APOLLO-SOYUZ TEST PROJECT

RECOVERY REQUIREMENTS

PREFACE

This document was prepared by the Flight Control Division, Lyndon B. Johnson Space Center, Houston, Texas, with technical support by LTV/Kentron Hawaii, Ltd.

The document contains recovery requirements (and information necessary to fulfill the requirements) levied on the Department of Defense for the Apollo-Soyuz Test Project.

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SECTION 1
INTRODUCTION

1.1 PURPOSE

The purpose of this document is to officially levy requirements on the Department of Defense (DOD) for the recovery of the Apollo flight crew and command module, which will participate in the Apollo-Soyuz Test Project (ASTP), and to provide the DOD with the necessary information for fulfilling these requirements. There are no requirements for recovery of the Soyuz space vehicle. Information in this document supersedes that contained in Reference 1.

1.2 SCOPE AND CONTENTS

Section 2 describes the normal mission and the abort possibilities for which procedures and landing data have been defined.

Section 3 defines the recovery force support required and gives data that defines the constraints and guidelines to be followed in providing this support.

Section 4 defines procedures and additional support required of the recovery forces.

Section 5 describes the command module location aids.

Section 6 lists the references.

Section 7 is the distribution list.

SECTION 2
GENERAL FLIGHT PLAN

2.1 OVERVIEW

This section contains the normal mission description, mission data, and abort data for the Apollo space vehicle. The abort data is based upon planned abort situations and provides the foundation for maximum use of the required recovery forces; however, responses to many contingency situations cannot be preplanned in detail and must be handled at the time of the anomaly.

The primary objectives of the ASTP jointly agreed upon between the U.S.A. and the U.S.S.R. are:

A. Spacecraft rendezvous.

B. Spacecraft docking and undocking.

C. Intervehicular crew transfer.

D. Interaction of control centers.

E. Interaction of spacecraft crews.

The ASTP begins with the launch of a Soyuz space vehicle by the U.S.S.R. from their launch complex at Baikonur, Kazakhstan. Approximately 7 hours 30 minutes later the Apollo space vehicle is launched from the John F. Kennedy Space Center. The Apollo spacecraft will rendezvous and dock with the Soyuz spacecraft, and docking will be followed by approximately 2 days of joint activities. When the joint activities are completed and final undocking has occurred, the Apollo and Soyuz spacecraft will then fly separate missions. The Soyuz spacecraft will deorbit and land in the U.S.S.R. approximately 6 days after it was launched. The Apollo spacecraft will deorbit with the command module (CM) landing in the Pacific Ocean near Hawaii. The Apollo mission duration is approximately 9 days.

Table 2-I lists the planned launch and landing dates and the end-of-mission (EOM) landing areas.

2.2 MISSION DESCRIPTION

The Soyuz spacecraft will be launched into a 102- by 123-n.-mi. orbit that has an inclination of 51.8°. After two maneuvers the Soyuz orbit will be circularized at an altitude of 122 n. mi. After the circularization maneuver no further translational maneuvers are planned for the Soyuz spacecraft until its deorbit.

The Apollo space vehicle will be launched northeasterly from launch complex 39B into an 81- by 90-n.-mi. orbit using a two-stage Saturn 1B launch vehicle. The launch configuration is shown in Figure 2-1. After orbital insertion of the S-IVB stage of the launch vehicle, along with the docking module (DM) and the command and service module (CSM), the CSM will separate from the S-IVB and DM. At this time the adapter panels, housing the DM and providing the interface between the CSM and S-IVB, will be jettisoned. The CSM will then rotate 180°, translate back to the S-IVB/DM, and dock with the DM. The DM will then be extracted from the S-IVB. After extraction the service module reaction control system (SM/RCS) will be used to perform an Apollo evasive maneuver to prevent recontact between the CSM/DM and the S-IVB. It is planned for the S-IVB to be deorbited during its fourth revolution, with subsequent impact in the Pacific Ocean (see Table 3-I for time and location).

During a 2-day period after the Apollo spacecraft separates from the S-IVB, a series of service propulsion system (SPS) and reaction control system (RCS) burns will be performed to effect the rendezvous and docking with the Soyuz. Figure 2-2 shows the Apollo and Soyuz docked configuration.

The Apollo spacecraft will remain docked with the Soyuz spacecraft for approximately 2 days. During this docked phase a series of intervehicular crew transfers and joint experiments will be conducted. The Apollo spacecraft will then undock from the Soyuz spacecraft and perform a joint solar eclipse experiment before redocking. The final undocking will take place a few hours after the first undocking, and the Soyuz spacecraft deorbit will occur approximately 2 days later. Following undocking, the Apollo spacecraft will continue on a solo mission for approximately 5 more days and perform additional experiments.

The orbital altitude for the Apollo solo phase of the mission will be approximately the same as for the docked phase.

Just prior to CSM deorbit, the DM will be jettisoned and left in orbit.

Table 2-II lists a normal sequence of events for the mission.

2.3 LAUNCH TO EARTH ORBIT

2.3.1 Launch Azimuth

The launch azimuth for Apollo may vary from 45° to 37°. The normal launch azimuth is 45°, with the launch window closing at 37° because of range safety considerations. The launch azimuth sweep from 45° to 37° takes 8 minutes.

Table 2-I lists launch data for each space vehicle.

2.3.2 Launch Aborts

If problems arise during launch that prevent following the normal flight plan, an abort to either a landing or Earth orbit will be performed, depending on the nature of the problem and the time at which the abort takes place. The following paragraphs discuss the five abort modes for the Apollo launch.

A. Mode I - This abort procedure is designed for safe landing of the CM following an abort that is initiated between launch escape system (LES) arming, at 42 minutes before launch, and launch escape tower (LET) jettison, at 2 minutes 49 seconds after launch. The procedure consists of the LET pulling the CM off the launch vehicle and propelling it a safe distance away from the launch vehicle. The resulting landing point would be near the groundtrack between the vicinity of the launch site and approximately 400 n. mi. downrange.

B. Mode II - This abort could be performed from the time the LET is jettisoned until the full-lift CM landing point reaches 2800 n. mi. downrange approximately 9 minutes 24 seconds after launch. The procedure consists of separating the CM from the service module (SM) and letting the CM freefall to entry. The entry would be a full-lift (or maximum range) trajectory, with a landing on the groundtrack between 320 n. mi. and 2800 n. mi. downrange.

C. Mode III - This abort procedure could be performed between approximately 9 minutes 24 seconds and 9 minutes 41 seconds of flight. The procedure consists of separating the CSM from the launch vehicle and then performing a posigrade or retrograde SPS burn to constrain a half-lift CM trajectory to a

discrete landing area 3400 n. mi. downrange. This procedure is designed to prevent a CM landing between 2800 n. mi. and 3400 n. mi. downrange and also beyond 3400 n. mi. downrange to avoid a land landing.

D. Mode IV and Apogee Kick - This procedure is an abort to orbit that could be performed anytime after the SPS has the capability to insert the CSM into Earth orbit. Apogee Kick is a variation of the Mode IV abort where the SPS burn to orbit is performed near apogee. The main difference between the two is the time at which the SPS burn is performed. This mode of abort is preferred over a Mode III abort.

E. Mode V - This procedure is an abort to orbit that could be performed after the SM/RCS has the capability to insert the CSM/DM/S-IVB into orbit (the last 1.5 seconds of powered flight). The procedure consists of using the SM/RCS to perform a posigrade burn to insert the entire "stack" into Earth orbit. This mode is preferred over a Mode IV because it results in the DM being taken into orbit.

2.3.3 Launch Abort Landing Data

Figure 2-3 is an analysis of a launch profile relating abort landing data to the normal launch profile. This figure depicts the downrange distance and ground elapsed time (GET) of landing as a function of the GET of an abort from a normal trajectory.

Figure 2-4 depicts the 45° and 37° launch azimuth groundtracks, the launch site area, and range of launch azimuths. Figure 2-5 depicts the groundtracks and abort modes for 45° and 37° launch azimuths.

2.4 EARTH ORBIT

2.4.1 Description

The spacecraft will complete approximately 15 revolutions per day with the groundtracks ranging from approximately 52° north to 52° south latitudes. Each revolution takes approximately 1 hour 30 minutes.

2.4.2 Abort from Orbit

If an abort is required after orbital insertion, the primary method of deorbit will be to use an SPS burn. This burn will place the CSM in an atmosphere-intersecting orbit that results in CM entry. If the SPS fails, the SM/RCS can be used for the entire burn or to complete a partial SPS deorbit burn. In either case the CM landing will be at the same target point. The deorbit burn will result in the CM centerline groundtrack being shifted approximately 10 minutes of longitude to the east of the CSM overflight groundtrack. The CM will be targeted to a point 50 n. mi. off (can be to either side) of the CM centerline groundtrack. The decision on whether to target to the right or left of the CM centerline groundtrack will be made prior to CSM deorbit.

2.4.3 Abort from Orbit Landing Data

One target point will be chosen for each spacecraft revolution. For each day, at least one of these target points will be located so that the primary recovery ship (PRS) can be on station at the time of CM landing (see Subsection 3.3.2.3). The remainder of the target points will be located as close as possible to home-based search-and-rescue aircraft (see Subsection 3.3.2.2).

Figure 2-6 depicts the groundtracks to be supported by the PRS. Table 2-III lists the target points for each Apollo spacecraft revolution for the normal

mission. Included in this table are "GO/NO-GO", "BLOCK DATA", and "CONTINGENCY" target points (see Subsection 3.3.2.1 for discussion of target point designation).

2.5 EARTH ENTRY AND LANDING

2.5.1 Description

The CM will enter the atmosphere with a velocity of approximately 24,400 miles per hour and will land approximately 2685 n. mi. downrange from the entry point. Table 2-I lists entry and landing point data.

2.5.2 End-of-Mission Landing Data

The primary mode of entry is utilization of the guidance and navigation (G&N) system. If the G&N operates properly, the CM landing will be constrained to a very small area around the target point. During a G&N entry the flight crew will "monitor" the performance of the G&N. For a malfunctioning G&N that cannot be detected by this "monitoring" technique, the CM landing dispersion is a somewhat larger area around the target point.

If the G&N system fails, an automatically guided entry to the EOM target point cannot be flown. In this case, the flight crew will use their entry-monitoring system (EMS) to fly a predetermined entry range. If both the G&N and EMS fail, the entry will be flown using the "bank angle/time-to-reverse bank angle" entry technique. For each case the CM will be targeted 50 n. mi. off the CM centerline groundtrack to the same EOM target point. Figure 2-7 depicts the CM maneuver footprint and the dispersion area for each of the entry modes.

Figure 2-8 shows the entry profile relating time to CM landing to range-to-go, CM velocity, CM altitude, and the major events during the entry seguence.

Figure 2-9 illustrates the planned entry groundtrack showing the major events during entry.

If deorbit to the planned EOM area cannot be accomplished, a backup deorbit will be initiated 6 revolutions later on a descending groundtrack. This target point will be located as close as possible to the planned EOM target point so that the maximum possible PRS support can be provided.

2.6 BACKUP SOYUZ AND APOLLO LAUNCH OPPORTUNITIES

To enhance the probability of a successful mission, two Soyuz space vehicles will be prepared in parallel for launch. Also, the Apollo space vehicle will be capable of being launched on 5 consecutive days, beginning with the planned launch day. For each day of a Soyuz space vehicle launch delay, the new Soyuz launch time will be approximately 1.5 minutes earlier. The Apollo launch will always be planned for 7 hours 30 minutes after the Soyuz launch. Each day that the Apollo space vehicle launch is delayed after a successful Soyuz space vehicle launch, the new Apollo launch time will be approximately 25 minutes earlier. For any launch case the Soyuz flight will be approximately 6 days and the Apollo flight approximately 9 days.

2.7 ALTERNATE MISSION

No specific alternate missions have been defined; however, as many of the primary objectives (see Subsection 2.1) as feasible will be completed. Any deviation from the planned mission will depend on the problem causing the deviation.

TABLE 2-I.- LAUNCH AND EOM LANDING DATA

Vehicle	Launch				End of mission						
					Entry point		Landing point		Azimuth through target point, deg true		
	Date	Planned launch azimuth, deg	Planned launch time, GMT	Launch window closing, GMT	Latitude, deg-min	Longitude, deg-min	Latitude, deg-min	Longitude, deg-min		Date	Time, GMT
Apollo	15 July	45	1950	1958	14-23 S	169-06 E	21-52 N	162-45 W	39	24 July	2119
Soyuz	15 July	NE	1220	1230	-	-	~50 N	~71 E	~85	21 July	1051

TABLE 2-II.- NORMAL SEQUENCE OF EVENTS

(a) Apollo prelaunch phase

Time prior to Apollo lift-off			Event
Days	Hr	Min Sec	
	7	30 00	Soyuz lift-off
	7	20 55	Soyuz orbital insertion
	2	40 00	Apollo flight crew ingress
	2	11 00	Soyuz first maneuver Burn time (BT) = normally zero
	0	42 00	Apollo launch escape system armed, Begin Mode I capability
	0	00 03	S-IB engine ignition

TABLE 2-II.- NORMAL SEQUENCE OF EVENTS - Continued

(b) Apollo launch phase

Ground elapsed time (GET) from Apollo lift-off				Event
Days	Hr	Min	Sec	
		00	00	Lift-off
		01	13	Maximum dynamic pressure
		02	16	S-IB inboard engine cutoff
		02	19	S-IB outboard engine cutoff
		02	21	S-IB/S-IVB separation, S-IVB ignition
		02	49	Launch escape tower jettison, Begin Mode II capability
		09	24	Begin Mode III (posigrade) capability
		09	32	Begin Mode III (retrograde) capability
		09	34	Begin Mode IV capability
		09	41	End Mode III (retrograde) capability, Begin Mode V capability
		09	42	S-IVB cutoff
		09	52	Orbital insertion

TABLE 2-II.- NORMAL SEQUENCE OF EVENTS - Continued

(c) Rendezvous phase

Ground elapsed time (GET) from Apollo lift-off				Event
Days	Hr	Min	Sec	
	01	14	00	CSM separation from S-IVB/DM, Adapter panels jettison
	01	23	00	CSM docking with DM
	02	34	00	DM extraction from S-IVB, Apollo evasive maneuver (AEM) from S-IVB, SM/RCS, BT = 8.7 sec
	03	45	00	Apollo circularization maneuver (ACM), SPS, BT = 9.0 sec
	05	19	00	Begin S-IVB deorbit maneuver
	05	41	28	First Apollo phasing maneuver (NC1), SPS, BT = 3.1 sec
	05	56	00	S-IVB impact
	06	47	52	Apollo plane change (NPC), SPS, BT = normally zero
	16	56	00	Soyuz circularization maneuver (SCM), BT = 19.9 sec
01	00	51	37	Apollo phasing correction maneuver (PCM), SPS, BT = normally zero
01	17	04	04	Second Apollo phasing maneuver (NC2), SPS, BT = 1.6 sec
01	17	48	03	Apollo corrective combination maneuver (NCC), SPS, BT = 1.8 sec
01	18	25	04	Apollo coelliptic maneuver (NSR), SPS, BT = 1.2 sec
01	19	24	25	Apollo terminal phase initiation (TPI), SPS, BT = 0.8 sec
01	20	01	55	Begin stationkeeping
01	20	25	00	Apollo/Soyuz docking

TABLE 2-III.- TARGET POINT DATA FOR EACH APOLLO REVOLUTION FOR THE NORMAL MISSION

Target point designator	Target point		Groundtrack heading, deg true	Time of landing, date/GMT
	Latitude, deg-min	Longitude, deg-min		
002-2B	48-53 N	12-00 W	116	15/2149
003-4G[1]	12-08 N	159-55 W	040	16/0021
004-4C	20-12 N	178-00 W	040	16/0152
005-1C	34-08 N	54-00 W	132	16/0218
006-1C	23-30 N	65-00 W	140	16/0351
007-5C	40-00 N	130-00 W	128	16/0641
008-5C	29-53 N	139-00 W	135	16/0813
009-4C	23-25 N	155-00 W	141	16/0943
010-4C	13-15 N	169-00 W	142	16/1116
011-3C	24-34 N	159-00 E	138	16/1240
012-3C	19-32 N	140-57 E	141	16/1411
013-2C	07-40 N	28-00 W	036	16/1504
014-2C	44-00 N	14-00 W	057	16/1644
015-2C	48-00 N	20-00 W	068	16/1811
016-2C	51-10 N	23-00 W	086	16/1947
017-2C	49-03 N	12-00 W	114	16/2122
018-4G[1]	12-04 N	159-50 W	040	16/2355
019-4C	20-12 N	178-00 W	040	17/0128
020-1C	34-08 N	54-00 W	132	17/0152
021-1C	23-30 N	65-00 W	140	17/0325
022-5C	40-00 N	130-00 W	128	17/0615
023-5C	30-00 N	139-00 W	135	17/0747
024-4C	23-35 N	155-00 W	141	17/0918
025-4C	13-30 N	169-00 W	142	17/1050
026-3C	24-43 N	159-00 E	138	17/1213
027-3C	19-35 N	141-06 E	141	17/1344
028-2C	07-27 N	28-00 W	036	17/1436
029-2C	43-53 N	14-00 W	057	17/1617
030-2C	48-00 N	20-00 W	068	17/1750
031-2C	51-10 N	23-00 W	086	17/1923
032-2C	48-58 N	12-00 W	114	17/2057
033-4G[1]	12-18 N	160-07 W	040	17/2332
034-4C	19-29 N	177-00 W	040	18/0103
035-1C	33-39 N	54-00 W	132	18/0126
036-1C	22-40 N	65-00 W	140	18/0301
037-5C	38-45 N	129-00 W	129	18/0554
038-5C	29-50 N	140-00 W	135	18/0725
039-4C	23-15 N	156-00 W	141	18/0858
040-4C	13-04 N	170-00 W	142	18/1029
041-3C	28-11 N	154-00 E	139	18/1153
042-3C	18-36 N	140-15 E	141	18/1326
043-2C	09-00 N	30-48 W	036	18/1419
044-2C	31-45 N	32-00 W	043	18/1555
045-2C	48-10 N	21-00 W	068	18/1732
046-2C	51-10 N	23-00 W	086	18/1904
047-2C	48-43 N	13-00 W	115	18/2039
048-4G[1]	13-58 N	162-50 W	040	18/2314
049-4C	19-13 N	179-00 W	042	19/0047
050-1C	33-02 N	55-00 W	132	19/0109
051-1C	23-55 N	65-30 W	140	19/0244
052-5C	34-42 N	125-00 W	130	19/0538
053-4C	29-08 N	141-00 W	135	19/0708

TABLE 2-III.- TARGET POINT DATA FOR EACH APOLLO REVOLUTION FOR THE NORMAL MISSION - Continued

054-4C	26-08 N	158-00 W	141	19/0839
055-4C	13-21 N	170-00 W	142	19/1011
056-3C	27-57 N	155-00 E	139	19/1136
057-3C	17-40 N	139-15 E	141	19/1308
058-2C	09-44 N	32-00 W	036	19/1401
059-2C	33-01 N	34-00 W	046	19/1537
060-2C	48-39 N	21-00 W	068	19/1714
061-2C	51-10 N	23-00 W	086	19/1846
062-2C	48-52 N	15-00 W	115	19/2020
063-4G[1]	14-40 N	163-54 W	040	19/2255
064-4C	30-14 N	170-00 W	043	20/0029
065-1C	32-31 W	56-00 W	133	20/0049
066-3C	22-50 W	135-00 E	039	20/0324
067-5C	34-13 N	126-00 W	136	20/0519
068-4C	28-35 N	142-00 W	135	20/0649
069-4C	28-30 N	162-00 W	141	20/0819
070-4C	12-35 N	171-00 W	142	20/0951
071-3C	24-10 N	157-00 E	139	20/1112
072-3C	14-55 N	142-00 E	142	20/1250
073-2C	21-53 N	24-00 W	040	20/1345
074-2C	45-17 N	16-00 W	058	20/1523
075-2C	48-58 N	21-00 W	068	20/1655
076-2C	51-09 N	19-00 W	093	20/1827
077-2C	49-00 N	17-00 W	115	20/2000
078-4G[1]	15-20 N	164-55 W	040	20/2236
079-4C	30-45 N	171-00 W	043	21/0010
080-1C	31-10 N	56-00 W	133	21/0031
081-3C	24-35 N	135-00 E	039	21/0305
082-5C	29-33 N	122-00 W	136	21/0500
083-4C	28-00 N	143-00 W	135	21/0630
084-4C	28-51 N	164-00 W	141	21/0759
085-4C	11-54 N	172-00 W	142	21/0933
086-6C	03-09 S	01-00 E	036	21/1020
087-3C	15-21 N	138-00 E	142	21/1230
088-2C	22-30 N	25-00 W	040	21/1326
089-2C	33-05 N	37-00 W	045	21/1459
090-2C	48-58 N	22-00 W	068	21/1635
091-2C	51-05 N	19-00 W	094	21/1808
092-2C	48-44 N	18-00 W	115	21/1941
093-4G[1]	18-47 N	163-44 W	040	21/2217
094-4C	33-40 N	169-00 W	043	21/2352
095-1C	30-50 N	57-00 W	134	22/0011
096-3C	25-06 N	134-00 E	039	22/0245
097-5C	29-45 N	121-00 W	136	22/0441
098-4C	27-26 N	144-00 W	136	22/0610
099-4C	27-09 N	166-00 W	141	22/0739
100-4C	11-17 N	173-00 W	142	22/0913
101-3C	19-18 N	156-00 E	140	22/1040
102-3C	13-35 N	138-00 E	142	22/1210
103-2C	24-00 N	25-00 W	040	22/1307
104-2C	46-07 N	17-00 W	058	22/1444
105-2C	49-20 N	22-00 W	068	22/1615
106-2C	51-03 N	19-00 W	095	22/1748
107-2C	48-23 N	18-00 W	115	22/1921
108-4G[1]	21-51 N	162-26 W	040	22/2158
109-4C	33-55 N	170-00 W	043	22/2331

TABLE 2-III.- TARGET POINT DATA FOR EACH APOLLO REVOLUTION FOR THE NORMAL MISSION - Concluded

110-1C	30-30 N	58-00 W	134	22/2351
111-3C	25-26 N	133-00 E	040	23/0226
112-5C	29-28 N	122-00 W	136	23/0421
113-4C	27-25 N	145-00 W	137	23/0551
114-4C	21-56 N	162-23 W	141	23/0721
115-4C	10-54 N	174-00 W	142	23/0853
116-3C	23-29 N	151-00 E	140	23/1018
117-3C	14-41 N	138-00 E	142	23/1150
118-2C	26-05 N	22-00 W	040	23/1247
119-2C	46-35 N	17-00 W	062	23/1423
120-2C	49-30 N	22-00 W	068	23/1555
121-2C	50-56 N	19-00 W	097	23/1728
122-2C	48-18 N	19-00 W	116	23/1902
123-4G[1]	21-55 N	161-31 W	040	23/2138
124-4C	25-40 N	177-00 E	041	23/2310
125-1C	30-08 N	59-00 W	136	23/2332
126-3C	25-31 N	134-00 E	041	24/0207
127-5C	29-00 N	123-00 W	135	24/0402
128-4C	26-55 N	146-00 W	137	24/0531
129-4C	21-55 N	161-31 W	141	24/0701
130-4C	11-30 N	178-00 W	142	24/0833
131-3C	21-55 N	151-00 E	140	24/0958
132-3C	18-00 N	134-00 E	142	24/1128
133-2C	27-54 N	24-00 W	040	24/1227
134-2C	38-20 N	38-00 W	047	24/1357
135-2C	49-43 N	22-00 W	069	24/1535
136-2C	50-47 N	19-00 W	099	24/1708
137-2C	47-52 N	19-00 W	116	24/1841
138-4G[2]	21-52 N	162-45 W	040	24/2119
139-4C	26-00 N	176-00 E	041	24/2249
140-1C	29-55 N	60-00 W	135	24/2301
141-3C	26-40 N	134-00 E	041	25/0145
142-5C	28-53 N	124-00 W	136	25/0341
143-4C	26-47 N	147-00 W	137	25/0510
144-4C[3]	21-57 N	162-39 W	141	25/0640

[1]Block Data target point is the same as the GO/NO-GO target point.
[2]Planned end-of-mission target point.
[3]Backup target point for planned end-of-mission target point.

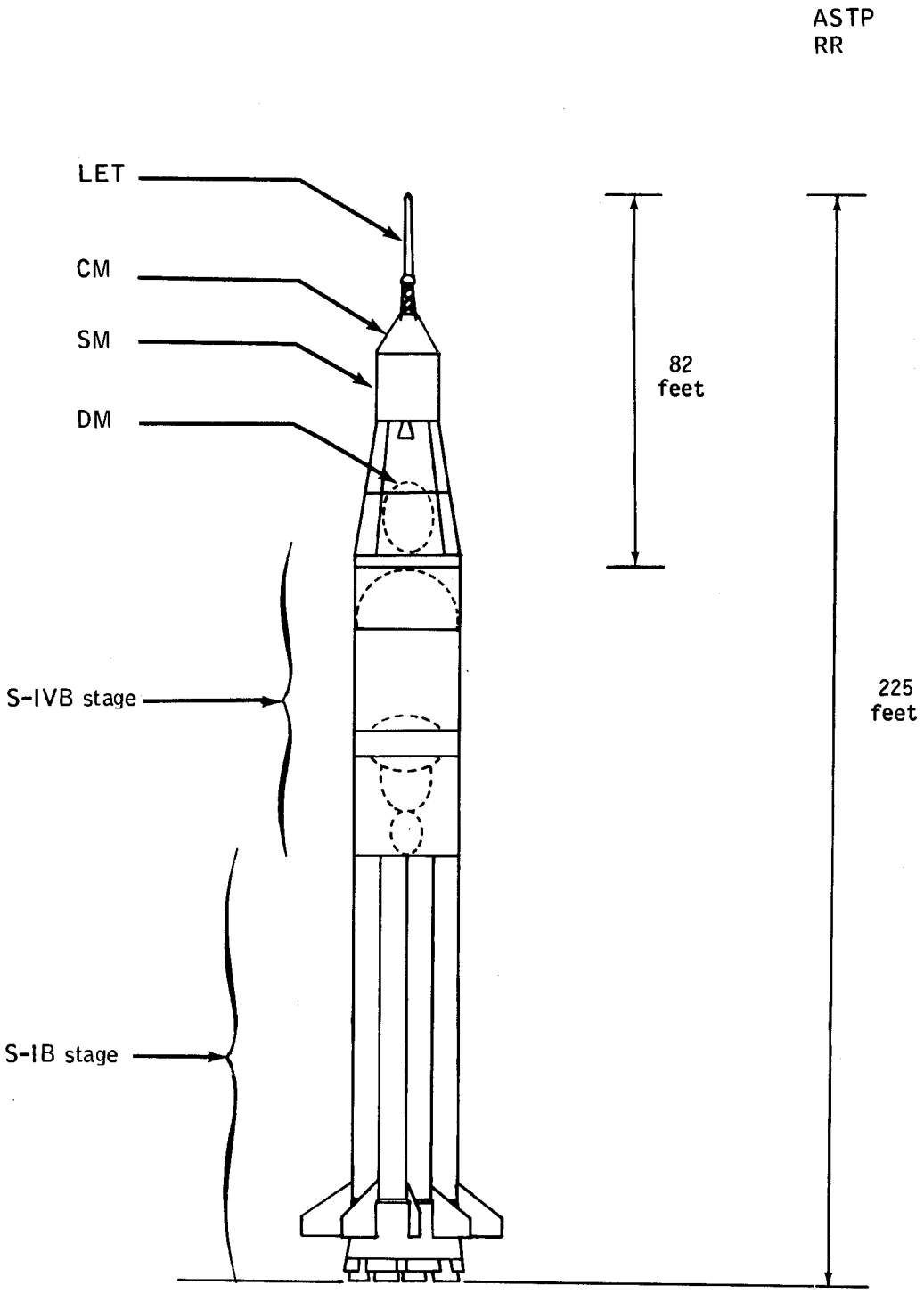

Figure 2-1.- Apollo launch configuration.

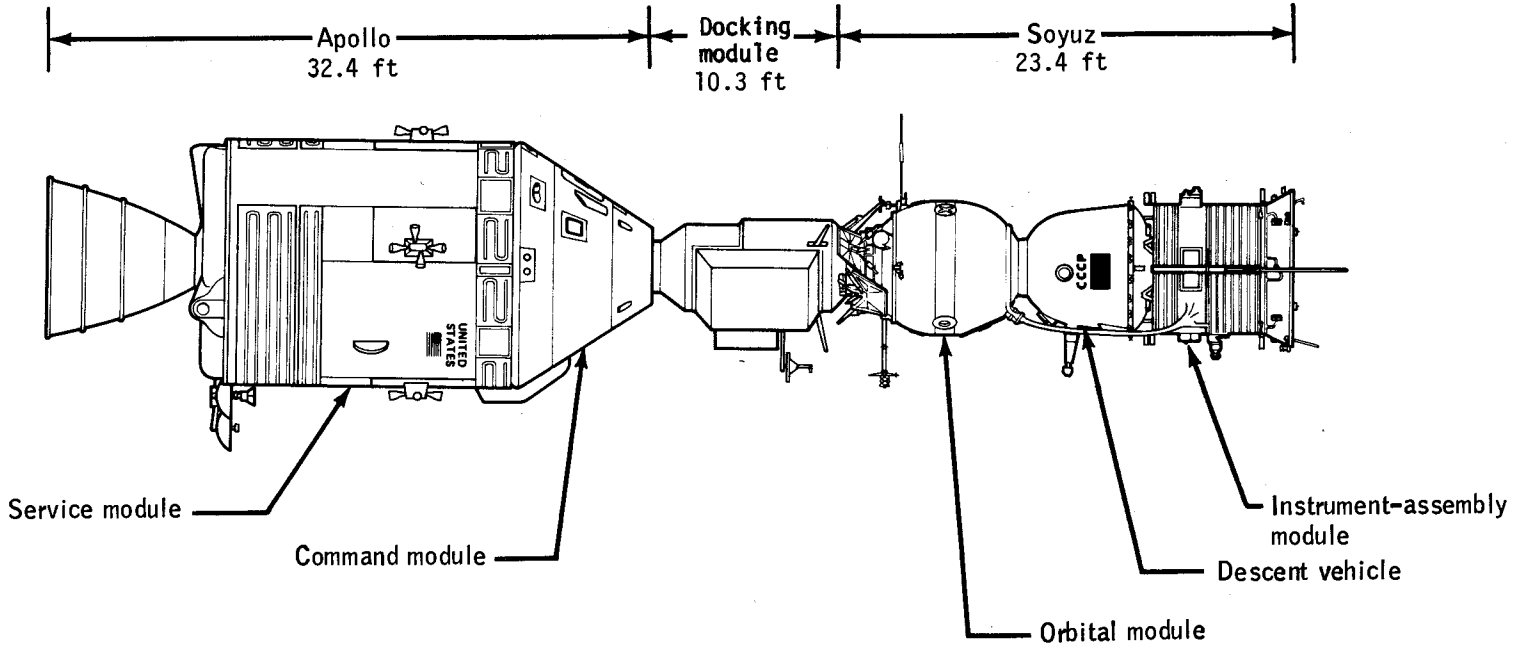

Figure 2-2.- ASTP docked configuration.

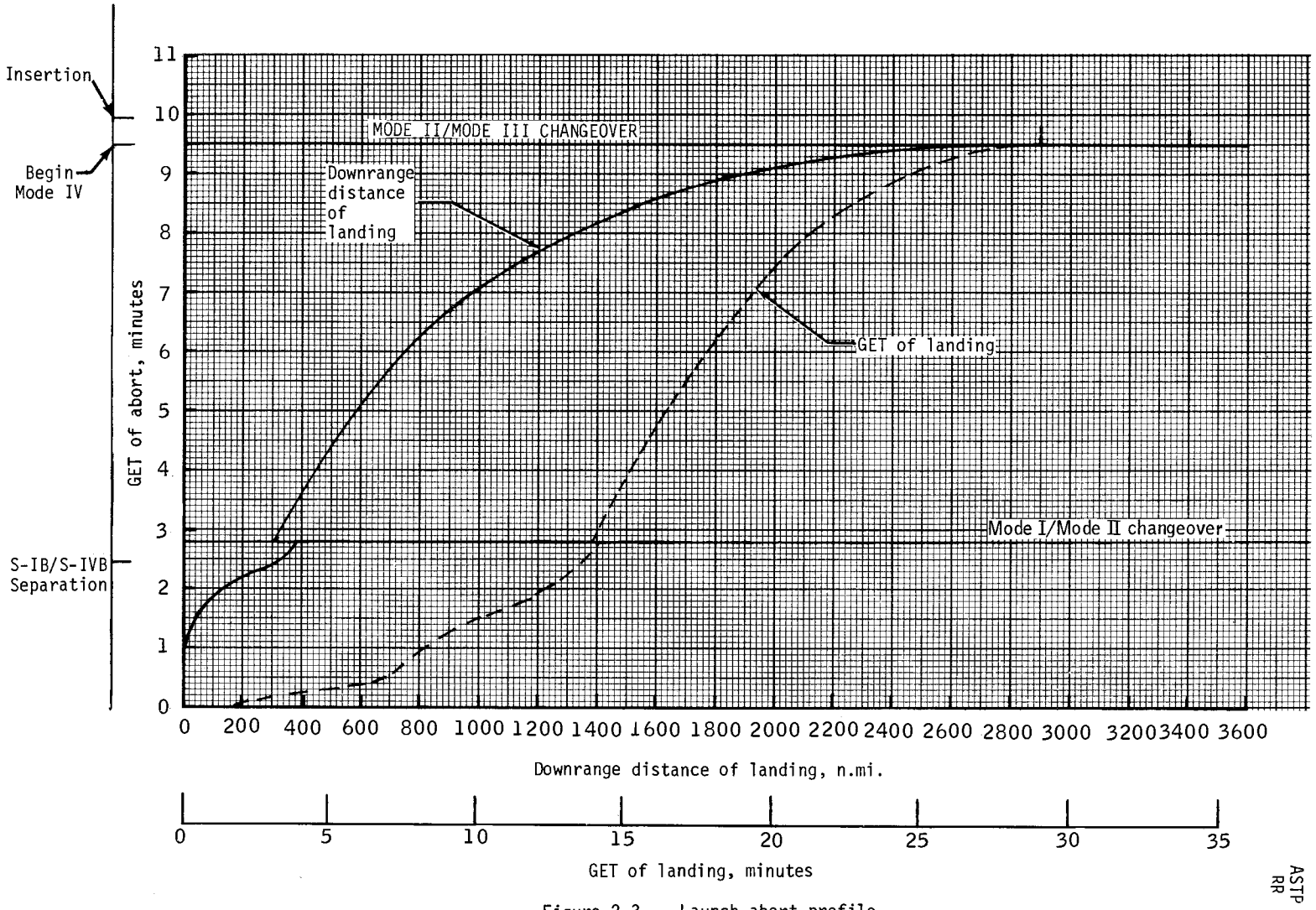

Figure 2-3. - Launch abort profile.

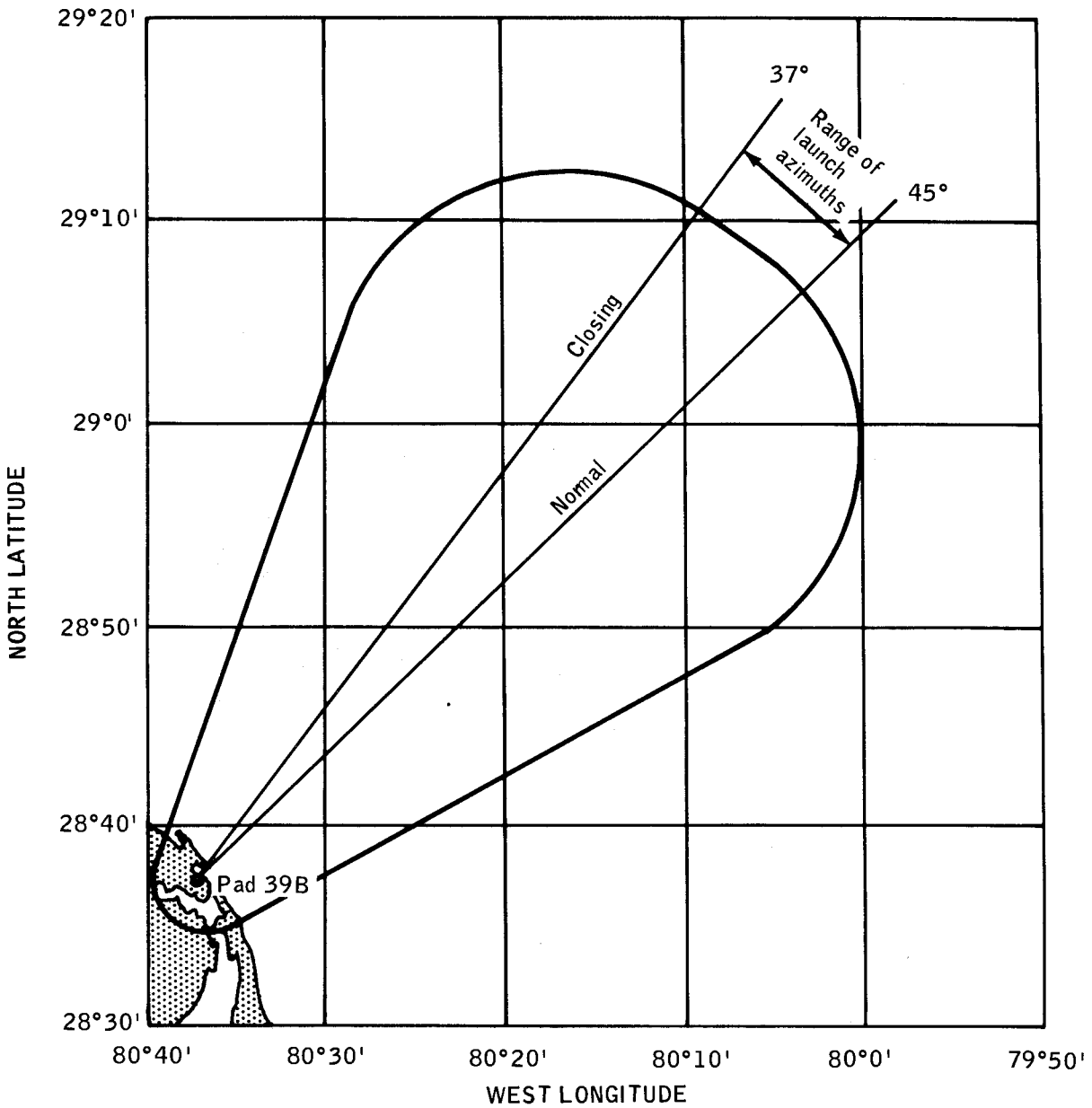

Figure 2-4.- Launch site area.

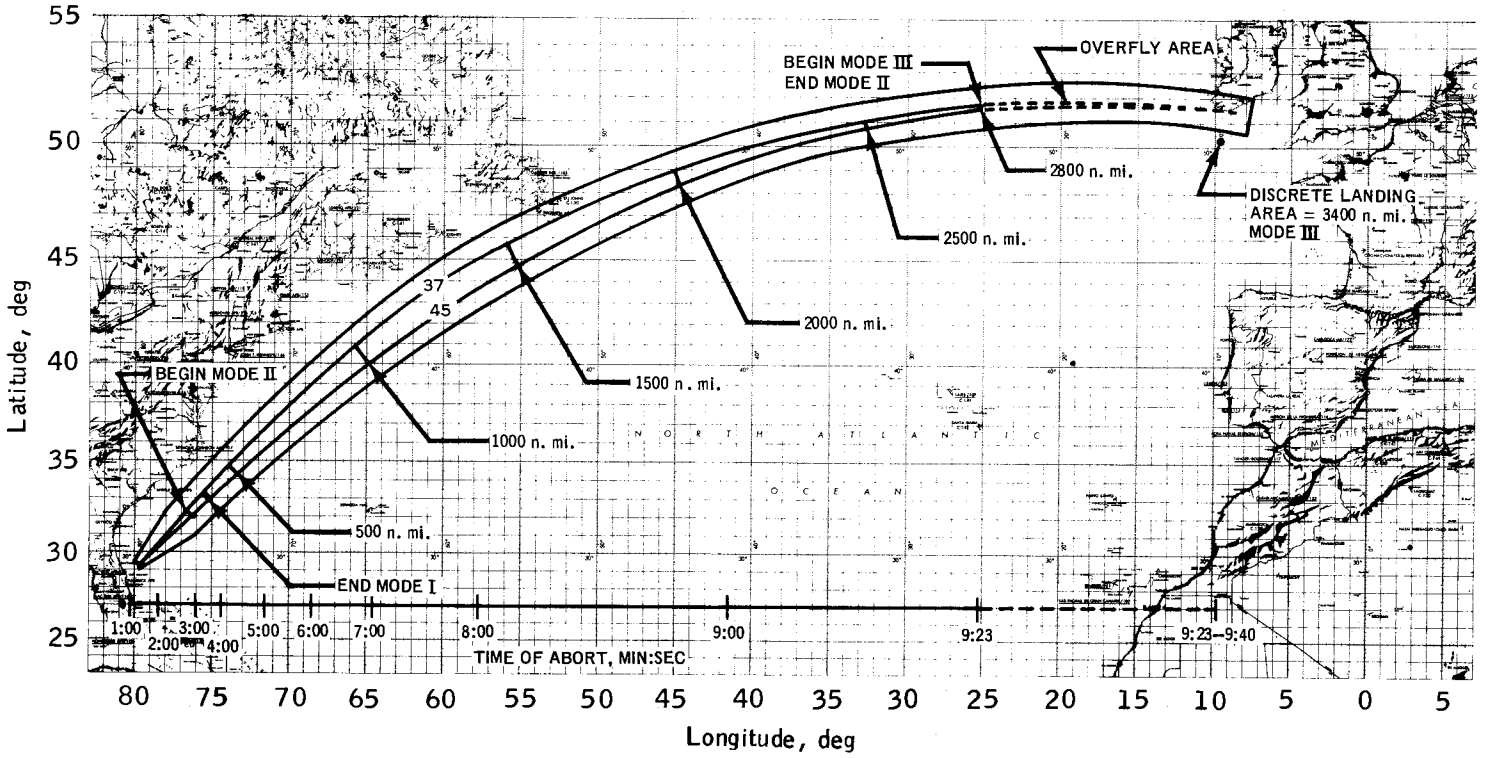

Figure 2-5.- Launch abort area.

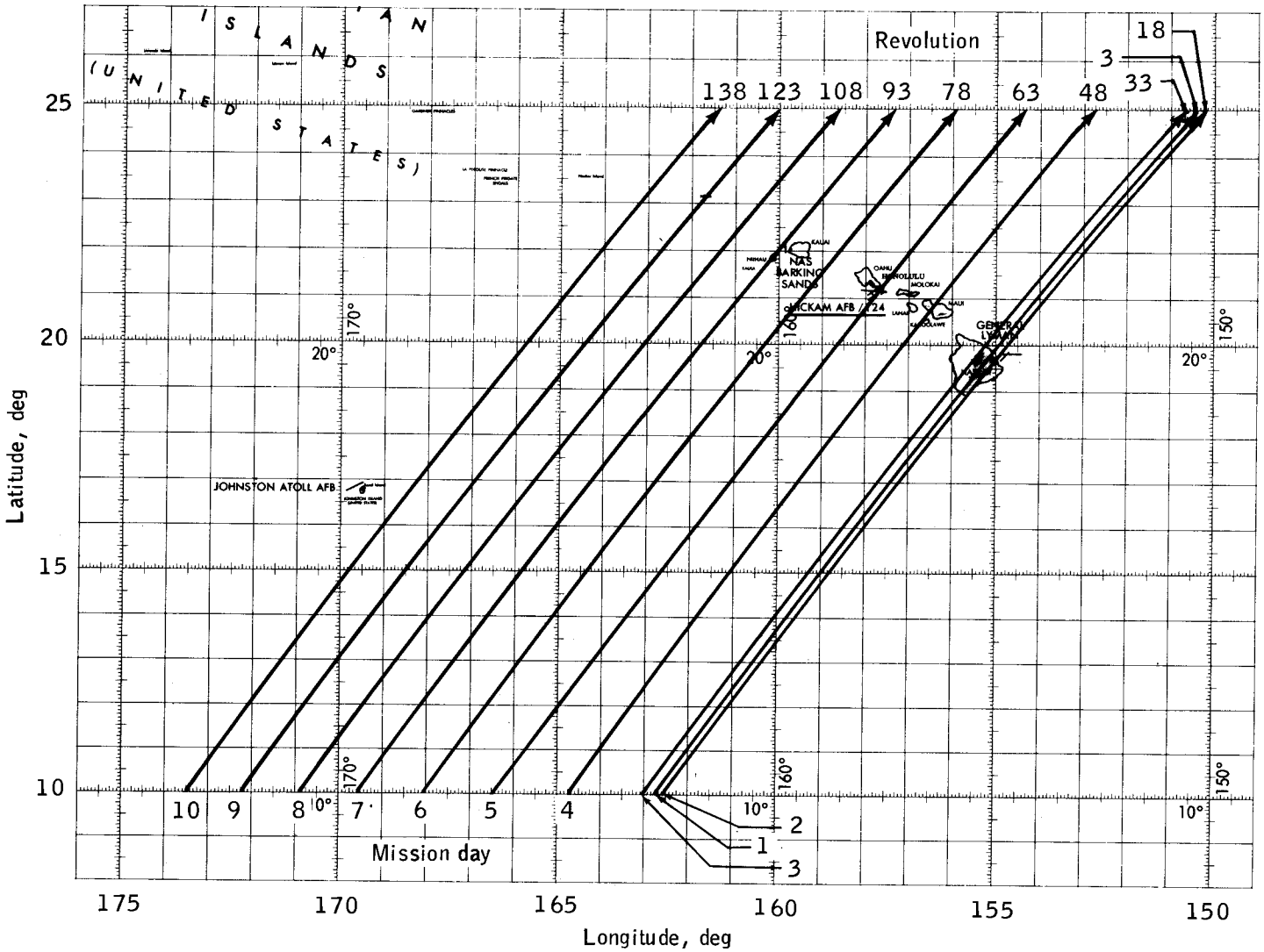

Figure 2-6.- PRS supported groundtracks.

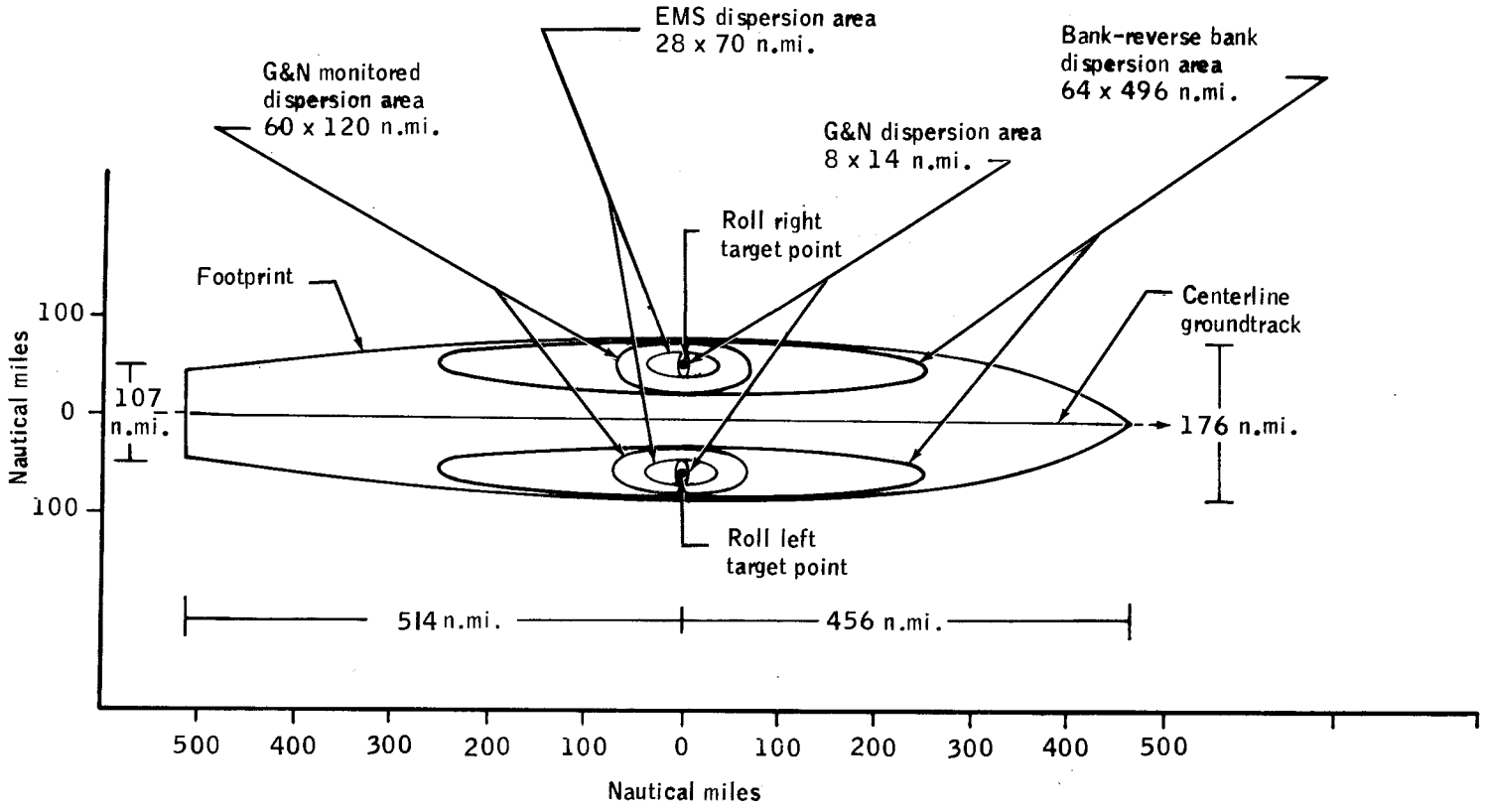

Figure 2-7.- CM manuever footprint and dispersion areas.

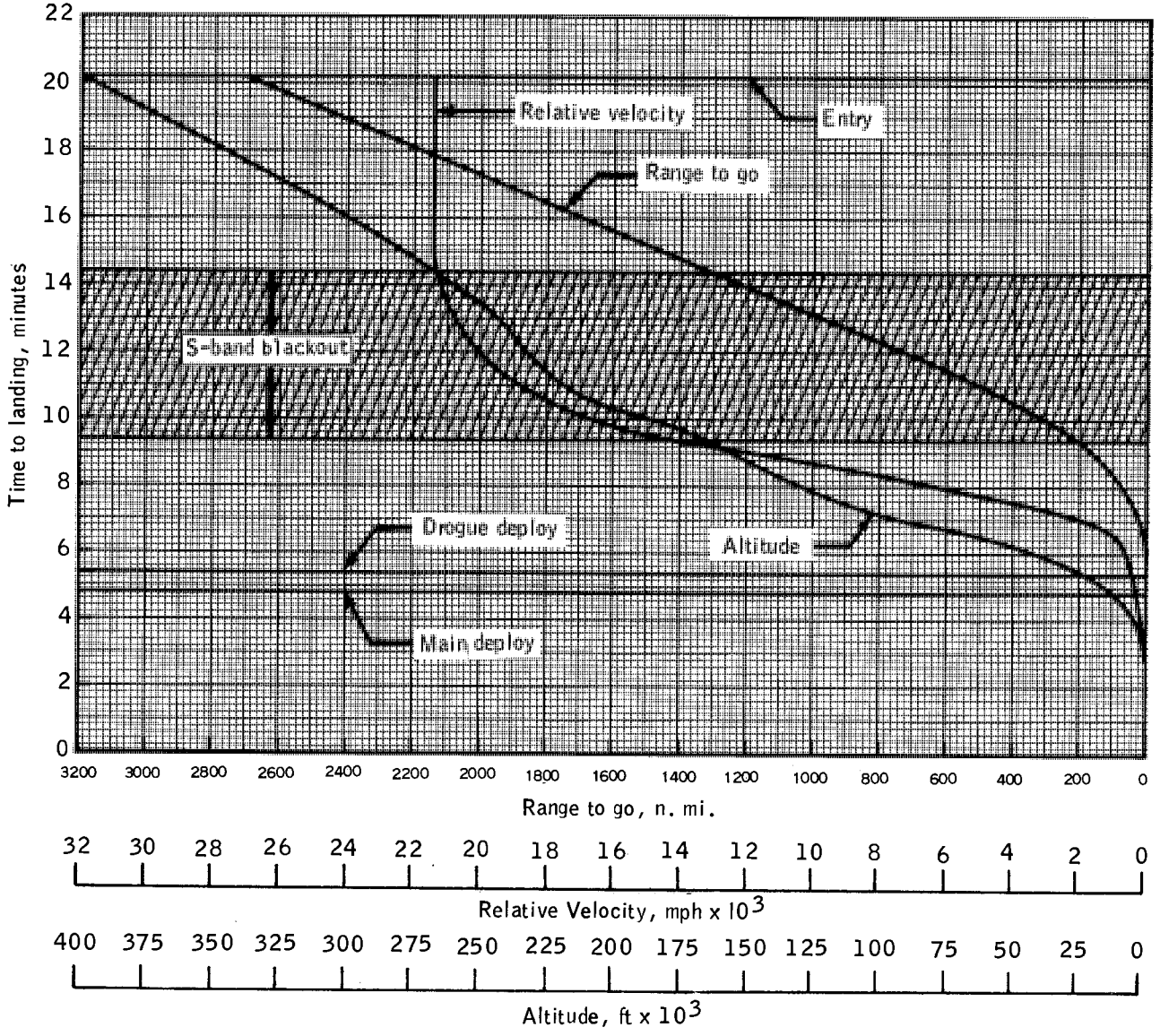

Figure 2-8.- Entry profile.

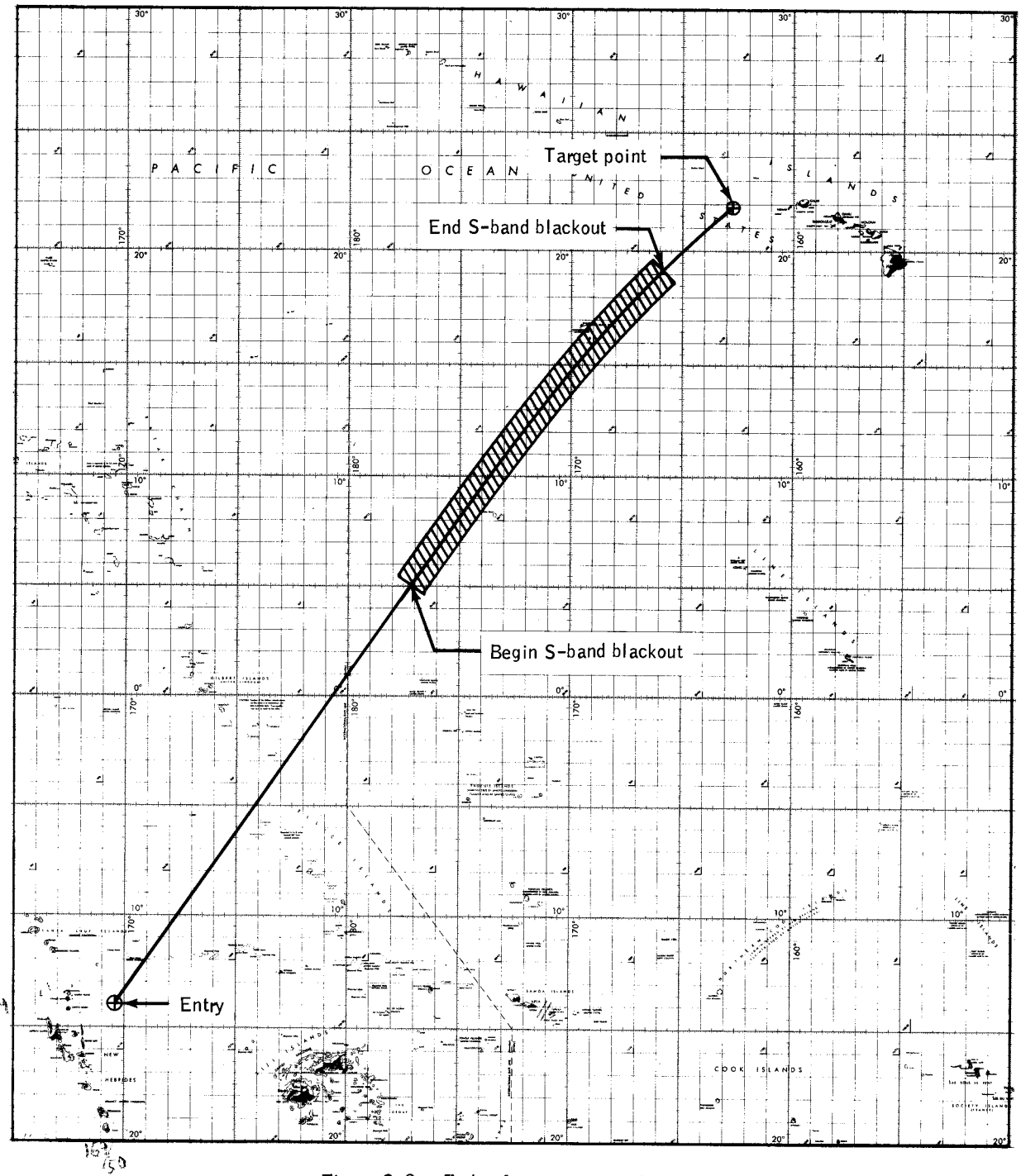

Figure 2-9.- End-of-mission groundtrack.

SECTION 3
RECOVERY FORCE REQUIREMENTS

3.1 GENERAL REQUIREMENTS

It is required that the Apollo flight crew and CM be recovered as soon after landing as is safely possible, within the capability of the required recovery forces. The preferred method of flight crew retrieval in the primary landing area is by a PRS boat and airplane (B&A) crane, with a National Aeronautics and Space Administration (NASA) winch installed on it and with the flight crew in the CM. The secondary method is by helicopter using a recovery net after the flight has egressed the CM into a recovery raft. It is understood that the final decision on the retrieval method to be used will be made by the on-scene recovery force commander on the basis of his evaluation of the operating condition, force capability, and safety consideration. Following recovery, the flight crew will be delivered to Ellington AFB, Texas, and the CM will be delivered to Hickam AFB, Hawaii, for deactivation. After deactivation the CM will be transported to the West Coast.

In the primary landing area there is a secondary requirement to recover the three main parachutes of the CM. This procedure should not significantly delay nor in any way compromise the safe recovery of the flight crew or the CM. The main parachutes should be delivered with the CM to the West Coast.

It is also required that recovery forces be capable of salvaging portions of the Apollo space vehicle in case of a catastrophic failure in the vicinity of the launch site. Specific components to be recovered will be identified after the fact.

Although there are no specific requirements for recovery of any parts of the launch vehicle or LES, if after launch they are found, they should be recovered if possible. If it appears that the items are too large or unsafe for retrieval, the Mission Control Center (MCC) at Houston should be contacted for guidance. Table 3-I contains a list of predicted impact information for these items.

3.2 DEFINITIONS

Terms useful in discussing recovery force requirements and support are defined in the following subsections.

3.2.1 Mission Termination Lead Time

This is the time interval between the decision to terminate the mission and CM landing. This information, along with the latitude and longitude of landing given in the figures and tables in Section 2, defines the amount of time available for recovery forces to proceed to the landing point in order to arrive by the time of CM landing.

3.2.2 Reaction Time

This is the elapsed time between notification of the recovery force commander to deploy forces to the CM landing point and actual departure of forces to that point.

3.3 RECOVERY FORCE REQUIREMENTS

3.3.1 Launch Phase

From the time of LES arming until orbital insertion, the recovery forces are required to provide support for landings that would follow a Mode I, II, or III launch abort. The required support for this period of time is defined for two different areas: the launch site area and the launch abort area.

3.3.1.1 Launch site area.- The launch site area includes all possible CM landing points following an abort initiated between LES arming and approximately 1 minute 30 seconds GET. This area is shown in Figure 2-4. The possible CM landing points in this area will be determined by the local wind conditions. For a given wind profile, the loci of possible CM landing points will lie in a narrow corridor whose position will be identified and passed to the launch site recovery force just before launch.

A. Recovery Operation

The recovery force in the launch site area is required to provide support to the pad egress team between flight crew ingress (launch minus 2 hours 40 minutes) and LES arming (launch minus 42 minutes). The launch site force is required to provide the following capabilities in the launch site area between LES arming and launch plus 1 minute 30 seconds.

1. Locating the CM in any part of the area.

2. Delivery of a rescue team to the CM landing point and installation of a flotation collar.

3. Delivery of fire-suppression and jammed-hatch kits to a land, swamp, or surf CM landing site.

4. Uprighting the CM.

5. Transportation of the flight crew from any point in the area to the Patrick AFB Hospital.

6. Transportation of the unoccupied CM to a predesignated location at the Kennedy Space Center following a land, swamp, or surf landing. Following a surf landing, it may be necessary to transport the CM with the flight crew still inside to the nearest beach area.

7. Provision for debris location, mapping, and recording assistance for a salvage operation, if required.

After launch plus 1 minute 30 seconds the launch site force is required to provide flight crew retrieval capability as far downrange as feasible.

To fulfill these requirements, the launch site recovery force should consist of the units listed in Table 3-II.

B. Salvage Operation

When the recovery of the flight crew and CM is completed, a salvage operation may be required. After initial location and marking of debris, NASA will determine which pieces, if any, will be salvaged and the priority of salvage.

To accomplish the salvage operation, it is required that the DOD provide a salvage force capable of starting a salvage operation immediately after CM recovery in shallow water and within 30 hours farther downrange.

3.3.1.2 Launch abort area.- The launch abort area is the area in which the CM would land following an abort initiated during the launch phase of the flight between approximately 1 minute 30 seconds GET and orbital insertion. The area is located in the North Atlantic Ocean, extends from the launch site area to 3450 n. mi. downrange, and is depicted in Figure 2-5.

The area includes all possible CM landing points following a launch abort from any launch azimuth. As a landing following a launch abort would be on or near the groundtrack, the loci of possible CM landing points are determined by the actual launch azimuth and compose a relatively narrow corridor within the area.

The area from 2800 n. mi. to 3400 n. mi. downrange is the overflight portion of the area. In this portion of the area there is a very low probability of a CM landing.

Recovery force requirements in the launch abort area consist of three search-and-rescue aircraft (designated A, B, and C, lettering northeastward from Cape Canaveral) and five air-refuelable helicopters. These forces are required to provide the following support:

A. Search-and-rescue aircraft

Three HC-130 aircraft with pararescue personnel onboard should be airborne in the launch abort area prior to launch. The positions of these aircraft and their inbound headings are shown in Table 3-III. These aircraft should be staged from bases that allow maximum on-station loiter time. The planned Apollo launch azimuth is approximately 45° true. If the launch is delayed, the launch azimuth will decrease at a rate of approximately 1° per minute; therefore, the aircraft should depart station at the planned launch time and fly inbound toward the groundtrack.

B. Helicopters

Two launch site air-refuelable helicopters are required to provide flight crew retrieval capability for a CM landing as far downrange as feasible. At lift-off these helicopters should fly downrange along the groundtrack (after setting down the fire-suppression kit (FSK)--if airborne) until released from support (5-6 minutes GET for a normal launch).

One air-refuelable helicopter, located at Pease AFB, New Hampshire, and one at Gander International, Newfoundland, are required to provide flight crew retrieval capability from each base. These helicopters with pararescue personnel onboard and the launch site helicopters will support the launch abort area to 2800 n. mi. downrange. An abort initiated between approximately 1 minute 30 seconds and 9 minutes and 24 seconds GET would result in a CM landing in this area.

One air-refuelable helicopter with pararescue personnel onboard located at Woodbridge RAF, England, will provide flight crew retrieval capability support for a CM landing at the discrete landing area (3400 n. mi. downrange). An abort after approximately 9 minutes 24 seconds GET would result in a CM landing in this area.

At launch, the helicopters at Pease AFB, Gander International, Newfoundland, and Woodbridge RAF should be on cockpit alert.

There is no requirement for a dedicated CM retrieval capability. Ships-of-opportunity may be called upon to provide this capability.

3.3.2 Earth Orbital Phase

3.3.2.1 Discussion.- During the orbital phase of the mission, the recovery forces are required to be prepared to support a CM landing that would result from an early mission termination. Target points, which are strategically located coordinates for which the CM would be targeted if it became necessary to land, have been selected for each CSM revolution. The following format is used to designate target points: X X X - X X. The first three slots designate the revolution number. The next slot designates the geographical sector in which the target point is located. The sectors are shown in Figure 3-1 and are defined as follows:

Sector 1 - includes the 80° W. meridian and all the area east to 50° W. from latitude 0° to 52° N.

Sector 2 - includes the 50° W. meridian and all the area east to 20° E. from latitude 0° to 52° N.

Sector 3 - includes the 20° E. meridian and all the area east to 170° E. from latitude 0° to 52° N.

Sector 4 - includes the 170° E. meridian and all the area east to 140° W. from latitude 0° to 52° N.

Sector 5 - includes the 140° W. meridian and all the area east to 80° W. from latitude 0° to 52° N.

Sector 6 - includes all the area of the world from latitude 0° to 52° S., excluding 0°.

The last slot designates the target point type. The three types of target points are defined as follows:

G - GO/NO-GO target point. This target point is geographically located to provide optimum recovery support. One GO/NO-GO target point will be chosen for each day.

B - BLOCK DATA target point. One BLOCK DATA target point per day, for the succeeding 2 days, will be stored aboard the CM. This target point would be used for deorbit after a loss in communications between the ground and CSM.

C - CONTINGENCY target point. This is a preplanned target point chosen to provide one target point for each CSM revolution.

For example, 108-4G indicates a target point for revolution 108, located in the mid-Pacific sector (see Figure 3-1), and is a GO/NO-GO type of target point.

The probability of a CM landing at a B- or C-designated target point is extremely low because of the low probability of communication loss and the low probability of a short mission termination's being necessitated before the next G-designated target point.

Landing areas for the orbital phase of the mission are designated either primary or contingency.

3.3.2.2 Contingency landing area.- The contingency landing area is defined as the area around the Earth in a band between latitude 52° N. and 52° S. that lies outside the primary landing area. In this area target points have been chosen to provide at least one target point for each revolution (see Table 2-III).

The probability of landing in this area is so low that only home-based search-and-rescue aircraft support is warranted. Recovery force support for this area

should be provided by the aircraft supporting the primary landing area and one ARRS SAR alert aircraft, Apollo-configured, at Kadena AB, Japan; Woodbridge RAF, England; McClellan AFB, California; and Eglin AFB, Florida. See Table 3-IV for summary of all search-and-rescue aircraft requirements.

If a contingency target point is used and an HC-130 can be on station prior to CM landing, the HC-130 should be positioned 50 n. mi. from the target point on a line through the target point and perpendicular to the CM centerline groundtrack. The target point should be between the CM centerline groundtrack and the HC-130 position. Should a second aircraft be available, it should be positioned 200 n. mi. uprange and 125 n. mi. abeam the CM centerline groundtrack. Both aircraft should be on the same side of the CM centerline groundtrack as the target point. The aircraft should depart station 2 minutes before predicted end of S-band blackout. If S-band blackout time is not available, the aircraft should depart station 12 minutes before predicted CM landing time.

There is no requirement for a dedicated flight crew and/or CM retrieval capability. Ships-of-opportunity may be called upon to provide this capability.

3.3.2.3 Primary landing area.- The primary landing area is that area where the probability of landing is highest and warrants the requirement of PRS capability. The primary landing area is located in the mid-Pacific in the vicinity of the Hawaiian Islands. See Figure 2-6 and Table 2-III for primary landing area target point locations. Target points to be supported by the PRS are designated by a G in the table.

Recovery force support for this area should consist of the PRS and a search-and-rescue aircraft, prepositioned as described in the following paragraphs.

A. PRS and helicopters

An aircraft-carrier type of ship with helicopters capable of search and flight crew retrieval should be positioned near the target point. The ship should be positioned on the G&N dispersion ellipse at the time of CM main-parachutes deployment. Four helicopters (three with swimmer teams onboard and one with photographers) should be airborne and positioned as shown in Figure 3-2 at the time of CM main-parachutes deployment.

NOTE

Although not required, if a communications relay aircraft is used, it is recommended that it be positioned as shown in Figure 3-2 to provide additional crossfixing capability.

B. Search-and-rescue aircraft

One fixed-wing search-and-rescue aircraft with pararescue personnel onboard will be positioned uprange of the target point as shown in Figure 3-2. Although not required, if a second aircraft is available, it should be positioned downrange of the target point as shown in Figure 3-2. Both aircraft should be on the same side of the CM centerline groundtrack as the target point.

The aircraft should depart station toward the groundtrack 2 minutes before the predicted end of S-band blackout. If the S-band blackout time is not available, the aircraft should depart station 12 minutes before predicted CM landing time.

TABLE 3-I.- PREDICTED IMPACT INFORMATION NONRECOVERABLE FLIGHT COMPONENTS

Component	Predicted GET of impact after Apollo launch	Predicted impact location
S-IB	8 min 31 sec	262 n. mi. downrange from launch site
S-IVB ullage cases	12 min 16 sec	269 n. mi. downrange from launch site
CSM/S-IVB adapter panels	Approximately 2.5 hr	Indian Ocean
S-IVB	5 hr 56 min	18°42' N. 178°12' W.
Service module	Approximately 5 min before CM landing	868 n. mi. uprange to 373 n. mi. downrange of CM landing, within 15 n. mi. of CM centerline groundtrack.

TABLE 3-II.- LAUNCH SITE RECOVERY FORCE SUPPORT

No.	Recovery unit	Mission	Recommended position	Recovery team and special equipment
2	Heavy-lift helicopters (at least 1 HH-53C)	Provide short access time to landing point for pararescue personnel, CM uprighting capability, and flight crew retrieval for abort in the launch site area and as far down-range as possible in the launch abort area	Airborne north of the launch pad	Recovery equipment[1] pararescue team, 24-foot nylon recovery sling, fire-suppression kit, jammed-hatch kit
1	LCU landing craft	Provide deepwater CM retrieval capability	To be determined on the day of launch	Equipment to retrieve CM and perform salvage operations
2	K-501	Provide fire suppression capability		Two firefighter personnel for each unit
1	ARS or ATF salvage ship	Provide deepwater salvage capability	On call (within 30 hours of Port Canaveral)	

[1]Recovery equipment refers to items such as stokes litters, first aid equipment, CM hatch-opening tool, etc., that are required by the recovery force to execute CM recovery.

TABLE 3-III.- LAUNCH ABORT AIRCRAFT STATIONS AND INBOUND HEADINGS

Aircraft	Station		Inbound heading, deg true
	Latitude, deg-min	Longitude, deg-min	
A	42-30 N.	56-00 W.	330
B	48-30 N.	33-00 W.	347
C	47-45 N.	10-00 W.	004

TABLE 3-IV.- AIRCRAFT STAGING BASES AND REACTION TIMES

<table>
<tr><th rowspan="2">Staging base</th><th colspan="4">Phase of mission</th></tr>
<tr><th>Planned launch time to orbital insertion</th><th colspan="2">Orbital insertion to CM entry</th><th>CM entry to CM landing</th></tr>
<tr><td>Patrick AFB FL</td><td>Two heavy-lift helicopters airborne in the launch site area</td><td colspan="3">Aircraft released when no longer required (normally 5-6 minutes after launch)</td></tr>
<tr><td>As required</td><td>Two HC-130 airborne in launch abort area, Stations A and B</td><td colspan="3" rowspan="3">Aircraft released after orbital insertion</td></tr>
<tr><td>Pease AFB, NH</td><td rowspan="3">One refuelable helicopter on cockpit alert at each base.</td></tr>
<tr><td>Gander International, Newfoundland</td></tr>
<tr><td rowspan="2">Woodbridge RAF, England</td><td>One refuelable helicopter on 30-minute reaction time until 2-2 deorbit time.</td><td colspan="2">Aircraft released after 2-2 deorbit time</td></tr>
<tr><td>One HC-130 airborne in launch abort area, Station C</td><td>Enroute to 2-2 until 2-2 deorbit time and then return to base.</td><td>One HC-130 on ARRS SAR alert, Apollo configured after 2-2 deorbit time.</td><td>Aircraft released after entry for normal mission.</td></tr>
<tr><td>Hickam AFB HI</td><td rowspan="4">Not required</td><td>One HC-130 on strip alert until 3-4 deorbit time.</td><td>One HC-130 with 2-hr reaction (duty hr) & 3-hr reaction (non-duty hrs) after 3-4 deorbit time.</td><td>One HC-130 airborne in the EOM area.</td></tr>
<tr><td>McClellan AFB, CA</td><td colspan="2" rowspan="3">One HC-130 on ARRS SAR alert, Apollo configured at each base.</td><td rowspan="3">Aircraft released after entry for normal mission.</td></tr>
<tr><td>Eglin AFB, FL</td></tr>
<tr><td>Kadena AB, Japan</td></tr>
</table>

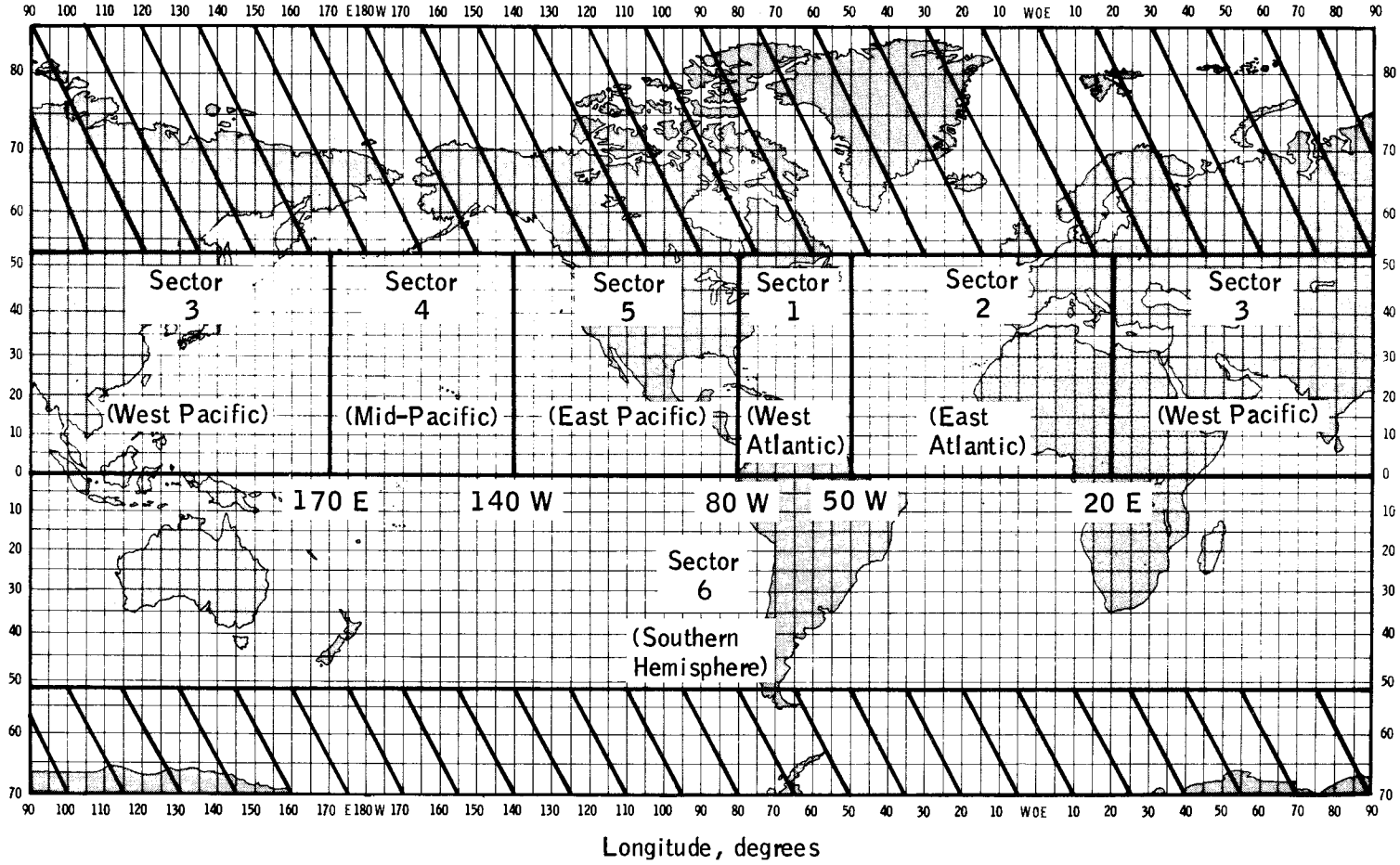

Figure 3-1.- Target point sectors designator.

SECTION 4
ADDITIONAL RECOVERY SUPPORT REQUIREMENTS

4.1 OPERATIONAL REPORT REQUIREMENTS

The following reports must be made to the NASA Recovery Officer at the MCC:

A. Recovery Force Readiness Report

B. Recovery Operation Reports

C. Summary Reports

D. Command Module Landing and Retrieval Point Summary

4.1.1 Recovery Force Readiness Report

This report is a summary of the recovery force readiness. The information normally will be requested by the NASA Recovery Officer at the MCC prior to launch and entry; however, any time a significant change in recovery force readiness occurs, the information should immediately be passed to the NASA Recovery Officer.

4.1.2 Recovery Operation Reports

Department of Defense forces are required to keep the MCC informed of all significant events that transpire during the mission. These reports include, but are not limited to, weather reports, departure of a recovery unit to or from an assigned station, arrival of a recovery unit at an assigned station, acquisition of electronic signals from the CM, voice contact with the flight crew, and visual sighting of the CM. Standard formats for the reports are provided in Reference 2.

It is required that upon location of the CM, a complete description of the pararescue or swimmer deployment, flotation collar installation, and retrieval operation (flight crew and CM) be passed to the MCC as it occurs. It is not required that this commentary be an automatic relay from the recovery area.

4.1.3 Summary Reports

All recovery units must submit Summary Reports in the appropriate format outlined in Reference 2. The reports are required from the recovery ship as soon as possible after retrieval, and from any recovery unit obtaining any pertinent information requested in the report formats as soon as possible after CM landing. Each report should be submitted in TWX form to the DOD Manager with an information copy to the Mission Support Branch (CF2), NASA Johnson Space Center (JSC), Houston, Texas 77058.

4.1.4 Command Module Landing and Retrieval Point Summary

For postmission evaluation of the performance of CM systems, it is imperative that the CM landing point be reported as accurately as possible to NASA-JSC. To provide an accurate reference point for Tactical Air Navigation (TACAN) and radar bearings to the CM landing point, the primary recovery ship must take navigational fixes as close to the times of CM landing and retrieval as is feasible. Along with the fixes, the ship must include a written description of the method used in obtaining these fixes. This summary should be given to the NASA Team Leader.

4.2 COMMUNICATIONS REQUIREMENTS

4.2.1 General

The DOD is responsible for providing rapid and reliable voice and teletype communications necessary to conduct flight crew and CM recovery and/or launch site salvage operations. NASA-JSC should be notified if DOD communication circuits are not adequate to satisfy recovery communications requirements. Arrangements will be made to furnish additional equipment if required or to make provisions for reimbursement to the DOD for augmentations made. NASA must be informed before commitment of DOD funds that are reimbursable by NASA and not covered by existing funding agreements.

4.2.2 Sharing of DOD Operational Voice Circuits

If the NASA Recovery Common circuit (see Subsections 4.2.3 and 4.2.6.1) becomes temporarily inoperative or a need arises to discuss NASA activities with personnel at a location not equipped with a voice coordination circuit, NASA desires to share DOD operational voice circuits on a not-to-interfere basis. This sharing will be done only with prior approval of the DOD Manager, the task force commander, and/or the task group commander.

4.2.3 NASA Recovery Common Circuit

To coordinate information concerning NASA recovery activities, a voice circuit between the MCC and Cape Canaveral, the Pacific RCC, and the PRS is required.

A. As outlined in Subsection 4.2.4.1, the circuit should terminate at the NASA Launch Site Recovery Advisior's console in the Range Central Control at the Cape Canaveral Air Force Station.

B. At the Pacific Recovery Control Center (RCC), the circuit should terminate at the NASA Recovery Advisor's and NASA PAO representative's (see Subsection 4.2.5) console.

C. NASA also requires use of the NASA Recovery Common or DOD Recovery Common circuit on a not-to-interfere basis for Houston and Honolulu National Weather Service coordination. Personnel at these positions will require the circuit for approximately 15 minutes at launch minus 24 and 12 hours. After CSM insertion, the circuit will be required for approximately 15 minutes every 12 hours to coordinate weather forecasts. If weather conditions are marginal, the circuit may be required more frequently. Refer to Subsection 4.3 for additional communications requirements related to weather observations and reports.

4.2.4 Launch Site Circuits

4.2.4.1 Recovery Technical Advisor's communications.- It is required that the NASA Recovery Advisor at the launch site be provided a separate console position at the Range Central Control. The console position must have the following capabilities:

A. Range Safety and Impact Display System and communications with the Launch Site Surveillance Officer (See Item F) - This capability is required for verification of the Air Force's wind-corrected impact point data.

B. Talk-and-monitor capability on the NASA Recovery Common circuit (See Subsection 4.2.3) - This capability is reguired from launch minus 6 hours until released by the NASA Recovery Officer located at the MCC (approximately launch plus 30 minutes for a normal launch).

C. Monitor capability on the Fire/Crash Net and Space Vehicle Test Supervisor circuits (OIS 111) - This capability is required from launch minus 3 hours until released by the Launch Site Recovery Advisor (approximately launch plus 30 minutes for a normal launch).

D. Monitor capability on the Launch Site Recovery nets 1 and 2 and "Air-to-Ground" - This capability is required from launch minus 6 hours until released by the Launch Site Recovery Advisor (approximately launch plus 30 minutes for a normal launch).

E. Talk-and-monitor capability on the Launch Area Coordination circuit - This communication capability is to the Launch Area Range Surveillance (LARS) console and the Superintendent for Range Operations (SRO) console. This capability is reguired from launch minus 6 hours until released by the Launch Site Recovery Advisor (approximately launch plus 30 minutes for a normal launch).

F. Circuit to the SRO console - "Green phone" circuit is required to provide access to the SRO console.

4.2.4.2 Medical circuit.- The pararescuemen onboard the launch site area recovery helicopters must have the capability to monitor the Launch Site Recovery circuit and must be able to communicate directly with the Patrick Air Force Base Hospital.

4.2.5 RCC Pacific NASA Consoles

The NASA Recovery Advisor and the NASA PAO representative will each require a console in the RCC. The following circuits should be terminated at the console from approximately launch minus 3 days through recovery plus 3 days.

A. Talk and monitor on the NASA Recovery Common circuit (see Subsection 4.2.3).

B. Talk and monitor on the DOD Recovery Common circuit.

C. Monitor only on the spacecraft Air-to-Ground circuit (if circuit appears at the RCC).

D. Talk and monitor on circuit Alpha.

E. Monitor only on circuit Hotel.

4.2.6 Primary Recovery Ship Circuits

4.2.6.1 NASA Recovery Common circuit.- A special configuration of the NASA Recovery Common circuit, identified in Subsection 4.2.3, is required to provide a voice circuit between the MCC, the Pacific RCC, and the PRS for coordination of NASA recovery, medical, and Public Affairs Office (PAO) activities. Sharing of the DOD Command and Control circuit on a not-to-interfere basis for this purpose is acceptable to NASA, except as outlined as follows. During those periods, a dedicated circuit will be required.

A. Schedule:

1. On the launch day from Apollo launch minus 30 minutes through launch plus 1 hour 30 minutes.

2. A 2-hour period during the recovery minus 2 days simulation.

3. From 1 hour prior to entry interface until 7 hours after CM landing.

4. On recovery plus 1 day from 1100-1300 local PRS time. The circuit will not be required after the PRS arrives in port at Pearl Harbor.

5. Daily from 1000-1200 local PRS time (except as outlined in 1 through 4) while the PRS is at sea for training and mission support.

NOTE

(For 1 through 5): If propagation or other conditions make the circuit temporarily inoperative, NASA will either wait until the circuit is made operational or relay the information through command and control circuits. The circuit termination requirements on the PRS are shown in Table 4-I.

B. MEDATA Transmissions

An extension of the NASA Recovery Common circuit is required at the mobile laboratory's Operational Medicine Lab (see Subsection 4.7.2.1) for special MEDATA transmissions. These transmissions will be conducted by NASA surgeons with their automated medical data system through use of a high-speed-printer terminal that will be located in the mobile laboratory. This system transmits data to and retrieves data from computer-stored magnetic tape files at JSC. The terminal is designed to operate with standard telephone voice circuits. The printer terminal/circuit coupling will be acoustical using a NASA-provided telephone handset. NASA will also provide a marine radio-telephone control unit (type C1138/UR) to provide the interface between the handset and the NASA Recovery Common circuit. Power required for the MEDATA terminal will be obtained from the mobile laboratory. The NASA surgeon accepts responsibility for the reliability of the terminal, and if conflicts arise, operational communications support will take priority.

At JSC an existing circuit will be used between the MCC and the data file.

The anticipated MEDATA transmission schedule is as follows:

1. From 1100 to 1200 local PRS time on recovery minus 6 and 3 days for checkout of the medical laboratory MEDATA terminal circuit interfaces.

2. On recovery day from CM landing plus 6 to CM landing plus 7 hours.

3. On recovery plus 1 day from 1200 to 1300 local PRS time. This period will not be required if the PRS is in port.

4.2.6.2 PRS/recovery helicopter circuit.- The NASA surgeon on board the "recovery" helicopter will require a direct talk-and-monitor capability with the NASA surgeon on the PRS. Use of an existing operational circuit will be acceptable. The NASA surgeon on the PRS will be located in the SACC/CIC area during this period of activity. The NASA surgeon onboard the "recovery" helicopter will also require a direct talk-and-monitor capability on the Astronaut Voice circuit.

4.2.6.3 NASA office space circuit terminations.- The NASA Recovery Common, Astronaut Voice, Alpha, India, and Hotel circuits and field phone or sound-powered system phone should be terminated in the NASA office space (SACC area) on individual speakers and handsets as indicated in Table 4-II.

4.2.6.4 Recording of landing area communications.- When involved in a recovery operation, the PRS must record VHF transmissions on 296.8 MHz and 243.0 MHz. If the capability exists to record a third frequency, transmissions on 259.7 MHz should also be recorded.

The recording should begin at CM entry and continue until the flight crew has been recovered. Each frequency should be recorded on a separate tape if possible, but recording on separate channels of the same tape is acceptable. These recordings should be made on 1/4-inch tape at 1-7/8-inch/second. These tapes should be on 7-inch or smaller reels and should be given to the NASA Team Leader.

4.2.6.5 News pool teletype circuit.- News media representatives on the PRS must be provided a teletype channel to relay their written pool copy to the Pacific RCC with drops to the ASTP News Center, Kennedy Space Center, Florida; the ASTP News Center, Houston, Texas; the Recovery Teletype Room, MCC, Houston, Texas; and the UPI Center, Nassau Bay Building 3, Houston, Texas. While the press pool is operating aboard the PRS, the circuit will be required for transmission of pool copy filed in two 1-hour periods per day. The specific filing periods should be at the option of the press pool members. The closing time of the afternoon filing period on recovery minus 1 day and the filing periods on recovery and recovery plus 1 day should be at the option of the press pool members. All filing must be completed before the PRS arrives in port. All pool copy filed during a filing period should be transmitted as soon as possible.

4.2.6.6 News pool voice circuit.- The news pool aboard the PRS will require a ship-to-shore voice circuit and will bring aboard portable-type equipment compatible with the shipboard equipment and limited in output to 1-kW peak envelope power. Special frequencies will be obtained by the news pool from the Federal Communications Commission. The news pool will also provide a shore terminal, will assume full responsibility for the reliability of their circuits, and agree to shut down their equipment if it interferes with operational communications. If the PRS can provide an extra ship-to-shore voice circuit and if requested by the pool as a backup circuit, the circuit should be offered to the pool with the understanding that the DOD is providing the service to assist the news media in the national interest with no guarantee of reliability, speed of service, et cetera, and that the service is subject to preemption for operational needs. The DOD should advise NASA of any problems in meeting this requirement, with the understanding that NASA does not desire to fund additional equipment or services.

4.2.6.7 PRS use of 296.8 MHz and 259.7 MHz (Astronaut Voice).- Both the Apollo and Soyuz spacecraft may be transmitting and receiving on 296.8 MHz and 259.7 MHz for communication between spacecraft and between spacecraft and ground stations; therefore, the PRS should not transmit on either frequency while in line-of-sight of either spacecraft. These time periods are listed in Table 4-III.

4.2.6.8 Flight crew congratulatory voice messages.- Shortly after the flight crew is aboard the PRS, they may receive congratulatory voice messages from the President or other high-level government officials.

The flight crew will require a talk-and-monitor capability on the circuit chosen for this transmission. To provide this capability in the mobile laboratory, NASA will provide three handsets (type H169U/Dynamic) connected in a "W" with a male plug (type 14S-5P cannon) on the end of the cable. The same marine radio-telephone control unit used for MEDATA transmission (Subsection 4.2.6.1B) will be used to provide the interface between the handsets and the NASA Recovery Common circuit. Additional information concerning the specific times for such calls if they are planned will be furnished when available.

4.2.6.9 PRS in-port communications.- When the PRS is in port at Pearl Harbor after the PRS training exercises and again after the PRS returns from EOM support, NASA requires a dedicated shore-line telephone to the NASA office space (SACC). This should be the only shipboard termination of this telephone line. When no longer required, the circuit will be released by the NASA Team Leader.

4.2.7 Flight Crew Return Ceremony Circuit

An audio patch of the flight crew ceremony (in Hawaii) is desired to the MCC for a patch into the "PAO RELEASE" circuit. If the patch to the MCC cannot be accomplished by use of existing circuitry at no additional cost to NASA, NASA should be advised of this fact before implementation.

4.2.8 Flight Crew Return Communications

A voice communication capability is required between the MCC and the aircraft that returns the flight crew to Houston in case the need arises to communicate with the flight crew or other returning personnel. This requirement should not require modifications to the aircraft communication system.

4.2.9 Ship Communications for Return of CM

After the ship (with the CM) departs from Hawaii for the West Coast, the capability to establish a voice circuit between the ship and telephones in the Houston and Los Angeles areas is required. This capability is necessary in the event that problems or hazards develop with the CM and technical advice is required by the NASA representative on the ship.

4.3 WEATHER OBSERVATIONS AND REPORT REQUIREMENTS

The weather status and forecasts for potential landing areas are of vital importance to recovery planning. Special observations must be made in order to meet forecast requirements. These observations will consist mainly of surface weather observations; however, a weather reconnaissance flight will be required in some instances. The observations required are summarized in the following subsections.

4.3.1 Recovery Ship Weather Observations

Reports of ship weather observations should be transmitted via normal routing for marine weather traffic so that they will be readily available to weather stations on national communications networks. To provide a backup, Pacific ship reports should also be addressed to Fleet Weather Central, Pearl Harbor, Hawaii, and to the National Weather Service, International Airport, Honolulu, Hawaii. All reports should also be addressed to the DOD Manager at the MCC.

4.3.1.1 Surface weather observations.- Regular surface weather observations are required from the PRS at 0000 GMT, 0600 GMT, 1200 GMT, and 1800 GMT daily according to the Marine Surface Code (World Meteorological Organization Code FM21V). These weather reports should be addressed as indicated in Subsection 4.3.1. Such observations are to begin with the first observation time after PRS departure from Pearl Harbor for mission support. These observations should continue through the first observation time after recovery of the CM and flight crew or after release of the PRS from the mission (whichever occurs first.)

4.3.1.2 Special surface observations.- In addition to the regular surface observations to be reported by the PRS as outlined in the preceding subsection, observations in the special A, B, and C format (see Reference 2) are required. They should be taken at 3-hour intervals with the first observation at 1200 GMT following PRS departure from Pearl Harbor. Observations should continue until

recovery of the CM and flight crew or release of the PRS from the mission (whichever occurs first). Furthermore, the PRS should take these observations hourly from 6 hours prior to CM landing until CM retrieval. Special surface observations should be forwarded from the PRS to the DOD Manager at the MCC via the task force commander at the Pacific RCC.

More frequent observations may be required in the event of marginal weather conditions. Such observations will be requested by the NASA Recovery Officer through the DOD Manager at the MCC.

4.3.1.3 EOM wind vector.- Prior to CM landing, the PRS is required to transmit by voice the 20,000-feet-to-surface wind vector (used for helicopter maneuvering near the CM--see Reference 2 for details) to the DOD Manager at the MCC via the task force commander at the Pacific RCC.

4.3.1.4 Postflight observations.- A surface weather observation prepared according to the Marine Surface Code (World Meteorological Organization Code FM21V) is required from the recovery ship nearest the landing point at the time of CM landing. Also, a surface weather observation is required from the retrieval ship at the time of CM retrieval. These reports should be addressed to the DOD Manager at the MCC.

4.3.2 Aircraft Weather Reconnaissance

The observations required from the aircraft assigned to weather reconnaissance are summarized in Table 4-IV. Details of the exact times and tracks to be flown are dependent upon the general weather patterns preceding the recovery. These details will be provided, at the earliest practicable time, directly to the appropriate DOD reconnaissance representative by the Spaceflight Meteorology Group. Changing weather conditions may necessitate alteration of the fight plan up to a few hours prior to takeoff. For an early mission termination any local DOD aircraft may be requested to fly weather reconnaissance in the Hawaii area if sufficient lead time does not exist to deploy a weather reconnaissance aircraft.

For the planned end-of-mission landing-area-weather reconnaissance flight, the weather information should be transmitted by radio teletype to the National Weather Service at Honolulu, Hawaii, and relayed to the DOD Manager at the MCC. Also, voice communication between the reconnaissance aircraft and the MCC is required. For voice communication, the circuit may be provided by using the "NASA Recovery Common circuit" (see Subsection 4.2.3) longlines.

4.4 MEDICAL SUPPORT REQUIREMENTS

The medical requirements for DOD support of recovery operations are summarized in this section. Details of medical personnel selection, training, assignment, and specific equipment lists will be coordinated directly between the NASA-JSC Health Services Division and the Assistant for Bioastronautics to the DOD Manager for Manned Space Flight Support Operations. Detailed requirements are found in Reference 3.

4.4.1 Personnel

4.4.1.1 PRS.- The NASA medical team will consist of 35 to 45 personnel. In addition to the NASA medical personnel, the following DOD medical personnel are required on the PRS.

A. Two surgeons

B. Two anesthesiologists

C. Two surgical technicians

D. One medical equipment repairman

E. One X-ray technician from ship's medical staff

F. Two microbiology laboratory technicians

G. One microbiologist (with Ph.D. training plus experience)

4.4.1.2 Launch site helicopter.- One flight surgeon is required on each helicopter.

4.4.2 Faciliites

4.4.2.1 Launch site DOD medical facility.- The Patrick AFB Hospital has been designated as the definitive care hospital in the launch site area. NASA requires control of the area used for flight crew care.

4.4.2.2 Launch site helicopters.- Surgical and resuscitative equipment is required for use by the pararescuemen aboard each helicopter.

4.4.2.3 DOD hospitals.- Any DOD medical facility may be requested to render emergency treatment to the flight crew, depending on the area of recovery. The MCC surgeon, Houston, Texas, will assist the DOD in selection of an appropriate facility for emergency treatment.

4.4.3 PRS Support

Detailed space, equipment, etc., requirements are contained in Subsection 4.7.14. Communications requirements are contained in Subsection 4.2.

4.5 PUBLIC INFORMATION REQUIREMENTS

4.5.1 News Centers

To allow the most efficient handling of news, NASA will provide for the establishment of ASTP news centers in Houston, Texas, at the Kennedy Space Center, and at contingency locations if necessary. The DOD is required to make available public information personnel as needed for liaison and to assist in mission PAO efforts. The number of personnel and assignments will be coordinated directly between the NASA and the DOD Manned Spaceflight Support Office Public Affairs Officers.

4.5.2 PRS

The DOD is required to provide support to the news pool onboard the PRS. On the basis of past experience, it is anticipated that a news media pool of writers; still and motion picture cameramen; and radio and television producers, directors, commentators, engineers, cameramen, and technicians will desire to be onboard the PRS. The number of personnel is expected to be between 40 and 60. NASA will assign four PAO representatives to coordinate the activities of the news media pool.

4.5.3 Pacific RCC

One NASA-PAO representative will be assigned to go to the Pacific RCC to assist in planning the flight crew arrival ceremonies. This representative will arrive in Hawaii approximately 2 days before launch. The DOD is required to make

available a public information officer to act as liaison between the recovery forces and the NASA PAO representative at the RCC.

4.5.4 CM Landing in Areas Other than the Primary Landing Area

The following guidance and direction is provided for DOD personnel in the event of a CM landing in an area other than the primary landing area.

Although NASA will dispatch a public information representative to such an area as soon as possible, it is recongized that for limited periods of time, DOD and/or NASA technical personnel may be the only sources of information of the scene. Responses to news media should be based on instructions through operational communication channels. Such instructions will be forwarded as expeditiously as possible. DOD personnel on the scene are required to keep the DOD Manager's public information officer informed of activities at the landing site. The officer will serve as the point-of-contact for the NASA ASTP Information Director at the MCC and will relay information and instructions to the DOD personnel on the scene.

Upon arrival of the NASA public information representative, the on-scene DOD information representative will be relieved of responsibility for public information activities related to the mission. However, because of his knowledge of the local news situation, the DOD representative may be requested to assist in handling the news media. Provisions of this section are not applicable where a NASA ASTP public information representative is present.

4.5.5 Flight Crew Return Ceremonies

Flight crew return ceremonies that may take place in Hawaii should be brief and open to the local press. Specific details of the ceremony will be worked out between the DOD public information personnel and the senior NASA-PAO representative present. A complete description of all PAO activities is contained in Reference 4.

4.6 PHOTOGRAPHIC REQUIREMENTS

NASA requires engineering, documentary, and news photography of all recovery operations. Where no NASA photographers are present, the DOD is required to provide photographic coverage of the flight crew and CM recovery operation on a not-to-interfere-with-operations basis. If NASA photographers are present (primarily on the PRS), DOD photographers will be required to assist in obtaining the coverage.

4.6.1 DOD Photographer Support

4.6.1.1 Launch site.- One photographer may be carried in the "beach boss" helicopter in the launch site area on a not-to-interfere-with-operations basis.

4.6.1.2 ARRS.- Photographers are not required on ARRS aircraft. It would be highly desirable, though, to have motion-picture coverage as described in Subsection 4.6.2 should the ARRS aircraft be involved in recovery operations. Therefore, dependent upon the availability of photographers and if there is no cost to NASA, consideration should be given to include a motion photographer on each HC-130.

4.6.1.3 PRS.- Eight to 10 official NASA motion-picture, still, and news photographers will be assigned aboard the PRS to provide photographic coverage. To assist the NASA photographers, the DOD is requested to assign one motion and one still photographer aboard the PRS. The NASA Photographer Coordinator assigned from NASA-JSC will be responsible to the NASA Team Leader for all NASA

photographic requirements, including coordination of DOD-assigned photographers and support of PAO photographic requirements.

4.6.2 Photographic Coverage

The coverage, both still and motion-picture, should include but not be limited to the following:

A. Observations of CM entry and descent, from ship and aircraft.

B. First sighting of the CM from ship and aircraft.

C. Deployment of equipment and personnel for the retrieval operation.

D. The CM in the water showing its flotation attitude and uprighting bags. The CM should be photographed from as many different directions as possible.

E. Installation of the flotation collar and recovery raft.

F. Hatch opening, egress, pickup, and arrival of the flight crew aboard the recovery ship.

G. Flight crew physical examination, debriefing, discussions/communications with high-level officers and officials, ceremonies and debarking, and arrival at and departure from any land-based transfer point enroute to Houston.

H. CM retrieval.

I. CM inspection and postretrieval operations (if requested by NASA personnel).

J. Offloading of the CM from the ship and arrival at and departure from land-based installations.

NASA-JSC has a requirement to obtain, if requested, prints of all official DOD camera film, both still and motion-picture, exposed in support of any phase of the recovery operation.

4.6.3 Film Type

To provide the required coverage, DOD photographers assigned to the PRS should have the capability to:

A. Provide still photography on color negative film (Ektachrome type-S) for all news and documentary coverage of recovery operation.

B. Provide 16-mm color-motion-picture coverage at 24 frames per second or faster if necessary. Ektachrome EF-B film, with correct filters, is preferred; however, a faster film, such as EF-Day, may be used.

The photographers on search-and-rescue aircraft should also attempt to provide coverage with the above types of film. Photographers will be responsible for providing their own equipment and a sufficient amount of film for the coverage required (see Subsection 4.6.2).

4.6.4 Film Handling

Following exposure, all film should be boxed or wrapped in a container and labeled as follows:

A. Type of film.

B. Size and/or footage count.

C. When exposed (e.g., CM recovery).

D. Special instructions (e.g., overexposed/underexposed).

All camera film (still and motion-picture) exposed in fulfilling official NASA photographic requirements will be immediately turned over, undeveloped, to the NASA Photographic Coordinator or Recovery Technical Advisor in the recovery area. Film acquired in a recovery area where no NASA personnel are present should be sent via air freight to the Transportation Officer, Building 420, NASA Johnson Space Center, Houston, Texas 77058, marked for the Mission Support Branch (CF2). The following information should appear on the waybill: (1) "Send collect," (2) "Urgent priority," and (3) "To be converted to a Government bill of lading at destination." All packages should be labeled "PHOTOGRAPHIC FILM - DO NOT X-RAY."

The NASA Team Leader on the PRS will coordinate all data flights from the ship. Film may depart the ship on one of these data flights and will be accompanied by a courier when possible. When required, personnel will be waiting at land bases to receive the film.

4.6.5 PRS Support

4.6.5.1 UDT.- Swimmers deployed to the CM by helicopter are required to take pictures of the CM on a not-to-interfere-with-operations basis. Special waterproof cameras and instruction in their use will be furnished by NASA photographers on the PRS. Photographic coverage of the following CM areas will be required:

A. Antennas and antenna whiskers

B. Flashing light

C. Drogue and pilot parachute mortars

D. Main parachute risers

E. Docking ring, shaped-charge holder, and springs.

F. Forward and crew hatch

G. Forward heat shield lanyard

H. General upper-deck area

I. Swimmer umbilical

J. Recovery loop

K. CM windows

L. Aft heat shield

M. General crew-compartment heat shield

4.6.5.2 Miscellaneous.- Detailed space, equipment, etc., requirements for PRS photographic operations are contained in Subsection 4.7.14.

4.7 MOBILE LABORATORY, COMMAND MODULE, EXPERIMENT CONEX BOXES, RECOVERY ACTIVITIES, AND ASSOCIATED EQUIPMENT

4.7.1 General

Major units of NASA-provided equipment, used to support flight crew and CM retrieval and associated postflight activities, are described in the following subsections. The equipment, facilities, and personnel required to be provided by DOD organizations to transport and operate this NASA equipment and its associated activities are described in these subsections.

NASA engineering personnel will be available to advise on recovery procedures, loading and unloading procedures, and to perform the necessary engineering functions.

4.7.2 Mobile Laboratory, Experiment Conex Boxes, and Command Module Description and Activities

4.7.2.1 Mobile laboratory.- For the Skylab Program, a six-unit mobile laboratory was developed in which biomedical tests and examinations were conducted shortly after CM landing. Five of these laboratory units will be used for ASTP postrecovery biomedical tests and examinations.

Each unit is 19 feet by 13 feet and 10 feet high and weighs between 14,000 and 19,000 pounds, with casters to facilitate towing. To facilitate handling of the laboratory units, NASA will provide two spreader-bar/hoisting-sling assemblies and two tow bars. Three modified conex boxes that contain miscellaneous auxiliary and support equipment will accompany the mobile laboratory. These conex boxes each weigh between 6000 and 10,000 pounds.

Approximately 15 days before launch the mobile laboratory and support equipment will be transported from Ellington AFB, Texas, to NAS North Island, California, by a C-5 aircraft. After recovery, the mobile laboratory will be transported from Hickam AFB, Hawaii, back to Ellington AFB, Texas, by a C-5 aircraft.

Transporting the mobile laboratory will require loading and unloading the mobile laboratory on the C-5 and PRS.

4.7.2.2 Experiment conex boxes.- To facilitate packaging, storing, and transporting ASTP experiments and equipment, special containers have been developed by modifying "conex boxes". These containers consist of one double conex box and three single conex boxes. The double conex box is approximately 8.5 feet by 13 feet and 8.5 feet high, weighing approximately 10,000 pounds loaded. Each single conex box is approximately 6.5 feet by 8.5 feet and 8.5 feet high and weighs approximately 5000 pounds loaded. In addition to the conex boxes, there will be one aircraft pallet with an auxiliary power unit weighing approximately 1000 pounds and one equipment pallet weighing approximately 4000 pounds.

The double conex box and one single conex box will be transported by truck to San Diego and loaded on the PRS approximately 1 month before departure. The other two single conex boxes, the auxiliary power unit pallet, and the equipment pallet will be flown on the C-5 aircraft (transporting the mobile laboratory) to NAS North Island, California, for transfer to the PRS. They will be loaded aboard the PRS at the same time as the mobile laboratory. After recovery, all conex boxes and associated equipment will be offloaded at Pearl Harbor. The two single conex boxes, the auxiliary power unit pallet, and equipment pallet will be transported to Ellington AFB, Texas, on the same C-5 as the mobile laboratory. Transporting the containers and pallets will require loading and unloading them on the C-5 and PRS.

The remaining conex boxes and other miscellaneous NASA equipment will be stored at Pearl Harbor until returned to the West Coast by a sealift-of-opportunity. From the West Coast this equipment will be transported by truck to JSC.

4.7.2.3 Command module.- Special tools and equipment reguired for the CM retrieval operation and not normally found onboard ship will be provided by NASA. Instructions pertaining to the use of NASA-provided CM retrieval equipment for the recovery operation are included in Reference 2.

Immediately after retrieval of the CM, several procedures must be performed that require provisions for special space and equipment aboard the PRS. These procedures include the powering down of the CM and removal of certain pieces of equipment.

After the PRS arrives in Pearl Harbor with the CM, the CM on its transport dolly (approximately 15,000 pounds total weight) will be offloaded and transported to the deactivation site at Hickam AFB. Following deactivation, the CM will be stored at Hickam AFB until transported to the West Coast by a sealift-of-opportunity, airlift-of-opportunity (C-5)--to Norton AFB, or possibly by a dedicated C-5.

4.7.3 Miscellaneous Equipment To Be Loaded on PRS at San Diego

The equipment listed in this subsection will be loaded on the PRS at San Diego. Details and schedules will be provided by NASA personnel.

4.7.3.1 Recovery equipment shipped by NASA.- Approximately 1 month before sailing, NASA (Johnson Space Center) will ship to the PRS one double conex (work) box, one single conex (supply) box, two single conex boxes (each containing one NASA winch) of 5000 pounds each, a CM transportation dolly (3550 pounds), and the sectional wooden mobile laboratory walkway. The following support will be required to load these items aboard the PRS.

A. One crane (minimum 10,000-pound capacity) and operator.

B. One forklift (10,000-pound capacity) and operator, on the PRS.

C. Tiedown capability on the PRS for all equipment.

One of the two NASA winches (to be designated by NASA) will require installation on the B and A crane boom, and proof testing. NASA will provide installation and test details (see Reference 2).

4.7.3.2 Communication equipment shipped by NASA.- Prior to sailing, NASA (Goddard Space Flight Center) will ship to the PRS one conex box containing the Applications Technology Satellite (ATS) ground-station equipment. This equipment will be loaded aboard the PRS. Information on specific equipment to be loaded, the support needed, and schedules will normally be provided by an ATS representative.

4.7.3.3 Equipment shipped by Rockwell International.- A separate shipment from Rockwell International, Downey, California, will consist of approximately 1200 pounds of CM/RCS depressurization equipment and approximately 33,100 pounds of CM deactivation equipment. The depressurization equipment will be loaded and stored with the NASA conex boxes and after recovery will be offloaded with the CM and transported to the deactivation site. At Pearl Harbor (prior to Launch) the deactivation equipment will be offloaded from the PRS and transported to the deactivation site at Hickam AFB and stored there until the CM arrives for deactivation. The deactivation equipment will be on six aircraft pallets. The largest unit is 10 feet by 6 feet and 6 feet high, and the heaviest unit weighs

7500 pounds. The total volume of the deactivation equipment is approximately 200 cubic feet. The following support will be required to load these items aboard the PRS.

A. On the Pier

1. One crane (40,000-pound capacity) with operator.

2. Rigging personnel to support loading operations.

B. Shipboard

1. A 5- to 10-man working party to support loading operations.

2. One forklift (15,000-pound capacity) with operator.

4.7.3.4 Equipment stored at NAS North Island.- Also prior to sailing, equipment (workstands, CM boilerplate and dolly, etc.) stored at NAS North Island will be loaded aboard the PRS. Information on specific equipment to be loaded and support needed will be provided by NASA personnel.

4.7.4 Loading/Offloading C-5 Aircraft

The following support will be required at Ellington AFB, NAS North Island, and Hickam AFB to load/offload the mobile laboratory, its support equipment, and the two conex boxes (for experiments) and support equipment. The total load (approximately 132,000 pounds) will be five laboratory units, five conex boxes, three pallets of loose equipment, and approximately 50 people.

A. Ellington AFB

Equipment and personnel required will be provided by NASA.

B. NAS North Island and Hickam AFB

1. One forklift (15,000-pound capacity with prong extensions) and operator.

2. Aircraft Loader

NAS North Island - NASA will provide a CLT-45 (Guppy Loader) to support offloading operations.

Hickam AFB - One 40K aircraft loader and operator. The 40K loader must have removable side guide rails to facilitate handling of the wide mobile laboratory units. To expedite loading operations, side guide rails are to be removed before mobile laboratory/conex box arrival at the C-5.

3. One mobile crane and operator. The crane should have a minimum capacity of 25 tons and a minimum boom length of 50 feet.

4. Rigging personnel to support loading/offloading operations.

4.7.5 C-5 Requirements

A. Interface Test

A 6-hour C-5/experiment conex box loading and interface test will be conducted at Ellington AFB prior to C-5 departure for NAS North Island.

B. Electrical power

Electrical power is required for the experiment conex boxes during the interface test, the flight from Ellington AFB to NAS North Island, after loading at Hickam AFB (postrecovery) - for approximately 8 hours, and during the flight from Hickam AFB to Ellington AFB. C-5 crew support is required during these periods to ensure that continuous electrical power is provided. Eight kVA of electrical power are required. Supplying this electrical power by the aircraft auxiliary power unit or a ground power cart is acceptable.

4.7.6 Transportation Between the C-5 and Pier

The following support will be required to transport the mobile laboratory, experiment conex boxes, equipment, and personnel from the C-5 (NAS North Island airfield) to the pier and from the Pearl Harbor Naval Base pier to the C-5 (Hickam AFB).

A. Sufficient flatbed trucks and operators to transport mobile laboratory units and associated equipment. (See Subsection 4.7.2.1 for size and weight of units.)

B. Two flatbed trucks and operators to transport the experiment conex boxes and associated equipment (see Subsection 4.7.2.2 for size and weight of units). For the Pearl Harbor/Hickam AFB transfer the 40K aircraft loader (subparagraph 4.7.4B2) may be used in lieu of one flatbed truck.

C. Security personnel and vehicles to escort equipment between C-5 and pier.

NOTE

Sufficient flatbed trucks and personnel should be available to effect the transportation between the C-5 and the pier as expeditiously as possible.

D. Ground transportation between the C-5 and PRS for approximately 50 people plus baggage.

4.7.7 Transportation Between NAS North Island Pier and PRS

The following support is required to transport the equipment offloaded from the C-5 from the NAS North Island pier to the PRS at the San Diego Naval Base. The equipment will be offloaded from the trucks and loaded aboard a barge. The barge will transport the equipment to the San Diego Naval Base for loading aboard the PRS.

A. One mobile crane and operator at the NAS North Island pier to transfer equipment from trucks to barge. The crane should have a minimum capacity of 25 tons and a minimum boom length of 50 feet.

B. Rigging personnel on pier and on barge to support truck-offloading and barge-loading operation.

C. One barge and tug, to transport equipment from NAS North Island pier to PRS.

4.7.8 C-5 Cargo Loading on PRS at San Diego (Premission) and Offloading at Pearl Harbor (Postrecovery)

The following support is required at the PRS to load/offload the mobile laboratory, conex boxes, and equipment coming from or going to the C-5; and,

additionally at Pearl Harbor, to offload the CM, two conex boxes (each with a NASA winch inside), one double conex box, one single conex box, one boilerplate and dolly, miscellaneous loose equipment, and news pool equipment.

A. At the Pier

1. One floating crane at San Diego and one pierside crane at Pearl Harbor and operator (see Subsections 4.7.2.1 and 4.7.2.2 for size and weight of units).

2. Rigging personnel to support barge (San Diego) and pierside (Pearl Harbor) operations.

B. Shipboard

1. One tractor with operator to position the mobile laboratory units on hangar deck and to position the CM and dolly for offloading.

2. One forklift (15,000-pound capacity with prong extensions) and operator to position conex boxes and miscellaneous equipment on the hangar deck.

3. Tiedown capability (at onloading) on the hangar deck for units and equipment.

4. Working party to assist in setup of equipment on hangar deck and deployment and routing of all utility cables and hoses from the mobile laboratory and conex boxes to ship connections. Also, to support "break down" operations, prior to offloading after PRS arrival (postrecovery) at Pearl Harbor, and offloading operations after docking.

4.7.9 Offloading Deactivation Equipment at Pearl Harbor

After the PRS arrives at Pearl Harbor (prior to launch) the CM deactivation equipment will be offloaded and transported to the deactivation site (Hickam AFB) for storgae. The following support is required to support these operations.

A. Shipboard

1. One forklift (15,000-pound capacity with prong extension) and operator to position equipment.

2. A 5- to 10-man working party to assist in equipment offloading.

B. On Pier

1. One pierside crane (40,000-pound capacity) and operator (see Subsection 4.7.3.3 for size and weight of units).

2. Rigging personnel to support dockside operations.

4.7.10 Transporting Deactivation Equipment from Pier to Deactivation Site

A. Two 40-foot flatbed trucks with drivers to transport equipment from Pearl Harbor pier to the deactivation site at Hickam AFB.

B. One forklift (15,000-pound capacity) and operator at the deactivation site to offload trucks and to position units for storage.

C. One aircraft tug with operator at deactivation site to tow units into building.

D. Rigging personnel at the deactivation site to support offloading operations.

4.7.11 News Pool Equipment Loading at Pearl Harbor

After the PRS arrives at Pearl Harbor (prior to launch) news pool equipment will be loaded on the PRS. Normally, news pool team equipment is handcarried aboard the PRS by pool team members; however, assistance will be needed in handling bulkier news pool team equipment such as generators, TV cameras, and trailer vans. Information on specific equipment to be loaded, the support needed, and schedules will normally be provided by a pool representative.

4.7.12 Transporting CM between Pier and Deactivation Site

The following support is required for this operation.

A. One aircraft tractor with driver to tow CM on its dolly between Pearl Harbor and the deactivation site at Hickam AFB.

B. Two 40-foot flatbed trucks with drivers to transport CM equipment between Pearl Harbor and the deactivation site at Hickam AFB.

C. One stake-body truck and driver.

D. A fire truck and base security personnel and vehicles to escort the CM between Pearl Harbor and the deactivation site at Hickam AFB. The security personnel will permit access to the CM only with prior authorization by the NASA Recovery Adviser. The transport route should be over good roads and provide for no stop in transit to the site.

4.7.13 Transportation and Storage of Miscellaneous Equipment at Pearl Harbor

After offloading from the PRS, the two conex boxes with NASA winches inside, one double conex box, one single conex box, one boilerplate and dolly, and miscellaneous loose equipment will be stored at Pearl Harbor until transported to the West Coast by a ship-of-opportunity. The following support is required to support this operation.

A. Sufficient flatbed trucks (see Subsections 4.7.2.2 and 4.7.3 for size and weight of equipment) and drivers to transport the equipment to a storage location.

B. A secure storage area (inside or outside acceptable).

4.7.14 Shipboard Requirements

A. Space

1. CM

A work area in the hangar bay, approximately 60 by 50 feet for conex box location and CM postretrieval operations. This area must be as clean and free of grease and oil as possible. Approximately 24 hours before recovery, this area is to be scrubbed and washed down.

2. Underwater demolition team (UDT)

A work and storage area, approximately 40 by 40 feet, for cleaning and repacking equipment used for recovery operations. The area should be as clean and free of grease and oil as possible.

3. Mobile laboratory

An area in the hangar bay, approximately 60 by 45 feet, for locating the mobile laboratory.

4. Photo

A secure working area for storage of equipment, checkout of camera systems, and packaging of exposed film. This area must be locked at all times, and two keys should be provided to the NASA Team Leader.

5. NASA office

A space in the vicinity of the CIC for storage and maintenance of documents, meetings, communications terminations, preparation and participation in simulations, and general office functions. On an LPH, SACC is usually chosen for this purpose.

6. Press pool

a. Office space to accommodate five writers.

b. A space suitable for use as a press room.

c. A space that can accommodate 20 to 30 people for use as a news pool briefing room (required approximately twice each day).

Reasonable material and personnel support will be needed in support of a, b, and c.

d. An area on the hangar deck for news pool trailers and vans.

e. An area on the hangar deck for the press pool to view the retrieval operation.

7. Flight crew staterooms

The postflight medical examinations for the flight crew will be accomplished in the mobile laboratory onboard the PRS. Staterooms will be required for the flight crew for sleeping quarters. The staterooms should be air-conditioned and have an attached head.

If the PRS is an LPH, it is requested that the Phibron Commander's stateroom and the Chief of Staff's stateroom and cabin be used for flight crew quarters.

8. Sick bay

A limited amount of space will be required in sick bay for certain postflight biomedical tests. In general, space and facilities in sick bay will be used only for emergency flight crew treatment.

9. ATS

A designated space on the flight deck for the ATS conex box and antenna.

10. CM deactivation equipment

A designated space (approximately 380 square feet) on the hangar deck for storage enroute from San Diego to Pearl Harbor.

B. Security

The following is a list of required general security measures. Authorization of access into each area will be by badge and/or access list. NASA personnel will provide the badges. Access lists and determination of personnel needing badges will be coordinated between the NASA Team Leader and ship's representatives. Detailed line locations and guard posts (anticipate six to eight) will be determined after the NASA team comes aboard. In addition to the times indicated, the security procedures should be exercised during the last few simulations.

1. CM area

A continuous Marine security watch to begin 24 hours before recovery and continue until the CM is offloaded. From the time the CM is brought into the hangar bay until the CM/RCS propellants have been depressurized (procedure takes approximately 12 hours), this area will include all of the after hangar bay. After depressurization has been completed, a smaller area will be secured. While the CM is being offloaded, the after hangar bay will again be secured. Stanchions and lines are required.

2. UDT area

A continuous Marine security watch during final checkout of UDT operational equipment (approximately 1 day's duration) and from approximately 1 day before recovery until UDT equipment is loaded aboard the helicopters. Stanchions and lines are required.

3. Mobile laboratory area

A continuous Marine security watch from beginning of laboratory checkout (24 hours before recovery) until offloaded. Stanchions and lines are required.

4. Flight crew staterooms

A continuous Marine security watch from approximately 2 hours before recovery until after the flight crew departs the ship.

5. Sick bay

A security watch (usually provided by Marine and sick bay personnel) to limit access to sick bay whenever the flight crew is in that area.

6. B&A crane/NASA winch

A Marine security watch from crane rerigging (prior to recovery minus 2 day simulation) until recovery stations are manned (approximately 2 hours before CM landing).

7. Helicopters

A security watch (usually provided by the helicopter squadron) to limit access to the helicopters. This watch is needed after the operational

recovery equipment has been loaded aboard the helicopters (approximately 24 hours before CM landing) until recovery stations are manned (approximately 2 hours before CM landing).

8. Hangar bay press area

A Marine security watch from approximately 2 hours before CM landing until the CM is brought into the hangar bay (approximately 1 hour after CM landing). Stanchions and lines are required.

C. Electrical power

1. CM area

One 115-volt ac, 200-ampere, 60-Hz line and five 220-volt ac, 25-ampere, 60-Hz, single-phase lines terminating in the CM operations area (at the double conex box). Power is required from the time the NASA personnel arrive onboard until the CM is offloaded. Grounding points will be required at each conex box.

2. Mobile laboratory

Two 208-volt, 3-phase (225-ampere per phase), 60-Hz lines or (preferably) one 480-volt, 3-phase (180-ampere per phase), 60-Hz lines. Acceptable supply voltages are as follows:

208 volts normal (194-218 volts range)
480 volts normal (440-490 volts range)

If 480-volt power is provided, the PRS is required to furnish the necessary electrical cable from the ship's power source to an electrical panel mounted on one of the conex boxes (Utility Package).

If 208-volt power is provided, NASA will provide two electrical receptacles to be installed within 250 feet of the utility package conex box prior to mobile laboratory arrival aboard ship. Electrical cables to be installed between the utility package conex box and these two power receptacles will accompany the mobile laboratory. The PRS is required to furnish cables from the ship's power source to the two electrical receptacles. One grounding point is required near the mobile laboratory.

3. ATS

One 208-volt, 3-phase (15-ampere per phase), 60-Hz line at the ATS conex box.

4. NASA winch

One 440-volt, 3-phase (50-ampere per phase), 60-Hz line. The power source breaker panel should be secured with a lock.

5. Press pool trailers/vans

Information on specific requirements will normally be provided by a pool representative.

6. Photo

Electrical power terminating in the vicinity of the mobile laboratory entrance to power lights to be installed for photography: 115-Vac, 80-ampere, 60-Hz.

D. Vehicles, pallets, etc.

1. It is anticipated that two tractors and one forklift (with a pallet 4 by 4 feet) with drivers will be required to support TV pool activities during all simulations and actual recovery. These resources will be needed full time during these operations.

2. One forklift (5000-pound capacity) with operator and a pallet (4 by 4 feet) with handrails for use by NASA photographers during simulations and actual recovery.

3. One aircraft tractor and operator to position the boilerplate during simulations and the CM during actual recovery.

4. One forklift (5000-pound capacity) with operator and a pallet (4 by 4 feet) with handrails during simulations and actual recovery to provide access to the CM upper deck. NASA will provide the pallet (in storage at North Island).

5. A set of stairs, with handrails, to be used by the flight crew to transfer from the starboard cargo door of the helicopter to the deck of the ship (stairs previously supplied by helicopter squadron).

6. Two inclines to allow wheelchairs to be moved to and from the hangar deck and the sick bay casualty elevator and between the casualty elevator and sick bay.

7. Six pallets 4 by 4 feet and one pallet 7 by 7 feet for the main parachutes and forward heat shield. These pallets are required by 2 days before recovery.

8. Two work tables (approximately 3 by 6 feet) and four chairs in the CM operations area from 2 days before recovery through CM offloading (tables to be supplied by NASA--in storage at North Island).

9. One work table (approximately 3 by 6 feet) and two chairs in the mobile laboratory area from 2 days before recovery through offloading.

10. One work stand with stairs for the flight crew to egress the CM on the elevator (NASA-provided--in storage at North Island).

E. Ship's service telephones

1. A ship's service telephone in the CM operations area from ship departure from San Diego until CM offloading. Phone to be installed in double conex box.

2. A ship's service telephone in the mobile laboratory operations area (operational medicine lab) while the laboratory is aboard.

3. A ship's service telephone, with call out capability only (inhibit ring), in the flight crew staterooms.

4. A ship's service telephone in the ATS conex box.

5. A ship's service telephone in the TV trailer.

F. Sound-powered phone or field phone system circuit

This circuit will be required with talk-and-monitor capability at the following locations:

1. NASA office space (SACC)

2. Television (TV) van

3. News room

4. Television commentator's position

5. Radio commentator's position

6. Radio producer's position

7. Writers' position (1 location)

The circuit will be used by the NASA PAO representative in narrating recovery activities to the press. If ship's personnel are available, it is requested that they be stationed at the TV and radio commentators' positions and the writers' position to assist and interpret recovery operations as required. This circuit will be required during all simulations after the PRS departs from Pearl Harbor for mission support.

G. Communications

See Subsection 4.2.

H. Additional CM area requirements

1. Two 100-psi air supplies, each with 100 feet of small air hose, from 1 day prior to recovery until CM offloading. Hoses to be interfaced with NASA equipment. Details will be provided by NASA.

2. Three fire hoses reaching to the CM operation area with a water supply (saltwater acceptable) and fog nozzle, while the CM is onboard. Three hose teams are required. This will be reduced to one team on duty and two teams on call after depressurization of the CM propellant system has been completed and it has been determined that there are no propellant leaks (approximately 12 hours after CM is onboard).

3. Two mattresses from 1 day prior to recovery until CM offloading.

4. Two 20-gallon trash cans in the CM operations area from ship departure from San Diego until CM offloading.

5. Two red-devil blowers and hoses from 1 day prior to recovery until CM offloading.

6. Two hundred pounds of crushed (cubed) ice twice daily in the CM operations area from 24 hours prior to recovery until after the ship docks at Pearl Harbor.

7. Two low-pressure freshwater outlets in the CM operations area from 24 hours before recovery until CM offloading.

8. The port liaison and/or assigned ship's officer will provide for filling two Linde LD-160B and one LD-50 liquid-nitrogen containers with liquid

nitrogen (approximately 370 liters total). This support should be provided within 2 days prior to the ship's departure from San Diego and again prior to departure from Pearl Harbor for mission support.

I. Additional mobile laboratory area requirements

1. Potable freshwater outlet (1 inch - 11-1/2 American standard tapered pipe thread nipple) capable of delivering 15 gpm minimum at 45 ± 15 psia. Total volume required will be approximately 200 gallons per 24-hour period. This capability should be provided from the time the mobile laboratory is loaded on the PRS until it is offloaded. A freshwater outlet is required within 250 feet of the mobile laboratory.

2. Waste-water disposal outlet capable of receiving waste water from the mobile laboratory at a flow rate of 30 gpm (maximum) at 15 psig (maximum) is required. Simple overboard dumping is acceptable. Total volume of waste water will be approximately 200 gallons per 24-hour period. Waste water may contain 5000 ppm sodium hypochlorite. A waste-water dumping facility is required within 250 feet of the mobile laboratory. This capability should be provided from the time the mobile laboratory is loaded on the PRS until it is offloaded. No sewage will be expelled from the mobile laboratory.

3. A warning device to alert personnel working inside the mobile laboratory of any emergency that will require evacuation of the mobile laboratory area (propellant leaks from CM during RCS depressurization, etc.) is required. This capability should exist for the recovery minus 2 day simulation and remain until the CM is offloaded.

4. Two large trash cans for use while the mobile laboratory is aboard.

J. Additional photographic requirements

1. To aid NASA photographers who will be deployed on the PRS, the PRS is requested to:

   a. Provide the photographers with the use of available shipboard photographic facilities.

   b. Make available the ship's regular photographic staff for additional support as may be required.

2. NASA photographers will install as many as five fixed still and motion-picture cameras on the primary recovery helicopter. These cameras will be remotely operated by a helicopter crewmember. The installation of these cameras in the photography helicopter will be coordinated with the participating helicopter squadron. Gunner belts will be required for the four photographers in the photography helicopter.

K. Additional UDT area requirements

One low-pressure freshwater outlet in the UDT work area at all times for washing down equipment.

L. Additional shipboard requirements

1. Use of an audiometer booth. Location aboard ship will be coordinated directly between the NASA Team Leader and Ship's personnel.

2. Use of the ship's X-ray machine.

3. The capability to reproduce up to 10 copies of outgoing news copy.

4. Desks and typewriters (in the press pool office space) for five writers.

5. A one-pint sample of seawater from the area of the CM retrieval. Obtain the sample during the period of CM retrieval and deliver to the NASA Team Leader after retrieval. The sample may be from the seawater intake.

6. A gyro-repeater in the ATS conex box to obtain ship's heading, for use in ATS antenna pointing.

4.7.15 Deactivation Site

The following listed support will be required from arrival of deactivation equipment (approximately 5 days before CM launch) until the CM deactivation is completed (approximately 5 days after CM arrival) and CM departs (could be as much as approximately 20 days after CM arrival).

A. A lighted, well-ventilated building

The building will have the following provisions:

1. Adequate drainage to accommodate runoff from the CM washdown, firefighting, cleanup. (Drains should be preinspected and cleansed to ensure this drainage.)

2. Minimum working area of 100 by 200 feet and areas designated for venting vapors (approximately 40 by 40 feet) and for container storage (approximately 40 by 40 feet).

3. A clean concrete floor. (This type of flooring is safest when working with CM/RCS propellants that react with oil-base flooring, usually resulting in fire.)

4. Two private telephones with different numbers in the work area. After the deactivation operation is complete only one telephone will be required.

5. A minimum overhead clearance of 20 feet.

6. Accessibility to a ready water supply: fire hydrant and standard water tap. If a fire hydrant is not available, a fire truck with self-contained water supply is required. If a fire truck is provided, it will be required only during the deactivation operation.

7. Four 115-volt ac, 60-Hz, 30-ampere power outlets.

B. Equipment

The following equipment will be required at the deactivation site:

1. An aircraft tractor with an operator at the beginning and end of the deactivation operation to move the deactivation units and CM dolly.

2. A mobile crane or overhead lift (18,000-pound capacity and 20-foot lift height) with an operator. This crane is needed immediately upon arrival of the CM at the deactivation site to remove the CM tiedown ring and cover and also at the end of the operation to reinstall same.

3. A 4000-pound capacity forklift with 6-foot extensions. This forklift will be needed from equipment arrival until the deactivation operation is complete. Rockwell will furnish a qualified driver.

4. Four large mobile floor fans.

5. Two hydrant hoses (1-1/2-inch) with spray nozzle and one standard (garden-type) water hose capable of reaching any point within the deactivation area (for connection to water supply listed in item A6).

6. One B-1 maintenance stand (required only during the deactivation operation).

7. Twenty-five to 30 aircraft chocks (4 by 2 inches) or suitable substitutes to place under palletized equipment to facilitate access by forklift.

8. Two carbon dioxide fire extinguishers.

9. Approximately 200 pounds of crushed ice to be delivered to the site per NASA Deactivation Team Leader's request.

10. Four large work tables (approximately 3 by 6 feet), 10 chairs, and five large trash containers. Positioning a Dempster Dumpmaster or equivalent in the area is desirable. This support is required only during the deactivation operation.

11. Four 110-foot extension cords.

12. Auxiliary lighting units.

    a. Two portable-stand spotlights.

    b. Two mobile flight-line floodlight clusters.

    c. Electrical power and extension cords for a and b.

C. Services

The following services are necessary for CM deactivation operations:

1. A 24-hour military security watch from arrival of the deactivation equipment (approximately 5 days before launch) until deactivation operations are completed and the CM departs. Ropes and stanchions will be necessary to rope off the deactivation work area. "Restricted Area" signs are also highly desirable.

2. A 24-hour medical service. (A medical facility within an access of 10 to 15 minutes is acceptable.)

3. Designated parking area is requested for approximately 10 cars belonging to deactivation team personnel (required only during the deactivation operation).

4.7.16 Loading/Offloading CM and Associated Equipment Aboard a Sealift-of-Opportuni

The following support is required to load and offload the ship if the CM, CM/RCS depressurization equipment and CM deactivation equipment are returned from Pearl Harbor to the west coast by a sealift-of-opportunity. Even though all fluids returned will be in Department of Transportation containers certified for

interstate transportation, caution should be exercised when loading and offloading containers to prevent rough handling.

A. Pierside

1. One crane (40,000-pound capacity) with operator.

2. Rigging personnel to support operations.

B. Shipboard

1. A 5- to 10-man working party to assist in loading/offloading operations.

2. One forklift (15,000-pound capacity) with operator.

3. One tractor with operator.

4. A 24-hour military security watch on all equipment.

5. Propellant containers should be stored in a well-ventilated area readily accessible by a forklift. Containers of oxidizer should be stored at least 50 feet from the containers of fuel.

4.8 LOGISTIC AIRCRAFT SUPPORT REQUIREMENTS

The projected logistic aircraft support requirements are listed in Table 4-IV. Additional flights from the PRS to land bases may be requested during the mission.

TABLE 4-I.- "NASA RECOVERY COMMON" CIRCUIT TERMINATION REQUIREMENTS ON PRS

Area	When required	Remarks
NASA office space (SACC)	As scheduled	Circuit should terminate on a speaker and handset with a cord long enough to reach NASA plotting table.
CM retrieval area (on hangar deck)	Recovery minus 2 day simulation and actual recovery	Circuit should terminate on handset with long cord so that user can view the retrieval operation.
CM operations area	After CM retrieval	Circuit should terminate on handset. May be same handset used in CM retrieval crane area.
Mobile laboratory operations area	As scheduled in Subsection 4.2.6.1	Three handsets and one jack (provided by NASA for Mobile Laboratory).
Ship's bridge	Recovery minus 2 day simulation and actual recovery	On handset.

TABLE 4-II.- PRS NASA OFFICE SPACE CIRCUIT TERMINATIONS

Circuit	Termination		When required	Remarks
	Speaker (M)	Handset (T/M)		
NASA Recovery Common	X	X	As scheduled	Reference Subsection 4.2.6.1
Astronaut Voice	X	X	Speaker: Simulations and actual recovery Handset: Simulations only	Handset used to simulate astronaut voice transmission and helicopter transmissions, when they are not supporting simulations
Circuit Alpha	X	X	All times	
Circuit India	X	X	Speaker: Simulations and actual recovery Handset: Simulations when helos are not supporting	Handset used to simulate helicopter transmissions
Field phone or sound-powered phone system	---	X	During simulations and actual recovery	Reference Subsection 4.7.14F
Circuit Hotel	X	---	Actual recovery	If circuit appears on ship

TABLE 4-III.- TIME PERIODS PRS SHOULD NOT TRANSMIT ON 296.8 MHz or 259.7 MHz

Apollo Revolution	Time, GMT	
	From	To
3	15/2358	16/0017
9	16/0926	16/0940
10	16/1055	16/1113
18	16/2337	16/2351
24	17/0907	17/0914
25	17/1038	17/1047
33	17/2320	17/2328
39	18/0849	18/0854
40	18/1020	18/1027
48	18/2302	18/2310
54	19/0829	19/0835
55	19/1001	19/1008
63	20/2243	19/2251
69	20/0810	20/0816
70	20/0942	20/0949
78	20/2224	20/2232
84	21/0750	21/0757
85	21/0922	21/0929
93	21/2206	21/2213
99	22/0730	22/0737
100	22/0904	22/0908
108[1]	22/2147	22/2154
109	22/2322	22/2323
114	23/0709	23/0717
123	23/2127	23/2135
128	24/0520	24/0522
129	24/0650	24/0657

[1]Transmissions during this period are acceptable for conduct of the recovery minus 2 day simulation.

TABLE 4-IV.- LOGISTIC AIRCRAFT REQUIREMENTS

Requirement number	Aircraft type	Time required	From	To	Purpose	Remarks
1	C-5	Approximately 14 days before launch	Ellington AFB, TX	NAS North Island	Transport mobile laboratory, experiment conex boxes and personnel	See Subsection 4.7 for description of equipment. Approximately 50 passengers will be on flight.
2	HC-130	2 days before recovery	Hickam AFB, HI	PRS	Transport medical isotopes	Required only if flight number 3 is not flown.
3	Helo	Approximately 1 day before recovery	Hickam AFB, HI	PRS	Transport VIP's and medical isotopes	Requirement is tentative at this time. Number of passengers TBD.
4	Weather reconnaissance	1 day before recovery	EOM Area		Long-range weather reconnaissance	Time of flight will be dependent on the weather conditions. Maximum of one flight will be required.
5	Helo	Approximately 1 hour after recovery	PRS	Hickam AFB, HI	Transport PAO film	
6	ARIA	After helo (requirement number 5) arrives at Hickam AFB, HI	Hickam AFB, HI	Ellington AFB, TX	Transport PAO film	If ARIA available
7	C-5	After PRS arrives in port at Pearl Harbor	Hickam AFB, HI	Ellington AFB, TX	Transport mobile laboratory, experiment conex boxes and personnel	See Subsection 4.7 for description of equipment. Approximately 50 passengers will be on flight.

SECTION 5
COMMAND MODULE LOCATION AIDS

5.1 ELECTRONIC

5.1.1 VHF Recovery Beacon

Activated:	By flight crew after main parachute deployment
Frequency:	243.0 MHz
Mode:	1000-Hz tone (duty cycle 2 seconds on, 3 seconds off)
Life:	Normally turned off after 33 hours; VHF survival transceiver/ beacon turned on
Output power:	3 watts

5.1.2 VHF Transceiver

Activated:	At flight crew discretion before CM/SM separation and after main parachute deployment
Frequency:	296.8 MHz (primary) 259.7 MHz (secondary)
Mode:	Voice
Life:	Normally 78 hours after landing
Output power:	5 watts

5.1.3 VHF Survival Transceiver/Beacon

Activated:	By flight crew normally 33 hours after landing
Frequency:	243.0 MHz
Mode:	Beacon - 1000-Hz tone to 300-Hz sweep tone modulation at 2-1/2 sweeps/second
Voice:	Transmit, receive
Life:	24 hours per battery (two batteries)
Output power:	1.25 watts, beacon 0.5 watt, voice

5.1.4 Unified S-Band Transmitter

Activated:	By flight crew prior to launch
Frequency:	2287.5 MHz
Mode:	PCM telemetry, voice, and ranging

Life: Turned off just prior to landing

Output power: 11.2 watts (high power), 2.8 watts (low power), 0.125 watt (bypass)

5.2 VISUAL

5.2.1 Flashing Light

The flashing light will be erected at main parachute opening and will be turned on by the flight crew during descent for a nighttime landing. The light is primarily a nighttime recovery aid. It has two selectable flash rates, 120 or 15 flashes per minute. The 15-flashes-per-minute rate will be used for nighttime parachute descent. The high rate will most likely not be used; however, should pararescuemen be deployed from an HC-130 to the CM at night, use of the high-rate flash will be as described in Reference 2.

5.2.2 Fluoresceine Sea Dye Marker

After CM landing, the sea dye marker is ejected into the water upon request from the recovery forces. Normally, the sea dye marker is not deployed. The marker is submerged and emits a yellow-green fluorescent streak in the wake of the CM. The width and density of the dye streak are dependent upon wind and sea conditions. The life of the dye marker will be about 12 hours.

SECTION 6
REFERENCES

1. Ship and Aircraft Requirements in Support of Future NASA Manned Space Flight Recovery Operations, Mission Support Branch, February 1, 1974.

2. Apollo Recovery Operational Procedures Manual, DOD Manned Spacecraft Recovery Forces and Mission Support Branch, October 10, 1973; change 1, April 10, 1973, change 2, October 24, 1973, and change 3, (to be published).

3. DOD Overall Medical Plan - ASTP Manned Space Flight Support Operations, Assistant for Bioastronautics, (to be published).

4. Public Affairs Plan, ASTP, (to be published).

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