DATA SET CATALOG #27

ARIEL I electron density

62-015A-01A 1 tape

Table of Contents

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1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

http://nssdc.gsfc.nasa.gov/nmc/

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents — To find associated documents you will need to know the document ID number and then click here. http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

ARIEL 1

ELECTRON DENSITY, TAPE

62-015A-01A

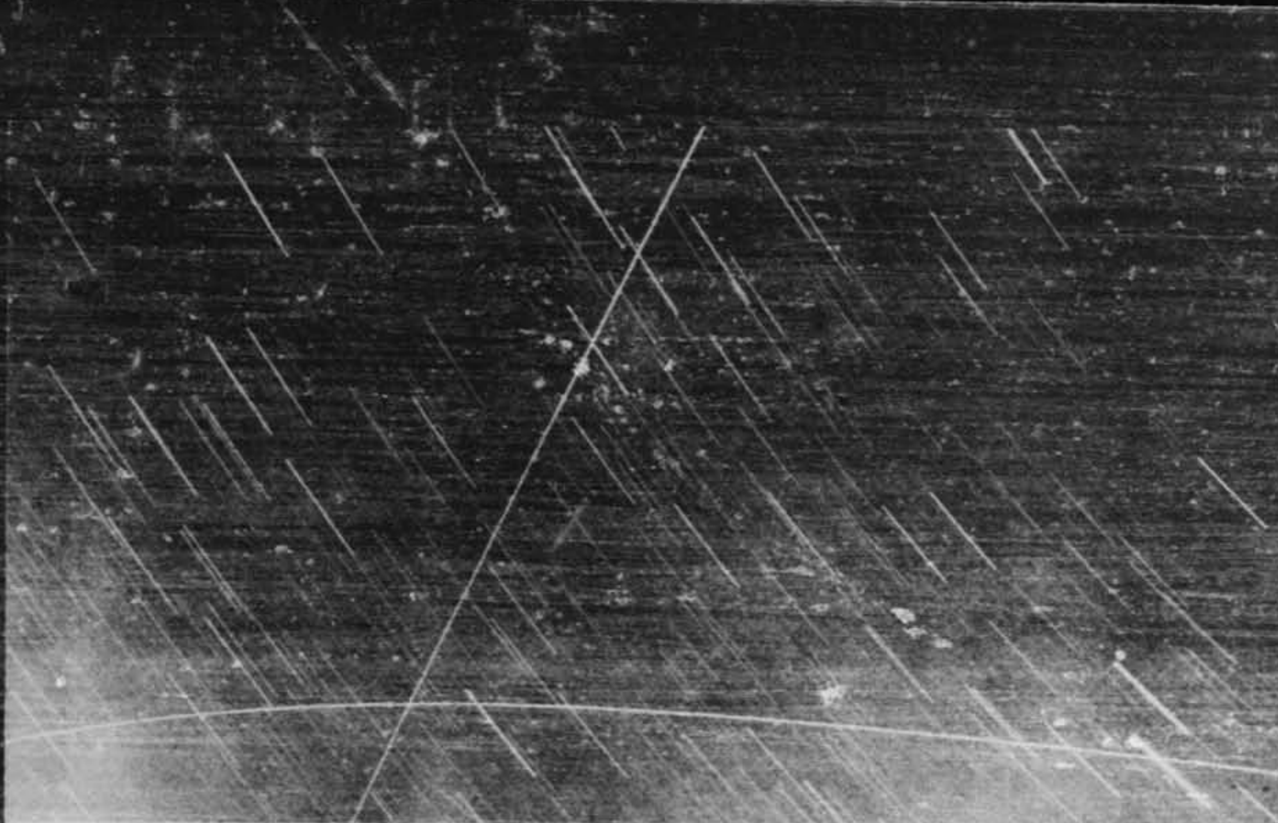
THIS DATA SET HAS BEEN RESTORED. THERE WAS ORIGINALLY ONE 7-TRACK, 556 BPI TAPE WRITTEN IN BCD. THERE IS ONE RESTORED TAPE WRITTEN IN ASCII. THE DR TAPE IS A 3480 CARTRIDGE AND THE DS TAPE IS 9-TRACK, 6250 BPI. ACCORDING TO THE DOCUMENTATION THE ORIGINAL TAPE SHOULD HAVE 11 FILES, BUT THE TAPE ONLY HAD 2 FILES. THE ORIGINAL TAPE WAS CREATED ON AN IBM 7094 COMPUTER AND WAS RESTORED ON THE MODCOMP. THE DR AND DS NUMBER ALONG WITH THE CORRESPONDING D NUMBER AND TIME SPAN IS AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR002981	DS002981	D000076	2	04/27/62 - 07/10/62

ARIEL I
LANGMUIR PROBE A
ELECTRON DENSITY

62-015A-01A

This data set consists of a single magnetic tape (D-00076) which contains fixed length records. This tape has replaced the original tape (D-00076) due to the addition of data keypunched from hardcopy. The original data is documented in DUN 67-23. Blocksize is 84 characters as is record length. The program documented in the back part of this catalog will have to be altered for future use due to the addition of data which changed the blocksize.



DATA USERS' NOTE

NSSDC 67-23

ARIEL 1 (1962 OMICRON 1)

ELECTRON DENSITY EXPERIMENT

APRIL 1967

NATIONAL SPACE SCIENCE DATA CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

DATA USERS' NOTE
NSSDC 67-23

ARIEL 1 (1962 OMICRON 1)
ELECTRON DENSITY EXPERIMENT

EXPERIMENTER
J. Sayers

APRIL 1967

FOREWORD

This Data Users' Note is specifically designed to help potential data users decide if they can make use of the data obtained in the Ariel 1 (1962 Omicron 1) electron density experiment. Once a data user decides that he requires the data, it will serve as the unifying element - the key - in the actual use of the data available at the National Space Science Data Center (NSSDC). To achieve these goals, the Note briefly describes the experiment, including the instrumentation and measurements, the telemetry, and the operational experience. All available details are then provided on the actual reduction techniques and format of recorded data. For those desiring more details, the experimenter's name and address are provided to facilitate direct contact. As a further aid, detailed references (and bibliography) are also included. When available, NASA accession numbers* are given. The primary purpose of these references is to identify the sources containing complete information concerning the subject under discussion. Most of them are physically available at NSSDC — those that are not are readily obtainable.

Inquiries concerning the availability of data should be directed to:

National Space Science Data Center
Goddard Space Flight Center
Greenbelt, Maryland 20771
Area Code 301 982-6695

*For example, N64-2243 is an accession number for an article reported in the *Scientific and Technical Aerospace Reports* (STAR), and A63-5921 refers to an entry in the *International Aerospace Abstracts* (IAA).

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ARIEL 1 (1962 OMICRON 1)
ELECTRON DENSITY EXPERIMENT

BACKGROUND

The first international satellite, Ariel 1 (1962 Omicron 1),* a joint United States-United Kingdom effort, was designed to contribute to man's knowledge of the ionosphere and its complex relation to the sun. It resulted from a proposal by U. S. representatives at the March 1959 meeting of COSPAR.** The United States offered to launch payloads or complete satellites prepared by foreign scientists; the United Kingdom was one of several nations to accept the offer.[1,2]

The electron density experiment was one of six (see Figure 1) carried aboard the Ariel 1 (1962 Omicron 1) satellite, which was launched at 1300 (EST) on April 26, 1962, from Cape Canaveral (Cape Kennedy), Florida. Ariel 1 achieved an orbit with an apogee of 1212 km, a perigee of 390 km, a period of 100.9 min, and an inclination of 53.86 deg.[1,2] The initial spin rate of the satellite was approximately 38 rpm.[3]

EXPERIMENTER

J. Sayers - University of Birmingham***

EXPERIMENT

Instrumentation and Measurements

The measurement of electron density was performed both by this experiment and by the Langmuir probes of the electron temperature-gage experiment. Since the two methods are quite different in principle, being subject to different errors in general, they complemented each other.[2]

The density of ionospheric electrons was measured by the change in capacitance between two circular disks of wire mesh, 3.5 in. in diameter and separated by 3.5 in., which formed a parallel-plate capacitor (mesh was used

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*Also known as UK-1 and S-51.

**Committee on Space Research of the International Council of Scientific Unions.

***Address: University of Birmingham, Edgbaston, Birmingham 15, England.

FIGURE 1

ARIEL 1 EXPERIMENTS

No.	Experiment	Investigator(s)	Affiliation
01	Electron Density	J. Sayers	University of Birmingham
02	Electron Temperature Gage	R. L. F. Boyd A. P. Willmore	University College, London University College, London
03	Cosmic-Ray Detector	H. Elliot J. J. Quenby A. C. Durney	Imperial College, London Imperial College, London Imperial College, London
04	Ion Mass Sphere	R. L. F. Boyd A. P. Willmore	University College, London University College, London
05	Lyman-Alpha Gage	J. A. Bowles A. P. Willmore	University College, London University College, London
06	X-Ray Emission	R. L. F. Boyd K. A. Pounds A. P. Willmore	University College, London University College, London University College, London

to allow free passage of electrons into the capacitor). To prevent the electron density from being greatly affected by the presence of the satellite, the capacitor was mounted at the outer end of a boom 49.5 in. long.[2,4]

The capacitor formed one arm of an RF capacitance bridge, which operated at 10 Mc/s. From a knowledge of the capacitance at 10 Mc/s and of the capacitance in vacuo, the dielectric constant k of the ionospheric plasma could be found. This was related to the electron density by the expression

$$k = 1 - \frac{N_e e^2}{\pi m \omega^2}$$

where N_e is the electron density, e is the electronic charge, m is the mass, and ω is the angular frequency of operation of the bridge (here $2\pi \times 10^{-7}$ rad/sec). However, N_e in the equation would be equal to the ambient electron density only if the potential of the capacitor plates was the same as the space potential. In general, there would be a potential difference between the satellite and space. To ensure that the capacitor plates were sometimes at space potential, a sawtooth wave with an amplitude of approximately 4 volts was applied to them; N_e was then taken to be the maximum value obtained during the sweep. Immediately prior to the start of each sweep, a rather large negative potential (-5 volts) was applied to the plates to remove electrons and to provide a check on the in-vacuo capacitance.[2]

Telemetry

The Ariel 1 telemetry system used pulse-frequency modulation (PFM) on a phase-modulated carrier.[4] The satellite contained both a high- and low-speed encoder system. To increase reliability, operation of the high-speed encoder was independent of the operation of the low-speed encoder; however, the two were synchronized to facilitate correlation of data. Data from the high-speed encoder were transmitted continually. The low-speed encoder data were recorded on an on-board tape recorder. The spacecraft contained a programmer whose main function was to control the transmission of the encoder data to the ground. This was accomplished by a phase-modulated transmitter, fully transistorized, which delivered 260 mw of power to the antenna system at a frequency of 136.410 Mc/s. When an RF command was sent to the satellite from a ground station, the tape-recorded data that had been recorded during the 100-min orbit were played back in approximately 2 min. The tape recorder then automatically returned to the record mode.[3]

To avoid possible interaction with the Langmuir probes, the electron density experiment was turned on for only 10 sec in each 61.42-sec period, control being by trigger pulses from the low-speed encoder binary sequence. For this period, a gating unit then supplied power to the VF (variable frequency) bridge circuitry and the bridge potential waveform generator — all of which were located at the hinge end of the boom. The output from the bridge was amplified, separated into its in-phase and quadrature components (corresponding to the real and imaginary parts, respectively, of the dielectric constant), and telemetered through the high-speed encoder. Also, the maximum values in each sweep were selected by peak reading circuits and were stored in capacitors until they were read out by the low-speed encoder.

The temperature of the boom electronics, the voltage supply levels, and the VF amplitude were also measured and telemetered by both encoders.[2]

Operational Experience

With the exception of the early orbit-determination phase, tracking of Ariel 1 was the sole responsibility of the South Atlantic and Singapore ground stations and the Minitrack network during the active lifetime of the satellite. Analysis of a computed preliminary orbit indicated that insufficient tracking data would be obtained from Minitrack during the first 12 hr of operation to define the orbit of the satellite. For this reason, outside tracking support was required.

Ariel 1 was tracked by the following stations under control of the Goddard Space Flight Center:

Antofagasta, Chile
Blossom Point, Maryland, U.S.A.
East Grand Forks, Minnesota, U.S.A.
Fort Myers, Florida, U.S.A.
Johannesburg, South Africa
Lima, Peru
Quito, Ecuador
Santiago, Chile
St. John's, Newfoundland
Winkfield, England
Woomera, Australia

In addition, the South Atlantic and Singapore stations tracked and recorded the satellite telemetry.[2]

The satellite's initial spin rate of approximately 38 rpm decayed to approximately 27 rpm by October 1963, then increased because of solar pressure on the paddles and the satellite's aspect with respect to the sun.[3]

From its successful launch on April 26, 1962, until July 12, 1962, Ariel 1 performed satisfactorily. Project scientists felt that there was a relationship between the beginning of satellite malfunction and the high-altitude nuclear explosion that occurred 3 days before (July 9, 1962).

The low-speed data store was lost in mid-August, accounting for the loss of approximately 75% of the data from this experiment. The experiment itself did not fail until March 1963.[3]

DATA

Reduction Techniques

The system used for processing the Ariel 1 data was of the PFM type. A comb filter was utilized for signal-to-noise improvement and to recover the burst rate for use in synchronization. A PFM digitizer and a computer format control buffer established synchronization, encoded the 120 lines from the comb filter, and multiplexed the frequency data with the time code. The digital magnetic tapes prepared on the format control buffer were printed on a high-speed line printer. Selected sections of the full format also could be provided after a simple operation in a CDC-160 Data Processor. Programs were available to decommutate, edit, accumulate, and record the data and provide digital magnetic tapes for further use, as required.[2]

The station telemetry tapes containing a 10-kc standard frequency, Minitrack time code, telemetry signal, etc., were received by GSFC for editing and storage. After being reviewed for quality and quantity of usable data, each tape was checked against expected station performance. Three categories of tapes were stored: (1) unusable tapes resulting from inadequate SNR (signal-to-noise ratio), interference, or operator error; (2) questionable tapes requiring extra handling to recover the data; and (3) good tapes of a quality sufficient to warrant immediate machine processing. Tapes of the first class were retained for archival purposes; tapes of the other two classes were processed.

Questionable tapes were so classified because of poor SNR, requiring special processing and handling of these tapes.

Good tapes were characterized by a good SNR and consequent high reliability of sync determination, permitting preparation of the digital format around the known sync location. This allowed a full data printout to be made immediately, without calibration or linearization, data sequence correction or grouping, or error correction and removal. Frequency and calibration information were provided. This method permitted a quick look at the data. Further processing was accomplished in the CDC-160 Data Processor, which accepted the magnetic tape prepared with time. The data were placed on magnetic tape in a form suitable for printing on an IBM line printer. The output was one frame per line, columnized by channels with one column for time. Identification data were inserted as the first record of each digital magnetic tape, including day of year, station number, experiment number, and analog tape number. This information was printed at the top of each page.[2]

Timespan of Data

Data from this experiment are available for the period of April 26 to July 8, 1962.

Format of Available Data

The data are available at NSSDC on one BCD even-parity magnetic tape, which has 11 files at 556-bpi density. The first record of the first file is a label that contains identification integers for the first orbit processed. Its format is as follows:

FORMAT (12H BIRMINGHAM, I6, 2I2, I3, I2, I3, I1, 3I2)

The other files do not have such a label.

The subsequent records on the tape are blocked and consist of 1 to 44 "lines" of data. Each "line" has the following information:

1. Day number	F4.0
2. Universal time in hours	F7.4
3. Satellite longitude in degrees	F6.1
4. Satellite latitude in degrees	F5.1
5. Satellite height in kilometers	F5.0
6. Satellite geopotential height in kilometers	F5.0
7. Local solar time in hours	F7.4
8. Electron density	E9.3
9. Earth's magnetic field in gauss	F6.5
10. McIlwain's L parameter	F5.3

Thus, the format of a 44-"line" record is as follows:

FORMAT (44(F4.0, F7.4, F6.1, F5.1, F5.0, F5.0, F7.4, E9.3, F6.5, F5.3))

These records were originally written with the EL9UP subroutine of the SHARE library and generally have more than 132 characters per record. Blank characters were added after the last data character of each record in sufficient quantity to make the total number of characters in a record an integral multiple of 6.

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1. "A-R-I-E-L — First International Satellite," NASA Facts, C-62, 1-4, GPO: 1962 0 - 665760.

2. ARIEL I: The First International Satellite — The Project Summary, NASA SP-43, 1963.

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```
BIRMINGHAM    99995162117 )   10102832       000000000000000000
117. 8.8053 -54.2 36.31023. 882. 5.22930.756E 04.317902.532
117. 8.8224 -51.2 38.61002. 865. 5.44390.101E 05.322942.680
117. 8.8394 -48.1 40.8 979. 849. 5.67340.126E 05.327422.826
117. 8.8564 -44.6 42.9 956. 831. 5.91930.126E 05.331182.964
117. 8.8735 -40.9 45.0 932. 813. 6.18560.202E 05.334473.089
117. 8.8906 -36.8 46.8 908. 795. 6.47140.202E 05.337283.195
117. 8.9075 -32.5 48.6 883. 776. 6.77830.227E 05.339873.275
117. 8.9247 -27.8 50.1 858. 756. 7.10990.227E 05.342233.324
117. 8.9417 -22.7 51.4 832. 736. 7.46300.252E 05.344653.338
117. 8.9587 -17.4 52.5 806. 716. 7.83620.302E 05.347123.308
117. 8.9758 -11.7 53.3 780. 695. 8.23030.302E 05.349743.246
117. 8.9929  -5.9 53.8 754. 674. 8.63980.378E 05.352633.148
117. 9.0098   0.1 54.0 728. 653. 9.05650.479E 05.355893.029
117. 9.0269   6.2 53.8 702. 632. 9.47940.554E 05.359552.889
117. 9.0440  12.2 53.3 676. 611. 9.89740.630E 05.363652.728
117. 9.0610  18.1 52.5 651. 591.10.30520.731E 05.368012.565
117. 9.0781  23.8 51.4 626. 570.10.70080.882E 05.372692.395
117. 9.0951  29.2 50.0 602. 550.11.07660.983E 05.377392.225
117. 9.1121  34.2 48.3 579. 531.11.43030.116E 06.381862.064
117. 9.1292  39.0 46.4 556. 512.11.76410.134E 06.386001.914
117. 9.1463  43.4 44.2 535. 493.12.07510.164E 06.389091.775
117. 9.1633  47.5 41.9 514. 476.12.36420.189E 06.391131.647
117. 9.1803  51.3 39.4 495. 459.12.63460.214E 06.391381.530
117. 9.1974  54.8 36.7 477. 444.12.88810.251E 06.389711.425
117. 9.2144  58.1 33.9 461. 430.13.12370.344E 06.385841.331
117. 9.2315  61.2 31.0 446. 417.13.34640.456E 06.379891.249
117. 9.2486  64.1 28.1 432. 405.13.55680.604E 06.372141.178
117. 9.2656  66.8 25.0 421. 395.13.75590.790E 06.362751.118
117. 9.2826  69.4 21.9 411. 386.13.94530.809E 06.352881.069
117. 9.2997  71.9 18.7 403. 379.14.12820.790E 06.343231.032
117. 9.3168  74.2 15.4 397. 373.14.30400.800E 06.334981.012
```

1st 47 Ru

D-00076

C-00028

THIS TAPE REPLA

OLD TAPE. MANY R

HAVE BEEN ADDED.

1st 47 Recd-

D-00076

C-00028

THIS TAPE REPLACES
OLD TAPE. MANY RECORDS
HAVE BEEN ADDED.

REC	1.	LENGTH	84
REC	2.	LENGTH	84
REC	3.	LENGTH	84
REC	4.	LENGTH	84
REC	5.	LENGTH	84
REC	6.	LENGTH	84
REC	7.	LENGTH	84
REC	8.	LENGTH	84
REC	9.	LENGTH	84
REC	10.	LENGTH	84
REC	11.	LENGTH	84
REC	12.	LENGTH	84
REC	13.	LENGTH	84
REC	14.	LENGTH	84
REC	15.	LENGTH	84
REC	16.	LENGTH	84
REC	17.	LENGTH	84
REC	18.	LENGTH	84
REC	19.	LENGTH	84
REC	20.	LENGTH	84
REC	21.	LENGTH	84
REC	22.	LENGTH	84
REC	23.	LENGTH	84
REC	24.	LENGTH	84
REC	25.	LENGTH	84
REC	26.	LENGTH	84
REC	27.	LENGTH	84
REC	28.	LENGTH	84
REC	29.	LENGTH	84
REC	30.	LENGTH	84
REC	31.	LENGTH	84
REC	32.	LENGTH	84

117.	9.3338	76.5	12.2	393.	370.14.47400.800E	06.329111.002
117.	9.3509	78.8	8.8	390.	368.14.64110.790E	06.326481.000
117.	9.3679	81.0	5.5	390.	368.14.80490.809E	06.327181.000
117.	9.3849	83.2	2.2	392.	369.14.96630.800E	06.331251.003
117.	9.4020	85.3	-1.1	396.	373.15.12760.800E	06.338291.024
117.	9.4191	87.5	-4.5	402.	378.15.28910.809E	06.347651.061
117.	9.4361	89.7	-7.8	409.	385.15.45150.800E	06.358761.106
117.	9.4531	91.9	-11.0	419.	393.15.61550.716E	06.370621.163
117.	9.4702	94.1	-14.3	431.	403.15.78380.511E	06.383021.235
117.	9.4873	96.5	-17.5	444.	415.15.95560.409E	06.395601.321
117.	9.5043	98.9	-20.7	459.	428.16.13240.288E	06.407891.426
117.	9.5213	101.4	-23.8	475.	442.16.31670.214E	06.419921.552
117.	9.5384	104.0	-26.8	493.	458.16.50900.181E	06.431171.705
117.	9.5554	106.8	-29.8	512.	474.16.70960.139E	06.441531.888
117.	9.5725	109.7	-32.7	533.	492.16.92210.106E	06.450682.109
	.	112.	35.4	555.	510 17 4670 90	0

```
REC     33, LENGTH     84
REC     34, LENGTH     84
REC     35, LENGTH     84
REC     36, LENGTH     84
REC     37, LENGTH     84
REC     38, LENGTH     84
REC     39, LENGTH     84
REC     40, LENGTH     84
REC     41, LENGTH     84
REC     42, LENGTH     84
REC     43, LENGTH     84
REC     44, LENGTH     84
REC     45, LENGTH     84
REC     46, LENGTH     84
REC     47, LENGTH     84
        48       T
```

```
      SUBROUTINE MATLT(KEY,VALUEL,T)
C
C     THIS ROUTINE PRODUCES A MATRIX OF 90 L VALUES OF L VERSIS LOCAL
C     TIME
C
C     WHEN KEY = 1  ALL ARRAYS ARE INITIALIZED
C          KEY = 0  VALUE IS USED TO UPDATE ELEMENT
C          KEY   -1 THE MATRIX IS PRINTED
C
C     IVALT   IS THE UNIVERSAL TIME IN MINUTES
C     VALUEP  IS THE LONGITUDE IN DEGREES EAST
C     VALUEL  IS THE L VALUE
C       NOTE - THIS ROUTINE ASSUMES THAT A TITLE HAS BEEN SET IN THE
C     HEAD ROURINE. ONLY THE FIRST LINE OF THAT HEADING WILL BE USED.
C
      COMMON  /USC/TITLE,IPAGE,NTTL1,NTTL2
      DIMENSION TITLE(44)
      DIMENSION ICOUNT(90,24), CTL(91)
      IF(KEY)1,2,3
1     CTL(1) =  1.
      DO 11 I = 1,90
11    CTL(I+1) = CTL(I) + .1
      WRITE (3,101) IPAGE, (TITLE(I), I = 1,NTTL1)

      IPAGE = IPAGE + 1
      WRITE (3,100) (CTL(I),CTL(I+1), (ICOUNT(I,J), J = 1,24), I = 1,45)

      WRITE (3,101) IPAGE, (TITLE(I), I = 1,NTTL1)

      IPAGE = IPAGE + 1
      WRITE (3,100) (CTL(I),CTL(I+1), (ICOUNT(I,J), J = 1,24), I=46,90)

      GO TO 21
2     IF(T - .5)204,205,205
204   T = T + 24.
205   CALL INDEX(T,.5,1.,24,J)
      CALL INDEX(VALUEL,1.,.1,90,I)
      ICOUNT(I,J) = ICOUNT(I,J) + 1
21    RETURN
3     DO 31 I = 1,90
      DO 31 J = 1,24
31    ICOUNT(I,J) = 0
      GO TO 21
100   FORMAT ( 40X50HMATRIX OF VALUES OF L AND LOCAL TIME FOR THIS TAPE
     1///      132H TIME        1    2    3    4    5    6    7    8    9
     2  10    11    12    13    14    15    16    17    18    19    20    21    22
     3 23    24             /8H L RANGE  // (F4.1, 1H-, F3.1, 24I5))
101   FORMAT (1H1, 75X4HPAGE,I5/21A6,A5)
      END
```

VERSIS LOCAL

N SET IN THE
WILL BE USED.

	.1					
	.2					
	.3					
	.4	.5				
	.6	.7	.8	.9	.10	.11
	.12					
1,24), I = 1,45)	.13	.14	.15	.16	.17	.18
	.19	.20	.21			
	.22	.23	.24	.25	.26	.27
	.28					
,24), I=46,90)	.29	.30	.31	.32	.33	.34
	.35	.36	.37			
	.38					
	.39					
	.40					
	.41					
	.42					
	.43					
	.44					
	.45					
	.46					
	.47	.48	.49			
	.50					
FOR THIS TAPE						
7 8 9						
20 21 22						
,1, 24I5))						
	.51					

```
      SUBROUTINE MATBL(KEY,VALUEX,VALUEL)
C
C     THIS ROUTINE PRODUCES A MATRIX OF 100 L VALUES VERSUS 20 X VALUES.
C
C     WHEN KEY = 1  ALL ARRAYS ARE INITIALIZED
C          KEY = 0  VALUE IS USED TO UPDATE ELEMENT
C          KEY   -1 THE MATRIX IS PRINTED
C
C          VALUE X  IS THE X VALUE
C          VALUE L  IS THE L VALUE
C       NOTE - THIS ROUTINE ASSUMES THAT A TITLE HAS BEEN SET IN THE
C     HEAD ROURINE. ONLY THE FIRST LINE OF THAT HEADING WILL BE USED.
C
      COMMON  /DSC/TITLE,IPAGE,NTTL1,NTTL2
      DIMENSION TITLE(44)
      DIMENSION ICOUNT(90,21), CTL(91)
      IF(KEY)1,2,3
1     CTL(1) =  1.
      DO 11 I = 1,90
11    CTL(I+1) = CTL(I) + .1
      DO 12 I = 1,90
      DO 12 J = 1,20
12    ICOUNT(I,21) = ICOUNT(I,21) + ICOUNT(I,J)
      WRITE (3,101) IPAGE, (TITLE(I), I = 1,NTTL1)

      IPAGE = IPAGE + 1
      WRITE (3,100) (CTL(I),CTL(I+1), (ICOUNT(I,J), J = 1,20), I = 1,45)

      WRITE (3,101) IPAGE, (TITLE(I), I = 1,NTTL1)

      IPAGE = IPAGE + 1
      WRITE (3,100) (CTL(I),CTL(I+1), (ICOUNT(I,J), J = 1,20), I = 46,90
     1)

      GO TO 21
2     CALL INDEX(VALUEX,0.,.05,20,J)
      CALL INDEX(VALUEL,1.,.1,90,I)
      ICOUNT(I,J) = ICOUNT(I,J) + 1
21    RETURN
3     DO 31 I = 1,90
      DO 31 J = 1,21
31    ICOUNT(I,J) = 0
      GO TO 21
100   FORMAT(45X41HMATRIX OF VALUES OF B AND L FOR THIS TAPE  ///
     1132H B RANGE 0-.05  -.10  -.15  -.20  -.25  -.30  -.35  -.40  -.4
     2  -.50  -.55  -.60  -.65  -.70  -.75  -.80  -.85  -.90  -.95  -1.
     3         /8H L RANGE
     4        // ( F4.1, 1H-, F3.1, 20I6))
101   FORMAT (1H1, 75X4HPAGE,I5/21A6,A5)
      END
```

NT - INTERNAL FORMULA NUMBER(S)

RSUS 20 X VALUES.

EN SET IN THE
WILL BE USED.

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

.17
1,20), I = 1,45) .18 .19 .20 .21 .22 .23
.24 .25 .26
.27 .28 .29 .30 .31 .32

.33
1,20), I = 46,90
.34 .35 .36 .37 .38 .39
.40 .41 .42
.43
.44
.45
.46
.47
.48
.49
.50 .51 .52
.53
S TAPE ///
-.35 -.40 -.45
-.90 -.95 -1.0

.54