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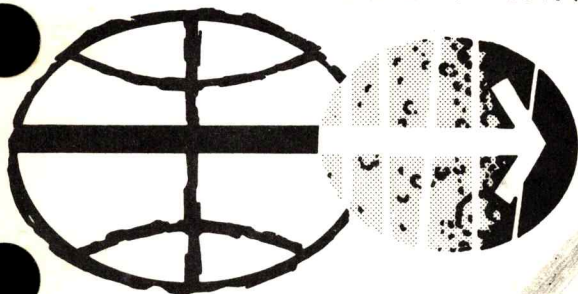
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CISLUNAR ONBOARD
NAVIGATION DATA FOR APOLLO 17
LAUNCH DECEMBER 6, 1972, C.S.T.
(DECEMBER 7, 1972, G.M.T.)

Mathematical Physics Branch

MISSION PLANNING AND ANALYSIS DIVISION



MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

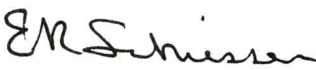
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PROJECT APOLLO

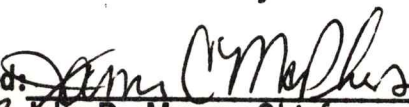
CISLUNAR ONBOARD NAVIGATION DATA FOR APOLLO 17 LAUNCH
DECEMBER 6, 1972, C.S.T.
(DECEMBER 7, 1972, G.M.T.)

By Flora B. Lowes, Mathematical Physics Branch,
and F. L. Barnes and B. A. Kinsler, TRW Systems Group

MISSION PLANNING AND ANALYSIS DIVISION
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1.0 INTRODUCTION

This document presents the loss-of-communications navigation procedures and sighting schedules to be included in the command and service module (CSM) contingency checklist and the Apollo 17 flight plan. These data apply to the December 7, 1972, launch date. Star availability plots are also presented for the pertinent dates (figs. 1 through 3).

The data are divided into two sections as follows:

- a. Loss-of-communication navigation procedures and sighting schedules.
- b. Star availability plots

2.0 LOSS OF COMMUNICATION NAVIGATION PROCEDURES

GENERAL RULES

- 1 A sighting or set is to consist of three marks.
- 2 Calibrate optics at the beginning of each batch and every half hour while navigation sightings in progress if the remaining sightings require more than 30 minutes to complete. The sextant calibration will be repeated until agreement of at least two checks (not necessarily sequential ones) are within 1 bit ($.003^\circ$).
- 3 All attitude control should be done using coupled RCS thruster pairs.
- 4 See loss of comm midcourse procedures for maneuver times
- 5 While in P23 V06N49 display:
If $\Delta R > 50$ nm, Or $\Delta V > 50$ fps;
Reject mark, reselect star and horizon,
verify procedures, and repeat mark.

If large correction recurs, accept.

Large ΔR , ΔV values may be expected at the following times:

At initiation of tracking (first mark of each star of first batch).

At first switch of reference bodies.

After long periods between sightings.

Last hours before EI.

6 Loss of W-Matrix after initiation of navigation sightings:

(a) Upon loss of W-Matrix, current onboard state vector is retained.

(b) W-Matrix Reinitialization and Navigation Procedures

(1) Sightings Not in Progress:

Before next batch, reinitialize W-Matrix. V67
V06N99 Load values shown in tables.

Continue Navigation

(2) Sightings In Progress:

Immediately reinitialize W-Matrix, V67
V06N99 Load values shown in tables.

Restart interrupted batch of navigation sightings.

Continue navigation

GENERAL PROCEDURE

- 1 If entry pad previously received, no tracking performed
If not, proceed.
- 2 Execute abort - if required (unless comm loss during nominal TEC).
- 3 Reinitialize W-Matrix, V67 (diagonal values, V06N99, from tables)
- 4 Determine return-time
- 5 Select navigation schedule (see tables). If table I, II, or III are not applicable, refer to do-it-yourself rules.
- 6 Select starting batch
first navigation sightings to use stars corresponding to navigation schedule time first occurring after abort.
- 7 Alternate sightings are provided in the event the preferred sighting cannot be performed.

GENERAL PROCEDURE (CONTINUED)

- 8 After each batch (or two batches if the batches are back to back), determine entry time from P37 by calling N38 after integration has been completed and before proceeding on the lat, long display.
- 9 Determine and record Hp using routine 30 V82 N44 by specifying the time load equal to entry time determined in above step.
- 10 The state vector from each previous batch of P23 sightings is retained in the LM state vector slot until the navigator has determined the current batch to be acceptable. When the state vector from the current batch has been determined to be acceptable, the state is transferred to the LM state vector slot (V66). If the batch is unacceptable, use V47 to transfer the good state vector from the LM slot to the CSM slot (do no reinitialize the W-matrix) and repeat current batch.

DO-IT-YOURSELF PECULIAR RULES

- 1 Reinitialize W-Matrix and schedule a tracking interval as soon as possible after the abort burn; or in the case of the lunar flyby, about 1 hour after perilune. If sightings are performed translunar for any reason, reinitialize the W-Matrix 1 hour after perilune for trans-earth sightings. W-Matrix values are given in tables IV-1 and 2 for each return type.
- 2 A batch is to consist of at least three star/horizon sightings, although as many as five can be advantageous, particularly following a sleep period.
- 3 All available stars should be used in the sighting schedule. No more than three marks should be taken on a star within a batch of data.
- 4 Sightings during the last 10 hours before entry interface are important. Five earth horizon sightings should be scheduled at EI-5 hours and three earth horizon sightings should be scheduled following the MCC at EI-3 hours. If no earth horizon sightings are available, lunar horizon sightings should be used.

- 5 Whenever possible, the navigation batches should be scheduled so that, immediately following a time period of length Δt (not to exceed 3 hours) in a non-PTC mode, five times Δt should be spent in a PTC mode (thermal constraints). This rule will be violated most frequently in the following situations: (1) aborts from a translunar trajectory with short return lengths, (2) time critical aborts, (3) the 10-hour period before entry interface.
- 6 If possible, both near and far horizons should be included in each batch of data.
- 7 Star availability is related to GMT not GET. Therefore, as a clue to determine star availability, refer to either Table I, II or III which has a GMT for entry corresponding to your GMT for entry. In addition, the star charts should be used to select available stars.
- 8 Go to Table IV.

TABLE I.- LIFT-OFF + 8 HR ABORT

W-MATRIX REINITIALIZATION

R1 + 80000
 R2 + 00070
 R3 + 00003

NAVIGATION SCHEDULE

ΔT to EI < 29 hrs, TABLE I(a)
 ΔT to EI > 29 hrs, TABLE I(b)

TABLE I(a)

Sighting Schedule for Abort from Translunar
 Coast at 8:00 Hours GET, Apollo 17
 December 7, 1972 Launch Date (GMT)
 Short Return (Less than 29 Hours)
 (GMT of EI = 8 December 1972, 11 Hours)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 11.0	16 PROCYON	EF	00120
	23 DENEbola	EN	00110
	22 REGULUS	EN	00110
	50 POLLUX	EF	00120
	67 CASTOR	EF	00120
EI - 9.0	22 REGULUS	EN	00110
	16 PROCYON	EF	00120
	50 POLLUX	EF	00120
	*67 CASTOR	EF	00120
	*23 DENEbola	EN	00110
EI - 7.0	50 POLLUX	EF	00120
	24 GIENAH	EN	00110
	153	EN	00110
	*16 PROCYON	EF	00120
	*156	EN	00110
EI - 5.0	23 DENEbola	EN	00110
	160	EN	00110
	156	EN	00110
	24 GIENAH	EN	00110
	154	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE I(a)

Sighting Schedule for Abort from Translunar
Coast at 8:00 Hours GET, Apollo 17
December 7, 1972 Launch Date (GMT)
Short Return (Less than 29 Hours)
(GMT of EI = 8 December 1972, 11 Hours)
(Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 2.5	22 REGULUS	EF	00120
	154	EN	00110
	26 SPICA	EN	00110
	*31 ARCTURUS	EN	00110
	*161	EN	00110

TABLE I(b)

Sighting Schedule for Abort from Translunar
Coast at 8:00 Hours GET, Apollo 17
December 7, 1972 Launch Date (GMT)
Long Return (Greater than 29 Hours)
(GMT of EI = 9 December 1972, 12 Hours)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 13.0	50 POLLUX	EF	00120
	24 GIENAH	EN	00110
	156	EN	00110
	16 PROCYON	EF	00120
	153	EN	00110
EI - 11.0	50 POLLUX	EF	00120
	24 GIENAH	EN	00110
	153	EN	00110
	*16 PROCYON	EF	00120
	*156	EN	00110
EI - 9.0	153	EN	00110
	16 PROCYON	EF	00120
	24 GIENAH	EN	00110
	*154	EN	00110
	*156	EN	00110
EI - 7.0	21 ALPHARD	EF	00120
	26 SPICA	EN	00110
	24 GIENAH	EN	00110
	*154	EN	00110
	*156	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE I(b)

Sighting Schedule for Abort from Translunar
Coast at 8:00 Hours GET, Apollo 17
December 7, 1972 Launch Date (GMT)
Long Return (Greater than 29 Hours)
(GMT of EI = 9 December 1972, 12 Hours)
(Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 5.0	21 ALPHARD	EF	00120
	26 SPICA	EN	00110
	24 GIENAH	EN	00110
	154	EN	00110
	22 REGULUS	EF	00120
EI - 2.5	31 ARCTURUS	EN	00110
	26 SPICA	EN	00110
	30 MENKENT	EN	00110
	*161	EN	00110
	*53	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II.- ABORTS FROM LUNAR ORBIT

A. ABORTS BECAUSE OF LOSS OF COMM

W-MATRIX REINITIALIZATION

R1 +30000
 R2 +00300
 R3 +00003

NAVIGATION SCHEDULE

GMT RETURN ON DECEMBER 16, TABLE II(a)
 GMT RETURN ON DECEMBER 17, TABLE II(b)
 GMT RETURN ON DECEMBER 18, TABLE II(c)
 GMT RETURN ON DECEMBER 19, TABLE II(d)

B. COMM LOSS AFTER ABORT FROM LUNAR ORBIT

W-MATRIX REINITIALIZATION

a. COMM LOSS PRIOR TO TIME FOR NAV STG
BATCH 1

R1 + 30000
 R2 + 00300
 R3 + 00003

b. COMM LOSS AFTER TIME FOR BATCH 1
AND NO SV UPDATE AFTER TEI

R1 + 99000
 R2 + 00020
 R3 + 00003

c. COMM LOSS AFTER TIME FOR BATCH 1
AND AT LEAST ONE SV UPDATE AFTER TEI

R1 + 45000
 R2 + 00006
 R3 + 00003

NAVIGATION SCHEDULE

GMT EI DECEMBER 16, TABLE II(a)
 GMT EI DECEMBER 17, TABLE II(b)
 GMT EI DECEMBER 18, TABLE II(c)
 GMT EI DECEMBER 19, TABLE II(d)

GMT NOT COVERED BY ABOVE, GO
 TO "DO-IT-YOURSELF", TABLE IV.

TABLE II(a)

Sighting Schedule for Abort from Lunar Orbit
 (GMT of EI = 16 December 1972, 15 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
TEI + 2.0	7 MENKAR	MN	00210
	226	MN	00210
	131	MN	00210
	46 HAMAL	MN	00210
	55 BETELGEUSE	MF	00220
TEI + 14.0	12 RIGEL	MF	00220
	60 EL NATH	MF	00220
	226	MN	00210
	*7 MENKAR	MN	00210
	*106 MENKALINAN	MF	00220
TEI + 14.5	24 GIENAH	EN	00110
	156	EN	00110
	23 DENEbola	EN	00110
TEI + 18.0 (SAME AS TEI + 14.5)	24 GIENAH	EN	00110
	156	EN	00110
	23 DENEbola	EN	00110
TEI + 27.0 (SAME AS TEI + 18.0)	24 GIENAH	EN	00110
	156	EN	00110
	23 DENEbola	EN	00110
EI - 29.0	160	EN	00110
	22 REGULUS	EF	00120
	151	EF	00120
	*154	EN	00110
	*24 GIENAH	EN	00110
EI - 23.0 (SAME AS EI - 29.0)	160	EN	00110
	22 REGULUS	EF	00120
	151	EF	00120
	*154	EN	00110
	*24 GIENAH	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(a)

Sighting Schedule for Abort from Lunar Orbit
 (GMT of EI = 16 December 1972, 15 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)
 (Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 21.0	21 ALPHARD	EF	00120
	22 REGULUS	EF	00120
	152	EN	00110
	*151	EF	00120
	*154	EN	00110
EI - 15.5	21 ALPHARD	EF	00120
	22 REGULUS	EF	00120
	152	EN	00110
	*151	EF	00120
	*154	EN	00110
EI - 5.0	26 SPICA	EN	00110
	21 ALPHARD	EF	00120
	53	EN	00110
	72 GACRUX	EN	00110
	25 ACRUX	EN	00110
EI - 2.5	30 MENKENT	EN	00110
	56 HADAR	EN	00110
	72 GACRUX	EN	00110
	*25 ACRUX	EN	00110
	*155	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(b)

Sighting Schedule for Abort from Lunar Orbit
 (GMT of EI = 17 December 1972, 16 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
TEI + 2.0	103 ALMACH	MN	00210
	10 MIRFAK	MN	00210
	57 BELLATRIX	MF	00220
	141	MF	00220
	136	MF	00220
TEI + 14.0	13 CAPELLA	MF	00220
	7 MENKAR	MN	00210
	226	MN	00210
	*60 EL NATH	MF	00220
	*144	MF	00220
TEI + 14.5	26 SPICA	EN	00110
	22 REGULUS	EF	00120
	151	EF	00120
	*154	EN	00110
	*24 GIENAH	EN	00110
TEI + 18.0 (SAME AS TEI + 14.5)	26 SPICA	EN	00110
	22 REGULUS	EF	00120
	151	EF	00120
	*154	EN	00110
	*24 GIENAH	EN	00110
TEI + 27.0 (SAME AS TEI + 18.0)	26 SPICA	EN	00110
	22 REGULUS	EF	00120
	151	EF	00120
	*154	EN	00110
	*24 GIENAH	EN	00110
EI - 29.0	21 ALPHARD	EF	00120
	22 REGULUS	EF	00120
	53	EN	00110
	*232	EN	00110
	*153	EF	00120
EI - 23.0	26 SPICA	EN	00110
	153	EF	00120
	53	EN	00110
	*232	EN	00110
	*161	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(b)

Sighting Schedule for Abort from Lunar Orbit
 (GMT of EI = 17 December 1972, 16 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)
 (Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 21.0	26 SPICA	EN	00110
(SAME AS	153	EF	00120
EI - 23.0)	53	EN	00110
	*232	EN	00110
	*161	EN	00110
EI - 15.5	72 GACRUX	EN	00110
	53	EN	00110
	26 SPICA	EN	00110
	*30 MENKENT	EN	00110
	*154	EN	00110
EI - 5.0	30 MENKENT	EN	00110
	166	EN	00110
	54 RIGIL KENT	EN	00110
	162	EN	00110
	56 HADAR	EN	00110
EI - 2.5	233	EN	00110
	166	EN	00110
	173	EN	00110
	*170 ZUBEN'UBI	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(c)

Sightings Schedule for Abort from Lunar Orbit
 (GMT of EI = 18 December 1972, 17 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
TEI + 2.0	16 PROCYON	MN	00210
	11 ALDEBARAN	MF	00220
	142	MF	00220
	57 BELLATRIX	MF	00220
	55 BETELGEUSE	MF	00220
TEI + 14.0	106 MENKALINAN	MF	00220
	60 EL NATH	MF	00220
	140	MN	00210
	*137	MN	00210
	*144	MF	00220
TEI + 14.5	23 DENEbola	EF	00120
	153	EF	00120
	26 SPICA	EN	00110
	*165	EN	00110
	*30 MENKENT	EN	00110
TEI + 18.0	26 SPICA	EN	00110
	153	EF	00120
	23 DENEbola	EF	00120
	*30 MENKENT	EN	00110
	*161	EN	00110
TEI + 27.0 (SAME AS TEI + 18.0)	26 SPICA	EN	00110
	153	EF	00120
	23 DENEbola	EF	00120
	*30 MENKENT	EN	00110
	*161	EN	00110
EI - 29.0	26 SPICA	EN	00110
	23 DENEbola	EF	00120
	162	EN	00110
	*161	EN	00110
	*30 MENKENT	EN	00110
EI - 23.0	24 GIENAH	EF	00120
	23 DENEbola	EF	00120
	56 HADAR	EN	00110
	*161	EN	00110
	*162	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(c)

Sightings Schedule for Abort from Lunar Orbit
 (GMT of EI = 18 December 1972, 17 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)
 (Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 21.0	24 GIENAH	EF	00120
(SAME AS	23 DENEbola	EF	00120
EI - 23.0)	56 HADAR	EN	00110
	*161	EN	00110
	*162	EN	00110
EI - 15.5	172	EN	00110
	54 RIGIL KENT	EN	00110
	56 HADAR	EN	00110
	*162	EN	00110
	*24 GIENAH	EF	00120
EI - 5.0	33 ANTARES	EN	00110
	154	EF	00120
	165	EN	00110
	24 GIENAH	EF	00120
	166	EN	00110
EI - 2.5	205	EN	00110
	76	EN	00110
	232	EF	00120
	*33 ANTARES	EN	00110
	*207	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(d)

Sighting Schedule for Abort from Lunar Orbit
 (GMT of EI = 19 December 1972, 18 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
TEI + 2.0	64 ALHENA	MF	00220
	22 REGULUS	MN	00210
	144	MF	00220
	21 ALPHARD	MN	00210
	106 MENKALINAN	MF	00220
TEI + 14.0	16 PROCYON	MN	00210
	11 ALDEBARAN	MF	00220
	50 POLLUX	MN	00210
	*57 BELLATRIX	MF	00220
	*142	MF	00220
TEI + 14.5	24 GIENAH	EF	00120
	173	EN	00110
	171	EN	00110
	*165	EN	00110
	*124	EN	00110
TEI + 18.0 (SAME AS TEI + 14.5)	24 GIENAH	EF	00120
	173	EN	00110
	171	EN	00110
	*165	EN	00110
	*124	EN	00110
TEI + 27.0	24 GIENAH	EF	00120
	124	EN	00110
	173	EN	00110
	*171	EN	00110
	*165	EN	00110
EI - 29.0	174	EN	00110
	33 ANTARES	EN	00110
	156	EF	00120
	*175	EN	00110
	*124	EN	00110
EI - 23.0	174	EN	00110
	33 ANTARES	EN	00110
	156	EF	00120
	*125	EN	00110
	*124	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE II(d)

Sighting Schedule for Abort from Lunar Orbit
 (GMT of EI = 19 December 1972, 18 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)
 (Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
EI - 21.0	174	EN	00110
(SAME AS	33 ANTARES	EN	00110
EI - 23.0)	156	EF	00120
	*125	EN	00110
	*124	EN	00110
EI - 15.5	174	EN	00110
	33 ANTARES	EN	00110
	26 SPICA	EF	00120
	*156	EF	00120
	*124	EN	00110
EI - 5.0	53	EF	00120
	33 ANTARES	EN	00110
	127	EN	00110
	76	EN	00110
	207	EN	00110
EI - 2.5	11 ALDEBARAN	MN	00210
	46 HAMAL	MN	00210
	16 PROCYON	MF	00220
	*64 ALHENA	MF	00220
	*50 POLLUX	MF	00220

* Alternate stars - to be used if other sightings cannot be made.

TABLE III.- COMM LOSS DURING NOMINAL TEC

W-MATRIX REINITIALIZATION

- a. COMM LOSS PRIOR TO TIME FOR NAV STG BATCH 1
 R1 + 30000
 R2 + 00300
 R3 + 00003
- b. COMM LOSS AFTER TIME FOR NAV STG BATCH 1
AND NO SV UPDATE AFTER TEI
 R1 + 99000
 R2 + 00020
 R3 + 00003
- c. COMM LOSS AFTER TIME FOR NAV STG BATCH 1
AND AT LEAST ONE SV UPDATE AFTER TEI
 R1 + 45000
 R2 + 00006
 R3 + 00003

TABLE III

Sighting Schedule for Nominal Transearth Coast
 (GMT of EI = 19 December 1972, 19 Hours)
 Apollo 17, December 7, 1972 Launch Date (GMT)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
TEI + 2.0	55 BETELGEUSE	MF	00220
	64 ALHENA	MF	00220
	151	MN	00210
	22 REGULUS	MN	00210
	16 PROCYON	MN	00210
TEI + 14.0	15 SIRIUS	MN	00210
	11 ALDEBARAN	MF	00220
	50 POLLUX	MN	00210
	*57 BELLATRIX	MF	00220
	*142	MF	00220
TEI + 14.5	202	EN	00110
	160	EF	00120
	165	EN	00110
	*166	EN	00110
	*171	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE III
Sighting Schedule for Nominal Transearth Coast
(GMT of EI = 19 December 1972, 19 Hours)
Apollo 17, December 7, 1972 Launch Date (GMT)
(Concluded)

<u>Time</u>	<u>Star</u>	<u>Horizon</u>	<u>R3</u>
TEI + 18.0	202	EN	00110
(SAME AS	160	EF	00120
TEI + 14.5)	165	EN	00110
	*166	EN	00110
	*171	EN	00110
TEI + 27.0	154	EF	00120
	171	EN	00110
	165	EN	00110
	*166	EN	00110
	*26 SPICA	EF	00120
EI - 29.0	202	EN	00110
	160	EF	00120
	171	EN	00110
	*205	EN	00110
	*173	EN	00110
EI - 23.0	202	EN	00110
(SAME AS	160	EF	00120
EI - 29.0)	171	EN	00110
	*205	EN	00110
	*173	EN	00110
EI - 21.0	202	EN	00110
	160	EF	00120
	171	EN	00110
	*205	EN	00110
	*26 SPICA	EF	00120
EI - 15.5	202	EN	00110
	26 SPICA	EF	00120
	171	EN	00110
	*205	EN	00110
	*173	EN	00110
EI - 5.0	207	EN	00110
	76	EN	00110
	30 MENKENT	EF	00120
	77 KAUS AUST	EN	00110
	33 ANTARES	EN	00110
EI - 2.5	207	EN	00110
	76	EN	00110
	25 ACRUX	EF	00120
	*124	EN	00110
	*77 KAUS AUST	EN	00110

* Alternate stars - to be used if other sightings cannot be made.

TABLE IV - DO-IT-YOURSELF1. ABORTS FROM TLC

W-MATRIX INITIALIZATION

R1 + 80000
 R2 + 00070
 R3 + 00003

NAVIGATION SCHEDULE

 ΔT TO EI < 20 hrs

BATCHES OF 3 SETS EVERY 2.5 hrs

BATCH OF 5 SETS AT EI-5

(BEFORE LAST MCC AT EI-3)

BATCH OF 3 SETS AFTER LAST MCC

 ΔT > 20 hrs

SLEEP PERIODS OF 8 HOURS MAY BE SCHEDULED.
 CREW SHOULD BE AWAKE LAST 10 HOURS PRIOR
 TO EI.

WHILE AWAKE:

BATCHES OF 3 SETS EVERY 3 HRS

BATCHES OF 5 SETS AFTER
 SLEEP PERIODS

BATCH OF 5 SETS PRIOR TO
 LAST MCC (AT EI-3)

BATCH OF 3 SETS AFTER LAST MCC

NOTE - ONLY STAR/EARTH HORIZON MARKS WILL BE MADE.

2. FLYBY, ABORT FROM LUNAR ORBIT, ETC.

I W-MATRIX INITIALIZATION

- a. COMM LOSS BEFORE BATCH 1
 (at TEI + 1 or perilune +1 hr)

R1 + 30000
 R2 + 00300
 R3 + 00003

TABLE IV - Continued

- b. COMM LOSS AFTER BATCH 1
(at TEI + 1 or perilune + 1 hr)
and
No SV update after TEI
R1 + 99000
R2 + 00020
R3 + 00003
- c. COMM LOSS AFTER BATCH 1
(at TEI + 1 or perilune + 1 hr)
and
At least one SV update
after TEI
R1 + 45000
R2 + 00006
R3 + 00003

II NAVIGATION SCHEDULE

A. RETURN LENGTH >70 hrs

- 1 Refer to Table III for placement of batches of star/horizon sightings and relate the times given at "TEI +" and "EI-" to the specific transearth situation. For each batch scheduled, take three marks on each available star (up to 5 stars).
- 2 Schedule three earth horizon sightings for every 5 hours between TEI + 32 and EI - 40 hours, or if an additional sleep period is needed for very slow returns, schedule five earth horizon sightings before the sleep period and five earth horizon sightings upon awakening.

TABLE IV - ContinuedB. RETURN LENGTH <70 hrs

- 1 Sleep periods of 8 hours should be provided. Astronauts should be awake the last 10 hours before entry interface.
- 2 Three sets of star horizon observations should be scheduled every three hours while awake with five sets scheduled before and after each sleep period.
 - (a) A batch of lunar horizon sightings should be taken at TEI + 1 hour or perilune + 1 hour.
 - (b) The second batch of data should consist of earth horizon sightings.
 - (c) The third batch of data should consist of lunar horizon sightings.
 - (d) The remainder of the data should be earth horizon sightings. If no earth horizon sightings are available, lunar horizon sightings should be substituted.
- 3 Five earth/horizon sets should be scheduled at EI-5 hours before the MCC at EI - 3 hours. Three sets should be taken after the midcourse. If no earth horizon sightings are available, lunar horizon sightings should be substituted.

APOLLO 17 (12/7) TLA SHORT RETURN

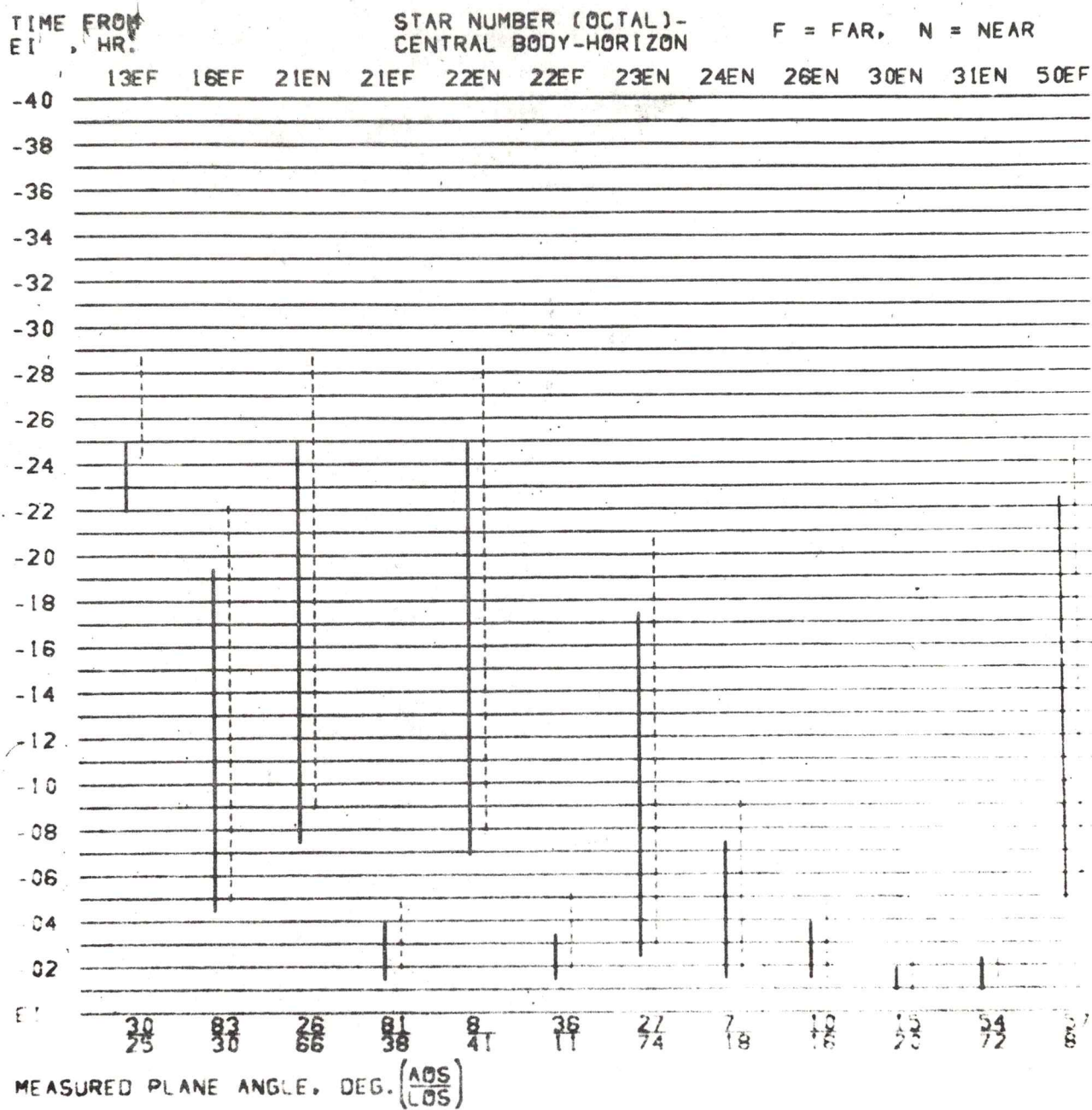


Figure I(a) Star Availability Plots for Apollo 17
Translunar Abort Trajectory at 8:00 Hours GET
Short Return (Less than 29 Hours)
December 7, 1972 Launch Date (GMT)

APOLLO 17 (12/7) TLA SHORT RETURN

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

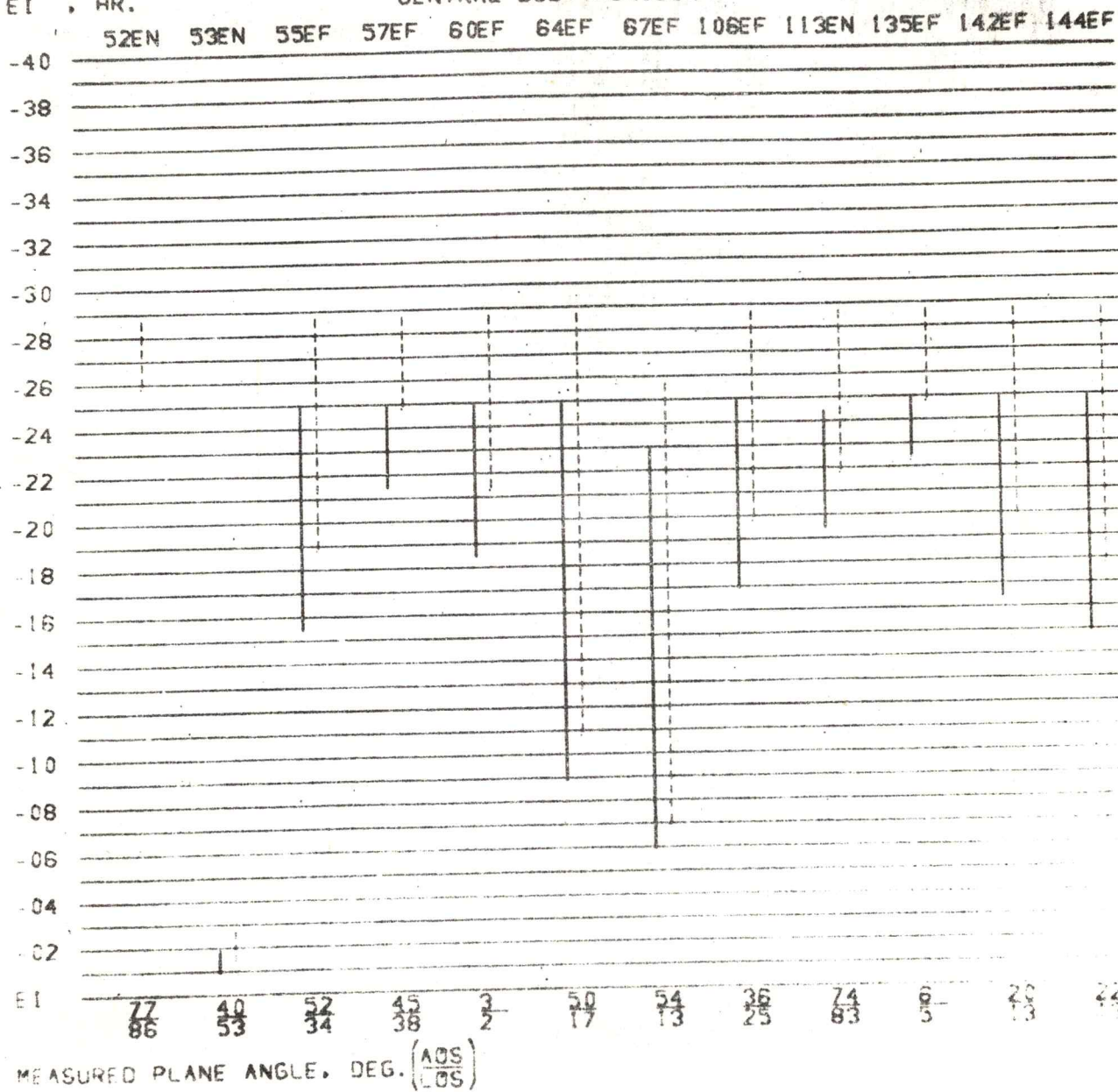


Figure I(a) (Continued)

APOLLO 17 (12/7) TLA SHORT RETURN

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

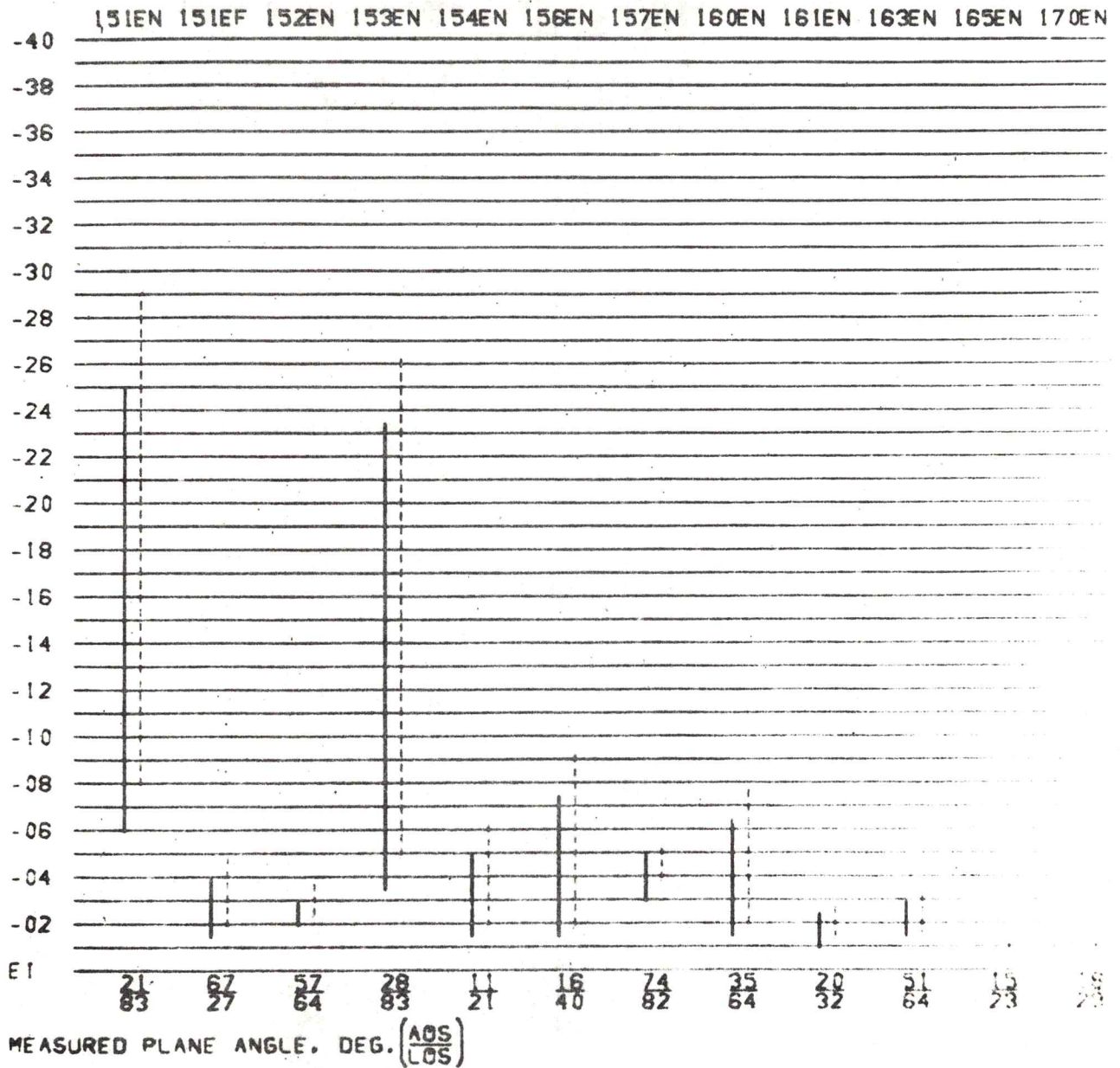


Figure I(a) (Concluded)

APOLLO 17 (12/7) TLA L

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

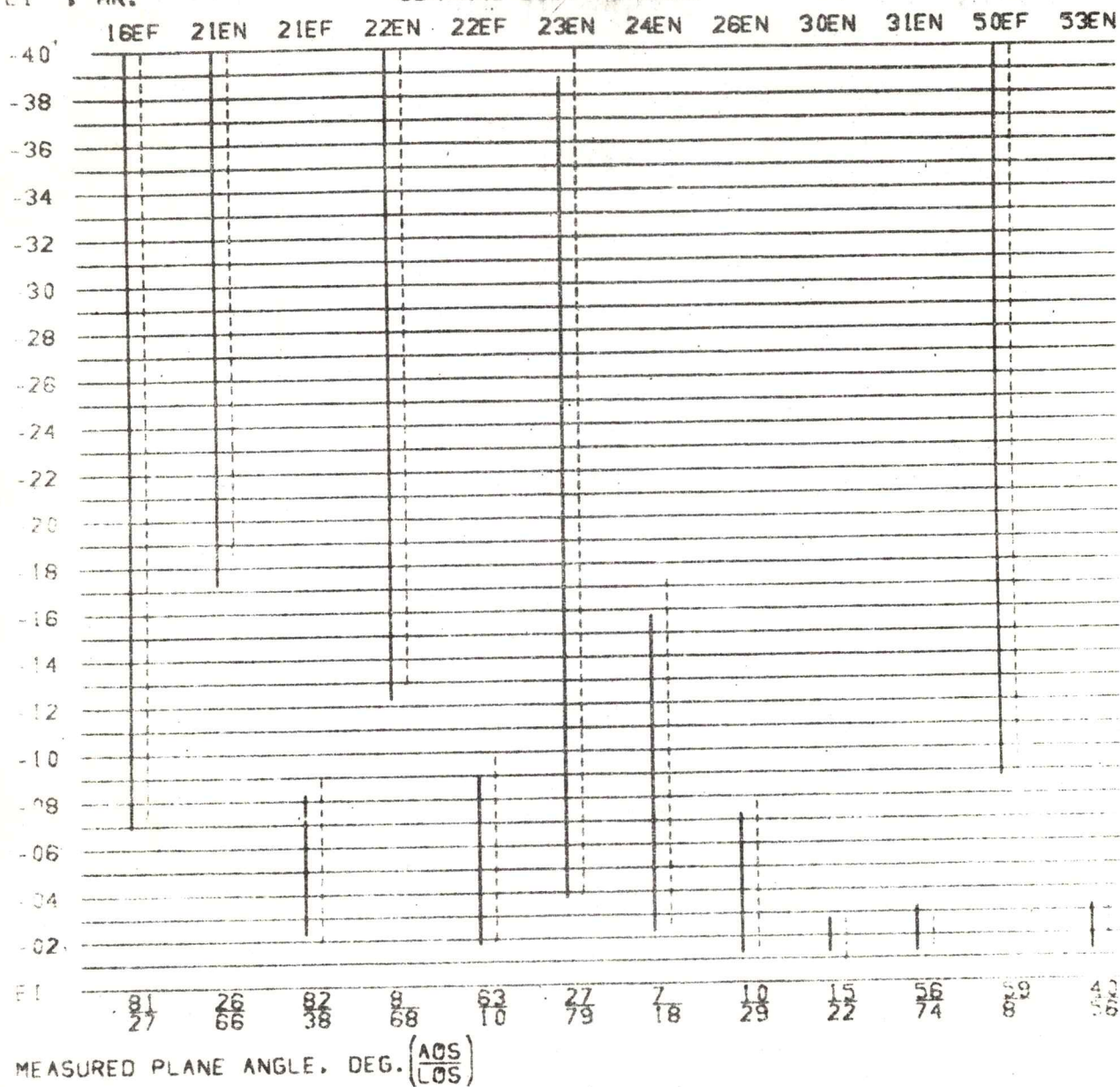


Figure I(b) Star Availability Plots for Apollo 17
Translunar Abort Trajectory at 8:00 Hours GET
Long Return (Greater than 29 Hours)
December 7, 1972 Launch Date (GMT)

APOLLO 17 (12/7) TLA L

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

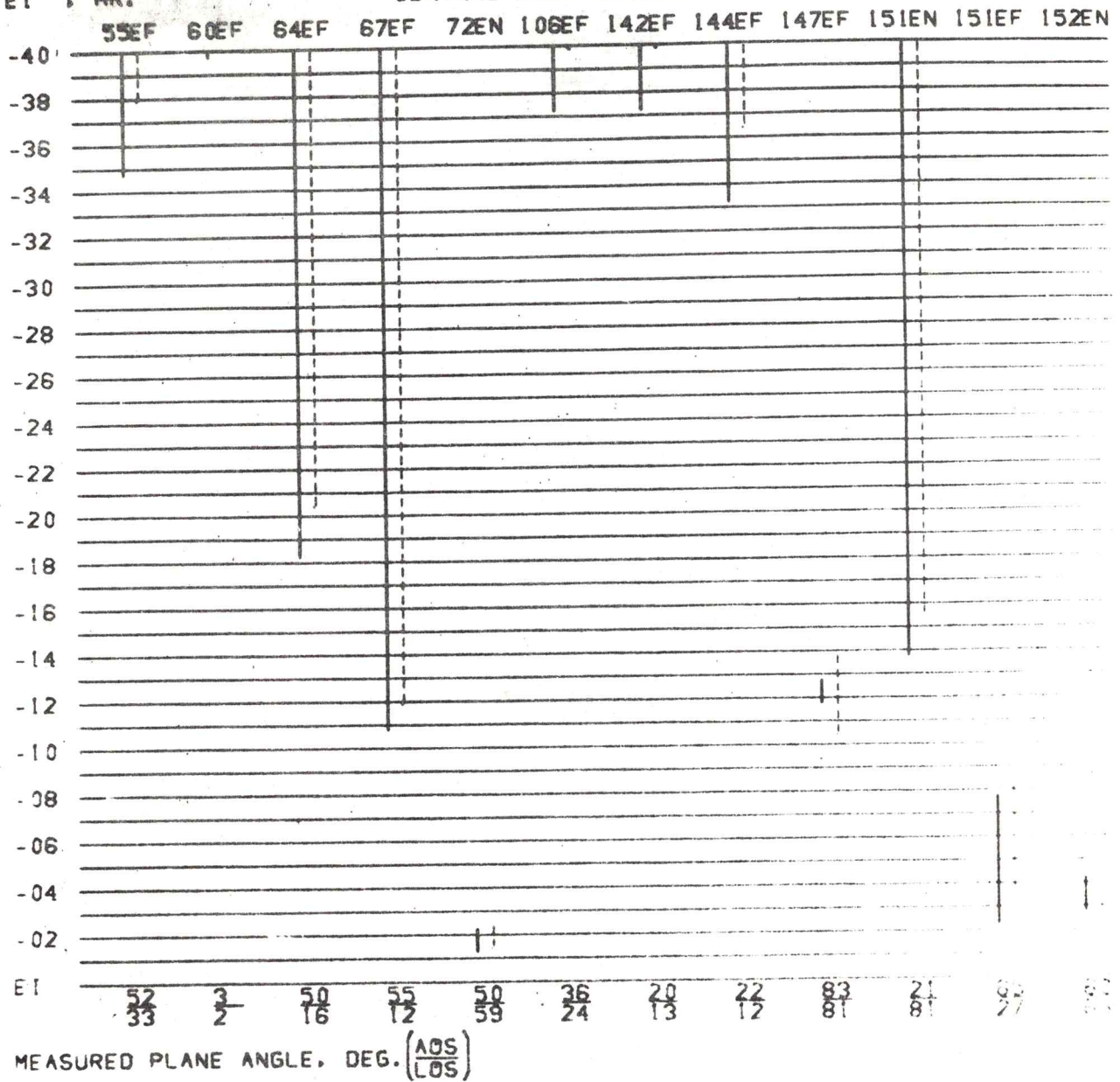


Figure I(b) (Continued)

APOLLO 17 (12/7) TLA L

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

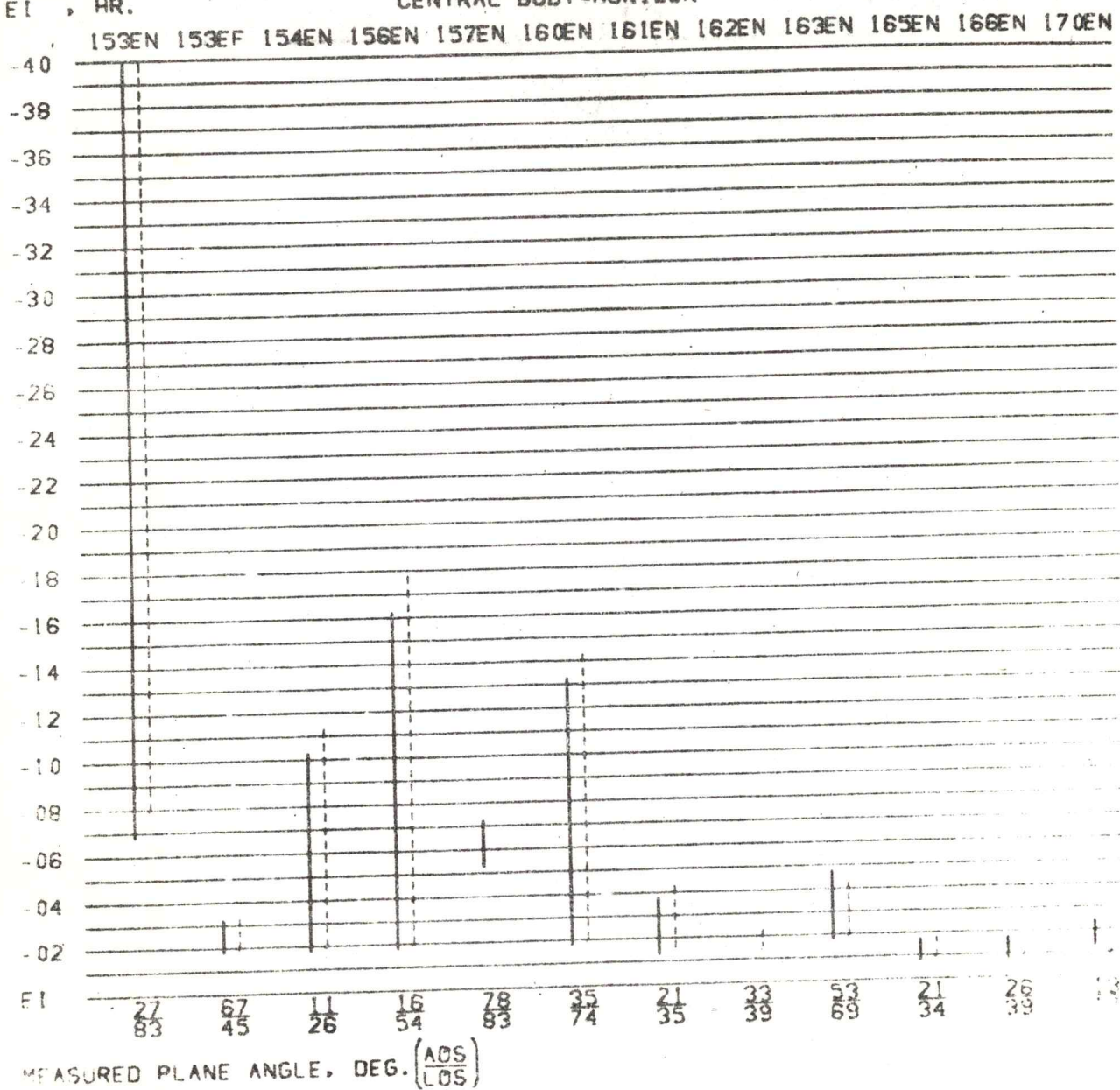


Figure I(b) (Continued)

APOLLO 17 (12/7) TLA L

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

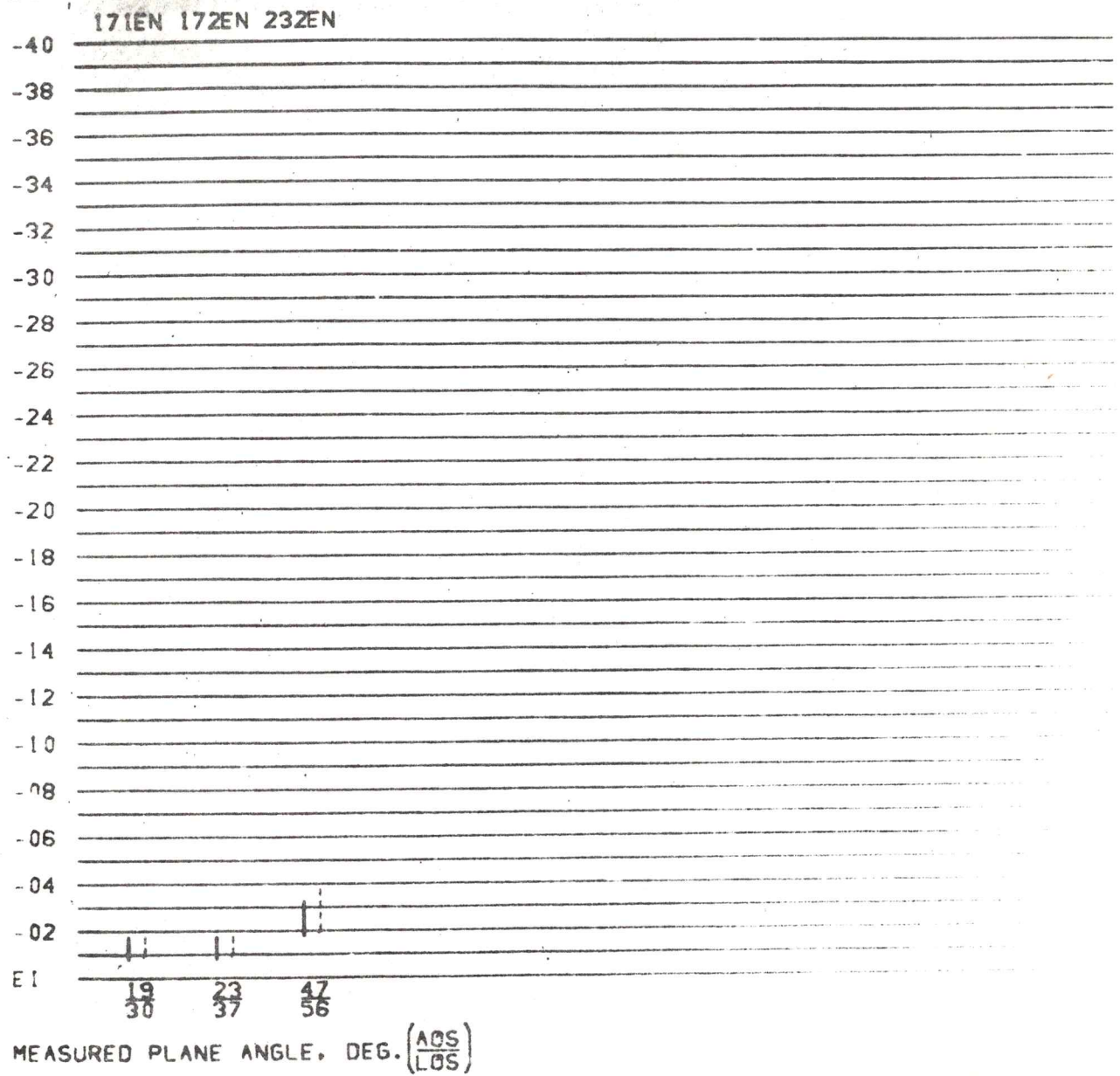


Figure I(b) (Concluded)

APOLLO 17 (12/7) LOA REV 14-28

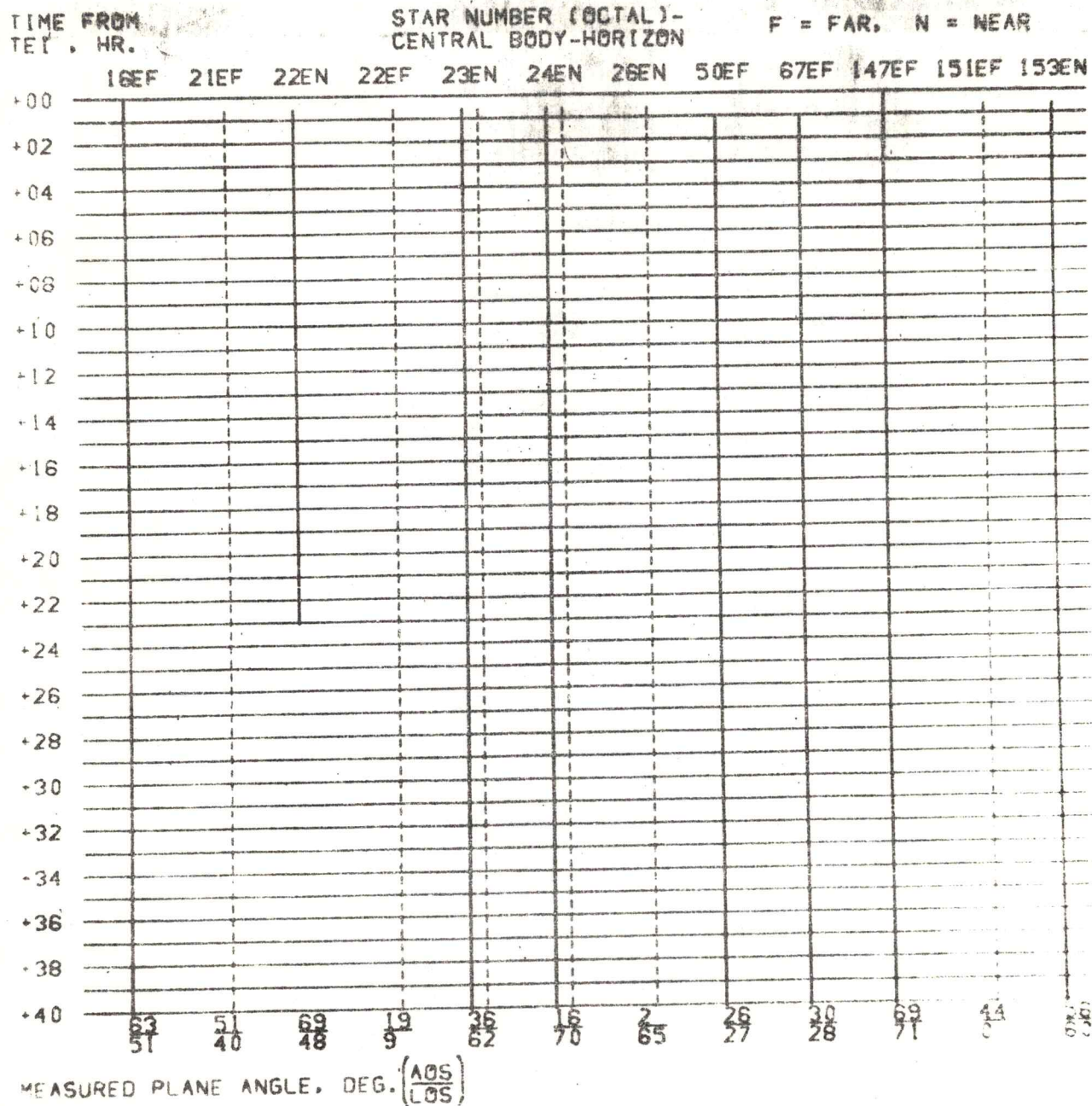


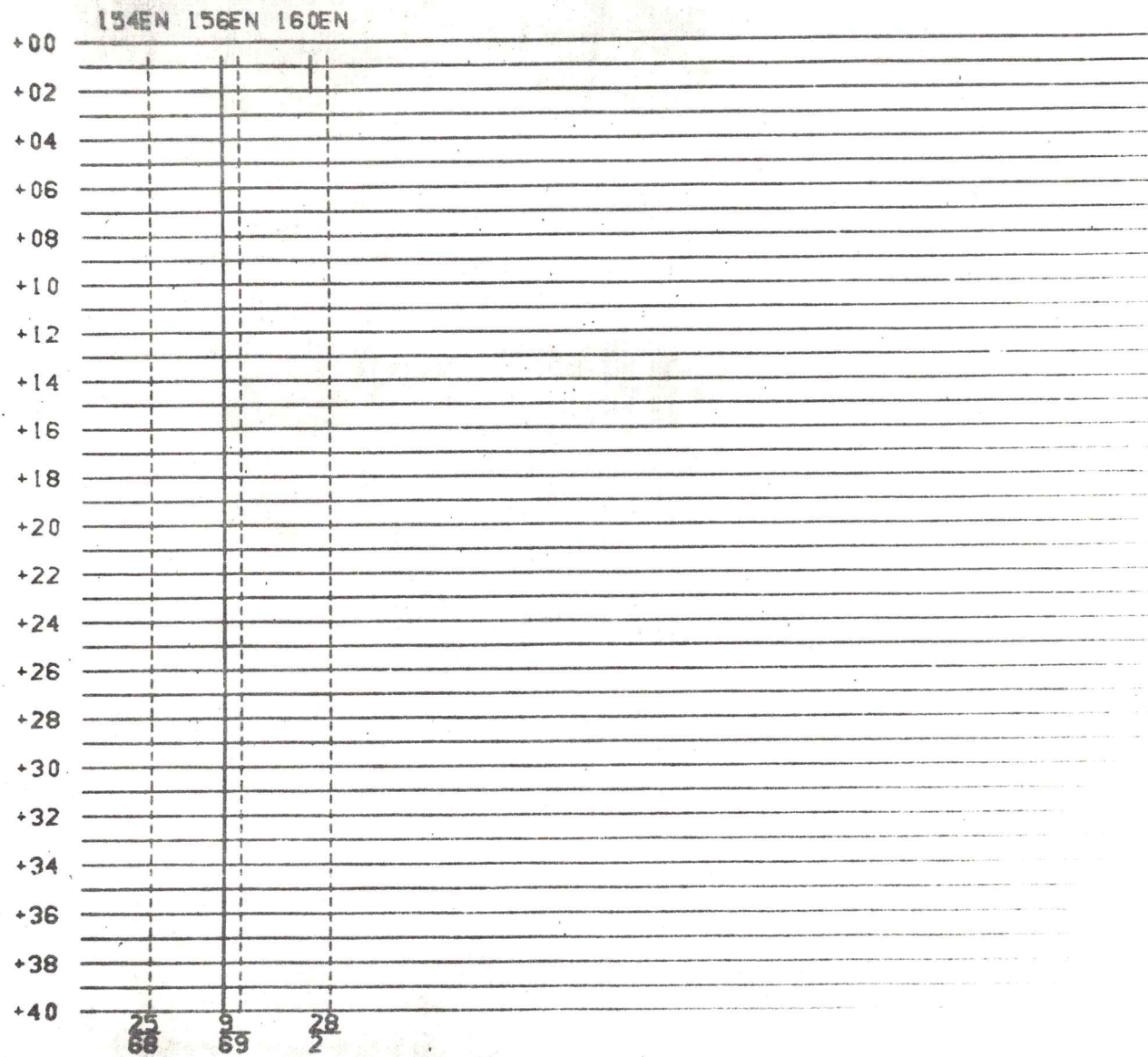
Figure II(a) Star Availability Plots for Apollo 17
Lunar Orbit Abort Trajectory
(GMT of EI = 16 December 1972, 15 Hours)
December 7, 1972 Launch Date (GMT)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
TEI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MEASURED PLANE ANGLE, DEG. $\left(\frac{AOS}{LOS} \right)$

Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

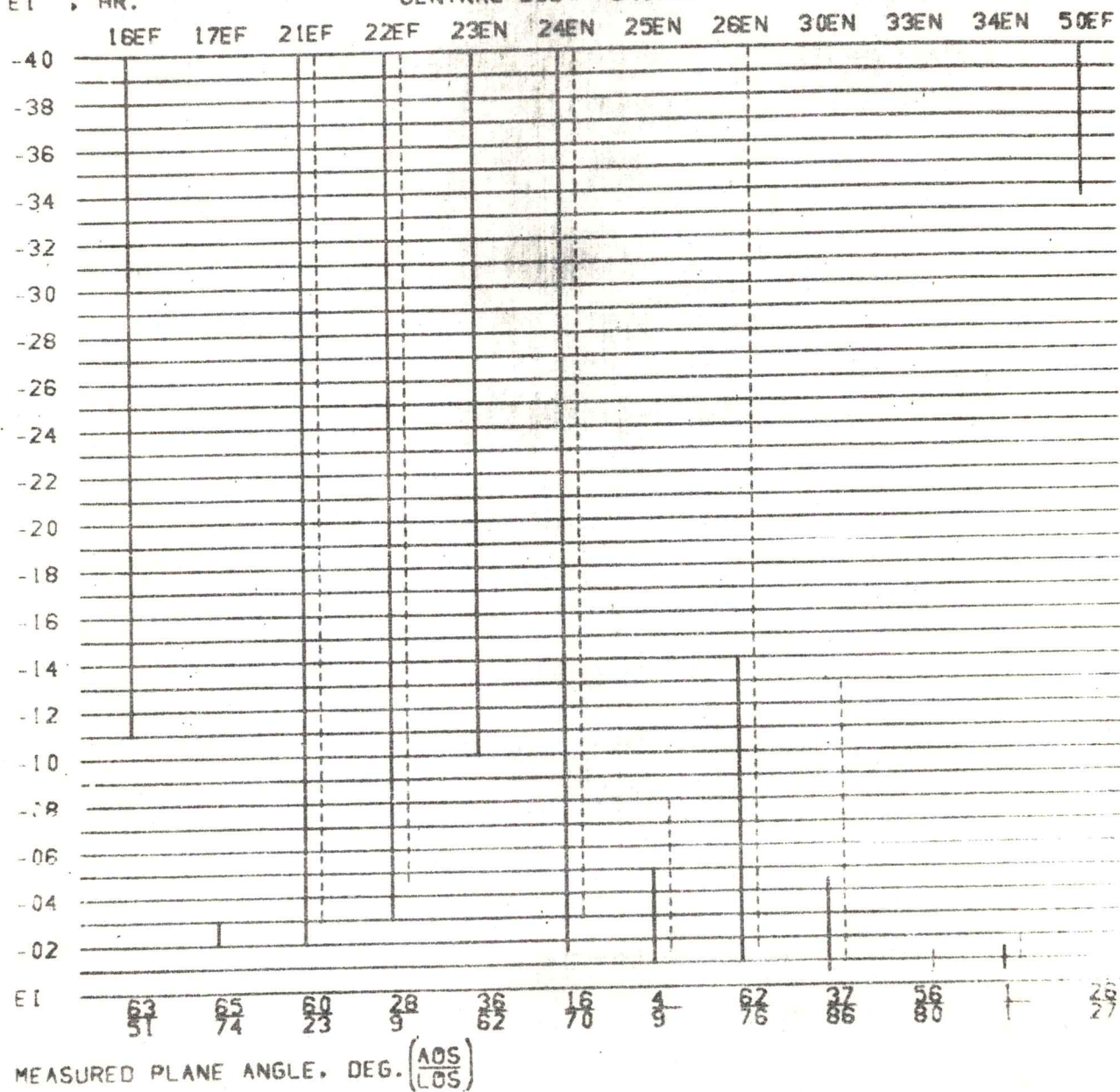


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
EI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

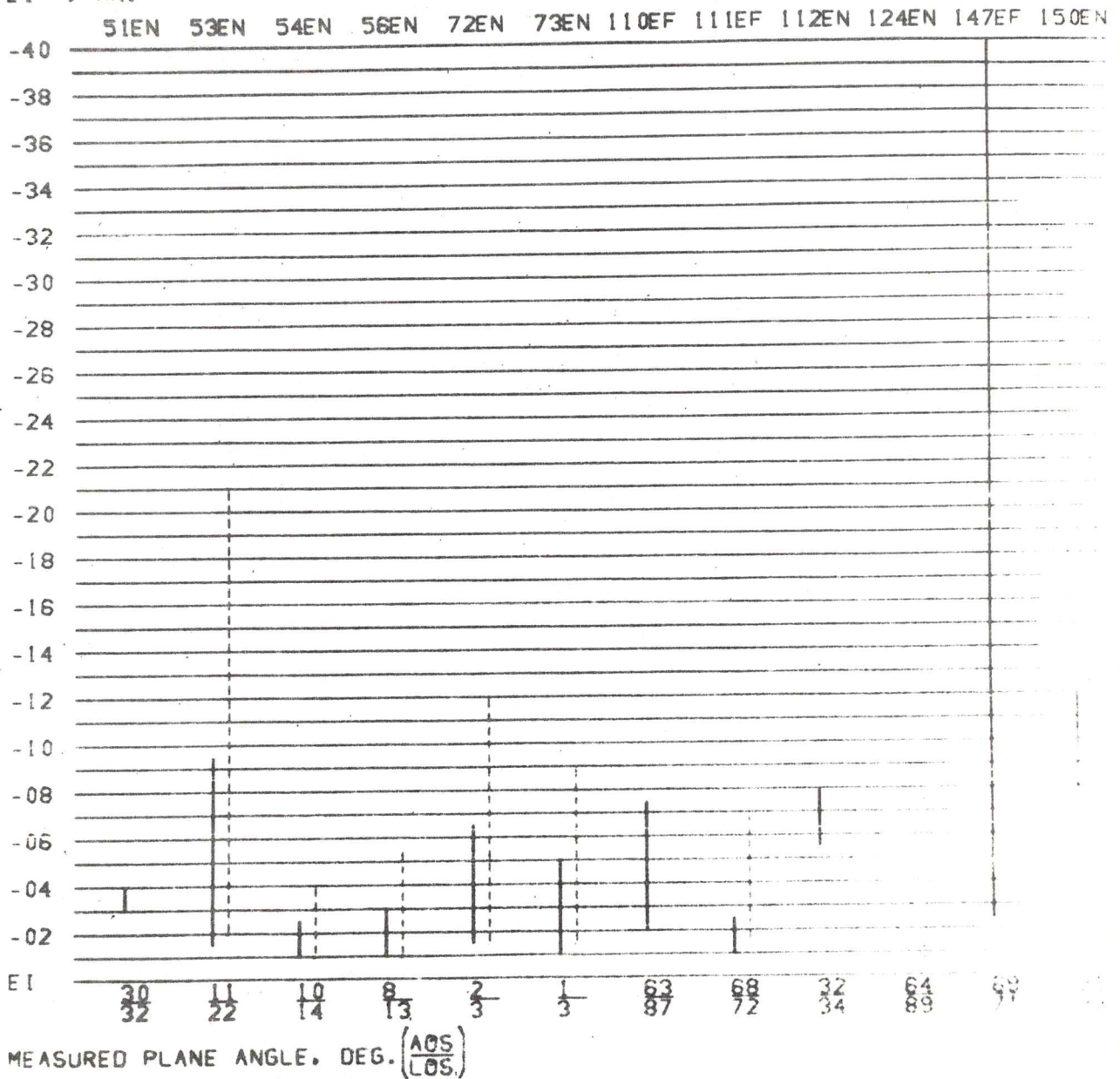


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

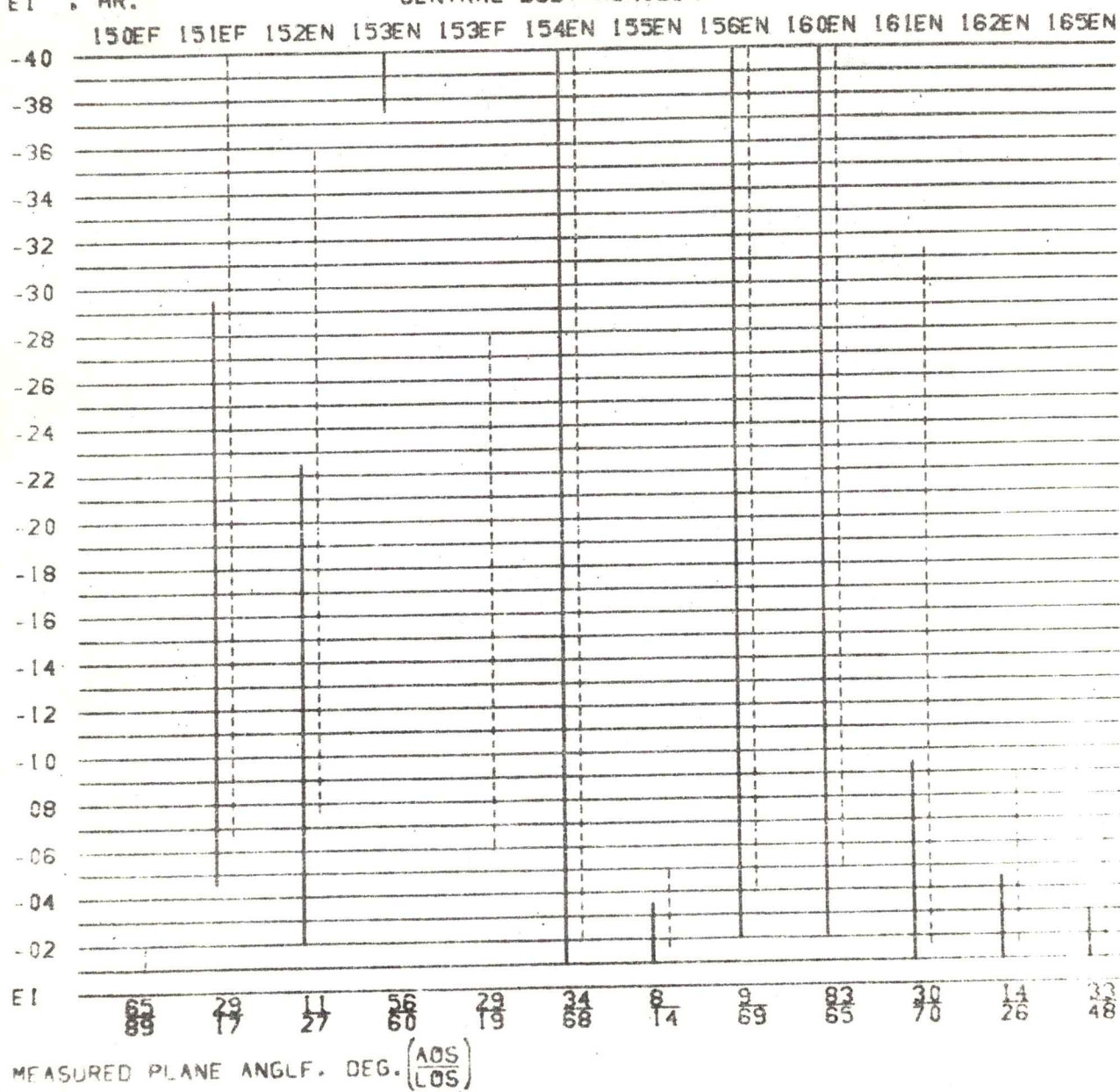


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

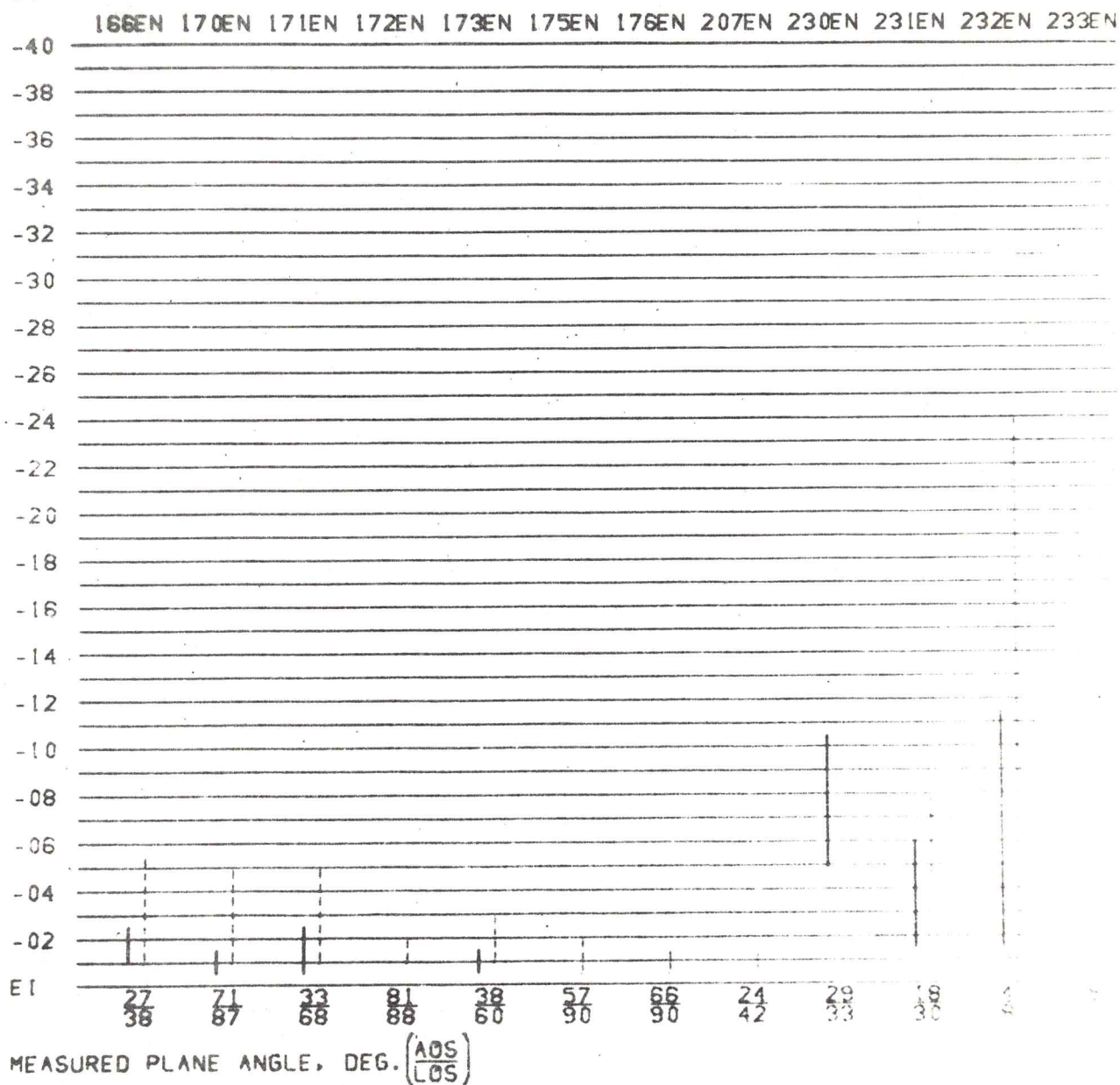


Figure II(a) (Continued)

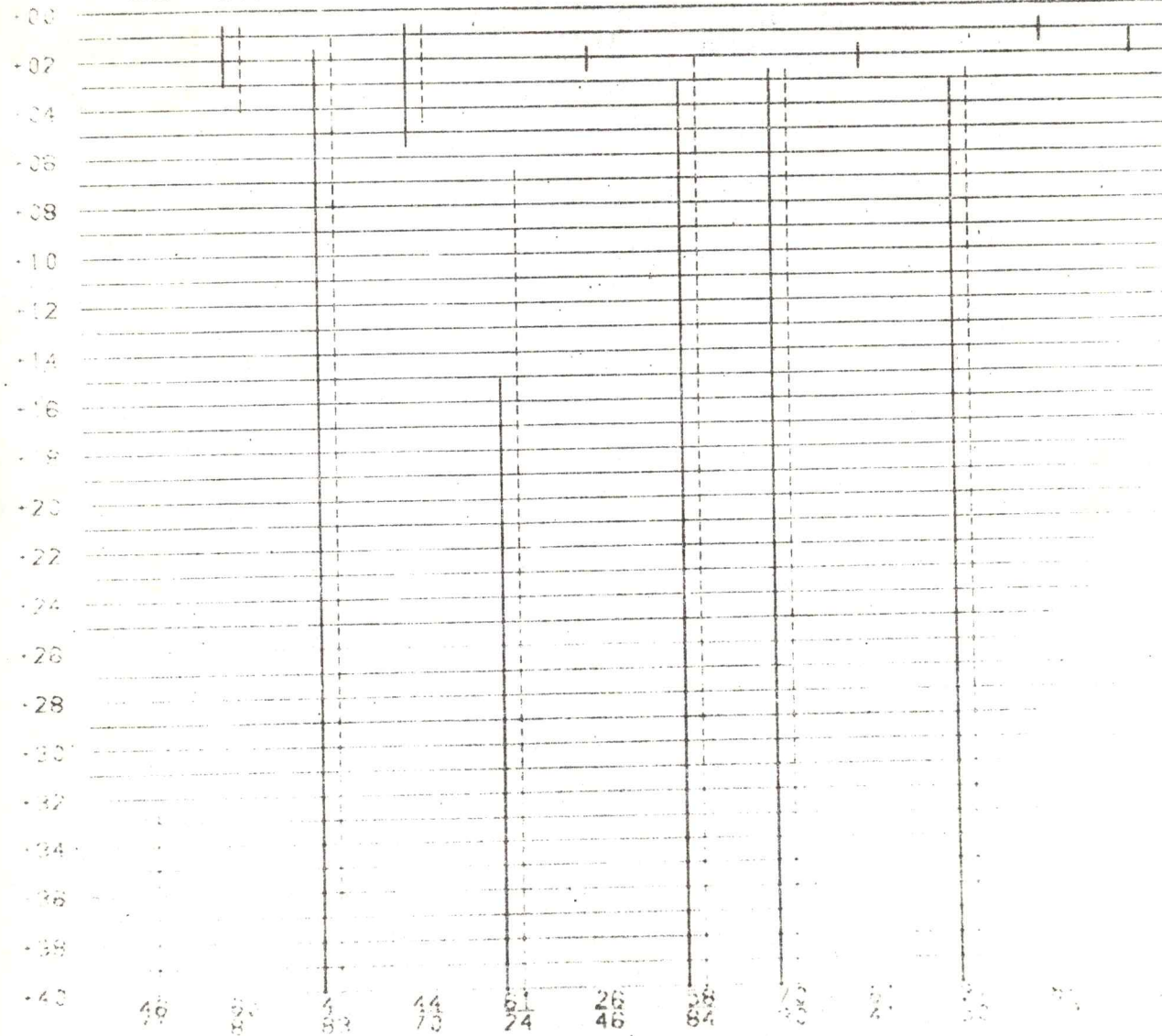
APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
TEI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

1MN 3MN 7MN 10MN 10MF 11MN 11MF 12MF 13MN 13MF 16MN 20MN



MAGNITUDE AND DISTANCE (COS)

Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

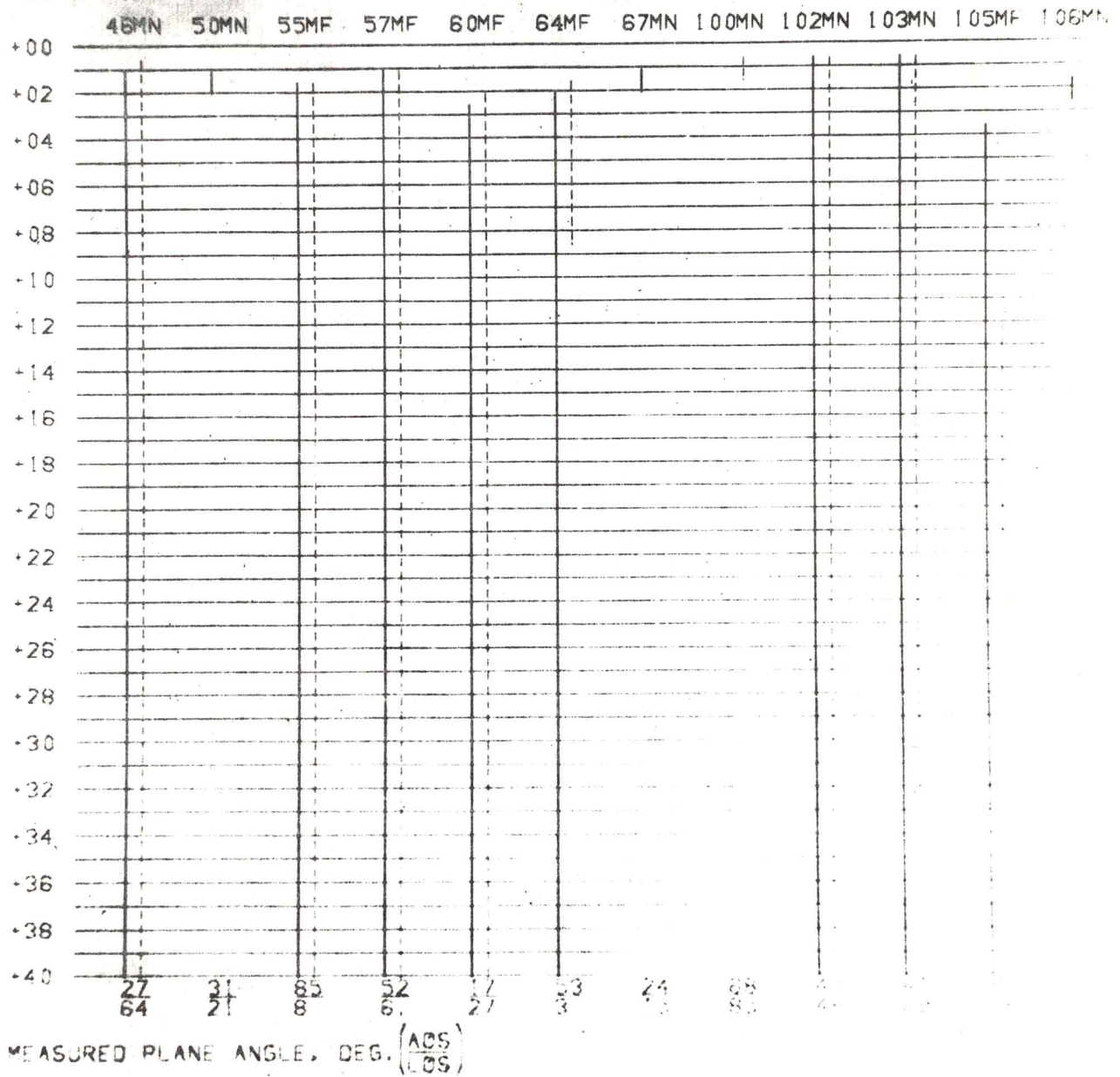
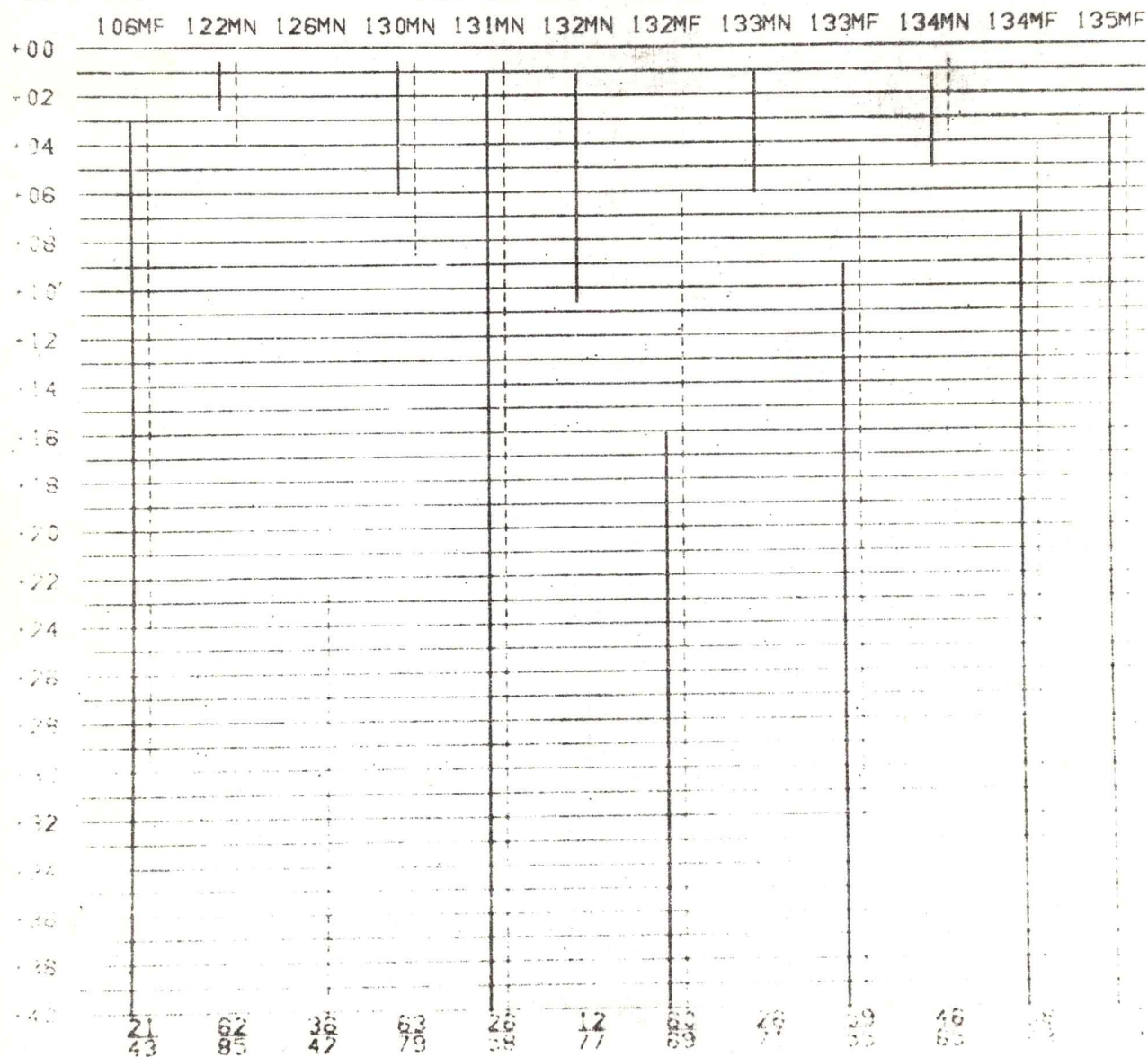


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
TEI % HR.STAR NUMBER (OCTAL) -
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MAGNITUDE PLANE AND E. DEG. (ACS)

Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
TEI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

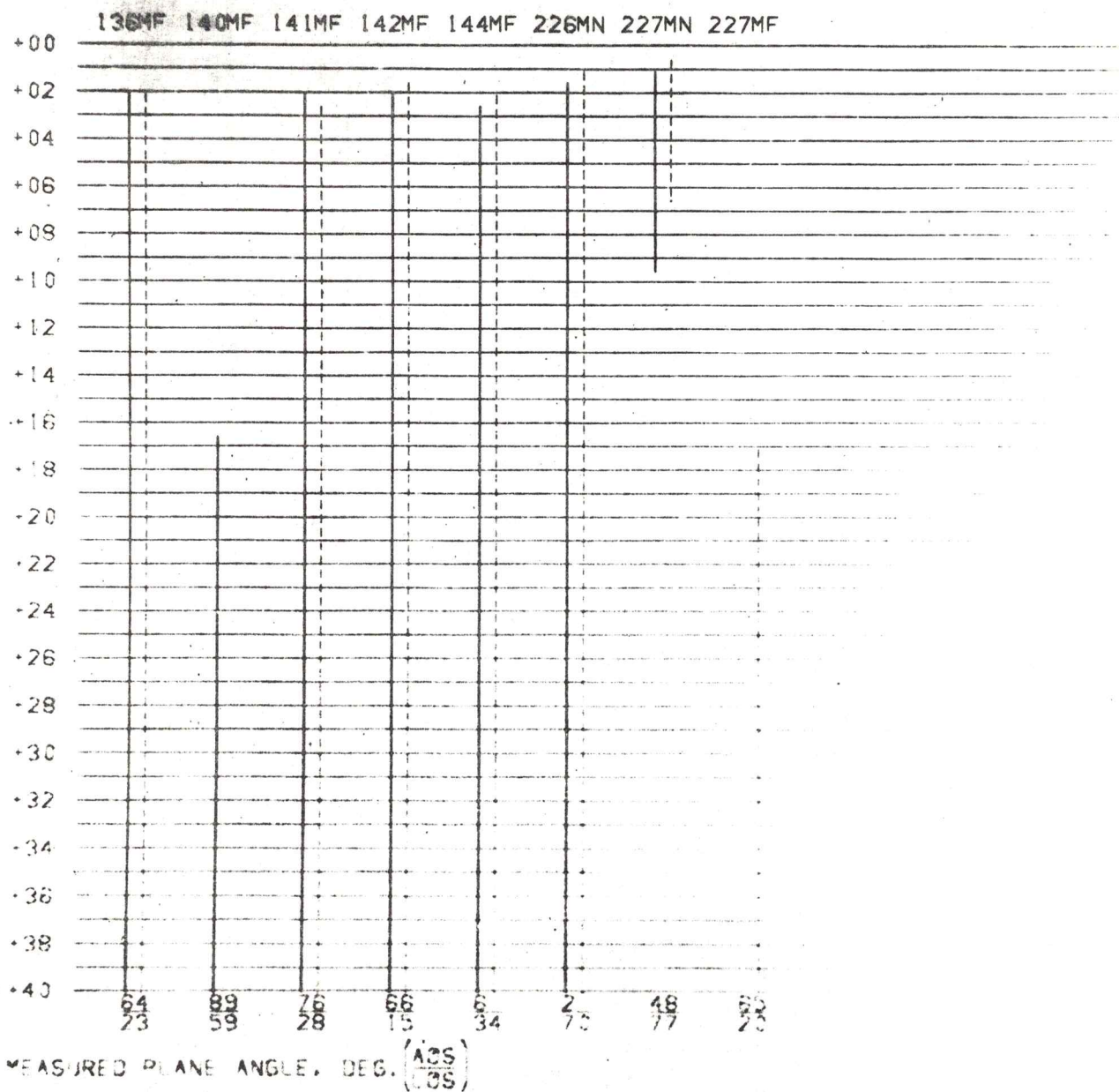


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

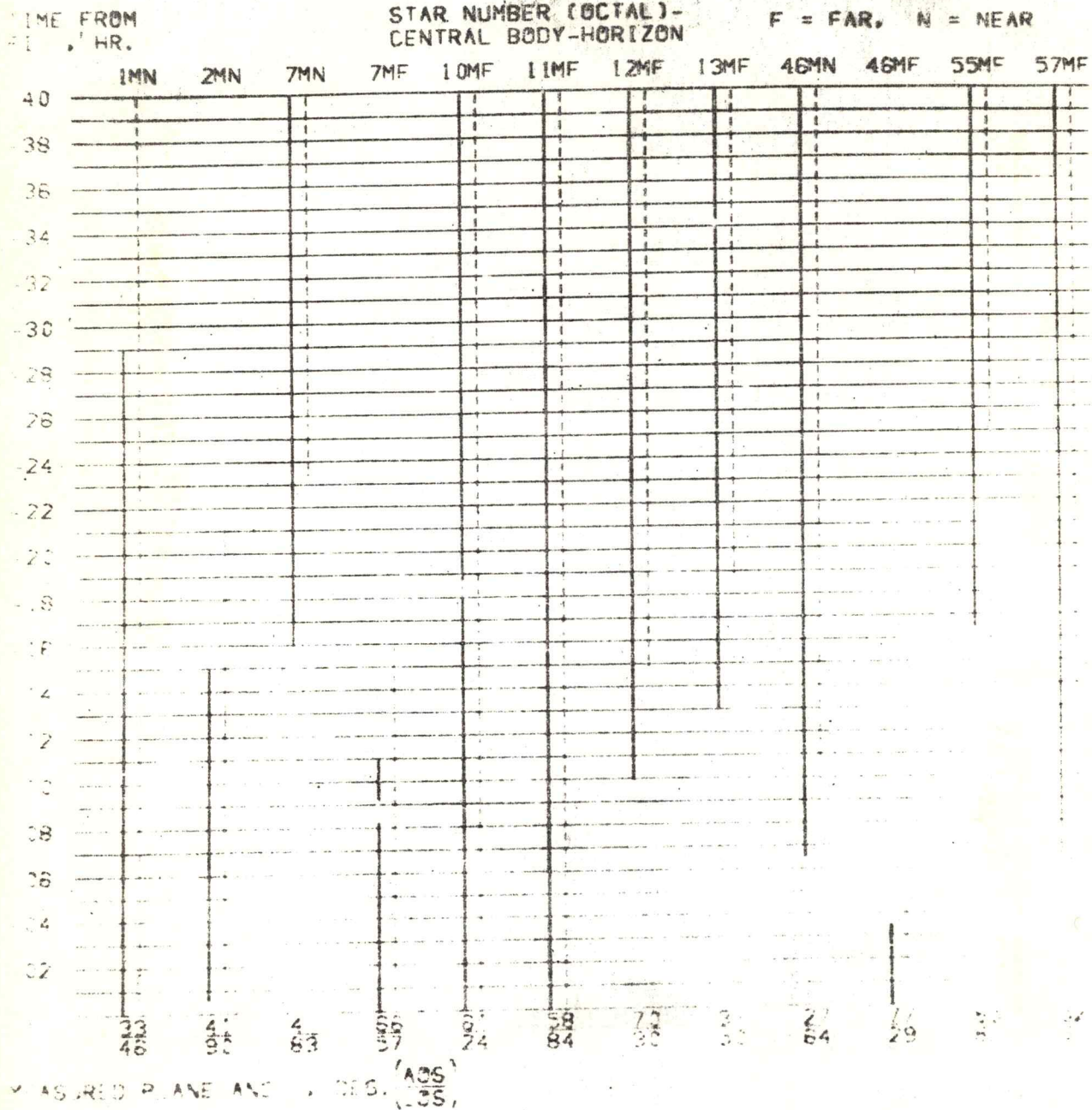


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
EI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

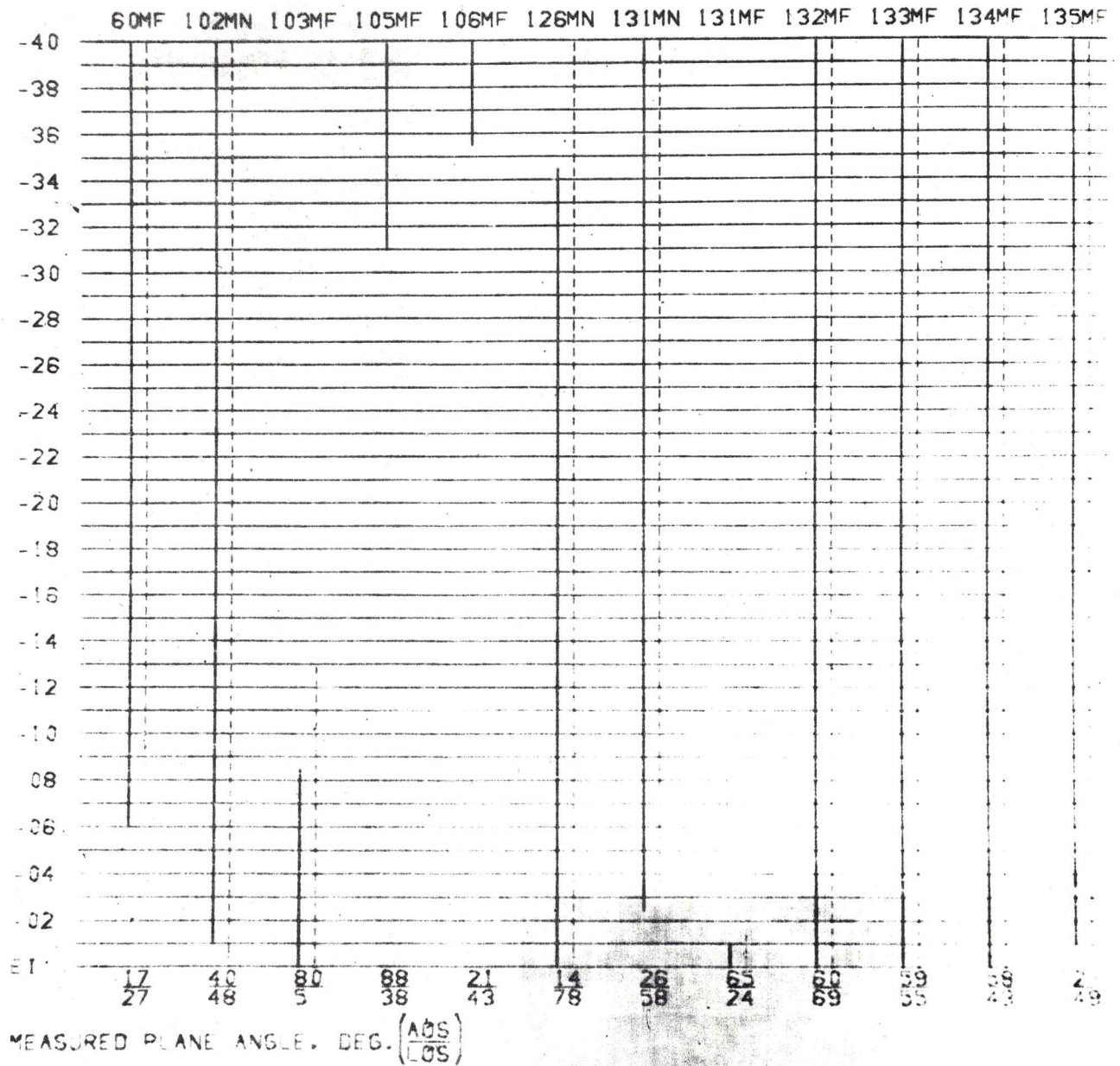


Figure II(a) (Continued)

APOLLO 17 (12/7) LOA REV 14-28

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

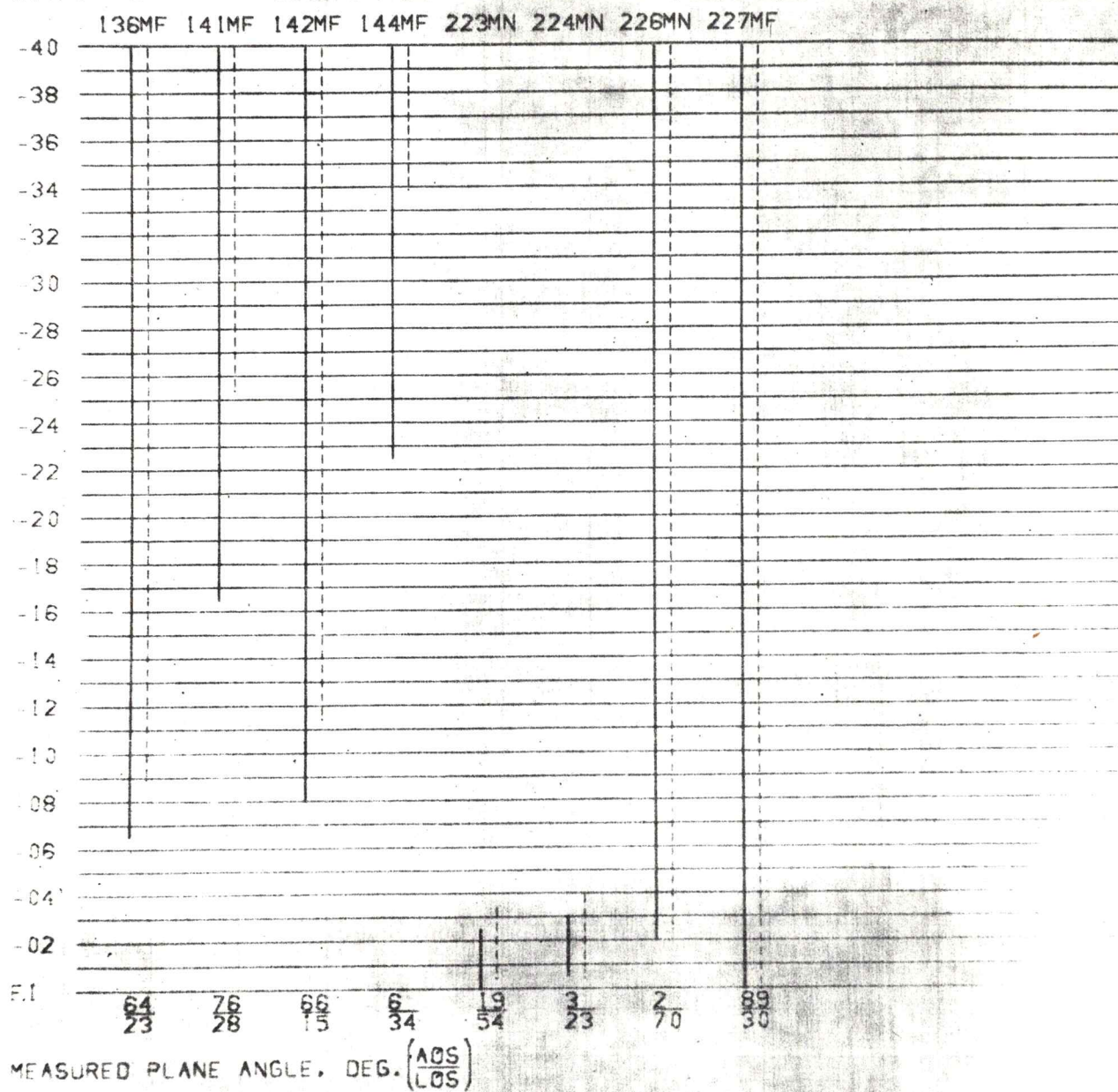


Figure II(a) (Concluded)

APOLLO 17 LOA REV 29-49

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

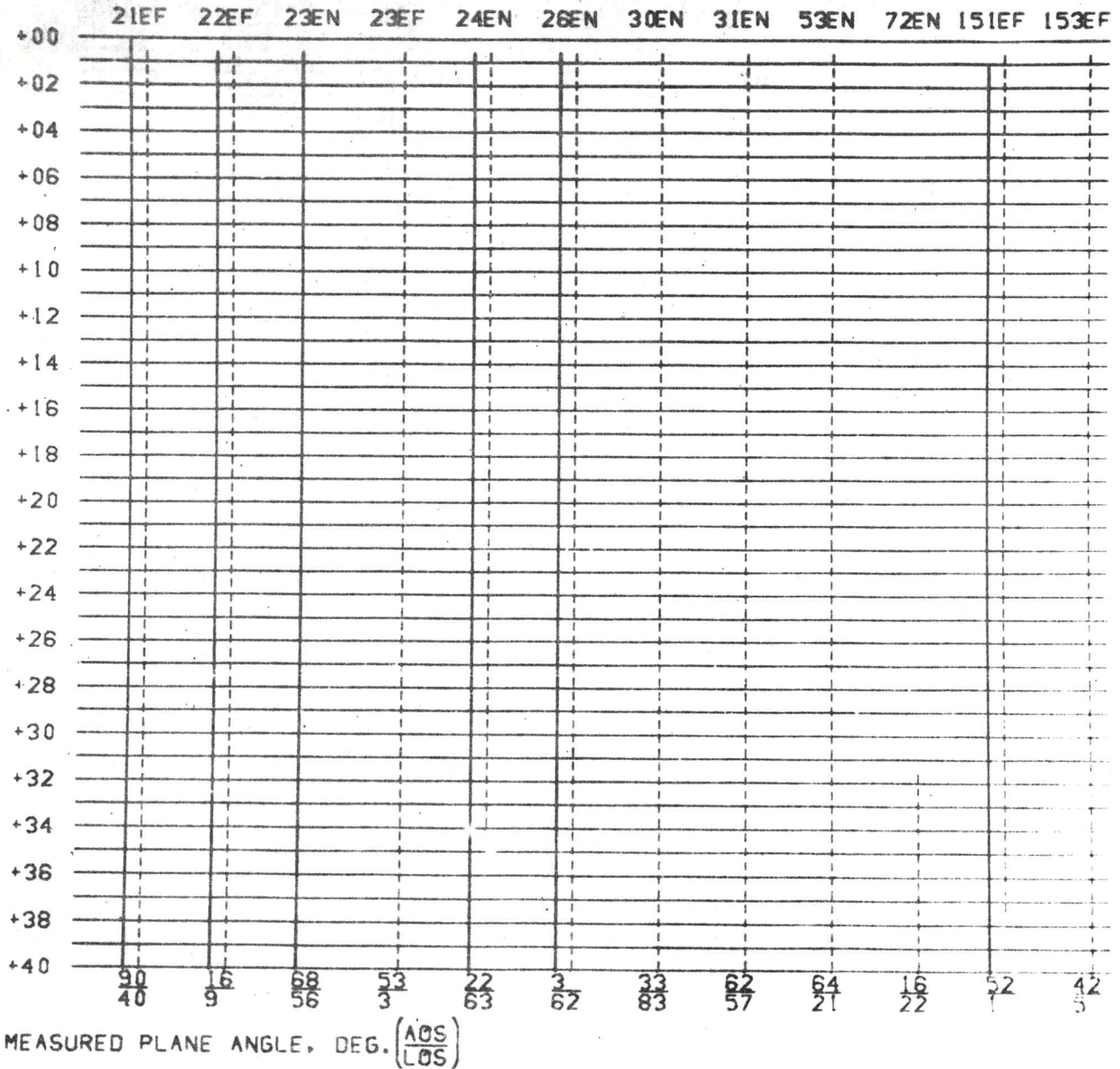


Figure II(b) Star Availability Plots for Apollo 17
 Lunar Orbit Abort Trajectory
 (GMT of EI = 17 December 1972, 16 Hours)
 December 7, 1972 Launch Date (GMT)

APOLLO 17 LGA REV 29-49

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

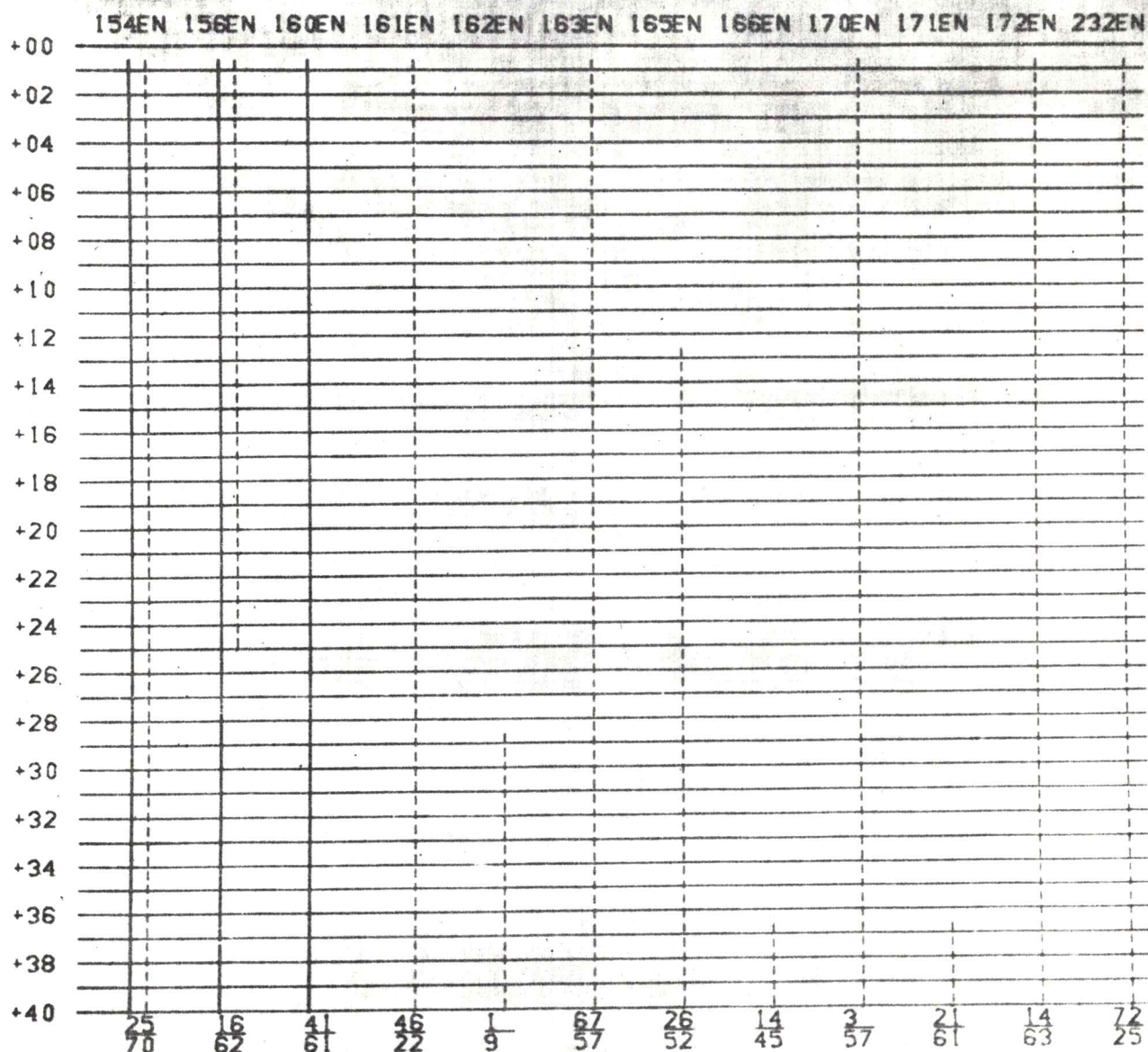
MEASURED PLANE ANGLE, DEG. $\left(\frac{AOS}{LOS}\right)$

Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

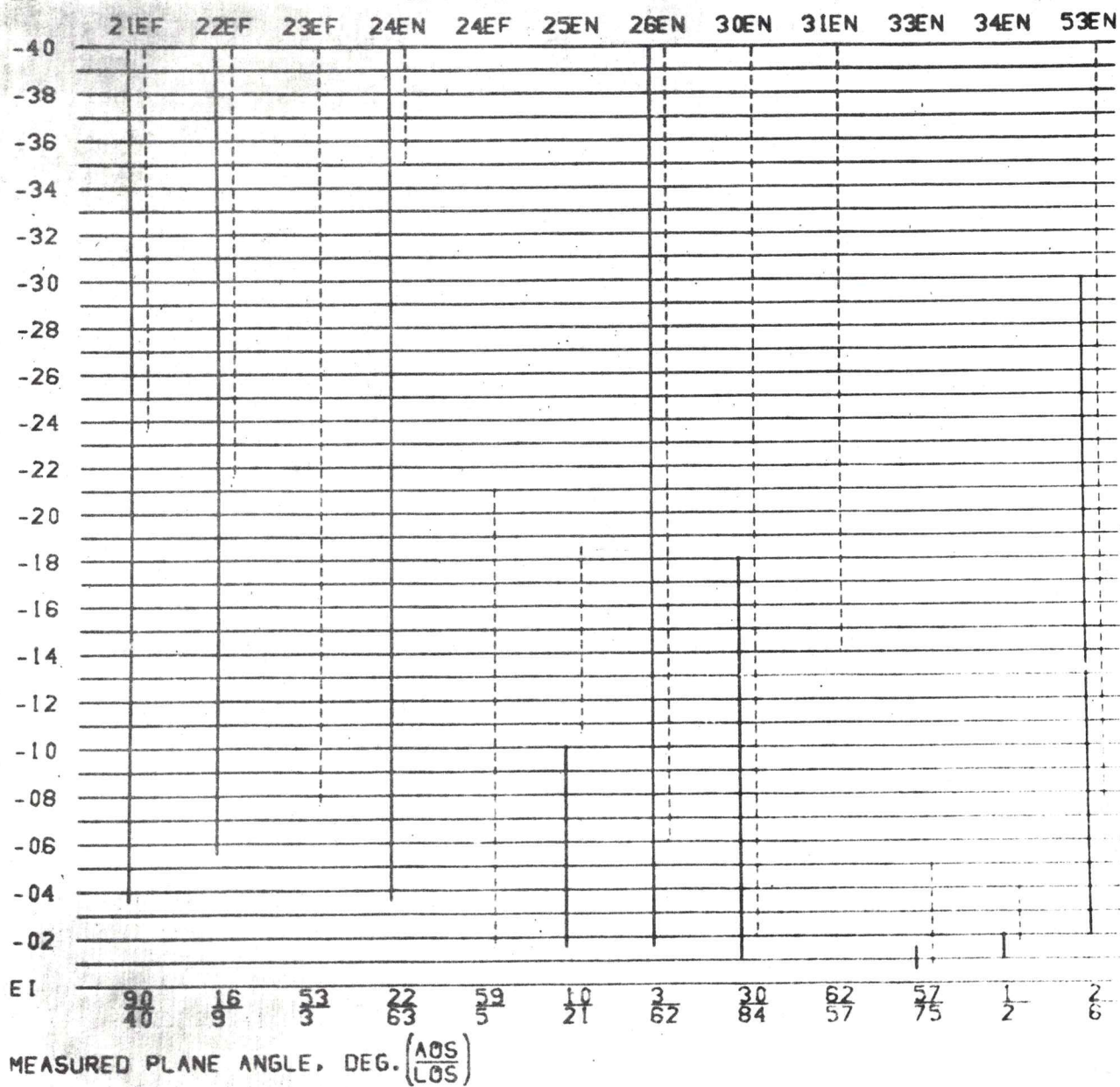


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

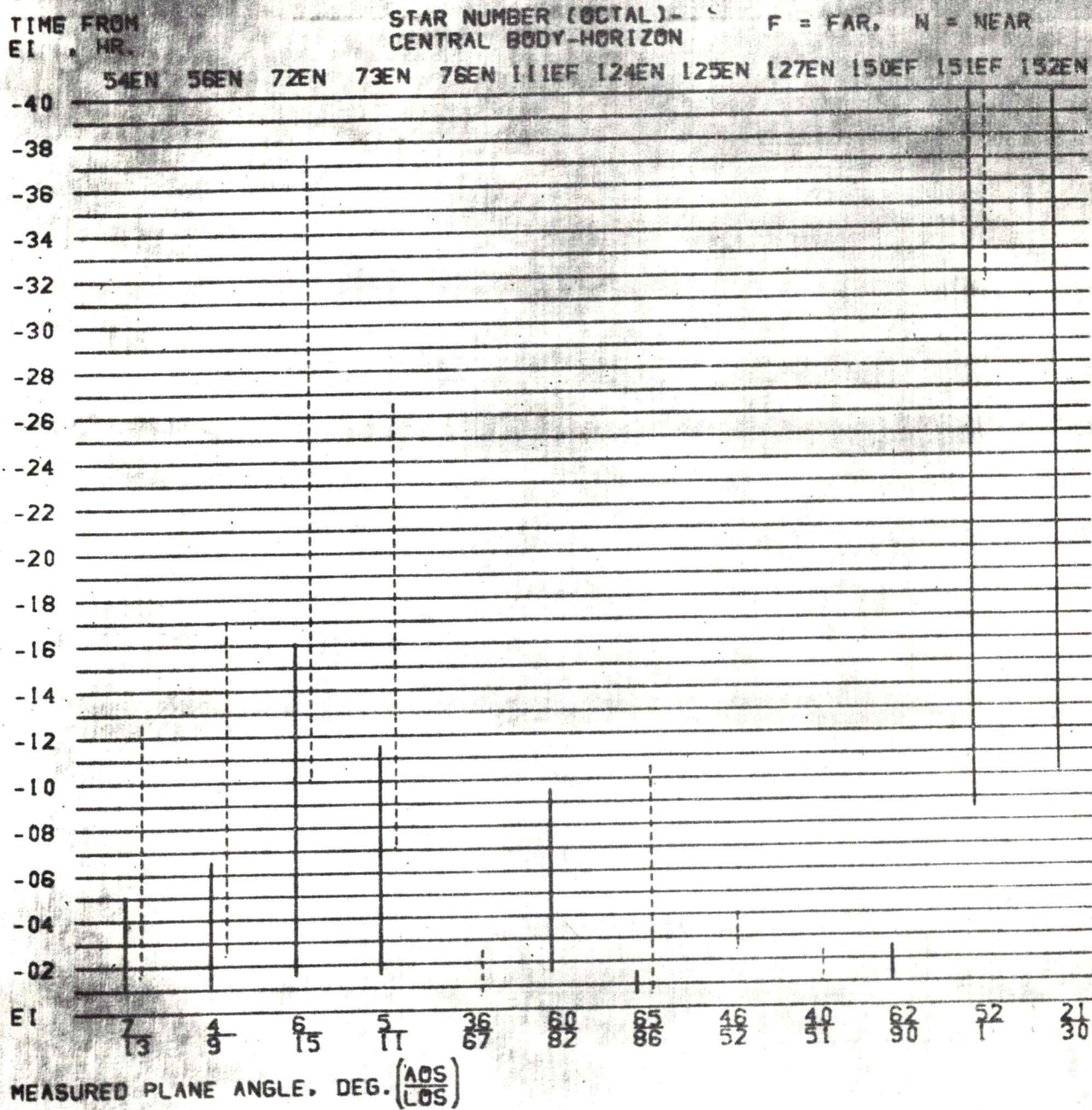


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

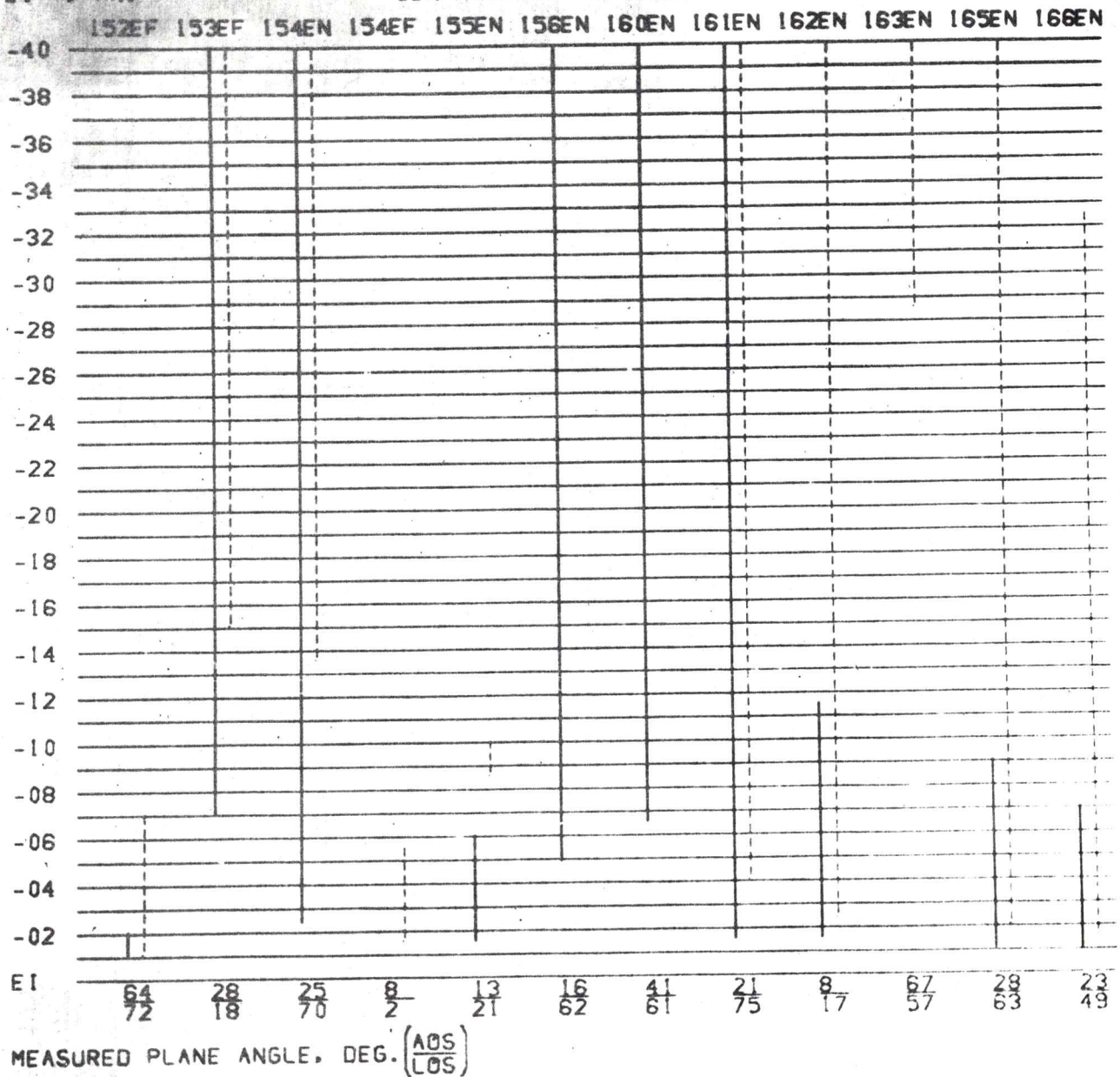


Figure II(b) (Continued)

APOLLO 17 LGA REV 29-49

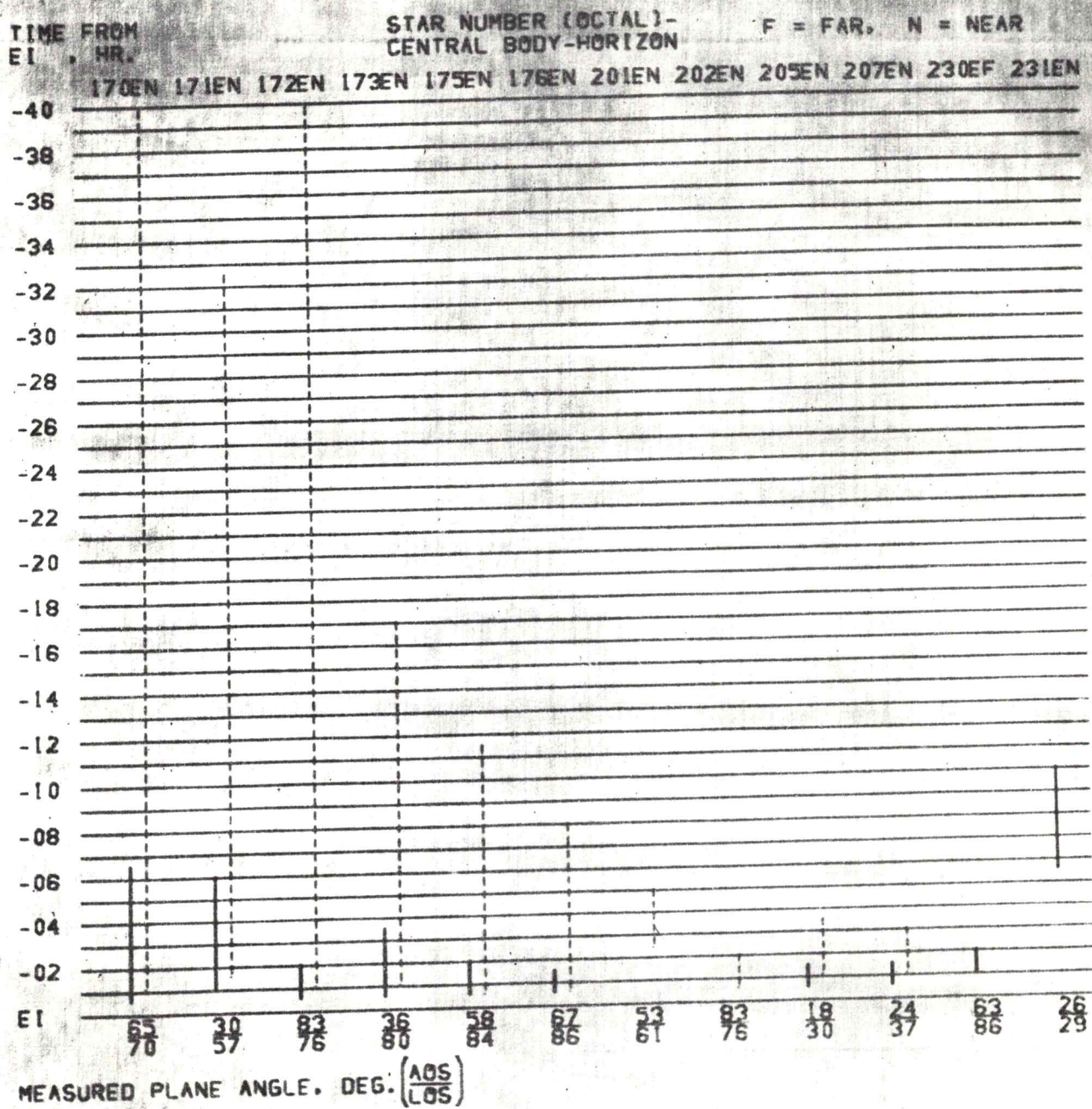


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

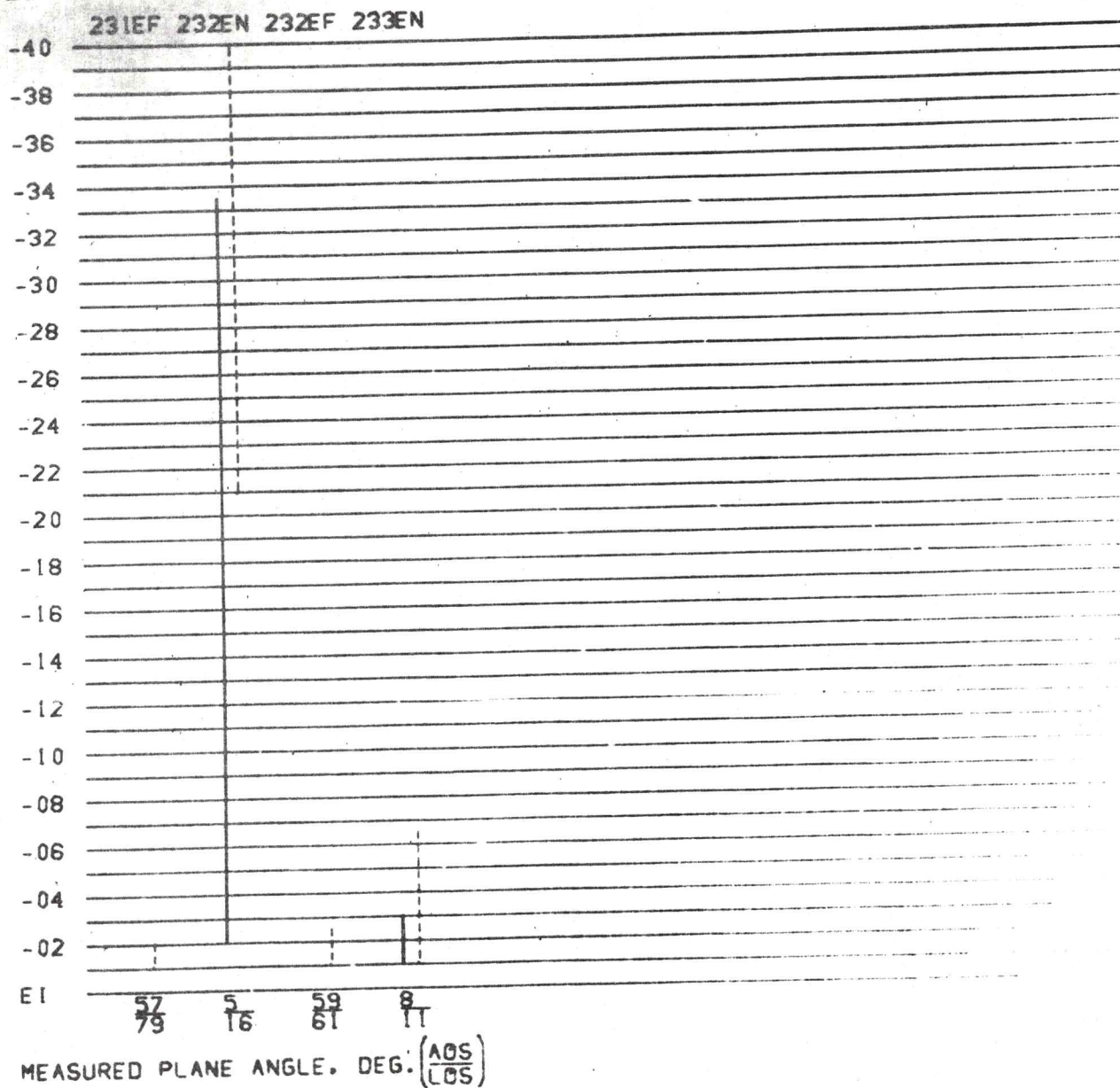


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

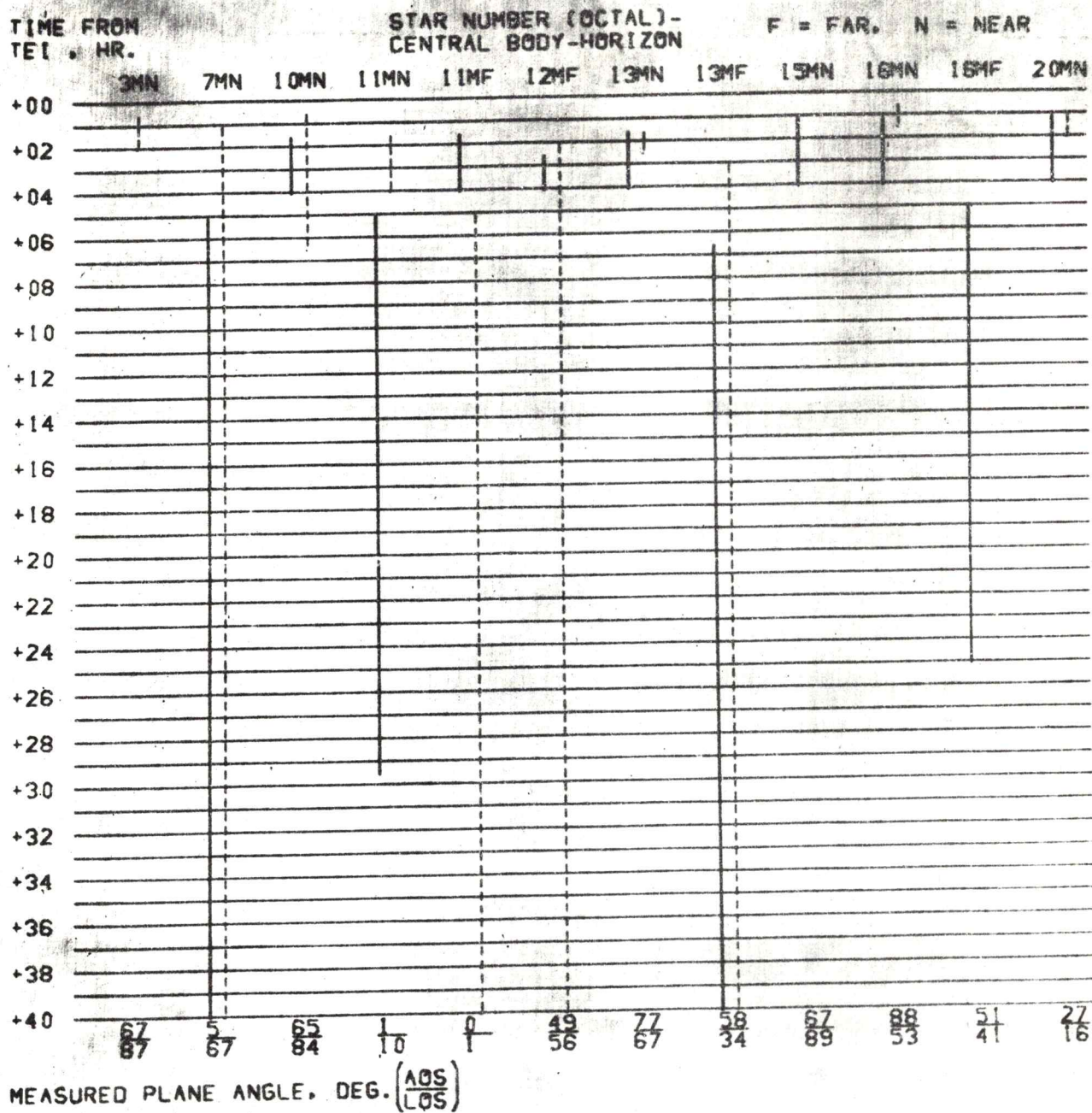


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

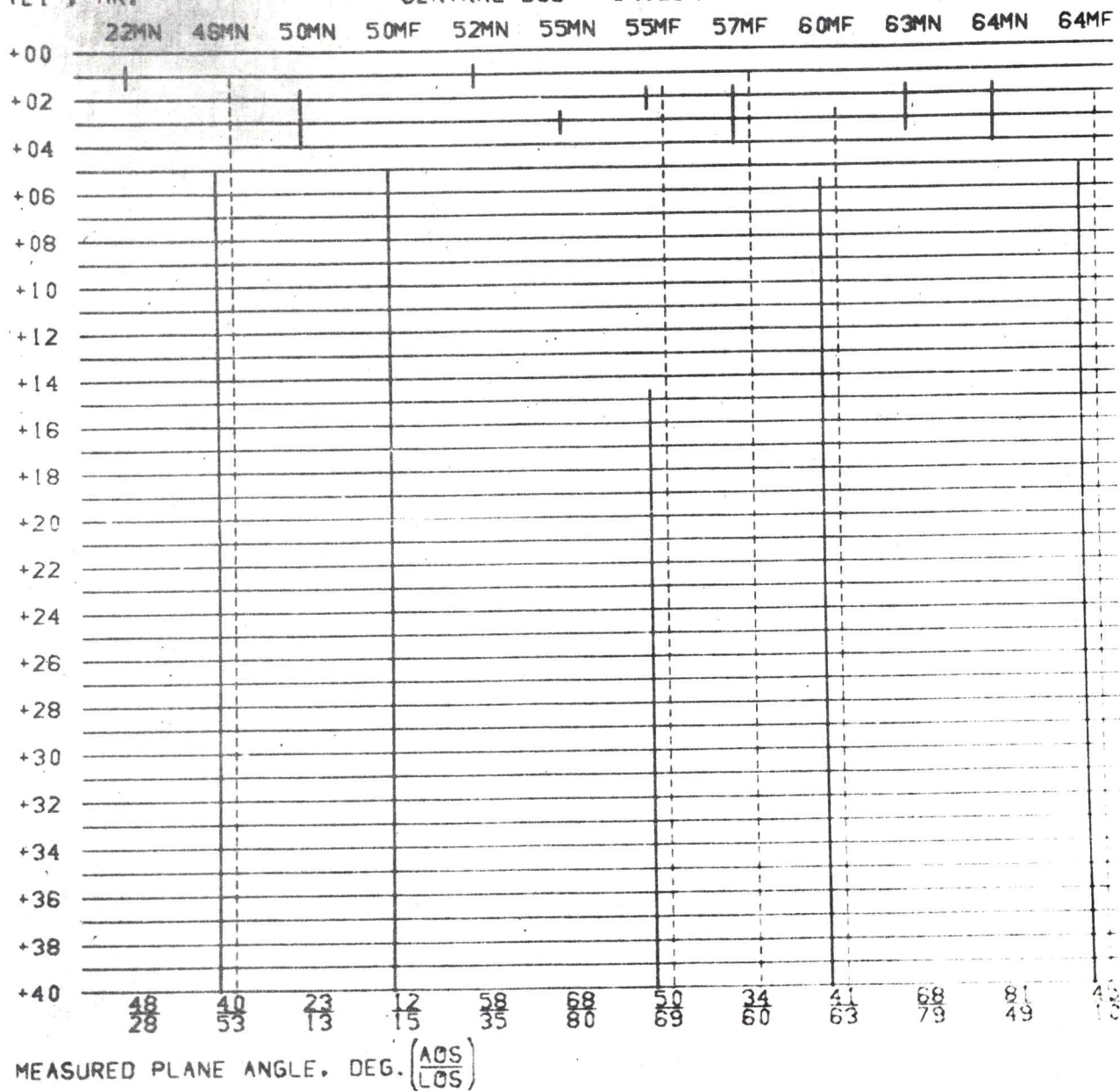


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

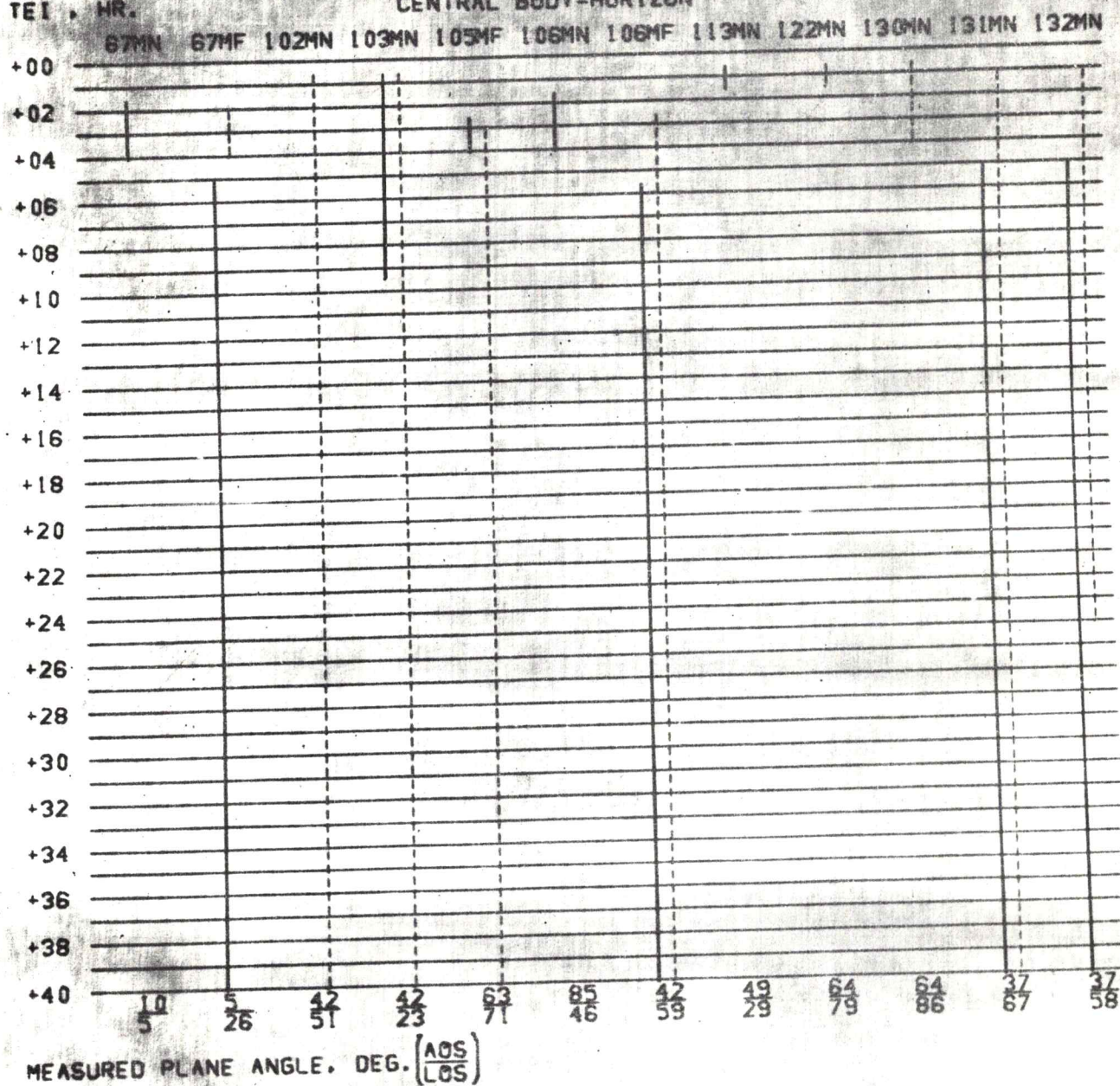


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

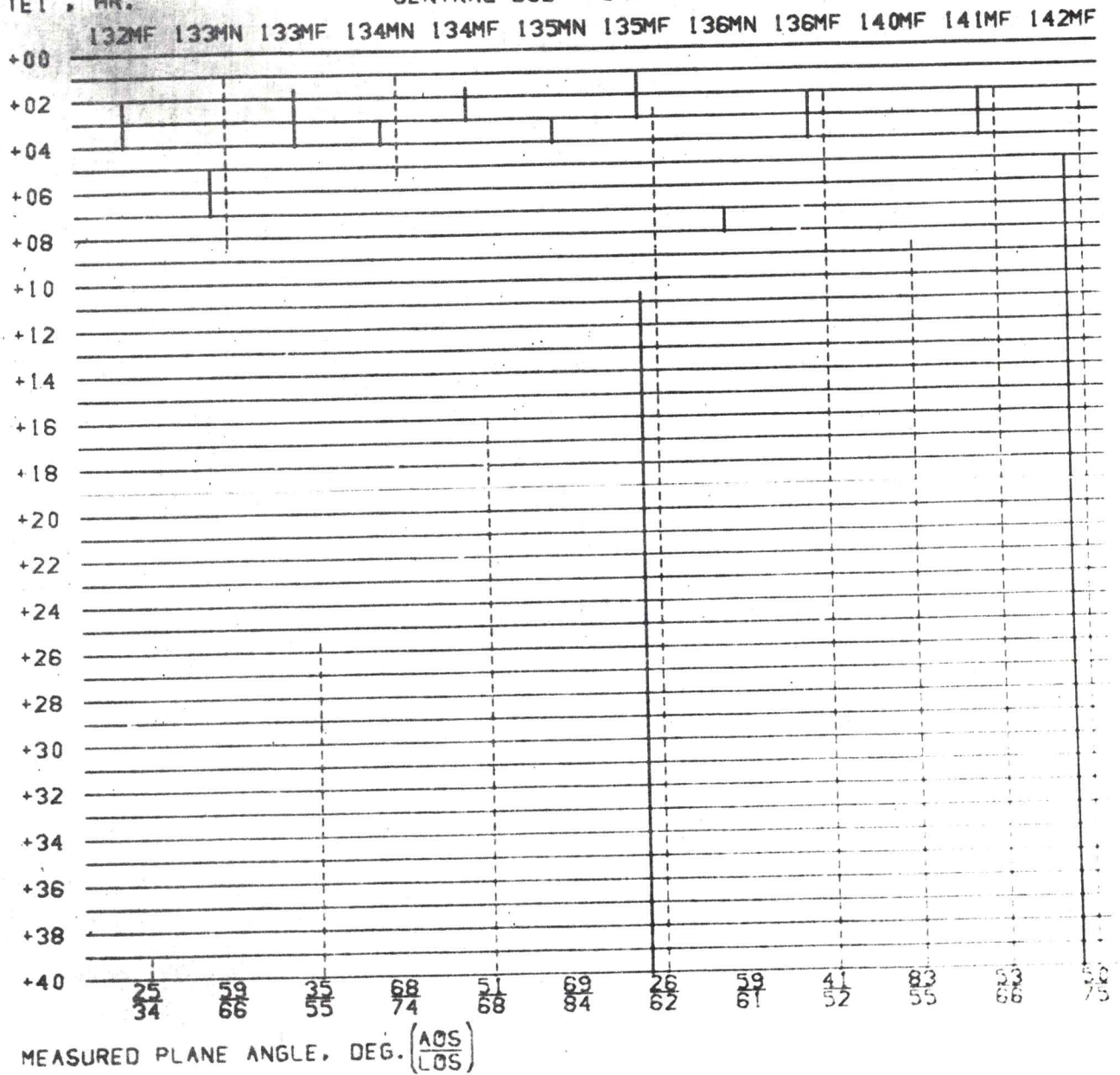


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

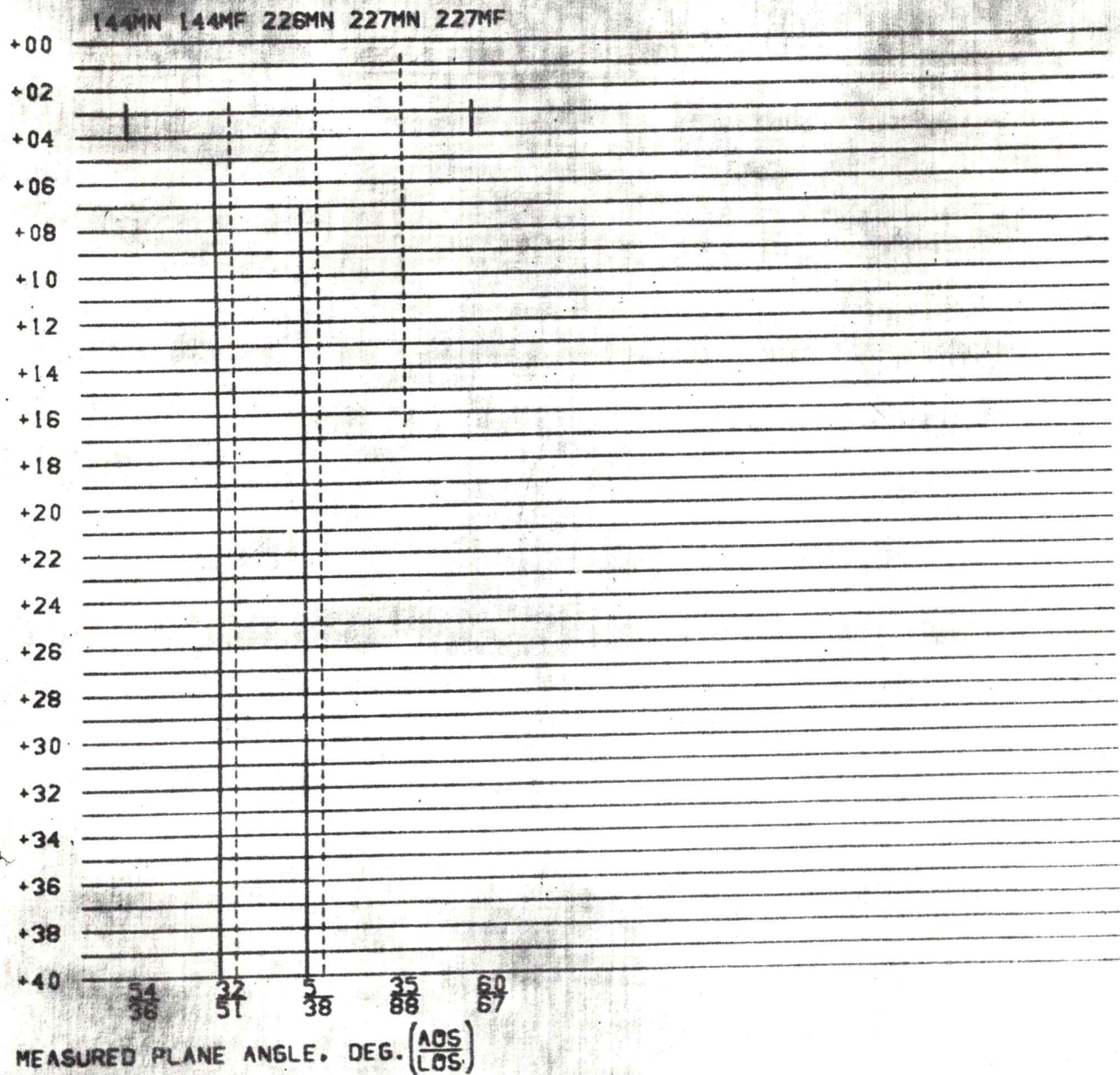


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

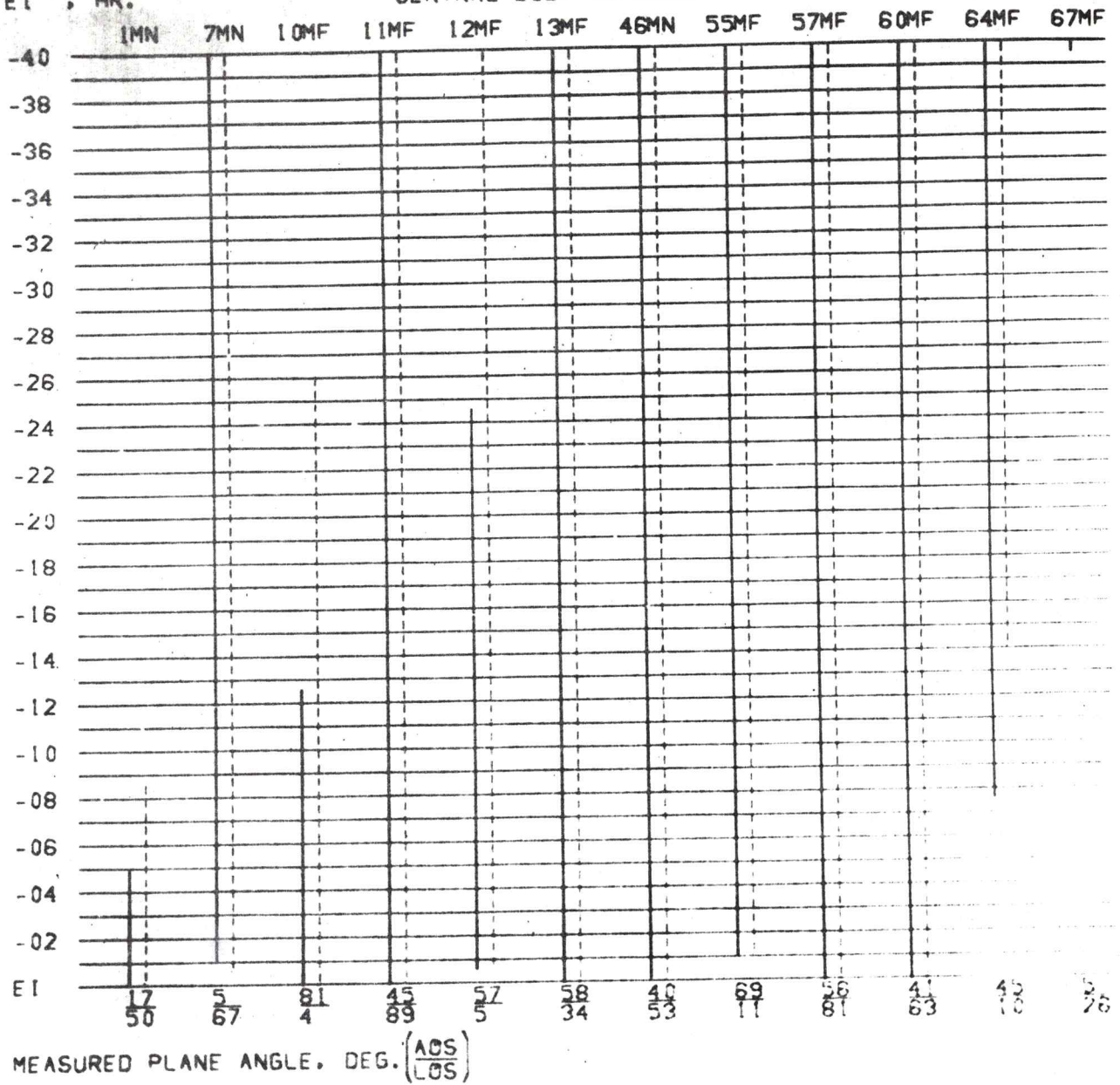


Figure II(b) (Continued)

APOLLO 17 LOA REV 29-49

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

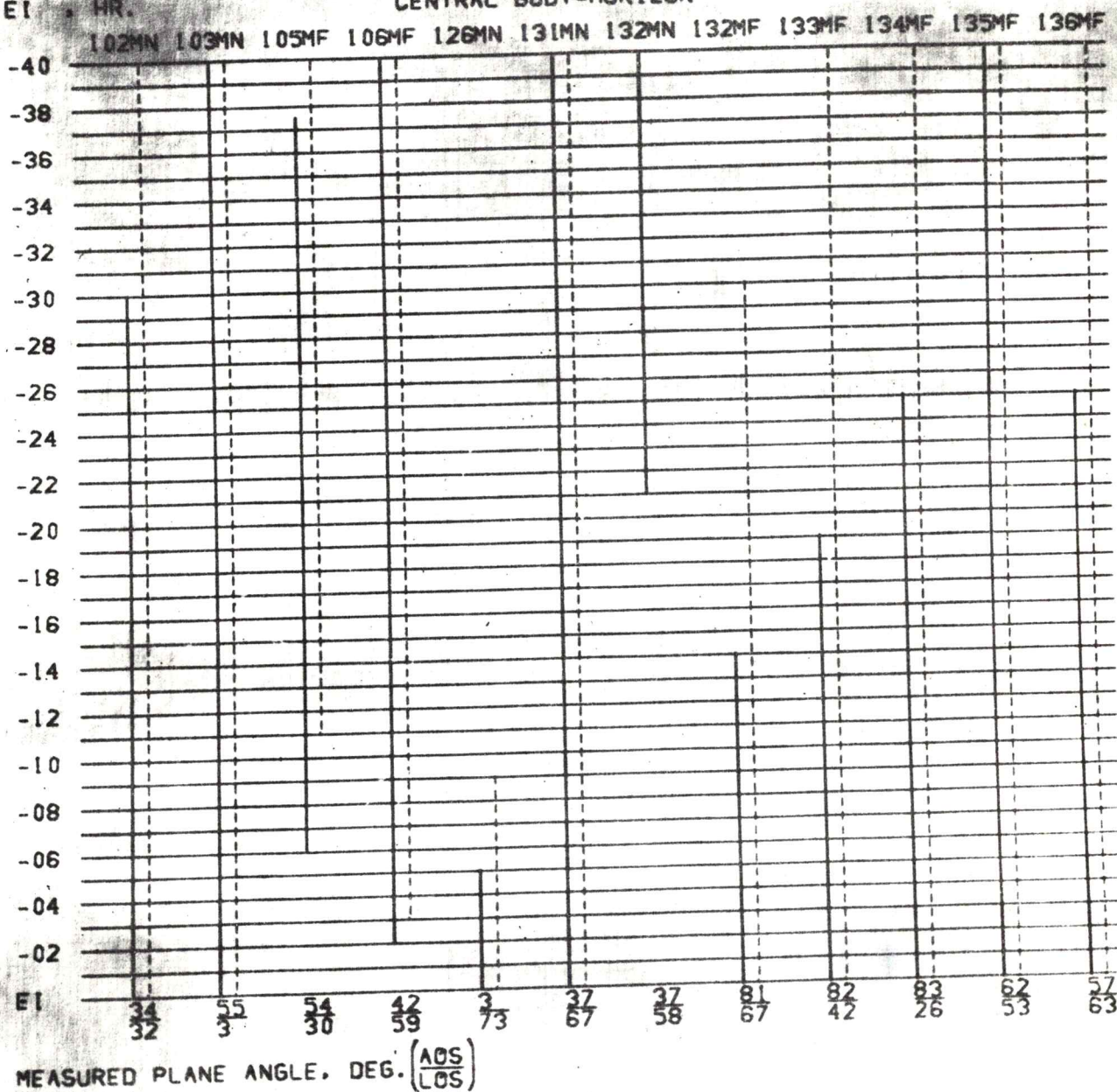


Figure II(b) (Continued)

APOLLO 17 LGA REV 29-49

TIME FROM
EI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

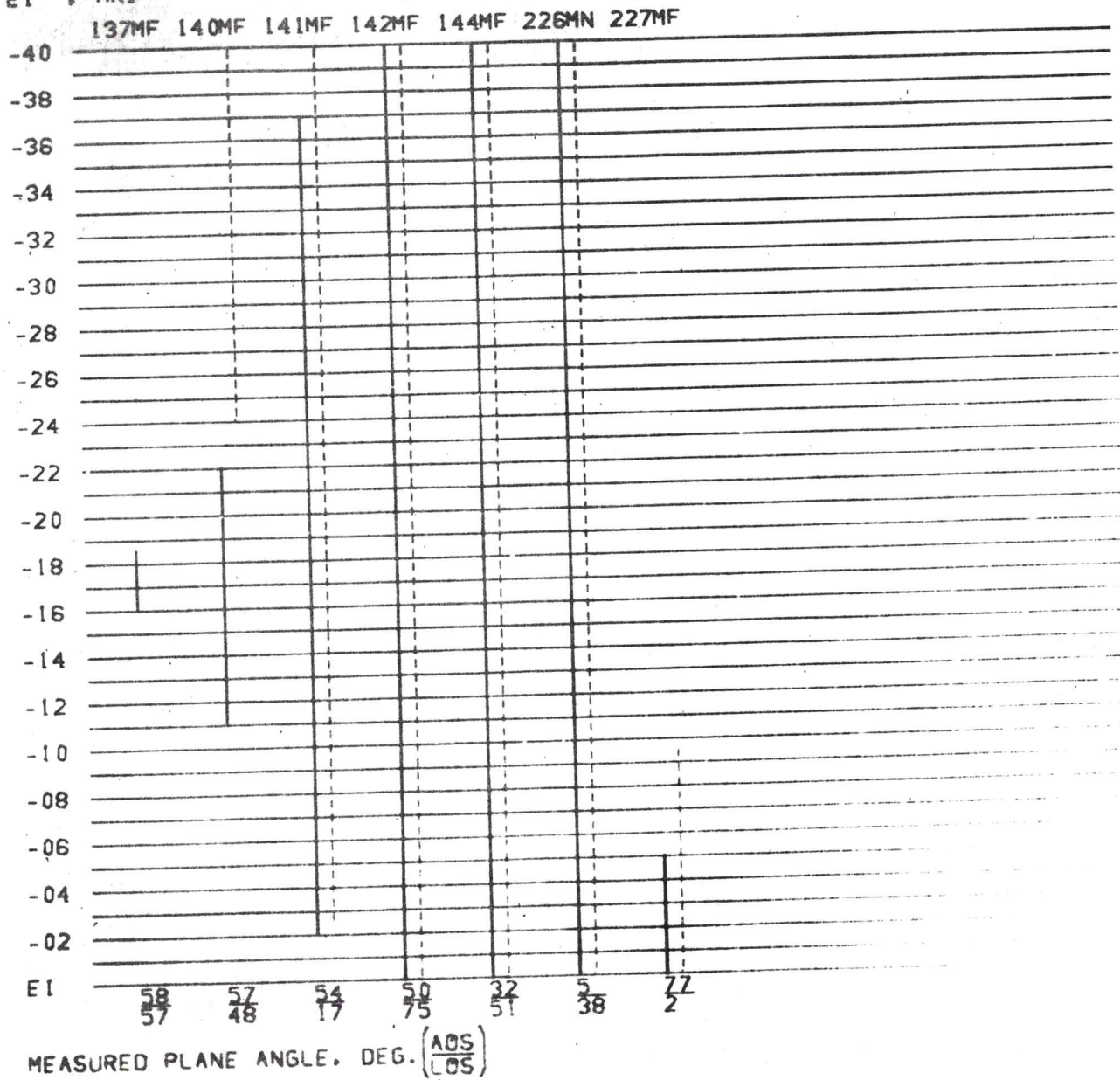


Figure II(b) (Concluded)

APOLLO 17 (12/7) LOA REV 50-59

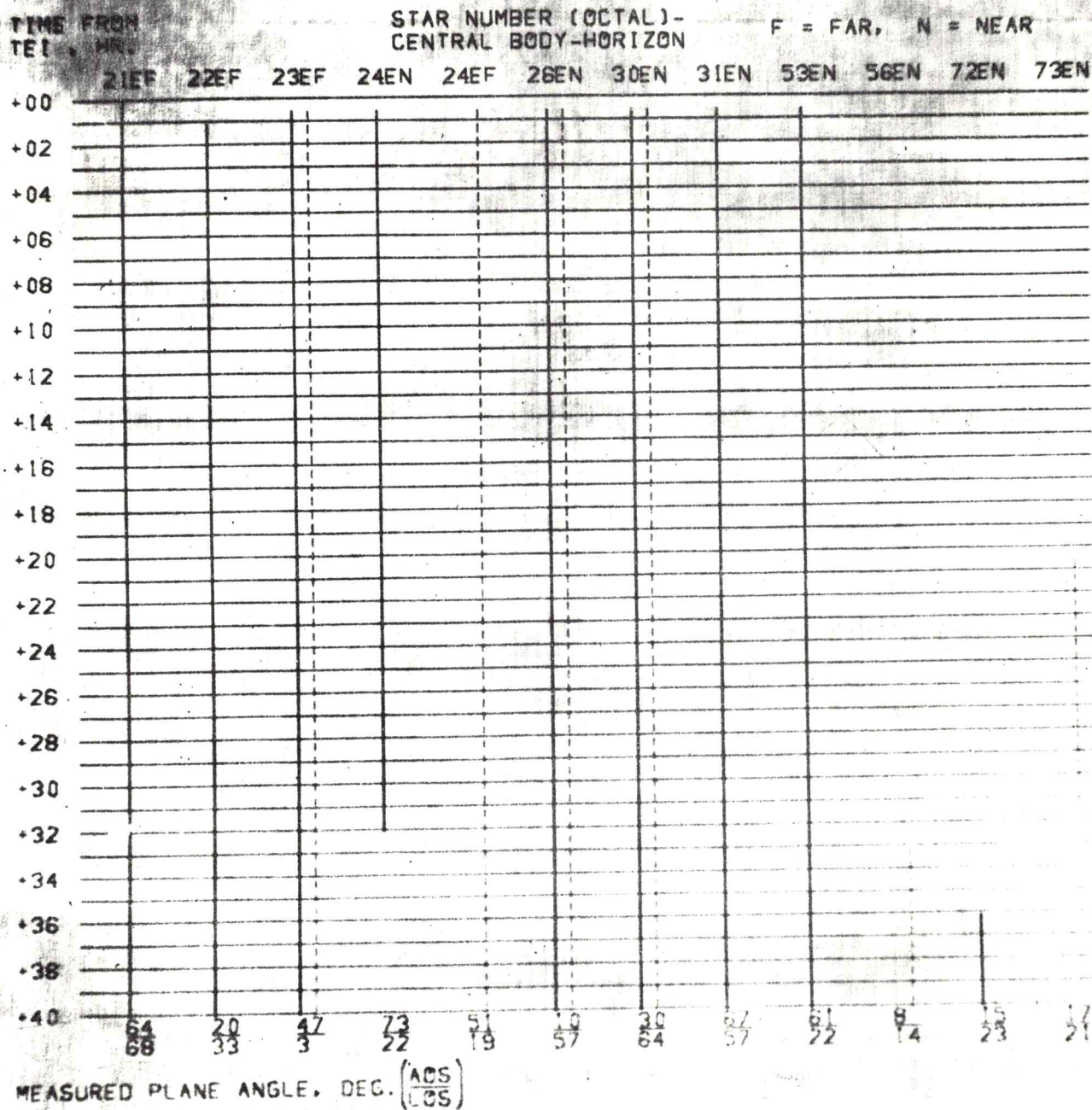


Figure II(c) Star Availability Plots for Apollo 17
Lunar Orbit Abort Trajectory
(GMT of EI = 18 December 1972, 17 Hours)
December 7, 1972 Launch Date (GMT)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

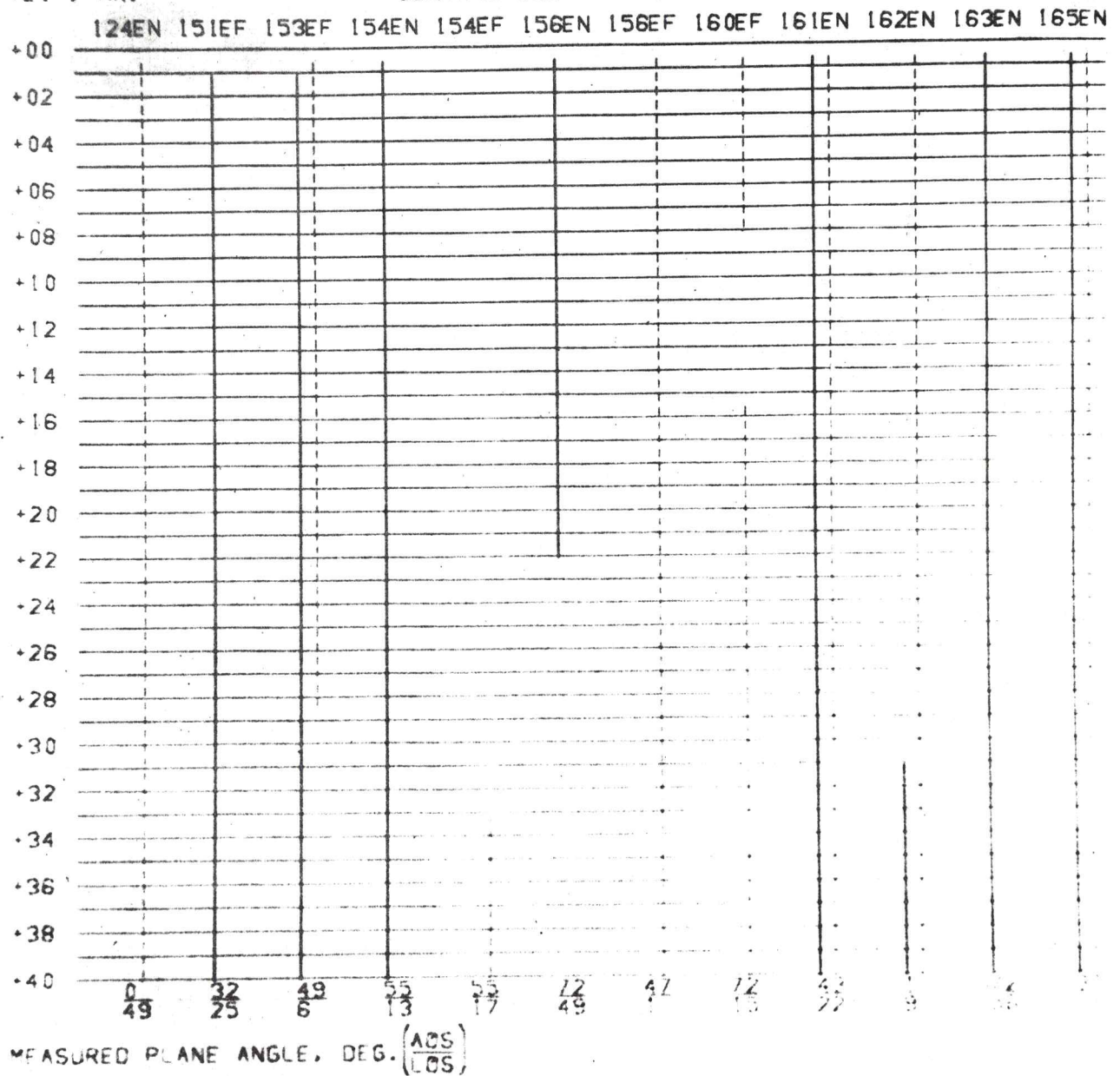


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TET - HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

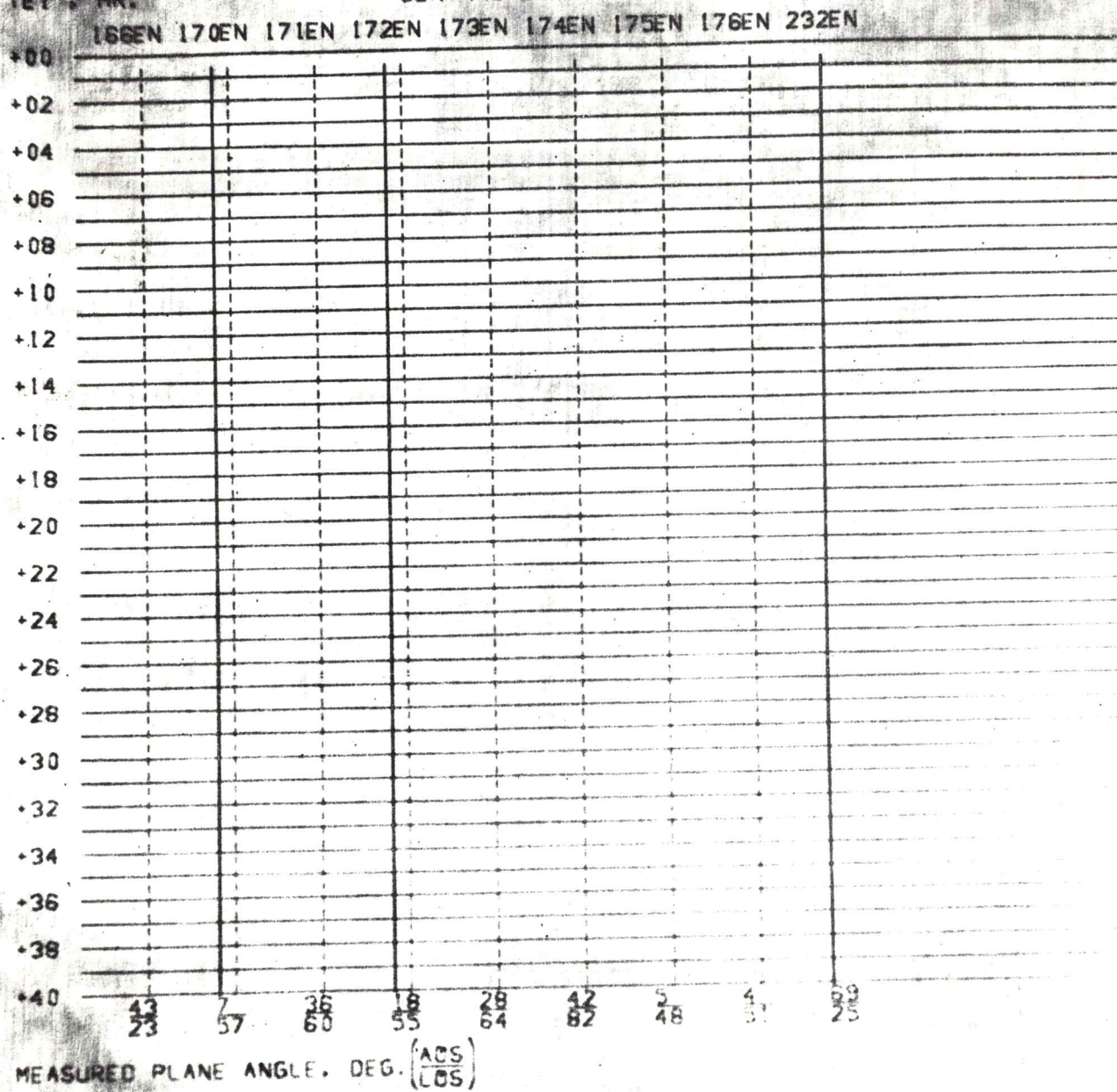


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

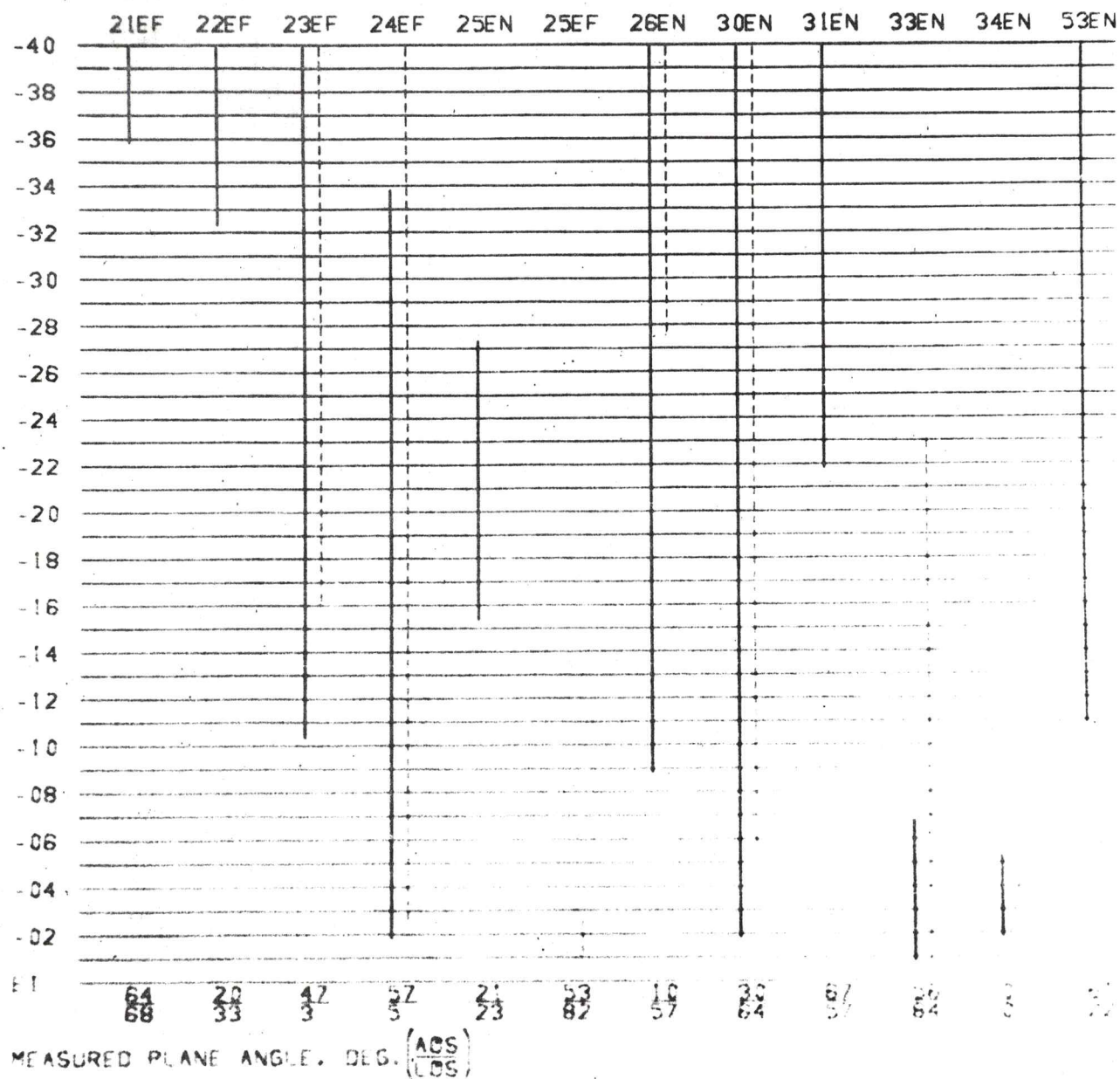


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

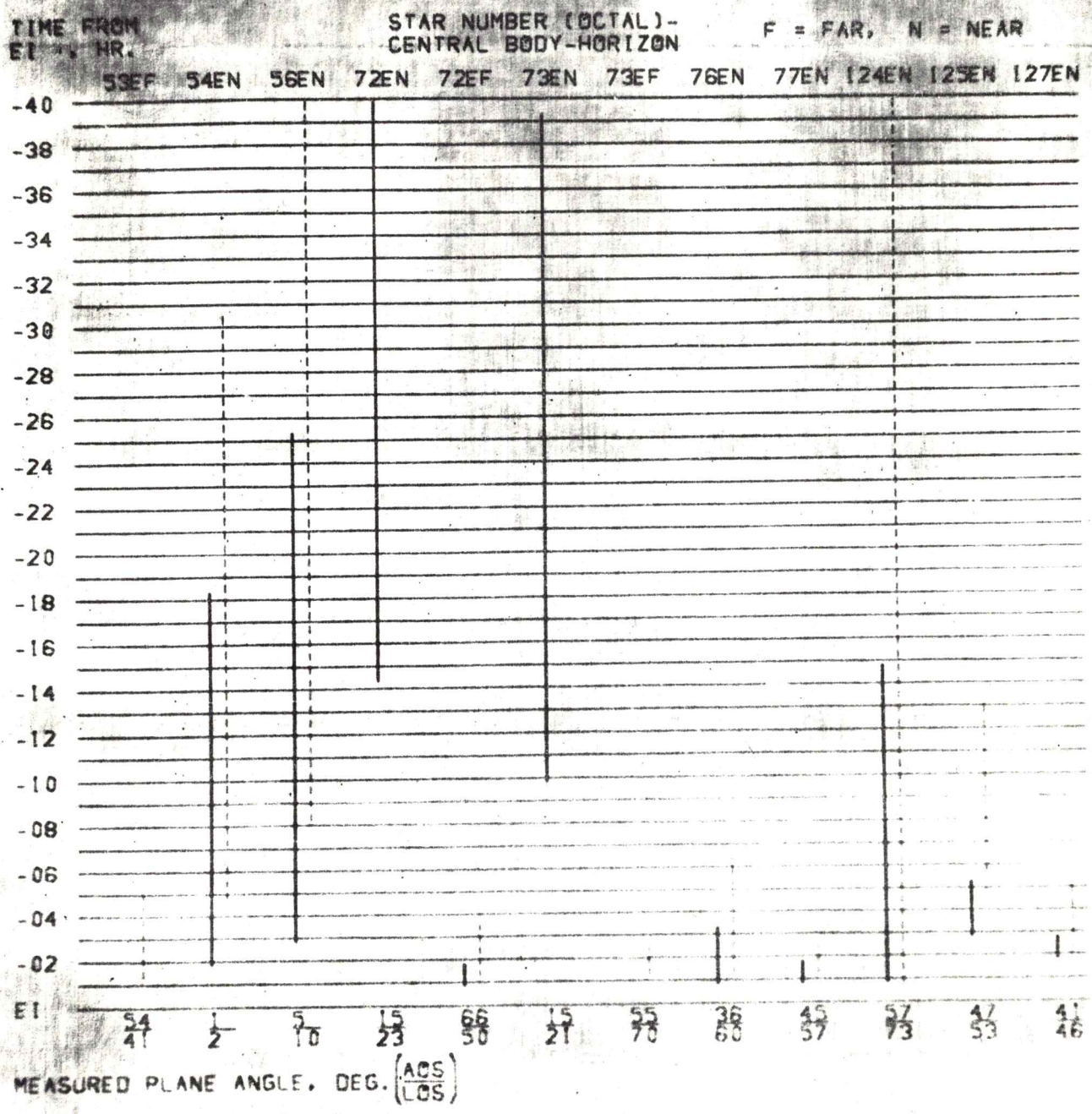


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
E1, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

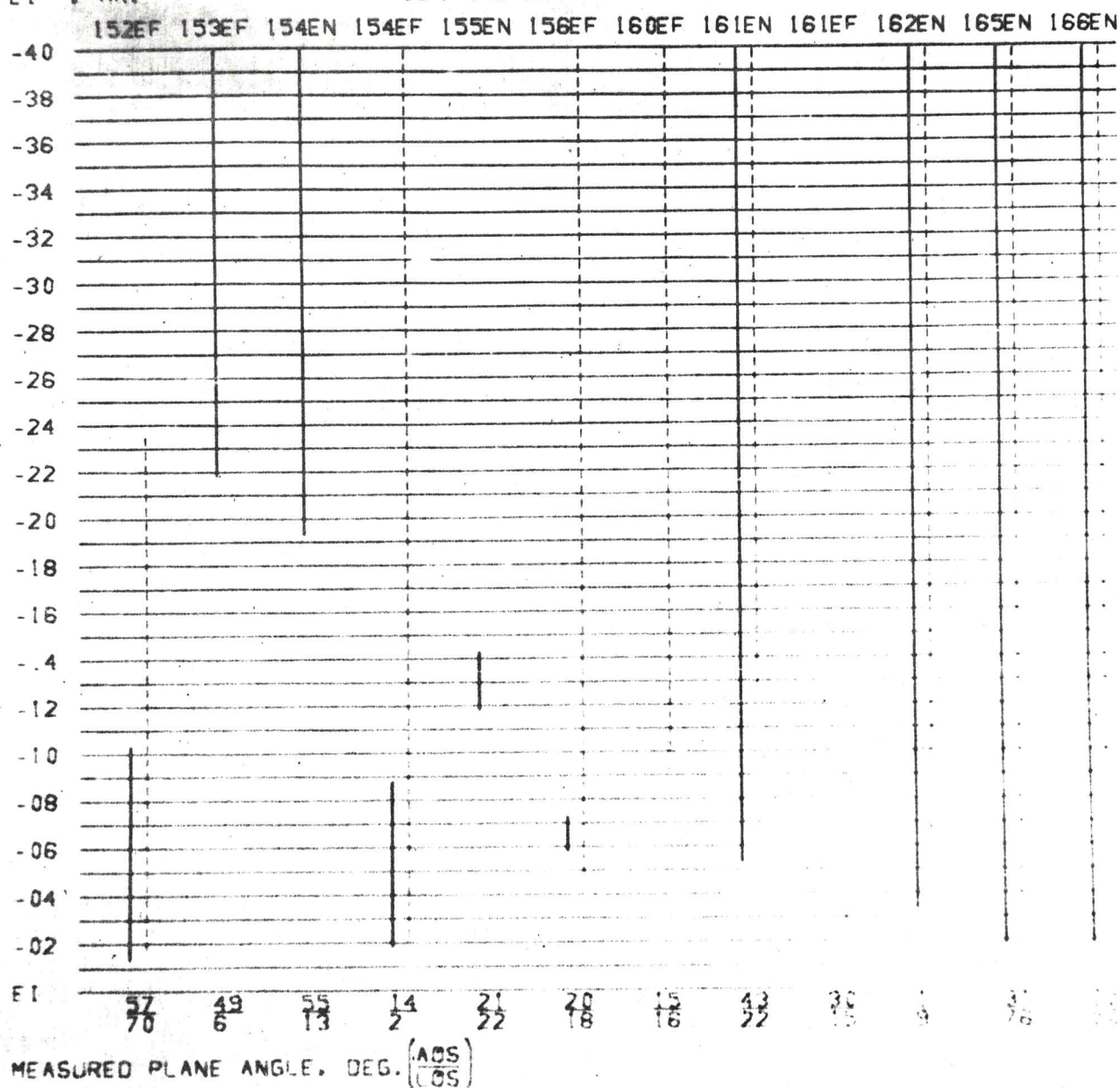


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
ET, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

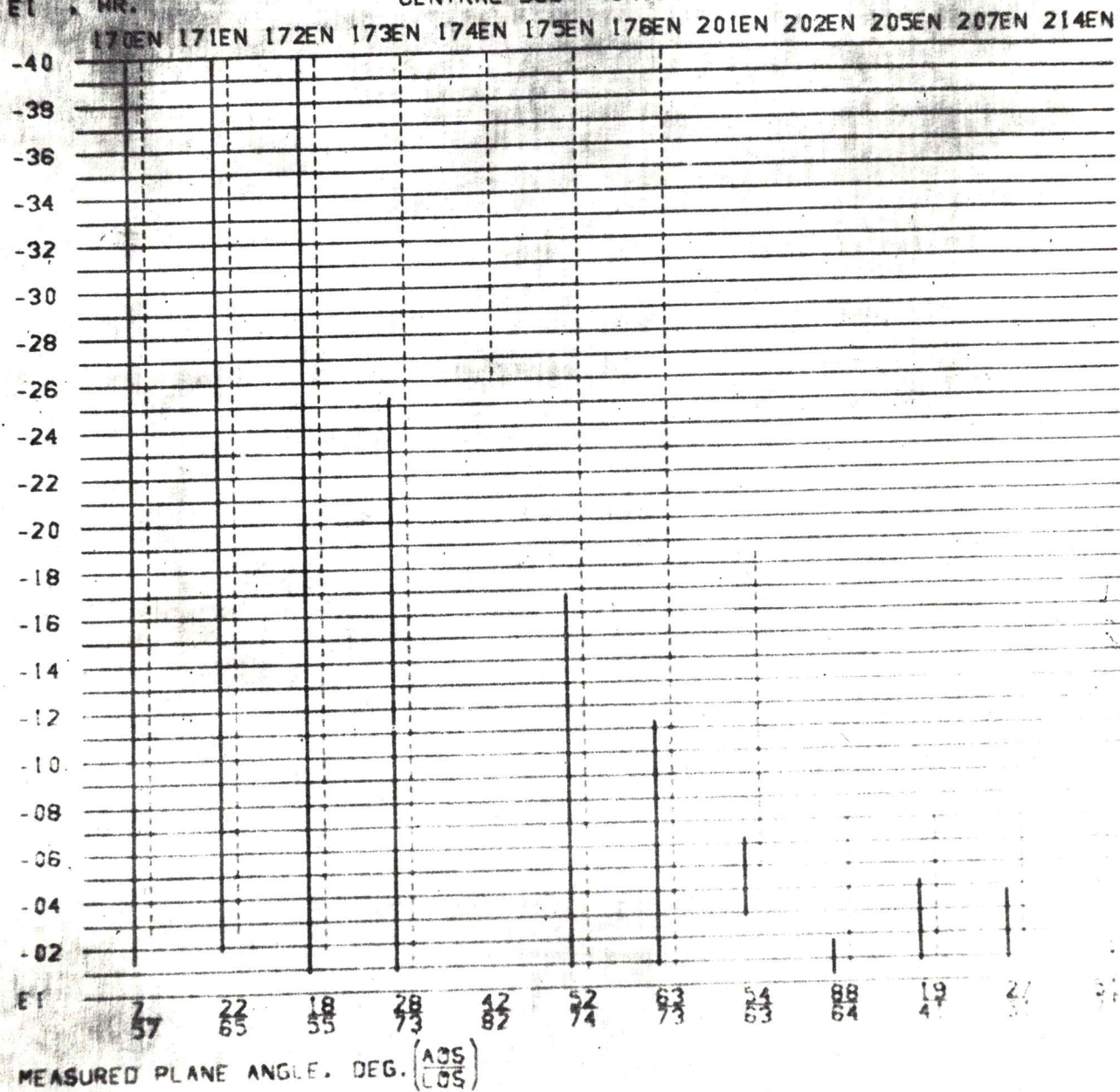


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
EI . HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

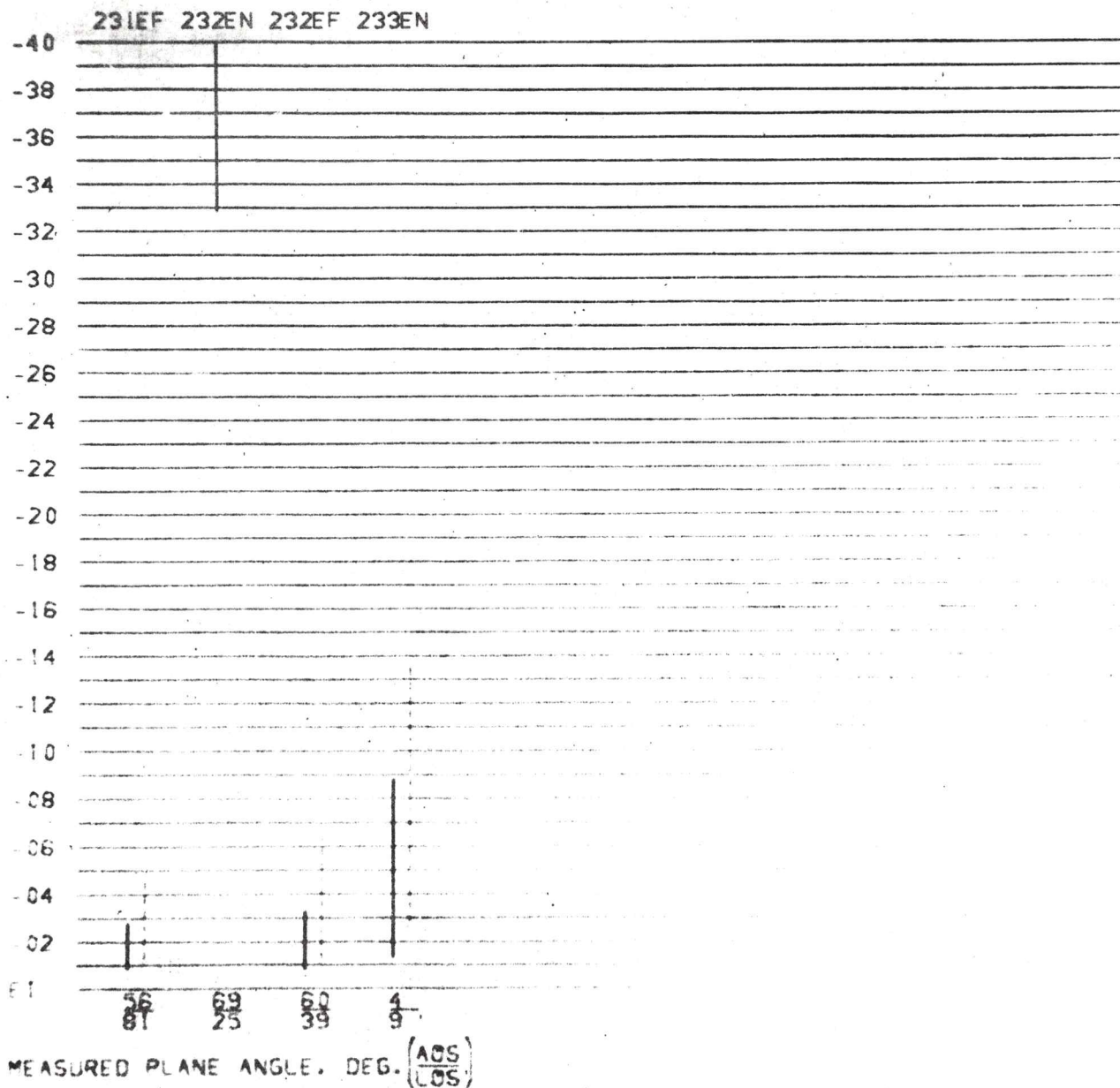


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TET, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

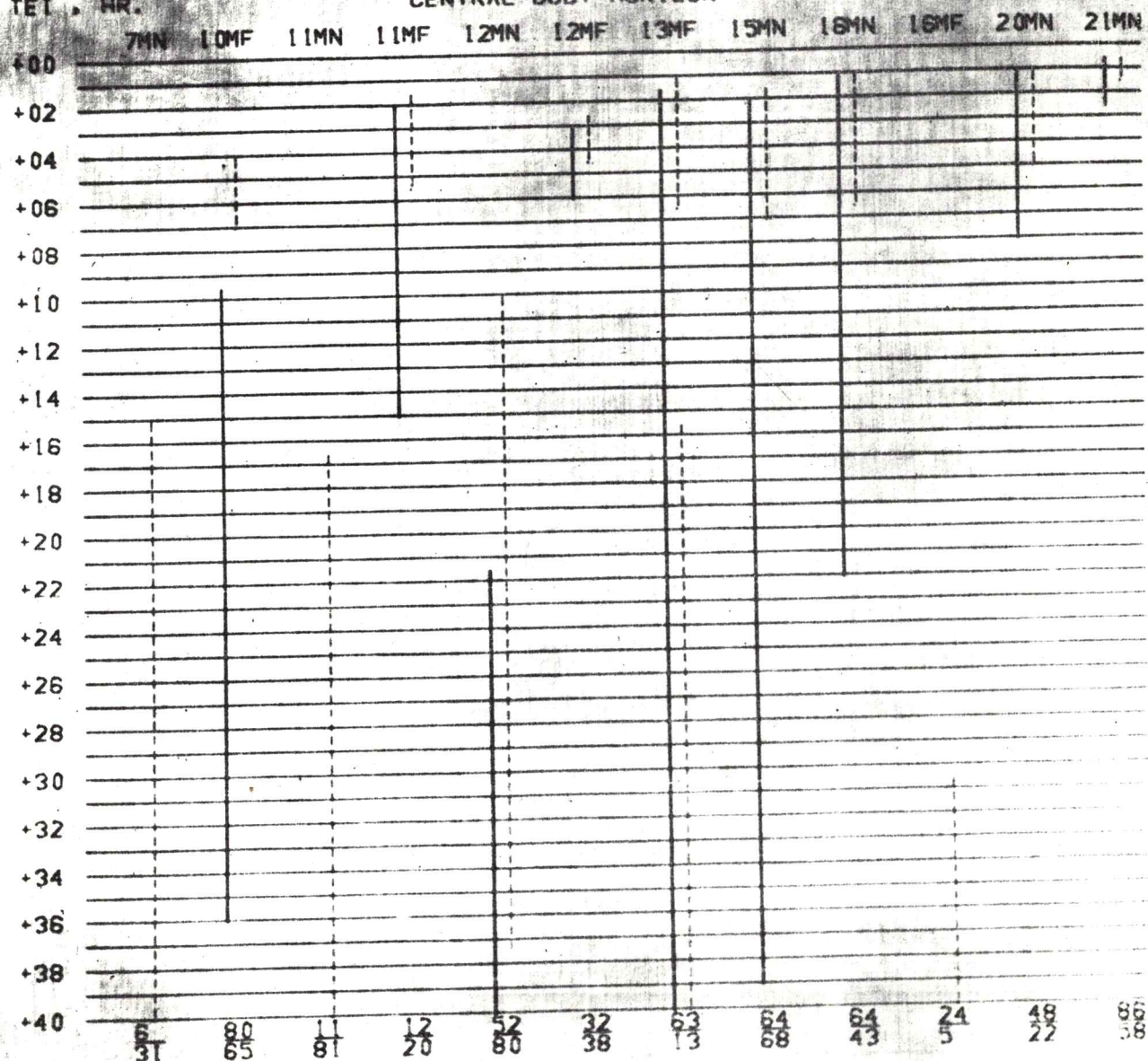
MEASURED PLANE ANGLE, DEG. $\left(\frac{AOS}{LOS}\right)$

Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

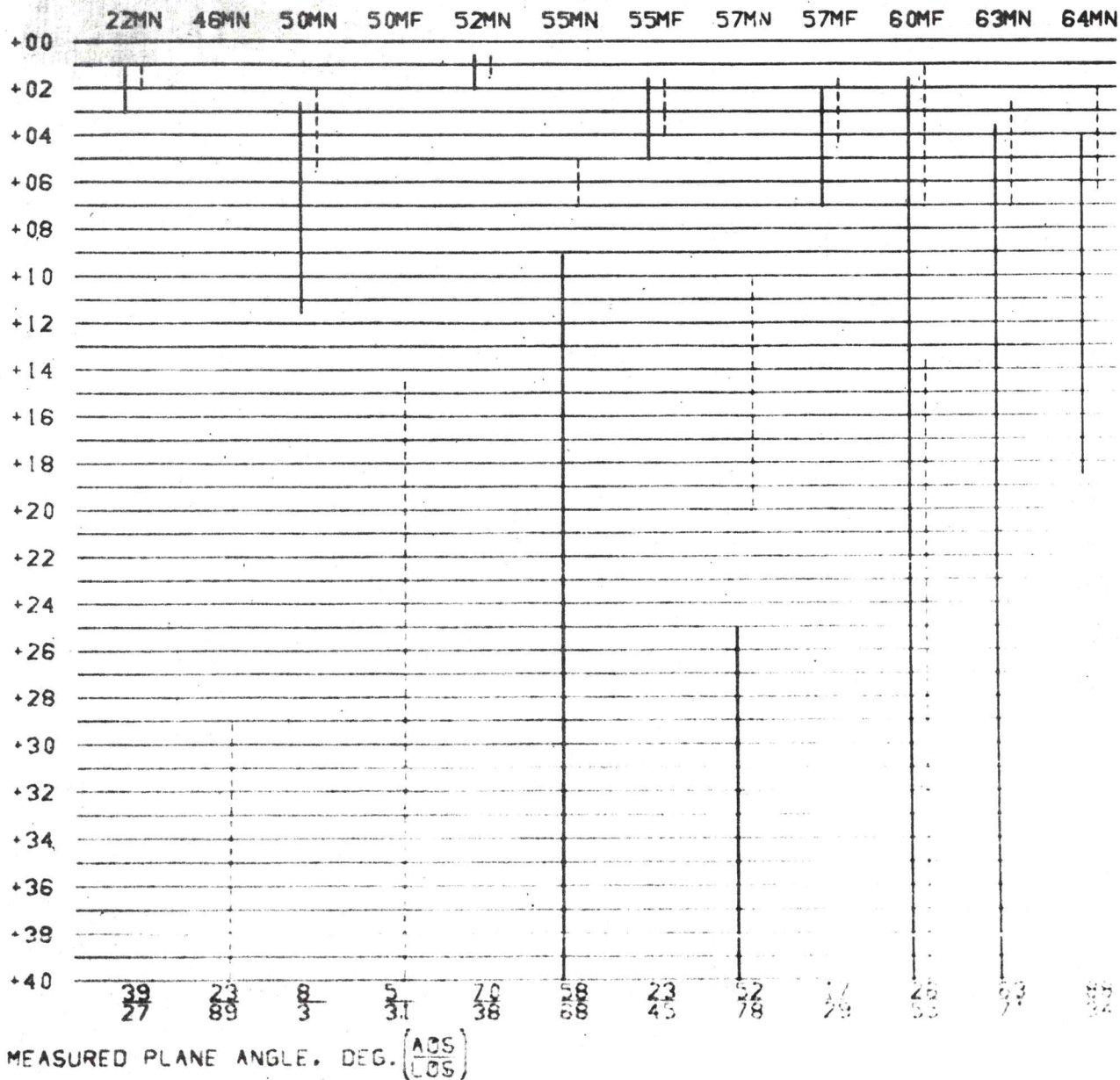


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TEL, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

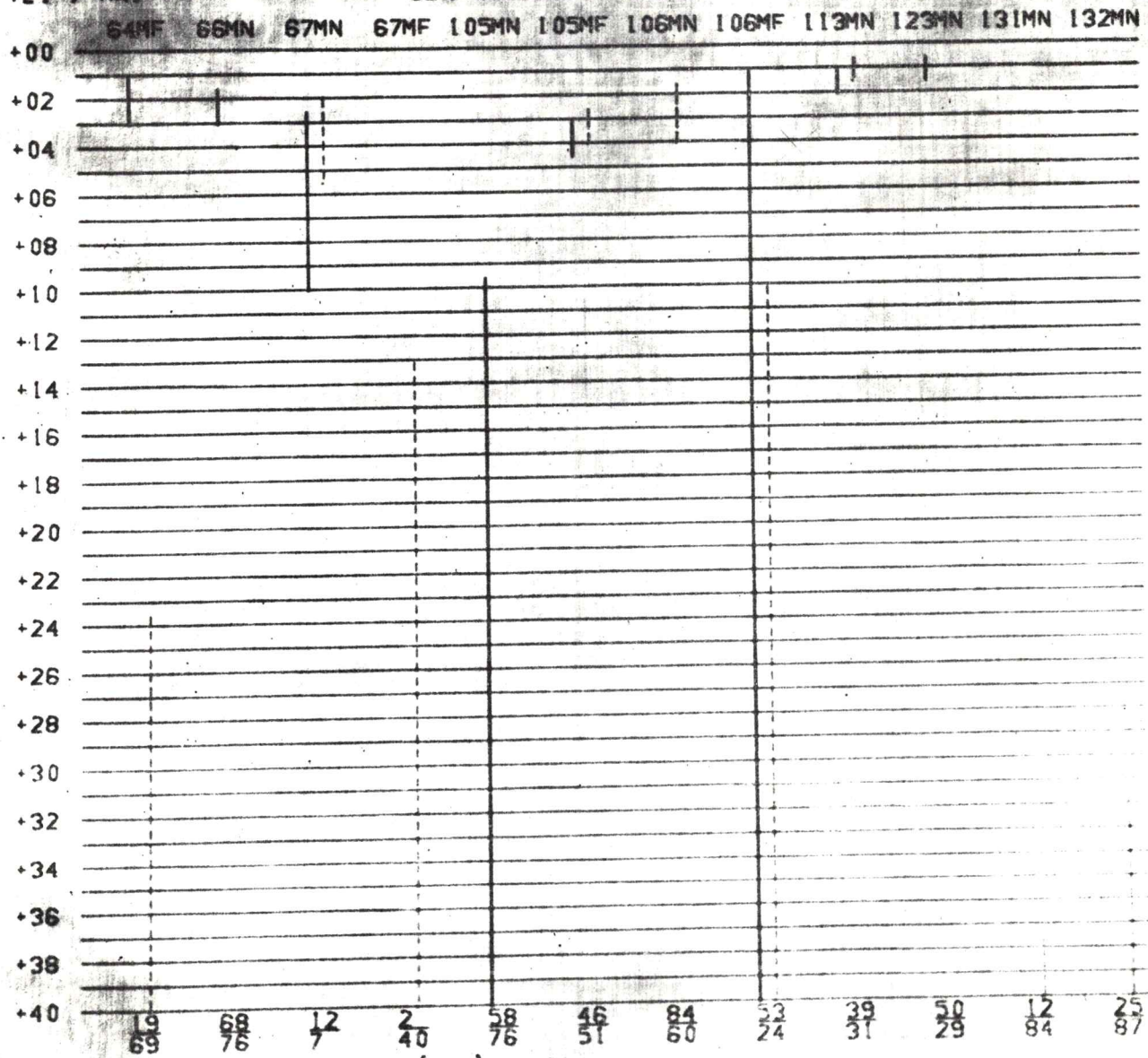
MEASURED PLANE ANGLE, DEG. $\left(\frac{\text{AOS}}{\text{LOS}}\right)$

Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TET, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

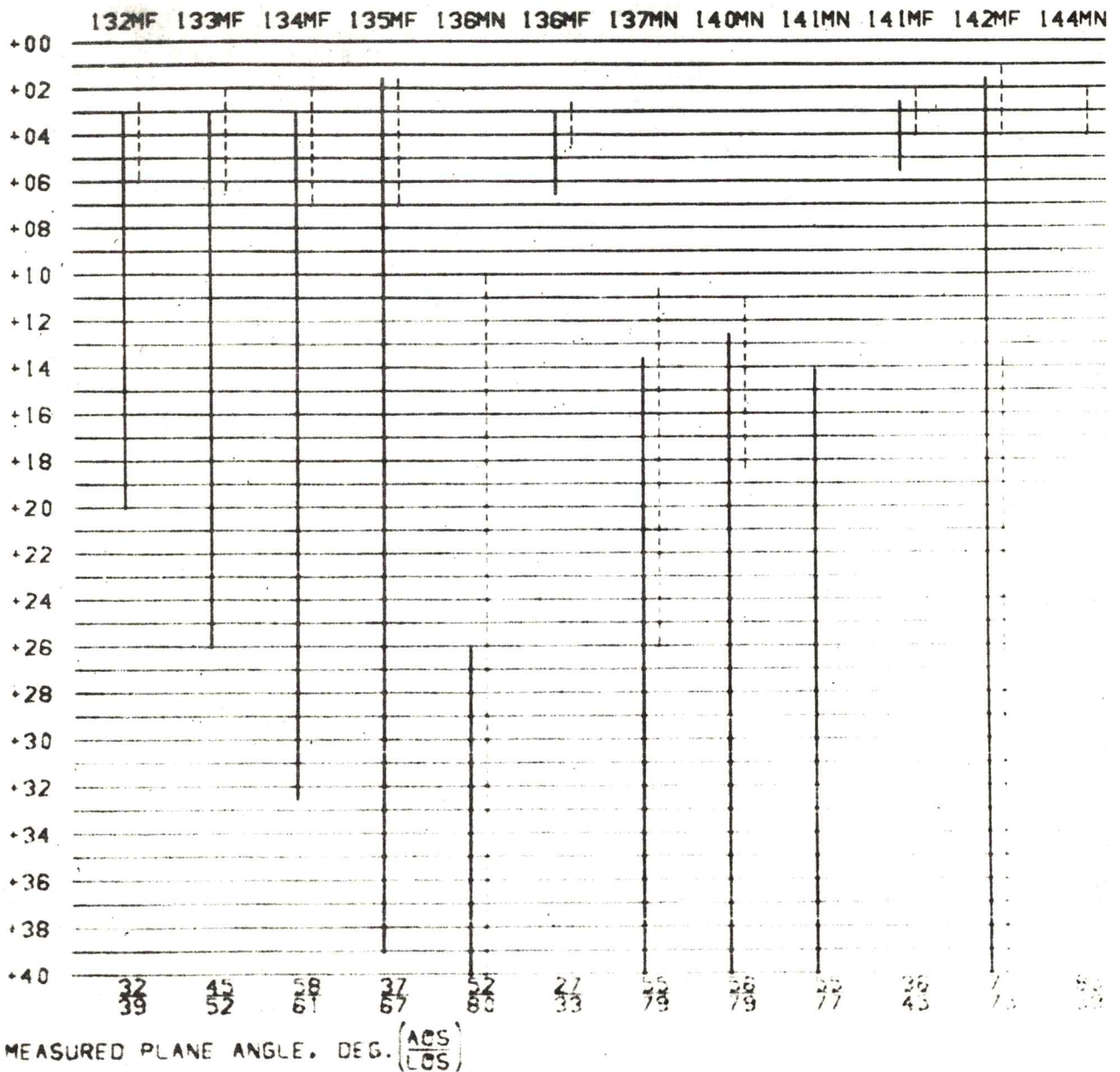


Figure II(c) (Continued)

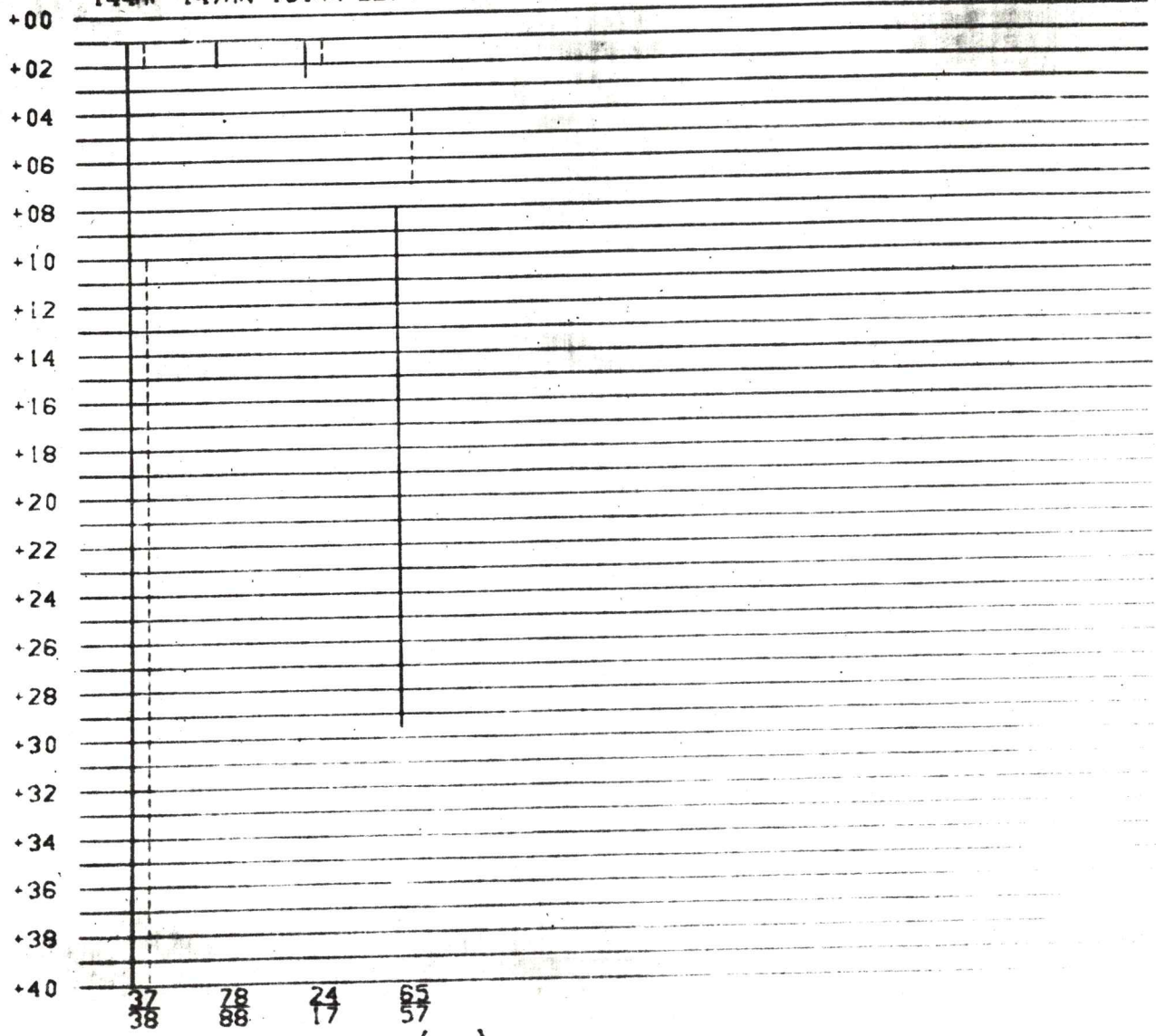
APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
TEI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

144MF 147MN 151MN 227MF



MEASURED PLANE ANGLE, DEG. $\left(\frac{AOS}{LOS} \right)$

Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
E1, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

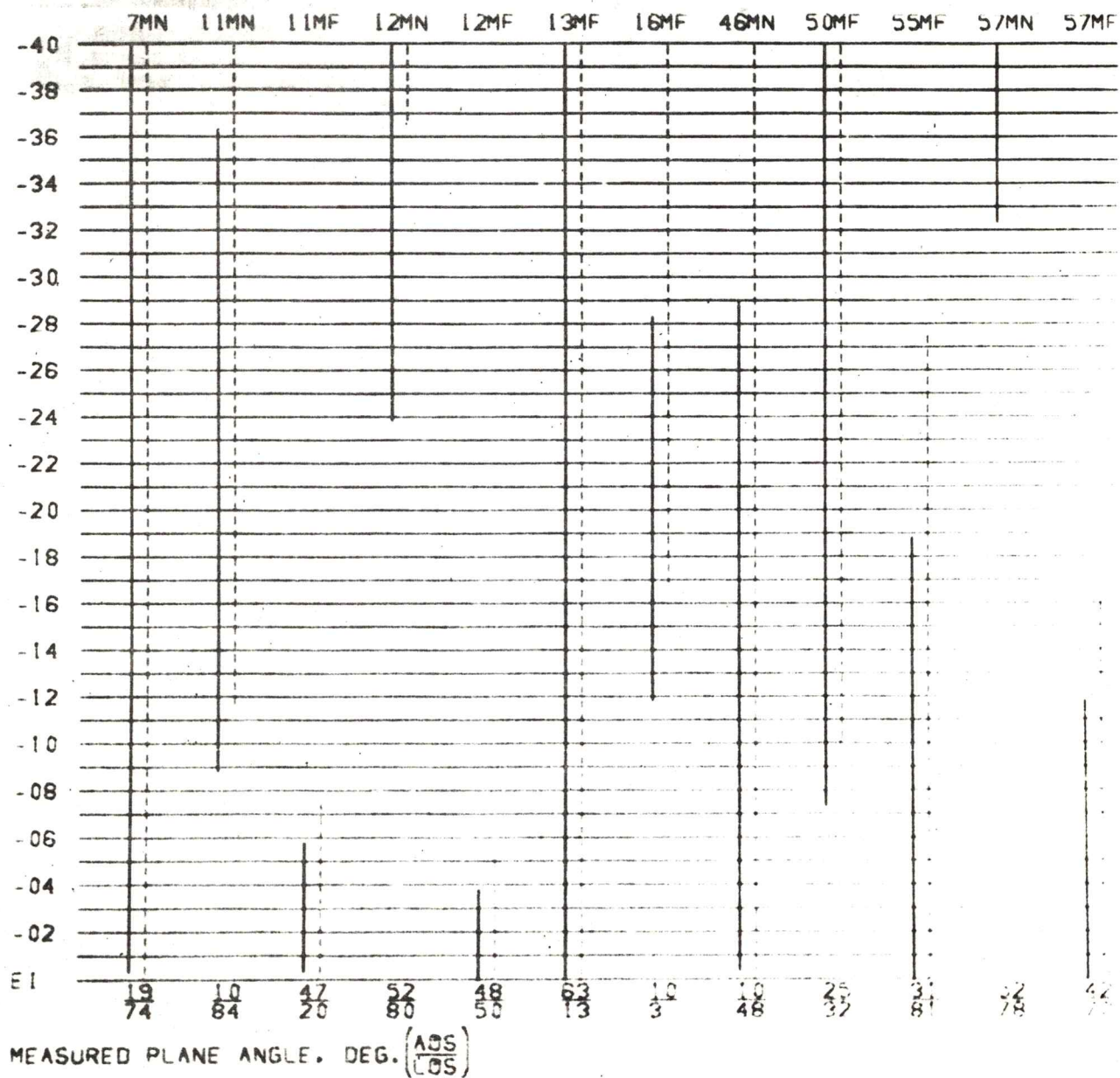


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

TIME FROM
EI . HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

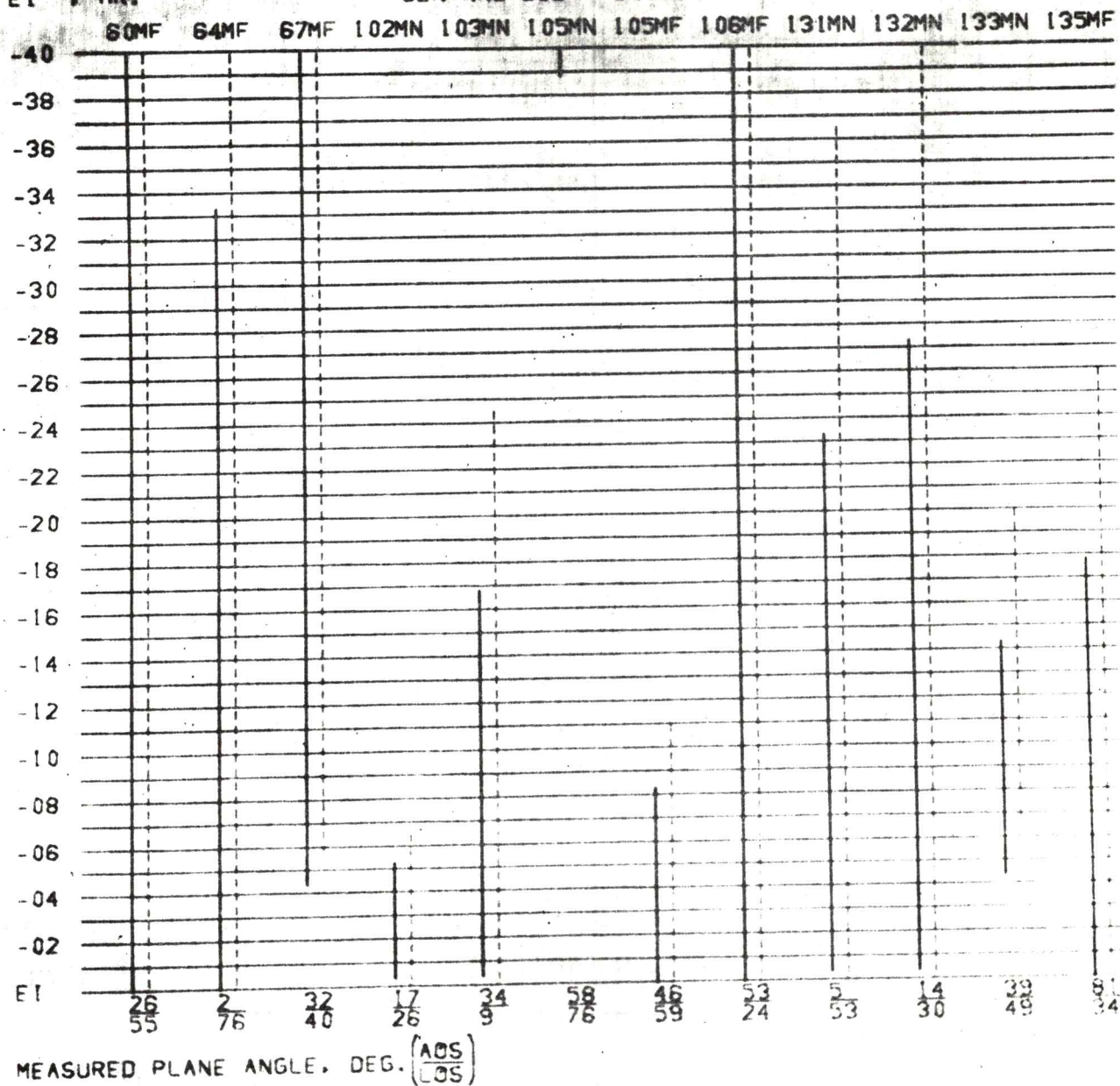


Figure II(c) (Continued)

APOLLO 17 (12/7) LOA REV 50-59

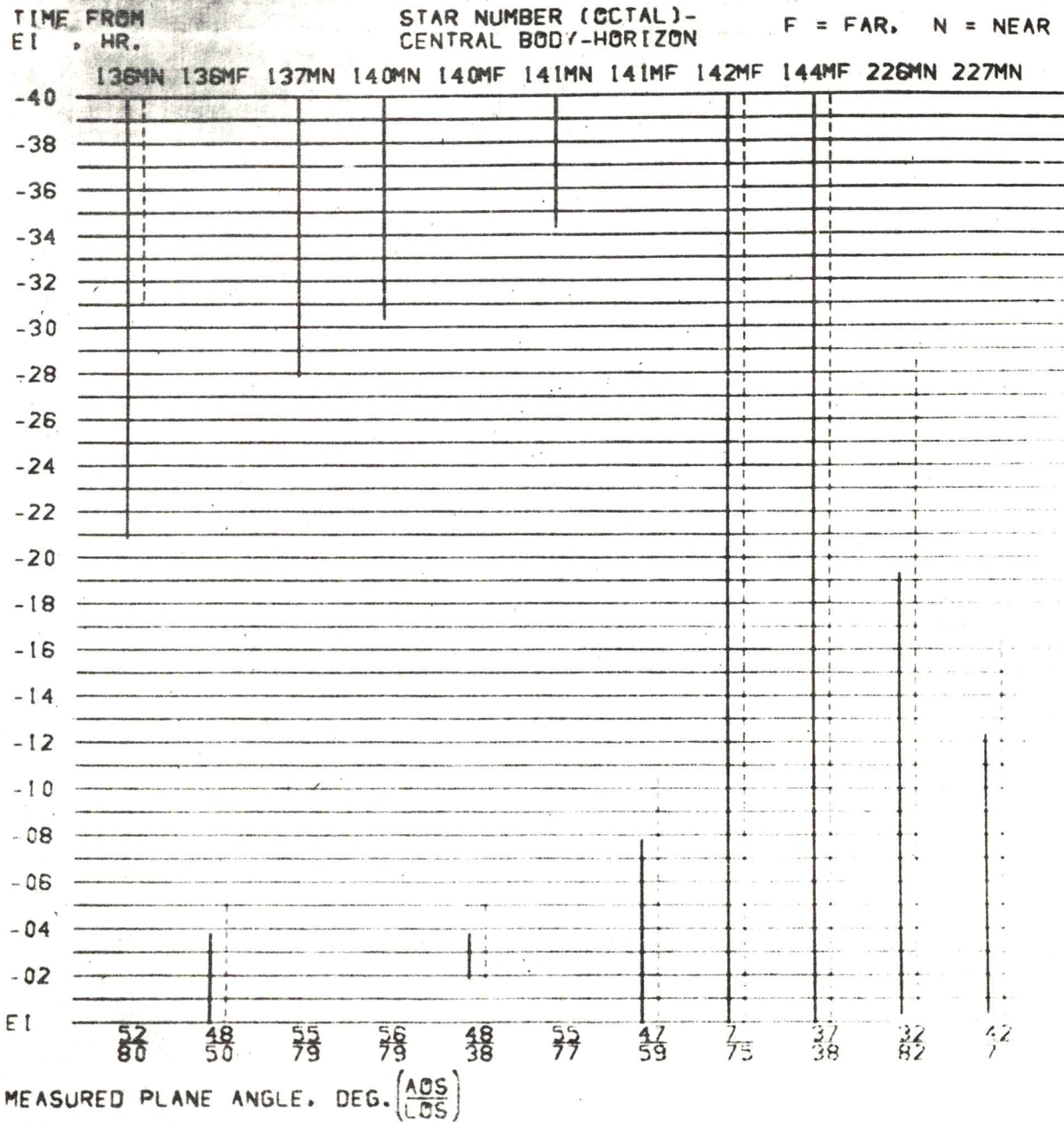


Figure II(c) (Concluded)

APOLLO 17 (12/7) TEC NOMINAL

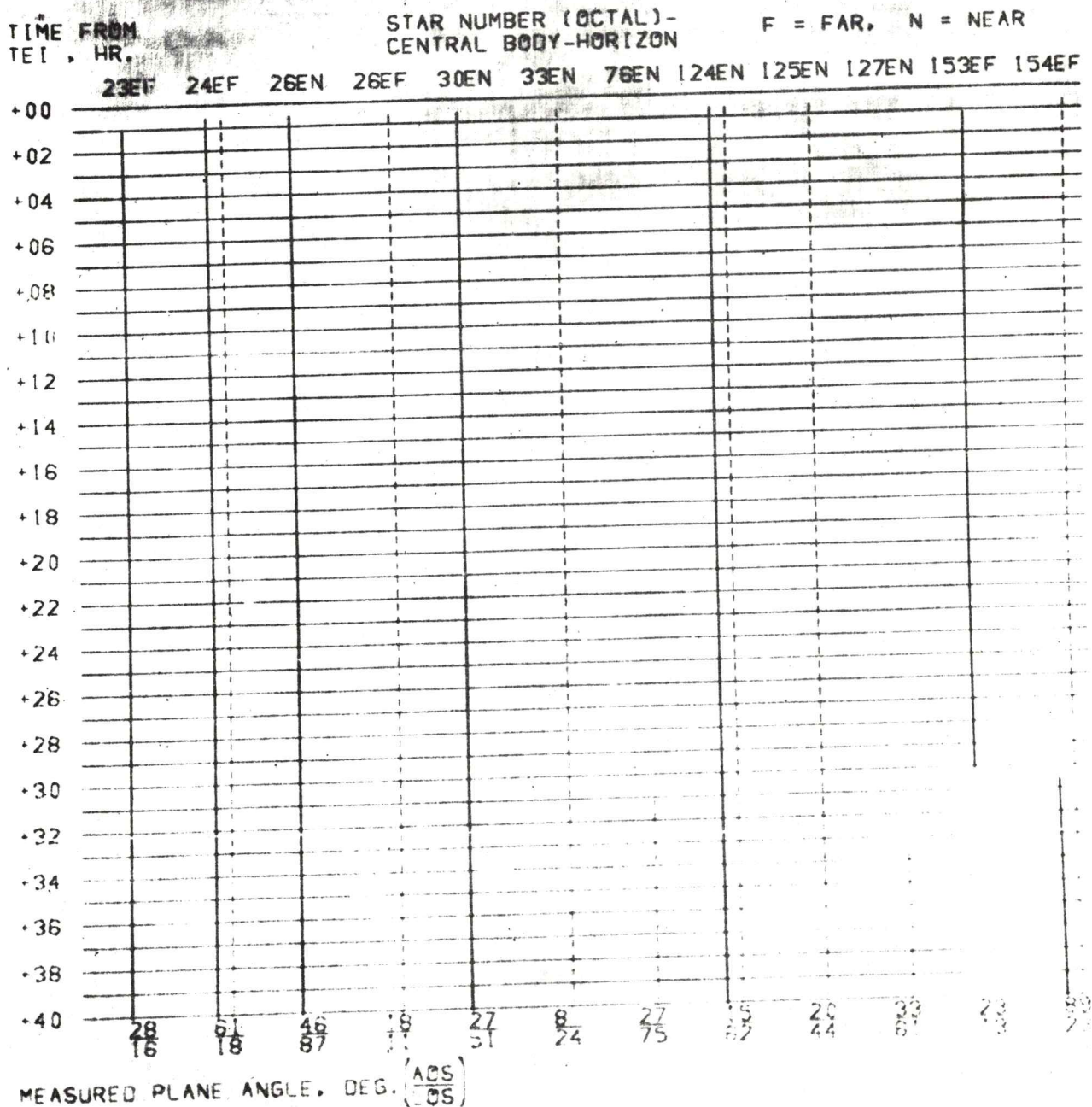


Figure II(d) Star Availability Plots for Apollo 17
 Lunar Orbit Abort Trajectory
 (GMT of EI = 19 December 1972, 18 Hours)
 December 7, 1972 Launch Date (GMT)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

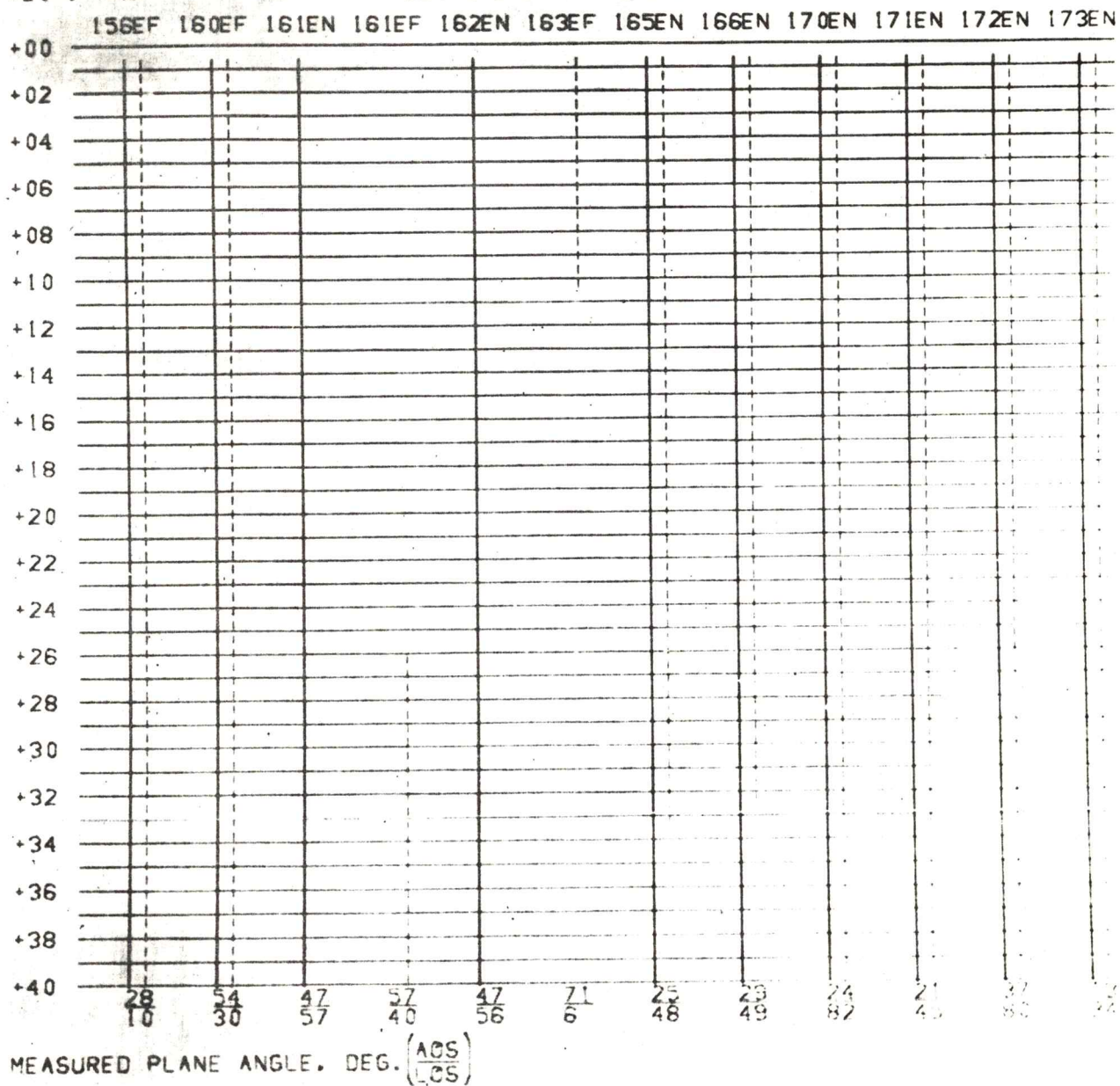


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

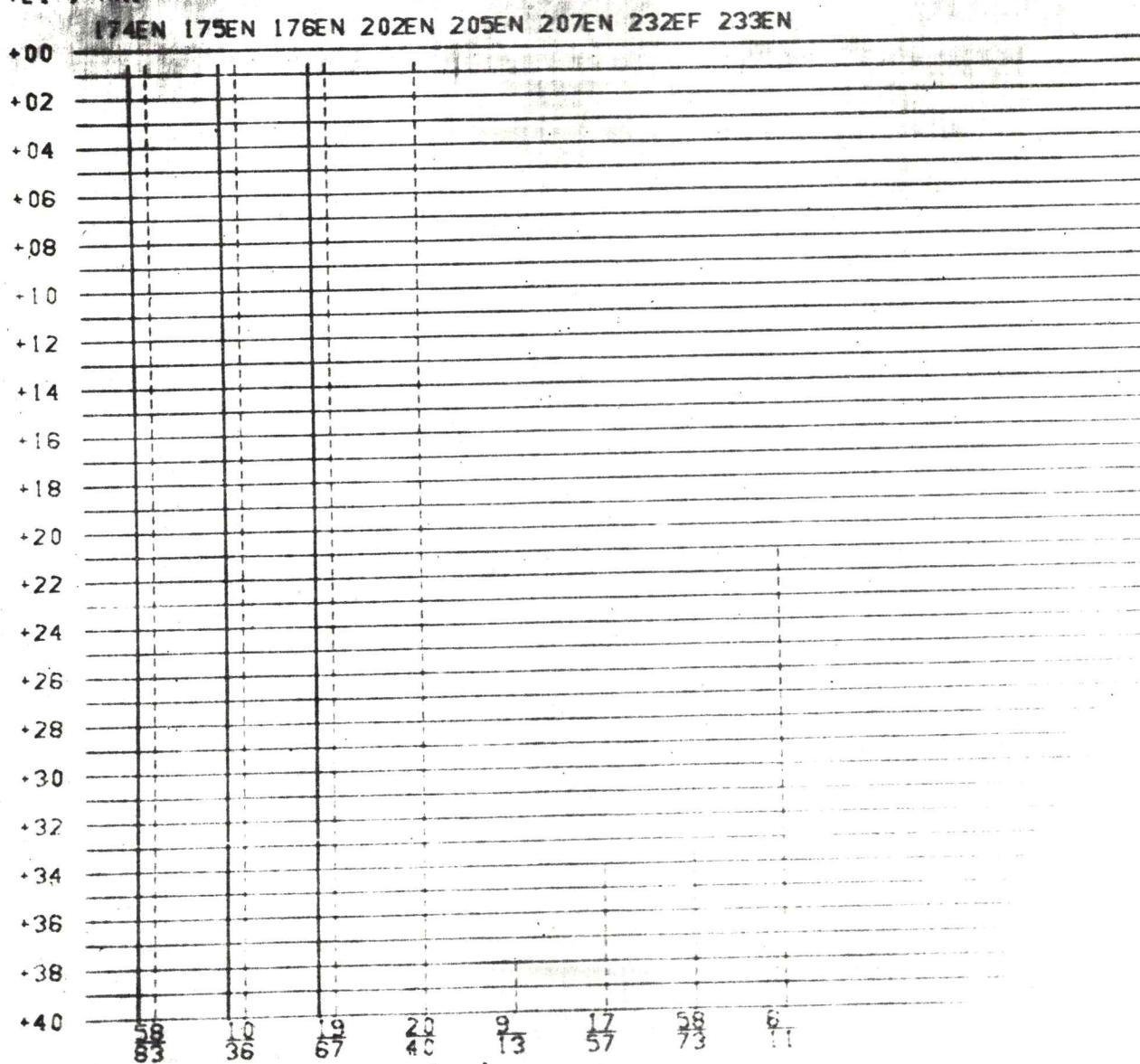
MEASURED PLANE ANGLE, DEG. (AOS)
(LOS)

Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

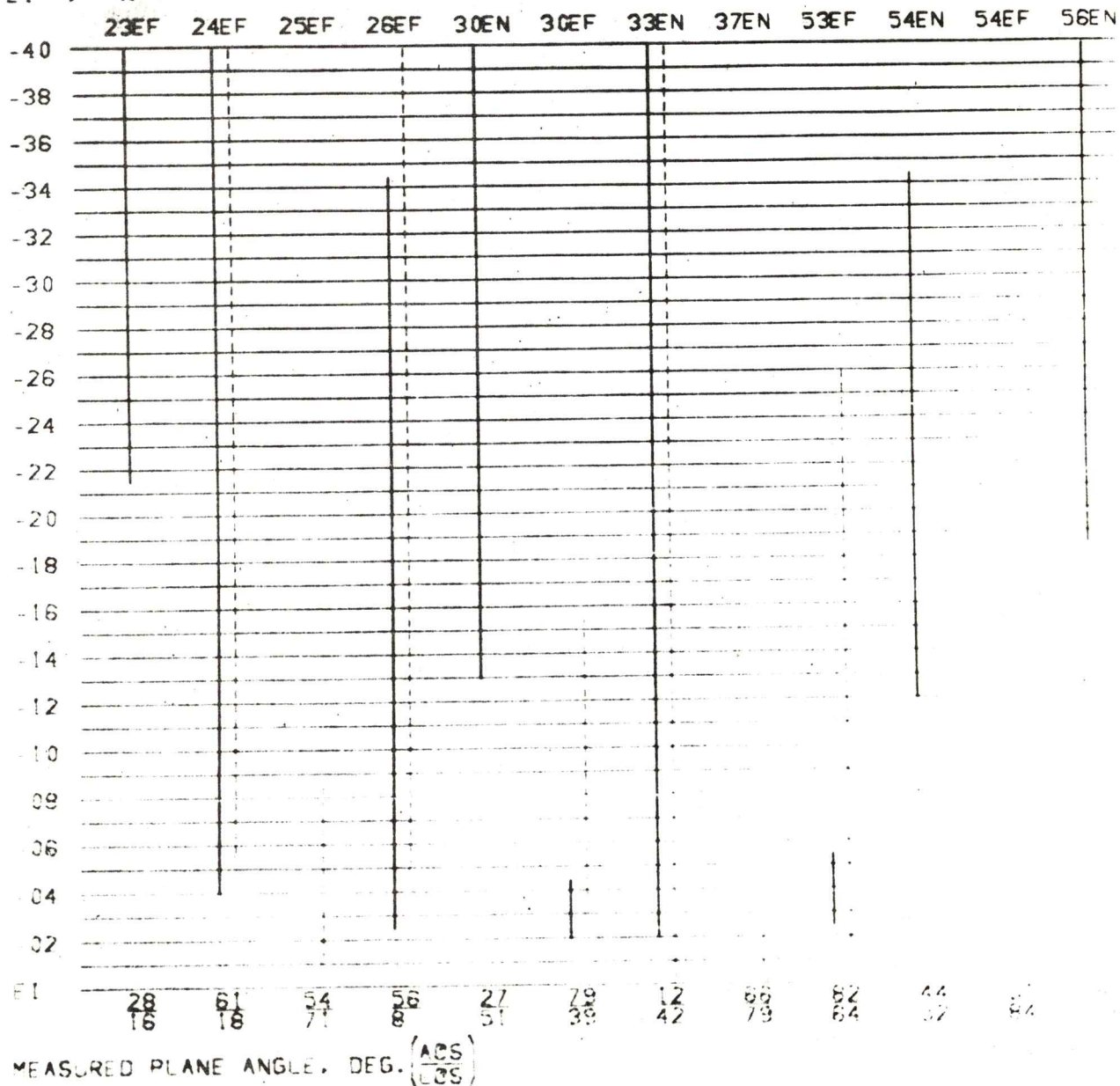


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

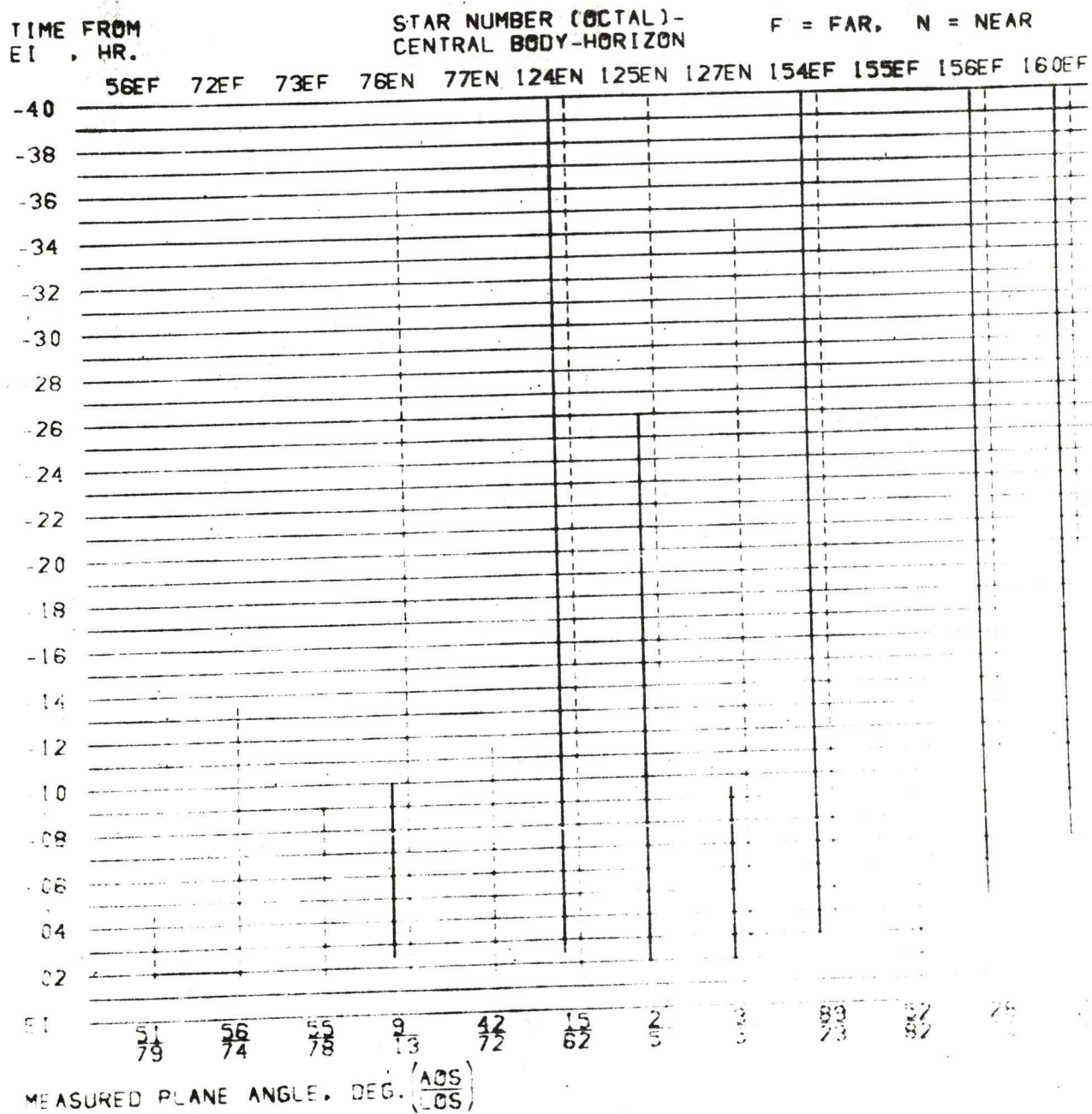


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

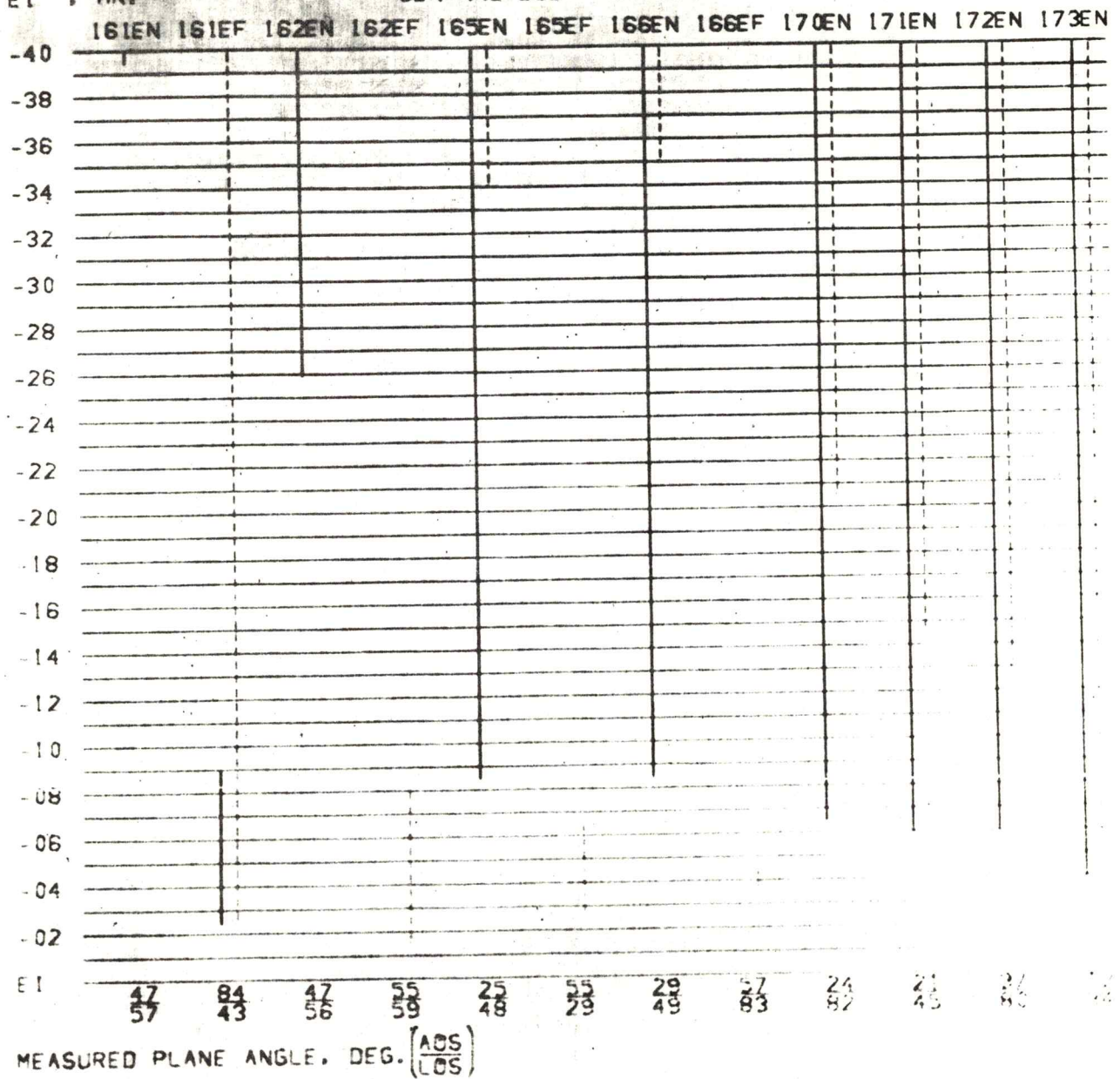


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

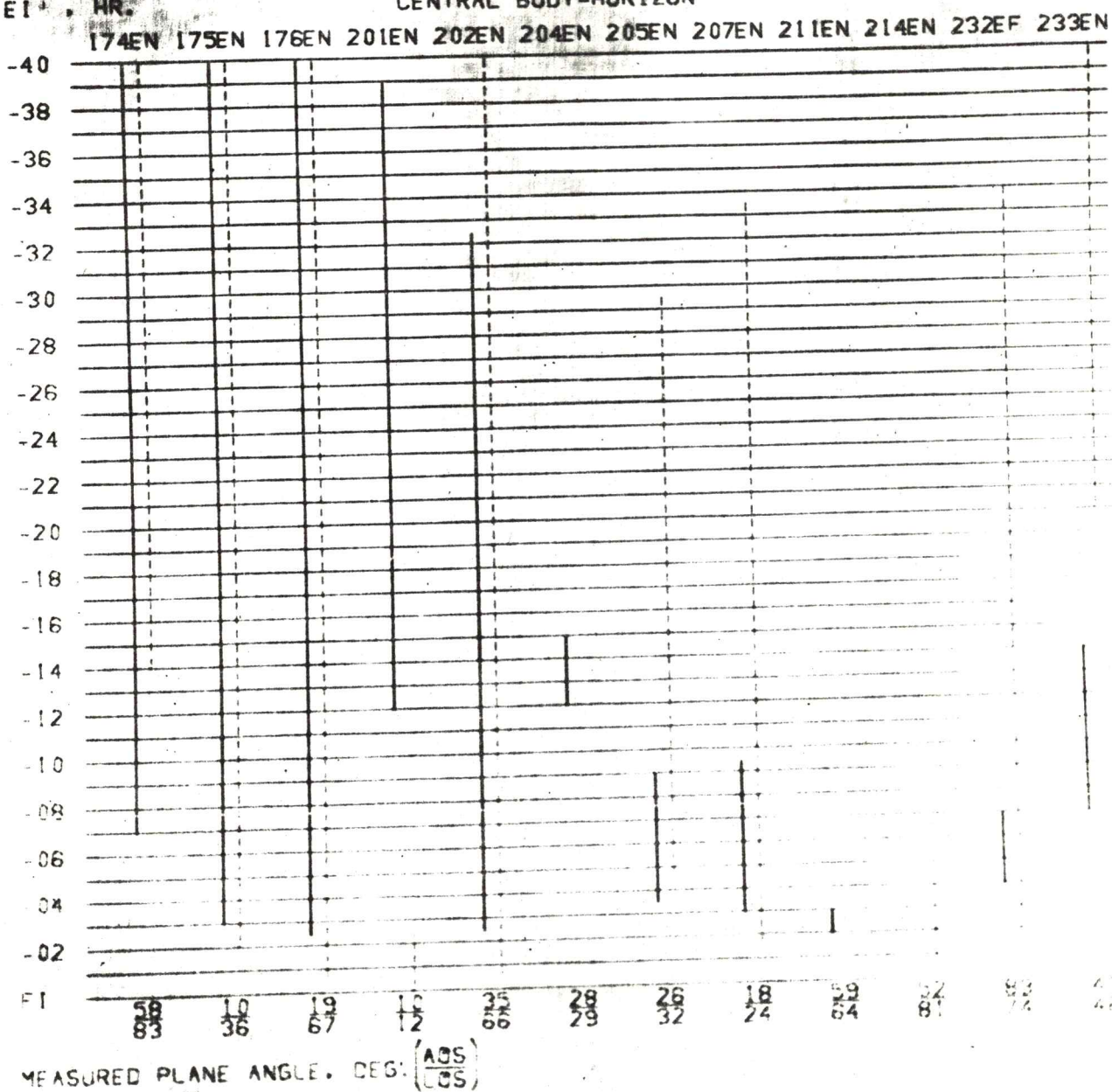


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

236EN

-40

-38

-36

-34

-32

-30

-28

-26

-24

-22

-20

-18

-16

-14

-12

-10

-08

-06

-04

-02

EI

44
75MEASURED PLANE ANGLE, DEG. $\left(\frac{ACS}{LOS}\right)$

Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

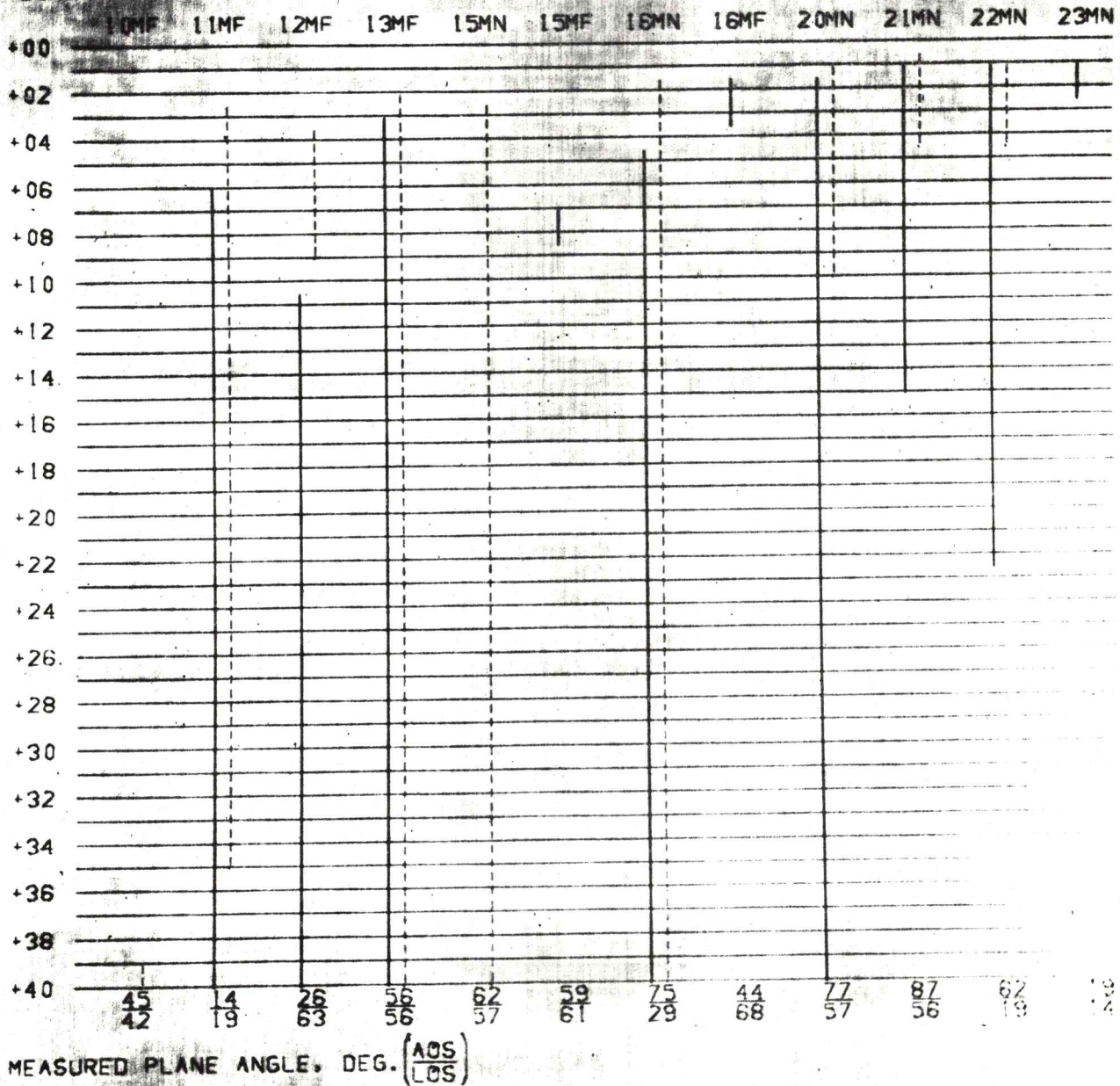


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

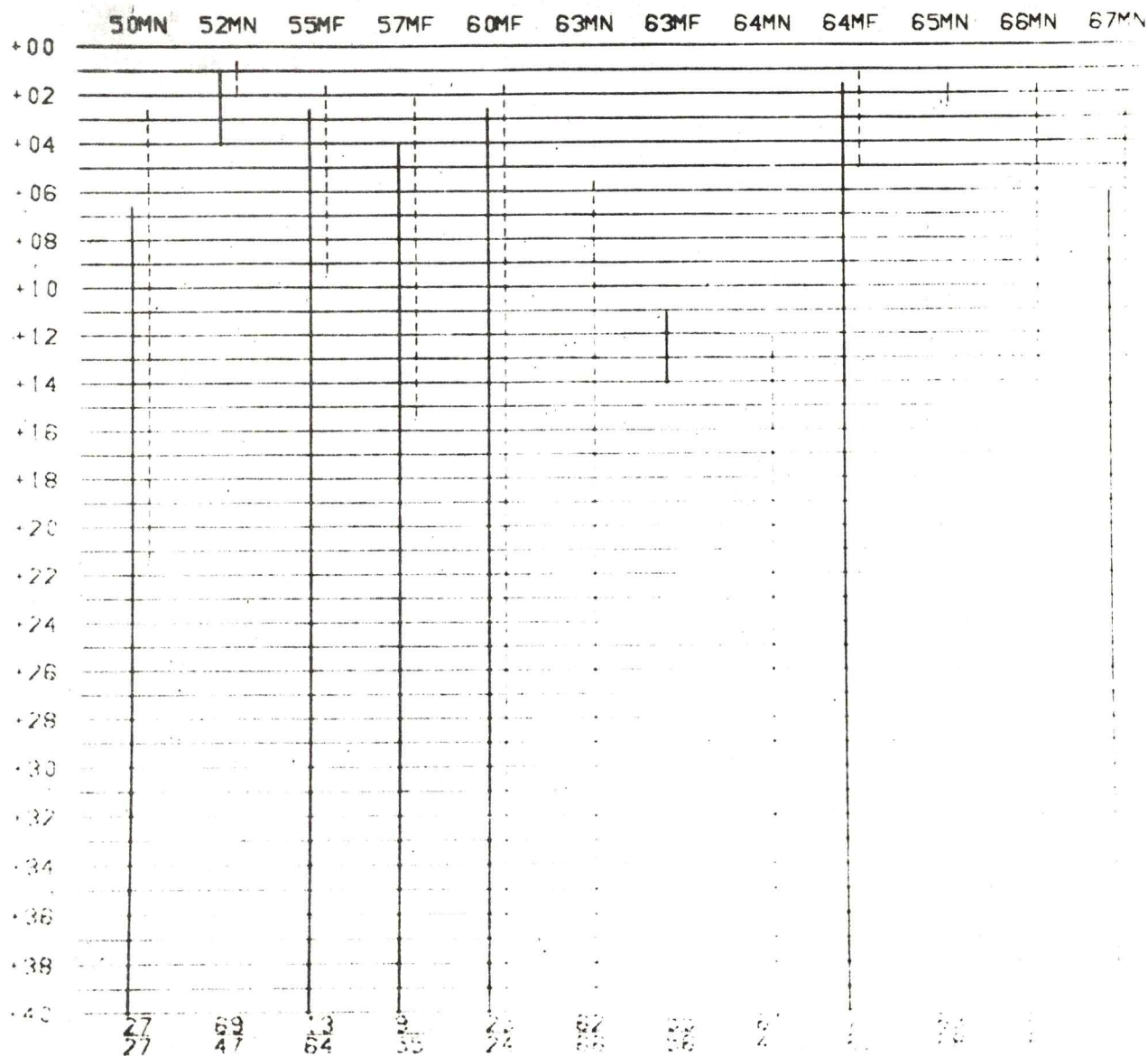
MEASURED PLANE ANGLE, DEG. (A35)
(CS)

Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

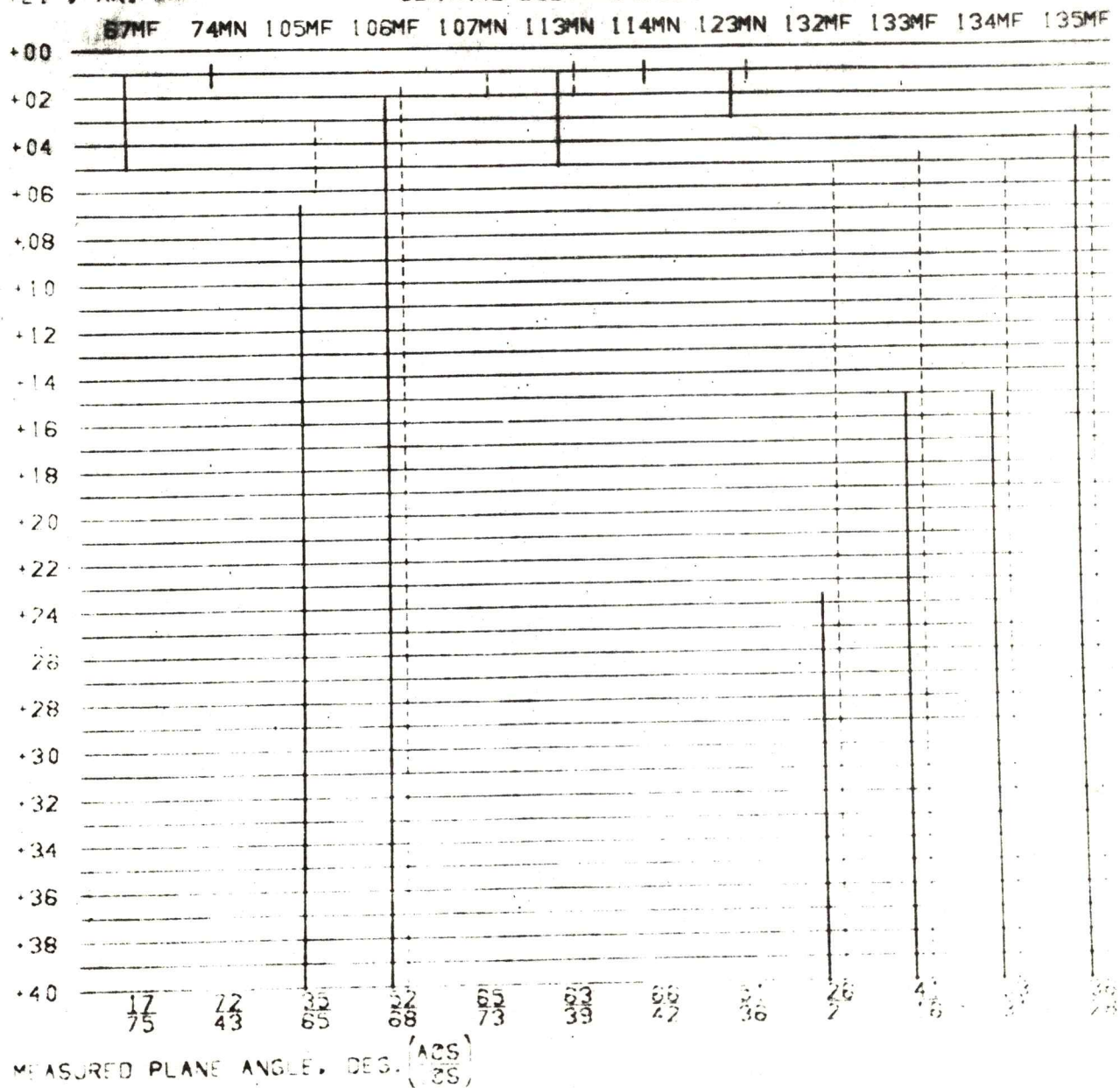


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

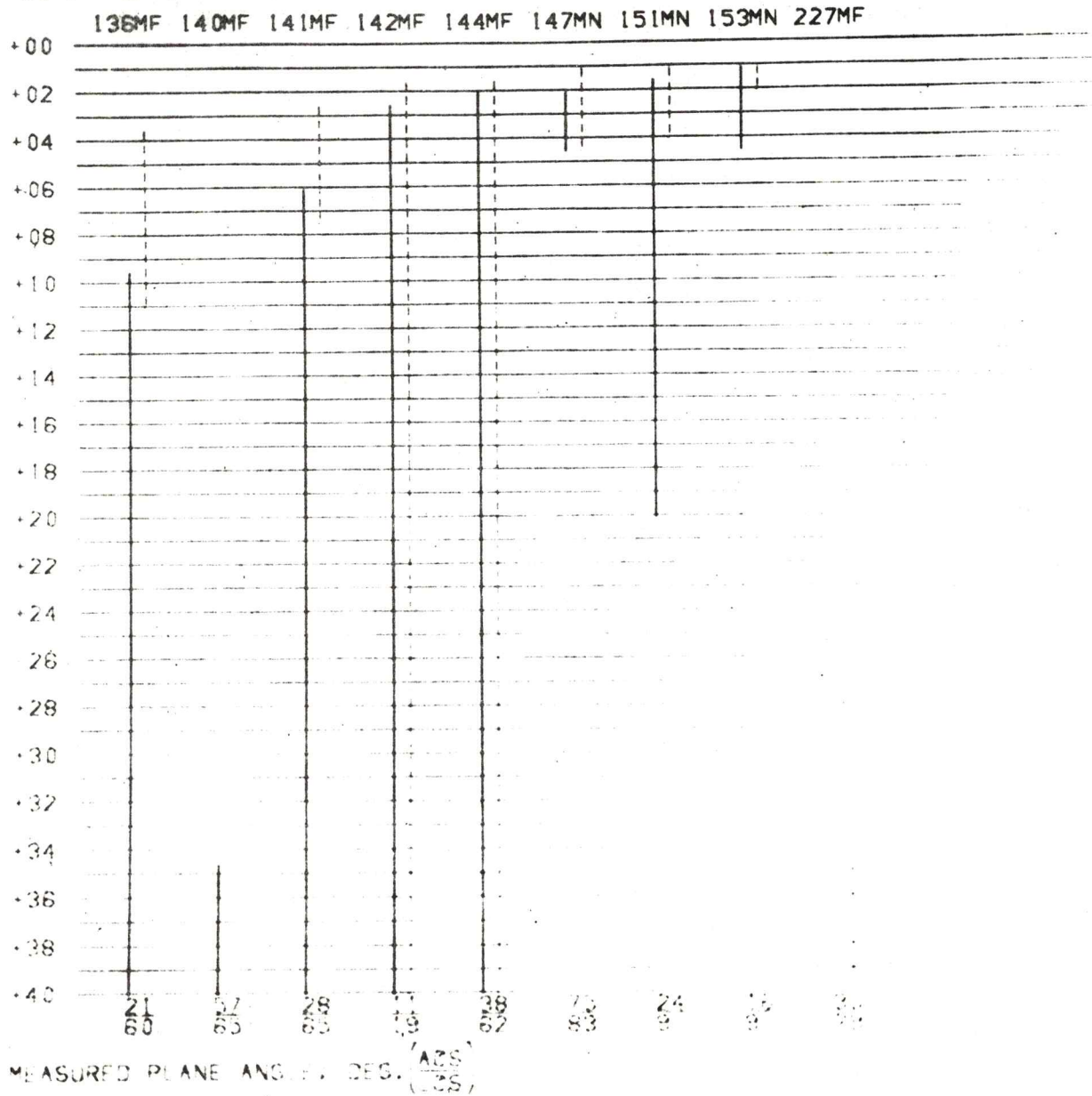


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

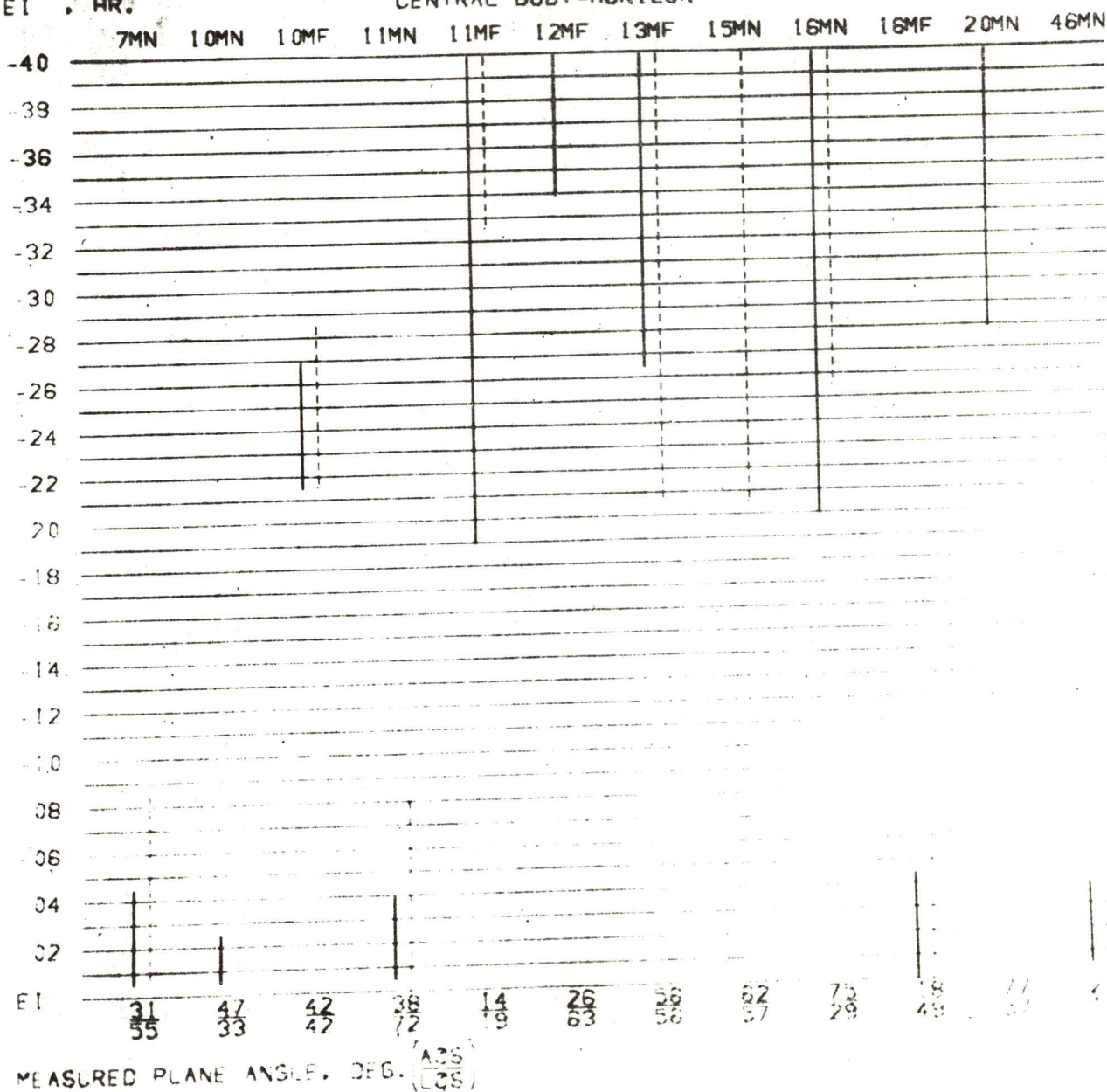
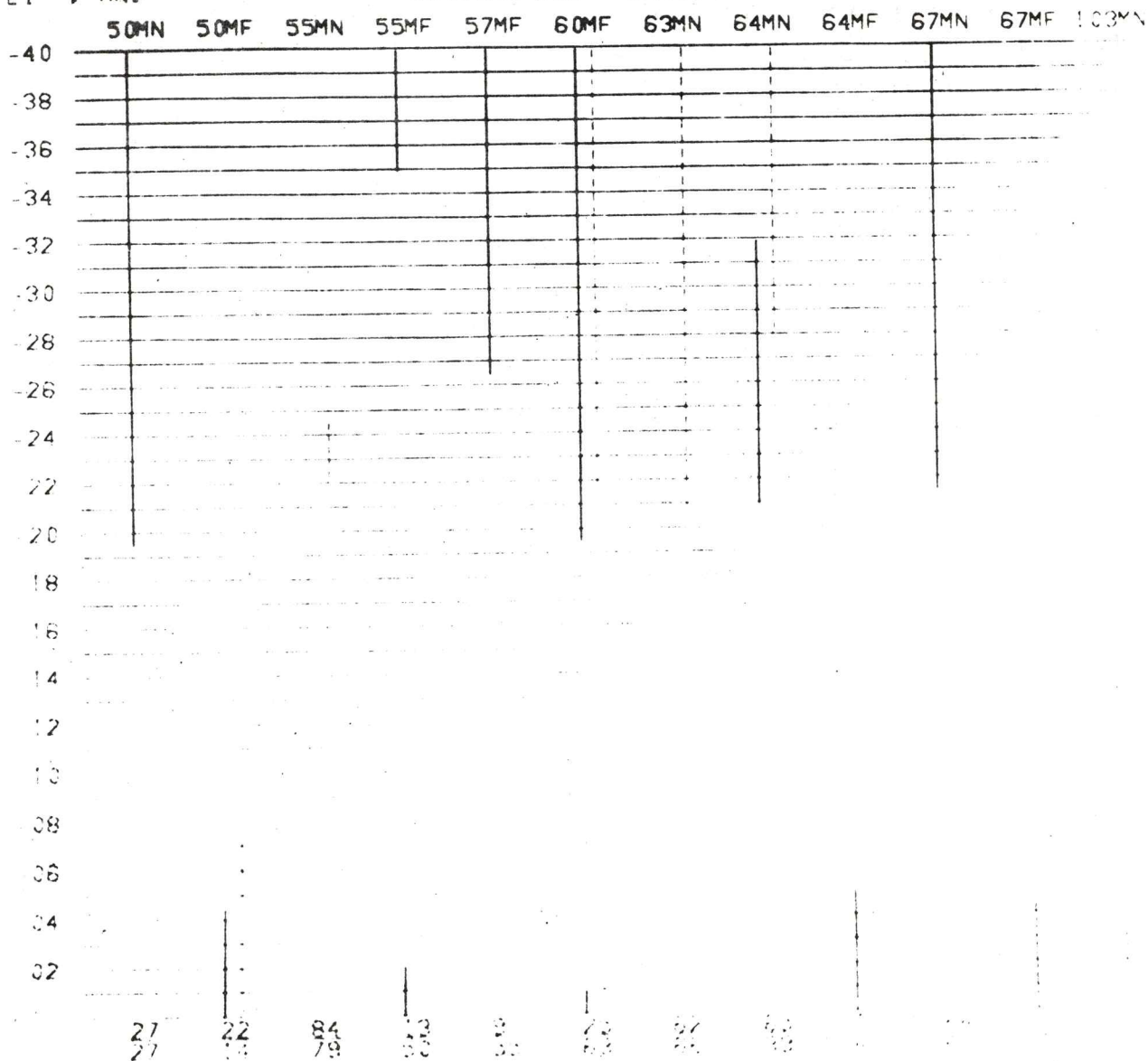


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MEASURED PLANE AND E. A. C. 135

Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

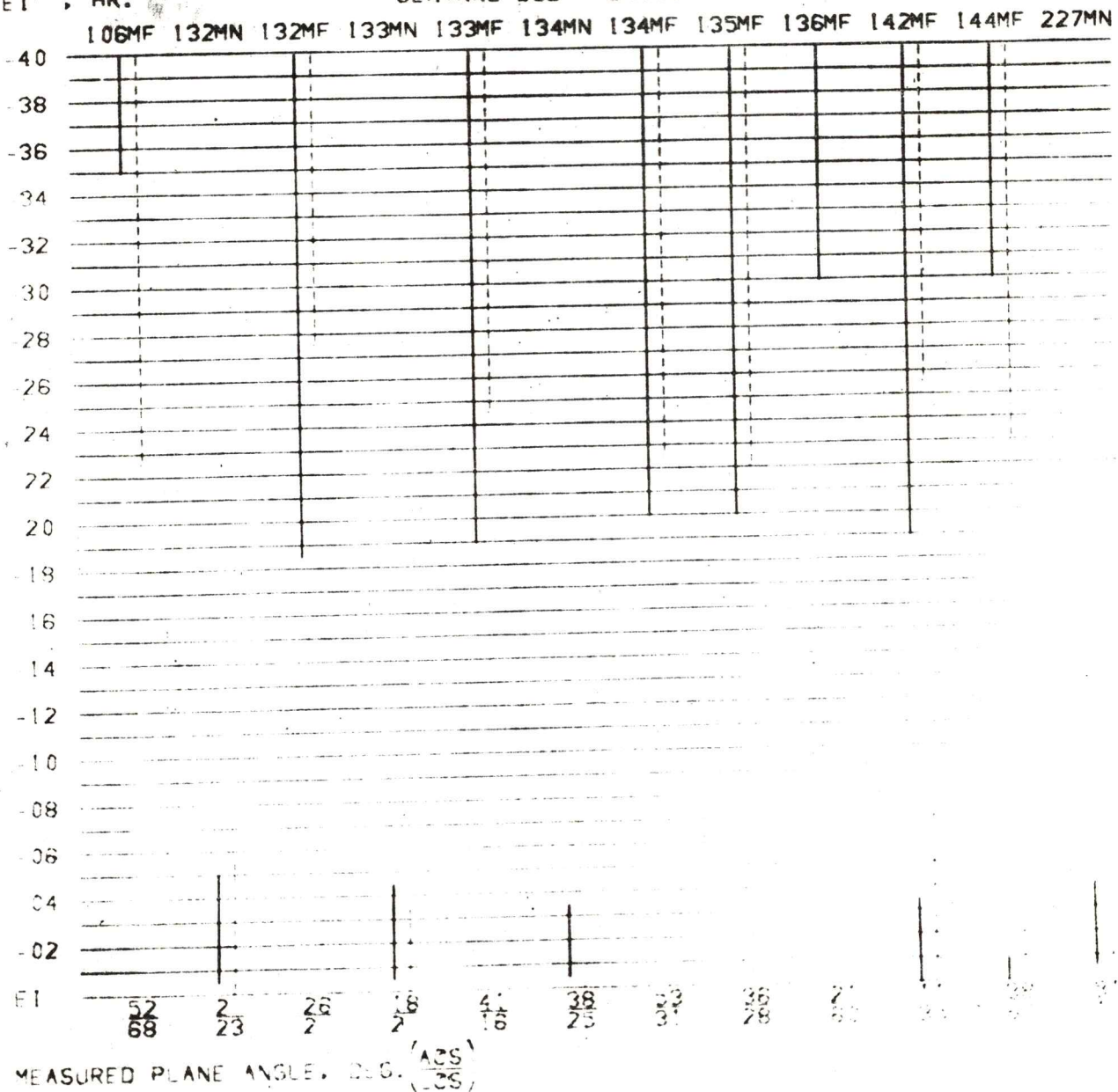


Figure II(d) (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

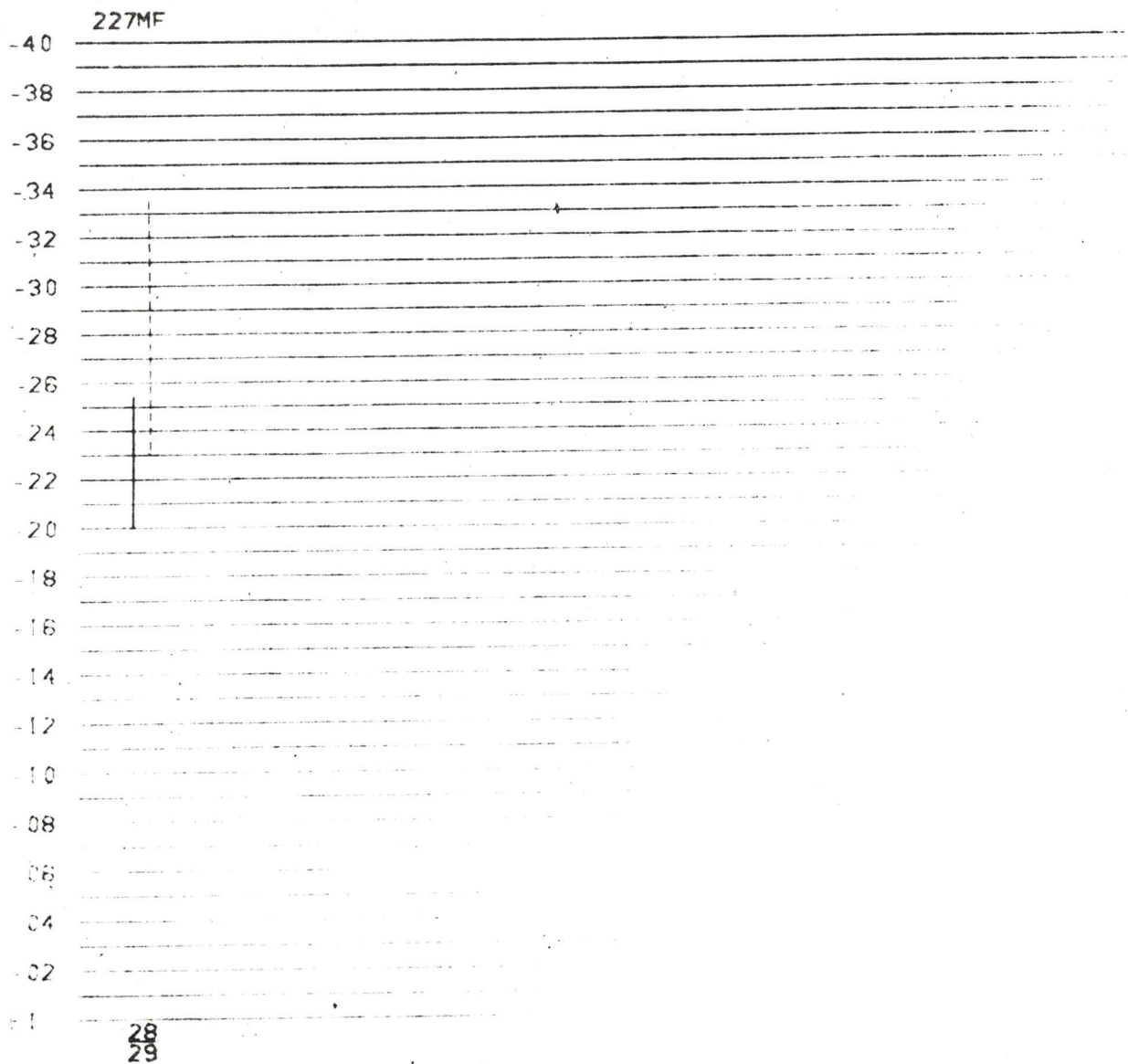
MEASURED PLANE ANGLE, DEG. $\left(\begin{smallmatrix} \text{ACS} \\ \text{LCS} \end{smallmatrix} \right)$

Figure II(d) (Concluded)

APOLLO 17 (12/7) TEC NOMINAL

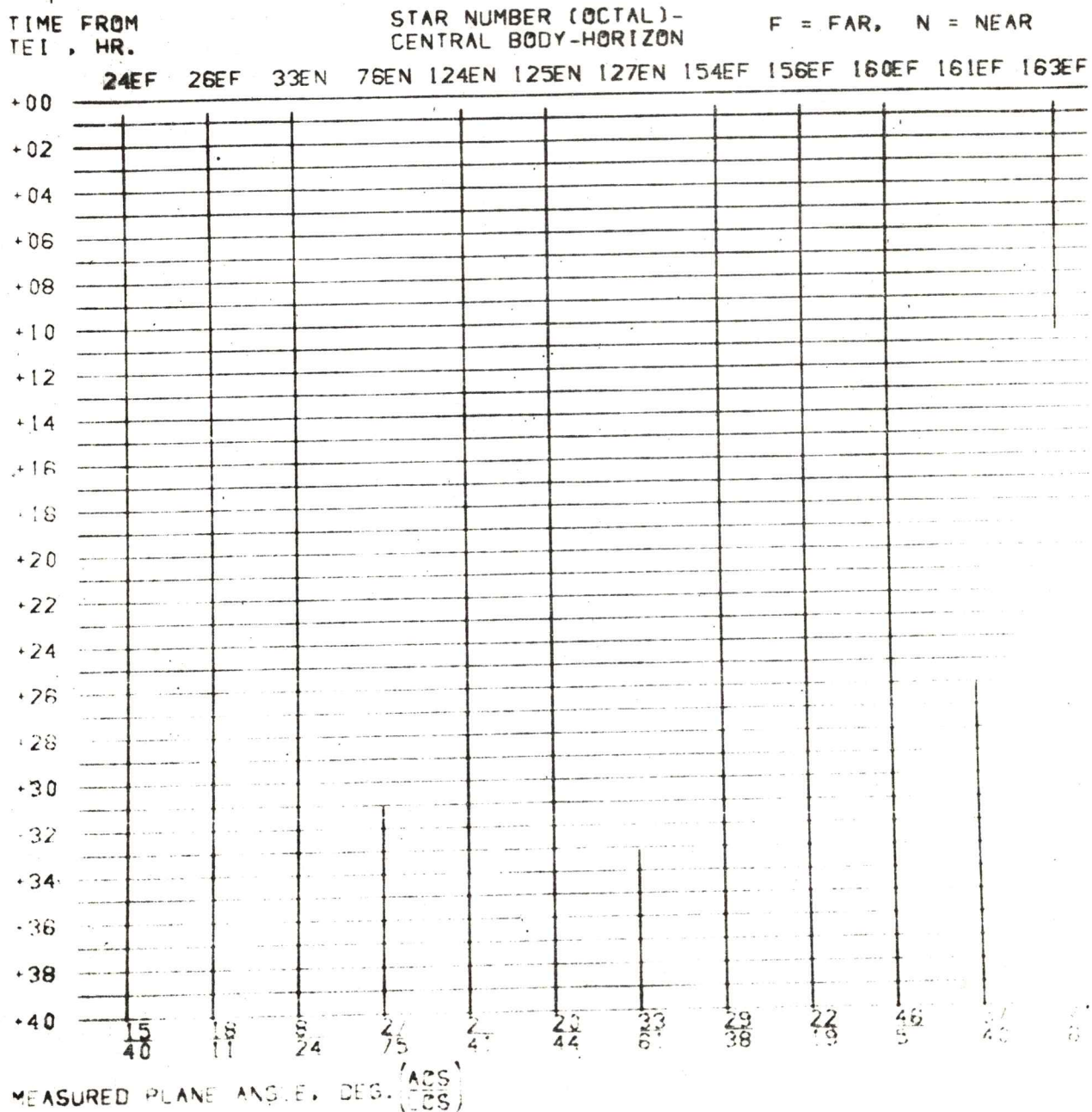


Figure III Star Availability Plots for Apollo 17
Nominal Transearth Coast Trajectory
(GMT of EI = 19 December 1972, 19 Hours)-
December 7, 1972 Launch Date (GMT)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.

STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

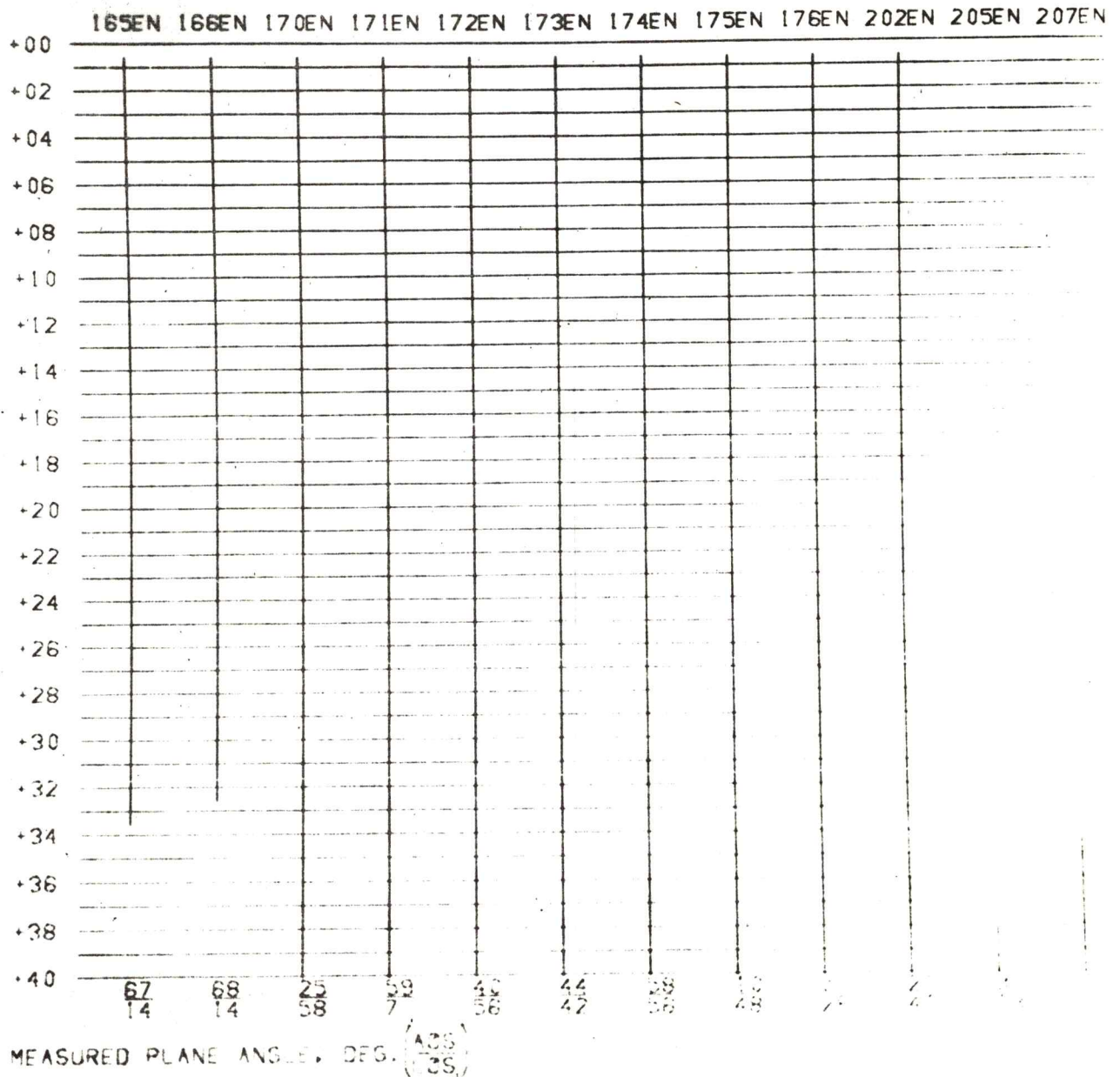


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

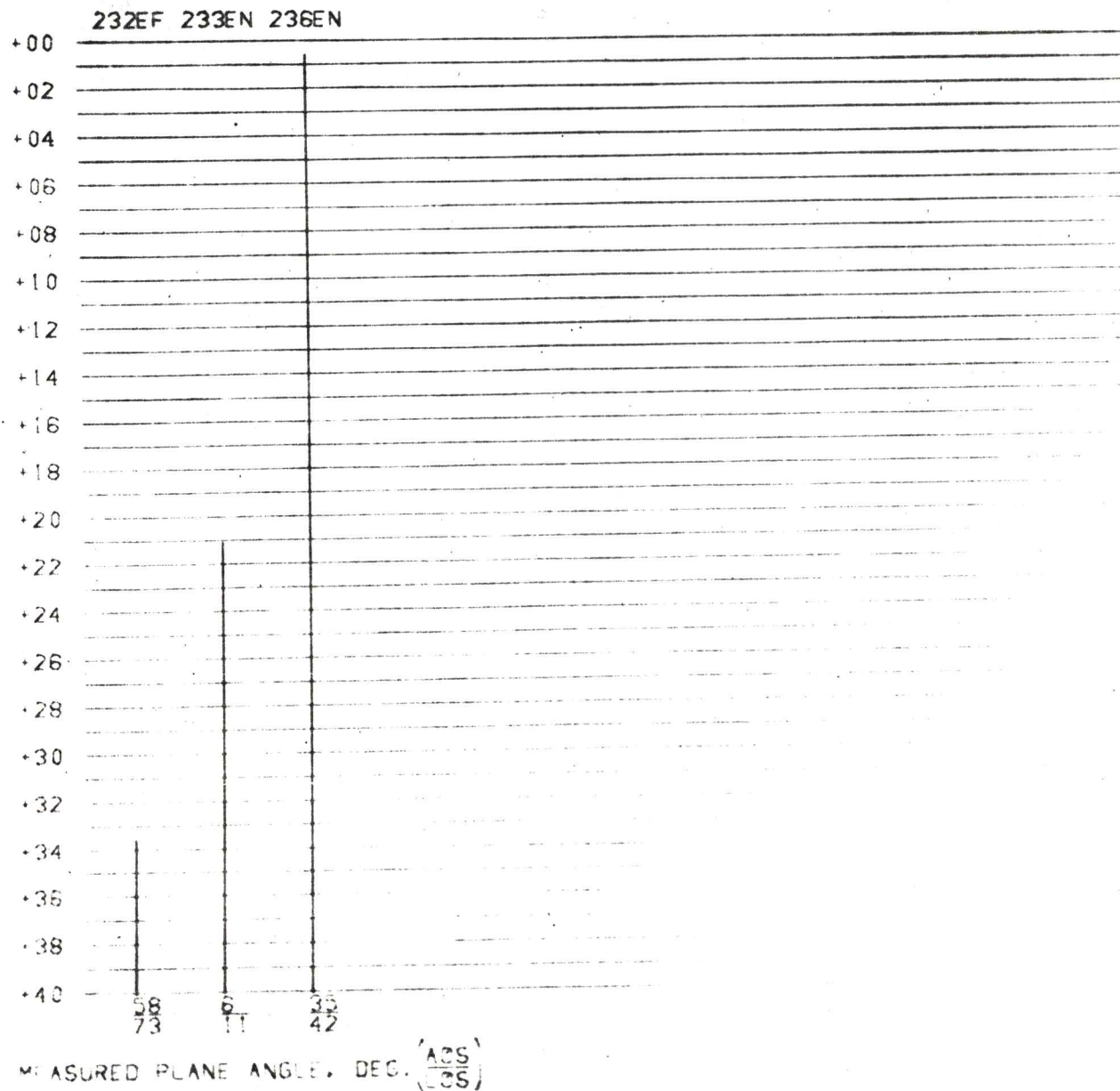
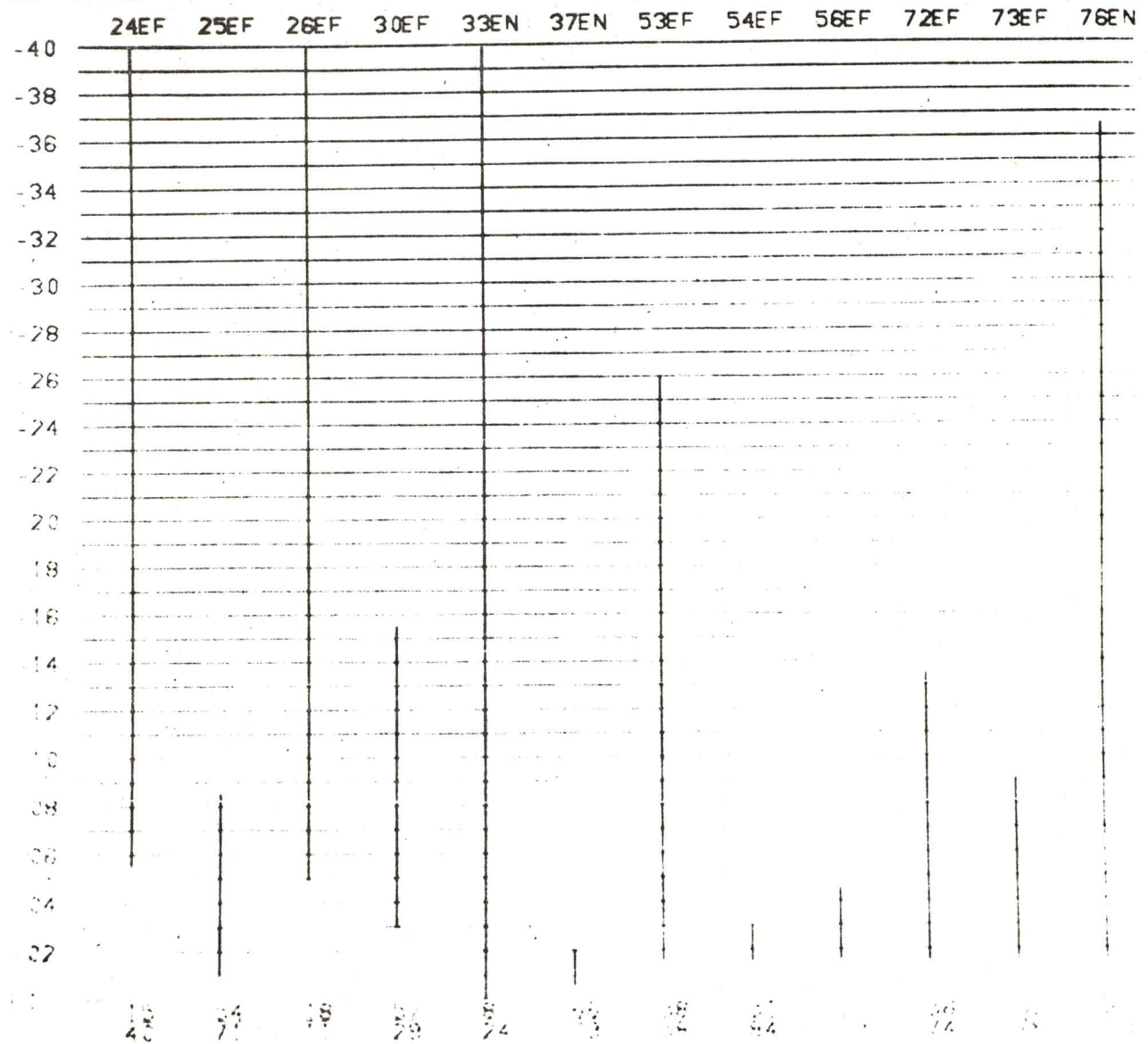


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MEASURED PLANE ANGLE, DEG. (A35, 35)

Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

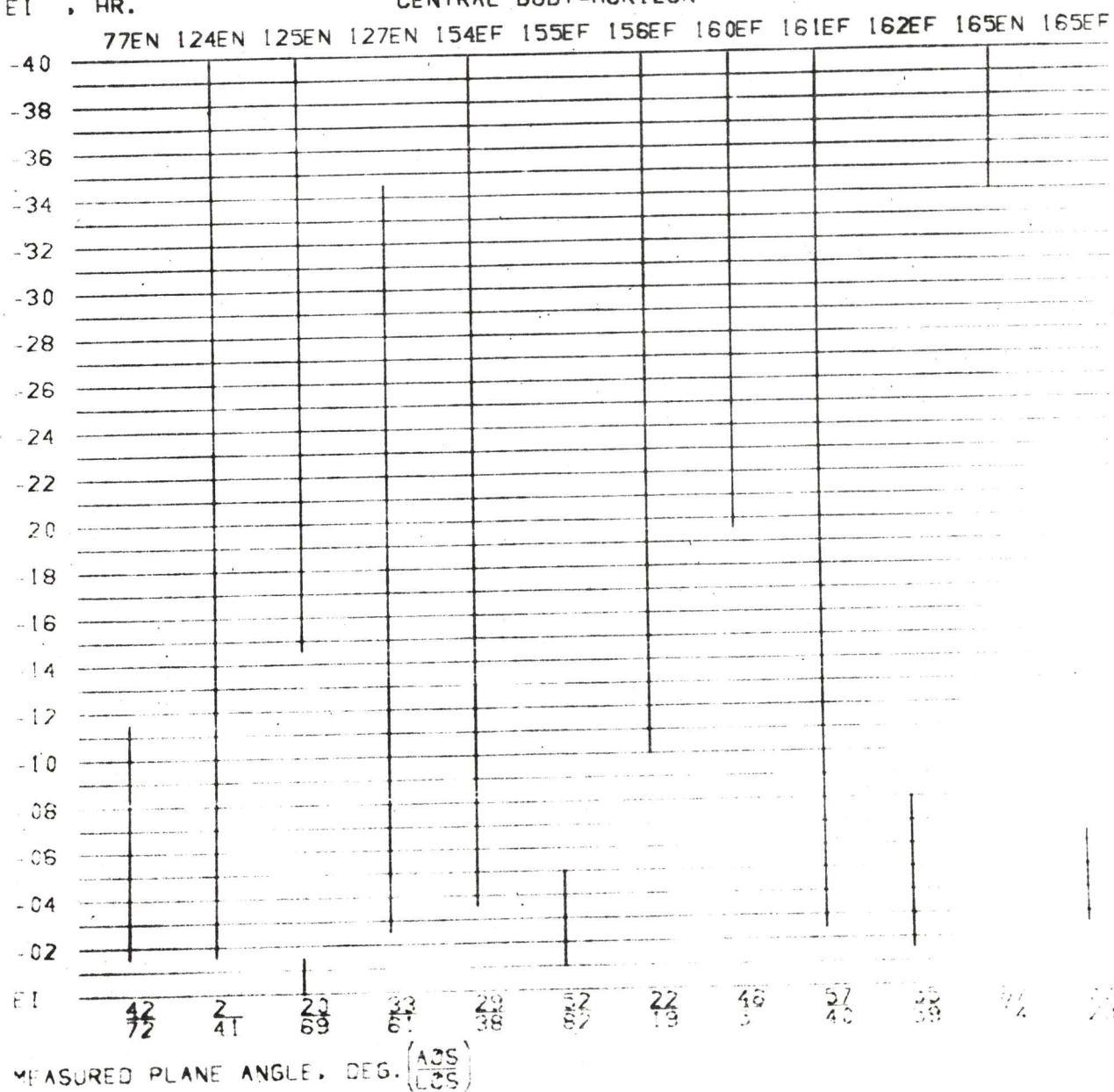


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

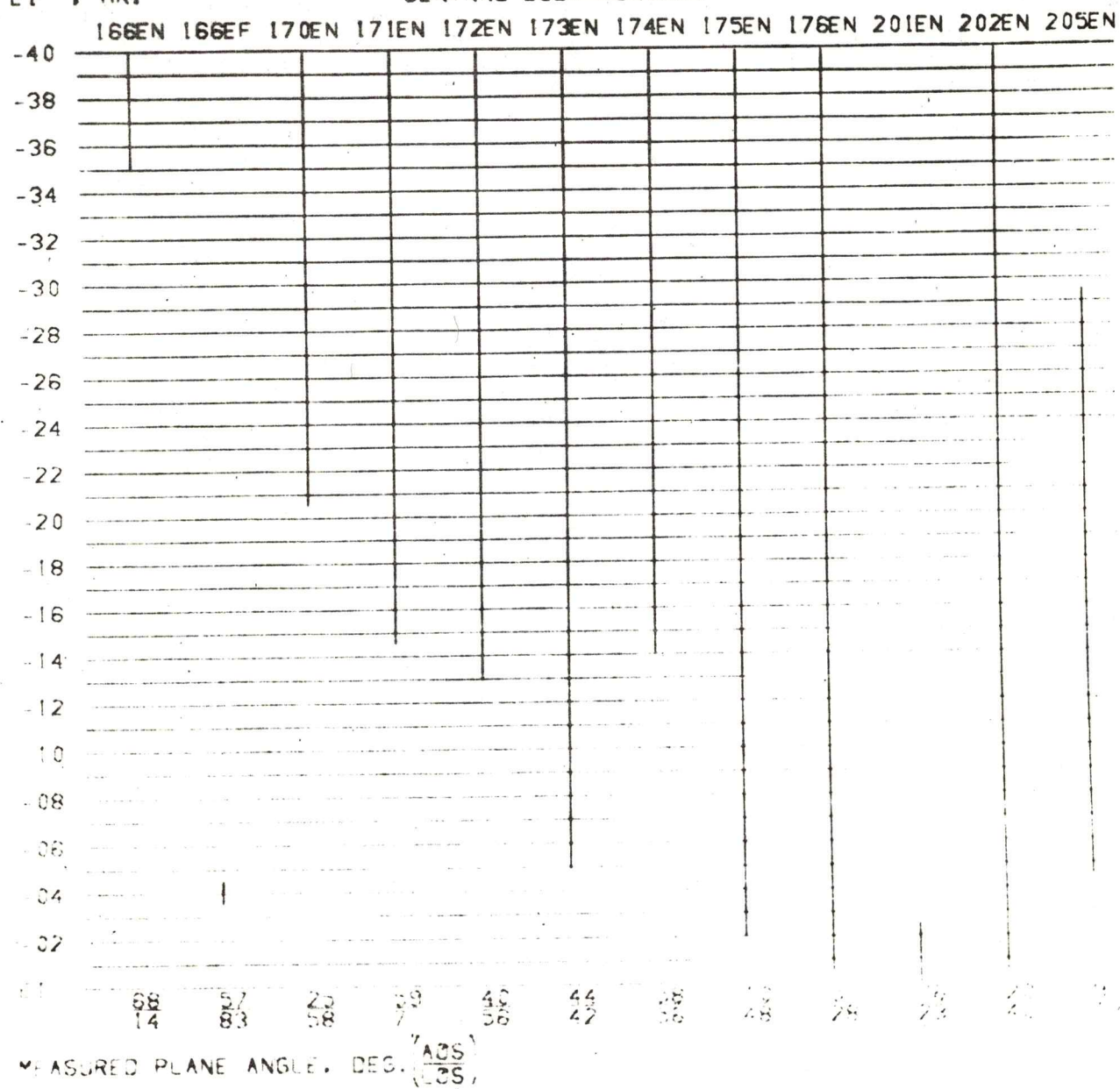


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

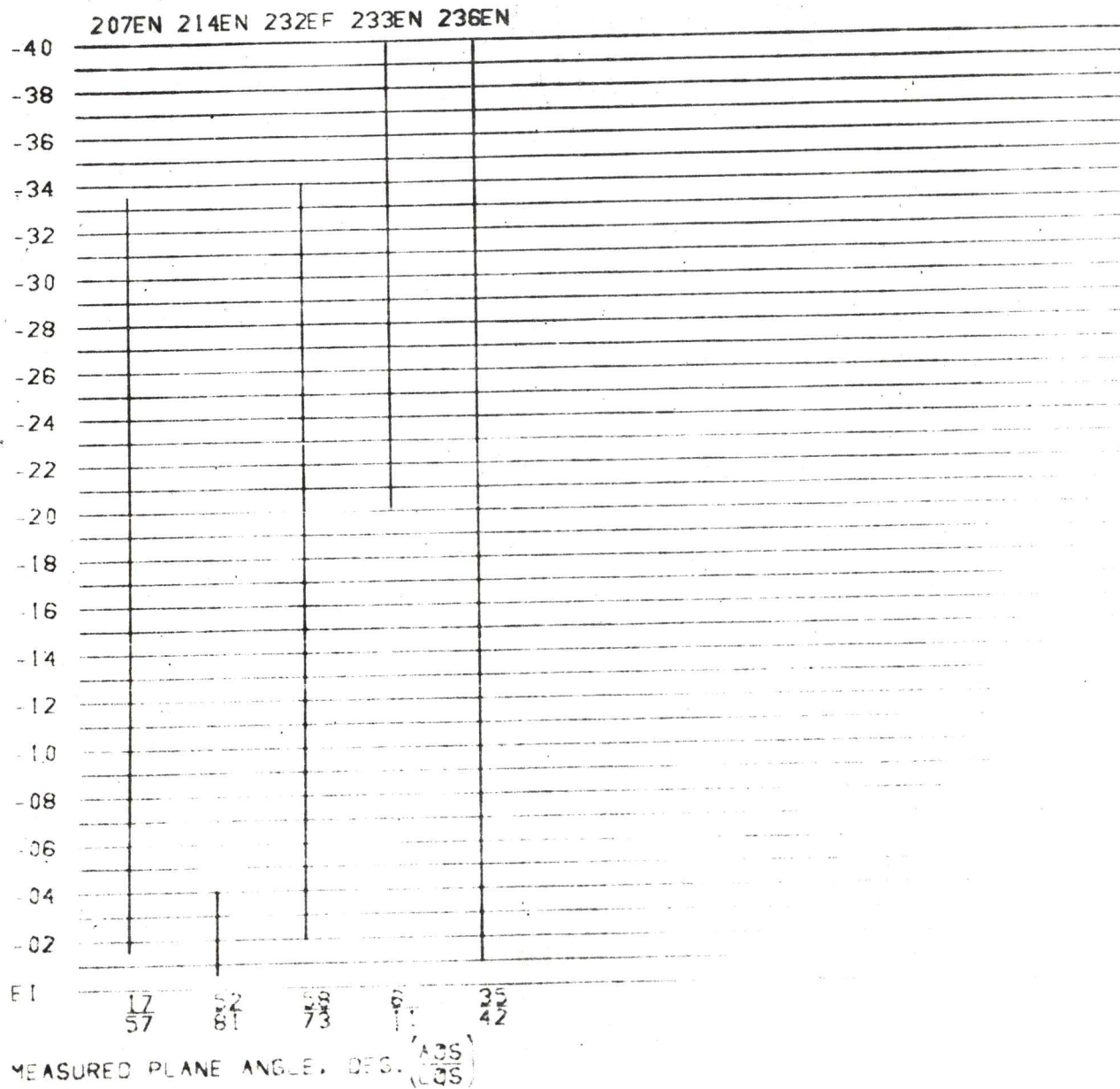
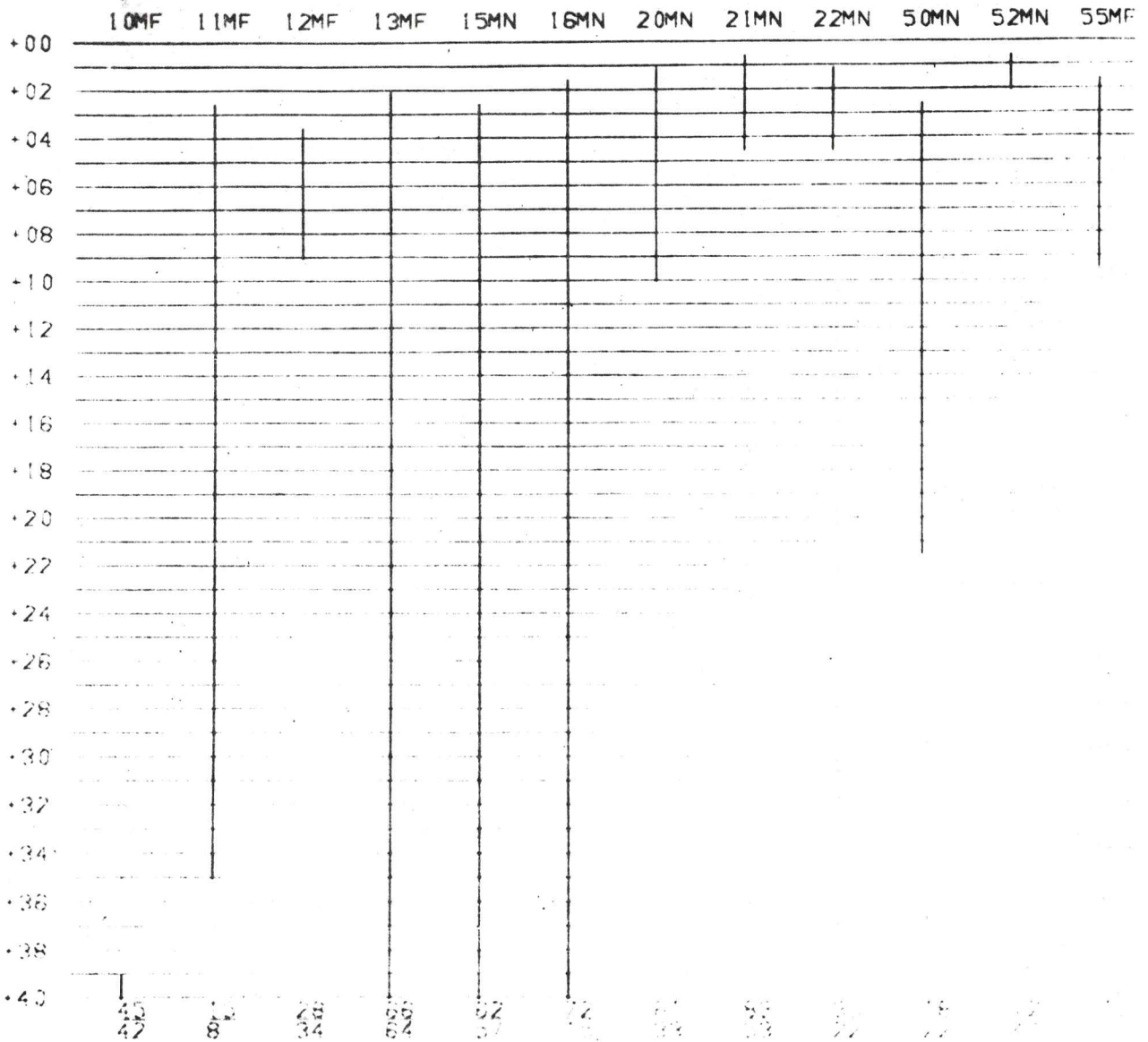


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MEASURED PLANE ANGLE, DEG. (35, 38)

Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

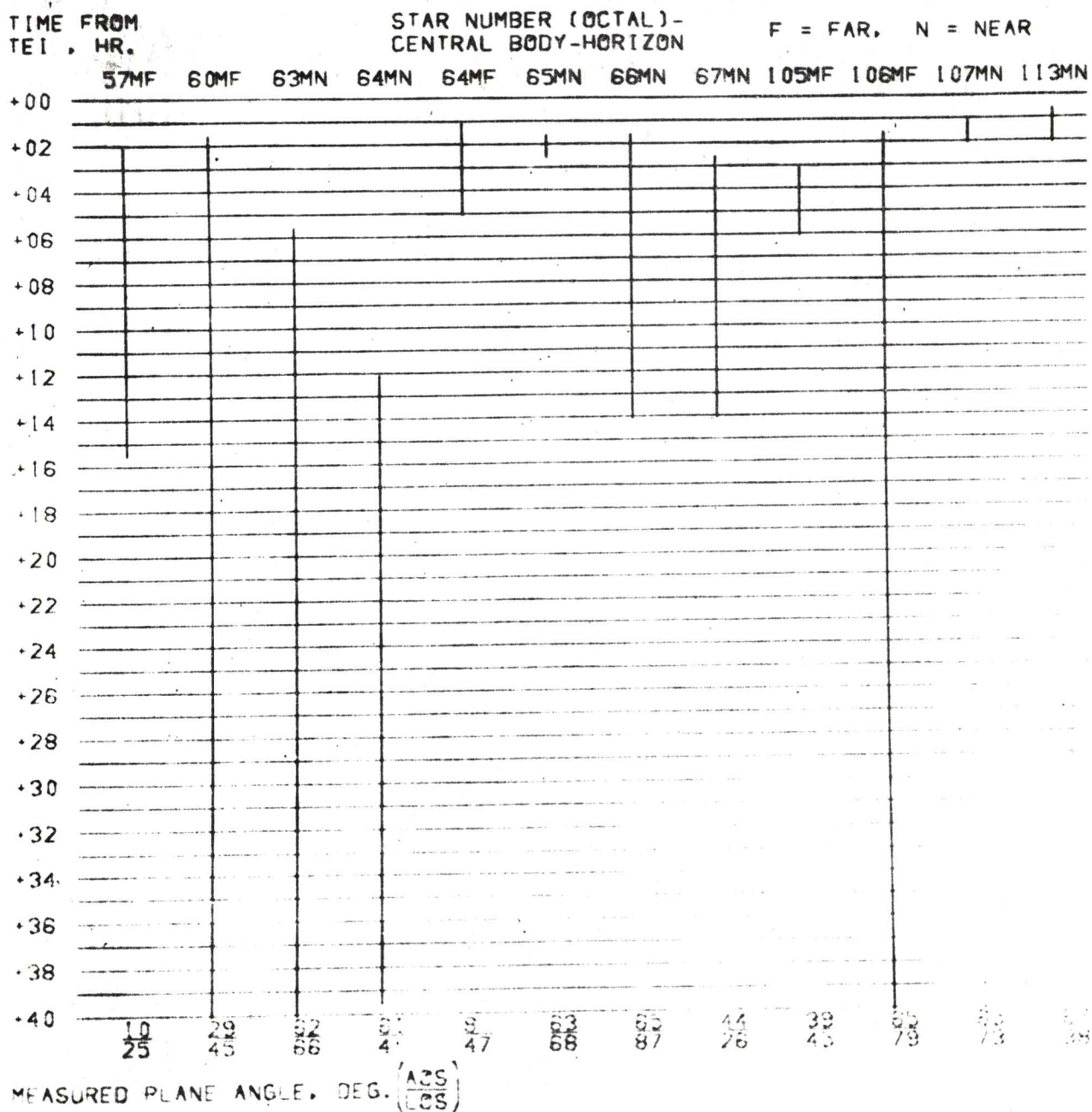
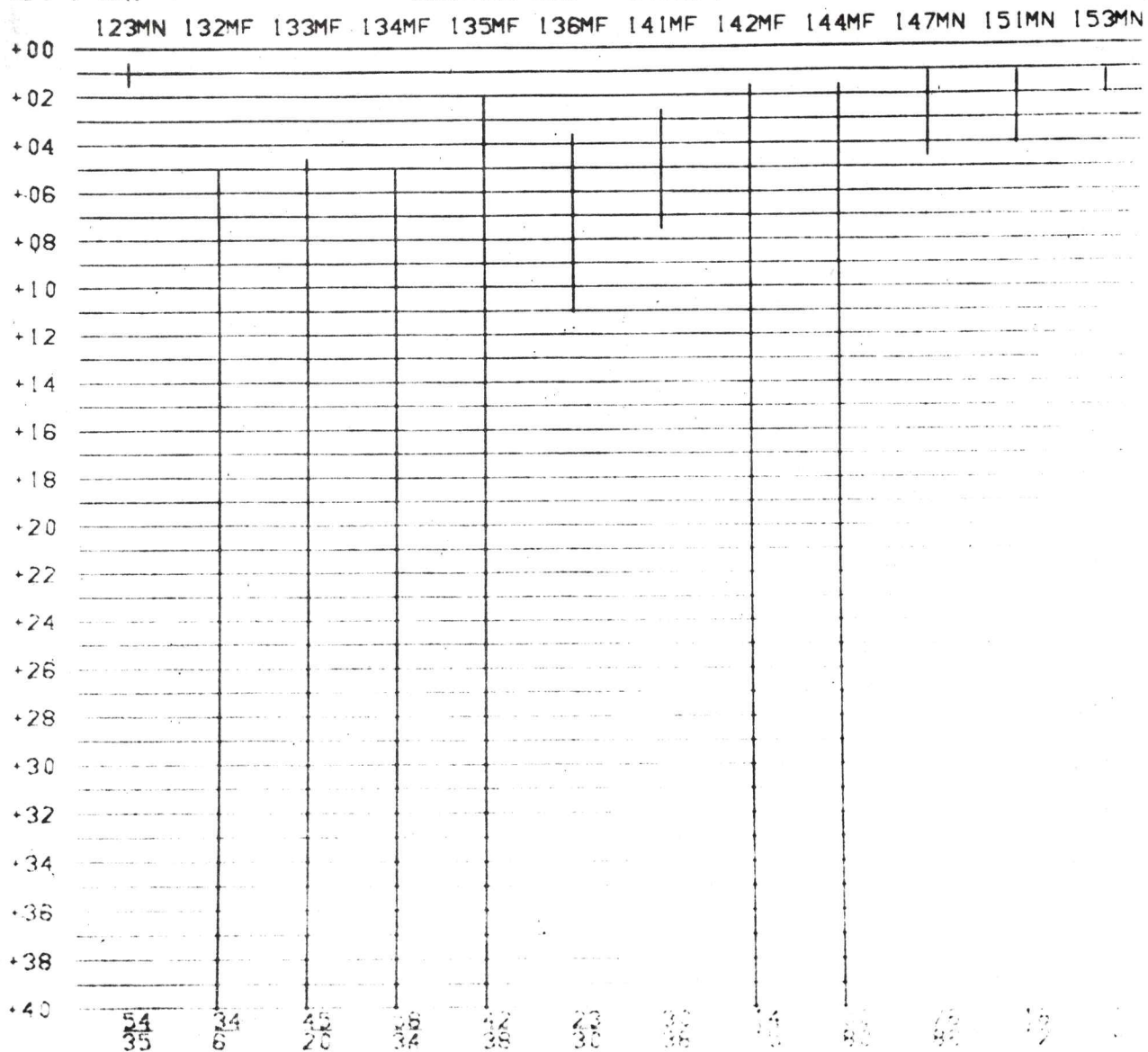


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MEASURED PLANE ANGLE, DEG.

(ACS)
(38)

Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
TEL. HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

227MF

+00

+02

+04

+06

+08

+10

+12

+14

+16

+18

+20

+22

+24

+26

+28

+30

+32

+34

+36

+38

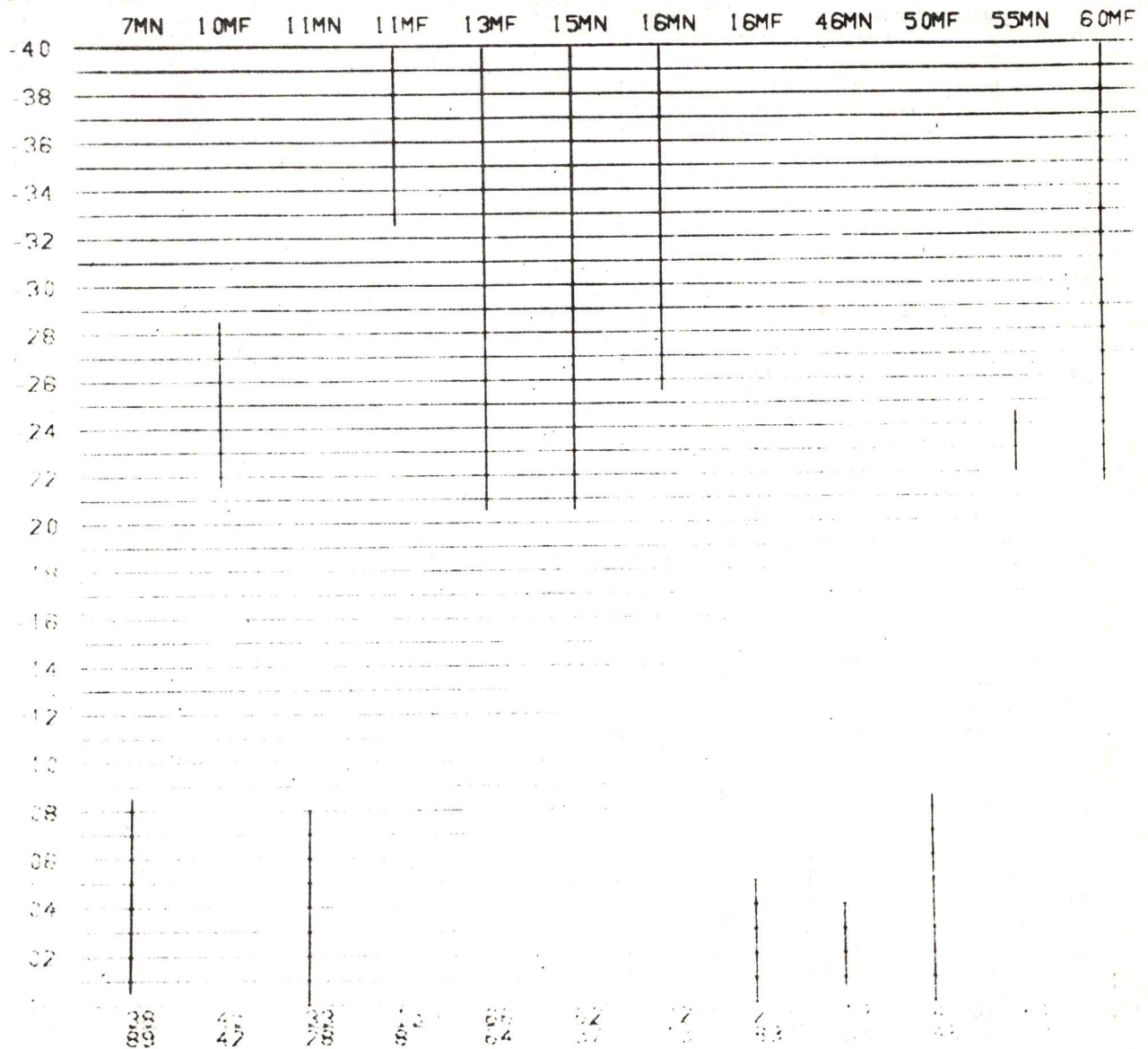
+40

35
29MEASURED PLANE ANGLE, DEG. $\left(\frac{ACS}{QS} \right)$

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
E1, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR



MEASURED PLANE ANG. E. OF C. (ACS)

Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

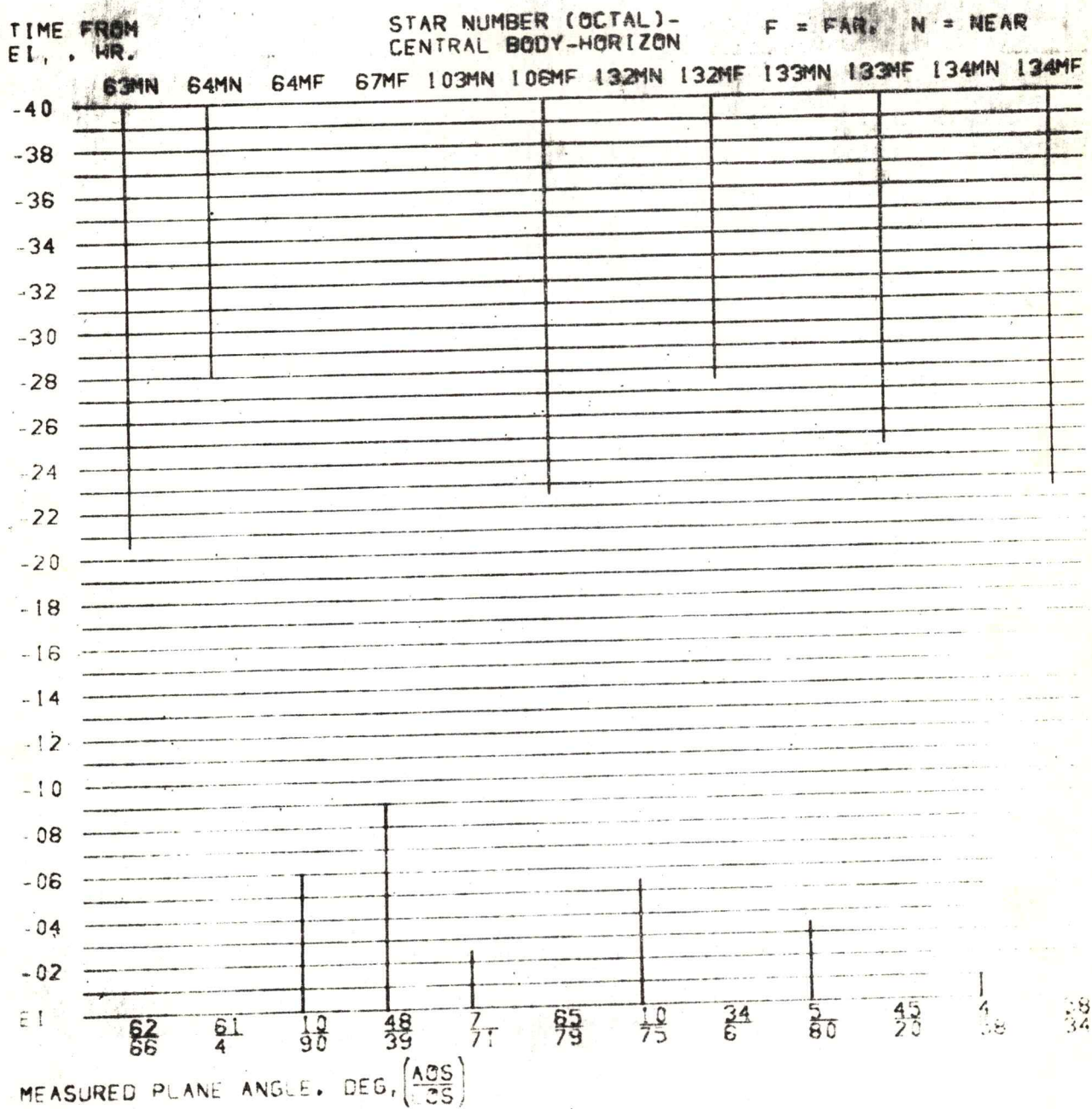


Figure III (Continued)

APOLLO 17 (12/7) TEC NOMINAL

TIME FROM
EI, HR.STAR NUMBER (OCTAL)-
CENTRAL BODY-HORIZON

F = FAR, N = NEAR

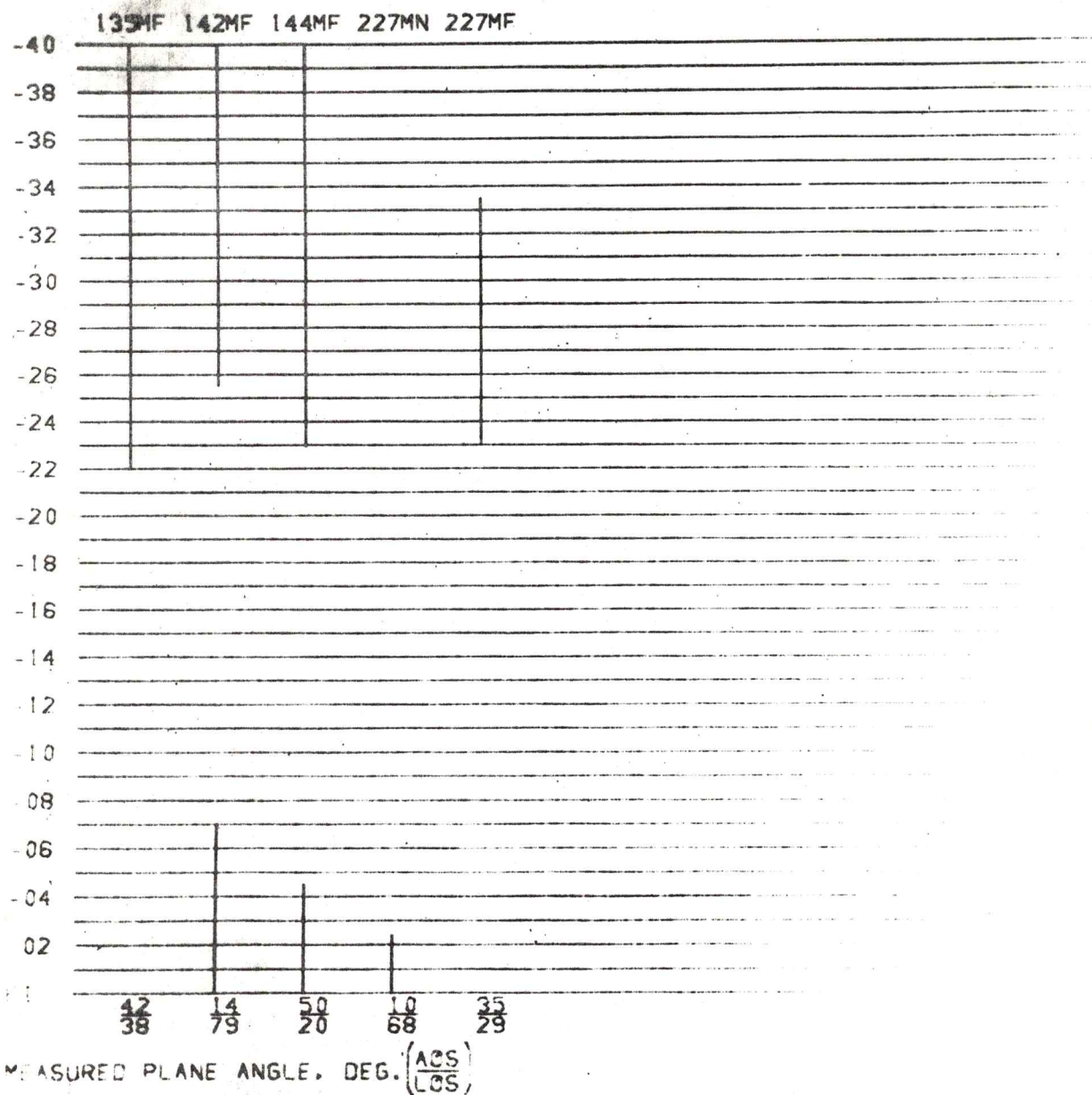


Figure III (Concluded)