQ.4) GO TC 23	00000270
C01012	•••	IF(MSTART.CT.NFF) GO TO 17	CC000271
001011	C		C0000272
	č	ŚŁE ↓F wE≠VE BEEN BY IT ALREACY.	CC00C273
	č	Ste 1 HERE BEEN BE I ADDERDID	C0000274
00101/	L	OUT TO UNDERAGE ACC	0000275
001016		DU 16 MERSTARTANEE	C0000276
C01017		IF(NNPST(1)+NE+LBLTBL(1+M)) GO TU 16	CC000277
C01022		IF (NWPST (2) .NE.LBLTBL(2,M)) GO TO 16	CCC00278
001025		\$F{N.FL.2} 00 TC 23	
CO1027		1F(HnPST(3).NE.LBLTBL(3,M)) 60 TU 16	00000275
CO1032		IF(N+Fy+1) GO TC 23	66000280
001033		IF(NMPST(4).NE.LOLTOL(4.K)) GO TO-16	CCC00281
CO1036		. 60 TO 23	00000282
C01036	16	CONTINUE	C0000283
001041	17	1F(EUR1) GG TO 19 -	CC000284
******	c*'		60000265
	č	GLESS IT≠S FURTHER DOWN THE TAPE.	00000286
	č	60233 TTP3 FORTHER DOWN THE TPFE	C0000287
001043	4	M=NFF+1	0000288
C01045		IF(NLF.GT.NFF) GC TO 24	0000289
	30		00000290
001050	20	M1=M-1	00000291
001052		00 27 1=NCF,M1	00000292
001054	26	READ(1)	60000292
CO1057		1F(FUF:1) 27. 26	
001062	27	CUNTINUE	00000294
001065		NCF=M	00000255
001066	24	READ(1) LBL	C0000296
001073		IF(L6L(1),NE.IEGR(1)) GO TO 25	CC000297
CO1075		1F(L0L(2).NE-IECR(2)) GC TO 25	C0000298
CO1077		EURI=.TRUE.	CC000299
C01100	19	IF(NFAP.NE.0) GC TO 35	00200300
CO1101		WF ITE(0,6(6)	0000301
001105	006	FORMAT (10X,19HNC SUCH CATA RECORD)	£0000302
C01105		CALL ABORT (2HYF)	C0000303
001107	5 د	NRITE(0, CC7) NFAP	C0000304
001115	607	FORMAT(102+13+32H FILES FOUND. CAN FIND NC MORE.)	0000305
001115	007		00000306
	_	LBLTGL(1,NCF)=LEL(1)	CC0CC3C7
GO1116	· >	LBL16L(2+NCF)=L8L(2)	83600000
001121		LBLTBL(3,NCF)=L8L(6)	00000309
001124		LBLTBL(4,NCF)=L2L(7) .	CC000310
001126			CC000311
CO1130		NFF=HAKO(NFF+NCF)	60000312
001133		IF(N.EQ.4) OUTC 36	
001135	•	IF(N#PST(1).NE.LBLT0L(1,N)) GO TO 22	CC000313
001140		IF(NWPST(2).NE.LBL1BL(2,M)) GO TO 22	60000314
C01143		IF(N.EQ.2) GC TC 36	C0000315
001144		IF(NWPST(3).NE.LBLTBL(3,M)) GO TO 22	00000316
CO1147		IF(N.Eq.1) GG TC 36	CC000317
C01150		IF(NuPST(4).NE.LBLTBL(4.M)) GD TO 22	00000316
CO1153		60 TO 36	0000319
001153	22	M=H+1	CC000320
001155		6C TU 20	CC0C0321
001155	23	IF(M-NCF) 28, 24, 20	00000322
001160	28	Ren Ind 1	C0000323
001162		NCF=1	CC000324
001163		GU TO 23	00000325
		FOUND IT. IT &S THIS ONE.	00000326
001164	6د آ	WRITE(0,608) LBL, ICSET, IDI, ID2, ID3	CC000327
C01202	608	FURHAT(1H1,51X,17HCCNVERSICN REPORT,	. 0000328
		* //10x,8HMISSICN-,13,9H FLIGHT-,13,	
		* 7H DATE-,213,15,2X,11H FLT LINE-,1X, 15,6H RUN	-,13, 00000330
		* 13H FRELUENCY-, F5.1, 7H FEEC-, 2X, A6;	00000331
		* 13H FREQUENCY-,F5.1,7H FEED-,2X,A6; * 6F IPAR=,12,313////	00000332
001202		IF(ICU.[L.0] GU TO 33	00000333
001202	~	ANT CONFRANCE OF 10 22 CET CONDECT INCT COND	66000334
001 303	С	GET CORRECT INST. CHAR. DO 29 K=1.4	00000335
C01203			00000336
C01205		IF(A85(FREC-P/R(*,K)/1.0 E9).GT.1.0) CO TO 29	CC000337
001215		IF(ILED.CPAR(2,K)) GO TO 30	
001221	29	CENTINUE	6660000 Recondo
001223		WRIIC(0.005) FRED, FEED	00000334

FIGURE A-2. (d) LISTING OF CONTROL SECTION

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001233		10031AT (10 + 1767) CUCH 1076 (CC0 C10 + 19 A10)	6000340
001233	605	FURMAT (10x,17HNL SUCH FREy-FEED,F10.5,1X,A10) CALL ABURT(2HFF)	60000341
001235	0 د	CO = 31 = 1 + 75	60000342
CO1237	31	RPAR(1)=PAR(1+K)	د4ذ0000 د
001246	51	00 32 1 = 1 + 15	[0000344
001247	32	SPAR(1) = PAR(1+75+K)	C(000345
001241	ເົ້	CALL COMPUTATION SECTION.	((000346
001256	33	ERKFLG=.FALSE.	00000347
001250	c	LABEL OUTPUT TAPE	C0000348
001257	C	WKITF(2) LCL	66000349
001257		WRITE(2) LCE WRITE(2) LCSET, 101, 102, 103, RPAR, SPAR	0000350
CO1303		CALL SEARCH(SPAR, RPAR, LNPMOD, ERRFLG)	00000351
C013C6		CALL ENDE2	00000352
01303		NCF=NCF+1	CCCOC353
001311		IF(FKRFLG) NERR=NERR+1	60000354
001313		IF (NEKK-GI-3) CALL ABERT(ZHER)	00000355
001317		M=N+1	C0000356
001321		YSTAKT=M	C0000357
001921	C	MURE FILES TO PROCESS	00000358
001322	U U	1F(N.Eq.3) 60 IC 1	C0000359
001324	4	NFAP=NFAP+1	00000360
001325		IF(NFAP.GE.NFP) GC TO 1	C00C0361
001327		GU TU 15	00000362
001021	c	00 10 19	CC0003£3
	с с	TERMINATIONS.	00000364
C01330	31	kETE(2) IECR. (1.1=3.9)	00000365
001342	• •	nRI 15(0, 70)	
001346	700	FORMAT(1H1,///11x,10(1H*),10HNORMAL_TERMINATION,10(1H*))	
001346	1.001	STOP	C0000366
C01350		ÉNC	00000307
001000		200	

FIGURE A-2. (e) LISTING OF CONTROL SECTION

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C. Peripheral Requirements

UNIT 01	RADSCAT Raw Data Tape
UNIT 02	Output Tape
UNIT 04	Characteristics Tape
UNIT 05	Card Reader
UNIT 06	Printer
UNIT 08	Scratch Unit (Perferably Disc)
UNIT 43	Punch

IV. SUBROUTINES

A. Subroutine Search

1. Theory and Design

This routine serves as an entry and exit point for the selected file. One of its primary purposes is to find calibration data of both kinds. It anticipates that both NORMAL and BASELINE calibrations are in the opening records of the file. If this is the case the processing of the remainder of the file is given to CRUNCH. Otherwise, a search for the missing calibrations is conducted deeper into the file. The bypassed files are stored on a scratch unit (08) for subsequent processing. When both types of calibrations are found, the bypassed records on file code 08 are processed by CRUNCH and the remainder of the records on file code 01 are also.

If the return from CRUNCH is without an error flag, control is simply returned to the Control Section. If not, an error message is given and the remainder of the file bypassed before returning.

See Figure A-3 for a descriptive logic diagram of SEARCH.

2. Program Listing and Variables

The listing for SEARCH is shown in Figure A-4(α) and A-4(b). The definitions of the variables are given in Table A-1. The entries in DATA were defined in Section III B.

Table A-1 Definition of Variable Used in SEARCH

DATA	=	Vector Containing Raw RADSCAT DATA
IDATA	=	Integer Equivalent of DATA
SCAL	=	SCAT Calibration Vector (Channels 1–4)
		57

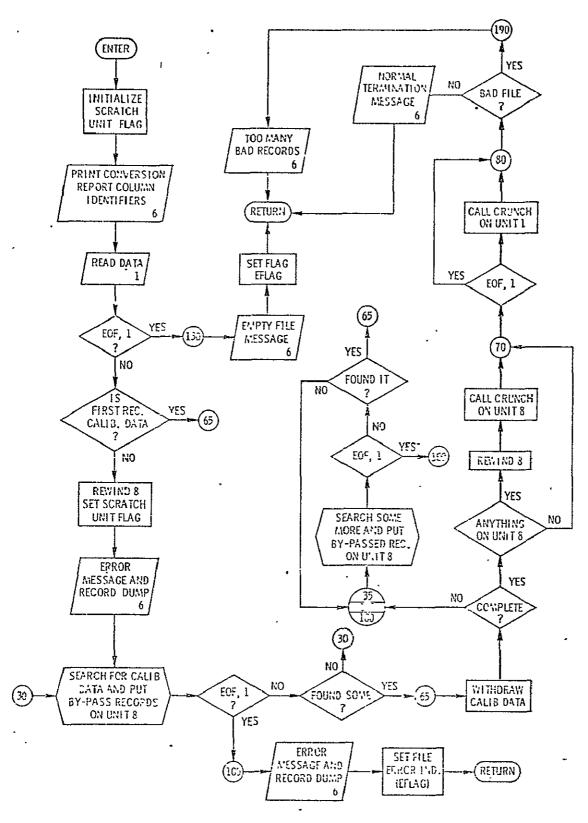


FIGURE A-3. DESCRIPTIVE LOGIC DIAGRAM FOR SEARCH

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	SUBROUTINE SEARCH(SPAR+EPAR+LNPHUD+EFLAG) CSEARCH CALIB SEARCH ROUTINE	00000438 C0000439
	C SUBROLTINE SEARCH(SPAR, RPAR, LNFMCD, EFLAG)	00000440
	<u> </u>	CCC00441
	C _ THIS PREGRAM WAS PREPARED BY	00000442 C0000443
	C JCHN P. CLAASSEN	00000444
	G GLEN E. ELLIOTT	CC000445
		00000446
··	CUNIVERSITY OF KANSAS CENTER FOR RESEARCH	CC000447 00000448
		00000449
	C THIS SUBROUTINE EXECUTES ENTRY INTO THE CONTENTS OF THE	C0000450
	C FILE AND SEEKS CALIBRATION INFORMATION, BOTH NORMAL AND	00000451
	C BASELINE. THE PROGRAM ANTICIPATES THAT BUTH TYPES CF C CALIBRATIONS ARE PRESENT IN THE INITIAL RECORDS. HOWEVE	00000452 '
••••••	C WEEN THIS NUT THE CASE, THE FILE IS SEARCHED UNTIL BOTH	
	C TYPES ARE FOUND. BY-PASSED RECURDS ARE STORED ON UNIT 8	
	C SLBSECLENT PROCESSING.	C0000456 C0000457
C00007	DIMENSION DATA(50), IDATA(50),	00000458
	* SPAR(65), FPAR(15), SCAL(4), RCAL(2)	00000459
(00007	CCMMUN /INPLT/ EGF1, DATA	00000460
CC0007 CC00C7	EQUIVALENCE (CATA(1),ICATA(1)) Lugical Eflag, ECF1, EOF8	00000461 00000462
(00007	LGGILAL NORMAL, BASE	0000463
	C	00000464
	C REAC CATA RECORD FROM TAPE UNIT 1	00000465
(00007	C IPASS=0	00000466 00000467
000010	WRITE(6,6G)	CG000468
C00013	60 FORMAT(12F RECCRD NO.*,13X,7HMESSACE,19X,1h*,20X, * 10HPARA*FTERS///1	00000469
000013	* 10HPARA*ETERS///) CALL REAC1	00000470 00000471
C00014		C000C472
	C	00000473
	C _ LHECK IF RECORD IS CALIB DATA C	CC000474 C0000475
CC0020	10 IF (IDATA(4) .EC. 0 .CR. ICATA(4).EQ.23 GO TO 50	00000476
		0000477
	C PREPARE LISC FOR BY-PASSEC RECORDS	00000478
		C0000479
600027	REWIND 8	60000480 -
C00031	IPASS=1	CC000481
	C	00000482 CC000483
		00000484
00032	hRITE(6,20) 1CATA(4)	CC060485
000040	20 FORMAT(5x,1H*,5x,27HFILE STRUCTURE INCOMPATIBLE,7x,1H*,5x, * 33HFIRST RECORD NOT CALIGRATION CATA,5x, 6HMODE= ,13/J	00000486 00000487
000040	WRITE(6,120) CATA	CC0C0488
	C	0000489
	CSEARCH_FOR_CALIBRATICN_RECORD	00000490
C00046	JO HRITE(8) CATA	00000491 00000452
C00053	35 CALL READI	00000493
C00054	IF(EOF1) GO TC 100	00000454
	CCHECK_IF_CALIB_DATA	00000495
	C C	00000457
000060	40 IF (ICATA(4) .NE. O .ANU. IDATA(4).NE.2) GC TO 30	CC000498.
000067 CC0070	50 ICOUNT=0 IL=0	00000500
• • • •	C	00000501 2
-	CHITHURAM CALIBRATION INFORMATION	CCC00502
C00071	NORMAL = .FALSE.	00000503
C00072	BASE = .FALSE.	0000050
C00073	oj CALL CALIEISCAL, KCAL, RPAR, NORMAL, BASE)	00000505
COOO77 COO1C4	IF (.NUT. NCRMAL .ANDNOT. BASE) GU TO 35 	000005075
000106	IF (.NOT. BASE) GC TO 180	00000508
600107	[F(IPASS.FC.0) 6C TO 70	CCCC0510
000110 000112		AAAAAAA
000112	REWIND 8 CALL GRUNCH(8,LATA,IDATA,IL,ICGUNT,SCAL,RCAL,	00000511 00000512
		00000513
000131	70 IF(E0F1) CO TL E0	00000514
000135	CALL CRUNCH(1,CATA, ICATA, IL, ICDUNT, SCAL, RCAL, SPAR, RPAR, LNPMUD, EFLAG, EUF1)	C0000515
000152	IF(EFLAG) GO TO 190	0000516
	C	00000517
	C NORMAL TERMINATION MESSAGE	C0000518 C0000519
00156	BO WRITE (C.SO) IL, ICOUNT	C00C0520
	•	

FIGURE A-4. (a) SOURCE LISTING FOR SUBROUTINE SEARCH 59

000166	90	FORMAT (16,5X+1++,2X,36HCCMPLETED CCMPUTATIONS FOR THIS FILE,	00000521
	4		Ç0000522
	*	24H WARNING FLAGS GENERATED	00000523
COO166		RETURN	0000525
	С		00000526
	C	ERRER MESSAGE	COOO0527
	Ċ		COQ00528
000167	1 00	WRITE (6+110)	00000529
000173	110	FUR MAT (11X,1H*,5X,27HFILE STRUCTURE INCOMPATIBLE,7X,1H*,5X,	00000530
	*		00000531
000173		WKI TE (6,120) CATA	CG000532
000201	120	FCKMAT(/10(5622/)/)	00000533
	C		COO00534
	C	ABURT FILE AND SEEK NEXT INSTRUCTION	00000535
	ç	· · · · · · · · · · · · ·	CCO00536
000 20 1		EFLAG=.IRLE.	00000537
600204		RETURN	00000538
000205	130	WRITE(6,140)	00000539
000211	140	FORMAT(11H EMPTY FILE)	C0000540
000211		LfLAG=•TRLE•	CC000541
000214		RETURN	COO00542
	G		COO00543
	C	SLARCH FOR MISSING CALIB DATA	00000544
```	С		00000545
000215	150	WRITE(8) LATA	CC00C546
000222	160	CALL READI	00000547
000223		$I + (E_U F_I) = GC + TC + 100$	C0000548
000227	165	IF (1CATA(4) .NE. 0) GO TO 150	COOQ0549
¢00230		ĜU TU 65	00000550
COO231	170	NRITE (d) GATA	00000551
000236	180	CALL READI	CC00C552
000237		IF(EUF1) 63 TC 100	C000C553
COOZ43	185	IF (ICATA(4) .NE. 2) GO TC 170	00000554
000245		60 Τύ ερ	<b>000</b> 00555
¢00246	190	uRI1E(6,195)	
000252	155	FURMAT(///11A+1H*,5X,23HEXCESSIVE NO. OF BAD RECORDS,6X,1H*)	
C00252		IF(EUFI) RETURN	
000257	200	READ(1)	
COO262		IF(EUF,1) 250,200	
C00270	∠50	RETURN	
COC271		END	00000556

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FIGURE A-4. (b) SOURCE LISTING FOR SUBROUTINE SEARCH

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(Continued) Table A-1 Definition of Variable Used in SEARCH entries in DATA

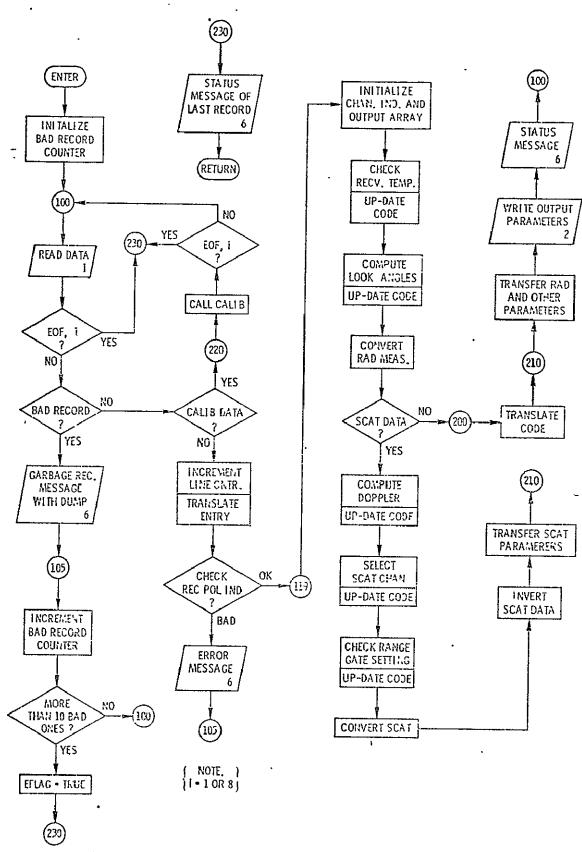
RCAL	=	RAD Calibrations (NORMAL, BASE)
EOF1	=	End of File for Unit 1
EOF8	=	End of File for Unit 8
EFLAG	=	File Error Flag
IPASS	=	Flag for Data on Unit 8
NORMAL	=	Flag for Normal RAD Cals
BASE	=	Flag for Baseline RAD Cals
ICOUNT	=	RADSCAT Performance Error Counter
IL	=	Record Counter .

#### B. Subroutine CRUNCH

#### 1. Theory and Design

The reduction algorithms are applied in or from subroutine CRUNCH. The routine was designed to process RADSCAT data whether it consisted of radiometer measurements (RAD only mode) or both scatterometer and radiometer measurements (alternating angles, fixed angle, or short SCAT modes). In processing the records on an independent basis, there is a tacit assumption that coupling between polarization is negligible. It was also necessary to equip the routine with the ability to read records from file code 01 (raw data tape) or file code 08 (scratch unit). A description of the internal operation of CRUNCH is shown in the logic diagram of Figure A-5.

In the opening steps of CRUNCH the data record is extracted from the file and verified by an in-line routine. The first sixteen entires in the data record are checked for type and magnitude. If an invalid entry is present, an error message identifying the bad entry is given and a bad record counter is incremented (NGR). If more than 10 bad records are encountered, an error flag (EFLAG) is set and control is returned to SEARCH. If not, the next record in read (statement 100) and the process repeated. If the record is valid, it is further examined to determine if it is a calibration record. If it is, CALIB is called (statement 220) to extract and average the calibrations. The next record is then read and the process



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FIGURE A-5. DESCRIPTIVE LOGIC DIAGRAM FOR SUBROUTINE CRUNCH

ORIGINAL PAGE IS OF POOR QUALITY repeated. If it is not calibration data, the mode entry is translated and the SCAT and RAD receiver polarization are checked for agreement when the instrument is not in the "RAD only" mode. If they disagree the record is declared invalid and treated as a bad record.* If the measurement occurred in the "RAD only" mode or the polarization agree, the record is then processed in the steps following and including statement number 119.

Initially the record counter is incremented, the SCAT channel indicator initialized and the output array cleared. CRUNCH then calls THERMO to compute and check receiver temperatures. An interpretation code is updated after which subroutine ANGLE is called. ANGLE computes the incident and cross-track angles and again the interpretational code is updated. Subroutine RCONV (radiometer convert) is called to compute the antenna temperature. If no scatterometer data is present, control advances to statement 200 where the computed results are transferred to the output array. Otherwise when SCAT data is present, DOPCHK is called to compute the doppler shift and set the doppler filter band index. The interpretational code is then updated.

In the following statements (up to number 170), the maximum on-scale SCAT measurement is selected from the four output channels (DATA(8) through DATA(11)). To select the appropriate channel output, the channels are tested for an output in excess of a value that would cause the output to saturate on the next higher sensitivity channel. Note that channel 1 (DATA(8)) is least sensitive whereas channel 4 (DATA (11)) is most sensitive. The selected measurement is stored in DATA(8) after scaling it with some channel dependent parameters. If the SCAT return fell below or above the channels, an interpretational flag is set in statements between 170 and 175.

Following the channel selection, the range gate setting is compared with the aircraft altitude. If the altitude is not within 300 feet of the range gate setting, an interpretation flag is set.

Subroutine SCONV (SCAT convert) is then called to compute the normalized input power. Once computed, the scatterometer measurement is inverted for antenna pattern effects with an in-line statement (number 190). The antenna inversion is based on the notion of an equivalent pencil beam replacing the actual main beam

The implication is that the instrument didn't operate correctly.

antenna pattern. Computer simulations have shown that the method is extremely accurate (errors  $\leq 0.1$  dB) for narrow beam antennas. Briefly the equivalent beam-width notion is based on the fact that the normalized input power

$$I(\theta_{o}) = \iint \frac{P^{2}(\theta, \phi) \sigma^{o}(\theta') dA}{R^{4}}$$

where

= normalized scattering coefficient

= radar range to elemental area dA

= normalized antenna pattern

= elemental area

can be approximated by an algebraic expression through the following considerations. For narrow beam antenna

$$I(\theta_{o}) = \int \int \frac{P^{2}(\theta, \phi) \sigma^{\circ}(\theta') \sin \theta R^{\prime}}{R^{4} (\cos \theta')}$$

where  $\cos \theta'$  is a projection factor, may be approximated by

$$I(\theta_{o}) \cong \frac{\sigma^{\circ}(\theta_{o})}{R^{2}(\cos\theta_{o})} \int \int P^{2}(\theta, \phi) \sin \theta \, d\theta \, d\phi$$

The integral may be computed numerically from a description of the antenna pattern and equated to the effect produced by a pencil beam of width  $\theta eq$ , i.e.,

$$\int \int P^{2}(\theta, \phi) \sin \theta \, d\theta \, d\phi = \int_{0}^{2\pi} \int_{0}^{\theta_{eq}/2} \sin \theta \, d\theta \, d\phi$$
$$\cong \frac{\pi \, \theta_{eq}}{4}$$

Therefore the normalized scattering coefficient is given by

$$\sigma^{\circ}(\theta_{o}) = \frac{4 I(\theta_{o}) R^{2} \cos \theta_{o}}{\pi \theta_{eq}^{2}}$$

But note that  $R = h/\cos \theta_o$  so that

$$\sigma^{\circ}(\theta_{o}) = \frac{4 I(\theta_{o}) h^{2}}{\hat{\tau} \theta_{eq}^{2} \cos \theta_{o}}$$

where h is the aircraft altitude. The entry  $\theta_{eq}$  is computed by the engineering routine WIDTH described in Appendix E as well as Section IV F of the text.

The scatterometer and radiometer products are then stored in the output array and the output array is transferred to the output tape (unit 02).

The next data record is then read (statement 100) and the sequence of events repeated. If an end of file is encountered on the input tape, control is returned to SEARCH.

2. Program Listing and Variables

The source listing for CRUNCH is shown in Figures A-6(a) through A-6(d). The variablesemployed in CRUNCH are defined in Table A-2. Entires in SPAR

Table A-2 Definition of Variables Used in CRUNCH

DATA	=	Input Raw Data Vector
IDATA	=	Integer Equivalent of DATA
SPAR	=	SCAT Parameters
RPAR	=	RAD Parameter
SCAL	=	SCAT Calibration Vector (Channel 1 to 4)
RCAL	=	RAD Calibration Vector (Normal and Base)
VERI	=	Data Validation Parameters
IVERI	=	Integer Equivalent of VERI
EOFIFC		End of File Indicator for FC 01
eflag	=	File Verification Indicator
IL	=	Record Count

	GUTAUUTINE (RUNCH (11 G+DATA+IDATA+IL+ICGUNT+SCAL+RUAL+) * SFAR+PP/R+LNFMUD+EFLAG+EDFIFC+ CURUNCH URUNCH	COUND557 CCOCC558 CCU00559
	ί,	C00C0560 C0000561
	C IF IS PREGRAM WAS PREPARED BY C	(0000562
	C JCHN P. CLAASSEN	00000563
	C GLEN E. ELLIOTT	C0000564 C0000565
	C UNIVEFSITY OF KANSAS CENTER FOR RESEARCH	CC0CC566
		£0000567
	C THE PRIMARY FUNCTION OF THIS ROUTINE IS TO CONVERT SCATTER-	CC000568 C0000569
	C THE PRIMARY FUNCTION OF THIS ROUTINE IS TO CONVERT SCATTER- C OVETLE AND RACIGMETER OUTPUT VOLTACES INTO THEIR RESPECTIVE	(0000570
	C NORMALIZED INPUT PUKERS. THE CONVERTED SCAT DATA IS	00000571
	C SUBSECTENTLY INVERTED FOR THE SCATTERING COEFFICIENT. C PRIMARY COMPUTATIONS ARE PERFORMED IN SUBROUTINE CRUNCH	00000572
	C PRIMARY COMPUTATIONS ARE PERFORMED IN SUBROUTINE CRUNCH C WHICH CALLS A NUMBER OF IMPORTANT ROUTINES. FROM CRUNCH	CC000574
	C INTERNAL CALIBRATION INFORMATION IS WITHDRAM FROM THE DATA	C0000575
	C RECORDS AND APPLIED TO SUBSEQUENT PEASUREMENTS. THE VIEW	00000576
	C ANGLE IS COFFECTED FOR AIRCRAFT ORIENTATION. A WARNING FLAG C IS GIVEN WHEN THE ROLL ANGLE CAUSES EXCESSIVE DEPULARIZATION	CC000577
	C A FLAG IS ALSC GENERATED WHEN THE DOPPLER SHIFT EXCEEDS	CC000579
	C THE UCPPLER FILTER BANDWIDTH. THERMISTER DATA IS	00000580
	C CHECKED FOR REASONABLE TEMPERATURES AND TEMPERATURES OF C CRITICAL COMPONENTS ARE WITHURAWN FOR SUBSEQUENT USE IN	00000582
	C CONVERTING RACIONETER MEASUREMENTS.	0000583
	c .	00000584
0017	UIMENSICN DAT#(50), ICATA(50), SPAR(85), RPAR(75), SCAL(4), * RCAL(2), ARRAY(20), IARRAY(20), ALT(4)	0000058
0017	REALLY, ARRATIZON, TARRATIZON, ALTIAN DIMENSICN ICHG(3)	00000581
0017	DIMENSION VERI(15,2), IVERI(15,2)	000058
0017	DIMENSICA VMAX(15), VMIN(15), 1VMAX(15), IVMIA(15)	0000058
0017		CC00059
0017		0000059
0017	EQUIVALENCE (APRAY(1), IARRAY(1))	0000059
0017	LOGICAL ECFLFC	00000594
0017	CATA (1VMIN(1),1=1,6)/1;0;0;1;0;0/ DATA (1VMAX(1),1=1,6)/3;4;2;6;1:1/	0000059
0017	DATA (VMIN(I),I=7,10),(VMAX(I),I=7,10)/440.0, 4*10.5/	000059
<b>0017</b>	DATA IVERI(11,1), IVERI(11,2)/0,1/	00000551
0017	UATA (VMIN(1),I=12,14),(VMAX(1),I=12,14)/3*0.0, 10.5, 10.5, 10.5	/ccooo599
0017	CATA IVERI(15,1), IVERI(15,2)/0,3/ CATA ICHG/1,0,2/	66060601
0017	CATA ALT/2030.0, 5000.0, 10000.0, 200C0.0/	0000602
-	C REAU IN NEXT RECORD	00000603
		00000604
0017	NGR=0	0000000
0020 0026	100 IF(IREAD(IFC).NE.0) GO TG 230	00000660
0020	C	00000609
	C VERIFY CONTENTS OF RECORD	CC000610
0037	C IF(ICATA(I).LT.IVERI(I-1.1).OR.	(000611
0027	* ICATA(I).GT.IVERI(I-1,1).GR.	00000612
0041	I=1o	00000614
0042	IF(IDATA(I).LT.IVEFI(I-1,1).OR.	00000615
0024	* ICATA(1).GT.IVERI(1-1.2)) GO TO 115 DO 111 1=2,7	C0000616 C0000617
00055	111 IF(IDATA(I).LT.IVER1(I-1,1).OR.	00000618
	* ICATA(I).GT.IVERI(1-1.2)) GO TO 115	0000061
00071 00072	DU 112 I=E,11 112 IF(DATA(I).LT.VERI(1-1,1).OR.	0000620
10012	* CATA(I).GT.VERI(I-1,2)) GO TO 115	C0000621
0106	00 113 I=13,15	CC000623
0107	113 16(CATA(1).LT.VERI(1-1,1).OR.	60000624
0123	* CATA(1).GT.VER1(1-1,2)) GO TC 115 GO TO 118	C0000625 C0000626
0123	115 WRITE(6,116) I	00000627
0131	116 FCRMAT(//11X+1++,11H BAD RECORD,28X,1H+,5X,9HCOMPONENT,13,	0000628
00131	* 12H IS GARBAGE.//) hRITE(64117) DATA	C0000629
00143	117 FURMAT(/10(5022/)/)	C0C00630
0143	105 NGR = NGR + 1	0000631
00145	1+ (NGR.LE.10) GO TO 100	00000632
00152	EFLAG ≠ .TRUE. G0 TU 230	00000633
	C	00000635
00153		
	C BRANCH IF CALIB DATA	
-	c	C0000636 CC000637

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FLOURE A-6. (a) SOURCE LISTING FOR CRUNCH

	C		00000642
000163		IDATA(3)=ICATA(3)=1	CCOCO643 COOCO644
	*	{JK=}VATA{4} {CATA{4}={CHC(IJK+L}	00000645
		10ATA(4)=10ATA(6)	CC000646
	C Î	- · · ·	C00C0647
	C	CHECK FOR AGREEMENT IN RECEIVE POL	00000648
	C		COOCO649 COOCO650
000165 C00175		IF(IDATA(7).EQ.IDATA(12).OR.IDATA(3).EC.0) GU TO 119 WRITE(6,1000) IDATA(7), IDATA(12)	00000651
000212	1000	FORMAT(//11x+1++,31H RECEIVE POLARIZATIONS DISAGREE,8X,1H+,5X,	00000652
	*	9HSCAT REC=,13+5X;8HRAD REC=,13//}	00000653
000212		60 TO 105	00000654
	ι L	INITIALIZE CHANNEL INDICATOR FLAG AND CLEAR OUTPUT ARRAY.	00000655
	C C		00000657
C00216	119	I CI1AN =0	C0000658
000217			C0000659
000221	120		0000660
000224	-	]L = ]L + 1	00000661
	с с		00000662
	č		00000663
C00226	• •		60000664
	C		00000665
	с с		COOOO666 COOOO667
C00234	с С		C0000668
000236		_ICOUNT_= ICOUNT + IWARM	00000669
000242			CC000670
000245			00000671
-	с с		66000673
	č		CC000674
<b>C</b> 00246		CALL ANGLE (DATA, SPAR, IL, LNPMOD, IFLAG)	00000675
	ç		CC000676 C0000677
	С С	AMENG ERRER CODE	00000678
000252	u.	ICOUNT=ICCUNT+IFLAG/10	00000679
C00262		1ARRAY(12) = IAFRAY(12)*100+IFLAG	00000680
	-c		CC000681 CC000682
	с с	CCNVERT RACICMETER CATA	00000683
-		•	
000264			0000684
	с с	BRANCH IF RED UNLY DATA	0C000685 C0000686
	Č		00000687
000270			0000688
	C		0000689
	с с		00000690
000275	U U		00000692
	C		CCCCC693
	c		00000654
000301	С		00000695
000304			COOOO696 00000697
	C	•	00000698
	C	SELECT SCAT CHANNEL OUTPUT	0000659
	ç		00000700
	c c	THIS SECTION SELECTS THE MAXIMUM CN-SCALE SCAT CHANNEL OUTPUT	CC000701 00000702
	Č C	AND TRANSFERMS IT TO A NURMALIZED RECEIVER INPUT POWER.	00000703
	C	WHERE READING FALLS CUTSIDE OF CYNAMIC RANGE OF THE FCUR	00000704
	C		CC00C705
	C C C		C0000706 00000707
	С		00000708
	c		CC000709
GC0310	С		00000710
600310	c	•	00000711 00000712
	C		(0000713
	C		00000714
C00311			¢0000715
.000314 600317			00000716 CCOC0717
000322			00000718
	C		00000719
	с С	DATA FELL JENEATH RANGE	00000/20
000326	C I	DATA(11)-DATA(11)+1.0 E-10	00000722
CC0330		IFLAG =1	CC000723
	C		0000724
	C C	APPLY SCALE FACTURS	00000725
	U U		00000726

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FIGURE A-6: (b) SOURCE LISTING FOR CRUNCH

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# FIGURE A-6. (c) SOURCE LISTING FOR CRUNCH

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C00331	130	UATA (b) = LATA (11) + SPAR(21) / SCAL(4)	(COC0/27
CO0336		16441=4	C0000728
166003		GO TO 170	CC000729 C0000730
	C C	UATA FELL ABOVE RANGE	00000731
	ĉ	DATA FELL ADOVE MANDE	CC000732
000337	140	IF (DATA(8) .GE. SPAR(27)) (FLAG=1	00000733
	C		(0000734
	C	APPLY SCALE FACTORS	00000735 00000736
000074	C	UATA (8)= LATA (8)*SPAR(18)/SCAL(1)	00000737
000344 000350	-	ICHAN=1	60000738
000351	•	GO TO 170	CC000739
000351	1 >0	LATA (8) = LATA(9)*SPAR(19)/SCAL(2)	00000740
000356		ICHAN=2	COOOO741 00000742
000357		60 TO 170 DATA (0)= CATA(10)*SPAR(20)/SCAL-(3)	60000742
COO397 COO304	160	ICHAN=3	00000744
000304	с	Leuwi-2	CCCC0745
	c	END SFLECTION OF SCAT CHANNEL.	00000746
	c		CC000747 CC000748
	ç	AMIND ERROR INCICATOR	60000748
000365	C 170	[ARRAY(12)=[ARRAY(12]*10+1FLAG	C0000750
006370		ICOUNT = I CC UNT + I FLAC	CO000751
000371		IF(IFLAG.NE.1) GO TO 175	00000752
CO0373	•	IF(HDD(1L,LNFMCD).EQ.0) WRITE(6,1700) IL	00000753 00000754
000410	1700	FURMAT(IC,5X,2P* 22HEXCEEDED DYNAMIC RANGE,16X,1H*)	00000755
	с с	CHECK RANGE GATE SETTING	C0000756
	č		C0000757
000410	175.	IFLAG = 0	CC000758
CC0411		IALT = ICATA(16)+1	C0000759 00000760
000414 C00416		CHFCK=ALT(IALT) IF(UATA(41) .L1. CHECK+300AND. DATA(41) .GT. CHECK-300.)	00000761
100410	\$	GC TO 177	00000762
C00431		IFLAG = 1	
000432		wRITE(6,1760) CHECK, CATA(41)	
CO0445	1750	FORMAT(16,5X,2F*,32HNOT WITHIN 300 FT. OF RANGE GATE, CX, IF*,	
C00445	177	5x, 11/1RAAGE GATE=, F7.0, 5X, 9HALTITUDE=, F7.0) - [ARRAY(12) = [AFRAY(12)+10 + IFLAG]	C000C763
000450	1	ICUL, T=I CLUNT+IFLAC	CC000764
	C		(CC0C765
	с С	COMPLETE CONVERSION OF SCAT DATA	C0000767
000454	180	CALL SCUNV (DATA, IDATA, SPAR, IBAND)	00000766
	c		00000769
	с	SCAT INVERSION.	C0000770
	ç		C0000/71 CCCGC772
	с с	CEMPARE SEAT PELARIZATIONS.	CC000/73
	č		C0000774
CO0457		I XM T= I DA TA (6)	CC000775
C00464		IREC=10ATA(7)	CCC0C776
000466	C	IF(IAMT.EU.IREC) GC TQ 190	00000777 CC00C778
	c	ERROR MESSAGE	C0000779
	č		00000760
000467		IF(MOD(IL,LNFMCC).EQ.D] mRITE(6,1800) IL, IXMT, IREC	CC000781
000511	1 ±00 *	FORMAT(16,5X,2F* ,37HJNABLE TO HANDLE CROSS PULARIZED EATA, 1X,2H* ,4X,26HWILL ASSUME PULARIZEC DATA, 5X,	C0000782 C0000783
	*	10HXMIT PUL.=, 12, 5X, 10HREC. PCL.=, 12)	
			10000784
	C		COOOO784 CCOOO785
	C	INVERT SCAT CATA	CC000785 C0000786
001511	с с	INVERT SCAT DATA	CC000785 C0000786 CC00C787
000511	C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453293*	CC000785 C0000786 CC00C787 C0000788
000511	C C 140	INVERT SCAT CATA UATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*5PAR(1XMT+32)*SPAR(IREC+32)*	CC000785 C0000786 CC00C787
000511	C C 190 * C	INVERT SCAT CATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453293* CATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.290304)	CC000785 C0000786 CC00C787 C0000788 CCCC0789 CCCC0789
000511	C C 190 * C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* EATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)*	CC000785 C0000786 CC00C787 CC00C788 CCCC0789 CCC00790 CC000791
-	C C 190 * C	INVERT SCAT CATA UATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(11XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICD	CC000785 C0000786 CC00C787 CC000788 CCCC0789 CC000790 CC000791 C000C792
000511 000533 C00535	C C 190 * C C	INVERT SCAT CATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453293* CATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.290304)	CC000785 C0000786 CC00C787 CC00C788 CCCC0789 CCC00790 CC000791
000533	C C 190 * C C	INVERT SCAT CATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(11xmT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IDATA(5)	CC000785 C0000786 CC00C787 C0000788 CCCC0789 CC000790 CC000791 C000C792 00000793
000533 C00535	C 140 * C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICD IND=HUATA(5) ARRAY(7)*SPAR(IND+3) IF(1UATA(3).FC.1) ARRAY(7)*SPAR(10)	CC000785 C0000786 CC00C787 CC000788 CCCC0789 CC000790 CC000791 C000C792 00000793 C000C795 C0000795
000533 C00535	C 140 * C C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* EATA(14))*3.14159265*SPAR(IXMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IDATA(5) ARRAY(7)*SPAR(IND+3)	CC000785 C0000786 CC000787 CC000788 CCCC0789 CC000790 CC000791 C0000791 C0000793 CG000793 CG000795 OC000797
000533 C00535 000537	C 140 * C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* EATA(14))*3.14159265*SPAR(IXMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IDATA(5) ARKAY(7)*SPAR(IND+3) IF(IDATA(3).FC.1) ARRAY(7)=SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY	CC000785 C0000786 CC00C787 CC0C0788 CCCC0789 CC000790 CC000791 C00CC792 06000793 CC00C795 0C0CC756 06000798
000533 C00535	C 140 * C C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICD IND=HUATA(5) ARRAY(7)*SPAR(IND+3) IF(1UATA(3).FC.1) ARRAY(7)*SPAR(10)	CC000785 C0000786 CC000787 CC000788 CCCC0789 CC000790 CC000791 C0000791 C0000793 CG000793 CG000795 OC000797
000533 000535 000537 000544 C00546 C00547	C 140 * C C C C C	INVERT SCAT CATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(IXMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IDATA(5) ARRAY(7)*SPAR(IND+3) IF(IDATA(3).FC.1) ARRAY(7)*SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY [ARRAY(5) *IDATA (6) IARRAY(6) = IDATA (6) ARRAY(6) = CATA (8)	CC000785 C000786 CC00C787 CC0C0787 CC0C0790 CC000791 CC00C792 C000C791 CC00C792 CC00C794 CC00C795 OC0C0798 OC0C0798 OC0C0798 OC0C0798 OC0C0798
000533 000535 000537 000544 000546 000547 000551	C 140 * C C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* EATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IUATA(5) ARRAY(7)*SPAR(1ND+3) IF(1UATA(3).FC.1) ARRAY(7)=SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY JARRAY(5) = IUATA (6) IARRAY(6) = EATA (8) ARRAY(6) = CATA (8) ARRAY(9) = 10.0*ALUCIO(DATA(8))	CC000785 C000786 CC000788 CC000787 CC000790 CC000791 C0000791 C0000793 CC000793 CC000793 CC000795 0C00C796 0C00C798 0C00C798 0C00C799 0C00C799 C0000800 CC000801 C000802
000533 000535 000537 000544 C00546 C00547	C 140 * C C C C C C C	INVERT SCAT CATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(IXMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IDATA(5) ARRAY(7)*SPAR(IND+3) IF(IDATA(3).FC.1) ARRAY(7)*SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY [ARRAY(5) *IDATA (6) IARRAY(6) = IDATA (6) ARRAY(6) = CATA (8)	CC000785 C0000786 CC000787 CC000787 CC000790 CC000791 C0000793 CC000793 CC000793 CC000795 OC0CC756 O0000797 OC0CC756 O0000797 OC0C0798 OC0C0798 OC0C0798 CC008002 CC008002 CC008002
000533 000535 000537 000544 000546 000547 000551	C 140 * C C C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=1DATA(5) ARRAY(7)*SPAR(1ND+3) IF(1DATA(3).FC.1) ARRAY(7)*SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY JARRAY(5) *IDATA (6) IARRAY(6) = 1DATA (7) ARRAY(6) = CATA (8) ARRAY(9) * 10.0*ALUCIO(DATA(8)) GO TO 210	CC000785 C0000786 CC000787 CC000787 CC000790 CC000791 C0000791 C0000793 C0000793 C0000795 OC0CC795 OC0CC798 OC000797 OC000797 OC000797 OC000798 OC000798 OC000798 C0000800 CC000803 CC00803
000533 000535 000537 000544 000546 000546 000551 000552	C 140 * C C C C C C C C C C C C C C C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* EATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=IUATA(5) ARRAY(7)*SPAR(1ND+3) IF(1UATA(3).FC.1) ARRAY(7)=SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY JARRAY(5) = IUATA (6) IARRAY(6) = EATA (8) ARRAY(6) = CATA (8) ARRAY(9) = 10.0*ALUCIO(DATA(8))	CC000785 C0000786 CC000786 CCCC0787 CC000790 CC000791 C0000791 C0000793 C0000793 C0000795 OC00C795 OC00C796 OC000798 OC000798 OC000799 OC0000799 OC0000799 C0000800 CC00803 CC00805 CC00805 C0000805
000533 000535 000537 000544 000546 000546 000551 000552	C 140 * C C C C C C C C C C C C C	INVERT SCAT EATA LATA(8) = 4.0*DATA(8)*DATA(41)*DATA(41)/(CCS(0.017453253* CATA(14))*3.14159265*SPAR(1XMT+32)*SPAR(IREC+32)* 5.250304) TRANSFER SCAT INT PERICO IND=1DATA(5) ARRAY(7)*SPAR(1ND+3) IF(1DATA(3).FC.1) ARRAY(7)*SPAR(10) TRANSFER SCAT LATA TO OUTPUT ARRAY JARRAY(5) *IDATA (6) IARRAY(6) = 1DATA (7) ARRAY(6) = CATA (8) ARRAY(9) * 10.0*ALUCIO(DATA(8)) GO TO 210	CC000785 C000786 CC000788 CCCC0787 CC000789 CC000791 C0000791 C0000793 CC000793 CC000795 OC000795 OC000798 OC000798 OC000798 OC000798 OC000798 CC000801 CC00802 CC00803

C00565	210	ARRAY (10) = $CAT = (13)$	80800000
	c		0000809
	С	Y TRANSFER CTHER SELECTED CATA	01600000
	С С		00000811
_00567		ARRAY(1) = LATA(1)	CC000812
C00570		IARRAY(2)=10A TA(3)	00000813
000572		ARPAY (3) = LATA (14)	C0000814
000573		ARRAY(4)= DATA(15)	C0000815
000575		ARRAY(11)=CATA(40)	CCCC0816
(00576		ARRAY (15)= DATA(41) .	00000817
CC0600		ARRAY (14)= LATA (47)	C0000918
C00601		ARRAY (15)= DATA (46)	C0000819
	C		CC0C0820
	C C	WRITE TO OUTPUT TAPE	00000821
	C		C0000822
000603		CALL WRITE2(ARRAY)	00000823
	C ,		COO00824
	C C	INTERMECIATE PRINT-OUT	00000825
	С		CO000826
CO0604	,	IF(MOD(IL,LNPMCD).EQ.0) WRITE(6,2000) IL, ARRAY(10), ARRAY(8),	00000827
	*	ICHAN, IEANC	CCCC0828
000643	2000	FORMAT(Ic,5X,2H**,4X,29HCOMPLETED RECCRD CCMPUTATIONS,4X,2H**,	60000829
		4X+14F ANTENNA TEMP=+F6.1,2X+16FSCATTERING COEF=+E12.6,	00000830
	*	2X; 0101A11122-71272X7 31001 04102-7137	ÇOOO0831
COO643		GC TO 100	CCCOC632
000644	220	CALL CALIB(SCAL, RCAL, RPAR, NORMAL, BASE)	00000833
CC0650		IF(.NUT.ECFIFC) GC TO 100	0000834
600656	230	WRITE(6,2000) IL, ARRAY(10), ARRAY(8), ICHAN, IBAND	00000835
_C00702	_	RETURN	CCOCC836
CO0703		'END	00000837

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FIGURE A-6. (d) SOURCE LISTING FOR CRUNCH

ICOUNT	= .	Number of Interpretational Flags
LNPMOD	=	Line Print Modulus
IFC	=	Unit Code Number (1 or 8)
NGR	=	Number of Bad Records
ALT	=	Pange Gate Settings
CHECK	=	One of Gate Settings
IXMT	=	Transmit Polarization Indicator
IREC	=	Receive Polarization Indicator
IND	-	SCAT Integration Selector
ARRAY	=	Output Array ·
IARRAY	=	Integer Equivalent

Table A-2 Definition of Variables Used in CRUNCH (Continued)

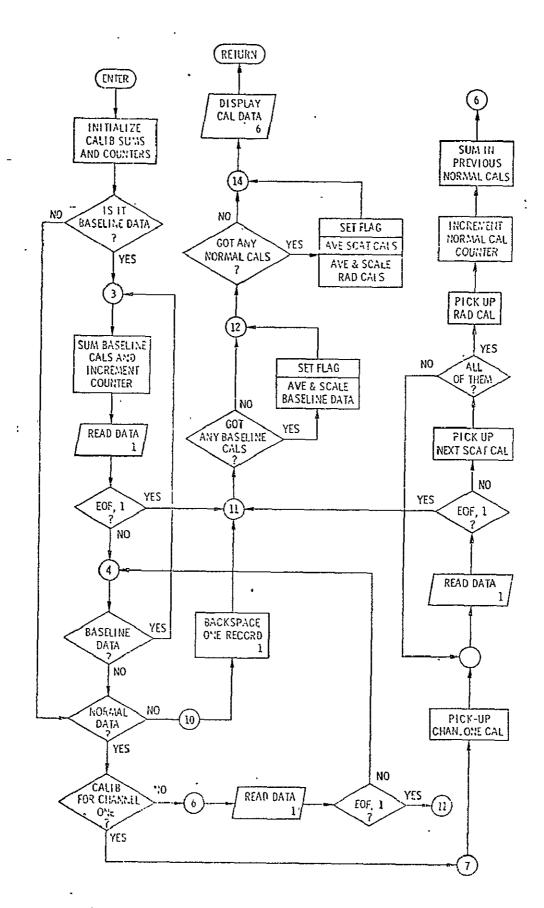
and RRAR are defined in Section III D; whereas, the entries in ARRAY are defined in Section III C.

#### C. Subroutine CALIB

1. Theory and Design

Subroutine CALIB extracts, averages and displays calibration parameters from calibration records. CALIB was designed to anticipate calibration records in a format generated by the RADSCAT instrument. Although additional flexibility is provided so that baseline records, which are entered by hand, may be inserted in almost any fashion. The baseline records may occur anywhere in the file except within a group of four normal calibration records. In regards to sequences of normal calibrations, the subroutine will orient itself on a set of four by interrogating whether the first normal calibration record causes SCAT outputs to saturate in channels 2, 3 and 4. This feature was embedded in the routine when it became apparent that the RADSCAT instrument would occasionally drop calibrations on the first few SCAT channels. A descriptive logic diagram for subroutine CALIB is shown in Figure A-7.

The baseline (BCAL) and normal calibration counters are initialized upon entry into the routine. Also the SCAT channel (CAL1(I), I = 1,4) and RAD accumulators(CAL1(5), RCL) are cleared. If the type of calibration record (normal or baseline, see Section III B) is normal (IDATA(4) = 0), processing is directed to statements including and following 4. Otherwise, if it is a baseline record, it is accumulated in RCL, the baseline counter is incremented, and the next record is



ORIGINAL PAGE ISFIGURE A-7. DESCRIPTIVE LOGIC DIAGRAMOF POOR QUALITYFOR SUBROUTINE CALIB

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read. In statement 4 and the one following, the type of record is again determined. If additional baselines records are present (IDATA(4) = 2), the above processing is repeated; if it is normal calibration data, the record is examined to determine whether the calibration indeed occurred on channel 1 (see DO loop terminating in statement 5). If not, the next record is read and the type is again determined. Once the program is aligned on the calibration for channel one, it extracts it in statement 7 and pulls the SCAT calibrations from the subsequent records for channels 2, 3 and 4 and the normal RAD calibration from the last SCAT calibration record (Channel 4). The normal cal counter is incremented and the calibration accumulator update.

The next record is read and the type determined again. If it is a calibration record the above steps are repeated. If not (measurement record), the unblocking routine READ1 is called to backspace a record (statement 10). The steps 11 through 60 determine what kinds of calibrations were present and how many. The accumulated calibrations are averaged and scaled accordingly. The types of calibrations present are reflected by setting the logical variables NORMAL and BASE to TRUE. The calibration parameters are then printed and control is returned to the calling routine, either SEARCH or CRUNCH.

2. Program Listing and Variables

The source listing for CALIB is shown in Figure A-8. The definitions of the variables are listed in Table A-3.

		Table A-3	Variables Used in CALIB	
DATA	=		Input Raw Data Vector	
IDATA	=		Integer Equivalent of DATA	
SCAL	=		SCAT Calibration Vector	
RCAL	=		RAD Calibration Vector	
RPAR	=	RAD Parameters		
NORMAL	=		Normal Cal Indicator	
BASE	=		Baseline Cal Indicator	
BCAL	=		Baseline Cal Record Counter	
CAL	=	•	Normal Cal Record Counter	
RCAL	=		Baseline Cal Accumulator	
CALI	=		Normal Cal Accumulator	

		SUBROUT INE CALIB(SCAL, RCAL, RPAP, NORMAL, BASE)	856000038
	CCALIB C	CALIERATION SLEROUTINE	C0000839 C0000849
	C C	THIS FREGRAM WAS PREPARED BY	CGON0841 COON0842
	C C	JCHN P. CLAASSEN Glen e. Elliott	CC000843 60000844
	č.		C0000845 00000846
	- <u>c</u>	UNIVERSITY OF KANSAS CENTER FCR RESEARCH	0000847
	C	THIS SUUROUTINE EXTRACTS CALIBRATICN INFORMATION FROM THE RADSCAT LATA FILE AND DISPLAYS IT.	C0000848 CC000849
000010	C	CONNON /INPUT/ EDF1, CATA	00000850 C000C851
C00010 CC0010	<	LOGICAL NCRMAL, BASE, EOF1 DIMENSION DATA(50), ICATA(1), SCAL(1), RCAL(1), RPAR(1)	00000652 (C000853
C00010 C00010		DIMENSION CALI(5), CAL2(5) EQUIVALENCE (CATA(1), CATA(1))	COOOO854 COCGCE55
	C C	INITIALIZE CAL COUNTERS	CODO0356 CODO0657
000010	Ċ	BCAL=0.0	COOOD858 CCC00859
C00011 C00012		RCL=0.0	00000860
00012	ç	CAL=0.0	C0000861 C0000862
	Ċ C	CLEAR CAL ACCUMULATORS	00000863 CC000864
C00013 C00014	1	_D0 l l=1,5 CALL(1)=C.C	C0000865 C0000866
	ເັ ເ	BRANCH WEEN NOT BASELINE	C0000867 C000868
-	С		CC000869
C00017	_ ¢	IF(ICATA(4).NE.2) GO TO 4	000C0870 00000871
•	с С	EXTRACT BASELINE	C000C872 C000C873
C00021	ذ c	RCL=RCL+CATA(13)	C0000874 00000875
	Č C	UPDATE ECAL CCUNT	COCCC876 00000877
C00023	- •	BCAL=BCAL+1.0	C0000878
-	C		00000879
	С Ĺ	READ NEXT RECORD	00000880 00000881
C00025 C00026		CALL READI 1F(FDF1) GG TC 11 /	CC000882 00000883
C00033	с ⁴	IF(ICATA(4).EC.2) GO TO 3	00000884 CC000885
	с с	EXIT WHEN NO MORE CAL DATA	C0000886 0000887
· CC0035	c	IF(IDATA(4).NE.C) GO TO 10	0000888
	č	CHECK IF RECORD CONTAINS CAL ON FIRST SCAT CHANNEL	00000889 00000889
	c		COODC891 COODC892
000036 C00057	5	DO > 1≈2+4 IF(DATA(I+7)+LT+9+0} GO TO 6	C0000893 0000C854
C00044	c	GO TO 7	00000895 00000896
	с с	FIND FIRST SCAT CAL	C000C857 C0000598
C00044 000045	. 6	CALL REAJI IF(EUF1) 11,4	CC0CCu99
	i C	EXTRACT SCAT 1	00060900 CC000901
6000/ D	С	_	00000902 C0C00903
C00053	c C	CAL2(1)=CATA(8)	00000904 00000905
	с с	EXTRACT REMAINDER OF CALS	00000906 0000907
CQ0055 CC0056		DO 8 1=2,4	00000908
000057 C00064	15	[F(EUF1) GO'TO 11 [F(1DATA(4).NE.0] GO TO 4	00000910 C00C0911
C00065 C00071	8	CAL2(1)=LATA(1+7) LAL2(5)=CATA(13)	00000912
¢00073	· · · ··	CAL=CAL+1.0	C0000913 00000914
	C C	ACCUMULATE REPETITIVE CALS	CCOGO915 00000916
000075	C	UU 9 I=1,5	C0000917 C0000918
CO0076 C00102	9	CAL1(I)=CAL1(I)+CAL2(I) GU TO 6	00000919 00000920
	C C	REPOSITION DATA RECORD	00000921
	•	NEL VOLTEN CATP NELUKU	00000 722

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FIGURE A-8. (α) FORTRAN LISTING FOR CALIB

			40000.23
	C		0000923
000102	10	CALL BCKSP1	CC 000924
	С		(000925
	C C C	CHECK FOR PRESENCE OF BASELINE CAL	00000926
	ċ		(0000927
000103	11	IF(8CAL.LT.1.0) GC TO 12	00000528
C00111		BASE = .TRUE.	66060529
	С		0000030
	č	AVERAGE AND TRANSLATE BASELINE	CO000931
	č		00000932
000111	C C	KCAL(1) = (RCL/ECAL) * RPAR(19) / RPAR(20)	CC0C0433
000111	С		66000934
	c	CHECK FOR PRESENCE OF NORMAL CAL	00000935
	c	Creck for fresence of Normal (AL	66660436
600116	12	1+(CAL.LT.1.0) GG TO 14	00000937
COO115 GOO120	12	NCRMAL = TRUE.	CC000>38
CCO120			00000939
CC0120	~	DO 13,1=1+4	CC000940
	C	AND ARE FORT ON C	CC000941
•	C C	AVERACE SCAT CALS	00000942
000100	~		00000943
000122	13	SCAL(1)=CAL1(1)/CAL	60000944
	Ç		00000545
	C	AVERACE AND TRANSLATE RAD CAL	00000945
	C		60000947
000126		RCAL(2)=(CAL1(5)/CAL)*RPAR(19)/RPAR(20)	60000947
	c		60000949
	С	EISPLAY CAL DATA	
	С		CC0CC950
000152	14	WRITE (6,100) (1,SCAL(1),1=1,4),RCAL(2), RCAL(1), CAL, BCAL	00000951
C00167	100	FORMAT (11X, 1H*10X, 16FCALIBRATION CATA, 13X, 1H*, 3X,	0000452
		* 4(2X,4HCHAN,12,1H=,F7.3),	CC000953
		* /51X,1H*,5X,5HRCAL=F7.3,2X,6HRBASE=,F7.3,	0000954
		* 7F NCAL=,F6.C, SH NdCAL=,F6.0)	00000955
000167	60	RETURN	C0000956
000170		END	00000959
		-	

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FIGURE A-8. (b) (continued)

## D. Subroutine ANGLE

### 1. Introduction

This routine computes the incident angle and cross track angle both of which are required to define the beam position on the surface with respect to the aircraft flight vector. When roll or pitch becomes excessive, as the case may be, so as to make the polarization difficult to interpret a flag is generated. Irrespective of the flagged condition the data is reduced in the standard way. The theory by which these angles are computed and the method by which the angles are applied to determine the polarization break-up at the surface are described below.

### 2. Theory and Design

<u>a. Incident and Cross-Track Angles</u> - Suppose the aircraft is vectored along the positive x axis of an unprimed coordinate system where the z axis corresponds to the local vertical. The orientation of the aircraft is represented in a primed coordinate system where x axis is located along the fore-aft axis of the aircraft. They are related to the unprimed system by a drift angle  $\phi_d$  about the z axis, a pitch angle  $\theta_p$  with respect to the x, y plane and a roll angle  $\phi_r$  about the x'axis (Figure A-9).*

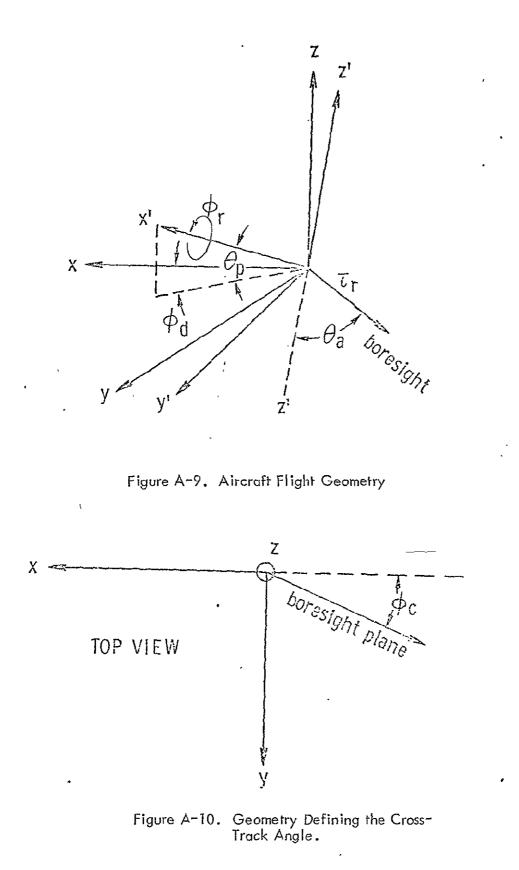
The antenna points at an angle  $\theta_a$  with respect to the -z' axis.  $\theta_a$  is assumed to be corrected for the relative angle between aircraft and antenna platforms. The true incident angle  $\theta$  on the ground is desired. The incident angle may be derived from relation

$$\cos \theta = -\bar{\iota}_{r} \cdot \bar{\iota}_{z} \tag{1}$$

where  $\tau_r$  is a unit vector in the boresight direction. Also of interest is the cross track angle  $\phi_c$  measured in the x, y plane with respect to the -x axis as shown in Figure A-10. Clearly we have

$$\tan \phi_c = \frac{\bar{\iota}_r \cdot \bar{\iota}_y}{-\bar{\iota}_r \cdot \bar{\iota}_x}$$
(2)

It should be noted that these definitions of roll, pitch and drift coincide with those provided by the Litton Navigator LTN-51.



Now in the primed coordinate system the boresight axis is described by

 $\overline{\iota}_r = -\sin\theta_a \,\overline{\iota}_{x'} - \cos\theta_a \,\overline{\iota}_{z'}$ (3)

The primed and unprimed coordinate systems are related by the following successive transformation

$$\begin{pmatrix} \vec{\imath}_{\alpha'} \\ \vec{\varkappa}_{g'} \\ \vec{\imath}_{z'} \end{pmatrix} = ABC \begin{pmatrix} \vec{\varkappa}_{\alpha} \\ \vec{\varkappa}_{g} \\ \vec{\varkappa}_{z} \end{pmatrix}$$
(4)

where

$$A = \begin{pmatrix} I & 0 & 0 \\ 0 & \cos \phi_r & \sin \phi_r \\ 0 & -\sin \phi_r & \cos \phi_r \end{pmatrix}$$
$$B = \begin{pmatrix} \cos \theta_p & 0 & \sin \theta_p \\ 0 & I & 0 \\ -\sin \theta_p & 0 & \cos \theta_p \end{pmatrix}$$
$$C = \begin{pmatrix} \cos \phi_d & \sin \phi_d & 0 \\ -\sin \phi_d & \cos \phi_d & 0 \\ 0 & 0 & I \end{pmatrix}$$

Substitution of (3) and (4) into (1) yields

$$\cos\theta = \sin\theta_p \sin\theta_a + \cos\theta_p \cos\theta_a \cos \varphi_r \qquad (5)$$

which reduces to the expected result when  $\phi_r = 0$ , namely,  $\cos(\theta_p + \theta_a)$ . When the drift angle is considered zero, a similar approach will yield

$$\tan \phi_{c} (\phi_{d} = 0) = \frac{\sin \phi_{r} \cos \theta_{a}}{\sin \theta_{a} \cos \theta_{p} - \sin \theta_{p} \cos \theta_{o} \cos \phi_{r}}^{(6)}$$

l

When  $\phi_d = 0$ , it is clear from Figure A-11 that the correction for  $\phi_d$  is simply given by

$$\phi_{c}(\phi_{d}=0) = - [\phi_{d} - \phi_{c}(\phi_{d}=0)]$$
(7)

or

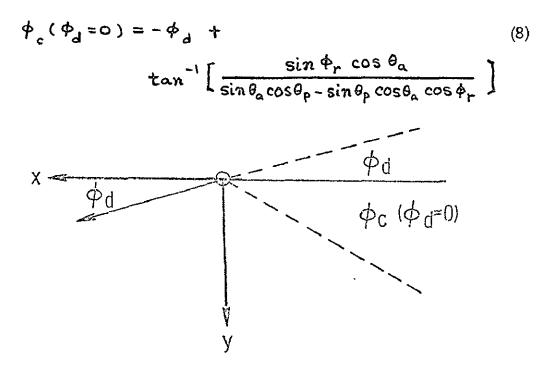


Figure A-11. Cross-Track Angle Correction for Drift.

Equations 5 and 8 thus define the beam position on the sea with respect to the aircraft trajectory.

<u>b. Polarization Decomposition</u> — When the aircraft pitches and rolls, the incident polarization can decompose into vertically and horizontally polarized components. When the unwanted component becomes excessive, the measurement becomes difficult to interpret; and, consequently, the reduced data should be flagged.* To determine the size of the undesired component, the degree of "de-polarization" is computed from considerations similar to those above.

[°]Correction for this situation is possible when polarized measurements are considered jointly.

Without loss of generality we may assume that the aircraft is vectored along the -x axis with zero drift. It is pitched at an angle of  $\theta$  with respect to the -xaxis and a positive roll of  $\phi_r$  is induced about the  $-x^r$  axis. The x,y plane forms the local horizontal and the z axis is pointed at nadir. See Figure A-12.

The antenna is boresighted in the x', z' plane with an angle  $\theta_a$  from the z' axis. The vertical polarization emitted by the antenna is described by

$$\overline{\iota}_{\theta'} = \cos\theta_a \,\overline{\iota}_{\chi'} - \sin\theta_a \,\overline{\iota}_{\chi'} \tag{9}$$

along the boresight axis. The horizontal surface polarization at the boresight point is described as

$$\bar{i}_{\phi} = -\sin\phi_{c}\bar{i}_{x} + \cos\phi_{c}\bar{i}_{y} \qquad (10)$$

where  $\phi_c$  corresponds to the cross-track angle for the zero drift condition. Now the percent power de-polarization is approximately given by  $100 |\overline{t}_{\theta} \cdot \overline{t}_{\phi}|^2$  for points illuminated by the main beam.

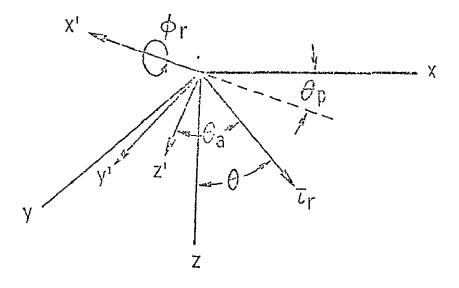


Figure A-12. "Depolarization" Geometry.

Now the transformation between the coordinates is given by

$$\begin{pmatrix} \overline{\imath}_{\alpha'} \\ \overline{\imath}_{g'} \\ \overline{\imath}_{g'} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \phi_r & -\sin \phi_r \\ 0 & \sin \phi_r & \cos \phi_r \end{pmatrix} \begin{pmatrix} \cos \theta_P & 0 & \sin \theta_P \\ 0 & 1 & 0 \\ -\sin \theta_P & 0 & \cos \theta_P \end{pmatrix} \begin{pmatrix} \overline{\imath}_{\alpha} \\ \overline{\imath}_{g} \\ \overline{\imath}_{z} \end{pmatrix}$$
(11)

or

$$\begin{pmatrix} \bar{\tau}_{\chi'} \\ \bar{\tau}_{y'} \\ \bar{\tau}_{z'} \end{pmatrix} = \begin{pmatrix} \cos \theta_{p} & 0 & \sin \theta_{p} \\ \sin \phi_{r} \sin \theta_{p} & \cos \phi_{r} & -\sin \phi_{r} \cos \theta_{p} \\ -\cos \phi_{r} \sin \theta_{p} & \sin \phi_{r} & \cos \phi_{r} \cos \theta_{p} \end{pmatrix} \begin{pmatrix} \bar{\tau}_{\chi} \\ \bar{\tau}_{y} \\ \bar{\tau}_{z} \end{pmatrix}$$
(12)

With the help of (12) we may thus write

$$|\bar{z}_{\theta'} \cdot \bar{z}_{\phi}| = |\sin \phi_c (\cos \theta_a \cos \theta_p + \sin \theta_a \cos \phi_r \sin \theta_p) + \cos \phi_r \sin \theta_a \sin \phi_r |$$
(13)

Now a suitable criterion for excessive polarization may be formed by requiring that

where  $0 < \epsilon < 1$ . However, when the aircraft roll becomes excessive so that  $|\vec{\tau}_{\theta} \cdot \vec{\tau}_{\phi}|^2 > 0.5$  the interpretation of the incident polarization should be reversed from that defined by the instrument. Under this circumstance the polarization criterion should be written as

$$|-|\overline{x}_{0'}\cdot\overline{x}_{\phi}|^{2} < \varepsilon$$
(15)

where  $0 < \epsilon < < 1$ . This latter criterion should be useful when RADSCAT observations are conducted from an aircraft in a roll (blank ) attitude.

From Section IV.B.I we noted that for zero drift

$$\tan \phi_c = \frac{\sin \phi_r \cos \theta_a}{\sin \theta_a \cos \theta_p + \sin \theta_p \cos \theta_a \cos \phi_r}$$
(16)

The drift angle does not influence the polarization decomposition as a little thought will substantiate. This is fortunate since drift angle is not well defined in a roll maneuver. As a consequence the criterion is now formed on the basis of measured and computed parameters.

Relationships (13), (14), (15) and (16) establish the depolarization parameters and the polarization reversal criterion.

3. Program Listing and Variables

The FORTRAN listing for ANGLE is shown in Figure A-13. The comment statements are sufficient to establish the logic of the program. The variables defined in Table A-4 should be helpful.

Table A-4 Definition of Variables in Subroutine ANG	Table A-4	Definition	of Variables	in Subroutine	ANGLE
-----------------------------------------------------	-----------	------------	--------------	---------------	-------

DATA	=	Input Raw Data Vector
SPAR	=	SCAT Parameters
IL	=	Record Count
LNPMOD		Line Print Modulus
IFLAG	=	Excessive Depolarization and Reversal Flag
DEGRAD	=	Degress to Radians Conversion Factor
ANTA	=	Antenna Angle
PITCH	=	Aircraft Pitch
DRIFT	=	Aircraft Drift
ROLL	=	Aircraft Roll
THETA	=	Incident Angle
ARG1,ARG2	=	Intermediate Storage
PHI	= `	Cross-track Angle
DEPOL	=	Depolarization Factor

	C SUBROUTINE ANGLE (DATA, SPAR+IL, LNPFOU, IFLAG) C	00001 00001
	C THIS FREGRAM WAS PREPARED BY	00001
		00001
	· · · · · · · · · · · · · · · · · · ·	00001
	CUNIVERSITY OF KANSAS_CENTER_FCR RESEARCH	00001
	C THIS ROUTINE COMPUTES THE INCIDENT ANGLE THETA FROM AIRCRAFT	00001
		00001
	C THE BORESIGHT CROSS-TRACK ANGLE PHI IS ALSO COMPUTED.	00001
		00001
		00001
0010		00001
	r · · · · · · · · · · · · · · · · · · ·	00001
•	c	00001
0010		00001
	C INITIALIZE FLAG	00001
0010		00001
010	c	CC001
		00001
010		00001
	C C C C C C C C C C C C C C C C C C C	00001
		00001
013	DATA(14)=CATA(14)*SPAR(30)	00001
		00001
	C	00001
0015		00001
<b>.</b>		00001
	¢	
0017		00001
0021	P11CH=DATA(43)+CECRAD	00001
0024		00001
		00001
	C ALL CONTRACTOR OF CALL CONTRACTOR OF C	00001 00001
0025 0043	THETA = SIN(ANTA)*SIN(PITCH)+COS(PITCH)*COS(ANTA)*COS(ROLL) THETA = ACCS(TEETA)	00001
		00001 00001
	C CENVERT TO DEGREES.	CGOOL
0046	DATA(14)=THETA/CEGRAD	00001. 00001
		00001
		00001 00001
0052 0057		00001
075	$[E_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}(AS_{1}($	00001. 00001.
0104 0107		00001
9112	_GU TU 40	00001
0115	10 PH(=0,	00001. 00001.
)116 )121		00001
0122	30 PHI=SIGN(1.57079633, ARG1)	00001. D0001.
0125	40 DATA(15)=PH1/DEGRAD-DATA(44)	00001
• •	C COMPUTE THE DEPOLARIZATION	00001; 00001;
0130		000012
	COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(PITCH)+SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*SIN(ANTA)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*COS(ROLL)*SIN(PITCH))+     COS(ANTA)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS(ROLL)*COS	000012 000012
	* CGS(PH1)+SIN(ANTA)+SIN(ROLL)	000014
4	C CHECK FCR POLARIZATION REVERSALS.	20001/ 20001/
2010	c	000012
163		000012
172	60 TO 60	000012
0172	$\sim$	000012
	C ILAG REVERSAL	000012

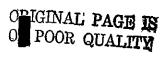


FIGURE A-1., (a) FORTRAN LISTING FOR SUBROUTINE ANGLE 82

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C00174 000210 C00210	C ⇒00 C C	IF(MOD(IL,LNPMCD).EQ.O) WRITE(6,500) IL FORMAT(I6,5%,2H* 21HPOLARIZATION REVERSAL,17%,1H*) IFLAG=1 FLAG EXCESSIVE GEPOL.	00001279 00001250 00001251 00001282 00001283 00001284 00001285
C00211	ັບປ	IF(DEPUL.GT.0.02) GO TO 70	00001286
000215		KETUKN	000012¢7
000215	10	IFLAG=IFLAG+10	00001285
000216 000235	700	IF(MUU(IL,LNPMCC).EQ.O) WRITE(6,700) IL, DEPOL FORMAT(IC.5%,2F* 24HEXCESSIVE DEPOLAR(ZATICN,14X,1H*, 5X,6HDEPCL=,F7.3)	C0001289 00001290 00001291
5د 2000		DATA(40)=LEPOL	C0001252
000237		KETUKN	00001293
C00240		END	00001294

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# FIGURE A-13. (b) FORTRAN LISTING FOR SUBROUTINE ANGLE

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#### E. Subroutine THERMO

Temperatures within the RADSCAT microwave assembly are monitored at various points. Certain of these temperatures are essential to the reduction of the radiometer data. All of the temperatures should be checked to determine whether the instrument is operating within its temperature limits.

The temperatures are monitored by means of thermistors. Above 283° the thermistor output voltages are linearly proportional to temperature. This routine converts the recorded thermistor voltages, DATA(17) through DATA(33), to degrees Kelvin by using linear conversion constants, RPAR(23) through RPAR(56). Once converted the computed temperatures are examined to see that they appear in the operating temperature range specified by RPAR(21) and RPAR (22). Those that fall outside this range are flagged with a message in the Conversion Report. A flag is also generated in the S/R validation code appearing in the output files. Routinely the temperatures critical to the conversion of radiometer data are reported by this routine.

The above steps are reflected in the FORTRAN listing for THERMO shown in Figure A-14. The variables employed in the routine are defined in Table A-5.

Table A-5 Definition of Variables Used in THERMO

DATA	=		Raw Dātā Vector
IDATA	=		Integer Equivalent of DATA
RPAR	= ,	۱. · · ·	•Radiometer Parameters
IL	·= \		Record Number
LNPMOD	=		Line Print Modulus
IFLAG	=		Abnormal Receiver Temperature Flag
IWARM	=		Warm Load Temperature Estimate Flag

# F. Subroutine RCONV

1. Introduction

This routine converts the radiometer output voltage into an antenna (input) temperature. Radiometer baseline calibration RCAL(1) and normal calibrations RCAL(2) are employed to properly scale the output voltage DATA(13) to a receiver input temperature. Thermal noise contributions from front-end elements are subtracted

SUBROUTINE THEREG (DATA, IDATA, RPAR, IL, LNPFOD, IFLAG, INARF) 0001068 00001069 С 06001070 CT RERMO CHECKS TEMPERATURE 00001071 С THIS FROGRAM WAS PREPARED BY ĉ 00001072 00001073 JCHN P. CLAASSEN С 00001074 C GLEN E. ELLICTT 00001075 С 00001076 UNIVERSITY OF KANSAS CENTER FOR RESEARCH С 00001077 С 00001078 C THIS ROUTINE EXAMINES ATM VULTAGES AND CONVERTS THEM TO CC001C79 TEMPERATURES. THE TEMPERATURE VALUES AND CUNVERTS THEM TO CCOOLC79 TEMPERATURES. THE TEMPERATURE VALUES ARE CHECKED TO SEE 00001080 IF THEY DOCUR IN THE PERMISSIBLE OPERATING RANGE. wHEN 00001081 THEY FALL CUTSIDE THE RANGE A FLAC IS CENERATED AND AN ERROR OCCOIDE2 MESSAGE DISCLOSING THE BAD VALUE AND MONITORING LOCATION 00001083 С ί C C IS PRINTED. THE VOLTAGE TO TEMPERATURE PARAMETERS ARE С 00001084 ENTERED FREM RPAR. THE STARRED STATEMENT IS TO BE USED WHEN THE HOT LCAD TEMP IS AVAILABLE. Ĉ 00001085 č 00001086 С 00001087 C00012 DIMENSION CATA(1), RPAR(1), IDATA(1) C0001C88 .... c c 00001089 INITIALIZE FLAGS 60001090 - - --С 00001091 -----000012 IFL AG=0 00001092 C00012 1hARM = 000001053 ---- --- - --С 00001054 С CONVERT TO TEMPERATURES 00001095 С 00001096 . . . 00013 J = 22 00001097 CG0014 00 20 1= 1,17 00001098 600016 K≡I+J 00001099 000020 UATA(1+16)=RPAR(K)*DATA(1+16)+RPAR(K+1)+273.18 00001100 000025 T=DATA(I+16) 00001101 00027 J = J+160001102 " IF(I.E...17) GC TO 20 000031 CC0033 IF (I.LT.RPAR(21) .AND. T.GT. RPAR(22)) GO TO 20 00001103 с С 00001104 FLAG AND PRINT MESSAGE WHEN NOT IN LIMITS. 66661165 С 00001106 000043 1.0 LELAGEL 00001107 IF(MOD(IL,LNPMCC).EQ.0) WRITE (6,100) 11,1,T CO0044 00001108 000066 100 FORMAT(16,5X,41F* RECVR TEMP NOT WITHIN OPERATING RANGE *, 5%,12HLCCATIEN NO. 13,5%, 00001105 ± 00001110 **....** ×-13HTEMPERATURE =, F5.1,7H KELVIN) c²⁰ 00001111 ---330003 CONTINUE 00001112 00001113 CHANGE AIR TEMP TO KELVIN С 00001114 С 00001115 £CC070 DATA(40) = DATA(46) + 273.1800001116 С 00001117 С CHECKS FOR ESTIMATED WARM LOAD TEMPERATURE 00001118 C IF (ICATA(36) .EC. 0) GO TO 30 00001119 C00072 00001120 600074 IWARH = 1CC0074 IF (MUD(IL, ENFMCC) . EG. 0) WRITE(6,150) IL 00001121 FURMAT (12, 5x, 2H* , 3 1HWARM LOAD TEMPERATURE ESTIMATED, 7X, , 1H+) 000113 150 00001122 С 00001123 ٤ LIST CRITICAL TEMPERATURES 00001124 Ĺ 00001125 30 1F(MOD([L,LNPMCD).EQ.0) WRITE (6,200) IL, CATA(27), DATA(33), 000113 00001126 * CATA(32), DATA(28), DATA(46), DATA(25) 200 FURMAT (16,5X,2H* 21HCRITICAL TEMPERATURES,17X, 00001127 CO0157 00001128 4 1H*,5X,5HWARM=,F6.1,2X,4HHOT=,F6.1,2X,4HOMT=,F6.1, 00001129 2X, 3H5W=, F6.1, 2X, 4HAIR=, F6.1, 2X, 4HGDE=, F6.1) * 00001130 600167 RETURN 00001131 C00170 END 00001132

FIGURE A-14. FORTRAN LISTING FOR SUBROUTH IE THERMO

ORIGINAL PAGE IS OF POOR QUALTUR out to refer the receiver input temperature to the antenna terminals with the help of conversion constants RPAR and temperatures of input elements, DATA (17) to DATA (33).

2. Theory and Design

• The radiometer conversion model was developed in TM 186-3.^{*} In view of the involvement in the derivation, only an outline of the derivation will be presented here.

During baseline calibration an output proportional to a zero receiver intput temperature is generated

$$V_{b} = -\frac{\tau_{c}}{RC} \left[ V_{r} + \frac{G}{4(T_{ir} - T_{2r})} (T_{ir} + T_{2r} - T_{ir} - T_{2r}) \right] (1)$$

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where

 $\tau_{c}$  = calibration integration period

RC = output integrator time constant

G = receiver gain established by AGC circuit

 $V_r$  = output reference bias

 $T_{1r}$  = hot load temperature referred to receiver input

 $T_{2r}$  = warm load temperature referred to receiver input

During a normal calibration sequence the output integration produces a voltage given by

$$V_{m} = -\frac{r_{c}}{Rc} \left[ V_{r} - \frac{G}{4(T_{ir} - T_{2r})} \left( 2T_{ir} - 2T_{2r} \right) \right]$$
(2)

This result yields the unknown gain factor

$$G = \frac{2RC}{\tau_c} (V_n - V_b)$$
(3)

where (1) has been employed. A measurement cycle yields an output voltage given by

$$V_{m} = -\frac{\tau}{RC} \left[ V_{r} + \frac{G(2T_{ar} - T_{ir} - T_{2r})}{4(T_{ir} - T_{2r})} \right]$$
(4)

Claassen, J. P., "The RADSCAT Radiometer Transfer Function and Its Application to the Reduction of RADSCAT Data," University of Kansas Center for Research, Inc. Lawrence, Kansas, December 1971.

where T_{ar} is the temperature at the antenna port of the Dicke switch. This result may be written as

$$T_{ar} = \frac{T_{ir} + T_{2r}}{2} - \beta_m (T_{ir} - T_{2r})$$
(5)

where

$$f_{m} = \frac{V_{m} - V_{b} \tau/\tau_{c}}{(V_{m} - V_{b}) \tau/\tau_{c}}$$
(6)

and where (1) and (3) have been employed. From pages 8-11 of TM 186-3 it is noted that certain leakages at the Dicke switch require that certain terms in (5) be modified with reflection factors  $R_a$  and  $R_c$  so that the modeling equation actually becomes

$$T_{ar}(I-R_{L}) = \frac{T_{ir} + T_{2r}}{2} (I-R_{a}) - \rho_{m} (T_{ir} - T_{2r}) (7)$$

Now the temperature at the antenna port of the Dicke switch can be described by

$$(1 - R_{a}) T_{ar} = \beta_{1} T_{a} + \beta_{2} T_{g} + \beta_{3} T_{3} + \beta_{4} T_{F}$$

$$+ \beta_{5} T_{o} + \beta_{6} T_{c} + \beta_{7} + \beta_{8} T_{L}$$

$$(8)$$

where

 $T_a = desired antenna temperature$ 

- $T_g$  = internal guide temperature
- $T_{S}$  = temperature of polarization switch
- $T_{F}$  = temperature of feed between switch and OMT

 $T_c$  = temperature of cutler feed

$$\Psi_i$$
 = referral constants i = 1,2,...,8

It should be noted that the factor  $f_7$  simply accounts for small but unknown contributions originating from front-end elements not well defined physically. Now let

$$\frac{T_{ir} + T_{2r}}{2} (I - R_a) = \sqrt{i} T_i + \sqrt{2} T_2$$
(9)

and

$$\ell_m (T_{ir} - T_{2r}) = \ell_m (v_3 T_i - v_4 T_2)$$
 (10)

Then (7) may be written as

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or after division by 💃 as

$$T_{a} + E_{c}T_{L} = \sigma_{i}T_{i} + \sigma_{z}T_{z} - Q_{m}(\sigma_{3}T_{i} - \sigma_{4}T_{z}) - \eta_{i}T_{3} + \eta_{z}T_{5} - \eta_{3}T_{F} - \eta_{4}T_{o}$$
(12)  
$$- \eta_{5}T_{c} - \eta_{6}$$

Now since  $T_F$  is not monitored it will be assumed that  $T_F = a_b T_s + a_t T_s$ where  $a_b + a_s = 1$ . In this case the conversion model simplifies to the form

$$T_{a} + \xi_{c}T_{L} = \sigma_{1}T_{1} + \sigma_{2}T_{2} - \ell_{m}(\sigma_{3}T_{1} - \sigma_{4}T_{2}) - \sigma_{5}T_{3}$$
(13)  
$$-\sigma_{6}T_{5} - \sigma_{7}T_{6} - \sigma_{8}T_{c} - \sigma_{9}$$

The leakage term  $T_L$  is actually the antenna temperature at the opposite polarization. This term can be estimated from measurements at that polarization. There is no quarantee that it is always available; however, over the sea it can be estimated from  $T_a$  with reasonable accuracy when the sky is clear. Hollinger* has shown that the polarized temperatures are related by

$$T_{av} = \frac{1-c}{1+c} T_{ah}$$

where

$$C = 0.00012 \Theta^2$$

 $\theta$  = observation angle in degrees

^{*}Hollinger, J. P., "Passive Microwave Measurements of the Sea Surface," Journal of Geophysical Research, vol. 75, no. 27, pp. 5209–5213, September 1970.

The latter estimating technique is employed by the subroutine since temperatures at the opposite polarization are not always available. Fortunately  $\xi_c$  is small (estimated at .004) so that under some circumstances the leakage term can be ignored (by setting  $\xi_c = 0$ ).

The above model is incorporated in RCONV. The listing for the subroutine is shown in Figure A-15. The variables are defined in Table A-6.

Table A-6 Definition of Variables in Subroutine RCONV

I =		Receive Polarization Index
J =		Frequency Indicator
RPAR(5) =	$\sigma_i$	
RPAR(6) =	02	
RPAR(7) =	σ ₃	
RPAR(8) =	$\sigma_{\varphi}$	
RPAR(I+9) =	σb	
RPAR(I+11) =	σ-7	
RPAR(I+13) =	$\sigma_{g}$	
RPAR(I+15) =	$c_5$	
RPAR(17) =	G.	
EST =	E. T.	
DATA(28) =	Ts	
DATA(32) =	70	
DATA(46) =	Tc	
DATA(18) =	Tg	

G. Subroutine DOPCHK

1. Introduction

This subroutine computes the doppler frequency shift induced by the relative motion between aircraft and sea. The doppler shift is compared with the doppler filter characteristic to determine whether the shift is within the bandpass. When it is, a frequency index IBAND, which is employed to locate the filter gain, is computed. When the doppler shift lies outside the defined doppler filter characteristic, the band index is set at the appropriate extreme and a flag is set.

SUGROUTINE RELNV IDATA, IDATA, RPAR, REAL, ILI 00600000 GREONV 0000961 CONVERT RACIGMETER с С SUBRELTINE RECOV (DATA, ILATA, RPAR, RCAL, IL) 0000362 0000963 00000 CCCCC564 THIS FREGRAM WAS PREPARED BY 60000965 CC000566 JCHN P. CLAASSEN 00000967 GLEN E. ELLICIT 6660000 00000 00000569 00000570 CC0C0971 THIS PRUGFAM CONVERTS RADIOMETER GUTPUT VOLTAGES TO ANIENNA 0000972 TEMPERATURE. 60060473 С C0000574 010001 DIMENSIUN DATA(1), ILATA(1), RPAR(1), RCAL(1) 00000975 C CC000976 с С 00000577 C0000978 FORM POLARIZATION AND FREQUENCY INDEX. С 00000975 CC0010 I=ICATA(12) 00000580 J=ILATA(2) 000011 (0000581 ¢ CC000485 00000523 Ŀ EXTRACT LCAD TEMPERATURES ũ 00000984 000012 T1 = CATA(33)0000586 C00014 T2=DATA(22) 10000987 CC0015 CCOCC588 1F(J.Eu.3) T2=DA14(27) С С 0000989 66066950 FORM MEASUREMENT PARAMETER. ¢0000991 C 000021 00000992 UATA(13) =- (LATA(15)-RCAL(1))/(RCAL(2)-RCAL(1)) 06000993 6 С APPLY JEPPERATURE FACTORS. 00000994 С 0000995 00025 JATA(13) = LATA(13) * (RPAR(5) * T1-RPAR(6) * T2) + RPAR(7) * T1 + RPAR(2) * T2 - 0000090060000997 KPAK(I+5)*DATA(28)-KPAR(I+11)*CATA(32)-RPAR(I+13)* * ± CATA(46) - RPAR(15)*CATA(18) 60003468 C 00000999 00001000 APPRCXIMATE MISSING CATA С С 00001001 0001002 С С APPRUXIMATING PARAMETER 100001003 00001004 c 000062 C=0.00012*CAT#(14)*DAT#(14) CCCC10C5 ί 00001006 CC0010C7 FOR HERIZENTAL POLARIZATION С CC001008 ſ, CC0065 EST=DATA(13)*(1.0+C)/(1.0-C) 0001009 С 00001010 FOR VERTICAL POLARIZATION 00001011 С 00001012 C IF (1 .EU.L) EST = DATA (13)*(1.0-C)/(1.0+C) 000071 00001013 FORM ANTENNA TEMPERATURES 60001014 С 00001015 Ç 000100 DATA(13) = DATA(13) - EST*RPAR(1+3) 00001016 00001017 KETURN 000104 00001018 C00105 END

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FIGURE A-15. FORTRAIN LISTING FOR SUBPOUTINE ROONV

### 2. Theory and Design

For non-relativistic speeds the two way doppler frequency shift is known to be given by

$$f_d = 2 \langle \overline{\nu} \cdot \overline{\iota}_r \rangle \frac{f}{c}$$
(1)

where

 $\overline{c}_r$  = boresight unit vector

 $\overline{v}$  = aircraft velocity

 $\hat{F}$  = operating frequency

c = speed of light

Denote  $\phi_C$  as the cross-track angle and  $\theta$  as the incident angle (see subroutine ANGLE). Then the boresight vector is given by

$$\overline{\iota}_r = -\sin\theta\cos\phi_c\,\overline{\iota}_z + \sin\theta\sin\phi_c\,\overline{\iota}_y - \cos\theta\,\overline{\iota}_z \quad (2)$$

Also

$$\overline{\boldsymbol{v}} = \boldsymbol{v} \, \overline{\boldsymbol{z}}_{\boldsymbol{x}} \tag{3}$$

So

$$\overline{v} \cdot \overline{\iota}_r = -v \sin\theta \cos\phi_c \tag{4}$$

and

$$f_d = -2 \frac{f_v}{c} \sin \theta \cos \phi_c \tag{5}$$

Expression (5) is the desired result.

Now the computer routine determines whether the doppler shift falls in the doppler bandwidth as defined by the upper and lower limits, SPAR(23) and SPAR(22), respectively. If  $f_d$  is between SPAR(22) and SPAR(23),  $f_d$  is divided by the doppler filter gain sample interval SPAR(24) and the result rounded off to determine the band index (IBAND) from the center frequency. When the shift is outside the bandpass, the band index is set at the appropriate extreme and a flag is set. An error message is also appended to the Conversion Report. A listing of DOPCHK is shown in Figure A-16. The variables employed by the routine are defined in Table A-7.

	รุษบค		0C0C1133 00001134
	с с с	SUBROUTINE DOPCHK (DATA, SPAR, IL, IBAND, LNPMOD, IFLAG)	00001135 00001136
	č	THIS PREGRAM WAS PREPARED BY	00001137
•	ā		00001138
	с С	JOHN P. CLAASSEN	C0001139
	C	GLEN E. ELLIOTT	00001140
	00000		00001141
	C	UNIVERSITY OF KANSAS CENTER FOR RESEARCH	60001142
	Ę		60001143
	C C	THIS SHOULD THE CONDUTES THE POSSIED SHIFT THOUSED BY THE	00001144 00001145
	č	THIS SUBRCLTINE COMPUTES THE DOPPLER SHIFT INDUCED BY THE RELATIVE MOTION BETWEEN AIRCRAFT AND SEA. THE DOPPLER SHIFT	00001145
	Ū.	IS CEMPARED WITH THE DOPPLER FILTER CHARACTERISTIC TO	00001147
	C	DETERMINE WHETHER SHIFT IS WITHIN THE BANDPASS AND WHEN	C0001148
	C	IT IS TO SELECT THE COPPLER FILTER GAIN RELATIVE TO THE	00001145
	6	CALIBRATICN SIGNAL.	00001150
	C		COOO1151
CO0011	_	DIMENSIUN DATA(1), SPAR(1)	00001152
600011	C		00001153
000011	~	DATA DEGRAD/0.0174532525/	00001154
	С С		00001155
	č	INITIALIZE FLAG	00001158
<b>CO</b> 0011	•	IFLAG=0	C00C1158
	C		00001159
	C	CONVERT AIRCRAFT SPEED TO METERS/SEC	00001160
	C		00001161
C00011		VEL=DATA (42)/3.048	00001162
	ç		00001163
	С С	CUNVERT TO PADIANS	00001164
00001.3	L	THETA = CATA (14)*CEGRAC	00001165
CC0015		PHI=DATA(15)+CEGRAD	CG001166 00001167
	¢		00001168
	ċ	CEMPUTE THE DOPPLER, SHIFT	00001169
	C		00001170
CO0017		00P=-2.0*SPAR(1)*VEL/259793000.0*SIN(THETA)*COS(PHI)	00001171
	с. с		00001172
		IF DEFPLER SHIFT EXCESSIVE FORM FLAG	C0001173
	С		00001174
CO0036		IF(DOP.LT.SPAR(22)) GC TC 10	00001175
000041		IF(DUP.GT.SPAR(23)) GD TC 20	00001170
	с с		00001177
		FORM DEPPLER BAND INDEX	00001178
000044	С		00001179
000044		IBAND=-DGP/SPAR(24)+0.5 IF (DOP.6T.0.0) IBAND= -COP/SPAR(24)-0.5	00001130
(00053		IF (DOP.GT.O.O) IBAND= ~COP/SPAR(24)-0.5 KETUKN	00001181
	c	FORM FLAG AND ASSIGN BAND	00001182 00001183
C00054	10	$I \cup AN() = -SPAR(22)/SPAR(24)$	00001184
C00057	••	60 TO 30	00001185
C00060	∠0	IdANU = -SPAR(23)/SPAR(24)	00001186
000063	0د	IFLAG=1	00001187
C00064		IF(MOL(1L,LNFP(G).EQ.0) WRITE (6,40) IL,DATA(42),DATA(14),DOP	00001185
000115	40	FORMAT (16,5%,1h*,1%,17hExCESSIVE DCPPLER,21%,1H*,5%,	00001189
		* 13HAIRCRAFT SPD=, F5.1, 5X, 11HVIEW ANGLE=, F5.1, 5X,	00001190
000115		* 14HDUPPLER SHIFT=,F6.0)	00001191
000116		END	00001192
			00001153

FIGURE A-16. FORTRAN LISTING OF SUBROUTINE DOPCHK

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	Table A-7	Definit	ion of Variables
IFLAG	=		Flag for Excessive Doppler
VEL	=		Aircraft Ground Velocity
THETA	=		Incident Angle
PHI	=		Cross-track Angle
DOP	=		Doppler Shift
	= ,		Doppler Band Index
SPAR(22)		ì	Lower Doppler Filter Limit
SPAR(23)	= '		Upper Doppler Filter Limit
SPAR(24)	=		Doppler Filter Sample Interval

#### H. <u>Subroutine SCONV</u>

1. Introduction

SCONV converts scatterometer output measurements into a normalized input power. The scatterometer transfer function is employed to perform the conversion. The transfer function is developed below. Certain significant simplifications arise when SCAT normal calibrations are employed.

2. Theory and Design

The block diagram for the RADSCAT scatterometer is shown in Figure A-17. The front-end elements have been decomposed into a calibration element  $G_c$ , transmission elements  $G_{VT}$ ,  $G_{HVT}$ ,  $\dot{G}_{HT}$ , and  $G_{VHT}$  and reception elements  $G_{VR}$ ,  $G_{HVR}$ ,  $G_{HR}$  and  $G_{VHR}$  for ease in analysis and reduction of data. The transfer functions account for mis-match and loss. Calibration attenuators  $A_1$  through  $A_4$  are employed to calibrate the output channels 1 through 4, respectively.

During calibration transmitter power is routed sequentially through  $A_1$ ,  $A_2$ ,  $A_3$  and  $A_4$  and the respective channel output is noted. The resulting output voltage for the ith channel is thus given by

$$V_{i}^{(c)} = d^{2} P_{z} G_{c} G_{R} A_{i} \alpha_{i} I_{i} \tau_{c}$$
(1)

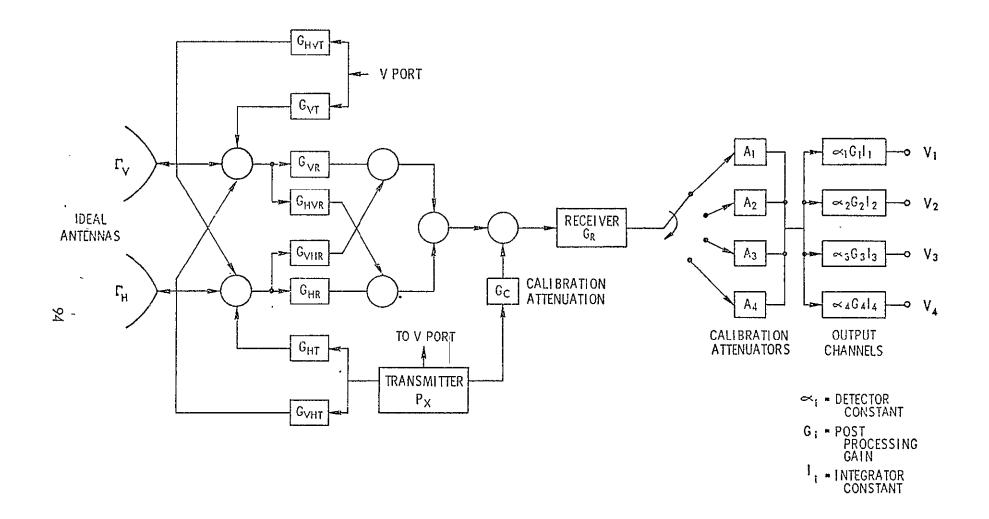


FIGURE A-17. BLOCK DIAGRAM FOR SCATTEROMETER

where

 $P_{x}$  = transmitter peak power

 $\tau_{c} = calibration$  integration period

The factor  $d^2$  occurs in the above expression since only the center frequency of the power spectrum is sampled by the receiver. The calibrations thus serve as a measure of the transmitted power

$$P_{\chi} = \frac{V_{L}^{(c)}}{d^{2} G_{c} G_{R} A_{i} \alpha_{i} G_{i} I_{i} \tau_{c}}$$
(2)

During measurements at VV polarization and incident angle  $\theta_{g}$  the power arriving at the receiver input is given by

$$P_{VV}(\theta_{o}) = \frac{\lambda^{2}}{(4\pi)^{3}} d^{2}P_{z} \left[ G_{VV} \Gamma_{V} I_{VV}(\theta_{o}) \Gamma_{V} G_{VT} + G_{VHR} \Gamma_{H} I_{HV}(\theta_{o}) \Gamma_{V} G_{VT} + G_{HVR} \Gamma_{H} I_{HH}(\theta_{o}) \Gamma_{H} G_{HVT} + G_{VR} \Gamma_{V} I_{VH}(\theta_{o}) \Gamma_{H} G_{HVT} + G_{VR} \Gamma_{V} I_{VH}(\theta_{o}) \Gamma_{H} G_{HVT} \right]$$
(3)

where

$$I_{mn} = \iint_{4\pi} \frac{P_m(\chi, \psi) P_n(\chi, \psi) \sigma_{mn}(\theta)}{R^4} dA$$
(4)

 $\sigma_{mn}$  = normalized scattering coefficient for transmission at polarization n and reception at polarization m

R = range to scattering element dA

 $P_m = normalized$  antenna pattern

 $I_m$  = antenna directivity at polarization m

 $\lambda$  = operating wavelength

Similarly for observations at HH polarization the power at the receiver input is given by

$$P_{HH}(\theta) = \frac{\lambda}{(4\pi)^3} d^2 P_{\chi} \left[ G_{HR} \Gamma_{H} I_{HH}(\theta) \Gamma_{H} G_{HT} + G_{HT} + G_{HT} \Gamma_{V} I_{VV}^{(o)} \Gamma_{V} G_{VHT} + G_{HR} \Gamma_{V} I_{VV}^{(o)} \Gamma_{V} G_{VHT} + G_{HR} \Gamma_{V} I_{VV}^{(o)} \Gamma_{V} G_{VHT} + G_{HR} \Gamma_{H} I_{HV}(\theta) \Gamma_{V} G_{VHT} \right]$$

$$(5)$$

The latter three terms in expressions (3) and (5) may be neglected since products such as G_{HVR} I_{VH}; G_{VHR}G_{VHT}, I_{HV}G_{VHT}, etc., are extremely small. Therefore (3) and (5) simplify to:

$$P_{vv}(\theta) = \frac{\lambda^2 d^2 G_{\pi}}{(4\pi)^3} G_{vR} \Gamma_v I_{vv}(\theta) \Gamma_v G_{vT}$$
(6)

and

$$P_{HH}(\theta_{s}) = \frac{\lambda^{2} d^{2} G_{z}}{(4 \pi)^{3}} G_{HR} \Gamma_{H} I_{HH}(\theta_{s}) \Gamma_{H} G_{HT}$$
(7)

The corresponding on-scale output voltage for these measurements occur on say, channels j and k, respectively. The outputs are given by

$$V_{jm} = P_{vv}(\theta) G_R \approx_j G_j I_j \approx_m$$
(8)

and

$$V_{km} = P_{HH}(\theta) G_R \alpha_k G_k I_k \tau_m$$
(9)

where

 $\tau_{m}$  = measurement integration⁻time m = 1,2,...,7

A subscript is employed on  $\tau$  to identify the different integration periods associated with six angle indicators (1 through 6) for the ALTERNATING and FIXED ANGLE MODES and the integration period  $\tau_{7}$  unique to the SHORT SCAT mode.

Now equations(8) and (9) may be employed to express the receiver input power. Thus we may write

$$\frac{V_{jm}}{G_R \propto_j G_j I_j \tau_m} = \frac{\lambda^2 d^2 P_x}{(4\pi)^3} G_{VR} G_{HT} \Gamma_V^2 I_{VV} (\theta_0)$$
(10)

$$\frac{V_{km}}{G_{R}^{\alpha}} = \frac{\lambda^{2} d^{2} P_{\chi}}{(4 \pi)^{3}} G_{HR} G_{HT} \Gamma_{H}^{2} I_{HH}(\theta) \qquad (11)$$

Now  $P_x$  may be replaced by expression (2) for the corresponding output channel to yield the desired results

$$I_{(vv}(\theta_{o})) = \frac{V_{jm}}{V_{i}^{(c)}} \frac{\tau_{c}}{\tau_{m}} \frac{G_{c} A_{j}}{G_{vR} G_{vT} \Gamma_{v}^{2}} \frac{(4\pi)^{2}}{\lambda^{2}}$$
(12)

э

and

$$I_{HH}(\theta_{o}) = \frac{V_{KM}}{V_{K}^{(c)}} \frac{\tau_{c}}{\tau_{m}} \frac{G_{c}A_{k}}{G_{HR}G_{HT}\Gamma_{H}^{2}} \frac{(4\pi)^{3}}{\lambda^{2}}$$
(13)

It is noted that the receiver gain terms have dropped out.

Subroutine SCONV implements the algebraic expressions for  $I_{VV}$  and  $I_{HH}$ . Actually the SCAT channel selection routine in CRUNCH applies the factors  $A_m$  and  $V_m^{(c)}$  (m = j or k) since they are channel dependent. Missing from these algebraic expressions is the doppler filter gain factor which is a function of the doppler frequency shift. The gain is normalized with respect to the gain at zero doppler since the calibrations are made there. An equally spaced sample version of this filter characteristic must appear in the lower part of SPAR. The filter gain at zero doppler must appear at SPAR(50). Down doppler filter gains must be stored in entries between SPAR(51) and SPAR(85) whereas entries for the up-doppler gain must appear between SPAR(34) and SPAR(50). Presently the gain function is sampled at 250 Hz intervals. To compensate the measurement, the relative doppler gain must divide the measurement, DATA(8).

The FORTRAN coding for SCONV is shown in Figure A-18. The variables are defined in Table A-8.

Table A	~8	Definition of Variables
DATA(8)	=	Selected Channel Output, V
INT	=	Integration Period Index
IDATA(3)	=	RADSCAT Mode
SPAR(3)	-	Calibration Period
SPAR(INT+3)	=	Measurement Period
SPAR(IBAND+50)	=	Relative Doppler Filter Gain
SPAR(17)	=	Calibration Attenuation, G _c
		97

		SUBRUUTINE SCENV (UATA, IDATA, SPAR, IBAND)	00001019
	CSCUNV	SCAT CONVERSION	00001020
	C	SUBRECTINE SCONV (DATA, IDATA, SPAR, IBAND)	00001021
	ů		00001022
	C	THIS FREGRAM WAS PREPARED BY	00001023
	C		00001024
	C	JCHN P. LLAASSEN ,	00001025
	ç	GLEN E. ELLIOTT	00001026 00001027
	Ը Ն		60001028
	C	UNIVERSITY_OF KANSAS CENTER FOR RESEARCH	00001029
	C		00001020
	ĉ	THIS SUBROUTINE CONVERTS A SCATTEROMETER NORMALIZED CUTPUT	00001030
	č	VOLTAGE TO THE SCATTERING INTEGRAL. THE RESULT IS LEFT	66061032
	č	IN DATA(8).	00001033
	č	IN DATALOJA	00001034
000007	C	DIMENSION DATA(1), IDATA(1), SPAR(1)	00001035
(00007		CATA PI/3.1415927/	00001036
	c	UNIX E11314712211	00001037
	C C		00001038
	Ċ		00001039
	ĉ	APPLY CONVERSION PARAMETERS	00001040
	c		00001041
C00007		UATA(ʊ)= CATA(ʊ)*(4.*PI)**3/{299753COO./SPAR(1))**2	00001042
	Ċ		CCC01043
	C	SET INTEGRATION TIME INDEX	60001044
	C		C0001045
CC0014		INT = IUATA (5)	00001046
C00015		IF (10ATA (3) .E(. 1) INT =7	00001047
	Ċ	-	0C001048
	ç	COMPENSATE FOR INTEGRATION TIMES	00001049
	َ ت		00001050
00020	~	$LAT A \{ v \} = LATA \{ v \} * SPAR (3) / SPAR (INT+3)$	CG001051 CC001052
	C C	CTT DOLLAR LATION DUNIORS	00001053
	C C	SET POLARIZATION INDICES	00001054
C00024	Ļ	IXMIT =10ATA (6)	C0001055
000025		$IREC = ILATA \{7\}$	00001056
	C	1020 = 10000 117	00001057
	č	COMPENSATE FOR DOPPLER FILTER CHARACTERISTIC	CC001058
	č		0001059
C00027	•	UATA(0)= CATA(0)/SPAR(1BAND+50)	0001060
		· ·	
	ĉ	ł	00001061
	ç	APPLY GAIN FACTORS	00001062
00031	С	DATA(d)=CATA(d)*SPAR(17)/(SPAR(IXMIT+11)*SPAR(IXMIT+25)*	0001063
000001	*		C0001064
C00041	~	SPAR(IREC+15)*SPAR(IREC+25))	00001065 CCCC1066
000042		END	00001067
		¢uo.	00001001

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FIGURE A-18. SOURCE LISTING FOR SUBROUTINE SCONT

Table A-8 Definition of Variables (Continued)

4	IXMIT	=	•	Transmit Polarization Index
	IREC	=		Receive Polarization Index
	SPAR(IXMIT+11)	=		Transmit Transfer Function
	SPAR(IREC+15)	=		<b>Receive Transfer Function</b>
	SPAR(IXMIT+25)	=		Transmit Antenna Gain
	SPAR(IREC+25)	=		Receive Antenna Gain

### V. SPECIAL ROUTINES

A. <u>Tape Read Routines</u>

FUNCTION subroutine IREAD and subroutine READ1 are employed to read the Input Raw Data records. IREAD permits CRUNCH to read records from either file code 01 or 08. IREAD calls READ1 to unblock records from file code 01. The records on the scratch unit (08) are not blocked and so can be read from IREAD. A second entry point in READ1 permits subroutine CALIB to backspace one physical record (DATA). Read functions on unit 1 may be performed by simply calling READ1. The source listings for IREAD and READ1 are shown in Figures A-19 and A-20, respectively.

B. <u>Tape Write Routine</u>

Subroutine WRITE2 performs WRITE functions on file code 02. Output records (IARRAY) are accumulated in IBLOCK until it is full at which time IBLOCK is written to file code 02. A second entry point in WRITE2 performs the END OF FILE function. However, the remainder of IBLOCK is first filled with zeros before putting an EOF mark on file code 02. See the listing for WRITE2 in Figure A-21 for further insight.

### C. Subroutine ABORT

To purposely stop the execution of the program and abort the job, an abort function was provided. The circumstances underwhich an abort is executed are described in Section III B. If the system has an abort routine available that dumps more registers and memory than this fatal execution will, it is advisable to replace the one provided. A listing of subroutine ABORT is shown in Figure A-22.

	-	FUNCTION IREAD(IFC)	00000379
	0 0 0 0 0 0	THIS PREGRAM WAS PREPARED BY GLEN E. ELLIDIT UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.	
	ι ι ι ι	THIS RELTINE PERMITS SUBREUTINE CRUNCH TO READ FROM FILE CEDE 1 OR 0. RECORDS ON FILE UNIT 1 ARE BLOCKED IN GREUPS OF 10 PHYSICAL RECORDS. EACH RECORD CONSISTING OF 50 WORDS. SUBROUTINE READI UNBLOCKS THE RECORDS. ON THE CITERHAND THUSE RECORDS ON FILE JNIT 8 ARE NOT BLOCKED AND AS A CONSEQUENCE A SIMPLE BINARY READ	
	C C C	IS EMFLOYED.	
C000C3 C000U3 C000C3 C000C6 C000C6 C000013 C00013 C00015 C00022 C00026 C00027 C00021	1 2	LUGICAL ECF1 COMMON /INPLT/ EGF1,CATA(50) IREAD=0 IF(IFC+EQ+E) GC TO 1 CALL READ1 IF(EDF1) IREAD=1 REAC(d) LATA IF(EUF+0) 2.3 IREAD=1 RETURN END	CC0C0380 00000381 CC0C0382 0G000383 CC000384 CC000385 CCCCC386 C0000387 CC000387 CC000386 00000389 C0000390 C0000391

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	r	SUBRUUTINE REALL	00060392
	C,	THIS PROGRAM WAS PREPARED BY	
		GLEN E. ELLIDIT	
	00000	UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.	
	č	THIS SCEROUTINE REAUS BLOCKS OF 10 PHYSICAL RECORDS AND	
	C	SEPARATES THEM. RECORDS FILLED WITH 99999. ARE BY-PASSEC	
	í.	UNTIL AN ECF IS ENCOUNTERED. A SECONDARY ENTRY POINT	
	C	IS PREVIDED TO PERMIT BACKSPACING INDIVIDUAL RECORDS	
	ι ι ι	WITHIN A ELOCK.	
	С		
(00002		CUMMON/INPUT/IECF,CATA(50)	0000353
00002		LOGICAL IECF	00000394
000002		DIMENSION BLOCK (50,10)	000003\$5
00002		GATA NDX+NUT/G+1/	66006346
000002		IEOH= .FALSF.	C000C397
(00003		IF(NDX-NE+C) GL TC 10	00000358
C00004		NDX=1	0000359
00005		PEAD(NUT) BLOCK	0000400
600012		IF(EOF, NUT) 100.10	00000401
000015	10	IF(BLCCK(1,NUX) .EQ. 99999.) GD TO 90	C000C402
000022		$00 \ 20 \ I = 1, 50$	CC0C0403
000023	∠0	CATA(1) = BLLCK(I, NDX)	CC 000404
00033		NDX=NDX+1	00000405
00034		$IF(ND\lambda,GT,10)$ NCX=0	CC000406
COOO37 CCOO40	0.0	KETURN	00000407
C00040	90	RFAC(NUT)	CCCCC408
		IF(EUF,NUT) 1C(, 90	00000405
(00046 (00047	100	IEOF=,TKJE,	01400032
CO0047		NDX=0	00000411
000351		RETURN	C00C0412
		ENTRY BCKSP1	00000413
CC0050		IF(NDX.LT.1) NOX=11	CC00C414
COO062 0COO63			00000415
0000003		RETURN	CC000416
100004		CNU	00000417

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FIGURE A-20. LISTING FOR READI

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		SUBRUUTINE WRITE2 (TARRAY)	CO000418
	С С С	THIS PREGRAM WAS PREPARED BY GLEN E. ELLIDIT	
	C	UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.	
	C L	TELS ROLTINE BLOCKS 20 WORD RECORDS INTO 20 RECORD	
		GRGUPS (BLOCKS) AND WRITES THE BLOCK OUT TO FILE UNIT	
	C C	02. WHEN INSUFFICIENT RECORDS EXIST TO FILL A BLOCK	
	Ĺ	THE REMAINING PERTION IS FILLED WITH ZEROES AS PROVIDED	
	Ċ	AT THE SECUNCARY ENTRY POINT. AN EOF IS APPENDED	
	Ĺ.	1G THE FILE THEREAFTER.	
•	Ċ		
00003		UINENSILN IBLCCK(20,20), IARRAY(1)	00000419
600003		CATA INDEX /1/	COO00420
(00003		$DC = 20 \ I = 1.20$	00000421
(00005	20	IBLUCK(1,INDEX) = IARRAY(I)	00000422
000015		INDEX = INDEX + 1	00000423
CC0016		IF (INDEX .LE. 20) RETURN	00000424
G00021		WKITE (2) IBLOCK	00000425
C00026		INDEX = 1	66000426
000027		RETURN	CC000427
C00030		ENTRY ENGE2	C000C428
CO0036		IF (INDEX .LE. 1) GO TO 30	00000429
C00042		$00 \ 25 \ I = 1 \ NDE x_{2} \ 20 \ DD \ 25 \ I = 1 \ NDE x_{2} \ 20 \ DD \ 25 \ I = 1 \ NDE x_{2} \ 20 \ DD \ 25 \ ND \ 20 \ 20 \ 20 \ 20 \ 20 \ 20 \ 20 \ 2$	00000430
CC0043		D0 25 J= 1,20	COOO0431
C00044	25	$I \bowtie LOCK (J, 1) = 0$	00000432
_C00054		WRITE (2) IBLCCK	00000433
C000(1		INDEX=1	00000434
C00062	30	ENDFILE 2	00000435
000064		RETURN	C0000436
C00065		ÊND	0000437
		,	

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# FIGURE A-21. LISTING FOR WRITE2

		SLBROUTINE ABORT(A)	8950000
	C	HALT PROGRAM IN CASE OF ERROR	00000369
د00003		DIMENSION IECR(2)	00000370
600003		DATA IEUR/10HENC CF REE,1HL/	00000371
00003		WKITE (0+100) A	(000372
000011	100	FORMAT (1CX,10HABCRT CODE,1X,A10)	00000373
CG0011		CALL ENDF2	0000374
C00012		WRITE(2) IEOR,(I,1=3,9)	CC000375
<b>C</b> 00024		B=A/0.0+1.0	CC00C376
000030		STOP	0000377
CC0032		END	C0000378

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# FIGURE A-22. LIST FOR SUBROUTINE ABORT

### APPENDIX B

### OUTPUT PROGRAM

### I. INTRODUCTION

The output program (OUTPUT) lists groups of output files produced by the conversion program. External directives permit the user to select file types to be listed. This appendix describes the operation of OUTPUT. In the description below it will be helpful to refer to the logic diagram of Figure B-1 and the listing of Figure B-2.

### II. DESIGN AND OPERATION

Upon entry into OUTPUT a control card is read. The format and content of the control card is treated in Section III C. The card content is printed and its validity is checked. An invalid command terminates the program. The tape on unit 2 is also rewound. The file label is read and compared with the validated directive. If the file label does not agree with the label, the file is bypassed and a bypass message is printed. The search continues until the appropriate file is found; if in the search the end of reel is encountered a message to that effect is printed and another control card is read (statement 1).

Specified file types are listed 80 records at a time. Each record is identified with a record number. The listing continues until the file is exhausted (EOF) at which time another file of the same type is sought.

The variables employed in OUTPUT are defined in Table B-1.

	Table B-1	Definition of Variables
MISSD	=	Directed Mission Number
FLTD	.=	Directed Flight Number
LIND	=	Directed Line Number
rund	=	Directed Run Number
		104

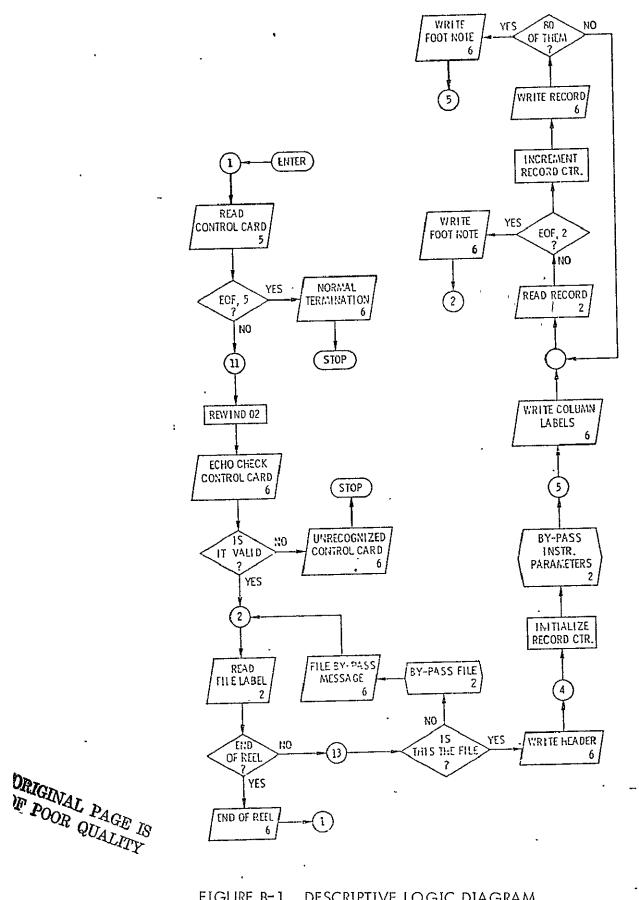


FIGURE B-1. DESCRIPTIVE LOGIC DIAGRAM FOR OUTPUT PROGRAM

		COUTPU	PROGRAM CUTPUTLINPUT,OUTPUT,TAPE2,TAPC5=LAFUT,TAPE6=OUTPUT) T OUTPUT PROGRAM	CC 001295 00001296 00001297
		C C	THIS PROGRAM WAS PREPARED BY	00001298
		Ç		00001249
		C	JCHN P. CLAASSEN	00001300
		C C	, GLEN E. ELLICTT	00001302
		č	UNIVERSITY OF KANSAS CENTER FOR RESEARCH	00001303
		č		C0001304
c	00003		INTEGER FLTD, RUND, FLT, RUN	00001305
	00003		DIMENSION CATA(20), DATE(3)	00001306
	00003		DIMENSION LSTYP(4), IMODE(4), IPL(2)	00001∍C7 CC0013C8
	60003 00003		DIMENSION IEOK(2) Logical ECF2	00001309
	00003		EQUIVALENCE (MCGE, DATA(2)),	C0001310
		*		00001311
	00003		CATA IEUR/10HENC OF REE: 1HL/	00001312
	00003		DATA INODE/4HR.C.,4HS.S.,4HF.A.,4FA.A./, IFL/1HH,1HV/	CC001313 C0001314
L	00003	C	DATA LSTYP/6HFLTLIN,6HMISFLT,6HSPECIF,3HALL/ GET DIRECTIVE AND FILE ID.	00001315
c	00003	ĩ	REAU(5,100) LIYPE, HISSDIFLIDILINDIRUND	00001316
	00021	100	FURNAT ( A6 , 4X , 415)	00001317
	00021		IF(EUF, 5) 10,11	00001×18
	00024	11	REWIND 2	00001319
	00026	200	%RITE(6,200) LTYPE, MISSD, FLTD, LIND, RUND ForMat(1h1,///lox13hcchTrol CarD=,3X,46,4X,415//)	
	00044	2.90	(15, 20, 1, 2, 1, 4)	
(	00046	20	IFILTYPE.EC.LSTYPII) GU TO 2	
	00052		WRITE(6,7(0)	
	00055 00055	700	FORMAT(1H1;///10x22HUNRECCGNIZED_CIRECTIVE) STOP	
	.000000	è	FIND THE FILE.	00001320
(	00057	2	LONTINUE	00001321
	00057		hRITE(0,300)	
	00063	300	FURMAT (1H1)	00001322
	COOO63 DOO104		KEAD(2) MISS, FLT, DATE, LIN, RUN, FREC, FEED . IF(MISS.ME.IECR(1)) GO TO 13	00001323
	00106		IF(FLT.NE.IEUR(2)) GO TC 13	00001324
	000110		WEITE(6,460)	
	60011+	400	FORMAT(///10x10(1H*),11FEND OF REEL,10(1H*)///)	00001325
•	00114		60 TO 1	00001325
	00115	13	CONTINUE	00001326
	00115		IF(LTYPE.E.LSTYP(4)) GC TO 4	00001327
	000117		IF(MISS.NE.WISSC) GO TO 3	00001328 00001329
	000121 000123		IF(FLT.VE.FLTD) GC TO 3 IF(LTYPE.EQ.LSTYP(2)) GC TO 4	00001330
	(00125		IF(LIN.NE,LIND) GC TO 3	00001321
	000127		IF(LTYPE.AE.LSTYP(3)) GC TO 4	00001332
	000131		IF(RUN.EJ.RUAD) GC TO 4 WRITE(6,500) MISS, FLT, LIN, RUN	00001333
	600133 000146	500	FGRMAT (//IOX13HEYPASSED FILE, 415)	
	000146	3	READ(2)	00001334
	000151		1F(E0F,2) 2,3	00001335
		ũ,	FOUND IT, CUTFUT HEADINGS.	00001336
	000154 000154	4 9	CONTINUE WRITE(6,604)	00001337 00001338
	000160	604	FORMAT(1+1,53X,14HPICROHAVE CATA)	00001339
	000120		LINEN=0	00001340
		C	BYPASS IC RECORD.	00001341
	000161		READ(2) ICSET, IC1, ID2, ID3 nkite(0,6C0) Miss, Flt, Date, Lin, Run, Freq, Feed,	00001342
	C00174	>	* ICSET, ID1, ID2, ID3	00001343 00001344
	C00226	600	FURNAT (/9F MISSIEN-, 13, Sh FLIGHT-, 13,	00001344
			# 7H DATE-,213,15,2X,11H FLT LINE-,1X,16,6H RUN-,13,	
			# 13H FRECUENCY-, F5.1,7H FEED-, 2X, A6,8H IPAR=, 12,313	
	COO232 COO232	6 05	WR [ TE ( 6 + 60 5 ) Furmat (/	00001348 00001349
		005	★ 62H KECURU TIME HUDE INCLU CROSS XMIT REC SINT	00001350
			# 53HSCAT SCAT RAD DEPCL S/R ALTITUDE.	0C001351
_ 1	e)		* 11H FLT /, ANGLE ANGLE POL POL TIME	00001352
JRIGINIALI PAGE OF POOR QUALT	1		* 62H NO. ANGLE ANGLE POL POL TIME * 52h De Factor coce +	00001353 00001354
T. PALTY	1.71		* 11H DIRECT /,	00001355
TAL MAL			# 62H (DEG) (DEG) (SEC)	00001356
DIGHTOR W			* 53H (DEG K) (FEET),	00001357
JEN DOUR		ι	* 12H (DEG)/) OUTPUT ONE DOUBLE COMPUTER PAGE.	00001358 00001359
OF	000232	v		00001360
Ū,	000234		CALL RFAD2(UATA,EOF2)	00001361
	(00230	1.2	1F(EUF2) GC IC 7	00001362
	000240	12	L INFN=L INCN+1 MUDE=IMUCE (MODE+1 )	00001363 00001364
	000242		[P1=1PL(1P1+1) ·	00001365
	C00245		1P2=IPL(1F2+1)	00001366

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FIGURE B-2. SOURCE LISTING FOR PROGRAM OUTPUT 106

C00246 C00204	6 601	WPITF(6,601) LINEN,(LATA(I), I = 1,14) Furmat	+ CCOC1367 00001368
600204	C 201	MATCH HEADING WITH FURMATS.	00001,369
	*	ALINE TIME MODE INCID CRESS XMIT REC S INT	≠,00001370
	*	ANGLE ANGLE PCL PUL TIME	<b>≠</b> ,00001371
	*	(DEG) (DEG) (SEC)	≠,00001372
		(1X,14, 2X,F8.1,3X, A6, F5.1,2X, F5.1,6X, A5, A1,4X, F5.3,2X,	00001373
	C		00001374
•	*	≠SCAT SCAT RAD DEPUL S/R ALTITUDE≠+	0001375
•	*	# DB FACTUR CODE #,	00001376
	*	t (DEG K) (FEET)#,	00001377
		E11.4, 2x, F6.1,2x, F7.1, F8.3, 19, F10.0,	00001578
	C		CC001379
	*	≠ [L] ≠/•	00001380
	*	# DIREC #/+	00001351
	*	≠ (DEG) ≠)	00001082
		× Fy.1)	00001383
			00001384
	с С	. FOOT PAGE WITH CODE KEY.	00001385
600264	-	WRITE(6+6C2)	00001386
CC0270	602	FORMAT(//14H KEY TC CODES-/,	00001367
		¢ ' 25X, 32H O NO FLAG ', 5X,	00001388
	:	* ZIH 1000 POLAR REVERSAL/.	C0001389
		≰  ŽŹŻX,* 1 POSSIELY OUTSIDE RANGE GATE*,5X,	00001390
		* 22H 10000 EXCESSIVE DEPOL/,	00001391
	:		00001352
		* 24H10C000 REC TEMP ABNORMAL/,	00001393
	1		00001354
		★ \$1000000 HARM LOAD TEMP ESTIMATED*/,	C0001395
•		* 25X,37H COMBINATIONS OF FLAGS CAN OCCUR./,1H1)	CC001356
CO0270		GU TO 5	00001357
	C	FOOT PARTIAL PAGE	00001358
CO0271	7	NRI TE (6+CO2)	00001359
000275		IF(LTYPE.EC.LSTYP(3)) CO TO 1	66061466
000277		GO TO 2	00001401
000300	10	STOP	CC001402
(00302		SNU	00001403

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igure B-2. (Continued)

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### Table B-1 Definition of Variables (Continued)

MISS		File Mission Number
FLT	=	File Flight Number
LIN	=	File Line Number
run	=	File Run Number
LTYPE	=	Control Directive
LSTYPE	=	Program Recognized Directives
IEOR	=	10H End of Reel
DATA	=	Output Data
EOF2	=	EOF Indicator on File Code 02

### III. SUBROUTINE READ2

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READ2 performs the record retrieval function for OUTPUT. Output files are blocked in 20 record groups. READ2 retrieves these blocks and withdraws records as required by OUTPUT. The end of the file indicator EOF2 is generated by READ2. A listing for this routine appears in Figure B-3.

	6	SUURUUTINE REALZ(ILATA, EUFZ)	00001404
	ι ι ι ι ι ι ι	THIS PREGRAM WAS PREPARED BY	
	C 、	GLEN E. ELLIDIT	
	Ċ `	UNIVERSITY OF KANSAS CENTER FCR RESEARCH, INC.	
	C		
	С	THIS RULTINE UNBLUCKS 20 RECORD BLUCKS AND PROVIDES	
	C	AN ENL OF FILE INDICATOR, EDF2.	
	Ċ		00001405
(00005		CIMENSICN IVATA(20), IBLOCK(20,20)	
(00005		LOGICAL LGF2	00001406
000005		CATA NUEX/G/	00001407
000005		EOF2=.FALSC.	06001468
(00005		IF(NDEX.NE.0) GC TC 10	00001409
COOOO6		NDEX=1	00001-10
COOOC7		REAL(2) IBLOCK	00001411
000014		If(EUF,2) 100,10	00001412
CC0020	10	1+(13LLCK(1,NCEx)-FQ.0) GO TO 90	00001413
CG0023		DD 20 1=1,20	00001414
00025	20	ICATA(I)=IBLOCK(I,NDEX)	00001415
(00035		NDFX=NDEX+1	00001416
CO0036		IF(NDEX.GT.20) NDEX=0	C0001417
000041		RETURN	CC0C1418
000042	90	READ(2)	00001419
C00045		IF(EUF+2) 100+90	00001420
00051	100	EDF2=.TRUE.	00001421
00052			CCCC1422
600053		RETURN	00001423
000054		END	00001424

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FIGURE B-3. SOURCE LISTING FOR SUBROUTINE READ2

### APPENDIX C

### INSTRUMENT CHARACTERISTICS MAINTENANCE PROGRAM (ICHAR)

### I. INTRODUCTION

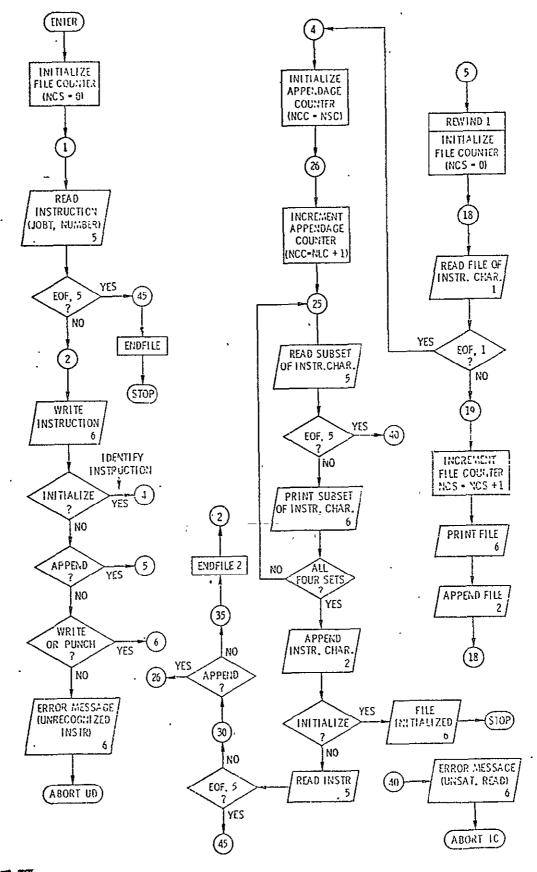
Program ICHAR maintains a historical file of RADSCAT instrument characteristics. New sets of instrument parameters may be submitted to ICHAR for storage; old sets may be printed or punched. The design and operation of ICHAR is treated in this appendix. The reader will find it helpful to refer to the logic diagram (Figure C-1) and listing (Figure C-2) for ICHAR.

### II. DESIGN AND OPERATION

The files on the historical parameter tape are identified numerically. So upon entry into the program the file pointer is initialized to zero. An instruction is read and echo checked. The instruction is then identified as one of three types. If the instruction is INITIALIZE, the file appendage counter (NNC) is set equal to one and four subsets of instrument parameters are read and transferred to file code 02. The format and entry for the parameters were described in Section III D of the text. The program is then halted.

If the historical tape had been initialized already and the command was APPEND, the old historical tape would have been rewound (Statement 5) and the contents of that tape transferred to another one (Statements between 5 and 18). Once transferred, the new set would be appended to the new file (Statements 26 through 23). When insufficient parameters are presented to fill the new file, the program is aborted. Otherwise the next control card is read; if it is APPEND, the process is repeated until all APPEND commands have been executed.

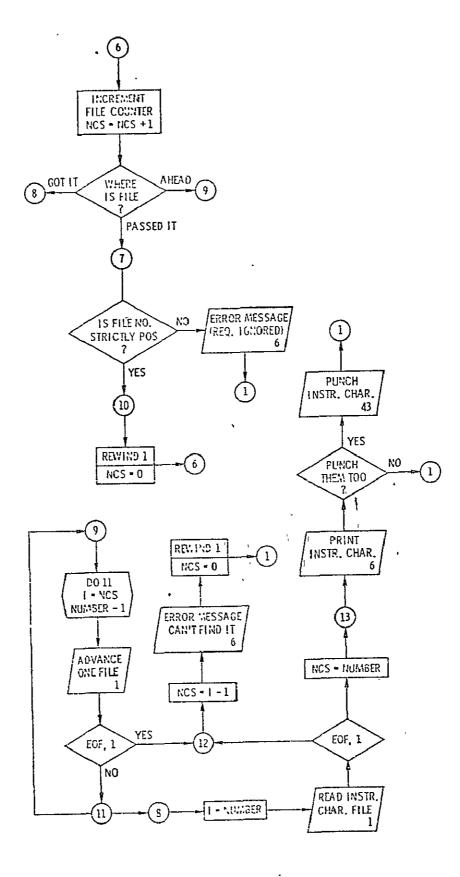
If the (next) command had been PRINT or PUNCH, the program would have advanced to statement 6 and executed the instruction. The program continues until all control cards have been exhausted.



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FIGURE C-1. DESCRIPTIVE FLOW CHART FOR PROGRAM ICHAR 111





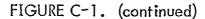


FIGURE C-2. SOURCE LISTING FOR PROGRAM ICHAR DRIGINAL PAGE IS II3 OF POOR QUALITY

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		PROGRAM ICHAR(INPUT+OUTPUT+PUNCH+TAPE1+TAPE2+	00001445
		TAPES=INPUT, TAPE6=OUTPUT, TAPE4 3=PUNCR)	00001496
	CICHAP C	HAINIAIN ICHAR FILE.	00001497 00001498
	С	THIS PROGRAM WAS PREPARED BY	00001499
	ç		00001500
	с С	JOHN P. CLAASSEN Glen E. Ellioit	00001501
	č		00001502
	с	UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.	00001503
	ç		00001505
	с с	THIS PROGRAM WILL STORE RADSCAT INSTRUMENT CHARACTERISTICS ON A HISTORICAL TAPE. THE HISTORICAL	
	č	TAPE IS INITIALLY PREPARED BY USING THE DIRECTIVE	
	с	*INITIALIZE* . TO APPEND NEW SETS OF CHARACTERISTICS TH	ΗĘ
	ç	COMMAND *APPEND* WILL TRANSFER OLD SETS FROM TAPE UNIT	
	C C	1 TO TAPE UNIT 2 AND APPEND THE NEW SET . NEW SETS ARE READ FROM CARDS. PREVIOUSLY STORED SETS MAY	
	с	RE PRINTED OR PUNCHED BY USING THE COMMANDS PRINT OR	
	C	PUNCH RESPECTIVELY. THE SET NO. HUST BE DESIGNATED .	
	с С	THE SETS WILL HAVE BEEN STORED NUHERICALLY IN ORDER ON The Tape. To maintain the instrument characteristics	5
	č	IT IS ADVISABLE TO RETAIN THE OLD TAPE WHEN A	
	ç	NEW ONE ONE IS PREPARED. OLDER VERSIONS MAY BE DISCARDE	D+
	с с	IT IS ADVISABLE ALSO TO USE A TAPE COMPARISON UTILITY PROGRAM TO VERIFY THE TRANSFER.	
	č		
	Ç	NCS = FILE COUNTER FOR THE OLD TAPE ALSO SERVES AS	
	c	A FILE POINTER ON UNIT 1	
	C C	NCC = FILE COUNTER FOR THE APPENDED SETS Jobt = External Dipictive. See data statement	
	с с	NUMBER = NUMBER OF THE REQUESTED FILE	
	C	PAR = INSTRUMENT PARAMETERS	
	C C	IDAT = DATE NUH2 = SET NO. AS READ FROM TAPE	
	č		
000003		DIMENSION PAR(160+4) + IDAT(3) + IOPT(4)	00001506
000003	с	DATA IOPT/10HINITIALIZE+6HAPPEND+5HPRINT+5HPUNCH/+ NCS/0/ READ DIPECTIVE AND SET NUMBER.	00001508
000003	ĩ	READ (5.500) JOPT. NUMBER	00001509
000013		IF (FOF+5) 45+2	
000016	500	FORMAT(A10.15)	00001511
000016	2	WRITE (6+600) JOPT+NUKHEP	00001512
000026	600 C	FORMAT(1H1+///* DIRECTIVE IS *+410+15) CHECK DIRECTIVE	
000026	•		00001514
		DO 3 N=1+4	00001514 00001515
000030	-	NO 3 N=1+4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N	00001515 00001516
000041	3	NO 3 N=1+4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE	00001515 00001516 00001517
	3 601	NO 3 N=1+4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N	00001515 00001516
000041 000043	601	NO 3 N=1+4 IF(JOPT.EQ.JOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD)	00001515 00001516 00001517
000041 000043 000047 000047	601 C	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FIND FILE	00001515 00001516 00001517 00001518
000041 000043 000047	601	NO 3 N=1+4 IF(JOPT.EQ.JOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD)	00001515 00001516 00001517 00001518
000041 000043 000047 000047 000051 000053 000055	601 C	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-S-1) GO TO 10	00001515 00001516 00001517 00001518 00001520
000041 000043 000047 000047 000051 000053 000055 000055	601 C 6 7	NO 3 N=1+4 IF(JDPT.EQ.JDPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(22HUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-GE+1) GO TO 10 WRITE(6+602) NUMBER	00001515 00001516 00001517 00001518 00001520
000041 000043 000047 000047 000051 000053 000055	601 C 6 7 602	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-S-1) GO TO 10	00001515 00001516 00001517 00001518 00001520
000041 000043 000047 000047 000051 000053 000055 000065 000065	601 C 6 7 602	NO 3 N=1.4 IF (JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FIND FILE NCS = NCS+1 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-SC-1) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* IC SET NUMBEP*+I5+* DOES NOT EXIST.*+ * REQUEST IGNORED.*//) GO TO 1	00001515 00001516 00001517 00001518 00001520 00001525 00001525 00001525
000041 000043 000047 000051 000053 000055 000060 000065 000065	601 C 6 7 602	NO 3 N=1.4 IF(JDPT.EQ.JDPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FINO FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-GE.1) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* IC SET NUMBEP*+I5+* DOES NOT EXIST.*+ * REQUEST IGNORED.*//) GO TO 1 REWIFO 1	00001515 00001516 00001517 00001518 00001520 00001525 00001526
000041 000043 000047 000047 000051 000053 000055 000065 000065	601 C 6 7 602	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-SE+1) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* IC SET NUMBEP*+I5+* DOES NOT EXIST.*+ * REQUEST IGNORED.*//) GO TO 1 REWIND 1 /.CS = 0	00001515 00001516 00001517 00001518 00001520 00001525 00001525 00001526
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065	601 C 6 7 602 °	NO 3 N=1.4 IF(JDPT.EQ.JDPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FINO FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-GE.1) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* IC SET NUMBEP*+I5+* DOES NOT EXIST.*+ * REQUEST IGNORED.*//) GO TO 1 REWIFO 1	00001515 00001516 00001517 00001518 00001520 00001525 00001525 00001525
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065	601 C 6 7 602 10 12	<pre>NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD)</pre>	00001515 00001516 00001517 00001518 00001520 00001525 00001525 00001526
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000066 000070 000071 000072	601 C 6 7 602 °	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMER-NCS) 7+8+9 IF(NUMER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 I	00001515 00001516 00001517 00001518 00001520 00001525 00001525 00001526
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065	601 C 6 7 602 10 12	<pre>NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD)</pre>	00001515 00001516 00001517 00001518 00001520 00001525 00001525 00001526
000041 000043 000047 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065 000065 000065 000065 000065 000065 000070 000071 000071 000074 000104	601 C 6 7 602 10 12	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER~NCS) 7+8+9 IF(NUMBER~NCS) 7+8+9	00001515 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001532
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000071 000071 000072 000074 000104	601 C 6 7 602 10 12 608	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(N</pre>	00001515 00001516 00001517 00001518 00001520 00001525 00001526 00001536 00001534 00001536
000041 000043 000047 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065 000065 000065 000065 000065 000065 000070 000071 000071 000074 000104	601 C 6 7 602 10 12	NO 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER~NCS) 7+8+9 IF(NUMBER~NCS) 7+8+9	00001515 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001532
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065 000070 000071 000072 000074 000104 000104 000106 000107	601 C 6 7 602 0 10 12 608 0 C	NO 3 N=1.4 IF (JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORWAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FIND FILE NCS = NCS+1 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-SC) 7+	00001515 00001517 00001517 00001518 00001520 00001525 00001526 00001536 00001532 00001534 00001537 00001538 00001538 00001538
000041 000043 000047 000047 000051 000053 000055 000065 000065 000065 000065 000065 000071 000071 000072 000074 000104 000104 000107 000110 000112 000114	601 C 6 7 602 0 10 12 608 0 C	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORWAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-SEL) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* [SET NUMBEP*+I5+* DQES NOT EXIST.*+ * REQUEST IGNORED.*//) GO TO 1 REWIF************************************</pre>	00001515 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001534 00001534 00001536 00001537 00001538 00001538
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065 000070 000071 000072 000074 000104 000104 000106 000107	601 C 6 7 602 0 10 12 608 0 C	NO 3 N=1.4 IF (JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORWAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(2HUD) FIND FILE NCS = NCS+1 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-SC) 7+	00001515 00001517 00001517 00001518 00001520 00001525 00001526 00001536 00001532 00001534 00001537 00001538 00001538 00001538
000041 000043 000047 000047 000053 000055 000065 000065 000065 000065 000065 000065 000072 000071 000072 000074 000104 000104 000104 000107 000110 000112 000114 000122	601 C 6 7 602 ° 10 12 608 ° C °	NO 3 N=1.4 IF (JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-SEL) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* [SET NUMBER*+15+* DQES NOT EXIST.*+ * REQUEST IGNORED.*//) GO TO 1 FEWIND 1 /CS = 0 GO TO 6 NCS = 1-1 WRITE (6+608) NCS+NUMBER FORMAT (//* THERE ARE ONLY*IS+* FILES.* * CANT FIND FILE*15//) REWITD 1 NCS = 0 GO TO 1 FORWARD SPACE TO CORRECT SET. NUM=NUMBER-1 DO 11 I=NCS+NUM PEAD(1) IF (FOF+1) 12+11 CONTINUE READ INSTRUMENT CHARACTERISTICS	00001515 00001517 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001537 00001537 00001538 00001538 00001539
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000071 000072 000074 000104 000104 000104 000107 000112 000112 000112 000122 000125	601 C 6 7 602 10 12 603 C 9	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORWAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-SET) GO TO 10 WRITE(6+602) NUMBER FORMAT(//* IC SET NUMBEP*+IS.* DOES NOT EXIST.*, * REQUEST IGNORED.*//) GO TO 1 REWIFD 1 /CS = 0 GO TO 6 NCS = I-1 WRITE (6+608) NCS+NUMBER FORMAT (//* THERE ARE ONLY*IS.* FILES.* * CANT FIND FILE*IS//) REWIFD 1 NCS = 0 GO TO 1 FORWARD SPACE TO CORRECT SET. NUM=NUMHER-1 DO 11 I=NCS+NUM PEAD(1) IF(FOF+1) 12+11 CONTINUE READ INSTRUMENT CHARACTERISTICS I = NUMBEP</pre>	00001515 00001517 00001517 00001517 00001520 00001520 00001526 00001526 00001536 00001536 00001537 00001538 00001538 00001538 00001539 00001540 00001541
000041 000043 000047 000047 000053 000055 000065 000065 000065 000065 000065 000065 000072 000071 000072 000074 000104 000104 000104 000107 000110 000112 000114 000122	601 C 6 7 602 ° 10 12 608 ° C °	NO 3 N=1.4 IF (JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-NCS) 7+8+9 IF (NUMBER-SET) GO TO 10 WRITE(6+6602) NUMBER FORMAT(//* IC SET NUMBEP*+IS+* DOES NOT EXIST.**, * REQUEST IGNORED.*//) GO TO 1 REWIFO 1 /CS = 0 GO TO 6 NCS = I-1 WRITE(6+601) NCS+NUMBER FORMAT (//* THERE ARE ONLY*IS+* FILES.** * CANT FIND FILE*IS//) REWIFD 1 NCS = 0 GO TO 1 FORWARD SPACE TO CORRECT SET. NUM=NUMBER-1 DO 11 I=NCS+NUM PEAD(1) IF (FOF+1) 12+11 CONTINUE READ INSTRUMENT CHARACTERISTICS I = NUMBEP READ(1) NUM2+IDAT+PAR	00001515 00001517 00001517 00001518 00001520 00001525 00001526 00001526 00001536 00001536 00001538 00001538 00001538 00001538 00001538 00001541 00001543
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000071 000072 000074 000104 000104 000104 000107 000110 000112 000112 000112 000112 000122	601 C 6 7 602 10 12 608 C C C 2 11 C 8 13	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORWAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 FORMAT(//* IC SET NUMBER*+15.* DOES NOT EXIST.*, * REQUEST IGNORED.*//) GO TO 1 REWIFO 1 /CS = 0 GO TO 6 NCS = I-1 WRITE (6+608) NCS+NUMBER FORMAT (//* THERE ARE ONLY*IS.* FILES.* * CANT FIND FILE*15//) REWIFND 1 NCS = 0 GO TO 1 FORWARD SPACE TO CORRECT SET. NUM=NUMBER-1 DO 11 I=NCS+NUM PEAD(1) IF(FOF+1) 12+11 CONTINUE READ INSTRUMENT CHARACTERISTICS I = NUMBEP READ(1) NUM2+IDAT,PAR IF(F(OF+1) 12+13 NCS=NUMBER</pre>	00001515 00001517 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001537 00001537 00001538 00001537 00001540 00001543 00001543 00001543
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000065 000071 000072 000074 000104 000104 000104 000107 000110 000112 000112 000112 000112 000122	601 C 6 7 602 ° 10 12 608 ° C °	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5,6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(N</pre>	00001515 00001517 00001517 00001518 00001520 00001525 00001526 00001526 00001536 00001536 00001538 00001538 00001538 00001538 00001538 00001541 00001543
000041 000043 000047 000047 000053 000055 000065 000065 000065 000065 000065 000065 000072 000074 000104 000104 000104 000107 000110 000112 000114 000112 000112 000122	601 C 6 7 602 ° 10 12 608 ° C ° C ° C ° C °	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) G0 T0(4+5+6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(STAUBER-NCS) 7+8+9 IF(STAU</pre>	00001515 00001517 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001537 00001537 00001538 00001537 00001540 00001543 00001543 00001543
000041 000043 000047 000051 000053 000055 000065 000065 000065 000065 000065 000065 000071 000072 000074 000104 000104 000104 000112 000112 000112 000112 000122 000127 000122 000127 000140 000143 000145	601 C 6 7 602 10 12 608 C C C 2 11 C 8 13	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) G0 T0(4+5,6+6)+N CONTINUE WRITE(6+601) FORMAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(N</pre>	00001515 00001517 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001537 00001537 00001538 00001537 00001540 00001543 00001543 00001543
000041 000043 000047 000047 000053 000055 000065 000065 000065 000065 000065 000065 000071 000071 000071 000072 000074 000104 000104 000107 000112 000112 000112 000112 000127 000123 000123 000125 000124 000143 000145 000150	601 C 6 7 602 ° 10 12 608 ° C ° C ° C ° C °	<pre>N0 3 N=1.4 IF(JOPT.EQ.IOPT(N)) GO TO(4+5+6+6)+N CONTINUE WRITE(6+601) FORWAT(//* UNRECOGNIZED DIRECTIVE*//) CALL ABORT(ZHUD) FIND FILE NCS = NCS+1 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-NCS) 7+8+9 IF(NUMBER-SET IGNORED.*//) GO TO 1 REWIFO 1 /CS = 0 GO TO 1 REWIFO 1 /CS = 0 GO TO 6 NCS = I-1 WRITE (6+608) NCS+NUMBER FORMAT (//* THERE ARE ONLY*IS.* FILES.* * CANT FIND FILE*IS//) REWIFO 1 NCS = 0 GO TO 1 FORWARD SPACE TO CORRECT SET. NUM=NUMBER-1 DO 11 I=NCS+NUM PEAD(1) IF(FOF+1) 12+11 CONTINUE READ INSTRUMENT CHARACTERISTICS I = NUMBEP READ(1) NUM2+IDAT,PAR IF(f(F+1) 12+13 NCS=NUMBER WRITE INSTRUMENT CHARACTERISTICS. WRITE INSTRUMENT CHARACTERISTICS. WRITE INSTRUMENT CHARACTERISTICS.</pre>	00001515 00001517 00001517 00001517 00001520 00001525 00001526 00001526 00001536 00001536 00001537 00001538 00001537 00001538 00001540 00001543 00001543 00001543

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000174	60J	FORMAT(//# SET#+15+# DATE#+315+F15.4+5X+A10+E15.4)	
000174	005	D0 14 J=4+75+7	00001551
000176		L=J+6	00001552
0002000	• -	1F(L+6T+75) L=75	00001553 00001554
000203	14	WRITE(6+604)(PAR(K+1)+K≍J+L) FORMAT(7€15+4)	00001555
000222	604	#RITE(6+603) NU12 +10AT+PAR(76+1)+PAR(77+1)+PAR(78+1)	00001000
000245		NO 15 J=79+160+7	00001557
000247		L=J+6	9000 <u>155</u> 8
000251		IF(L.GT.160) L=160	00001559
000254	15	WRITE (6+604) (PAR(K+1)+K=J+L)	00001560
000275	<u>^</u>	JF(N.E0.3) GO TO 1 PUNCH 1C#5.	00001561 00001562
000277	с	DO 17 I=1+4	00001563
000301			00001564
000302		WRITE (43,4303) NUM2+IDAT +PAR(1+1)+PAR(2+1)+PAR(3+1)+	
-		NUMBER. I. LL	U0001566
000333	4303	FORMAT(415,10X,E10,3,A10,E10,3,12X,12,11,15)	
000333		10 16 J=4+75+7	00001568 00001569
009335 000337		LL=LL+l L=J+6	00001570
000341	16	WRITE (43+4304) (PAR(K+I)+K=J+L)+NUMBER+I+LL	00001571
000364	4304	FORMAT(7E10.3+2X+12+11+15)	
000364		LL=LL+1	00001573
000366		WRITE (43+4303) NUM2+IDAT +PAR(1+1)+PAR(2+1)+PAR(3+1)+	000
	•	NUMBER I LL	00001575 00001576
000416		no 17 J=79+160+7	00001577
000420 000422		LL=LL+1 L=J+6	00001578
000422	17	L=3+0 WRITE(43+4304)(PAR(K+1)+K=J+L)+NUHBER+I+LL	00001579
000451		60 TO 1	00001580
	C	······	00001583
	С	COPY OLD IC#S	00001584
	¢_		00001581
000452	5	REW11D 1	00001585
000454 000455		NCS ≠ 0 WPITE(6+605)	00001587
000461	605	FORMAT(1H)+* THE FOLLOWING IC SETS WERE COPIED FROM **	00001588
000401		THE OLD FILE**/	00001589
		* SET NUMBER ID NUMBER DATE*)	00001590
000461	18	READ(1) NUM2+IDAT+PAR	00001591
000472		IF(E0F+1) 4+19	00001592
006475	19	NCS = NCS+1	
000477		WRITE (6+606) NCS+NU42+IDAT	
000477 000510	606	WPITE (6+606) NCS+NU42+IDAT FORMAT (3X+15+9X+15+3X+315)	00001594
	606		00001594 00001595
000510		FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+10AT+PAR G0 TO 18	00001595 00001597
000510 000510 000521	c	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS.	00001595
000510 000510 000521	с 4	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GQ TO 18 READ NEW SETS. NCC = NCS	00001595 00001597
000510 000510 000521 000522 000522	с 4	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1	00001595 00001597
000510 000510 000521 000522 000524 000526	C 26	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607)	00001595 00001597
000510 000510 000521 000522 000522	C 26 607	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1	00001595 00001597 00001598
000510 000510 000521 000522 000524 000526 000531	C 26 607	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO * *THE OUTPUT FILE.*) DO 23 1=1+4	00001595 00001597
000510 000510 000521 000522 000524 000526 000531 000531 000533	C 4 26 607	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 WRITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO * *THE OUTPUT FILE.*) DO 23 1=1+4 READ(5+4303) NUHBER+1DAT+PAR(1+1)+PAR(2+1)+PAR(3+1)	00001595 00001597 00001598 00001598
000510 000510 000521 000522 000524 000526 000531 000531 000533 000555	C 26 607 25	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • •THE OUTPUT FILE.•) DO 23 1=1+4 READ(5+6303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(E0F+5) 40+20	00001595 00001597 00001598 00001601
000510 000510 000521 000522 000524 000524 000531 000531 000533 000555 000560	C 4 26 607	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 NCC = NCS NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) DO 23 I=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+I)+PAR(2+I)+PAR(3+I) IF(FOF+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+I)+PAR(2+I)+PAR(3+I)	00001595 00001597 00001598 00001601 00001602 00001603
000510 000510 000521 000522 000524 000526 000531 000531 000533 000555	C 26 607 25	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+IDAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.*) DO 23 1=1+4 READ (5+4303) NUMBEP+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(f0+5) 40-20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6	00001595 00001597 00001598 00001601 00001601 00001603 00001606
000510 000521 000521 000524 000524 000526 000531 000531 000533 000555 000560 000603	C 26 607 25	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+IDAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.*) DO 23 1=1+4 READ (5+4303) NUMBEP+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(f0+5) 40-20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6	00001595 00001597 00001598 00001601 00001602 00001603
000510 000521 000521 000522 000524 000526 000531 000533 000555 000560 000603 000607 000612	C 26 607 25	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • •THE OUTPUT FILE.•) DO 23 1=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(E+0+5) 40+20 WRITE(6+603) NUC+1DAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=3+6 IF(L+6T+75) L=75 READ(5+4304)(PAR(K+1)+K=J+L)	00001595 00001597 00001598 00001601 00001602 00001603 00001606 00001606
000510 000520 000521 000524 000526 000531 000533 000555 000560 000603 000605 000607 000612 000627	C 4 26 607 25 20	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WRITE(6+6607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO * *THE OUTPUT FILE.*) DO 23 I=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(FOF+51 40+20 WRITE(6+6603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF(L.GT-75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) IF(FOF+51 40+21	00001595 00001597 00001598 00001601 00001602 00001603 00001606 00001606 00001608 00001609
000510 000521 000521 000524 000526 000531 000531 000533 000555 000560 000605 000607 000612 000627	C 26 607 25	FORMAT(3X+15+9X+15+3X+315) wRITE(2) NUM2+IDAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 wPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) DO 23 1=1+4 READ(5+4303) NUHBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(cof+51 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF(L+GT+75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) IF(FOF+51 40+21 WRITE(6+604)(PAR(K+1)+K=J+L)	00001595 00001597 00001598 00001601 00001602 00001603 00001606 00001603 00001608 00001609 00001611
000510 000521 000521 000524 000526 000531 000533 000553 000560 000603 000603 000607 000612 000627 000632 000651	C 4 26 607 25 20	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR G0 TO 18 NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO * *THE OUTPUT FILE.*) OO 23 1=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(E+0+5) 40+20 WRITE(6+604) NCC+1DAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 2] J=4+75+7 L=J+6 I*(1,67+75) L=75 READ(5+4304) (PAR(K+1)+K=J+L) IF(FOF+5) 40+21 WRITE(6+604) (PAR(K+1)+K=J+L) READ(5+4303) NUMBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1)	00001595 00001597 00001598 00001601 00001602 00001603 00001606 00001606 00001608 00001609
000510 000520 000521 000524 000526 000531 000533 000533 000555 000560 000603 000607 000612 000632 000651 000674	C 26 607 25 20 21	FORMAT(3X+15+9X+15+3X+315) wRITE(2) NUM2+IDAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 wPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • oTHE OUTPUT FILE.*) DO 23 1=1+4 READ (5+4303) NUHBEP+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(f0f+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF(L.GT.75) L=75 READ (5+4304) (PAR(K+1)+K=J+L) IF(f0f+5) 40+21 WRITE(6+604) (PAR(K+1)+K=J+L) READ (5+4303) NUHBEP+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(f0f+5) 40+22	00001595 00001597 00001598 00001601 00001602 00001603 00001606 00001603 00001608 00001609 00001611
000510 000521 000521 000524 000526 000531 000533 000533 000555 000560 000605 000607 000612 000627 000632 000674 000674	C 4 26 607 25 20	FORMAT(3X+15+9X+15+3X+315) wRITE(2) NUM2+IDAT+PAR GO TO 18 NCC = NCS NCC = NCS NCC = NCC+1 wPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) DO 23 I=1+4 READ(5+6303) NUHBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(f0F+51 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 If(LoT.75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) IF(FOF+51 40+21 WRITE(6+604) NUHBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(E0F+51 40+22 WRITE(6+603) NUHBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(E0F+51 40+22 WRITE(6+603) NUC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(E0F+51 40+22 WRITE(6+603) NUC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1)	00001595 00001597 00001598 00001601 00001602 00001603 00001603 00001603 00001608 00001609 00001611 00001612
000510 000520 000521 000524 000526 000531 000533 000533 000555 000560 000603 000607 000612 000632 000651 000674	C 26 607 25 20 21	FORMAT(3X+15+9X+15+3X+315) wRITE(2) NUM2+IDAT+PAR GO TO 18 NCC = NCS NCC = NCC+1 wPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • oTHE OUTPUT FILE.*) DO 23 1=1+4 READ (5+4303) NUHBEP+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF(f0f+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF(L.GT.75) L=75 READ (5+4304) (PAR(K+1)+K=J+L) IF(f0f+5) 40+21 WRITE(6+604) (PAR(K+1)+K=J+L) READ (5+4303) NUHBEP+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(f0f+5) 40+22	00001595 00001597 00001598 00001601 00001602 00001603 00001606 00001603 00001608 00001609 00001611
000510 000521 000522 000524 000526 000531 000531 000533 000555 000560 000605 000605 000605 000605 000632 000632 000632 000632 000632 000632 000651 000674 000722	C 26 607 25 20 21	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+IDAT+PAR G0 TO 18 NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) D0 23 I=1+4 READ(5+4303) NUHBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(f(07+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) D0 21 J=4+75+7 L=3+6 IF(L,GT.75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) IF(f(07+5) 40+21 WRITE(6+604)(PAR(K+1)+K=J+L) READ(5+4303) NUHBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(f(07+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(f(07+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(c07+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(c07+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(L,GT+160) L=160	00001595 00001597 00001598 00001601 00001602 00001603 00001603 00001603 00001609 00001611 00001612 00001615 00001615
000510 000521 000522 000524 000526 000531 000533 000533 000553 000560 000603 000603 000607 000612 000627 000632 000651 000674 000677 000722 000724 000726 000726	C 26 607 25 20 21	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • oTHE OUTPUT FILE.•) DO 23 1=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF (FOF+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF (L+67+75) L=75 READ(5+4304) (PAR(K+1)+K=J+L) IF (FOF+5) 40+22 WRITE(6+604) NUMBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (6+604) NUMBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (6+604) NUMBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (6+604) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (L+61+160) L=160 READ(5+4304) (PAR(K+1)+K=J+L)	00001595 00001597 00001598 00001601 00001602 00001603 00001603 00001603 00001609 00001611 00001612 00001615 00001615
000510 000522 000524 000524 000524 000531 000531 000531 000533 000555 000560 000605 000605 000605 000605 000651 000651 000651 000651 000651 000651 000674 000722 000724	C 26 607 25 20 21 21 22	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR G0 TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • •THE OUTPUT FILE.•) D0 23 1=1+4 READ(5+4303) NUMBER+IDAT*PAR(1+1)*PAR(2*I)*PAR(3*I) IF (FOF*5) 40*20 WRITE(6+603) NUCC+IDAT*PAR(1+1)*PAR(2*I)*PAR(3*I) D0 21 J=4*75*7 L=J+6 IF (L.6T*75) L=75 READ(5*4304) (PAR(K+1)*K=J+L) IF (FOF*5) 40*21 WRITE(6+604) NUMBER*IDAT*PAR(76*I)*PAR(77*I)*PAR(78*I) IF (E0F*5) 40*22 WRITE(6+603) NUCCEIDAT*PAR(76*I)*PAR(77*I)*PAR(78*I) IF (E0F*5) 40*22 WRITE(6+604) L=160 READ(5*4304) (PAR(K*I)*K=J+L) IF (FOF*5) 40*23	00001595 00001597 00001598 00001602 00001603 00001603 00001608 00001608 00001611 00001612 00001615 00001615 00001616 00001618
000510 000521 000522 000524 000526 000531 000533 000533 000553 000560 000603 000603 000607 000612 000627 000632 000651 000674 000677 000722 000724 000726 000726	C 26 607 25 20 21 22 21 22	FORMAT(3X+15+9X+15+3X+315) whITE(2) NUM2+IDAT+PAR G0 TO 18 NCC = NCS NCC = NCC+1 wPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) D0 23 1=1+4 READ(5+6303) NUHBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(cof+51 40+20 wRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) D0 21 J=4+75+7 L=J+6 If(Loft-75) L=75 READ(5+6304)(PAR(K+1)+K=J+L) READ(5+6303) NUHBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) If(coft+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) If(coft+5) 40+22 WRITE(6+603) NUC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) If(coft+5) 40+22 WRITE(6+604)(PAR(K+1)+K=J+L) IF(coft+5) 40+23 WRITE(6+604)(PAR(K+1)+K=J+L) If(coft+5) 40+23 WRITE(6+604)(PAR(K+1)+K=J+L)	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
000510 000521 000521 000524 000526 000531 000533 000533 000553 000560 000603 000603 000603 000607 000612 000627 000632 000651 000674 000724 000726 000721 000746 000751	C 26 607 25 20 21 21 22	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • oTHE OUTPUT FILE.•) DO 23 1=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF (FOF+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF (L=61+75) L=75 READ(5+4304) (PAR(K+1)+K=J+L) IF (FOF+5) 40+22 WRITE(6+604) (PAR(K+1)+K=J+L) READ(5+4304) (PAR(K+1)+R=7AR(76+1)+PAR(77+1)+PAR(78+1)) IF (E0F+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1)) IF (E0F+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (E0F+5) 40+22 WRITE(6+604) (PAR(K+1)+K=J+L) IF (FOF+5) 40+23 WRITE(6+604) (PAR(K+1)+K=J+L) APPEND IC#5	00001595 00001597 00001598 00001602 00001603 00001603 00001608 00001608 00001611 00001612 00001615 00001615 00001616 00001618
000510 000522 000524 000524 000524 000531 000531 000533 000555 000560 000605 000605 000605 000605 0006527 000632 000651 000651 000674 000722 000724 000724	C 26 607 25 20 21 22 21 22	<pre>FORMAT(3x+15+9x+15+3x+315) wRITE(2) NUM2+1DAT+PAR G0 T0 18</pre>	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
000510 000522 000524 000524 000524 000531 000531 000531 000533 000555 000560 000605 000605 000605 000605 000607 000612 000627 000632 000651 000674 000722 000724 000721 000751 000772	C 26 607 25 20 21 22 21 22	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • oTHE OUTPUT FILE.•) DO 23 1=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF (FOF+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF (L=61+75) L=75 READ(5+4304) (PAR(K+1)+K=J+L) IF (FOF+5) 40+22 WRITE(6+604) (PAR(K+1)+K=J+L) READ(5+4304) (PAR(K+1)+R=7AR(76+1)+PAR(77+1)+PAR(78+1)) IF (E0F+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1)) IF (E0F+5) 40+22 WRITE(6+603) NCC+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (E0F+5) 40+22 WRITE(6+604) (PAR(K+1)+K=J+L) IF (FOF+5) 40+23 WRITE(6+604) (PAR(K+1)+K=J+L) APPEND IC#5	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
000510 000522 000524 000524 000524 000531 000531 000531 000533 000555 000560 000605 000605 000605 000605 000607 000612 000627 000627 000632 000651 000674 000722 000724 000725 000751 000751	C 26 607 25 20 21 22 21 22	<pre>FORMAT(3x+15+9x+15+3x+315) wRITE(2) NUM2+IDAT+PAR G0 T0 18</pre>	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
000510 000521 000521 000524 000526 000531 000531 000533 000555 000503 000605 000605 000605 000607 000632 000632 000632 000632 000632 000632 000632 000632 000674 000726 000726 000726 000721 000726 000751 000775	с 26 607 25 20 21 22 21 22 21 22 21 22 21 22 23 22 23 22 23	FORMAT(3X+15+9X+15+3X+315) white(2) NUM2+1DAT+PAR G0 TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 white(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • ofthe OUTPUT FILE.•) D0 23 1=1+4 READ(5+4303) NUMBEP+1DAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(f(f)f+5) 40+20 white(6+603) NCC+1DAT+PAR(1+1)+PAR(2+1)+PAR(3+1) D0 21 J=4+75+7 L=J+6 If(L.GT.75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) If(f0f+5) 40+21 white(6+604)(PAR(K+1)+K=J+L) READ(5+4304)(PAR(K+1)+K=J+L) READ(5+4304)(PAR(K+1)+K=J+L) READ(5+4304)(PAR(K+1)+K=J+L) If(f0f+5) 40+22 white(6+604)(PAR(K+1)+K=J+L) IF(c0f+5) 40+23 white(6+604)(PAR(K+1)+K=J+L) APPEND IC+5 WHITE(2) NCC+1DAT+PAR IF(J.OFT.NE+1DPT(1)) GO TO 29 white(6+604)(PAR(L+1)+K=J+L) IF(C0F+1LE INITIAL12ED+//) STOP	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
000510 000521 000521 000524 000526 000531 000531 000533 000555 000605 000607 000612 000627 000627 000627 000627 000627 000627 000627 000627 000627 000726 000726 000721 000726 000751 000746 000751 000751	C 26 607 25 20 21 22 21 22 21 22 21 22	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR GO TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) DO 23 1=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) IF (FOF+5) 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) DO 21 J=4+75+7 L=J+6 IF (L+GT+75) L=75 READ(5+4304) (PAR(K+1)+K=J+L) IF (FOF+5) 40+21 WRITE(6+604) (PAR(K+1)+K=J+L) READ(5+4303) NUMBER,IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF (60F+5) 40+22 WRITE(6+604) (PAR(K+1)+K=J+L) IF (FOF+5) 40+22 WRITE(6+604) (PAR(K+1)+K=J+L) IF (FOF+5) 40+23 WRITE(2) NCC+IDAT+PAR WRITE(2) NCC+IDAT+PAR WRITE(2) NCC+IDAT+PAR IF (J=0+1,NE-IOPT(1)) GO TO 29 WRITE(6+800) FORMAT(//10X*FILE INITIALIZED*//) STOP PEAD(6+500) JOBT, NUMBER	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
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000510 000521 000521 000524 000526 000531 000531 000533 000555 000560 000605 000605 000605 000605 000605 000605 000605 000607 000632 000632 000632 000632 000631 000677 000672 000724 000726 000725 000725 000725 000725 000725 000725 000726 000751 000726 000726 000751 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000510 000510 000510 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000500 000000	с <u>26</u> 607 25 20 21 22 21 22 21 22 23 2 23 2 23 2 23	FORMAT(3X+15+9X+15+3X+315) WRITE(2) NUM2+1DAT+PAR G0 TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 WPITE(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • OTHE OUTPUT FILE.•) D0 23 I=1+4 READ(5+4303) NUMBER+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(cof+51 40+20 WRITE(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) D0 21 J=4+75+7 I=J+6 IF(L.GT.75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) IF(cof+51 40+21 WRITE(6+604)(PAR(K+1)+K=J+L) READ(5+4304)NUMBER+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) IF(cOf+51 40+22 WRITE(6+603) NCC+(DAT+PAR(76+1)+PAR(77+1)+PAR(78+1)) IF(cOf+51 40+22 WRITE(6+604)(PAR(K+1)+K=J+L) IF(cOf+51 40+23 WRITE(6+604)(PAR(K+1)+K=J+L) IF(cOf+51 40+23 WRITE(6+604)(PAR(K+1)+K=J+L) IF(cOf+51 40+23 WRITE(6+604)(PAR(K+1)+K=J+L) APPEND IC+5 WRITE(2) NCC+IDAT+PAR IF(JOFT-NE+IDPT(1)) GO TO 29 WRITE(6+600) JOBT, NUMBER IF(COF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(LOF+51 45+36 IF(JOFT-KE) 45+36	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618
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000510 000521 000521 000524 000526 000531 000531 000533 000555 000560 000605 000607 000612 000627 000632 000627 000632 000632 000631 000677 000632 000651 000677 000672 000724 000726 000724 000726 000725 000725 000725 000725 000726 000725 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000531 000533 000533 000533 000555 000500 000531 000555 000500 000531 000555 000500 000531 000555 000500 000505 000500 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000505 000526 000526 000525 000505 000520 000525 000520 000520 000520 000520 000520 000520 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 000726 0000726 0000726 0000726 0000726 0000726 0000726 0000726 0000726 0000726 0000000000	C 4 26 607 25 20 21 22 21 22 21 22 23 22 23 22 23 29 30 35 40 609	FORMAT(3X+15+9X+15+3X+315) white(2) NUM2+1DAT+PAR G0 TO 18 READ NEW SETS. NCC = NCS NCC = NCC+1 white(6+607) FORMAT(1H1/* THE FOLLOWING IC SETS WEPE APPENDED TO • of HF OUPPUT FILE.•) D0 23 I=1+4 READ(5+4303) NUMBEP+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) If(fof5) 40+20 white(6+603) NCC+IDAT+PAR(1+1)+PAR(2+1)+PAR(3+1) D0 21 J=4+75+7 I=J+6 If(L.GT.75) L=75 READ(5+4304)(PAR(K+1)+K=J+L) If(fof5) 40+21 white(6+604)(PAR(K+1)+K=J+L) READ(5+4304)NUMBEP+IDAT+PAR(76+1)+PAR(77+1)+PAR(78+1) If(c0f5) 40+22 white(6+604)(PAR(K+1)+K=J+L) IF(c0f5) 40+23 white(6+604)(PAR(K+1)+K=J+L) IF(c0f+5) 40+23 white(6+604)(PAR(K+1)+K=J+L) APPEND IC#5 WHITE(2) NCC+IDAT+PAR IF(JOFT-NE+IOPT(1)) GO TO 29 white(6+600) JOBT, NUMBER IF(C0f+5) 40+23 WHITE(6+600) JOBT, NUMBER IF(C0f+5) 40+23 WHITE(6+600) JOBT, NUMBER IF(C0f+5) 40+20 VARITE(2) NCC+IDAT+PAR IF(10F+5) 45+36 IF(10F+5) 45+36	00001595 00001597 00001598 00001602 00001603 00001603 00001603 00001603 00001609 00001611 00001615 00001615 00001615 00001618 00001618

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Figure C-2. (continued)

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001042		CALL ABORT	(SHIC)
001044	45	ENDFILE 2	
001045		STOP	
001050		END	

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00001622 00001623

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с		SUBPOUTINE ABORT(A)	
c		HALT PROGRAM IN CASE OF ERROR	
000003		W ^D ITE (6+100) A	
000011	100	FORMAT (10X, 10HABORT CODE +1X, A10)	
000011		ENDFILE 2	
000013		B=A/0.0+1.0	
000017		STOP	
000021		Ent)	

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Figure C-2. (Continued)

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# III. DEFINITION OF VARIABLES

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The variables employed by ICHAR are defined in Table C-1.

Table C-1 Definition of Variables

NSC	=	File Pointer for File Code 01
NCC	=	File Pointer for File Code 02
JOBT	=	Job Instruction
NUMBER	=	File Number to be Printed or Punched
IOPT	=	Array of Recognized Instructions
IDAT	=	Date in Parameters
NUM2		Set Number as Read from File Code 01
PAR	=	Set of Instrument Parameters

### APPENDIX D

### PROGRAM TDUPE

### I. INTRODUCTION

Program TDUPE is a translation and duplication program which prepares an integer version of the output tape. It is intended that copies of the integerized tape be sent to the investigators upon request for use on other computing machines. A utility program may be used to prepare additional copies. This appendix describes the design and operation of TDUPE. Helpful to the reader are the flow charts of Figure D-1 and the program listing of Figure D-2.

### II. DESIGN AND OPERATION

Action in TDUPE is initiated by an external control card specifying the files, by mission and flight, which are to be copied. A file counter is initialized, file unit 1 is rewound and the instruction is listed. The labels on the files are examined and compared with the instruction. Files not having the designated mission and flight are bypassed until one is found. At this time a record counter is initialized. Then the instrument parameters are read, scaled, and integerized. The file heading and instrument parameters are transferred to file unit 2. The file heading is also listed on the printer and the file counter is incremented.

Consecutive records are then read, scaled and integerized. In each instance the record counter is incremented. The records are accumulated in blocks by subroutine WRITE2 and transferred to tape unit 2 when the block is filled. The terminating block is filled with integer zeroes when there are insufficient records to fill it. When the file has been exhausted, an EOF is appended to the transferred file and a message is given to indicate the number of records which have been transferred.

The search for additional files continues until the end of the reel is encountered. At this point another instruction is sought. The program terminates

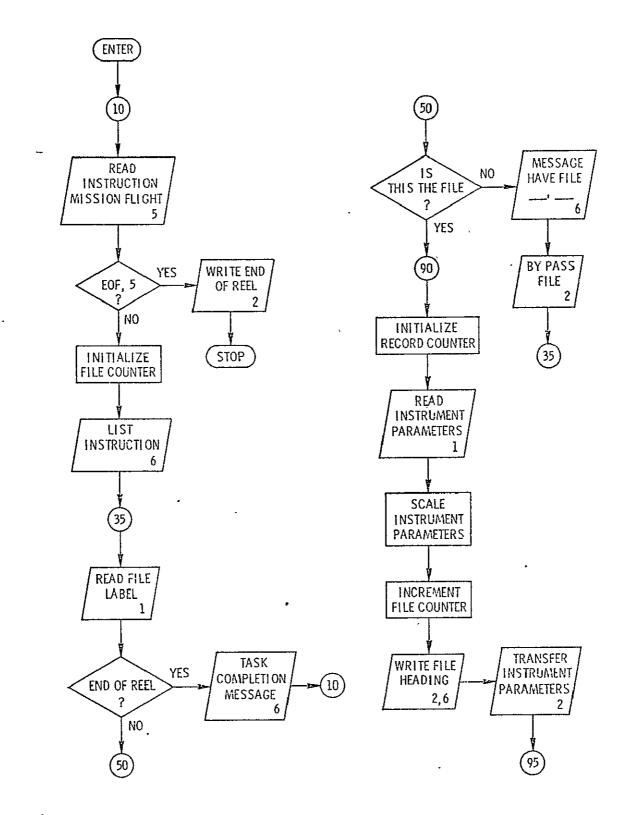


FIGURE D-1. DESCRIPTIVE LOGIC DIAGRAM FOR PROGRAM TDUPE

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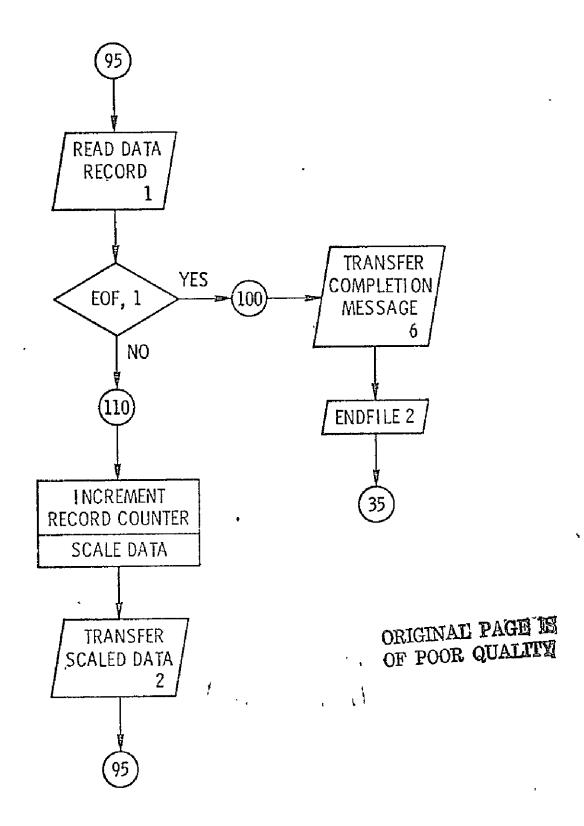


FIGURE D-1. (continued)

		PROGRAM TOUPE (INPUT+OUTPUT+TAPE1+TAPE2+TAPE5=INPUT+TAPE6=OUTPUT)	00001338
	c	TAPE TRANSLATION AND DUPLICATION ROUTINE	60001337 00001340
	с С	TAPE TRATSLATION AND DUPLICATION ROOTING	00001341
	č	THIS PROGRAM WAS PREPARED BY	00001342
	С		00001343 00001344
	с С	JOHN P. CLAASSEN	40001345
	č	UNIVERSITY OF KANSAS	00001346
	c	CENTER FOR RESEARCH	00001347
	c		60001348 00001349
	C C	THIS PROGRAM PREPARES A MASTER DUPLICATE TAPE OF THE	00001350
	č	RADSCAT OUTPUT TAPE FOR USE ON OTHER MACHINES. OTHER	00001351
	с	COPIES OF THE MASTER DUPLICATE TAPE HAY BE PREPARED	00001352
	¢ c	BY USING AN IN-HOUSE UTILITY PROGRAM. THE OUTPUT DATA Records are translated to integer format after	60001353 30001354
	c	HULTIPLICATION BY AN APPROPRIATE SCALE FACTOR.	00001355
	č	HESSAGES ARE LISTED TO INDICATE THE STATE OF THE	00001356
	C	TRANSFER.	00001357 00001358
	C C	CONTROL PARAMETERS	00001359
	с с		00001360
	с	HISFLT = MISSION AND FLT DATA TO BE DUPLICATED	00001361
	с с	INPUT/OUTPUT PARAMETERS	00001362 00001363
	č		00001364
	C	IHEAD = FILE HEADING	00001365
	с с	LCHAR = INSTRUMENT PARAMETER LABEL ICHAR = INSTRUMENT CHARACTERISTICS	00001366 00001367
	č	DATA = INPUT RECORDS	00001368
	С	IDATA = INTEGER EQUIVALENT OF DATA	00001369
	с с	IARRAY = OUTPUT RECORDS	00001370
	č	WORKING PARAMETERS	00001372
	с		00001373
	с с	NOF ≈ NO. OF FILES IREC = NO. OF RECORDS IN A FILE	00001374 00001375
	č	IEOR = "END OF REEL"	00001376
	ç		00001377 00001378
000003	с	DIMENSION IHEAD(9), ICHAR(160), DATA(20), IDATA(20),	00001379
000003 000003	*	IARRAY(20), 1EOR(2), HISELT(2), LCHAR(4) Dimension Rpar(75), Spar(35), Sfact(15) Logical Eofi	00001380 00001381
000003		EQUIVALENCE (ICHAR(1), RPAR(1)), (ICHAR(76), SPAR(1))	00001382
000003 000003		EQUIVALENCE (DATA(1), IDATA(1)) DATA SFACT/1.0E10; 1.0; 1.0E5; 1.0E7; 1.0E9; 3º1.0; 4º10.0;	00001363 00001384
	•	1.0E3,24100.0/	00001385
000003	~	DATA IEOR/IOHEND OF REE.IHL/	00001386 00001387
	с С	READ THE DIPECTIVE	00001388
	С		00001389
000003 000011	10 1000	READ (5:1000) MISFLT Format (2110)	00001370 00001391
000011	,	IF (E0F+5) 20+30	00001392
	ç		00001393
	с с	WRITE *END OF REEL*	00001394 00001395
000014	_ 50	WRITE (2) IEOR+ (I+I=3+9)	00001396
000056	~	STOP	00001397 00001398
	C C	INITIALIZE FILE COUNT	00001399
	с		00001+00
000030 000031	30	NOF = 0 REWIND 1	00001401
000033		WRITE (6,2000) HISFLT	00001402
000041	2000	FORMAT (1H1.11X. WILL PREPARE COPY OF DATA FROM MISSION#15." AN	000001403 00001~04
000041	35	FLT+13///) PEAD (1) IHEAD	00001405
	C		00001406
	c c	CHECK FOR END OF REEL	00001407 00001408
000046	· ·	10 40 1 = 1.2	00001409
000050	40	IF(IHEAD(I) .ME. IEOR(I)) GO TO 50	00001+10
000054 000061	3000	WRITE (6.3000) NOF Format (//11x+15* Files have been transferred #///)	00001411
000061	3000	60 TO 10	00001412
	c		00001414
	C C	CHFCN FOR FILE NAME	00001→15 00001+16
000062	۲ 50	10 60 I=1.2	00001-17
000064	60	IF (IHEAD(I) .NE. HISFL1(I)) 60'TO 70	0000141A
000070 000070	70	60 TO 90 WRITE(6+4000) (IHEAD(I)+1=1.2), HISELT	00001419 00001420
		and a second descent and a	

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FIGURE D-2. SOURCE LISTING FCR TDUPE ORIGINAL PAGE IS OF POOR QUALITY

000104	4000	FORMAT (11X+ *FILE HEADING * 215 * DOES NOT AGREE WITH DIRECTIVE	00001421
000104		PORMAN (IIX4 "FILL HEADING " 215 " DOES NOT NONLE WITH DIRECTIC. #2[5]	00001422
		*2157	00001423
		BY-PASS UNWANTED FILF	00001424
	C C C	BI-FROS ONNATED FILE	00001425
000104	60	PEAD (1)	00001426
000107	00	IF (E0F+1) 35-80	00001427
000100	С		00001428
	č	INITIALIZE RECORD COUNT	00001429
	č		00001430
000112	<b>9</b> 0	$I^{\text{RFC}} = 0$	00001431
000113		READ (1) LCHAR, ICHAR	00001432
	С		00001433
	č	SCALE AND TRANSFER INSTR. PARAMETERS	00001434
	с с		00001435
000122	-	$ICHAP(1) = RPAR(1) * 1 \cdot 0E - 6$	00001436
000125		00 91 1=3+20	00001437
000127	91	ICHAR(I)=RPAR(I)*1.0E4	00001438
000134		ICHAR(21)=RPAR(21)*10.0	00001439
000137		1CHAR(22)=RPAR(22)*10+0	00001440
000142		nn 92 I=23.75	00001441
000143	92	ICHAP(I) = RPAR(I)*1.0E4	00001442
000150		ICHAR(76)=>PAR(1)41.0E+6	00001443
000153		00 93 1=3+16	00001444
000155	93	ICHAR(I+75)=SPAR(I)+1.0E4	00001445
000162		D0 96 I=17+31	00001446
000164	96	ICHAR(I+75)=SPAR(I)*SFACT(I-16)	00001447
000171		no 97 I=32+85	00001448
000173	97	ICHAR(I+75)=SPAR(I)*1+0E4	00001449
000200		WRITE (6,5000) (IHEAD(I),I=1,7)	00001450
000212	5000		
		* RUN*I3)	00001452
	С		00001453
	C C	UPDATE FILE COUNTER.	00001454
	C		00001455
000212		NOF = NOF + 1	00001456
· 000214 000221		WPITE(2) IHEAD WRITE(2) LCHAR, ICHAR	00001457
000221	95	CALL READI (DATA+EOF)	00001458
000232	70		
000234	100	IF (.NOF.EOFI) 60 10 110 · WRITE (5.6000) IREC.NOF	00003463
000244	6000	FORMAT (//11X+14* RECORDS HAVE BEEN TRANSFERRED FROM FILE* 13///)	00001461
000244	0000	CALL ENDF2	00001402
000244			

006245		GO TO 35	00001464
	C		40001465
	C C	UPDATE RECORD COUNTER.	00001-66
			00001467
000246	110	IREC = IREC + 1	00001468
	С		00001469
	C C	SCALE AND TRANSFER RADSCAT MEASUREMENTS.	00001470
	С	e e e e e e e e e e e e e e e e e e e	00001471
000250		IARRAY(1)=DATA(1)*100.0	00001472
000253		IARRAY(2)=IDATA(2)	00001473
000254		IARRAY(3)=DATA(3)*100.0	00001474
000257		IAPRAY(4)=DATA(4)*100.0	00001475
000261		IAPRAY(5)=IDATA(5)	00001476
000263		IARRAY(6)=IDATA(6)	00001477
000264		IARRAY(7)=DATA(7)#10000.0	00001478
000267		IF (DATA(8) .LT. 1.0E-03) GO TO 120	00001479
000272		IARRAY(8) = DATA(8)*1.0 E06	00001490
000275		IAPRAY (9)=1000000	00001481
000276		GO TO 130	00001482
000277	120	IAPRAY(8)=DATA(8)#1.0E+09	00001403
200000		IAFRAY(9) = 1000000000	00001444
000304	130	IAPRAY(10)=DATA(9)*100.0	00001435
000307		IARRAY(11)=DATA(10)*100.0	00001486
212000		IARRAY(12) = DATA(11)*10000.0	00001487
000315		IAPRAY(13) = IDATA(12)	00001488
000316		TAPRAY(14)=DATA(13)*10.0	00001439
000321		IAPRAY(15)=DATA(14)+100.0	00001490
000324		TARRAY(16)=DATA(15)*100.0	00001491
000327		CALL WRITEZ (IARRAY)	
000330		60 TO 95	00001493
000331		END	00001494

Figure D-2. (Continued)

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000005 000005 000005 000005 000005 000006 000007 000014 000020 000023	10	SUBROUTINE READ1(IDATA,EOF1) DIMENSION IDATA(20), IBLOCK(20,20) LOGICAL FOF1 DATA NDEX/0/ EOF1=.FALSE. IF(NDEX.NE.0) GO TO 10 HDEX=1 READ(1) IBLOCK IF(FDF.1) 100.10 IF(IRLOCK(1.NDEX).E0.0) GO TO 90 DO 20 I=1.20
000023 000035 000036 000041 000042 000045 000045 000051 000052 000053 000054	20 90 100 ·	IDATA(I)=IBLOCK(I,NDEX) NDEX=NDEX+1 IF(NDEX.GT.20) NDEX=0 RETURN PEAD(1) IF(EOF.1) 100.90 EOF1=.TRUE. NDEX=0 RETURN FND

$\begin{array}{c} 000003\\ 000003\\ 000003\\ 000005\\ 000015\\ 000016\\ 000021\\ 000026\\ 000027\\ 000030\\ 000036\\ 000042\\ 000043\\ 000043\\ 000044 \end{array}$		SUBROUTINE WRITE2 ( DIMENSION IBLOCK(20) DATA INDEX /1/ DO 20 I = 1.20 IBLOCK(I.INDEX) = I INDEX = INDEX + 1 IF (INDEX .LE. 20) WRITE (2) IBLOCK IMDEX = 1 RETURN ENTPY ENDF 2 IF (INDEX .LE. 1) DO 25 I = INDEX.20 DO 25 J= 1.20 IBLOCK(I.I.) = 0	920), IARRAY(1) ARRAY(I) RETURN
000044	25	IBLOCK(J.I) = 0 · WRITE (2) IBLOCK	
000061		INDEX=1	
000062	30	ENDFILE 2	TAGE IS
000064			ORIGINAL PAGE IS OF POOR QUALITY
000065		$E^{(slt)}$	OF POUR QUALLE

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Figure D-2. (Continued) 122

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when there are no additional instructions. However, before terminating an end of reel statement is written on file unit 2.

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The variables are defined in Table D-1.

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	Table D-1	Definition of Variables
IHEAD		File Label
LCHAR	=	Instrument Parameters Label
ICHAR	=	Instrument Parameters
DATA	. =	Input Records
IDATA	=	Integer Equivalent
IARRAY		Output Records
IEOR	=	11HEND of Reel
SFACT	=	Scale Factors

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### APPENDIX E

### SPECIAL PROGRAMS

### I. INTRODUCTION

Two special engineering routines WIDTH and GAIN prepare several antenna parameters essential to the reduction of the scatterometer data. WIDTH computes the equivalent beamwidth of the RADSCAT antenna; whereas GAIN computes the antenna directivity. Other parameters of special interest to antenna engineers are also computed in GAIN. These programs are provided with the realization that the antenna pattern may eventually change through an alteration of the antenna. In this case the equivalent beamwidth and gain should then be recomputed based on new pattern information and the instrument parameters changed accordingly.

Each of the programs are described below. Operating instructions are given in Section IV F of the main text.

## II. PROGRAM WIDTH

The theory for this program was described in Appendix A, Section III B. In that development it is apparent that the equivalent beamwidth is given by

$$\theta_{eq} = \sqrt{\frac{4}{\pi}} \int_{0}^{2\pi} \int_{0}^{\pi} p^{2}(\theta, \phi) \sin \theta \, d\theta \, d\phi \tag{1}$$

where  $P(\theta \phi)$  is the normalized power pattern function described in the standard spherical coordinate system (r,  $\theta$ ,  $\phi$ ). When the pattern is elliptically symmetric, the integration may be limited to one quadrant in which case

$$\theta_{eq} = \int \frac{16}{\pi} \int_{0}^{\pi} \int_{0}^{\pi/2} P^{2}(\theta, \phi) \sin \theta \, d\theta \, d\phi \qquad (2)$$

Here it is assumed that the main beam lies on the x-axis as shown in Figure E-1. It is convenient to work in terms of elevation angle  $\epsilon$  rather than polar angle in which case

$$\theta_{eq} = \sqrt{\frac{16}{\pi}} \int_{0}^{\pi} \int_{0}^{\frac{\pi}{2}} p^{2}(\theta, \phi) \cos \epsilon \, d\epsilon \, d\phi \qquad (3)$$

Since quadrature techniques usually require rectangular domains of integration, it is necessary to apply the transformation

$$\Psi = \sin \epsilon$$
 (4)

so that

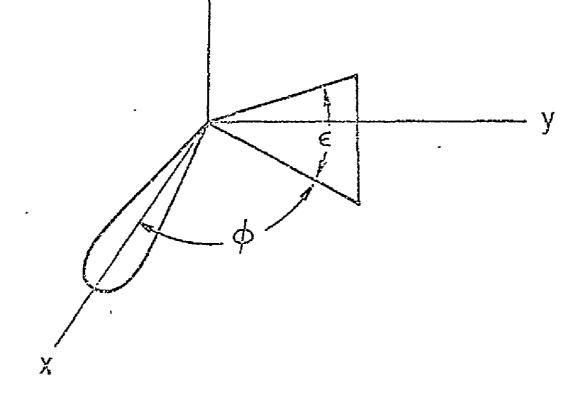
$$\theta_{eq} = \sqrt{\frac{16}{\pi}} \int_{0}^{\pi} \int_{0}^{1} P_{\mu}^{2}(\psi, \phi) d\psi d\phi \qquad (5)$$

The full limits of integration are not necessary since the integral converges rapidly over the main beam. Program WIDTH whose listing is shown in Figure E-2 use this property to advantage. As shown in the driver routine, the upper limits of integration are progressively increased by 1/2 degree intervals in  $\epsilon$ . The convergence of the equivalent beamwidth can then be observed as the domain increases to include more of the beam.

A Gaussian-legendre quadrature technique is employed to perform the double integration. This technique is embodied in RINTEG. The reader is referred to Klerer and Korn* or any other advanced text on numerically techniques for a discussion of this technique.

The main beam of the RADSCAT antenna pattern is functionally represented in the FUNCTION subroutine FUN. RINTEG calls FUN repeatedly to evalute the pattern function squared.

Klerer, M. and Korn, G. A., "Digital Computer User's Handbook," McGraw-Hill Book Company, 1970.



# FIGURE E-1. ANTENNA PATTERN GEOMETRY FOR WIDTH

			PROGRAM WIDTH(OUTPUT,TAPE6=OUTPUT)	00000001
	С			00000002
	С		THIS ROUTINE DETERMINES THE EQUIVALENT (PENCIL)	00000003
	С		BEAMWIDTH	00000004 00000005
	С С		BEAMWIDTH FOR AN ANTENNA WHOSE PATTERN IS SPECIFIED In subroutine fun. subroutine rinteg integrates	00000006
	č		THE PATTERN BY A QUASSIAN (LEGENDRE) QUADRATURE METHOD.	00000007
	č		INTEGRATION ARE REPETIVELY PERFORMED AT ONE DEGREE	5000000
	č		INTERVALS OUT TO SIX DEGREES. THE EQUIVALENT	00000004
	Ċ		BEAMWIDTH IS CHOSEN FROM THE LISTING AT THE POINT AT	00000010
	С		WHICH THE VALUES BEGIN TO CONVERGE	00000011
	С			00000012
	ç		THIS PROGRAM WAS PREPARED BY	00000013 00000014
	с с		JOHN P. CLAASSEN	00000015
	č		Sona Py CERRSSEA	00000016
	č		UNIVERSITY OF KANSAS	00000017
	Ċ		CENTER FOR RESEARCH.	00000018
	С			00000019
000003			EXTERNAL-FUN	020000020 12000000
000003 000003			DATA PI/3.14159265/	22000000
0000007		300	FORMAT (1H1//)	00000023
000007			WPITE (6,100)	00000024
000013		100	FORMAT(30X.5(1H*), SEARCH FOR THE EQUIVALENT BEAMWIDTH*5(1H*)//)	00000025
000013			00 20 I=1+6	00000026
000015			$x_2 = 0.0174532925*FLOAT(I)*0.50$	00000027
000017 000021			$Y_2 = X_2$ $X_2 = SIN(X_2)$	00000028 00000029
000023			$x_1 = 0.0$	000000030
000024			YI = 0.0	00000031
000025			$IX = 10^{\circ}I$	SE000000
000030			CALL RINTEG (FUN, Z, X2, X1, Y2, Y1, IX, IX, 4, 4)	00000033
000041			8FAP = SQRT (16.0*Z/PI)/0.0174532925	00000034
000047		200	WPITE (6,200) I BEAM	00000035 00000036
000056			FORMAT (10X,*ACTIVE BEAMWIDTH IS *I3,* DEGREES+ WHEREAS*, * * THE EQUIVALENT DEAMWIDTH IS*F5.2,* DEGREES*)	00000037
000056		20	CONTINUE	00000038
000060			STOP	00000039
000062			END	00000040
000056			DO 30 I = 1,MP	00000083
000057			SY(I) = SAMPLE(MP+I)*HDELY	00000084
000066		30	CONTINUE	00000085
000070			DO 50 I = 1 + NP	00000086
000071			DO 40 J = 1.4P	00000087
000072 000105		40	C(1.J) = COEF(NP.1)*COEF(MP.J) CONTINUE	00000088 00000089
000110		50	CONTINUE	00000090
000112			00 40 N=1.NX	00000091
000114			x1=x2	00000092
000116			X2=X1+DELX	00000093
000120			XM = XI + HDELX	00000094
000121			YZ = YIP	00000095
000122 000124			ΩΟ R0 H=1+MY Y1 = Y2	00000096 00000097
000126			Y2 = Y1 + DELY	00000098
000130			YM = YI + HDELY	00000099
000131			DO 70 I=1+NP .	00000100
000133			X=5X(I)+XM	00000101
000136 000137				00000102
000137			Y=5Y(J)+YM SUM = SUM+C(1+J)*FUN(X+Y)	00000103 00000104
000142		60	CONTINUE	00000105
000162		70	CONTINUE	00000106
000164		80	CONTINUE	00000107
000167		90	CONTINUE	0000108
000171 000174			ZZ = SUM#DELX#DELY#0.250	00000109
000174			RFTURN F'ID	00000110 00000111
000115				0000111

### FIGURE E-2. SOURCE LISTING FOR WIDTH

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		SUMROUTINE RINTEG (FUN+ZZ+X2P+X1P+Y2P+Y1P+NNX+MMY,NNP+MMP) THIS ROUTINE EMPLOYS A QUASSIAN LEGENDER QUADRATURE INTEGRATION PROCEDURE. INTEGRATION OVER X-Y SEGMENTS ARE PERFORMED AFTER TRANSLATION TO (-1+1)X(-1+1). FUN= INTEGRAND FUNCTION ZZ = EITHER A PARAMETER FOR FUN OR THE INTEGRATED RESULT OR BOTH X2P+X1P = UPPER AND LOWER LIMITS ON X Y2P+Y1P = UPPER AND LOWER LIMITS ON Y NX+MY = SEGMENTS IN X AND Y, RESPECTIVELY NP+MP = DEGREE OF PRECISION IN X AND Y, RESPECTIVELY NP+MP = DEGREE OF PRECISION IN X AND Y, RESPECTIVELY	00000047 00000043 00000049 00000050 00000051
000015 000015 000015	6	DIMENSION SAMPLE(5.S)+COEF(5.5)+SX(5)+SY(5)+C(5.5)+SV(25)+CV(25) EQUIVALENCE (SV(1)+SAMPLE(1+1)), (CV(1)+COEF(1+1)) DATA SV/ 1.00.577350269, -0.774596669, -0.861136312, -0.906179846, 1.0. 0.577350269, 0.00.339981044, -0.538469310, 1.0. 0.0, .774596669, 0.339981044, 0.0.	00000052 00000053 00000055 00000055 00000056 00000057
000015	4 43 43 43 43	1.0, 0.0, 0.0, 0.861136312, 0.538469310, 1.0, 0.0, 0.0, 0.0, 0.906179846/ DATA CV/ 1.0, 1.0, 0.55555556, 0.347854845, 0.236926885, 1.0, 1.0, 0.8888888889, 0.652145155, 0.478628670,	00000058 00000059 00000060 00000061 00000062
000015 000016 000017	4	1.0. 0.0. 0.555555556. 0.652145155. 0.5688888888. 1.0. 0.0. 0.0. 0.0. 0.347854845. 0.478628670. 1.0. 0.0. 0.0. 0.0. 0.0. SUM = 0.0 X1 = X1P X2 = X2P	00000063 00000064 00000065 00000066 00000067 00000067
000020 000021 000022 000023 000025		Y1       =       Y1P         Y2       =       Y2P         NX       =       NNX         MY       =       MMY         NP       =       NNP	00000069 00000070 00000071 00000072 00000073
000026 000030 000033 000037 000041 000042		MP = MMP DELX = (X2-X1)/FLOAT(NX) DELY = (Y2-Y1)/FLOAT(NY) HDELX = DELX*0.50 HDELY = DELX*0.50 X2 = X1	00000074 00000075 00000076 00000077 00000078 00000079
000043 000045 000054	20	DO 20 I = 1.NP SX(I) = SAMPLE(NP,I)*HDELX CONTINUE	00000080 00000081 00000082
C		FUNCTION FUN (XX+YY) . THIS ROUTINE DEFINES THE SQUARE OF THE ANJENNA PATTERN OVER THE MAIN BEAM.	00000112 00000113 00000114
000005 000005 000015 000020 000024		AMXEP = AMAX1 (ESP.PHIP) IF (AMXEP .LE. 0.0291 ) GO TO 10	00000115 00000116 .00000117 00000118 00000119
000027 000031 000034 000036 000041	10	IF (AMXEP .LE. 0.0349 ) GO TO 20 IF (AMXEP .LE. 0.0611 ) GO TO 30 IF (AMXEP .LE. 0.105 ) GO TO 40 IF (AMXEP .LE. 0.628) GO TO 50 F'IN = 10.0F-39 FUN = EXP ( ~4690.°ESP*ESP -3280.°PHIP*PHIP )	00000120 00000121 00000122 00000123 00000124
000042 000050 000052 000052 000050 000050	20	FUN = FUN*FUN RFTUR: FUN = EXP(-121.1*ESP-3280.*PHIP*PHIP) FUN = FUN*FUN	00000125 00000126 00000127 00000128 00000129 00000129
000062 000071 000073 000073 000073	30 40	FUN = 0.0398>EXP(-821.*ESP*ESP-1072.*PHIP>PHIP) FUN = FUN*FUN RETURN FUN = 0.0159*EXP(-486.*ESP*ESP~53.6*PHIP) FUN = FUN*FUN	00000130 00000131 00000132 00000133 00000134 00000135
000104 000104 000114 000116 000116	50	RETURN FUN =0.000159*EXP(-8.59*SORT(ESP*ESP+PHIP*PHIP)) FUN = FUN*FUN RETURN E*11)	00000135 00000137 00000138 00000139 00000139

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Figure E-2. (Continued)

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### A. Introduction

Program GAIN computes the antenna directivity, beam solid angle and, antenna efficiency. The theory and design of the program is described below.

### B. Theory

The antenna beam solid angle is given by

$$\Omega = \int_{0}^{2\pi} \int_{0}^{\pi} p(\theta, \phi) \sin \theta \, d\theta \, d\phi \tag{6}$$

where

 $P(\theta, \phi) = normalized antenna pattern$  $<math>\theta = polar angle$  $\phi = az imuthal angle$ 

 $p(\theta,\phi)$  represents the normalized power in the antenna pattern. It can be shown that the antenna directivity  $\Gamma$  is related to  $\Omega$  by the following expression

$$\Gamma = \frac{4\pi}{\Omega}$$
(7)

The antenna efficiency, on the otherhand, is the ratio of the power in the main beam to that in the entire pattern. Clearly then, the efficiency is given by

$$\eta_i = \int_0^{2\pi} \int_0^{\theta_i} P(\theta, \phi) \sin \theta \, d\theta \, d\phi \tag{8}$$

where  $\theta_i$  is a polar angle which subdivides the main beam. In the above expression it is tacitly assumed that the main beam lies on the positive z axis as illustrated in Figure E-3.  $\theta_i$  is chosen somewhat arbitrarily. Commonly  $\theta_i$  is chosen at the -3 dB point or at the first null of the antenna pattern. For narrow beam antenna, the latter is most appropriate for radiometric work.

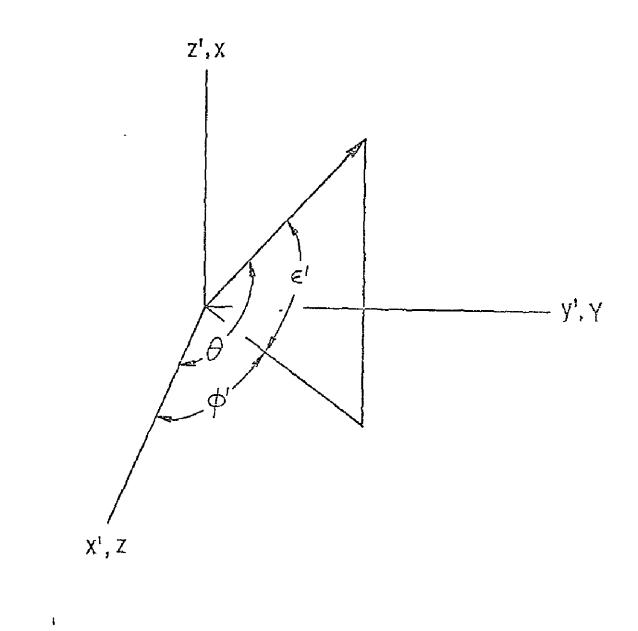


FIGURE E-3. ANTENNA PATTERN GEOMETRY FOR GAIN

### C. Design and Operation of GAIN

In the discussion which follows it will be helpful to examine the FORTRAN listing for GAIN as shown in Figure E-4. Upon entry into GAIN, an array BEAM in which various polarized beam solid angle factors will be stored, is cleared. The main beam solid angles are then computed for various  $0_i$  spaced at 1/2 degree intervals. The integration of the antenna pattern is performed by RINTEG which in turn calls for polarized pattern information from FUN1. The results are stored in BEAM. The accumulated solid beam angle is stored in TOTAL. The remainder of the polarized beam solid angle is then computed in the following statements.

At this point the antenna gain is computed and the gain and beam solid angle are printed.

In the remainder of the program the power content in the cross-polarized pattern (FUN2) is computed and added to TOTAL. A DO loop terminating on 30 then computes the antenna efficiency at one degree intervals out to 8 degrees. The result is listed.

Finally, the total beam solid angle, including polarized and cross-polarized contributions, is printed.

### D. Subroutines FUN1 and FUN2

The antenna patterns described in FUN1 and FUN2 are actually represented in terms of another coordinate system. The relationship between the two coordinate systems is illustrated in Figure E-3. In the primed system the pattern is described in terms of the elevation angle  $\epsilon$  and azimuth  $\phi$  as shown in Figure E-1. The necessary transformations between the two are performed in the opening statements of FUN1 and FUN2. The latter statements simply evaluate the pattern over one of six domains in FUN1 and over five domains in FUN2.

		PROGRAM GAIN (OUTPUT, TAPE6=OUTPUT)		00000142
	с			00000143
	С	THIS PROGRAM COMPUTES THE ANTENNA GAIN AND EFFECIENCY FROM		00000144 00000145
	с с	ANTENNA (POWER) PATTERNS DESCRIBED IN FUNI AND FUN2.	< тнғ	00000146
	č	CROSS-POLARIZED PATTERN.		U0000147
	C			00000148
	C C	THIS PROGRAM WAS PREPARED BY		00000144 00000150
	č	JOHN P. CLAASSEN		00000151
	С			00000152
	c	UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.		00000153 00000154
000003	с	DIMENSION BEAM(10) + EFF(10)		00000155
600003		EXTERNAL FUNI		00000156
000003		EXTERNAL FUN2		00000157
000003 000003		DATA P1/3.14159265/ DATA FACTOR/0.0174532925/		00000158 00000159
000003		WP1TF (6.500)		00000160
000007	500	FORMAT (1H1//)		00000101
000007		TOTAL = 0.0 DO 10 1 = 1.10		00000162 00000163
000012		BEAM(1) = 0.0		00000164
000013	10	CONTINUE		00000165
000015		Y2 = P1/2.0		00000166
000016 000017		Y1 = 0.0 Wuite (0.100)		00000167 00000168
000023	100	FORWAT (30X+*ANTENNA GAIN AND EFFICIENCY FACTORS*//)		00000169
	С			00000170
	ç	COMPUTE THE MAIN BEAM SOLID ANGLE		00000171 00000172
000023	с	00 20 1 = 1+8		00000172
000025		X1 = COS(FIOAT(1)*FACTOR#0.50)		<b>U0000174</b>
000031		$x2 = COS(FLOAT(1-1) \circ FACTOR \circ 0.50)$		00000175
000040 000051		CALL RINTEG (FUN)+ Z+ X2+ X1+ Y2+ Y1+ 2+ 90+ 3+ 3) BEAM (I+1) = HEAM (1) + 4+04/		00000176 00000177
000055		TOTAL = TOTAL + $4.0$ °Z		00000178
000057	20	CONTINUE		00000179
	с с	COMPUTE THE PENAINDER REAM SOLID ANGLE		00000180 00000181
	C C			00000182
000061		$x^{2} = COS(4.0^{\circ}FACTOR)$		00000183
000054 000071		X1 = COS(120.0°FACTOR) CALL PINTEG (FUN1, 7, X2, X1, Y2, Y1, 115, 90, 3, 3)		00000184 00000185
000102		TOTAL = TOTAL + 4.04/		0000186
	C			00000187
	с с	COMPUTE GAIN		00000188 00000189
000105	L.	GAINI = 4.0°PI/TOTAL		00000190
000107		GAIN2 = 10.0*ALGG10(GAIN1)		00000191
000113	<b>3</b> -  -	WRITE ( 6.200) TOTAL: GAINI: GAIN2 Format ( 5x.ºPolak]ZED BEAM Solid Angle=@E14.6/		20100000
000124	500	• 5X. *POLARIZED GAIN=*E14.6.* OR*F6.1.* DB*//)		00000193 00000194
	С			00000195
	ç	COMPUTE THE CONTRIBTION FROM THE CHOSS PATTERN		00000196
000124	c	*2 = 1.0		00000197 00000198
000125		$x1 = COS (FACTOR^{\circ}5.0)$		00000199
000132		CALL RINTEG(FUN2+2+X2+X1+Y2+Y1+5+40+4+4)		00000200
000143	с	TOTAL = TOTAL + 4.0°Z		00000505
	č	COMPUTE BEAM EFFICIENCY		00000203
	С			00000204
000146 000150		DO 30 1 = 1+8 EFF(I) = BEAM(I+1)/TOTAL		00000205 00000206
000150		$W^{\text{PITE}}$ (6,300) 1. EFF(1)		00000207
000162	300	FORMAT(5X+*ACTIVE BEAMWIDTH IS *13+* DEGREES.*+		00000208
000140		* CORRESPONDING EFFICIENCY IS*F6.3* .*)		00000209 00000210
000162	30 C	CONTINUE		00000211
	с	WRITE THE BEAM SOLID ANGLE		00000212
A04144	С			00000213
000164 000172	400	WRITE (5+400) TOTAL Format (75x+°total blam solid Angle=0e14+5}		00000214 00000215
000172	400	STOP		00000216
000174		E(II)		00000217

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# FIGURE E-4. SOURCE LISTING FOR GAIN

ORIGINAL' PAGE IS OF POOR QUALITY

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			•	
			SUBROUTINE RINTEG (FUN, ZZ,X2P,X1P,Y2P,Y1P,NNX,MMY,NNP,MMP)	00000719
	С		THIS ROUTINE EMPLOYS A QUASSIAN LEGENDRE QUADRATURE	00000219
	C		INTEGRATION PROCEDURE. INTEGRATION OVER X-Y SEGMENTS	05200000
	ç		ARE PERFORMED AFTER TRANSLATION TO (-1+1)x(-1+1)+ Fun= Integrand function	00000221
	с с		ZZ = ETTHER A PARAMETER FOR FUN OR THE INTEGRATED RESULT	
			OR BOTH	00000224
	ç ç		X2P+X1P = UPPER AND LOWER LIMITS ON X	00000225
	ç		Y2P+Y1P = UPPER AND LOWER LIMITS ON Y	00000226
	ç		NX+HY = SEGH+NTS 1N X AND Y+ RESPECTIVELY NP+HP = DEGREE OF PRECISION 1N X AND Y+ RESPECTIVELY	00000227
000015	С		DIHENSION SAMPLE (5+5) + COEF (5+5) + SX (5) + SY (5) + CV (5+5) + SV (25) + CV (25)	-
000015			FOUTVALENCE (5V(1) +SAMPLE(1+1)) + (CV(1) +COEF(1+1))	00000230
000015			DATA SV/	00000231
		•		00000232
		4	1.0. 0.577350269: 0.0: +0.339981044: -0.538469310; : 1.0: 0.0: .774596669: 0.339981044: 0.0:	00000233 00000234
		0 9	1.0. 0.0. 0.0. 0.861136312. 0.538469310.	22200000
		8	1.0. 0.0. 0.0. 0.0. 0.906179846/	00000236
000015	_		DATA CV/	00000237
	•	8	1.0, 1.0, 0.555555556, 0.347854845, 0.236926885,	00000238
			1.0, 1.0, 0.8888888889, 0.652145155, 0.478628670, 1.0, 0.0, 0.555555556, 0.652145155, 0.568888888,	00000239 00000240
		-		00000241
		o	1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.236926885/	00000242
	С			00000243
	c		CLEAR SUMMING VARIABLE	00000244 00000245
000015	С		SUM = .0+0	00000246
000015	С			00000247
	č		RE-ASSIGN INPUT ARGUMENTS	00000248
	С			00000249
000016			$x_1 = x_{10}$	00000250
000017 000020			X2 ≠ X2P Y1 ≠ Y1P	00000252
000021			Y2 = Y2P	00000253
000022			NX = NNX	00000254
000023	•		HY = HHY	00000255
000025			NP ≠ NNP	00000256 00000257
000026	с		MP = MHP	00000258
	č		COMPUTE LENGTH OF CELL SIDES	00000259
	С			00000260
000030			DELX = (X2-X1)/FLOAT(NX)	00000261
000033			DELY = (Y2-Y1)/FLOAT(MY)	00000262
000037			HDELX = DELX + 0.50	
				00000263
000041	c		HDELY = DELX*0.50	00000264
000041	с с		HDELY = DELX*0.50	
000041	с с с			00000264
000042	С		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP	00000264 00000265 00000266 00000267 00000268
000042 000043	С	20	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX (I) = SAMPLE (NP.I)*HDELX	00000264 00000265 00000266 00000267 00000268 00000268
000042	C C	20	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP	00000264 00000265 00000266 00000267 00000268 00000269 00000269
000042 000043	С	20	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX (I) = SAMPLE (NP.I)*HDELX	00000264 00000265 00000266 00000267 00000268 00000269 00000269 00000270 00000271 00000272
000042 000043	с с с	20	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP.I) *HDELX CONTINUE	00000265 00000265 00000266 00000267 00000268 00000269 00000270 00000271 00000272 00000273
000042 000043 000052 000054	с с с с	20	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP	00000265 00000265 00000267 00000267 00000268 00000269 00000270 00000271 00000272 00000273 00000274
000042 000043 000052 000054 000055	с с с с		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(1) = SAMPLE (NP.1) *HDELX CONTINUE FORM SAMPLE FACTOR FOR Y NO 30 I = 1.MP SY(I) = SAMPLE (MP.I) *HDELY	00000265 00000265 00000267 00000267 00000268 00000269 00000270 00000271 00000271 00000272 00000273 00000274 00000275
000042 000043 000052 000054	с с с с	20 30	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP	00000265 00000265 00000267 00000267 00000268 00000269 00000270 00000271 00000272 00000273 00000274
000042 000043 000052 000054 000055	00 000 00		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(1) = SAMPLE (NP.1) *HDELX CONTINUE FORM SAMPLE FACTOR FOR Y NO 30 I = 1.MP SY(I) = SAMPLE (MP.I) *HDELY	00000265 00000265 00000267 00000268 00000268 00000270 00000270 00000271 00000273 00000274 00000275 00000275 00000277 00000278
000042 000043 000052 000054 000055 000064	сс ссс с		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE (MP.I)*HDELY CONTINUE FORM GAUSSIAN WEIGHTS	00000265 00000265 00000266 00000267 00000268 00000270 00000270 00000272 00000273 00000273 00000275 00000275 00000276 00000277 00000277
000042 00043 000052 000054 000055 000064	00 000 00		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FORM GAUSSIAN WEIGHTS DO 50 I = 1.NP	00000265 00000265 00000267 00000268 00000269 00000270 00000270 00000273 00000273 00000273 00000275 00000275 00000275 00000277 00000276 00000277
000042 000043 000052 000055 000055 000064 000066 000066	00 000 00		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX(I) = SAMPLE(NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FORM GAUSSIAN WEIGHTS NO 50 I = 1.NP DO 40 J = 1.MP	00000265 00000265 00000266 00000267 00000268 00000270 00000270 00000272 00000273 00000273 00000275 00000275 00000276 00000277 00000277
000042 00043 000052 000054 000055 000064	00 000 00		HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FORM GAUSSIAN WEIGHTS DO 50 I = 1.NP	00000265 00000265 00000267 00000268 00000269 00000270 00000271 00000273 00000273 00000273 00000275 00000275 00000276 00000277 00000278 00000279 00000280 00000280 00000281 00000283
000042 00043 000052 000055 000055 000064 000066 000067 000070	<b>00 000 000</b>	30	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP,I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS DO 50 I = 1.NP DO 40 J = 1.MP C(I+J) = COEF(NP+I)*COEF(NP+J)	00000265 00000265 00000267 00000267 00000269 00000270 00000271 00000273 00000274 00000274 00000275 00000274 00000275 00000277 00000277 00000278 00000279 00000281 00000281 00000284
000042 000043 000052 000054 000055 000064 000066 000067 000070 000104	00 000 000 D	30	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS DO 50 I = 1.NP C(I.J) = COEF(NP.I)*COEF(NP.J) CONTINUE CONTINUE	00000265 00000265 00000266 00000267 00000269 00000270 00000270 00000273 00000273 00000273 00000275 00000275 00000276 00000276 00000279 00000280 00000281 00000283 00000283
000042 000043 000052 000054 000055 000064 000066 000067 000070 000104	<b>00 000 000</b>	30	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS DO 50 I = 1.NP DO 40 J = 1.MP C(I.J) = COEF (NP.I)*COEF (NP.J) CONTINUE	00000265 00000265 00000267 00000267 00000269 00000270 00000271 00000273 00000274 00000274 00000275 00000274 00000275 00000277 00000277 00000278 00000279 00000281 00000281 00000284
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000042 00043 000052 000054 000055 000064 000066 000067 000070 000104 000106	00 000 000 00	30	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE (MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS DO 50 I = 1.NP DO 40 J = 1.MP C(I*J) = COEF (NP*I)*COEF (NP*J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 DO 90 N=1*NX	00000265 00000265 00000267 00000268 00000269 00000270 00000271 00000273 00000273 00000273 00000274 00000275 00000275 00000275 00000276 00000278 00000281 00000283 00000283 00000283 00000284 00000283 00000284 00000285 00000285 00000285
000042 000043 000052 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113	00 000 000 00	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS NO 50 I = 1.NP DO 40 J = 1.MP C(I+J) = COEF(NP.I)*COEF(MP.J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 DO 90 N=1*NX X1=X2 *	00000265 00000265 00000267 00000267 00000269 00000270 00000271 00000272 00000273 00000273 00000275 00000275 00000275 00000276 00000276 00000280 00000281 00000285 00000285 00000284 00000285 00000284 00000285 00000284 00000285
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000042 000043 000052 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113	00 000 000 00	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP SX(I) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS NO 50 I = 1.NP DO 40 J = 1.MP C(I+J) = COEF(NP.I)*COEF(MP.J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 DO 90 N=1*NX X1=x2 *	00000265 00000265 00000267 00000267 00000270 00000271 00000273 00000273 00000273 00000275 00000275 00000275 00000275 00000276 00000276 00000280 00000280 00000283 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285 00000285
000042 000053 000055 000064 000055 000064 000066 000067 0000104 000106 000110 000113 000113	<b>υο υου υου ου</b>	30	HDELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP Sx(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(I) = SAMPLE(MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS DO 50 I = 1.NP DO 40 J = 1.MP C(I.J) = COEF(NP.I)*COEF(MP.J) CONTINUE CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 DO 90 N=1:NX X1=X2 X2=X1+DELX	00000265 00000265 00000267 00000267 00000270 00000270 00000273 00000273 00000273 00000273 00000275 00000275 00000275 00000276 00000276 00000279 00000281 00000281 00000283 00000283 00000284 00000285 00000285 00000284 00000289 00000289 00000289 00000291 00000291 00000291
000042 00043 000052 000054 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113 000117	<b>υου υνο υνου υ</b>	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(1) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y 00 30 I = 1.MP Sy(1) = SAMPLE (MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS NO 50 I = 1.NP D0 40 J = 1.MP C(1.J) = COEF (NP.I)*COEF (MP.J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 D0 90 N=1*NX X1=X2 XM = X1 * HDELX INTEGRATE ALONG Y	00000265 00000265 00000267 00000268 00000269 00000270 00000271 00000273 00000273 00000273 00000274 00000275 00000276 00000277 00000278 00000278 00000282 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283
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000042 000043 000052 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113 000115 000117	<b>υο υου υου ου</b>	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X DO 20 I = 1.NP SX(1) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y DO 30 I = 1.MP SY(1) = SAMPLE(MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS DO 50 I = 1.NP DO 40 J = 1.MP C(I+J) = COEF(NP+I)*COEF(HP+J) CONTINUE CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 DO 90 N=1*NX X1=X2 - X2=X1+DELX XM = X1 + HDELX INTEGRATE ALONG Y Y2 = Y1P DO R0 M=1*NY	00000265 00000265 00000267 00000268 00000269 00000270 00000271 00000273 00000273 00000273 00000274 00000275 00000276 00000277 00000278 00000278 00000282 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283
000042 000054 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113 000115 000117	<b>υο υου υου ου</b>	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y 00 30 I = 1.MP SY(I) = SAMPLE (MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS 00 50 I = 1.NP D0 40 J = 1.MP C(I*J) = COEF (NP*I)*COEF (NP*J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 D0 90 N=1*NX X1=X2 X2 = X1 + HDELX INTEGRATE ALONG Y Y2 = Y1P 00 R0 H=1*NY Y1 = Y2 Y2 = Y1 + DELY	00000265 00000265 00000267 00000268 00000269 00000270 00000271 00000273 00000273 00000273 00000274 00000275 00000275 00000275 00000275 00000277 00000278 00000279 00000280 00000280 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000283 00000284 00000283 00000284 00000289 00000291 00000291 00000291 00000293 00000294 00000294 00000294 00000294 00000294 00000294
000042 00043 000052 000054 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113 000117 000120 000121 000123	<b>ບບ ບບບ ບບບ ບບບ</b>	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(1) = SAMPLE (NP.1)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y 00 30 I = 1.MP Sy(1) = SAMPLE (MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS 00 50 I = 1.NP D0 40 J = 1.MP C(1.J) = COEF (NP.I)*COEF (MP.J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 D0 90 N=1*NX X1=X2 X2 = X1 + HDELX INTEGRATE ALONG Y Y2 = Y1P 00 A0 M=1*NY Y1 = Y2	0000284 0000265 0000267 0000268 0000267 0000270 0000270 0000273 0000273 0000273 0000273 0000275 0000275 0000275 0000275 0000276 0000275 0000279 0000279 0000281 0000281 0000283 0000283 0000284 0000285 0000285 0000288 0000285 0000285 0000288 0000289 0000289 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291
000042 00043 000052 000054 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113 000115 000117 000121 000121 000121 000123 000125	<b>ບບບ ບບບ ບບບ ບບບ ບ</b>	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(1) = SAMPLE (NP.I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y 00 30 I = 1.MP Sy(1) = SAMPLE (MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS 00 50 I = 1.NP D0 40 J = 1.MP C(1.J) = COEF (NP.I)*COEF (MP.J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 D0 90 N=1*NX X1=X2 X2 = X1 + HDELX INTEGRATE ALONG Y Y2 = Y1P 00 A0 M=1*NY Y1 = Y2 Y2 = Y1 + DELY YH = Y1 + HDELY	00000265 00000265 00000267 00000268 00000269 00000270 00000271 00000273 00000273 00000273 00000275 00000275 00000275 00000275 00000275 00000275 00000275 00000275 00000280 00000281 00000283 00000283 00000283 00000284 00000283 00000283 00000284 00000283 00000285 00000284 00000285 00000285 00000285 00000285 00000285 00000285 00000290 00000291 00000293 00000294 00000295 00000295 00000295 00000294 00000297 00000295
000042 00043 000052 000054 000055 000064 000066 000067 000070 000104 000106 000110 000112 000113 000115 000117 000121 000121 000121 000123 000125	<b>ບບ ບບບ ບບບ ບບບ</b>	30	HOELY = DELX*0.50 FORM SAMPLE FACTOR FOR X NO 20 I = 1.NP Sx(I) = SAMPLE (NP,I)*HDELX CONTINUE FORM SAMPLE FACTOR FOR Y 00 30 I = 1.MP SY(I) = SAMPLE (MP.I)*HDELY CONTINUE FOPM GAUSSIAN WEIGHTS 00 50 I = 1.NP D0 40 J = 1.MP C(I*J) = COEF (NP*I)*COEF (NP*J) CONTINUE INTEGRATE IN STRIPS OF DELX X2 = X1 D0 90 N=1*NX X1=X2 X2 = X1 + HDELX INTEGRATE ALONG Y Y2 = Y1P 00 R0 H=1*NY Y1 = Y2 Y2 = Y1 + DELY	0000284 0000265 0000267 0000268 0000267 0000270 0000270 0000273 0000273 0000273 0000273 0000275 0000275 0000275 0000275 0000276 0000275 0000279 0000279 0000281 0000281 0000283 0000283 0000284 0000285 0000285 0000288 0000285 0000285 0000288 0000289 0000289 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291 0000291

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Figure E-4. (Continued)

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	с			00000303
000130	v		00 70 I=1+NP	00000304
000132			X=5X(1)+XH	00000305
000135			00 60 J=1+MP	00000 106
000135	с			00000 108
	č		FORH PARTIAL SUM	600000105
	č			00000310
000136	C		Y=SY(J)+YH	00000307
			SUH = SUH + C(I + J) + FUN(X + Y)	00000311
000141		60	CONTINUE	00000312
000157				00000313
000161		70	CONTINUE	00000314
000163		80	CONTINUE	00000315
000166	-	90	CONTINUE	
	ç			00000316
	С		APPLY JACOBIAN	00000317
	С			00000318
000170			ZZ = SUM#DELX#DELY#0.250	00000319
000173			RETURN	00000320
000174			END	00000321
				00000322
	-		FUNCTION FUN1 (X,Y)	
	ç			0000323
	c		POLARIZED PATTERN	00000324
	Ç		THIS FUNCTION SUBROUTINE EVALUATES THE PATTERN INTENSITY	
	¢		IN THE PRIMED COORDINATE SYSTEM. THE PATTERN IS	00000326
	С		EXPRESSED IN TERMS OF ELEVATION AND AZINTH IN THAT	00000327
	С		COORDINATE SYSTEM. THE INPUT ARGUMENTS, HOWEVER, ARE	00000328
	С		DESCRIBED IN AN UNPRIMED COORDINATE SYSTEM RELATED	00000329
	С		TO THE PRIMED SYSTEM BY A ROTATION ABOUT THE	00000330
	C		Y AXIS, THE BOPE SIGHT IS ON THE X-PRIME AXIS IN	00000331
	С		THE PRIMED SYSTEM AND ON THE Z AXIS IN THE UNPRIMED	00000332
	С		SYSTEM.	00000333
	С			00000334
	Ċ			00000335
	С		TRANSFORM TO PATTERN COORDINATES	00000336
	С			00000337
000005			SINX = SORT(1.0 - X*X)	00000338
000013			COSY = COS(Y)	00000339
000016			S1NY=S0RT().0-COSY*COSY}	00000340
220000			COSTP =-SINX*COSY	00000341
000024			SINTP = SORT (1.0-COSTP*COSTP)	00000342
000031			THETAP=ATAN2 (SINTP, COSTP)	00000343
000034			PHIP= ATAN2 (SINX#SINY+X)	00000344
000045			APHIP = ABS(PHIP)	00000345
000046			AESPP = ABS(1.57079633-THETAP)	00000346
000051			ESQ = AESPP*AESPP	00000347
000052			PSQ = PHIP*PHIP	00000348
	с			00000349
	č		EVALUATE THE PATTERN FUNCTIONS	00000350
	č			00000351
000054	•		AMXEP = AMAX1(AESPP.PHIP)	00000352
000057			IF (AMXEP .LE. 0.0291 ) GO TO 100	00000353
200002			IF (AMXEP .LE. 0.0349 ) GO TO 200 3	00000354
000064			IF (AHXEP .LE. 0.0611 ) GO TO 300	00000355
000067			IF (AMXEP .LE. 0.105 ).GO TO 400	00000356
000071			IF (AMXEP .LE. 0.628 ) GO TO 500 .	00000357
000074			XI = -SINTP+COS(PHIP)	00000358
000077			XI = ATAN2(SORT(1.0-XI*XI)*XI)	00000359
000106		-	xID = XI*57.2957796	00000360
000110			IF (XID +LT+ 100+ +AND+ XID +GT+ 60+ ) GD TO 600	00000361
000123			FUN1 = 0.0	00000362
000124			RETURN	00000363
000124		100		00000364
000124		100	RETURN	00000365
000133		200	FUN1 =EXP(- 121.1*AESPP-3280.*PSQ)	00000366
000155		200	RETURN	00000367
000142		300		00000368
000152			RETURN	00000369
000152		400	FUN] = 0.0159*EXP(-486.*ESQ-53.6*APHIP)	00000370
000162			RETURN -	00000371
000102		500		000003/2
000173		565	RFTURN	00000373
	•	600		00000374
000173 000177		000	PSI = ATAN(TANPSI)	00000375
			COSPS = COS(PS1)**2	00000376
000201			SINPS = SIN(PS1) * 2	00000377
000204			$SINPS = SIN(FSI)^{-2}$ FUN1 = (3.16E-05*COSPS + 6.31E-06*SINPS)*	000003/8
000207			• EXP(-(X1D-80.)**2/(106.*COSPS + 36.*S1NP5))	00000379
				00000380
000224			RFTURN END	00000381
000225				

Figure E-4. (Continued)

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000005 00013 000016 000022 000024 000034 000045 000045 000046 000051 000052 000057 000052 000062 000064 000067 000071 000072 000073	CCCC 100	FUNCTION FUNP (X.Y) CROSS-POLARIZED PATTERN THIS FUNCTION SUBROUTINE EVALUATES THE PATTERN INTENSITY IN THE PRIMED COORDINATE SYSTEM. THE PATTERN IS EXPRESSED IN TERMS OF ELEVATION AND AZIMTH IN THAT COORDINATE SYSTEM. THE INPUT ARGUMENTS, HOWEVER, ARE DESCRIBED IN AN UNPRIMED COORDINATE SYSTEM RELATED TO THE PRIMED SYSTEM BY A ROTATION ABOUT THE Y AXIS. THE BORE SIGHT IS ON THE A-PRIME AXIS IN THE PRIMED SYSTEM AND ON THE Z AXIS IN THE UNPRIMED SYSTEM. TRANSFORM TO PATTERN COORDINATES SINX = SORY(1.0 - X*X) COSY = COS(Y) SINY=SORT(1.0-COSY*COSY) COSTP =-SINX*COSY SINTP = SORT(1.0-COSTP*COSTP) THETAP=ATAN2(SINX*SINY*X) APHIP = ATAN2(SINX*SINY*X) APHIP = ABS(1.57079633-THETAP) ESO = AESPP*AESPP PSQ = PHIP*PHIP EVALUATE THE PATTERN FUNCTIONS AMXEP = AMAX1(AESPP,PHIP) IF (AMXEP .LE. 0.024) ) GO TO 100 IF (AMXEP .LE. 0.0349 ) GO TO 200 IF (AMXEP .LE. 0.0135 ) GO TO 400 FIUPZ = 0.00 RFTUPN FUNZ = 0.00	00000386 00000387 00000389 00000390 00000391 00000392 00000392 00000395 00000395 00000395 00000395 00000395 00000395 00000396 00000399 00000401 00000401 00000405 00000405 00000405 00000405 00000405 00000405 00000405 00000405 00000405 00000405 00000405 00000405 00000410 00000412 00000413 00000415 00000415 00000415 00000415 00000418 00000417 00000417
000073 000103	100	FUN2 = 0.0063°EXP (-4690.°E5Q-3280.°PSQ) RETURN	00000419 00000420
000103	200	FUN2 = 0.0063 * EXP ( -4690.* ESQ -3280.* PSQ )	00000421
000113 000113	300	RFTURN FUN2 = 0.00025*EXP(+821.*PSQ-821.*ESQ)	00000423
000123 000123 000133 000133	400	RETURN FUN2 = 0.00025*EXP(-821.*ES0) RETURN END	00000424 00000425 00000426 00000427



Figure E-4. (Continued)

### CRINC LABORATORIES

Chemical Engineering Low Temperature Laboratory Remote Sensing Laboratory Flight Research Laboratory Chemical Engineering Heat Transfer Laboratory Nuclear Engineering Laboratory Environmental Health Engineering Laboratory Information Processing Laboratory Water Resources Institute Technology Transfer Laboratory

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