BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D.C. 20024

SUBJECT: Communications Coverage Provided by Goldstone Mars Station for Reception of LM Television from Lunar Surface - Case 900

DATE: September 17, 1968

FROM: J. P. Maloy

MEMORANDUM FOR FILE

[redacted]

(NASA-CR-73577) COMMUNICATIONS COVERAGE PROVIDED BY GOLDSTONE MARS STATION FOR RECEPTION OF LM TELEVISION FROM LUNAR SURFACE. CASE 900 (Bellcomm, Inc.) 9 p
N79-72648
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This memorandum indicates the line-of-sight coverage (above 5° elevation angle) that can be provided by the Goldstone Mars station (210' antenna) for the period March 1, 1969 to January 1, 1970 for purposes of providing television reception from the LM on the lunar surface.*

A modification was made to the Ephemeris computer program of Department 2011 to include the position of the Goldstone station and to be able to calculate at 1/2 hour increments of time, slant range from the tracking station to the moon, azimuth, and elevation angle. The time at which the elevation angle reached 5° to the time when the elevation angle once again went below 5° elevation was considered to be useful coverage time during which television reception was possible from the moon. Landing times of the LM on the moon were derived from the basic data used in Memorandum For File, "Apollo Opportunities and Recycle Times for 1969," dated May 10, 1968, by D. R. Anselmo. These times were compared with coverage periods of Goldstone in Table I and plotted in Figure I. It can be seen that in fourteen of forty opportunities (4 times per month for 10 months), Goldstone has the LM in view when it lands on the lunar surface and that the period of continuous visibility varies from 2.4 hours to 13.2 hours. Mean time of possible continuous 210' antenna coverage is about 5.0 hours. More often than not (26 vs 14), the moon is not visible from Goldstone at the moment of touchdown and the time before visibility occurs varies from about one-half hour to 15.2 hours with a mean time of about 2.2 hours.

Two EVA periods spaced approximately eleven hours apart are presently planned for the astronauts. The first period would last about two hours and the second about three hours so that there would be sixteen hours from the start of the first period to the end of the second. If this were the

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*Memorandum For File, "Use of Goldstone Mars Station for Reception of LM Television from Lunar Surface," by J. J. Hibbert, J. T. Raleigh, and R. L. Selden, dated June 11, 1968.

[redacted]

condition, some television reception would be possible for about 95% of all landing opportunities under consideration here because in no case does the interval between coverage times by Goldstone 210' antenna exceed seventeen hours.

This study looked at a limited number of landing opportunities - those associated with a 72° launch azimuth and injection on the third revolution. A spread of approximately six hours would be required to include all launch azimuths in the 72° - 108° range and for all injection opportunities in the second and third revolution. In addition to looking at all landing opportunities within these constraints, Department 2013 is studying the coverage that could be provided by a station near Canberra. It is expected that the two stations, Goldstone and Canberra, will provide more continuous coverage of the moon so that it would be possible to have television operation for a lunar landing more of the time.

J. P. Maloy

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Attachments
Table I
Figure I (5 sheets)

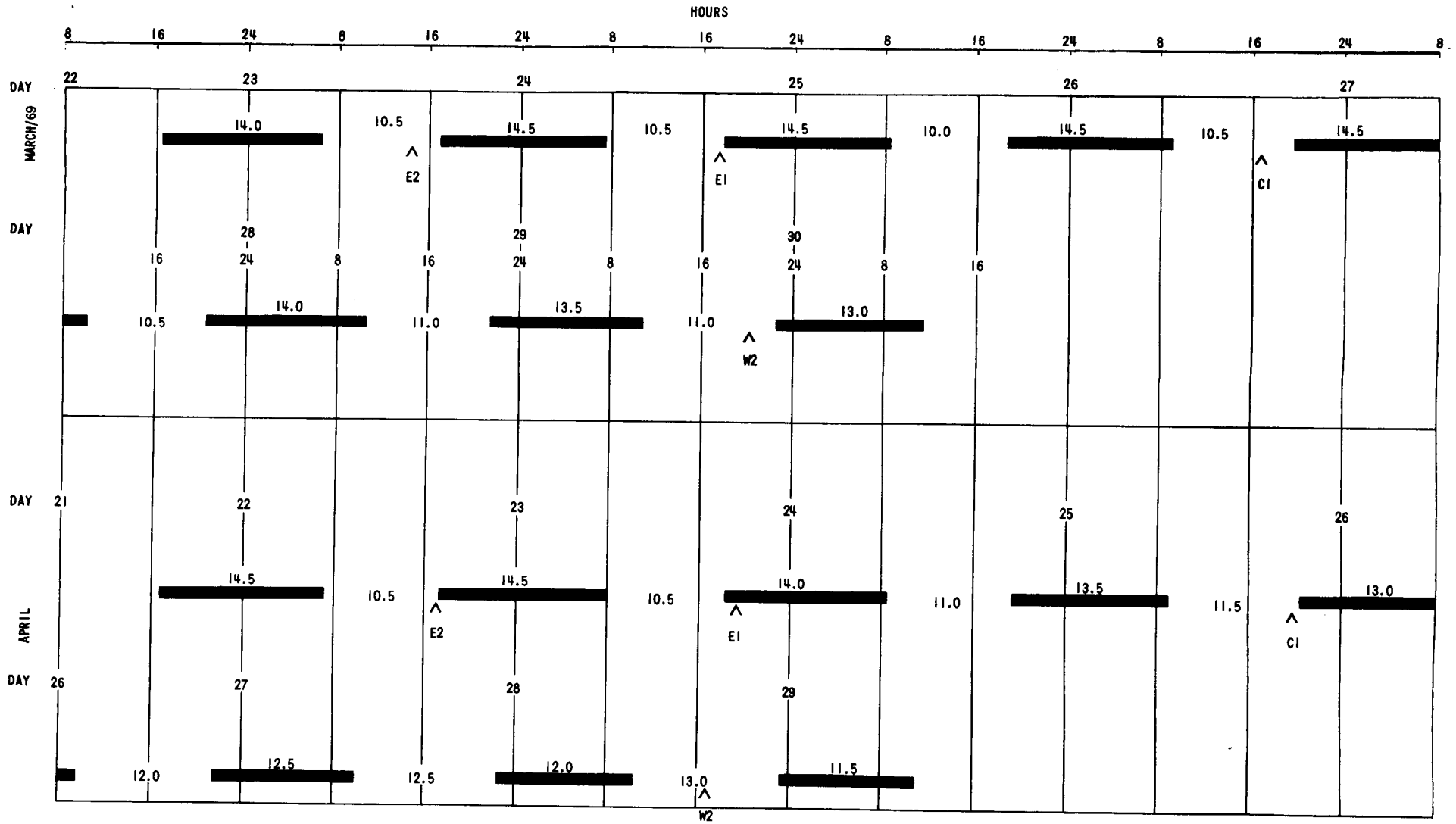
TABLE 1

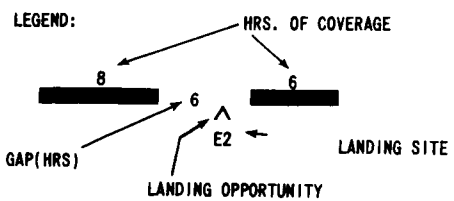
COVERAGE OF LM LANDINGS ON THE MOON BY GOLDSTONE MARS STATION

MONTH	LANDING POINT	LANDING DAY/HR.	GLD COVERAGE FROM TO (DAY/HR.)	TIME FROM LANDING TO COVERAGE (HRS.)	LM VISIBILITY (CONTINUOUS FROM LANDING) (HRS.)
March	E2	23/14.2	23/17.0-24/7.5	2.8	
	E1	24/17.6	24/18.0-25/8.5	0.4	
	C1	26/16.1	26/19.5-27/10.0	3.4	
	W2	29/20.2	29/22.5-30/11.5	2.3	
April	E2	22/16.9	22/17.5-23/8.0	0.6	
	E1	23/19.3	23/18.5-24/8.5		13.2
	C1	25/19.6	25/20.5-26/9.5	0.9	
	W2	28/16.8	28/23.5-29/11.0	6.7	
May	E2	21/18.6	21/17.5-22/7.0		12.4
	E1	22/19.0	22/18.5-23/7.5		12.5
	C1	24/18.6	24/20.5-25/8.5	1.9	
	W2	27/13.1	27/23.5-28/10.0	10.4	
June	E2	20/17.1	20/18.0-21/6.5	.9	
	E1	21/16.9	21/19.0-22/7.0	2.1	
	C1	23/15.4	23/21.0-24/8.0	5.6	
	W2	26/9.3	27/0.5-27/9.5	15.2	
July	E2	19/14.6	19/18.0-20/5.5	3.4	
	E1	20/13.9	20/19.0-21/6.0	5.1	

TABLE 1 (Continued)

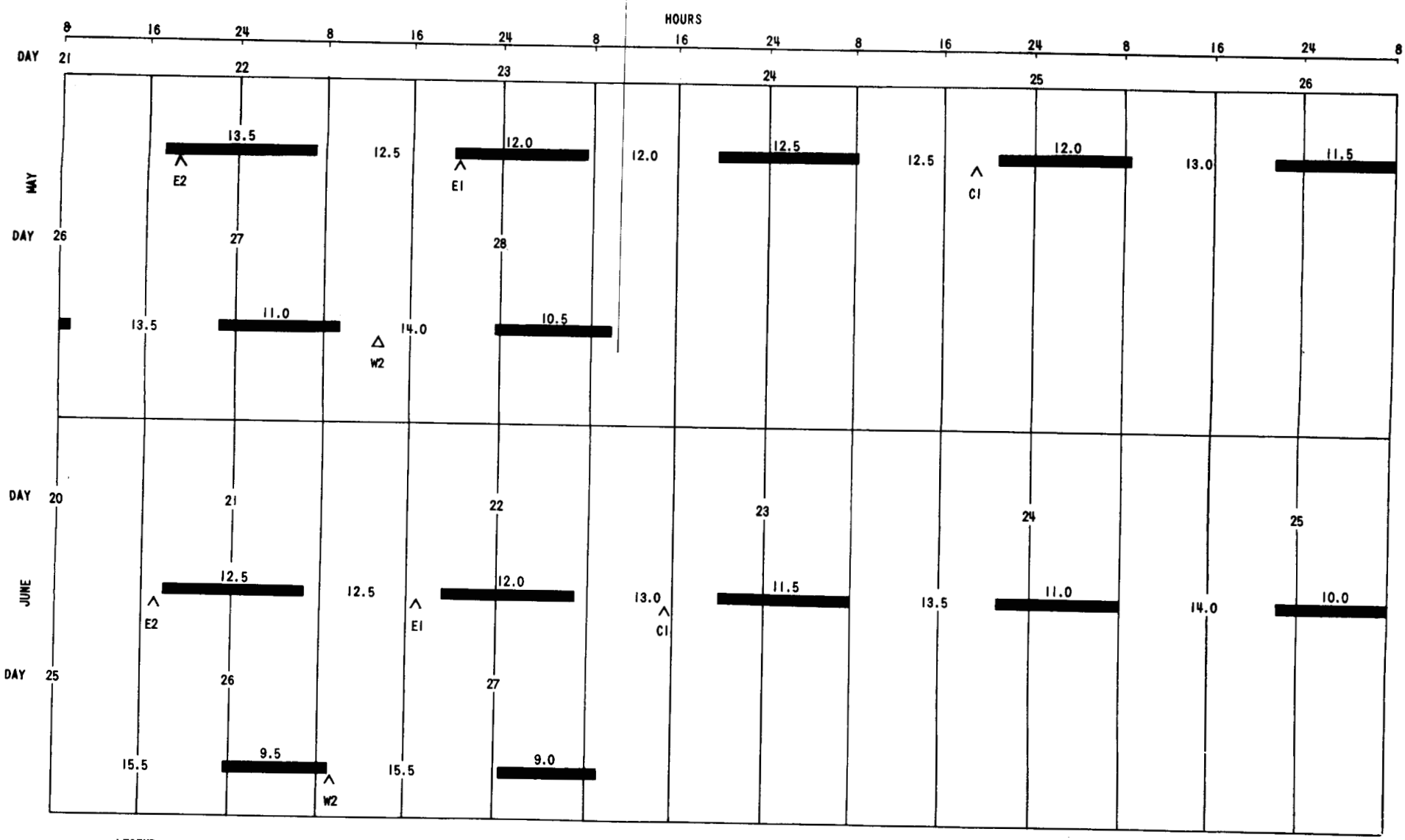
MONTH	LANDING POINT	LANDING DAY/HR.	GLD COVERAGE FROM TO (DAY/HR.)	TIME FROM LANDING TO COVERAGE (HRS.)	LM VISIBILITY (CONTINUOUS FROM LANDING) (HRS.)
July	C1	22/12.0	22/21.0-23/6.5	9.0	
	W2	26/4.2	26/1.0-26/9.0		4.8
August	E2	18/1.7	17/18.0-18/4.5		2.8
	E1	19/2.1	18/19.0-19/4.5		2.4
	C1	21/2.6	20/21.5-21/6.0		3.4
	W2	24/23.4	25/1.5-25/10.5	2.1	
September	E2	17/.17	16/19.0-17/4.0		3.8
	E1	18/.56	17/20.5-18/4.5		3.9
	C1	20/1.3	19/22.5-20/6.5		5.2
	W2	22/22.3	23/.5 -23/10.5	2.2	
October	E2	15/21.2	15/19.5-16/3.5		6.3
	E1	17/.09	16/20.5-17/4.5		4.4
	C1	18/22.4	18/22.0-19/7.0		8.6
	W2	22/21.8	23/0.0-23/11.5	2.2	
November	E2	14/20.4	14/20.0-15/5.0		8.6
	E1	15/20.4	15/21.0-16/6.0	0.6	
	C1	17/21.5	17/22.0-18/8.5	0.5	
	W2	20/20.7	20/23.0-21/11.5	2.3	
December	E2	14/17.4	14/20.5-15/7.5	3.1	
	E1	15/18.3	15/20.5-16/8.5	2.2	
	C1	17/20.1	17/21.5-18/10.5	1.4	
	W2	20/21.8	20/23.5-21/13.5	1.7	





LUNAR COVERAGE BY 210' GOLDSTONE ANTENNA

FIGURE I (PART A)



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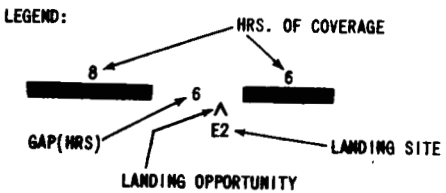


FIGURE I (PART B)

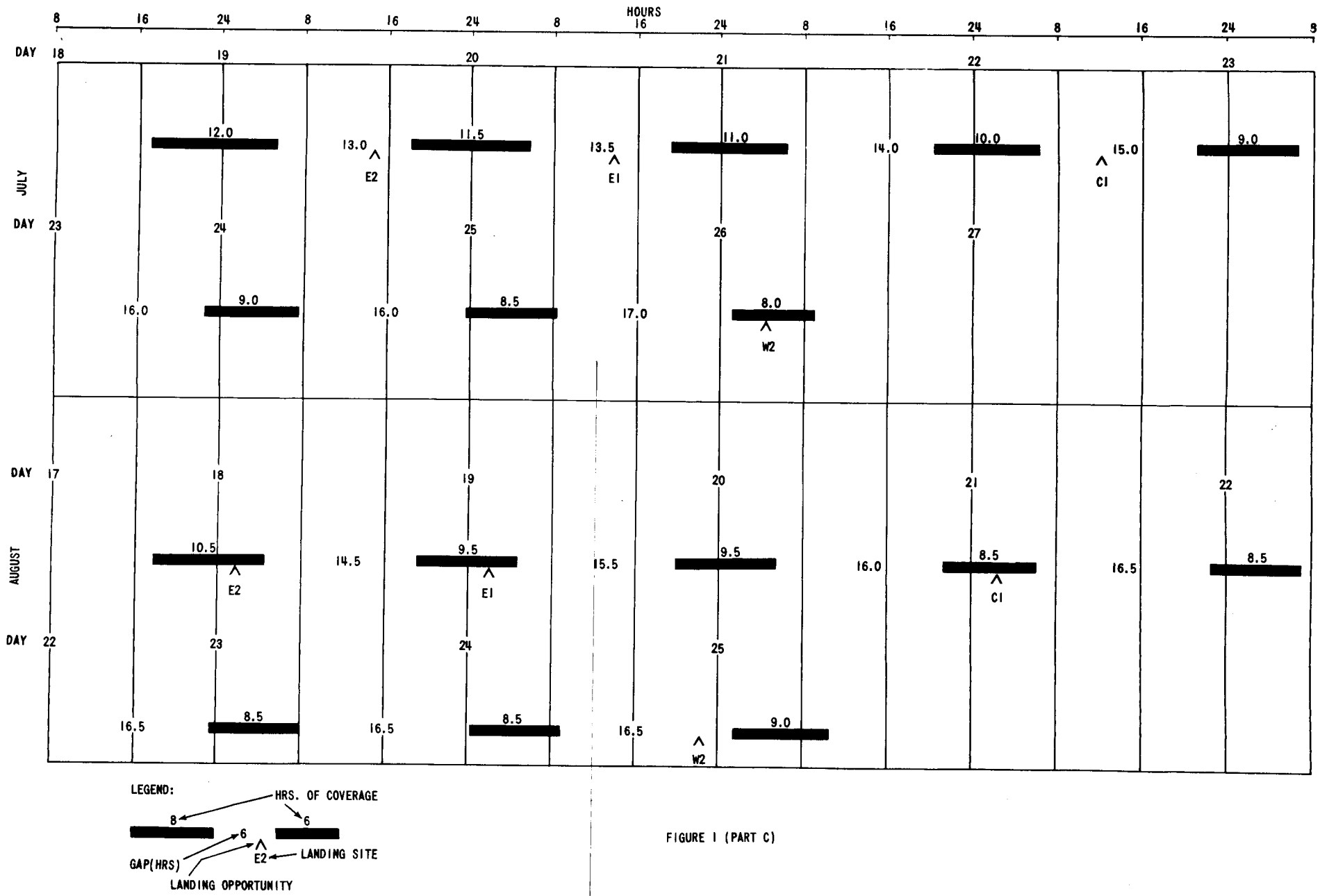
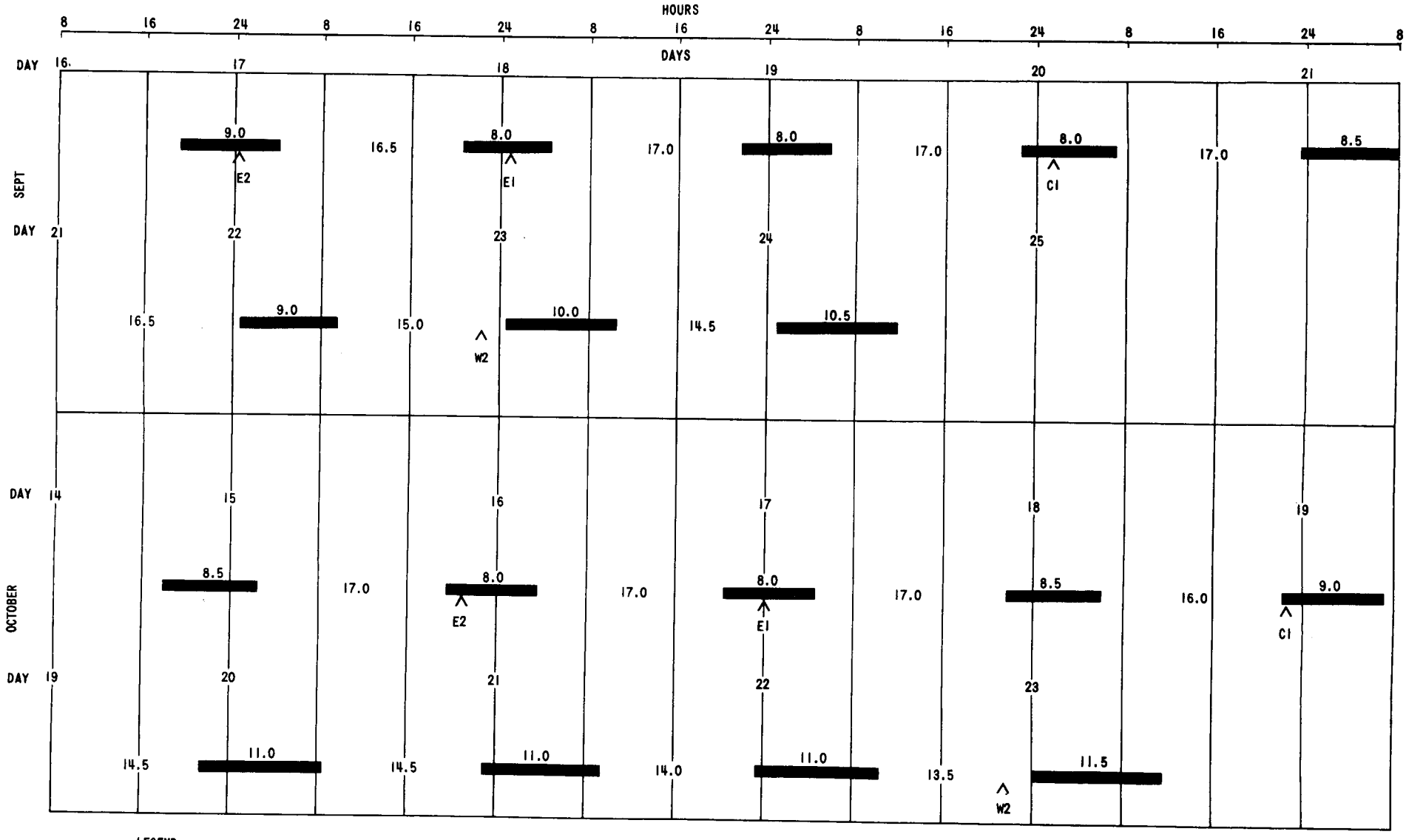


FIGURE I (PART C)



LEGEND:

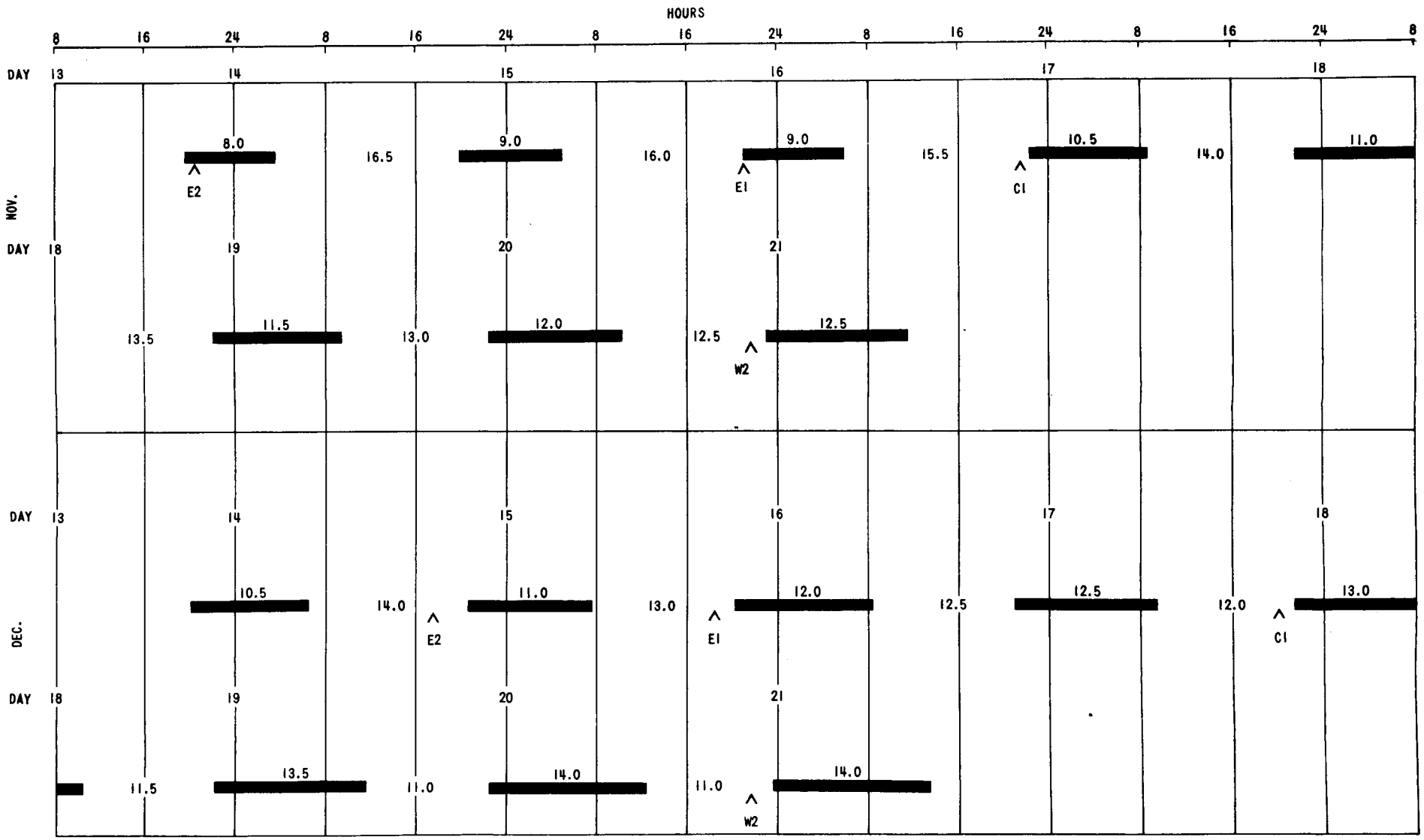
8 — HRS. OF COVERAGE — 6

GAP(HRS) — 6

E2 — LANDING SITE

LANDING OPPORTUNITY

FIGURE I (PART D)



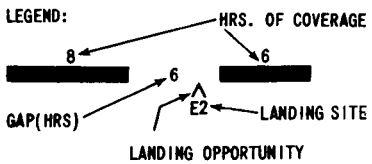


FIGURE 1 (PART E)

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Subject: Communications Coverage Provided by Goldstone Mars Station for Reception of LM Television from Lunar Surface

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