Project Report

Data Reduction Program Documentation
ALCOR Tape Read Package

(Effective: April 1971)

Lincoln Laboratory
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Lexington, Massachusetts

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PA-229-7
(RSP)

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Unclassified
DATA REDUCTION PROGRAM DOCUMENTATION
ALCORN TAPE READ PACKAGE
(EFFECTIVE: APRIL 1971)

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FOREWORD

This is the seventh report in the Data Reduction Program Documentation series. It is dated according to the date of completion of the documentation. No implication is made that this program will not subsequently be modified, amended, or superseded; on the contrary, the history of radar data processing is one of continuous evolution of techniques, and it is unrealistic to assume that steady-state has been reached. The PA-229 series is being published for the convenience of interested parties, and Lincoln assumes no responsibility for the correctness of the information presented, nor for its currency.

The preparation of reports in this series is under the Editorship of Charles R. Berndtson of Lincoln, and of D.E. Nessman and R.H. French of Philco-Ford Corporation. Inquiries, suggestions, corrections, criticisms, and requests for additional copies should be directed to C.R. Berndtson.

The principal contributor to this report was G.L. Shapiro (Philco-Ford). Due to the intricate, evolutionary manner in which the programs came into being, the editors regret that it is in general impossible to give due credit to all -- mathematicians or radar analysts or programmers -- who contributed to the definition and writing of the programs.

Alan A. Gromestein

Alan A. Gromestein
COMMON SYMBOLS AND ABBREVIATIONS

(The units given for certain quantities are the units commonly used for those quantities, unless otherwise noted.)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT</td>
<td>ALCOR Data Tape</td>
</tr>
<tr>
<td>ALCOR</td>
<td>ARPA-Lincoln C-band Observables Radar</td>
</tr>
<tr>
<td>ALTAIR</td>
<td>ARPA Long-Range Tracking and Instrumentation Radar</td>
</tr>
<tr>
<td>Alt</td>
<td>Altitude (km)</td>
</tr>
<tr>
<td>APS</td>
<td>Average Pulse Shape</td>
</tr>
<tr>
<td>ARS</td>
<td>ALTAIR Recording System</td>
</tr>
<tr>
<td>Avg</td>
<td>Average, Averaging</td>
</tr>
<tr>
<td>Az</td>
<td>Azimuth (deg)</td>
</tr>
<tr>
<td>CADJ</td>
<td>Adjusted Calibration Constant (db)</td>
</tr>
<tr>
<td>C-band</td>
<td>ALCOR frequency, 5664 MHz (NB) and 5667 MHz (WB)</td>
</tr>
<tr>
<td>DBLT</td>
<td>Wide Band Pulse Doublet</td>
</tr>
<tr>
<td>El</td>
<td>Elevation (deg)</td>
</tr>
<tr>
<td>EOF</td>
<td>End of File</td>
</tr>
<tr>
<td>GMT</td>
<td>Greenwich Mean Time</td>
</tr>
<tr>
<td>h</td>
<td>Hours</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>IF</td>
<td>Intermediate Frequency</td>
</tr>
<tr>
<td>in</td>
<td>Inches</td>
</tr>
<tr>
<td>LC</td>
<td>Left Circular Polarization</td>
</tr>
<tr>
<td>lsb</td>
<td>Least Significant Bit</td>
</tr>
<tr>
<td>min</td>
<td>Minutes</td>
</tr>
<tr>
<td>NB</td>
<td>Narrow Band</td>
</tr>
<tr>
<td>NRTPOD</td>
<td>Non-real Time Precision Orbit Determination Program</td>
</tr>
<tr>
<td>POD</td>
<td>Project PRESS Operation and Data Summary Report</td>
</tr>
<tr>
<td>Phase</td>
<td>Presented in deg</td>
</tr>
<tr>
<td>PRF</td>
<td>Pulse Repetition Frequency (pps)</td>
</tr>
<tr>
<td>PRI</td>
<td>Pulse Repetition Interval (s)</td>
</tr>
<tr>
<td>pps</td>
<td>Pulses per second</td>
</tr>
<tr>
<td>pts</td>
<td>Points</td>
</tr>
<tr>
<td>Symbol</td>
<td>Definition</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
</tr>
<tr>
<td>R</td>
<td>Range (km)</td>
</tr>
<tr>
<td>R</td>
<td>Range Rate (km/s)</td>
</tr>
<tr>
<td>rad</td>
<td>Radians</td>
</tr>
<tr>
<td>RC</td>
<td>Right Circular Polarization</td>
</tr>
<tr>
<td>RCS</td>
<td>Radar Cross Section (dbsm)</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>s</td>
<td>Seconds</td>
</tr>
<tr>
<td>SD$_{w}$</td>
<td>Standard Deviation of Wake Velocity</td>
</tr>
<tr>
<td>SDBLT</td>
<td>Wide Band Slaved Pulse Doublet</td>
</tr>
<tr>
<td>S/N</td>
<td>Signal-to-noise Ratio</td>
</tr>
<tr>
<td>T</td>
<td>Time</td>
</tr>
<tr>
<td>TAL</td>
<td>Time After Launch (s)</td>
</tr>
<tr>
<td>UHF</td>
<td>ALTAIR Frequency; 415 MHz</td>
</tr>
<tr>
<td>V</td>
<td>Velocity</td>
</tr>
<tr>
<td>V$_{d}$</td>
<td>Doppler Velocity</td>
</tr>
<tr>
<td>V$_{w}$</td>
<td>Mean Wake Velocity</td>
</tr>
<tr>
<td>VHF</td>
<td>ALTAIR Frequency; 455.5 MHz</td>
</tr>
<tr>
<td>WB</td>
<td>Wide Band</td>
</tr>
<tr>
<td>WBS</td>
<td>Wide Band Slaved</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Total Off-axis Angle (deg)</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Wavelength</td>
</tr>
<tr>
<td>$*$</td>
<td>Denotes Multiplication</td>
</tr>
</tbody>
</table>
FLOW DIAGRAM SYMBOLS

PROCESS, ANNOTATION

DECISION

TERMINATOR

SUBROUTINE: where NAME is the entry call into the subroutine

CONNECTOR: where P specifies a page in the flow diagram, and L designates a statement number in the program listing or a reference point in the flow diagram

CONNECTOR: where X implies a continuation of the diagram to the next page

INPUT/OUTPUT OPERATION

MAGNETIC TAPE

PUNCHED CARD

DISK
ALCOR TAPE READ PACKAGE

The ALCOR Tape Read Package retrieves data from the ALCOR Data Tape. It contains two IBM 360 assembler language subroutines which are called from the user’s program. They are READJS and UNPACK.

A. READJS (See Appendix A.)

The first call to READJS opens the file and reads the ADT header record. The second call to READJS reads the ADT calibration record and stores the values in a buffer area. The main program extracts the individual calibration values it requires. Each subsequent call to READJS reads an ADT data record consisting of eight ALCOR pulses.

If a parity error or an end of file condition is encountered by READJS, indicators are set and transferred to the main program.

The call statement is READJS (INBUF, IEOF, IERR).

INPUT

INBUF First word in an ADT record#

OUTPUT

IEOF Indicator set if EOF is encountered
(0 = no EOF; 1 = EOF found)

IERR Indicator set if parity error is encountered
(0 = no parity error; 1 = parity error found)

B. UNPACK (See Appendix B.)

UNPACK unpacks the raw data from the ADT, and translates it into a format usable by the IBM 360/67 computer. The call statement is UNPACK.

# INBUF (2) to INBUF (1803) contain the remaining words in the record.
Unpacked data for each pulse is transferred to the main program by a fixed common statement which is part of the main program. The common statement differs slightly depending on the program used.

The listing in Appendix B is used in ALCTAP and ALC10. Listings for the versions used by ALCPOD, ALC102, and ALERT are given in the reports describing those programs.

All items used in any common statement are defined below. Many items have been retained in the common statement even though they are no longer used because of changes in tape format.
STORED IN COMMON

INBUF
ADT data record consisting of 8 pulses (900 bytes/pulse)

IAZ
Az encoder angle (lsb = 360 * 2^-17 deg)

IEL
El encoder angle (lsb = 360 * 2^-17 deg)

INDEX
Not used

IPPRCS
Tracked target NB LC RCS (lsb = 1 dbsm)

IORS
Not used

IRANGE#
Uncorrected R (lsb = 14.989125 * 2^-14 m)

IPKPWR
Peak transmit power (counts)

1RDOT
Range rate (lsb = 14.989125 * 2^-13 m/s)

IALT
Not used

INDAZ
Not used

JNDAZ
Not used

INDEL
Not used

IRB54
LC amplitude (counts) in Range Gate 52

IRB85
Not used

IOPRCS
Tracked target NB RC RCS (lsb = 1 dbsm)

1240B1
Reference channel log detector count

1240B2
ΔAz log detector count

1240B3
ΔEl log detector count

1241B1
Reference phase detector count

1241B2
ΔAz phase detector count

1241B3
ΔEl phase detector count

---

# See Appendix C.

### This is a misnomer. It is a value used in peak transmit power computation.
XPPAGC
  Total LC attenuation (lsb = 1 db)

IBETA
  Not used

NEWA
  Attenuation flag: 0 = prior to 15 Oct 1970
                  1 = after 15 Oct 1970

IBAND
  Not used

NSW
  Flag: 0 = compute transmission time of pulse
       1 = do not compute transmission time

RBIAS†
  8 range bias words [RBIAS (1) - RBIAS (8)] used for correcting R (μs)

ISVPRI
  Not used

IHRS
  Time pulse received, GMT h (lsb = 1 h)

IMIN
  Time pulse received, GMT min (lsb = 1 min)

ISEC
  Time pulse received, GMT s (lsb = 1 s)

IMSEC
  Time pulse received, GMT ms (lsb = 1 ms)

ISTAT
  Used by Subroutine STATUS called only by ALERT²

TRBIAS†
  Range bias

ISTAT1
  Not used

ISTAT2
  Not used

ISTAT3
  Not used

ISTAT4
  Not used

IASW
  Not used

ISTSW
  Used by Subroutine STATUS called only by ALERT²

NBWB
  Not used

ISIGNO
  Not used

---

# See Appendix D.

## Only in ALCPOD common statement.

† See Appendix E.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I27B12</td>
<td>Pulse transmission: 0 = NB only; 1 = NB and WB</td>
</tr>
<tr>
<td>H115B2</td>
<td>Not used</td>
</tr>
<tr>
<td>JCON</td>
<td>Counts pulses/record; when count reaches 9, a new record is read and count is reinitiated</td>
</tr>
<tr>
<td>NBEG</td>
<td>Initial pulse no. requested</td>
</tr>
<tr>
<td>NEND</td>
<td>Not used</td>
</tr>
<tr>
<td>ITST</td>
<td>Program Flag; indicates averaging interval completed</td>
</tr>
<tr>
<td>NUMPRI</td>
<td>PRI count</td>
</tr>
<tr>
<td>XOPAGC</td>
<td>Total RC attenuation (lsb = 1 db)</td>
</tr>
<tr>
<td>ITBAND</td>
<td>Bandwidth: 0 = NB; 1 = WB</td>
</tr>
<tr>
<td>ITAPNO</td>
<td>Not used</td>
</tr>
<tr>
<td>IPRF</td>
<td>PRF</td>
</tr>
<tr>
<td>IPOLAR</td>
<td>Polarization: 0 = LC; 1 = RC</td>
</tr>
<tr>
<td>ISSERR</td>
<td>Attenuation slow switch flag: 0 = attenuation usable; 1 = attenuation indeterminate</td>
</tr>
<tr>
<td>PIFA</td>
<td>16 step LC IF attenuation (db)</td>
</tr>
<tr>
<td>OIFA</td>
<td>16 step RC IF attenuation (db)</td>
</tr>
</tbody>
</table>

# Not in ALERT common statement.

## Only in ALERT common statement.

† See Appendix D.

† † See Appendix F.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFSA</td>
<td>LC fast switch RF attenuation (db)</td>
</tr>
<tr>
<td>OFSA</td>
<td>RC fast switch RF attenuation (db)</td>
</tr>
<tr>
<td>PSSA</td>
<td>LC slow switch RF attenuation (db)</td>
</tr>
<tr>
<td>OSSA</td>
<td>RC slow switch RF attenuation (db)</td>
</tr>
<tr>
<td>PSSL</td>
<td>LC slow switch attenuator loss (db)</td>
</tr>
<tr>
<td>OSSL</td>
<td>RC slow switch attenuator loss (db)</td>
</tr>
<tr>
<td>ICODE</td>
<td>Code designating type of pulse:</td>
</tr>
<tr>
<td></td>
<td>0 = NB</td>
</tr>
<tr>
<td></td>
<td>1 = WB</td>
</tr>
<tr>
<td></td>
<td>2 = Phantom (not expected on ADT)</td>
</tr>
<tr>
<td></td>
<td>3 = WBS</td>
</tr>
<tr>
<td></td>
<td>4 = not used</td>
</tr>
<tr>
<td></td>
<td>5 = DBLT</td>
</tr>
<tr>
<td></td>
<td>6 = not used</td>
</tr>
<tr>
<td></td>
<td>7 = SDBLT</td>
</tr>
<tr>
<td>I273B5</td>
<td>Code for WBS waveform transmission: 0 = off; 1 = on</td>
</tr>
<tr>
<td>I273B6</td>
<td>Code identifying altitude region: 0 = endoatmospheric (&lt; 120 km); 1 = exoatmospheric (&gt; 120 km)</td>
</tr>
<tr>
<td>I273B7</td>
<td>Mode for control of offset range gates: 0 = automatic control; 1 = manual control</td>
</tr>
<tr>
<td>I273B8</td>
<td>DBLT waveform transmission: 0 = off; 1 = on</td>
</tr>
<tr>
<td>IMOVP</td>
<td>Indicates whether primary and offset range gates are being moved manually; 62 to 66 counts: not moved; &lt; 62 or &gt; 66 counts: are moved; the separation between the primary and offset gates remains constant</td>
</tr>
<tr>
<td>IMOVO</td>
<td>Indicates whether offset range gates are being moved manually; 62 to 66 counts: not moved; &lt; 62 or &gt; 66 counts: are moved</td>
</tr>
<tr>
<td>IOFFST</td>
<td>Range offset (WBS and SDBLT) (lsb = 14.989125 * 2^{-11} m)</td>
</tr>
</tbody>
</table>

# Range offsets are a function of altitude region.
XDPTIM#  Pulse transmit time (GMT total s)  (lsb = 10^-6 s)
IDAT##  680 amplitude and phase data words for LC and RC (counts)

REFERENCES


2. "Data Reduction Program Documentation, ALERT, (Effective: April 1971)", PA-229-11, Lincoln Laboratory, M.I.T. (to be published), UNCLASSIFIED.

# Only in ALCPOD common statement.
## Not used in ALERT common statement.
APPENDIX A
SUBROUTINE READJS PROGRAM LISTING

* CALL READJS(INBUF,IEOF,IERR)
START
ENTRY READJS
SPACE
XZBUF EQU 4
XECF EQU 5
XERR EQU 6
BASE EQU 12
SPACE
READJS SAVE (14,17),T,*
BALR 12,C
USING *,BASF
ST 13,SAVEA+4
LA 7,SAVF
ST 7,B(0,13)
LR 13,7
SPACE
LM XZBUF,XERR,O(1)
SPACE
L 7,IFRST1
C 7,ZERF
BNE WHICHF
SPACE
CPEN (INCCP,(INPUT))
REAC RCB3,5F,INDCB,BUFF1,7212
CHECK RCB3
MVC BUFNUM(4),ZERC
MVC IFRST1(4),CNE
B SK1
SPACE
WHICHF
L 3,BUFNUM
S 3,UEN
BM NEXTBUF2
B NEXTBUF1
SPACE
NEXTBUF1 MVC BUFNUM(4),ZERC
CHECK RCB1
SK1 REAC RDR2,5F,INDCB,BUFF2,7212
L 9,ABUFF1
B LCOPQ
SPACE
NEXTBUF2 MVC BUFNUM(4),CONE
CHECK RCB2
READ RCB1,CF,INDCB,BUFF1,7212
L 9,ABUFF2
SPACE
LCCPC LR 1C,XZPUPF
SR 11,11
SR 3,3
LA 8,1803
LCCPZ L 7,0(3,9)
ST 7,0(11,10)
BCT 8,INDUP
B CUTLP
INDUP LA 3,4(3)
LA 11,4(11)
B LCPOPZ
CUTLP B RETURN
SPACE
BACKG L 2,ONE
ST 2,0(XFRR)
BR 14
SPACE
ENDFILE L 2,ONE
ST 2,0(XCF)
S99 CLOSE (INCC,LEAVE)
RETURN L 13,SAVEA+4
RETURN (14,12),T
SPACE
INDCB DCB DSORG=PS,MACRF=(RC),DEVDTA,DEN=2,BLFNC=1,ECDAD=ENDFILE,C
SYNAD=BADRC,BFTEK=S,DDNAME=FT11F001
SPACE
CNCP 0,8
ZERO DC F*O'
CNE DC F*1'
TNC DC F*2'
IFRST1 DC F*0'
BUFNUM DC F*0'
SPACE
ABUFF1 DC A(BUFF1)
ABUFF2 DC A(BUFF2)
SAVEA DC 18A(*)
SPACE
HUFF1 DS 1803F
HUFF2 DS 1803F
END
APPENDIX B
SUBROUTINE UNPACK PROGRAM LISTING

CSECT
ENTRY UNPACK
SAVEL

CROP 15
CNP 0, 4
BALW 2, 0

USING START, 2, 3

START
L 3, BASA
L 4, CLIUF
L 5, CIUF
L 6, CLIF
A 5, =F'T056'
A 6, =F'T192'

USING CHUF, 4, 5, 6
B START

CUUF
CC WEICM)
HASA CC A*(START+4046)
START1 LA 8, INBUF NUMPRI=8*NPR-1)+JON
MVC TEMP(?) O(B)
MVC TEMP2(3), O(R)
L 9, TLM
SLL 9, B
SRL 9, 16
S 9, ONE
SR 8, 0
M 8, LIGHT
A 9, JCOM
ST 9, NUMPRI
L 9, NPEC
C 9, NUMPRI

SPACE
LA 8, WC273
A 8, INDX
MVC TEMP(7), O(B)
N 9, =X'C000000'
SRL 9, 28
ST 9, TCOM
L 9, TEMP
N 9, =X'C000000'
SRL 9, 27
ST 9, 127H6
L 9, TEMP
N 9, =X'C400000'
SRL 9, 26
ST 9, 127H6
L 9, TEMP
N 9, =X'C200000'
SRL 9, 25
ST 9, 127H7
L 9, TEMP
N 9, =X'C000000'
SRL 9, 24
ST 9, 127H8
L 9, TEMP
N 9, =X'C0100000'
SRL 9, 20
ST 9, 127H12

COMPUTE THE CODE FOR PHI

WBS MCCE INDICATOR

ENCO-EXC SCAN INDICATOR

WBS SCAN MODE INDICATOR

DOUBLET MODE INDICATOR

NB/WB INDICATOR
GOCDI  
SPACE
LA 8, WC233  COMPUTE GMT
A 8, INDFX
MVC TEMP(3), 0(B)
L 9, TEMP
N 9, X*3FC0000D*
SRL 9, 24
ST 9, IH
L 9, TEMP
N 9, X*3FC0000D*
SRA 9, 16
ST 9, IMIN
L 9, TEMP
N 9, X*3FC0000D*
SRA 9, 8
ST 9, ISEC
LA 8, WC234
A 8, INDFX
MVC TEMP(3), 0(B)
L 9, TEMP
N 9, X*3FC0000D*
SRL 9, 21
ST 9, TMSFC
STORE MSEC
SPACE
L 10, GN
ST 10, IXC
LA 10, IXC
LA 9, WC1
SR 11, 11
LCPC
A 9, INDFX
SR 12, 12
LA 9, 170
SPACE
LCPC
IC 7, 0(17, 9) STORE ONE POLARIZATION (PP CH OP)
SLL 7, 24
SRL 7, 24
ST 7, 0(11, 10)
BCT 8, INDP
LA 11, 4(11)
SPACE
L 9, IXC
A 9, ONE
ST 9, IXC
C 9, TWO
BE PPPH
C 9, TMRFE
BE CPLCG
C 9, FCUP
BE CPPH
B OUT
SPACE
INDP
LA 12, 11(1)
LA 11, 4(11)
B LCCPC
PPPH
LA 9, WC5P
B LCCPC
LPLGC
LA 9, WC118
B LCCPC
CPPH
LA 9, WC115
B LCCPC
CUT
SPACE
LA 9,WC264
A 8,INDEX
MVC TEMP(3),0(B)
L 9,TEMP
ST 9,WCRED64
LA 8,WC273
A 8,INDEX
MVC TEMP(3),0(8)
L 9,TEMP
ST 9,WCRED73
L 9,WCRED64
N 9,*X'FFFFE000'
SRL 9,13
ST 9,STEMP
L 9,*F'10C0000'
SR 8,8
ST 9,STEMP
SPACE
L 9,1NB1F
SRL 9,31
C 9,ZERG
NEW
SPACE
L 9,WCRED73
N 9,*X'10C0000'
SRL 9,24
C 9,ZERG
BE SLVCUP1
SPACE
L 6,FCU0
XLIV ST 8,CIVSR
D NEWPRF
SPACE
SLVDUB1 L 9,WCRED73
A 9,*X'BC00000'
SRL 9,27
C 9,ZERG
BE NENB8K
B XCIV
SLVDUB2 L 9,WCRED73
N 9,*X'010C000'
SRL 9,2C
C 9,ZERG
BE NCDIVS
L 8,THO
B XCIV1
NCDIVS L 8,ONE
B XCIV1
SPACE
WBAND L 9,WCRED73
N 9,*X'10C0000'
SRL 9,24
C 9,ZERG
BNE SLVCUP2
L 8,THO
B XCIV1
SLVDUB2 L 9,WCRED73
N 9,*X'BC00000'

12
SRL 9,27
C 9,ZERO
BNE XDIV
L 8,TWO
B XCVI

NEWPFR
SR 8,6
L 9,STEMP
D 8,DIVSR
ST 9,IPRF

NEXTh
LA 8,WC297
A 8,INDFX
MVC TEMP(1),O(8)
L 9,TEMP
N 9=X'7FFFF000'
SRL 9,14
ST 9,IAZ
LA 8,WC296
A 8,INDFX
MVC TEMP(1),G(8)
L 9,TEMP
N 9=X'7FFFF000'

GCCCN
LA 8,WC295
A 8,INDFX
MVC TEMP(1),O(8)
L 9,TEMP
N 9=X'7FFFF000'
SRL 9,13
ST 9,TEMP2
LA 8,WC297
A 8,INDFX
MVC TEMP(1),G(8)
L 9,TEMP
N 9=X'7FFFF000'
SRL 9,16
A 9,TEMP2
SLL 9,11
ST 9,TEMP2
LA 8,WC296
A 8,INDFX
MVC TEMP(1),O(8)
L 9,TEMP
N 9=X'7FFFF000'
SRL 9,21
A 9,TEMP2
ST 9,IRANGE
LA 8,WC115
A 8,INDFX
MVC TEMP(1),O(8)
L 9,TEMP
N 9=X'00FF000'
STA 9,16
ST 9,IPKPOW
LA 8,WC299
A 8,INDFX
MVC TEMP(1),O(8)
L 9,TEMP
C 9,FIFO

IN SLAVED SUMBLET MCDE
WB ONLY

STORE A2
STORE ELEV
STORE RANGE
STORE PEAK POWER
BNL DOTG1
N 9,*X'7F0000'
SRA 9,8
LCR 9,9
B DOTG2
SRA 9,8
ST 9,IRDCT
SPACE
LA B,WCL17
A B,INDTX
MVC TEMP(7),O(8)
L 9,TEMP
N 9,*X'FF0000'
SRL 9,24
ST 9,IMOV
SPACE
L 9,TEMP
N 9,*X'F00000'
SRL 9,8
ST 9,IMOV
SPACE
SR 9,9
ST 9,ICFFST
L 9,ICODE
C 9,THREE
HE OFFCOM
G 9,SEVEN
BE OFFCOM
B OFFSKP
SPACE
LA B,WC278
A B,INDTX
MVC TEMP(7),O(8)
SR 9,9
L 9,TEMP
C 9,ZER
RNL RPLUS
N 9,*X'7F0000'
SRA 9,8
LCR 9,9
B RNEG
RPLUS SRA 9,8
RNEG ST 9,ICFFST
SPACE
CFFSKP
LA 8,WC283
A 8,INDTX
MVC TEMP(7),O(8)
L 9,TEMP
N 9,*X'000000'
SRL 9,26
LA 11,PIFA
LE 0,(O9)11
STE 0,XPPAGC
L 9,TEMP
N 9,*X'000000'
SRL 9,22
LA 11,CIFA
LE 0,(O9)11
STE 0,XCPAGC
L 9,ZER

STORE R-CTT

ARE PRIMARY AND OFFSET MOVING

IS OFFSET WINDOW MOVING

RANGE OFFSET FOR SLAVED WINDOW

GET VALUE FROM PIFA TABLE

GET VALUE FROM NIFA TABLE
ST B.ISSRR
LA 8,WC239
A 8,INDEX
MVC TEMP(3),0(8)
L 9,TEMP
N 9,=X'C000200'
C 9,ZERO
BE CKFSDP
LE 0,PFSA
AE 0,XPPAGC
STE 0,XPPAGC
CKFSDP
L 9,TEMP
N 9,=X'C000100'
C 9,ZERO
BE CKSSPP
LE 0,O.FSA
AE 0,XPPAGC
STE 0,XPPAGC
CKSSPP
L 11,TEMP
N 11,=X'00802000'
C 11,=F'0'
BNE CKFSDP
INDE CKSSCP
L 8,CNE
ST 8,ISFRR
B CDELTAR
CKSSCP
L 11,TEMP
N 11,=X'C004C000'
C 11,=F'0'
BE INDE CKFSDP
PTEST
LA 9,WC239
A 9,INDEX
MVC TEMP(1),0(9)
L 10,TEMP
LA 9,WC252
A 9,INDEX
MVC TEMP(3),0(9)
L 11,TEMP
LA 9,WC272
A 9,INDEX
MVC TEMP(1),0(9)
N 10,=X'C0002000'
C 10,=X'C0002000'
BNE 574
LE C,PSSL
AE 0,XPPAGC
STE 0,XPPAGC
L 9,CNE
ST 9,ISWSSP
S74
L 8,NEWA
C 8,ZERO
BE PTEST
L 9,TEMP
N 9,=X'00800000'
C 9,=F'0'
BE MBKLC
N 11,=X'08000000'
C 11,ZERO
BNE SLC

CHECK BIT 23 (PFSA)

ADD IN PFSA VALUE

CHECK BIT 24 (CFSA)

ADD IN CFSA VALUE

INDETERMINATE SITUATION

ALX,MICR,WCRD INTO REG.10
ALX,MICROWAVE WCRD INTO REG.11

RANGE TR.WCRD INTO TEMP

ADD IN PSSL (CCNO.8)

OLD OR NEW ATTEN.

ATTENLACR READBACK
S74 ARMED
STATUS READ BACK
NOATTLC LE 0,PREVLC
STE 0,XPPAGC
MVC JSWLC(4),ONE
MVC ISSERP(4),ONE
B OPTEST

RDBKLC N 11,=X'04000000'
C 11,=X'00000000'
BE NCATTLC
D OPTEST

SLC LE 0,PSSA
AE 0,XPPAGC

STSRC LE 0,XPPAGC
MVC 1SWS(4),ONE

CPTES / LA 9,WC272
A 9,INDEX
MVC TEMP(3),0(9)
L 1C,TEMP
LA 9,WC252
A 9,INDEX
MVC TEMP(3),0(9)
L 1L,TEMP
LA 9,WC272
A 9,INDEX
MVC TEMP(3),0(9)
N 1C,=X'00400000'
C 1C,=X'00400000'
BNE S75

LE 0,GOSSL
AE 0,XCPAGC
STE 0,XCPAGC
L 9,ONE
ST 9,ISWSSC

S75 L 8,NEWA
C 8,ZERO
BE OUT1
L 9,TEMP
N 9,=X'00400000'
C 9,=X'0000'
BE RDBKRC
N 11,=X'02000000'
C 11,ZERO
BNE SRC

ACATTC LE 0,PREVRC
STE 0,XCPAGC
MVC JSWRC(4),ONE
MVC ISSERS(4),ONE
B CLTI

RDBKRC N 11,=X'01000000'
C 11,ZERO
BE NCATTC
D OUT1

SRC LE 0,OSSA
AE 0,XCPAGC

STORCC STE 0,XCPAGC
MVC 1SWS(4),ONE

CUTI L 9,JSWLC
C 9,ZERO
BNE CUT2
LE 0,XPPAGC
SE 0,='E*16'

S74 NOT ARMED
STATUS READBACK

ADD IN PSSA (COND.B)

AUX.MICR..WCRD INTG REG.10
AUX.MICROWAVE WCRD INTG REG.11

RANGE TR..WCRD INTG TEMP

ADD IN GOSSL (COND.B)

OLD OR NEW ATTEN.

ATTENLATCR READBACK
S75 ARMED
STATUS READBACK

S75 NOT ARMED
STATUS READBACK

ADD IN OSSA (COND.B)
STE 0, XPPAGC
STE 0, PREVLC
C 9, ZERO
BNE ENDAFLRT
LE 0, XCPAGC
SE 0, =E'16'
STE C, XCPAGC
STE 0, PREVRC
MVC JSWLC(4), ZERO
MVC JSWHC(4), ZERO
L 9, ITBAND
C 9, ZERO
BE NEBAND
LE 2, RBIAS+16
STE 2, TRBIAS
L 9, IPOLAR
C 9, ZERO
BE LCPLAR
LE 2, RBIAS+20
AE 2, TRBIAS
STE 2, TRBIAS
L 9, ISWSP
C 9, ONE
BNE CDELTAR
LE 2, RBIAS+24
AE 2, TRBIAS
STE 2, TRBIAS
B CDELTAR
NPAND
LE 2, RBIAS
STE 2, TRBIAS
LA 8, MC273
A 8, INDEX
MVC TEMPL(7), 0(8)
L 9, TEMP
N 9, *X'00C10000'
C 9, LAC
BNE CKNEDGE
B CKPLAR
L 8, IROP
C 8, ZERO
BH CKNLOW
LE 2, RBIAS+4
AE 2, TRBIAS
STE 2, TRBIAS
B CKPLAR
CKNLOW
LE 2, RBIAS+8
AE 2, TRBIAS
STE 2, TRBIAS
CKPOLAR
L 9, IPOLAR
C 9, ZERO
BE CDELTAR
LE 2, RBIAS+12

CCMPUTE RANGE BIASES

WIDE BAND TAPE

OP POLARIZATION
ADD WE CP BIAS

ISWSSC WAS SET IN AGC CCP.
*1, ADC 32 CB (CP)

ADD IN CPSSA- RBIAS(8)

ADD IN CPSSA- RBIAS(7)

NARROW BAND

CENTER CR EDGE TRACK

EDGE TRACKING
CENTER TRACK
CHECK SIGN RF O'UCT

LEADING EDGE BIAS

TRAILING EDGE BIAS

CHECK POLARIZATION DESIRED

ACC NE OP BIAS
<table>
<thead>
<tr>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>2, TRBITAS</td>
</tr>
<tr>
<td>STE</td>
<td>2, TRBITAS</td>
</tr>
<tr>
<td>CODELTAR</td>
<td>RETL</td>
</tr>
<tr>
<td>TEMP</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>TEMP2</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>IXC</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>NPTAPE</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>PRINU</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>IPASS</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>ISWSSO</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>ISWSSP</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>DIVSR</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>WORD64</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>WORD73</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>STEMP</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>JSWLC</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>JSWRC</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>PREVLC</td>
<td>CC E10.0^8</td>
</tr>
<tr>
<td>PREVR</td>
<td>CC E10.0^8</td>
</tr>
<tr>
<td>ZERO</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>LVE</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>TWO</td>
<td>DC F10^4</td>
</tr>
<tr>
<td>THREE</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>FOUR</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>SEVEN</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>EIGHT</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>CIO</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>CIGO0</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>CIO00</td>
<td>CC F10^4</td>
</tr>
<tr>
<td>CRUF</td>
<td>CSECT</td>
</tr>
<tr>
<td>INBUF</td>
<td>CS CL3</td>
</tr>
<tr>
<td>WD1</td>
<td>DS CL3, PP LCG D.</td>
</tr>
<tr>
<td>WD18</td>
<td>DS CL3, PP LCG D.</td>
</tr>
<tr>
<td>WD19</td>
<td>DS CL3, PP LCG D.</td>
</tr>
<tr>
<td>WD29</td>
<td>DS CL3, PP PHASE C.</td>
</tr>
<tr>
<td>WD30</td>
<td>DS CL3, PP PHASE C.</td>
</tr>
<tr>
<td>WD58</td>
<td>CS CL171, PP PHASE C.</td>
</tr>
<tr>
<td>WD115</td>
<td>US CL3, CP LCG D.</td>
</tr>
<tr>
<td>WD116</td>
<td>US CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD117</td>
<td>US CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD118</td>
<td>US CL171, CP PHASE C.</td>
</tr>
<tr>
<td>WD119</td>
<td>US CL171, CP PHASE C.</td>
</tr>
<tr>
<td>WD232</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD233</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD234</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD236</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD237</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD238</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD239</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD240</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD241</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD242</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD252</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD253</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD254</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
<tr>
<td>WD255</td>
<td>DS CL3, CP PHASE C.</td>
</tr>
</tbody>
</table>

18
ISIGNO DS 1F
I27812 DS 1F
JCON DS 1F
NBEG DS 1F
NEND DS 1F
ITST DS 1F
NUMPRI DS 1F
XOPAGC DS 1F
ITBAND DS 1F
ITAPNO DS 1F
IPRF DS 1F
IPOLAR DS F
ISSERR DS F
PiFA DS 16F
CIA DS 16F
PFSA DS 1F
CFSA DS 1F
PSSA DS 1F
CSSA DS 1F
PSSL DS 1F
CSSL DS 1F
ICODE DS F
I273B5 DS F
I273B6 DS F
I273B7 DS F
I273B8 DS F
IMCVP DS F
IMVCV DS F
IOFFST DS F
IDAT DS 682F
END
The raw tracked target range (IRANGE) is recorded in a set of three registers: two coarse range registers (lsb = 15 m) and one fine range register (lsb = 14.989125 * 2^{-11} m). IRANGE is the sum of these three ranges, which is always larger than the true target range. The main program must correct for the difference between the true range and IRANGE.

# See Appendix E and Ref. 1, Appendix E.
APPENDIX D
TOTAL ATTENUATION

The total LC (XPPAGC) and RC (XOPAGC) attenuation is computed in Subroutine UNPACK and transferred to the main program through the common statement. The equations used for attenuation depend on the date of the mission.

A. Missions between 15 February 1970 and 14 October 1970

\[
\begin{align*}
\text{XPPAGC (db)} &= \text{PIFA}(I) + \text{PFSA}(J) + \text{PSSL}(K) + \text{PSSA}(L) - 16 \\
\text{XOPAGC (db)} &= \text{OIFA}(I) + \text{OFSA}(J) + \text{OSSL}(K) + \text{OSSA}(L) - 16
\end{align*}
\]

where

PIFA and OIFA are sixteen step IF attenuators. The attenuation is found in Calibration Record Words 512 - 527 (PIFA) and 528 - 543 (OIFA) as a function of I.

I is found in ADT Data Record Byte No. 787 [Bits 1-4 (PIFA), Bits 5-8 (OIFA)].

PFSA and OFSA are fast switch attenuators. The magnitude of the attenuation is given in Calibration Record Words 592 (PFSA) and 594 (OFSA).

J is found in ADT Data Record Byte No. 717 [Bit 7 (PFSA) and Bit 8 (OFSA)].

PSSL and OSSL are slow switch losses. The magnitude of the loss is found in Calibration Record Words 629 (PSSL) and 630 (OSSL).
K has three possible values determined from the ADT data record as follows:

For PSSL

<table>
<thead>
<tr>
<th>Byte 716</th>
<th>Byte 717</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 1</td>
<td>Bit 3</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

For OSSL

<table>
<thead>
<tr>
<th>Byte 716</th>
<th>Byte 717</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 2</td>
<td>Bit 4</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

# Indeterminate, therefore RCS data cannot be calibrated. When this occurs, a flag (ISSERR) is set for the main program, and XPPAGC and XOPAGC do not include slow switch losses or attenuation.
PSSA and OSSA are slow switch attenuators. The magnitude of the attenuation is given in Calibration Record Words 593 (PSSA) and 595 (OSSA).

L is found in ADT Data Record Byte 815 [Bit 5 (PSSA) and Bit 6 (OSSA)].

Note: If K is zero, PSSA and OSSA are not used and L need not be checked.

B. Missions after 15 October 1970

XPPAGC (db) = PIFA(I) + PFSA(J) + PSSA(L) - 16
XOPAGC (db) = OIFA(I) + OFSA(J) + OSSA(L) - 16

L is determined by combining the command to the slow switch attenuators, found in ADT Data Record Byte 815 [Bit 5 (PSSA) and Bit 6 (OSSA)], and the status readback of the attenuators, found in Byte 754 [Bits 5 and 6 (PSSA) and Bits 7 and 8 (OSSA)].

L has three possible values determined from the ADT data record as follows:

<table>
<thead>
<tr>
<th>For PSSA</th>
<th>Byte 815</th>
<th>Byte 754</th>
<th>Byte 754</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bit 5</td>
<td>Bit 5</td>
<td>Bit 6</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

# Indeterminate. When this condition exists, L is set equal to its previous value (previous pulse), XPPAGC and XOPAGC computed, and a flag (ISSERR) set for the Fortran main program.
For OSSA

<table>
<thead>
<tr>
<th>Byte 815</th>
<th>Byte 754</th>
<th>Byte 754</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 6</td>
<td>Bit 7</td>
<td>Bit 8</td>
</tr>
<tr>
<td>0</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Indeterminate. When this condition exists, L is set equal to its previous value (previous pulse), XPPAGC and XOPAGC computed, and a flag (ISSERR) set for the Fortran main program.
**RANGE BIAS (TRBIAS)**

TRBIAS is computed from 8 range bias words \([\text{RBIAS} (1) - \text{RBIAS} (8)]\) as follows:

<table>
<thead>
<tr>
<th>NB Data</th>
<th>Track</th>
<th>TRBIAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC</td>
<td>Centroid</td>
<td>\text{RBIAS} (1)</td>
</tr>
<tr>
<td>LC or RC</td>
<td>Leading edge</td>
<td>\text{RBIAS} (1) + \text{RBIAS} (2)</td>
</tr>
<tr>
<td>LC or RC</td>
<td>Trailing edge</td>
<td>\text{RBIAS} (1) + \text{RBIAS} (3)</td>
</tr>
<tr>
<td>RC</td>
<td>Centroid</td>
<td>\text{RBIAS} (1) + \text{RBIAS} (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WB Data</th>
<th>Slow Switch</th>
<th>Attenuator</th>
<th>TRBIAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC</td>
<td>Inactive</td>
<td>\text{RBIAS} (5)</td>
<td></td>
</tr>
<tr>
<td>RC</td>
<td>Inactive</td>
<td>\text{RBIAS} (5) + \text{RBIAS} (6)</td>
<td></td>
</tr>
<tr>
<td>LC</td>
<td>Active</td>
<td>\text{RBIAS} (5) + \text{RBIAS} (7)</td>
<td></td>
</tr>
<tr>
<td>RC</td>
<td>Active</td>
<td>\text{RBIAS} (5) + \text{RBIAS} (8)</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F
PRF DETERMINATION

IPRF is the PRF for the particular waveform on the tape and is computed as follows:

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Waveform</th>
<th>IPRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB</td>
<td>DBLT</td>
<td>PRF/4</td>
</tr>
<tr>
<td>NB</td>
<td>SDBLT</td>
<td>PRF/4</td>
</tr>
<tr>
<td>NB</td>
<td>WBS</td>
<td>PRF/4</td>
</tr>
<tr>
<td>NB</td>
<td>WB</td>
<td>PRF/2</td>
</tr>
<tr>
<td>NB</td>
<td>NB</td>
<td>PRF##</td>
</tr>
<tr>
<td>WB</td>
<td>WB</td>
<td>PRF/2</td>
</tr>
<tr>
<td>WB</td>
<td>DBLT</td>
<td>PRF/2</td>
</tr>
<tr>
<td>WB</td>
<td>WBS</td>
<td>PRF/2</td>
</tr>
<tr>
<td>WB</td>
<td>SDBLT</td>
<td>PRF/4</td>
</tr>
</tbody>
</table>

# ALCOR waveforms are shown in Fig. 1.

## When in this mode the ADT may contain every pulse or, more frequently, every other pulse.
FIGURE 1
ALCOR WAVEFORMS

Waveform

<table>
<thead>
<tr>
<th>I  (NB)</th>
<th>NB</th>
<th>NB</th>
<th>NB</th>
<th>NB</th>
<th>NB</th>
<th>NB</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>II (WB)</th>
<th>NB</th>
<th>WB</th>
<th>NB</th>
<th>WB</th>
<th>NB</th>
<th>NB</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>III (WBS)</th>
<th>NB</th>
<th>WB</th>
<th>WBS</th>
<th>WB</th>
<th>NB</th>
</tr>
</thead>
<tbody>
<tr>
<td>T (ms)</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
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<table>
<thead>
<tr>
<th>IV (DBLT)</th>
<th>NB</th>
<th>DBLT</th>
<th>P</th>
<th>DBLT</th>
<th>NB</th>
</tr>
</thead>
<tbody>
<tr>
<td>T (ms)</td>
<td>0</td>
<td>6.25</td>
<td>12.50</td>
<td>18.75</td>
<td>25.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V (SDBLT)</th>
<th>NB</th>
<th>DBLT</th>
<th>P</th>
<th>SDBLT</th>
<th>NB</th>
</tr>
</thead>
<tbody>
<tr>
<td>T (ms)</td>
<td>0</td>
<td>6.25</td>
<td>12.50</td>
<td>18.75</td>
<td>25.00</td>
</tr>
</tbody>
</table>

NOTES
1. All waveforms are shown at maximum system PRF.
2. Wide band pulse doublet leading edge to leading edge spacing is 23.2 μs.
3. The phantom pulse (P) is an imaginary pulse inserted by the Real Time Program for timing considerations. This pulse is not found on the ADT.