

SPACE DIVISION

FURN V APOLLO FLIGHT CONFIGURATI(

LE STATION IN:	INCHES	METERS			
(NORTH AMERICAN ROCKWELL)					
TTISON MOTOR & LAUNCH ESCAPE	SYSTEM				
AUNCH ESCAPE TOWER					
ND MODULE					
AND PILOT					
CE MODULE					
ON UMBILICAL	3757.17 3760.92				
SUMP TANK YOGENIC STORAGE TANK					
ULE (grumman)					
HRUSTER ASSEMBLY 4 PLACES					
PPER DOCKING TUNNEL				1	
SCENT STAGE				14	
ESCENT STAGE				· · · · ·	3.311
ANDING GEAR 4 PLACES					/
TUNIT (IBM)					1
ONNELL DOUGLAS)			S- IVB	S- IVB METERS	
ANK VENT	3203.56	81.370	657.70	17.188	_//
SS PLATFORM SUPPORT FITTING		80.303			-/
INAS CENTERLINE	3193,56	81,116			-/
HELIUM SPHERES (8)			-	191.125	_
ANK PROBE					
			100		//
FAIRING LH2 FILL & DRAIN	2832.00	71,933	286.15	7.268	
H2 FILL AND DRAIN	2760.05		214.19	5.440	
ROCKET (4 PLACES)			-	-	-/
M OF AFT SKIRT S PLATFORM SUPPORT FITTING	2746.50 2664.33		200.05	5.096	
AMERICAN ROCKWELL)			XB STA	XB STA METERS	- 1
MS TUNNEL	INCHES	METERS	1NCHES 938.50	23.837	///
ENT			938.50	23.926 -	1/2
OP FORWARD SKIRT	2519.00	63,982		24.257	//
COMMAND ANTENNA 4 PLACES			923.00	23.444	/
THE PLACES			902.00	22.910	
ANK					
ROPELLANT MANAGEMENT PROBE					1
SLOSH BAFFLE			357.00	9.067	X
ECIRCULATION SYSTEM 5 PLACES			366.60	9.311 —	-
					A.
ILL & DRAIN			341.00	8.661	
ON OF AFT SKIRT F AFT SKIRT	1890.00	48.006	283.00 326.00	7.188	X
M OF SLOSH BAFFLE			284.00	7,213.	
LLAGE ROCKET FAIRING MOTOR			176.68	3.725	1
F THRUST CONE			112.00	5.664 2.844	X
NG)					
DRWARD SKIRT	1541.00	39.141	-23.00	-0.584	
					2
SECTION OF FORWARD SKIRT	1420.30	36.075			
					1
LOSH BAFFLES					
					P
					2h
SECTION OF HEI HIM BOTTLES (4)	046 -0	24 044			114

_	VEHICLE STATIONS IN:	INCHES	METERS		
SPAC	CECRAFT VEHICLE STATION	4240 70	107.716		
	BASE OF CONARD NOSE CONE	4240.79 4203.73	106.774		
		4185.53	106.312		
_	CENTERLINE LAUNCH ESCAPE MOTOR	4165,55	106,312		
_	BOTTOM OF LES SKIRT	3960.03	100.585		
_	TOP OF BOOST COVER	3890.03	98.527		
	VEHICLE SEPARATION	40.03	97.536		
	AFT HEAT SHIELD	3749.56	95,239		
	REACTION CONTROL SYSTEM MODULE	3715.45	94.372		
- 4	VEHICLE STATION FLIGHT SEPARATION	3594.55	91.301		
1	VEHICLE SEPARATION	3593.50	91.275		
	PROPULSION MOTOR				
	RENDEZVOUS RADAR ANTENNA				
	LUNAR MODULE				
_	L/M FORWARD DOCKING TUNNEL				
-	VEHICLE SEPARATION	3340.05	84.837		
-	VEHICLE STATION	3285.19	83.443		1
INST	RUMENT UNIT INSTRUMENT UNIT TOP	3258.56	82.767 81.853		
S-IV	B		0.,000	S- IVB	S- ME
	TOP FORWARD SKIRT			676.70	r
-	BOTTOM OF FORWARD SKIRT	3100,56	78.754	554.70	1.
-	FUEL MASS SENSOR PROBE				
	INSTRUMENTATION PROBE				
-	AUXILIARY PROPULSION SYSTEM (APS) (2)				
-	FLIGHT SEPARATION				
_	LOX VENT (FAR SIDE)	2759.00	70.078	213.15	
_	HELIUM SPHERES (9 PLACES)				
_	TOP J-2 ENGINE	2645.85	67.204	100.00	
_	J-2 ENGINE				
_	BOTTOM S-IVB TOP S-II	2519.00	63,982	-26.98	
S-11		INCHES	METERS	XB STA	XB
_	BOTTOM OF FORWARD SKIRT			823.00	2
_	LH2 PROPELLANT MANAGEMENT PROBE				
_	PRESSURIZATION MAST				
_	LOX VENT LINE				
-	TOP OF LH2 FEED FAIRING 5 PLACES			451.75	
_	LOX TANK EQUATOR	1848	46.939		
-	LOX FILL & DRAIN (FAR SIDE)			207.00	
_	CRUCIFORM BAFFLE			173.00	
-	BOTTOM LH2 FEED FAIRING			158.00	
	FLIGHT SEPARATION	1760,00	44.704	196.00	
	GIMBAL PLANE			100.00	
_	BOTTOM ULLAGE R M FAIRING			-0.44	
-	J- 2 ENGINES (5 PLACES)				-
S-I	C FLIGHT SEPARATION			0.00	
_	S-II INTERSTAGE BOTTOM	1541.00		-23.00	-
-	LOX VENT	1521,00			
_	GOX LINE	1511.75	38,398		
_	YRING	1404.00	35,661		

PRESSURIZATION TUNNEL (2 PLACES)

NK VERT 203.56 81.700 827.70 7.18 PLATFORM SUPPORT FITTING 316.56 80.00				
Initial Street (1) NN NINNOLES NN AT SKIRT 282.00 YELLAND DRAIN 2700.05 70.055 280.07 70.055 29.00 71.933 200.07 70.055 200.07 70.055 200.07 70.055 200.07 70.055 200.07 70.055 200.07 70.055 200.07 70.055 200.07 70.055 200.07 70.057 200.07 70.057 200.00 70.057 200.00 70.057 200.00 70.057 200.00 70.057 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 200.00 70.07 <td>BOTTOM OF FORWARD SKIRT</td> <td>3100.56 7</td> <td>78.754 554.70</td> <td>14</td>	BOTTOM OF FORWARD SKIRT	3100.56 7	78.754 554.70	14
NR NK AFT SKIRT 2832.00 71.933 286.15 7.364 12 FILL AND DRAIN 270.05 70.105 244.19 5.440 13 OF AFT SKIRT 2134.90 67.071 200.05 5.004 14 OF AFT SKIRT 100.05 70.105 244.19 5.440 15 TUNEL 100.05 10.907 10.907 10.907 10.907 16 OF AFT SKIRT 210.00 63.982 95.00 24.49 10 OF AFT SKIRT 210.00 63.982 95.00 24.49 10 OF AFT SKIRT 190.00 48.000 22.00 22.190 ANK 00.00 48.000 23.00 7.183 10 OF AFT SKIRT 190.00 48.000 7.211 11 LAG DRAIN 341.00 8.661 0.220 11 AFT SKIRT 190.00 39.41 -23.00 7.183 11 AGE ROCKET FAIRING MOTOR 176.46 3.220 0.644 11 AGE ROCKET FAIRING MOTOR 176.46 3.200 7.644 12 AGE ROCKET FAIRING MOTOR 176.18 3.737 10.664	FUEL MASS SENSOR PROBE			
NK	INSTRUMENTATION PROBE			
NRING LLIP FILL & DRAIN 2832.00 71.933 286.15 7.864 ATT SKIRT 2832.00 71.933 286.15 7.864 IOF AFT SKIRT 2760.05 70.165 214.19 5.464 IOF AFT SKIRT 2745.30 69.701 200.05 5.066 PLATFORM SUPPORT FITTING 2064.31 67.674 201.05 21.437 IOF AFT SKIRT 2319.00 63.982 535.00 21.437 INT 533.00 21.437 221.00 21.437 INT 2319.00 63.982 521.00 21.427 INT 2319.00 63.982 521.00 21.440 OR ORANAN ANTENNA 4 PLACES 327.00 9.067 INT AFT SKIRT 1890.00 48.000 326.00 8.200 INT AFT SKIRT 1890.00 48.000 326.00 8.200 INT AFT SKIRT 1890.00 48.000 326.00 8.200 IN OF AFT SKIRT 1990.00 48.000 326.00 8.200 IN OF THRUST CONE 122.00 36.075 126.00 8.200	AUXILIARY PROPULSION SYSTEM (APS) (2)			
AFT SKRT 282,00 71,933 286,15 7,264 FILL AND DRAIN 270,05 70,05 244,19 5,440 OF AFT SKIRT 276,50 69,701 200,05 5,064 DF AFT SKIRT 276,50 69,701 200,05 5,064 MERICAN ROCKWELL) INCHES METERS MESTAGE MESTAGE 219,70 63,822 95,50 24,437 STUNKEL 982,00 23,926 22,926 22,926 22,926 22,926 NN OF AFT SKIRT 219,00 63,822 95,50 24,437 MOMMADO ANTENNA 4 PLACES 920,00 22,900 22,900 22,900 NN OF AFT SKIRT 290,00 48,006 36,00 8,260 A OF SLOSH BAFFLE 327,00 9,667 224,00 7,221 L & DRAIN 341,00 39,441 -23,00 -0.584 SECTION OF HELIUM BOTTLES (#) 945,50 24,041	FLIGHT SEPARATION			
AFT SKRT 283,00 71,933 286,15 7,264 FILL AND DRAIN 220,05 70,05 241,19 5,440 NOF AFT SKIRT 2746,50 69,701 200,05 5,066 NOF AFT SKIRT 2746,50 69,701 200,05 5,066 AMERICAN ROCKWELL) INCHES METERS MARTAR AN STA AMERICAN ROCKWELL) INCHES METERS 100,015 21,197 STUNNEL 983,00 24,137 200,05 24,137 SOMAND SKIRT 219,00 63,982 95,00 24,137 SOMAND SKIRT 1210,00 34,005 326,00 8,280 COMMAND ANTENA 4 PLACES 902,00 22,90 90,007 NO F AFT SKIRT 1890,00 48,005 326,00 8,280 Carl of SLOSH BAFFLE 37,00 9,067 336,00 8,280 LAG DRAIN 341,00 34,100 9,667 326,00 7,231 LAG DRAIN 341,00 39,141 -23,00 -0.584 90,007 RECTION OF FORWARD SKIRT 1420,30 36,075 -0.584 -0.584	LOX VENT (FAR SIDE)	2759.00	70.078 213.15	5
ROCKET (4 PLACES) 1 OF AFT SKIRT PLATFORM SUPPORT FITTING 2246, 30 RETERAN ROCKWELL) INCHES MERECAN ROCKWELL) INCHES MERECAN ROCKWELL) INCHES MERCAN ROCKWELL) INT SECTION ANTENNA 4 PLACES INN OF AFT SKIRT IN OF AFT SKIRT IN OF AFT SKIRT IAGE ROCKET FAIRING MOTOR ITHUST CONE III. A DRAIN SECTION OF HELIUM BOTTLES (A) PALAGE SCHET FAIRING MOTOR III. A DRAIN (FAR SIDE) INTERTANK ASSEMBLY SECTION OF HELIUM BOTTLES (A) P45.50 24.041 INTERTANK ASSEMBLY SECTION OF HELIUM BOTTLES (A) P46.50 24.041 INTERTANK ASSEMBLY	HELIUM SPHERES (9 PLACES)			
OF AFT SKIRT 224,50 69,701 200,65 5,064 PLATFORM SUPPORT FITTING 204,33 67,674 201 MARREAN ROCKWELL) INCHES METERS METERS ASTUNEL 938,36 23,307 ASTUNEL 938,36 23,307 ASTUNEL 938,36 23,307 ASTUNEL 923,00 33,444 PORWARD SKIRT 219,00 63,982 955,00 CIRCULATION ANTENNA 4 PLACES 902,00 23,944 CIRCULATION SYSTEM 5 PLACES 366,00 9,307 CIRCULATION SYSTEM 5 PLACES 366,00 38,00 7,188 AFT SKIRT 1690,00 41,00 8,661 NOF AFT SKIRT 1690,00 41,00 8,661 NOF AFT SKIRT 1690,00 36,00 7,320 CIRCULATION SYSTEM 5 PLACES 223,00 7,188 37,220 LL& DRAIN ANTERS 120,00 36,075 23,444 OF HIRUST CONE 12,30 36,075 -0.584 SECTION OF HELIUM BOTTLES (A) 945,50 24,041 -0.584 UNSH BA	TOP J-2 ENGINE	2645.85	67.204 100.0	0
P PLATFORM SUPPORT FITTING 2664.33 67.674 AMERICAN ROCKWELL) INCHES MERTA MERTA MERTA MERTA AS TUNNEL 938,50 23.877 938,50 24.267 937.00 23.977 NT 942,60 23.920 23.927 92.00 23.927 92.00 23.927 NT 942,60 23.927 92.00 23.907 93.92 93.90 23.927 NT 239.00 63.982 95.00 24.437 93.90 93.92 93.90 93.92 NMK OPFLICANT MANAGEMENT PROBE 937.00 9.067 93.92 90.07 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.92 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.90 93.	J-2 ENGINE			
AMERICAN PROCEWELL) INCHES METERS North Stress North Stress MS TUNNEL 39.00 23.02 23.02 NT 942.00 23.02 P FORWARD SKIRT 2519.00 63.932 95.00 24.237 ORMAND ANDENA 4 PLACES 902.00 23.02 24.444 NK 907.00 53.932 95.00 24.237 ONG SOMAND ANTENA 4 PLACES 902.00 23.00 34.444 NK 907.00 53.932 90.00 3.02 NK 907.00 8.561 90.00 9.07 NK 907.00 8.561 9.07 9.07 NG 9.067 9.067 9.067 SECTION OF HELINM BOTTOR 190.00 48.000 23.00 7.42 NG 9.067 3.72 23.00 7.444 NG 9.067 3.72 23.00 7.444 NG 9.067 3.724 7.20 7.22 NG 9.067 3.724 7.20 7.244 NG 9.047 9.04.00 3.724	BOTTOM S-IVB TOP S-II	2519.00	63.982 - 26.9	8
MS TUNNEL 998,50 23,637 NT 942,00 23,028 MS TUNNEL 928,50 23,287 MS TORWARD SKIRT 2519,00 63,982 95,50 23,244 MS TENNA 4 PLACES 902,00 22,990 ANK MOPELLANT MANAGEMENT PROBE 337,00 9,067 LOSH BAFFLE 337,00 9,067 MS TENNE 4 PLACES 366,60 9,311 LL & DRAIN 341,00 8,661 NO OF SLOSH BAFFLE 337,00 9,067 LL & DRAIN 341,00 8,661 NO OF SLOSH BAFFLE 326,00 7,212 LL & DRAIN 341,00 8,661 M OF SLOSH BAFFLE 1890,00 48,005 7,212 LL & DRAIN 341,00 9,661 12,00 7,212 LL & DRAIN 1541,00 39,141 -23,00 -9,584 R SECTION OF HELIUM BOTTLES (4) 96,50 24,041 12,00 -9,584 R SECTION OF HELIUM BOTTLES (4) 96,50 24,041 112,00 -9,584 M OF INTERTANK ASSEMBLY 952,20 22,484	S-II	INCHES M	IETERS INCH	TA XE
NT 942.00 23.926 IP FORWARD SKIRT 2319.00 53.962 955.00 24.237 SCOMMAND ANTENNA 4 PLACES 923.00 23.444 STANK SOC.00 22.90 23.444 STANK SOC.00 22.90 23.444 STANK SOC.00 22.90 23.444 STANK SOC.00 22.90 23.444 STANK SOC.00 23.90 9.007 STANK SOC.00 9.007 9.007 STANK SOC.00 35.00 7.186 STANK SOC.00 49.005 326.00 8.200 STANK SOC.00 23.00 5.646 9.311 SOC.00 SOC.00 23.00 5.646 9.20 SOC.00 SOC.00 23.00 5.646 9.20 SOC.00 SOC.00 SOC.00 23.444 9.20 23.00 5.646 SOC.00 STANK 1540.00 35.075 9.20 9.20 9.24.44 SOC.00 STANK 120.30 36.075 9.21 9.21	BOTTOM OF FORWARD SKIRT		823.0	
P PORWARD SKIRT 2519,00 63,922 955,00 24,257 COMMAND ANTENNA 4 PLACES 902,00 22,00 22,444 SOURCELLATION APPLACES 902,00 22,90 NMK SOURCELLATION SYSTEM 5 PLACES 962,00 9,007 SUBAFFLE 337,00 9,007 LOSIN BAFFLE 327,00 9,007 LOSIN BAFFLE 326,60 9,311 LL & DRAIN 341,00 8,661 N OF AFT SKIRT 283,00 7,188 W OF SLOSH BAFFLE 1890,00 48,066 2,722 LLAGE ROCKET FAIRING MOTOR 176,66 2,722 2,644 MOF THRUST CONE 12,00 2,644 12,00 VOI DRWARD SKIRT 1541,00 39,141 -23,00 -0.584 SECTION OF FORWARD SKIRT 1420,30 36,075 -0.584 -0.584 RECCTION OF HELIUM BOTTLES (4) 946,30 24,041 -0.584 -0.584 SECTION OF HELIUM BOTTLES (4) 946,30 24,041 -0.578 -0.576 SECTION OF HELIUM BOTTLES (4) 946,30 24,041 -0.571 -0.57				
COMMAND ANTENNA 4 PLACES 923.00 23.444 ETRY ANTENNA 4 PLACES 922.00 22.444 NOPELLANT MANAGEMENT PROBE 357.00 9.067 LOSH BAFFLE 357.00 9.067 ICIRCULATION SYSTEM 3 PLACES 366.60 9.311 ILI & DRAIN 341.00 8.661 NO OF AFT SKIRT 1890.00 48.005 326.00 IN OF AFT SKIRT 1890.00 48.005 326.00 8.260 ILI & DRAIN 341.00 8.661 9.200 7.188 ILI & DRAIN 341.00 8.661 9.200 7.189 ILI & DRAIN 341.00 8.661 9.200 7.644 NOF AFT SKIRT 1541.00 39.141 -23.00 -0.584 IN OF INTERTANK ASSEMBLY 95.20 24.041 9.00 -0.584 IS SECTION OF HELIUM BOTTLES (A) 946.50 24.041 9.00 -0.584 IS SECTION OF HELIUM BOTTLES (A) 946.50 24.041 -0.578 -0.578 -0.578 IS DOOR (FAR SIDE) 194.18 20.172 -0.178 -0.172 -0.172 -0.172 <td< td=""><td>LH2 PROPELLANT MANAGEMENT PROBE</td><td></td><td></td><td></td></td<>	LH2 PROPELLANT MANAGEMENT PROBE			
NNK NOPELLANT MANAGEMENT PROBE LOSH BAFFLE SIGROULATION SYSTEM 3 PLACES SIGROULATION SYSTEM 3 PLACES NO of AFT SKIRT 1100 0 AFT SKIRT NO OF AFT SKIRT 1100 0 AFT S	PRESSURIZATION MAST			
NOPELLANT MANAGEMENT PROBE LOSH BAFFLE 337.00 9.057 SCIRCULATION SYSTEM 3 PLACES 366.60 9.31 ILI & DRAIN 341.00 8.641 NO OF AFT SKIRT 283.00 7.188 AFT SKIRT 1890.00 48.005 326.00 M OF SLOSH BAFFLE 223.00 5.664 LAGE ROCKET FAINT MONTOR 223.00 5.664 M OF THRUST CONE 122.00 7.444 RO SECTION OF FORWARD SKIRT 1541.00 39.141 -23.00 -0.584 RECTION OF FORWARD SKIRT 1420.30 36.075				
NOPELLANT MANAGEMENT PROBE LOSH BAFFLE 337.00 9.057 SCIRCULATION SYSTEM 3 PLACES 366.60 9.31 ILI & DRAIN 341.00 8.641 NO OF AFT SKIRT 283.00 7.188 AFT SKIRT 1890.00 48.005 326.00 M OF SLOSH BAFFLE 223.00 5.664 LAGE ROCKET FAINT MONTOR 223.00 5.664 M OF THRUST CONE 122.00 7.444 RO SECTION OF FORWARD SKIRT 1541.00 39.141 -23.00 -0.584 RECTION OF FORWARD SKIRT 1420.30 36.075	LOX VENT LINE			
LOSH BAFFLE 37.00 9.067 SCIRCULATION SYSTEM 5 PLACES 36.60 9.311 LL & DRAIN 341.00 8.661 NO OF AFT SKIRT 1890.00 48.006 326.00 NO OF AFT SKIRT 1890.00 48.006 326.00 7.188 LLAGE ROCKET FAIRING MOTOR 176.68 3.725 7.188 LLAGE ROCKET FAIRING MOTOR 176.68 3.725 7.188 CHARDS CONE 12.00 2.844 7.213 GO NOF THRUST CONE 12.00 2.844 GO SECTION OF FORWARD SKIRT 1420.30 36.073 SECTION OF HELIUM BOTTLES (4) 946.50 24.041 F INTERTANK ASSEMBLY 885.20 22.484 VENT LINE 696.00 17.678 SIDOOR (FAR SIDE) 174.18 20.172 ILL & DRAIN (FAR SIDE) 74.18 20.172 ILL & DRAIN (FAR SIDE) 130.00 3.302 ON OF INTERTANK ASSEMBLY 628.80 15.971 ILL & DRAIN 130.00 3.302 DM OF FUEL TANK 225.00 5.715 DF HEAT SHIE	TOP OF LH2 FEED FAIRING 5 PLACES		451.	75
CORCULATION SYSTEM 5 PLACES 36.60 9.31 LL & DRAIN 341.00 8.661 NO GATT SKIRT 1890.00 48.006 326.00 NO F SLOSH BAFFLE 1890.00 48.006 326.00 LLAGE ROCKET FAIRING MOTOR 176.68 3.723 CLAGE ROCKET FAIRING MOTOR 176.68 3.724 CHARD SKIRT 1541.00 39.141 -23.00 -0.584 OF FINDER CONE 12.00 2.844 12.00 -0.584 SECCTION OF HELIUM BOTTLES (4) 946.50 24.041 1420.30 36.075 SECCTION OF HELIUM BOTTLES (4) 946.50 24.041 1420.172 111.14 111.14 111.14 20.172 111.14 111.14 111.14 20.172 111.14 20.172 111.14 20.172 111.14 20.172 111.14 20.172 111.14 20.172 111.14 20.172 111.14 20.172 111.14 20.172	LOX TANK EQUATOR	1848	46.939	
LL & DRAIN 341,00 8.651 NO OF AFT SKIRT 1890,00 48.065 326.00 6.280 M OF SLOSH BAFFLE 1890,00 48.065 7.182 LLAGE ROCKET FAIRING MOTOR 176.68 3.723 THRUST CONE 233.00 5.664 M OF THRUST CONE 12.00 2.844 KQ DRWARD SKIRT 1541,00 39.141 -23.00 -0.584 R SECTION OF FORWARD SKIRT 1420.30 36.073 -0.584 R SECTION OF HELIUM BOTTLES (4) 946.50 24.041 -0.584 M OF INTERTANK ASSEMBLY 855.20 22.484 -0.72 VENT LINE 96.00 17.678 -0.778 IS DOOR (FAR SIDE) 794.18 20.172 -0.172 INL & DRAIN (FAR SIDE) 776.18 19.715 -0.172 M OF INTERTANK ASSEMBLY 628.80 15.971 -0.100 M OF INTERTANK ASSEMBLY 628.90 5.715 -0.100 M OF FUEL TANK 25.00 5.715 -0.100 DM OF FUEL TANK 225.00 5.715 -0.100 DM	LOX TANK EQUATOR			
NN OF AFT SKIRT 233.00 7.185 AFT SKIRT 1890.00 48.005 326.00 6.280 M OF SLOSH BAFFLE 244.00 7.213 7.15 LLAGE ROCKET FAIRING MOTOR 176.68 3.725 THRUST CONE 23.00 5.664 M OF THRUST CONE 12.00 2.844 KG SECTION OF FORWARD SKIRT 1541.00 39.141 -23.00 -0.584 RECTION OF FORWARD SKIRT 1420.30 36.075 - - - SECTION OF HELIUM BOTTLES (4) 946.50 24.041 -	LOX FILL & DRAIN (FAR SIDE)		207.	00
NN OF AFT SKIRT 233.00 7.185 AFT SKIRT 1890.00 48.005 326.00 6.280 M OF SLOSH BAFFLE 244.00 7.213 7.15 LLAGE ROCKET FAIRING MOTOR 176.68 3.725 THRUST CONE 23.00 5.664 M OF THRUST CONE 12.00 2.844 KG SECTION OF FORWARD SKIRT 1541.00 39.141 -23.00 -0.584 RECTION OF FORWARD SKIRT 1420.30 36.075 - - - SECTION OF HELIUM BOTTLES (4) 946.50 24.041 -	CRUCIFORM BAFFLE		173.	00
AFT SKIT IB90.00 48.006 326.00 8.280 M OF SLOSH BAFFLE 284.00 7.213 244.00 7.213 LLAGE ROCKET FAIRING MOTOR 176.68 3.725 3.664 F THRUST CONE 223.00 5.664 M OF THRUST CONE 12.00 2.844 NGD SECTION OF FORWARD SKIRT 1541.00 39.141 -23.00 -0.584 R SECTION OF FORWARD SKIRT 1420.30 36.075 - - - R SECTION OF FORWARD SKIRT 1420.30 36.075 - - - R SECTION OF HELIUM BOTTLES (4) 946.50 24.041 - - - - R SECTION OF HELIUM BOTTLES (4) 946.50 24.041 -			158.	00
AND AT SUMM 1890.00 48.006 322.00 8.280 M OF SLOSH BAFFLE 284.00 7.213 244.00 7.213 LLAGE ROCKET FAIRING MOTOR 176.68 3.722 3.644 M OF THRUST CONE 223.00 5.644 M OF THRUST CONE 12.00 2.844 M OF THRUST CONE 124.00 3.644 NGO 223.00 5.644 ORWARD SKIRT 1541.00 39.141 -23.00 -0.584 R SECTION OF FORWARD SKIRT 1420.30 36.075 - - SLOSH BAFFLES - - - - - SLOSH BAFFLES - - - - - - - SLOSH BAFFLES - <td>BOTTOM LH2 FEED FAIRING</td> <td></td> <td>158.</td> <td>00</td>	BOTTOM LH2 FEED FAIRING		158.	00
M OF SLOSH BAFFLE 284.00 7.213	FLIGHT SEPARATION	1760.00	44.704 196.	00
F THRUST CONE 223.00 5.664 M OF THRUST CONE 112.00 2.844 NGD ORWARD SKIRT 1541.00 39.141 -23.00 -0.584 R SECTION OF FORWARD SKIRT 1420.30 36.075	GIMBAL PLANE		100.	.00
III.00 2.844 NO ORWARD SKIRT I541.00 39.141 -23.00 -0.584 R SECTION OF FORWARD SKIRT I420.30 36.075	DE K			
NG) ORWARD SKIRT I 541.00 39.141 -23.00 -0.584 R SECTION OF FORWARD SKIRT 1420.30 36.075 SLOSH BAFFLES	BOTTOM ULLAGE R M FAIRING		-0.	.44
DRWARD SKIRT 1541,00 39,141 -23.00 -0.584 R SECTION OF FORWARD SKIRT 1420,30 36.075	J-2 ENGINES (5 PLACES) S-IC			
A SECTION OF FORWARD SKIRT 1420.30 36.075 SLOSH BAFFLES	STIL FLIGHT SEPARATION		0.	.00
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FILL & DRAIN 130.00 3.302 D ROCKETS (2 EACH 4 PLACES) Image: Constraint of the second se	TOP OF ENGINE FAIRING	362.00	9,194	
DROCKETS (2 EACH 4 PLACES)				
DROCKETS (2 EACH 4 PLACES)	TOP OF THRUST STRUCTURE	345.70	8,780	
DF HEAT SHIELD 112.00 2.844	INTERCONNECT LOX DRAIN	130.00	3.302	
DF HEAT SHIELD 112.00 2.844		1		
DF HEAT SHIELD 112.00 2.844				
DF HEAT SHIELD 112.00 2.844				
OM OF F-I ENGINE (5 PLACES) -115.36 -2.930				
DM OF F-I ENGINE (5 PLACES) -115.36 -2.930	BOTTOM OF ENGINE FAIRING	48.50	1.231	
POS II				
POS II	BOTTOM OF THRUST STRUCTURE	116.00	2.946	
POS II	GIMBAL	100.00	2.540	
	POS III	SATU	RN APOLLO 500	SERIE
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Launch Control and Checkout Equipment (LCCE) - General Electric's Apollo Systems Organization has provided a broad range of equipment used to control and check out the facilities used in launching America's Apollo astronauts. This hardware is known as Launch Control and Checkout Equipment (LCCE), and includes systems which spread over the entire Cape Kennedy Complex. Shown here is a test of the Water Control System used for cooling and quenching the launch site and storage areas before, during, and after a launch.

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PRODUCT INFORMATION

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FACT SHEET

APOLLO SYSTEMS Space Division General Electric Company

CHECKOUT AND GROUND SUPPORT EQUIPMENT FOR APOLLO

- Fifth Largest Apollo Contractor.
- Supplied most of Apollo Ground Support Equipment.
- Supplied Equipment for Pre-Launch Checkout and Control of the Apollo Spacecraft, the Saturn Launch Vehicles, and the Launch Facilities themselves.

APOLLO SYSTEMS DEPARTMENT MISSION AT-A-GLANCE

- 1. Development of ACCEPTANCE CHECKOUT EQUIPMENT (ACE-S/C) for pre-launch test and checkout of the three Apollo spacecraft modules.
- 2. Development of ELECTRICAL SUPPORT EQUIPMENT (ESE) for pre-launch checkout and control of the Saturn IB and Saturn V launch vehicles.
- 3. Development of Launch Control and Checkout Equipment for pre-launch control and checkout of the launch equipment and the launch facilities at the launch complexes.
- 4. Engineering and technical services, including mission analysis and Reliability and Quality Assessment.

RESOURCES

The General Electric Apollo Systems Organization (General Manager, Gerald T. Smiley) has about 3,300 employees. It has major facilities in four locations:

- 1. <u>Daytona Beach, Florida</u>—Organization Headquarters. Major manufacturing facility.
- <u>Cape Canaveral</u>, Florida-Was responsible for development of launch control and checkout equipment. Provides engineering services to NASA's Kennedy Space Center.
- 3. <u>Houston, Texas</u>—Primarily concerned with engineering support to NASA's Manned Spacecraft Center. Responsible for ACE-S/C Program.
- 4. <u>Huntsville, Alabama</u>—Major development and manufacturing facility for ESE equipment. Provides engineering services for NASA's Marshall Space Flight Center.
- 5. <u>Other</u>—Apollo Systems personnel are also located at major Apollo contractor's facilities in Downey, California, and Bethpage, New York, to provide engineering services in connection with ACE Stations at each location. In addition, the Organization maintains offices in Washington, D.C., and Dayton, Ohio.

HARDWARE FOR APOLLO

APOLLO SPACECRAFT CHECKOUT

• Acceptance Checkout Equipment (ACE).

LAUNCH VEHICLE CHECKOUT AND CONTROL

• Electrical Support Equipment (ESE).

LAUNCH CONTROL AND CHECKOUT EQUIPMENT

- Electrical Launch Support Equipment.
 - Propellants and Gases Systems.
 - ELSE Control Systems.
 - Facility Control Systems.
 - DC Power System.

- Instrumentation System
 - Vehicle Measuring Checkout Systems.
 - Measurements Monitoring and Recording Systems.
 - RF Checkout Equipment.
 - Saturn Telemetry Checkout System.
 - Saturn Abort Advisory System (AAS).
- Power Systems, Cables, and Racks (Design Management).
 - Cables.
 - 60-Hertz Power System.
 - Facilities Grounding System.
- Communications and Photo-Optical Systems (Design Management).
 - Television System.
 - Operational Intercommunications System (OIS).
 - Photo-Optical System.
 - Wideband Transmission System.
 - Paging System.
 - Timing and Countdown Systems.
 - Speciality Operational Television (OTV) and Photo-Lighting Systems.
 - General Telephone, Data, and Special Audio Systems.

RELATED WORK EXPERIENCE

Organized in 1962 to provide equipment and services for the Apollo Program, Apollo Systems has since evolved into other aerospace-defense and industrial work areas.

Apollo Systems is under contract to provide equipment and engineering services for such programs as Minuteman III and Safeguard.

Apollo Systems has also designed and built a Nuclear Power Plant Simulator (NPPS), which is used to train operators for boiling-water reactor plants. This system duplicates in function and appearance a typical nuclear power plant control room and utilizes digital computer techniques and math modeling to simulate all systems external to the control room. Another simulation system developed by Apollo Systems involves Computed Perspective Image Generation, a technique employing computer-generated color TV-like pictures to simulate such operations as spacecraft docking and landings, aircraft carrier and airport landings and defense oriented applications. A similar technique, called Digital Radar Landmass Simulation, is used to generate a display on a radar scope for use in training navigators.

Apollo Systems has also developed a high-speed information search and retrieval system known as the GESCAN Rapid Search Machine. This system can search natural language information files at speeds of up to one million words per minute.

These products and program activities outside the space field illustrate some of the wide-spread benefits derived from the technological development of our nation's space program.



PRODUCT INFORMATION

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CHECKOUT EQUIPMENT FOR APOLLO SPACECRAFT: ACE-S/C

Houston, Texas—The Apollo Spacecraft will start on its complicated mission only after having received a thorough pre-launch testing from a vast complex of ground checkout equipment provided by the General Electric Company. Designated ACE-S/C, for Acceptance Checkout Equipment-Spacecraft, the system is capable of testing all spacecraft systems automatically. GE's Apollo Systems Organization has fabricated and assembled fourteen of these spacecraft checkout systems.

The widespread use of these stations makes it possible to conduct uniform, standard tests and procedures, and to detect variances in the spacecraft systems while they are still at the factory, and then after they arrive at the Kennedy Space Center.

<u>Six</u> ACE stations are located at NASA facilities at Merritt Island; <u>three</u> are at the North American Aviation plant at Downey, California, where the Command and Service Modules are manufactured; <u>two</u> are at Grumman Aircraft Engineering Corporation in Bethpage, New York, where the Lunar Module is built; and <u>two</u> are at the Manned Spacecraft Center at Houston, where simulated space environmental tests are conducted. One ACE station is located at the Manned Space Flight Center in Huntsville for use on the Skylab Program.

ACE provides NASA with a highspeed, effective means of testing Apollo's key systemscommunications, instrumentation, biomedical, environmental control, fuel cell and cryogenics, service propulsion and reaction control, guidance and navigation, stabilization and control, and power and sequential. Each ACE station consists of three rooms of electronic equipment—a control room, a computer room, and a terminal facility room. This design allows a staff of key engineers to monitor and control the spacecraft checkout tasks.

Checkout can be handled manually, semi-automatically, or fully automatically. ACE receives data at the rate of approximately 200,000 bits per second, which is equivalent to approximately 25,000 data "words" per second. If all the data compiled on a continuous eight-hour test were printed out and stacked beside the Saturn V, it would stand 65 feet taller than the space vehicle itself.

A systems engineer sitting at an ACE console performs testing on a spacecraft subsystem by sending a "command" signal to the spacecraft on the launch pad. Measurements of spacecraft performance are continuously being sent back to "ACE" for display to the test operator. If the checkout data does not meet prescribed limits, the various display lights, meters, recorders, and indicators will allow the test engineer to immediately note the discrepancy. By this method, engineers can check one tiny circuit deep within a single subsystem or the entire spacecraft.

During launch operations, ACE exchanges key information with a similar system which checks out and controls the Saturn launch vehicles. This system, known as Electrical Support Equipment (ESE), was also designed and manufactured by Apollo Systems.

Together, these two systems—in conjunction with the Launch Control and Checkout Systems—provide the capability for an integrated test for Apollo/Saturn.



PRODUCT INFORMATION

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CHECKOUT AND CONTROL OF LAUNCH VEHICLE OPERATIONS: ESE

Huntsville, Alabama—Saturn V, and Saturn IB, are examined, inspected, tested, and controlled by the largest array of checkout equipment in the Apollo Program.

This booster diagnosis is accomplished through use of Electrical Support Equipment (ESE) developed and built by the Apollo Systems Organization of the General Electric Company. This is the type of equipment seen in the blockhouses and control centers at Cape Kennedy.

ESE is a vast array of ground support equipment that checks out the launch vehicle and its support systems. In addition to operator and launch conductor control and display stations for each stage of the vehicle, ESE consists of a computer complex and associated equipment, the vehicle telemetry system, primary power and distribution equipment and system test equipment.

This equipment permits engineers to check and recheck the circuits of the launch vehicles, such as those for propellants and gases and vehicle components associated with these systems.

ESE sends commands to exercise or control each of the critical components of the various booster stages. It then reports the information from each of the thousands of test points to the engineers conducting the tests so they know at all times, in detail, if the launch stages are operating properly.

ESE, through appropriate interfaces, also supplies operational support to other ground systems and conducts all switching operations required during the final three minutes of countdown.

At KSC, Electrical Support Equipment is located at the Launch Control Center, the Mobile Launch Facility, and the Vehicle Assembly Building.

General Electric, fifth largest contractor to the National Aeronautics and Space Administration, also provides checkout equipment for the Apollo spacecraft. This spacecraft checkout system is known as ACE-S/C. ESE is functionally similar to ACE, but is about twice as large. ESE is the largest known checkout system in the world.

The Electrical Support Equipment was developed and fabricated by the Apollo Systems Organization at its Center operation in Huntsville, Alabama.



PRODUCT INFORMATION

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LAUNCH CONTROL AND CHECKOUT EQUIPMENT

Cape Kennedy, Florida—The Apollo Systems Organization of General Electric has provided a wide range of equipment and design engineering management to check out and control the launch facilities used in NASA's Apollo Program. This hardware is known as Launch Control and Checkout Equipment (LCCE). Where other GE-provided systems check out and control the Apollo spacecraft and the Saturn launch vehicles, LCCE performs this function for many of the launch facilities, themselves.

The LCCE may be grouped into four main functional system categories:

- <u>Electrical Launch Support Equipment</u> consisting of approximately 800 racks of electrical equipment in twenty-four systems. These racks of equipment are used for propellants and gases control, launch support equipment control, and facility remote control.
- <u>Instrumentation Systems</u> consisting of approximately 650 racks of electrical equipment in thirty-nine systems. These racks of equipment are used for measurements, RF checkout, Telemetry checkout, and abort advisory functions.
- <u>Cables, Racks, and Power Systems</u> including the 115 kilovolt network, the 13.2/13/8 kilovolt substations, and the secondary distribution system to technical loads. Equipment placement drawings for approximately 130,000 cables and 7,000 racks have been provided.
- <u>Communications and Photo-Optical Systems</u> consisting of equipment comprising the Saturn/Apollo Television System, Photo-Optical System, Wideband Transmission System, Operational Intercommunications System, Paging System, Radio Frequency (RF) System, Timing and Countdown System, and the General Telephone, Data, and Special Audio System.

Specifically, the various systems used for launch control and checkout of the space vehicle perform the following functions:

- a. Provide operator controls and displays necessary to remotely service the launch vehicle by loading propellants, provide high and low pressure gases control, vehicle compartment conditioning, and controlling movement of service and holddown arms prior to launch.
- b. Provide protection to the space vehicle, pad, and personnel with control and displays of a Firex Water Systems area warning system, purging system, and hazardous gas monitoring system.
- c. Provide both visual and oral communications essential in controlling all operations during assembly and checkout of the space vehicle.
- d. Provide instrumentation checkout equipment necessary to validate performance and calibrate on-board sensors, transponders, and telemetry equipment.
- e. Provide and distribute critical power to all technical equipment and administrative facilities.

The LCCE gives NASA a broad launch support capability for the servicing, protecting, and checking out of the launch vehicle and spacecraft from arrival of the various stages at Kennedy Space Center on through testing and assembly in the Vehicle Assembly Building and Manned Spacecraft Operations Building; and to final flight readiness verification at the pad prior to and during launch.

GENERAL DE ELECTRIC GROUND SUPPORT EQUIPMENT FOR

PROJECT APOLLO



APOLLO SYSTEMS DEPARTMENT

The Apollo Systems Department of General Electric Company was organized in 1962 to provide equipment and engineering services to NASA's Apollo project. ASD is the fifth largest contractor in the program, having supplied most of its Ground Support Equipment.

This ground support equipment may be divided broadly into three functional areas:

- Checkout of Spacecraft (ACE-S/C)
- Checkout and control of launch vehicle (ESE)
- Checkout and control of launch facilities (LCCE)

The Apollo Systems Department is headquartered at Daytona Beach, Florida, and has large Center operations at Cape Canaveral, Florida; Houston, Texas; Huntsville, Alabama; and maintains, in addition, a Washington Office. ASD personnel are also located at Apollo contractors' facilities in Downey, California, and Bethpage, New York.

SPACECRAFT CHECKOUT EQUIPMENT (ACE S/C)



Before lift-off, thousands of test points on the Apollo spacecraft must be checked out. This testing is accomplished utilizing checkout equipment built by the Apollo Systems Department of General Electric. This equipment, called "ACE" for Acceptance Checkout Equipment, checks out the three Apollo modules, but not the launch vehicles.



An ACE checkout station consists of two main rooms of equipmenta control room, and a computer room. The computer room contains two high-speed computers. Advanced system design permits centralized, preprogrammed operation.

ACE can make tests in three different operating modes-manual, semiautomatic, or fully automatic. ACE checks all spacecraft systems including instrumentation, communications, environmental control, power, stabilization, and control. ACE can test one tiny component buried deep within the spacecraft or the entire, integrated spacecraft.

The 14 ACE stations, manufactured by General Electric, are used from factory to launch pad.

LAUNCH VEHICLE CHECKOUT EQUIPMENT (ESE)

While ACE checks out the Apollo spacecraft, other GE-built equipment checks out the Saturn launch vehicle. Known as ESE, for Electrical Support Equipment, this system contains about 10,000 racks, panels, and control consoles.



ESE is the type of equipment seen in the launch control centers at KSC. It tests all the thousands of checkpoints on Saturn V's three stages manually and automatically. ESE also conducts all switching operations in the final three minutes of countdown.



General Electric also provides equipment to check out and control the launch facilities themselves.

LAUNCH FACILITIES CHECKOUT EQUIPMENT (LCCE)



Water Control Systems Provide Fire Protection, Pad Cooling and Quenching

The launch facilities are controlled and tested by Launch Control and Checkout Equipment (LCCE). This equipment is located throughout the entire launch complex and includes systems used to check and control fueling of the various stages, as well as equipment concerned with communications, telemetry, water control, and other launch complex operations.

General Electric's Ground Support Equipment never leaves the ground..... but without it, neither does anything else.



GENERAL (%) ELECTRIC MISSILE AND SPACE DIVISION APOLLO SYSTEMS DEPARTMENT

ASD

DAYTONA BEACH, FLA.



Acceptance Checkout Equipment—Spacecraft (ACE-S/C)—Thousands of system test points on the Apollo spacecraft must be thoroughly checked out before it can be launched. These tests are made using checkout equipment developed and manufactured by General Electric's Apollo Systems Organization. Called ACE-S/C, for Acceptance Checkout Equipment—Spacecraft, this system is capable of testing all the checkpoints on the Apollo modules manually, semiautomatically, or fully automatically. Shown above is the control room of one of the 14 ACE stations manufactured by GE for NASA. Each station also contains a computer room and terminal/switching facility. These ACE stations are in use at locations throughout the nation for checkout of the Apollo modules from factory to launch pad.

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Electrical Support Equipment (ESE) —During the countdown and launch of the Saturn V Rocket which starts American Astronauts on their way to the moon, the giant space vehicle is checked out and controlled by the largest checkout system in the world. Called Electrical Support Equipment (ESE), this system comprises enough racks of electronic equipment to make a column 3 miles high, stacked end on end. ESE also provides operational support to other ground systems and conducts all switching operations in the final three minutes of countdown. ESE was designed and manufactured by General Electric's Apollo Systems Organization at their Center Operation in Huntsville, Alabama.

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