TWR-5672

PTS-15479

STUDY OF SOLID ROCKET MOTOR FOR SPACE SHUTTLE BOOSTER

VOLUME II TECHNICAL

BOOK 4 OF 5

APPENDICES B THRU D

by

Thiokol / WASATCH DIVISION

A DIVISION OF THIOKOL CHEMICAL CORPORATION

prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

George C. Marshall Space Flight Center

Contract NAS 8-28430
Data Procurement Document No. 314
Data Requirement MA-02

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TWR-5672

FINAL REPORT

STUDY OF SOLID ROCKET MOTOR FOR SPACE SHUTTLE BOOSTER

VOLUME II TECHNICAL

BOOK 4 OF 5

APPENDICES B THRU D

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THIOKOL/WASATCH DIVISION
A Division of Thiokol Chemical Corporation
P.O. Box 524, Brigham City, Utah 84302

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15 March 1972

CONTRACT NAS 8-28430
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George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama

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APPENDIX B

MASS PROPERTIES REPORT

This report contains the mass properties and related data as required according to PD-RV-V, attachment to Exhibit "A," Scope of Work, Contract NAS8-28430. Data for three solid rocket motor (SRM) designs are presented: (1) baseline parallel burn; (2) optional parallel burn; and (3) baseline series burn.

A summary of the data reported shows:

Item	Motor Design Weight (lb) Parallel Baseline	Parallel Optional	Series Baseline
Stage inert	154,081	169,866	529,092
Total propellant	1,217,664	1,214,327	4,501,875
Total stage	1,371,745	1,384,404	5,030,968
Expended inert	7,300	7,448	24,959
Expended propellant	1,217,664	1,214,327	4,501,675
Burnout weight	146,781	162,628	504,132
Mass fraction - stage	0.888	0.877	0.895

The basic design differences presented are:

Design	No. of Seg	No. of SRM's	Fixed	Movable	TVC	TT	DES	REC	SM	CM
Parallel										
Baseline	3	2	x							D6AC
Optional	3	2		x	x	x	x	x	x	D6AC
Series	4	3		x	x					D6AC

Code: SRM - Solid Rocket Motor
TVC - Thrust Vector Control
TT - Thrust Termination System
DES - System to Destruct Motor
REC - Recovery System
SM - Staging Motors
CM - Case Material

Basically, when parallel motors are used, one motor is attached to each side of the orbiter and are fired at the same time as the orbiter during the boost phase of flight. When the series design is used, three SRM's are attached to the rear of the orbiter and are fired during the initial boost phase while the orbiter is fired after completion of the SRM firing. Thus, the design differences between the parallel and series designs account for the different requirements of burn during the boost phase of flight.

The insulation design contains more weight than would normally be required. In addition to an insulation safety factor of 2.0, there is a 0.080 in. layer of asbestos-filled NBR covering the complete cylindrical wall of the center segments to protect the case so that it can be recovered and reused. This adds about 860 lb to the insulation weight in the parallel burn motors or 1,140 lb to the insulation weight of the series burn motor. To allow for a regressive thrust-time curve and a long tailoff, four longitudinal slots were added to the forward segment, and the aft segment used a conical instead of cylindrical port. This grain design requires insulation thicknesses ranging from 0.85 in. in the cylinder of the forward segment and tapers to a maximum of 1.0 in. at the joint and forward dome. The use of the grain design in the forward segment added about 2,200 lb of insulation to forward segment. The conical grain design of the aft segment adds about 220 lb of extra insulation to the aft segment.

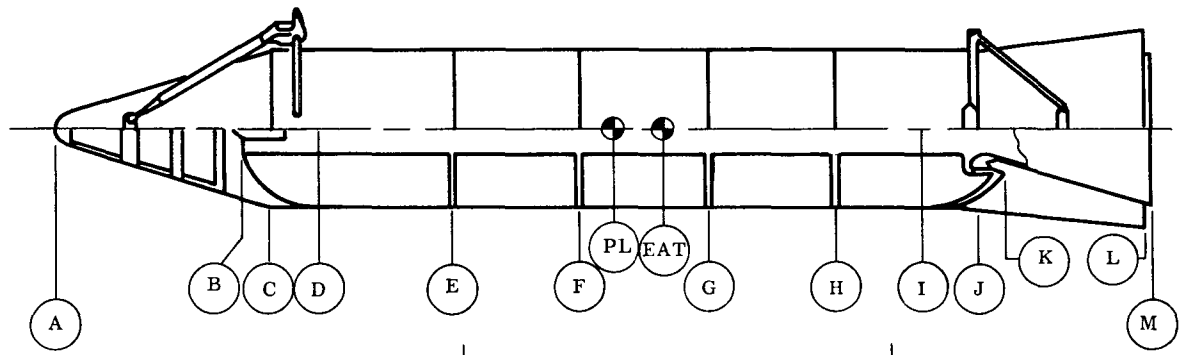
Tables I thru III show the weight summary with percents calculated, estimated, or measured by functional parts. Tables IV thru VI show the mass properties summary by segment. Tables VII thru IX provide the mass properties summary by function including materials expended during flight. Tables X thru XII show the detail mass properties by function, and Tables XIII thru XV show mass properties data vs burn time.

Throughout the report, moment of inertia data are reported in slug feet squared divided by 1,000 and measured about axes passing through the component or assembly center of gravity. The center of gravity data are in reference to the systems shown in Figures 1 thru 3, entitled center of gravity reference system.

Figures 4 thru 6 are layouts of the respective designs giving particular design and dimensional data. Table XVI reports the propellant parameters, while Figure 7 shows the thrust-time curve for the baseline parallel burn motor. Table XVII gives mass properties related design information.

The mass properties control and reporting program will be administered by the organization shown in Figure 8. Figure 9 shows the relationship of the elements of the organization to each other, their responsibilities, and the mass properties data flow systems.

Critical mass properties have not yet been identified. Total motor weight, total propellant weights, and stage mass fraction will likely be the critical items.



LOCATION	DESCRIPTION	CG
A	FWD END OF NOSE CONE	100.00
B	FWD FACE OF FWD DOME	285.50
C	FWD FACE OF FWD SKIRT	314.50
D	FWD SEG TAN. LINE	364.50
E	FWD SEG-SEG 1 CASE JOINT	468.50
F	SEG 1-SEG 2 CASE JOINT	750.00
PL	PRELAUNCH LONG. CG	917.54
EAT	END OF ACTION TIME, CG	941.33
G	SEG 2-SEG 3 CASE JOINT	1,031.50
H	SEG 3-AFT SEG CASE JOINT	1,313.00
I	AFT SEG TAN. LONG	1,469.34
J	FWD FACE AFT SKIRT	1,513.00
K	AFT FACE OF AFT DOME	1,537.00
L	AFT FACE OF AFT SKIRT	1,659.45
M	NOZZLE EXIT CONE	1,669.45

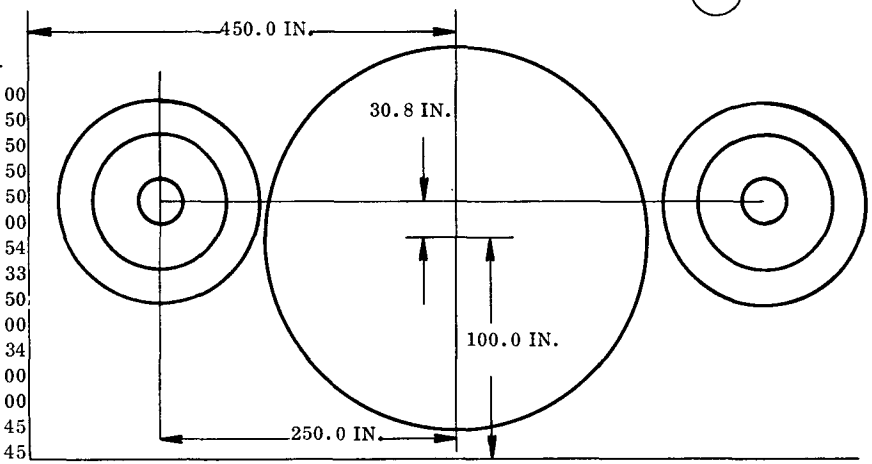


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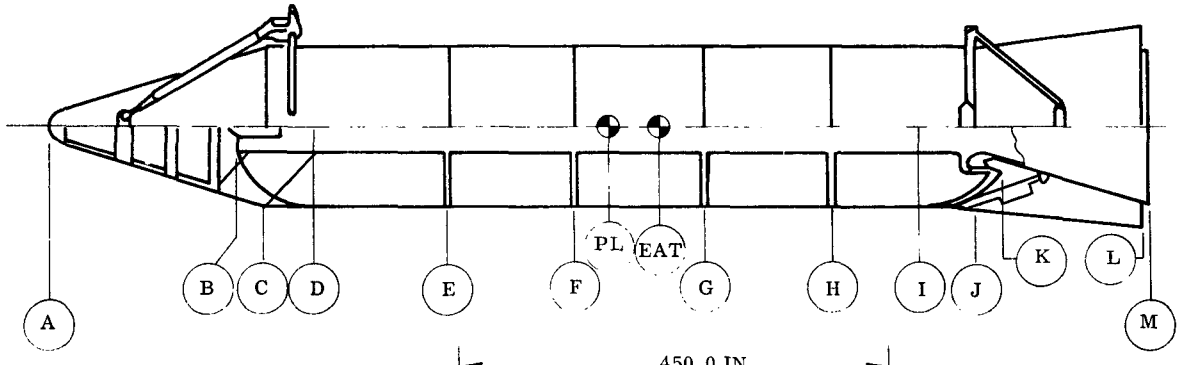
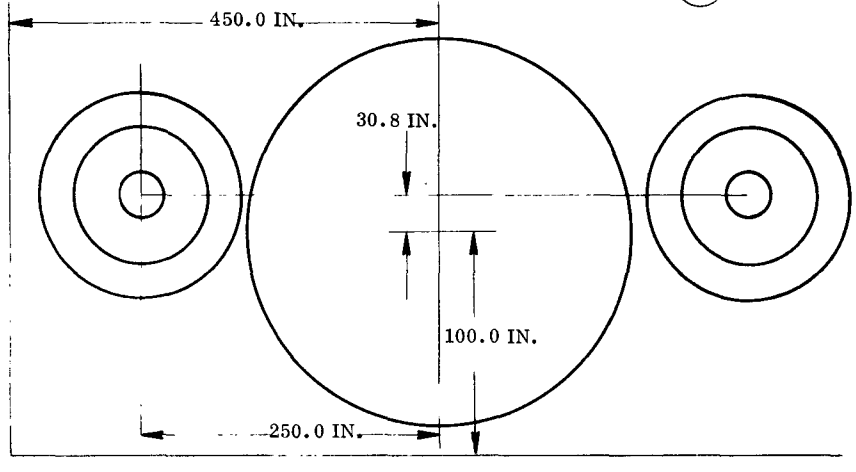
Figure 1. Center-of-Gravity Reference System, Baseline Parallel Burn

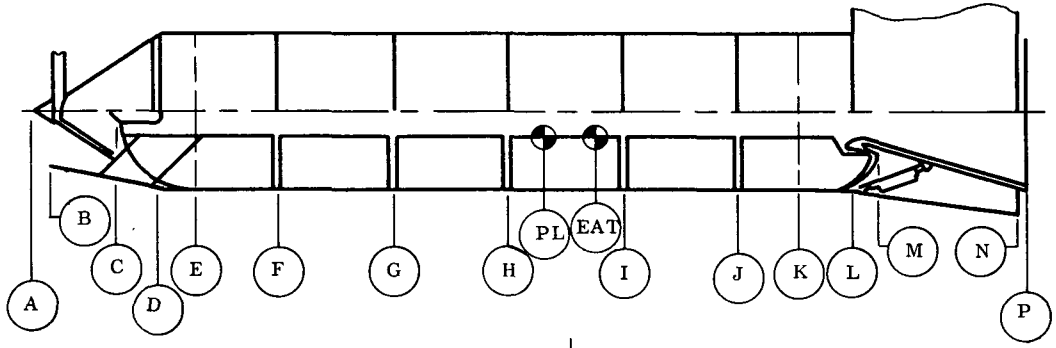


LOCATION	DESCRIPTION	CG
A	FWD NOSE CONE	100.00
B	FWD DOME	285.50
C	FWD SKIRT	314.50
D	FWD SEG TAN. LINE	364.50
E	FWD SEG-SEG 1 JOINT	468.50
F	SEG 1-SEG 2 JOINT	750.00
PL	PRELAUNCH LONG. CG	925.266
EAT	END OF ACTION TIME CG	982.048
G	SEG 2-SEG 3 JOINT	1,031.50
H	SEG 3-AFT SEG JOINT	1,313.00
I	AFT SEG TAN. LINE	1,469.34
J	AFT SKIRT FWD FACE	1,513.00
K	AFT DOME	1,537.00
L	AFT SKIRT AFT FACE	1,659.45
M	NOZZLE EXIT CONE	1,669.45



36175-17

Figure 2. Center-of-Gravity Reference System, Optional Parallel Burn



LOCATION	DESCRIPTION	CG
A	FWD RING	94.00
B	NOSE CONE	100.00
C	FWD DOME	125.60
D	FWD SKIRT	142.40
E	FWD SEG TAN. LINE	208.476
F	FWD SEG-SEG 1 JOINT	341.50
G	SEG 1-SEG 2 JOINT	616.5
H	SEG 2-SEG 3 JOINT	891.5
PL	PRELAUNCH, LONG. CG	910.414
EAT	END OF ACTION TIME, LONG. CG	975.067
I	SEG 3-SEG 4 JOINT	1,166.5
J	SEG 4-AFT SEG JOINT	1,441.5
K	AFT SEG TAN. LINE	1,583.195
L	AFT SKIRT FWD FACE	1,618.8
M	AFT DOME	1,646.3
N	AFT SKIRT AFT FACE	1,798.8
P	NOZZLE EXIT CONE	1,812.7

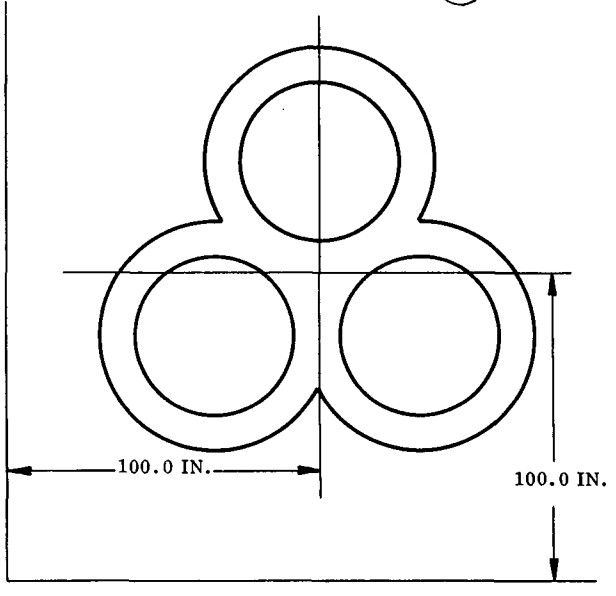


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Figure 3. Center-of-Gravity Reference System, Baseline Series Burn

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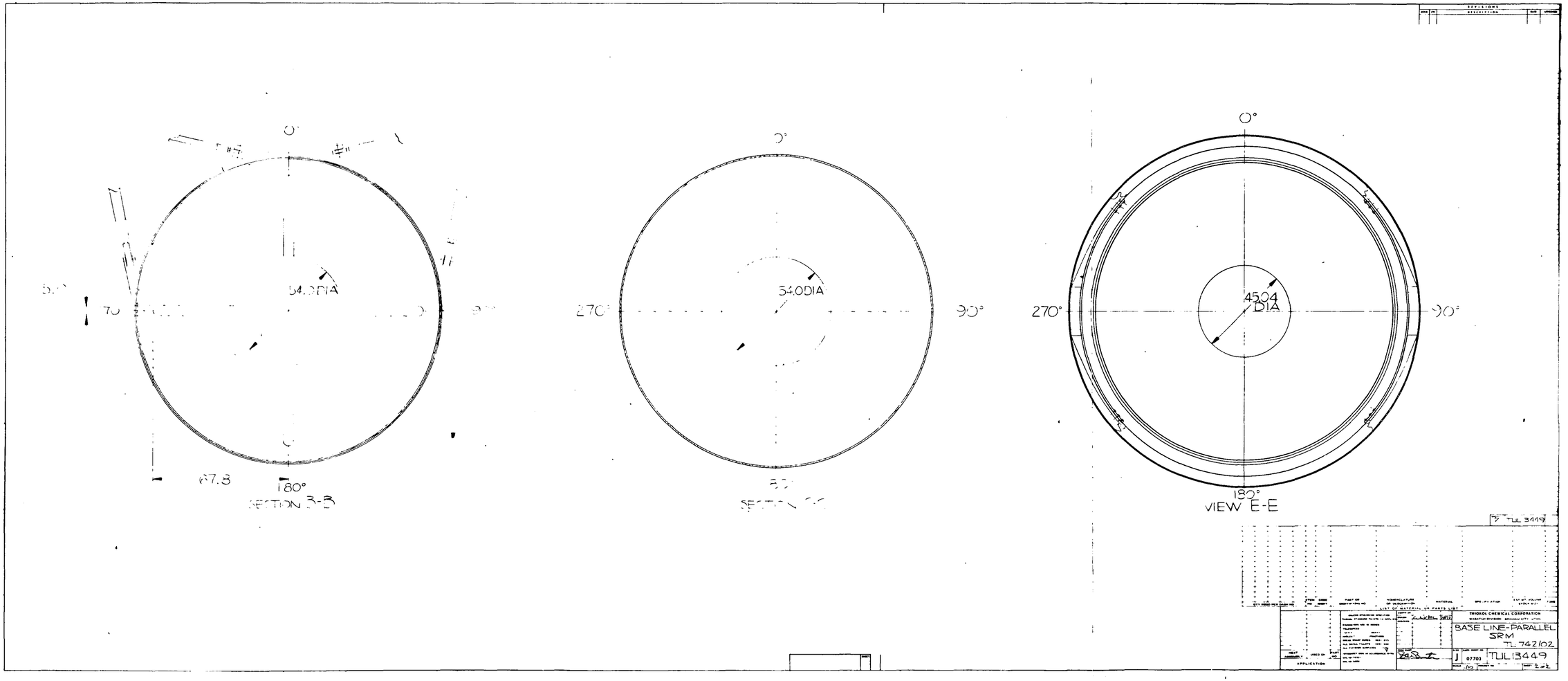

Figure 4. Baseline Parallel SRM TU-742/02 (Sheet 2)

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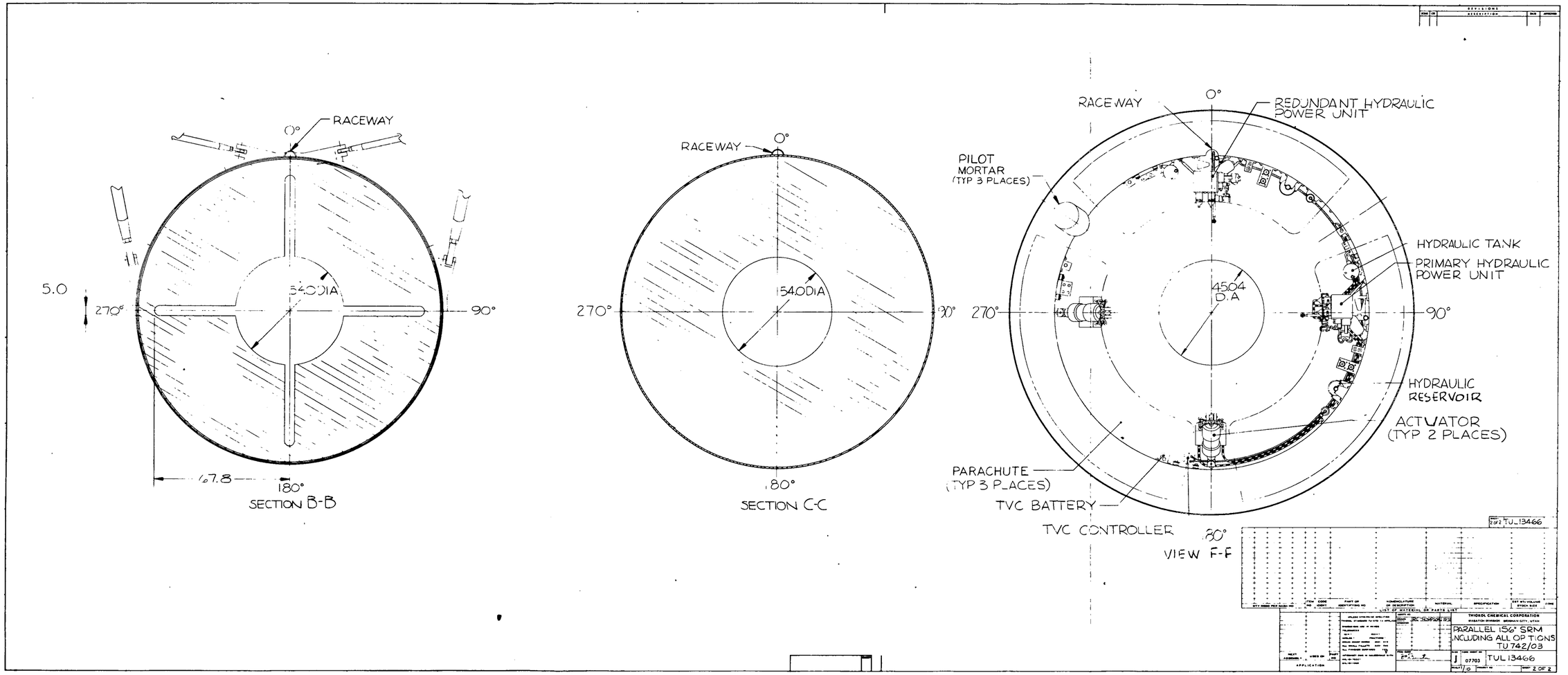

Figure . Parallel 156 In. SRM Including All Options, TU-742/03 (Sheet 2)

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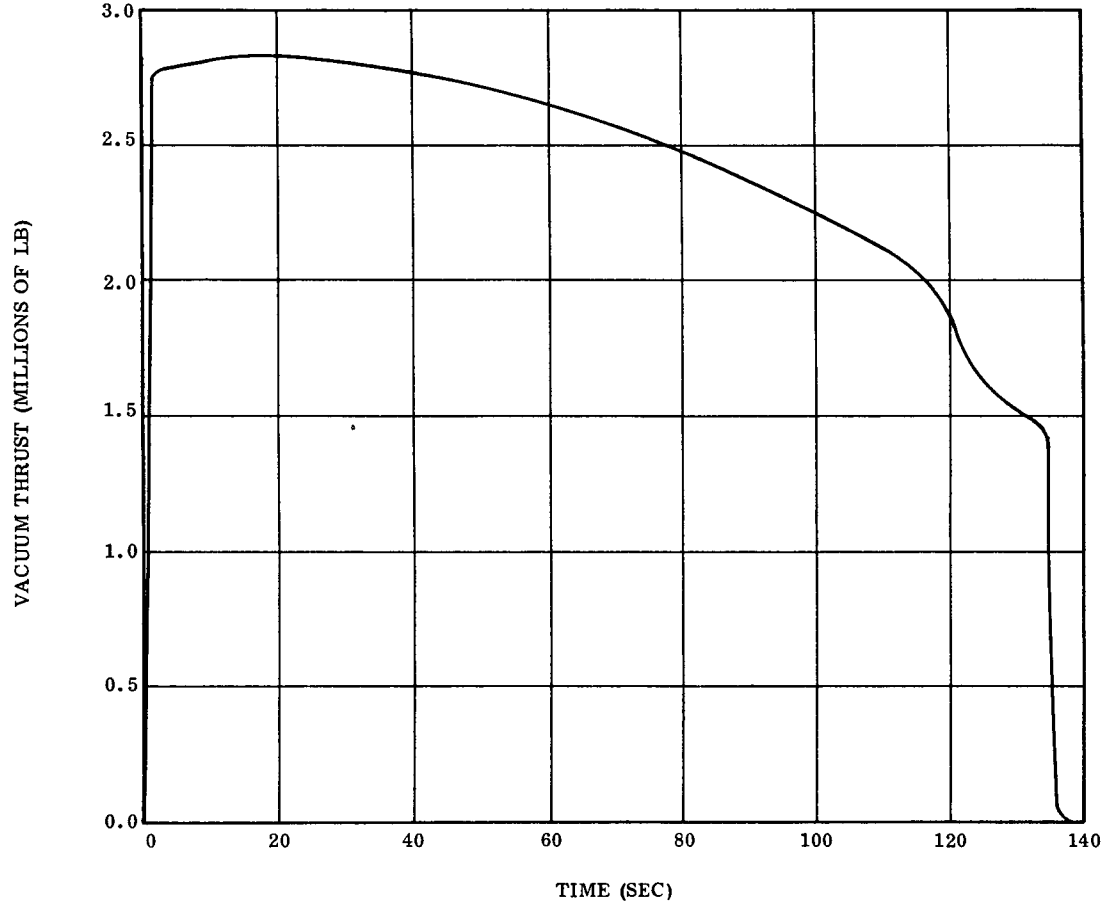


Figure 7. TU-742/02 Thrust-Time Performance

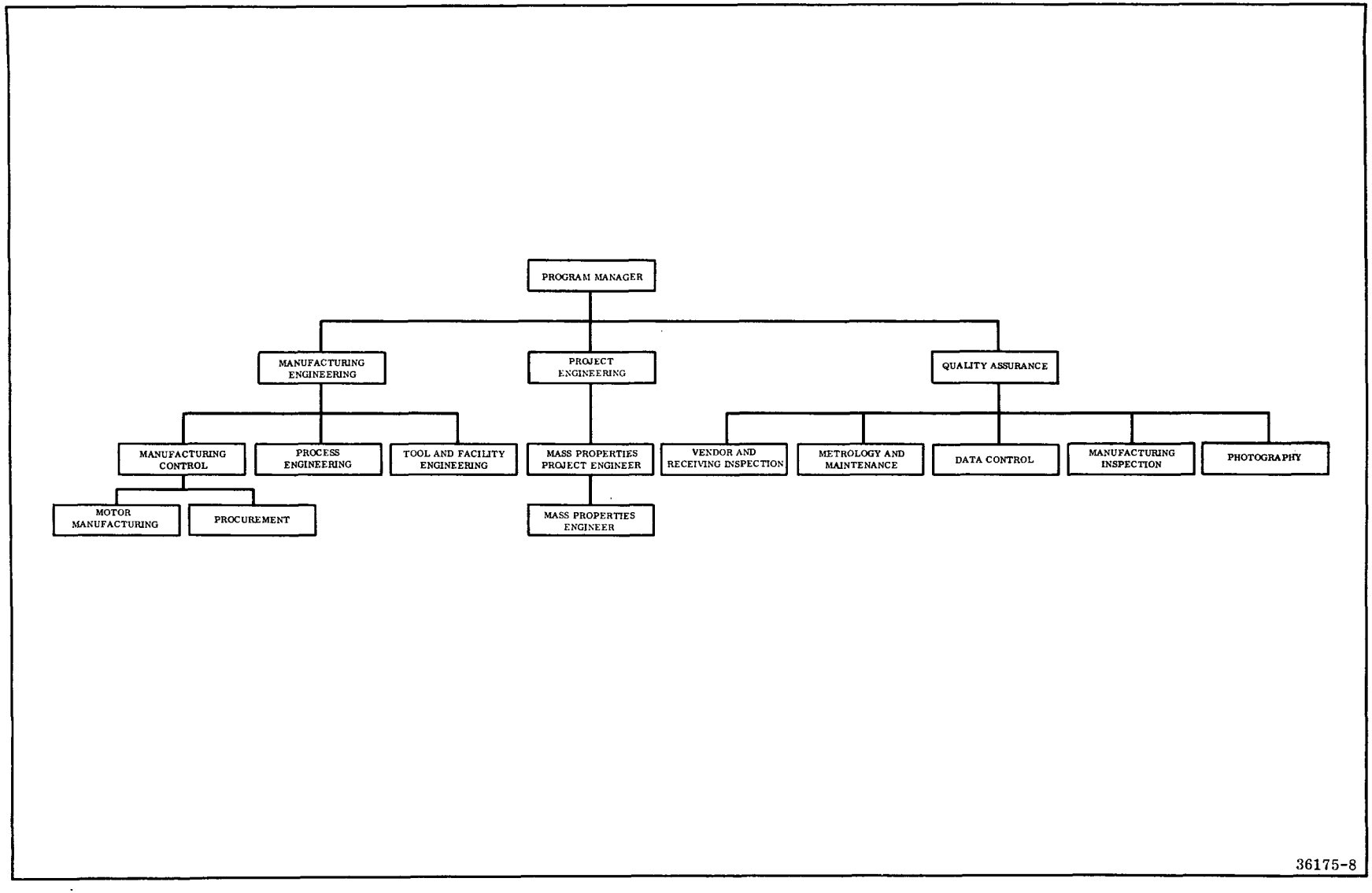


Figure 8. Solid Space Shuttle Booster Mass Properties Organizational Assignments

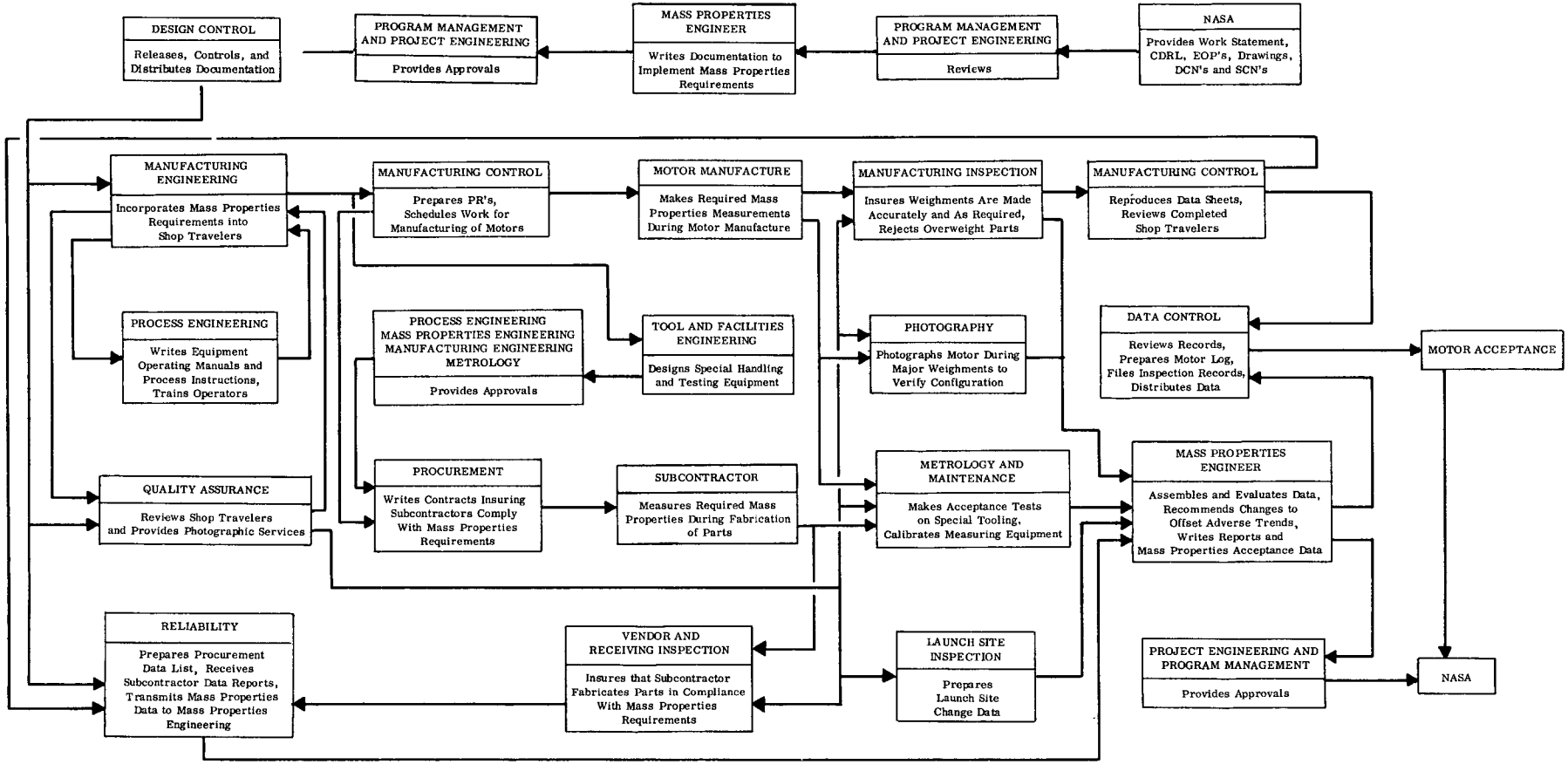


Figure 9. Mass Properties Data Flow Chart

TABLE I

BASELINE SOLID ROCKET MOTOR BOOSTER
156 INCH-PARALLEL BURN

MASS PROPERTIES SUMMARY - PART I

Description	Specified Weight Base ( )	Procuring Activity and GFE Changes	Revised Specified Weight Base	Current Weight (lb)	Changes Last to Current	Percentage Breakdown of Current Weight		
						Est	Calc	Act
Case				102,755			100	
Insulation				11,907			100	
Liner				1,278			100	
Igniter				570			100	
Nozzle				10,286			100	
Raceway				171		100		
Propellant				1,217,664			100	
Motor assembly				1,344,630			100	
Nose cone				9,275			100	
Aft skirt				12,112			100	
Stage attach provisions				5,177			100	
Instrumentation				552			100	
Total stage				1,371,746		100		
Total stage (2 ea)				2,743,492			100	

TABLE II

OPTIONAL SOLID ROCKET MOTOR BOOSTER
156 INCH - PARALLEL BURN

MASS PROPERTIES SUMMARY - PART I

	Specified Weight Base ( )	Procuring Activity and GFE Changes	Revised Specified Weight Base	Current Weight (lb)	Changes Last to Current	Percentage Breakdown of Current Weight		
						Est	Calc	Act
Case				102,724			100	
Insulation				11,906			100	
Liner				1,278			100	
Igniter				571			100	
Nozzle				11,862			100	
Raceway				171		100		
Thrust vector control				2,154		100		
Thrust termination				661		100		
Propellant				1,214,327			100	
Motor assembly				1,345,654			100	
Nose cone				9,269			100	
Aft skirt				12,112			100	
Stage attach provisions				5,177			100	
Instrumentation				552		100		
Destruct system				211		100		
Staging motors				296		100		
Recovery system				11,133		100		
Total stage				1,384,404			99	

TABLE III

BASELINE SOLID ROCKET MOTOR BOOSTER
156 INCH - SERIES BURN

MASS PROPERTIES SUMMARY - PART I

Description	Specified Weight Base ( )	Procuring Activity and GFE Changes	Revised Specified Weight Base	Current Weight (lb)	Changes Last to Current	Percentage Breakdown of Current Weight		
						Est	Calc	Act
Case				123,244			100	
Insulation				13,150			100	
Liner				1,554			100	
Igniter				660			100	
Nozzle				12,724			100	
Raceway				213		100		
Thrust vector control				2,260		100		
Propellant				1,500,625			100	
Motor assembly				1,654,430			100	
Motor assembly (3 ea)				4,963,290			100	
Forward thrust structure				34,806		100		
Aft skirt				31,216		100		
Instrumentation				1,656		100		
Total stage				5,030,968			98	

TABLE IV. MASS PROPERTIES SUMMARY PART II

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	CENTER OF GRAVITY LAT.	CENTER OF GRAVITY VERT.	MOMENT OF INERTIA PITCH	MOMENT OF INERTIA ROLL	MOMENT OF INERTIA YAW
FORWARD SEGMENT	168841.703	387.900	200.000	200.000	142.332	125.028	142.332
CASE	14395.715	382.327	200.000	200.000	16.934	17.215	16.934
INSULATION	3913.519	377.359	200.000	200.000	4.413	4.362	4.413
LINER	182.688	377.496	200.000	200.000	0.205	0.201	0.205
PROPELLANT	150349.782	388.720	200.000	200.000	120.564	103.250	120.564
CENTER SEGMENT 1	314290.942	609.228	200.000	200.000	558.943	240.770	558.943
CASE	22943.254	609.375	200.000	200.000	49.373	29.955	49.373
INSULATION	1295.944	608.391	200.000	200.000	4.217	1.661	4.217
LINER	289.369	609.225	200.000	200.000	0.588	0.371	0.588
PROPELLANT	289762.376	609.220	200.000	200.000	504.764	208.783	504.764
CENTER SEGMENT 2	314290.942	890.728	200.000	200.000	558.943	240.770	558.943
CASE	22943.254	890.875	200.000	200.000	49.373	29.955	49.373
INSULATION	1295.944	889.891	200.000	200.000	4.217	1.661	4.217
LINER	289.369	890.725	200.000	200.000	0.588	0.371	0.588
PROPELLANT	289762.376	890.720	200.000	200.000	504.764	208.783	504.764
CENTER SEGMENT 3	314290.942	1172.228	200.000	200.000	558.943	240.770	558.943
CASE	22943.254	1172.375	200.000	200.000	49.373	29.955	49.373
INSULATION	1295.944	1171.391	200.000	200.000	4.217	1.661	4.217
LINER	289.369	1172.225	200.000	200.000	0.588	0.371	0.588
PROPELLANT	289762.376	1172.220	200.000	200.000	504.764	208.783	504.764
AFT SEGMENT	221308.855	1414.789	200.000	200.000	251.091	169.293	251.091
CASE	18950.505	1425.965	200.000	200.000	29.052	22.953	29.052
INSULATION	4104.268	1481.034	200.000	200.000	5.549	3.664	5.549
LINER	227.179	1423.845	200.000	200.000	0.330	0.269	0.330
PROPELLANT	198026.903	1412.336	200.000	200.000	211.501	142.408	211.501
TOTAL SEGMENT ASSEMBLY	1333602.385	914.048	200.000	200.000	35012.203	1017.391	35012.203
CASE	102754.980	918.487	200.000	200.000	2951.267	130.792	2951.267
INSULATION	11905.618	925.203	200.000	200.000	595.198	13.010	595.198
LINER	1277.973	912.128	200.000	200.000	36.395	1.582	36.395
PROPELLANT	1217663.813	913.566	200.000	200.000	31428.524	872.007	31428.524
IGNITER ASSEMBLY	569.777	295.444	199.999	199.998	0.371	0.692	0.371

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE IV. (Cont) MASS PROPERTIES SUMMARY PART II

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
NOZZLE ASSEMBLY	10285.993	1564.586	200.000	200.000	6.836	4.093	6.836
RACEWAY ASSEMBLY	171.200	934.313	161.000	270.000	4.649	0.001	4.649
TOTAL MOTOR	1344629.354	918.765	199.995	200.009	36004.419	1022.414	36004.294
MASS FRACTION	0.906						
NOSE CONE	9274.550	235.079	202.628	200.338	11.410	6.264	11.380
AFT SKIRT	12112.415	1557.996	203.802	200.038	15.529	15.461	13.733
STAGE ATTACH PROVISIONS	5176.540	376.470	256.587	203.831	159.184	6.948	154.991
INSTRUMENTATION	551.995	411.190	232.144	248.984	0.064	0.215	0.167
TOTAL STAGE	1371744.854	917.536	200.273	200.046	38553.706	1055.334	38551.094
MASS FRACTION	0.888						
TOTAL STAG-2 EA.	2743489.707	917.536	450.273	200.046	77107.412	39120.389	114111.908

THRU THE CENTER OF GRAVITY
MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES

TABLE V. MASS PROPERTIES SUMMARY PART II

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY			MOMENT OF INERTIA		
		LONG.	LAT.	VERT.	PITCH	ROLL	YAW
FORWARD SEGMENT	165505.031	389.545	200.000	200.000	136.725	124.109	136.725
CASE	14395.715	382.327	200.000	200.000	16.934	17.215	16.934
INSULATION	3913.519	377.359	200.000	200.000	4.413	4.362	4.413
LINER	182.688	377.496	200.000	200.000	0.205	0.201	0.205
PROPELLANT	147013.110	390.591	200.000	200.000	114.845	102.331	114.845
CENTER SEGMENT 1	314290.942	609.228	200.000	200.000	558.943	240.770	558.943
CASE	22943.254	609.375	200.000	200.000	49.373	29.955	49.373
INSULATION	1295.944	608.391	200.000	200.000	4.217	1.661	4.217
LINER	289.369	609.225	200.000	200.000	0.588	0.371	0.588
PROPELLANT	289762.376	609.220	200.000	200.000	504.764	208.783	504.764
CENTER SEGMENT 2	314290.942	890.728	200.000	200.000	558.943	240.770	558.943
CASE	22943.254	890.875	200.000	200.000	49.373	29.955	49.373
INSULATION	1295.944	889.891	200.000	200.000	4.217	1.661	4.217
LINER	289.369	890.725	200.000	200.000	0.588	0.371	0.588
PROPELLANT	289762.376	890.720	200.000	200.000	504.764	208.783	504.764
CENTER SEGMENT 3	314290.942	1172.228	200.000	200.000	558.943	240.770	558.943
CASE	22943.254	1172.375	200.000	200.000	49.373	29.955	49.373
INSULATION	1295.944	1171.391	200.000	200.000	4.217	1.661	4.217
LINER	289.369	1172.225	200.000	200.000	0.588	0.371	0.588
PROPELLANT	289762.376	1172.220	200.000	200.000	504.764	208.783	504.764
AFT SEGMENT	221308.855	1414.789	200.000	200.000	251.091	169.293	251.091
CASE	18950.505	1425.965	200.000	200.000	29.052	22.953	29.052
INSULATION	4104.268	1481.034	200.000	200.000	5.549	3.664	5.549
LINER	227.179	1423.845	200.000	200.000	0.330	0.269	0.330
PROPELLANT	198026.903	1412.336	200.000	200.000	211.501	142.408	211.501
TOTAL SEGMENT ASSEMBLY	1330234.713	915.559	200.000	200.000	34742.545	1016.432	34742.545
CASE	102723.980	918.314	200.000	200.000	2949.030	130.752	2949.030
INSULATION	11905.618	925.203	200.000	200.000	595.198	13.010	595.198
LINER	1277.973	912.128	200.000	200.000	36.395	1.582	36.395
PROPELLANT	1214327.141	915.235	200.000	200.000	31161.484	871.088	31161.484
IGNITER ASSEMBLY	570.867	295.486	199.999	199.998	0.371	0.692	0.371
NOZZLE ASSEMBLY	11862.340	1558.736	200.000	200.000	7.943	4.365	7.943
RACEWAY ASSEMBLY	171.200	934.313	161.000	270.000	4.649	0.001	4.649

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE V (Cont) MASS PROPERTIES SUMMARY PART II

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
TOTAL MOTOR	1345654.463	921.531	200.021	199.995	35077.877	1024.973	36078.098
MASS FRACTION	0.902						
NOSE CONE	9268.770	235.116	202.609	200.339	11.405	6.263	11.374
AFT SKIRT	12112.415	1557.996	203.802	200.038	15.529	15.461	13.733
STAGE ATTACH PROVISIONS	5176.540	376.470	256.587	203.831	159.184	6.948	154.991
TVC SYSTEM	2154.043	1465.983	215.680	191.661	24.911	2.092	25.171
INSTRUMENTATION	551.995	411.190	232.144	248.984	0.064	0.215	0.167
THRUST TERMINATION SYSTEM	661.300	268.939	201.181	199.456	0.513	1.007	0.516
DESTRUCT SYSTEM	210.700	707.977	189.756	260.746	7.690	0.110	7.776
STAGING MOTORS	296.000	922.750	150.250	243.000	25.503	0.006	25.503
RECOVERY SYSTEM	11133.000	1586.741	195.743	235.712	71.775	15.120	73.497
TOTAL STAGE	1384403.883	925.580	200.249	200.339	39797.781	1076.683	39794.184
MASS FRACTION	0.877						
TOTAL STAGE 2 EA.	2768807.765	925.580	450.249	200.339	79595.562	39504.628	116939.630

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VI. MASS PROPERTIES SUMMARY PART II

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
FORWARD SEGMENT	178434.881	238.531	100.000	209.700	173.459	132.441	173.459
CASE	15110.007	231.512	100.000	209.700	19.169	18.148	19.169
INSULATION	3973.177	224.628	100.000	209.700	4.869	4.439	4.869
LINER	212.263	235.948	100.000	209.700	0.283	0.238	0.283
PROPELLANT	159139.434	239.548	100.000	209.700	148.775	109.616	148.775
CENTER SEGMENT 1	313757.159	480.862	100.000	209.700	539.449	240.074	539.449
CASE	22427.376	479.124	100.000	209.700	46.764	29.282	46.764
INSULATION	1284.808	478.153	100.000	209.700	4.025	1.647	4.025
LINER	282.599	478.975	100.000	209.700	0.556	0.362	0.556
PROPELLANT	289762.376	481.010	100.000	209.700	488.085	208.783	488.085
CENTER SEGMENT 2	313757.159	755.862	100.000	209.700	539.449	240.074	539.449
CASE	22427.376	754.124	100.000	209.700	46.764	29.282	46.764
INSULATION	1284.808	753.153	100.000	209.700	4.025	1.647	4.025
LINER	282.599	753.975	100.000	209.700	0.556	0.362	0.556
PROPELLANT	289762.376	756.010	100.000	209.700	488.085	208.783	488.085
CENTER SEGMENT 3	313757.159	1030.862	100.000	209.700	539.449	240.074	539.449
CASE	22427.376	1029.124	100.000	209.700	46.764	29.282	46.764
INSULATION	1284.808	1028.153	100.000	209.700	4.025	1.647	4.025
LINER	282.599	1028.975	100.000	209.700	0.556	0.362	0.556
PROPELLANT	289762.376	1031.010	100.000	209.700	488.085	208.783	488.085
CENTER SEGMENT 4	313757.159	1305.862	100.000	209.700	539.449	240.074	539.449
CASE	22427.376	1304.124	100.000	209.700	46.764	29.282	46.764
INSULATION	1284.808	1303.153	100.000	209.700	4.025	1.647	4.025
LINER	282.599	1303.975	100.000	209.700	0.556	0.362	0.556
PROPELLANT	289762.376	1306.010	100.000	209.700	488.085	208.783	488.085
AFT SEGMENT	204424.446	1543.668	100.000	209.700	170.879	156.134	170.879
CASE	17739.859	1547.479	100.000	209.700	25.308	21.371	25.308
INSULATION	4037.032	1597.831	100.000	209.700	4.878	3.577	4.878
LINER	211.308	1544.710	100.000	209.700	0.281	0.249	0.281
PROPELLANT	182436.248	1542.098	100.000	209.700	137.703	130.936	137.703

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VI. (Cont) MASS PROPERTIES SUMMARY PART II

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
TOTAL SEGMENT ASSEMBLY	1638572.963	903.183	100.000	209.700	63272.271	1249.766	63272.271
CASE	123244.370	905.090	100.000	209.700	5148.067	157.543	5148.067
INSULATION	13149.442	906.521	100.000	209.700	946.167	14.604	946.167
LINER	1553.966	890.760	100.000	209.700	65.003	1.934	65.003
PROPELLANT	1500625.185	903.010	100.000	209.700	57112.844	1075.685	57112.844
IGNITER ASSEMBLY	660.229	138.401	99.999	209.698	0.379	0.693	0.379
NOZZLE ASSEMBLY	12723.745	1767.587	100.000	209.700	43.574	5.292	43.574
RACEWAY ASSEMBLY	213.400	899.665	61.000	279.700	8.785	0.001	8.785
TVC SYSTEM	2259.639	1554.153	117.355	201.761	49.520	2.199	49.839
TOTAL MOTOR	1654429.976	910.414	100.019	209.698	65698.157	1258.425	65698.437
3 EA MOTOR ASSY	4963289.928	910.414	100.019	99.998	203540.383	16666.706	203540.831
MASS FRACTION	0.907						
FORWARD THRUST STRUCTURE	34806.000	123.441	100.000	209.700	44.147	100.630	44.147
AFT SKIRT	31215.500	1722.049	100.000	100.700	147.192	256.066	147.192
INSTRUMENTATION	1655.985	139.090	132.144	148.987	2.343	4.947	2.651
TOTAL STAGE	5030967.414	909.751	100.029	100.781	213127.549	17118.931	213038.460
MASS FRACTION	0.895						

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VII. MASS PROPERTIES SUMMARY PART III

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CASE	102754.980	918.487	200.000	200.000	2951.267	130.792	2951.267
FORWARD SEGMENT	14395.715	382.327	200.000	200.000	16.934	17.215	16.934
CENTER SEGMENT 1	22943.254	609.375	200.000	200.000	49.373	29.955	49.373
CENTER SEGMENT 2	22943.254	890.875	200.000	200.000	49.373	29.955	49.373
CENTER SEGMENT 3	22943.254	1172.375	200.000	200.000	49.373	29.955	49.373
AFT SEGMENT	18950.505	1425.965	200.000	200.000	29.052	22.953	29.052
INSULATION	11905.618	925.203	200.000	200.000	595.198	13.010	595.198
EXPENDED PAT	0.949	286.019	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	4076.941	920.789	200.000	200.000	199.781	4.404	199.781
FORWARD SEGMENT	1300.023	374.124	200.000	200.000	1.549	1.413	1.549
CENTER SEGMENT 1	468.640	606.018	200.000	200.000	1.862	0.587	1.862
CENTER SEGMENT 2	468.640	887.518	200.000	200.000	1.862	0.587	1.862
CENTER SEGMENT 3	468.640	1169.018	200.000	200.000	1.862	0.587	1.862
AFT SEGMENT	1370.999	1473.273	200.000	200.000	2.100	1.231	2.100
UNEXPENDED EAT	7827.727	927.579	200.000	200.000	395.307	8.605	395.307
FORWARD SEGMENT	2612.546	379.002	200.000	200.000	2.858	2.948	2.858
CENTER SEGMENT 1	827.304	609.736	200.000	200.000	2.355	1.075	2.355
CENTER SEGMENT 2	827.304	891.236	200.000	200.000	2.355	1.075	2.355
CENTER SEGMENT 3	827.304	1172.736	200.000	200.000	2.355	1.075	2.355
AFT SEGMENT	2733.269	1484.927	200.000	200.000	3.422	2.433	3.422
LINER	1277.973	912.128	200.000	200.000	36.395	1.582	36.395
EXPENDED PAT	3.370	878.975	200.000	200.000	0.098	0.004	0.098
FORWARD SEGMENT	0.534	388.281	200.000	200.000	0.001	0.000	0.001
CENTER SEGMENT 1	0.745	581.765	200.000	200.000	0.003	0.001	0.003
CENTER SEGMENT 2	0.745	863.265	200.000	200.000	0.003	0.001	0.003
CENTER SEGMENT 3	0.745	1144.765	200.000	200.000	0.003	0.001	0.003
AFT SEGMENT	0.603	1371.510	200.000	200.000	0.001	0.001	0.001
EXPENDED TDAT	636.271	888.673	200.000	200.000	25.759	0.754	25.759
FORWARD SEGMENT	180.724	377.361	200.000	200.000	0.203	0.199	0.203
CENTER SEGMENT 1	95.697	609.371	200.000	200.000	0.341	0.120	0.341
CENTER SEGMENT 2	95.697	890.871	200.000	200.000	0.341	0.120	0.341
CENTER SEGMENT 3	95.697	1172.371	200.000	200.000	0.341	0.120	0.341
AFT SEGMENT	168.456	1433.475	200.000	200.000	0.270	0.194	0.270
UNEXPENDED EAT	638.333	935.683	200.000	200.000	10.385	0.825	10.385
FORWARD SEGMENT	1.430	390.570	200.000	200.000	0.001	0.002	0.001
CENTER SEGMENT 1	192.927	609.259	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 2	192.927	890.759	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 3	192.927	1172.259	200.000	200.000	0.244	0.249	0.244
AFT SEGMENT	58.120	1396.475	200.000	200.000	0.045	0.075	0.045

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE VII. (Cont) MASS PROPERTIES SUMMARY PART III

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
IGNITER ASSEMBLY	569.777	295.444	199.999	199.998	0.371	0.692	0.371
EXPENDED PAT	221.827	297.749	200.000	200.000	0.006	0.002	0.006
EXPENDED TDAT	31.500	300.694	200.000	200.000	0.001	0.001	0.001
UNEXPENDED EAT	316.449	293.305	199.999	199.996	0.364	0.690	0.364
RACEWAY ASSEMBLY	171.200	934.313	161.000	270.000	4.649	0.001	4.649
FORWARD SEGMENT	24.900	401.000	161.000	270.000	0.017	0.000	0.017
CENTER SEGMENT 1	38.600	638.250	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 2	38.600	919.750	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 3	38.600	1201.250	161.000	270.000	0.055	0.000	0.055
AFT SEGMENT	30.500	1425.000	161.000	270.000	0.028	0.000	0.028
NOZZLE ASSEMBLY	10285.993	1564.586	200.000	200.000	6.836	4.093	6.836
EXPENDED PAT	54.006	1558.098	200.000	200.000	0.036	0.019	0.036
EXPENDED TDAT	2376.520	1558.098	200.000	200.000	1.566	0.840	1.566
UNEXPENDED EAT	7855.467	1566.593	200.000	200.000	5.205	3.234	5.205
TOTAL MOTOR INERT PARTS	126965.541	968.621	199.947	200.094	4500.673	150.407	4500.548
EXPENDED PAT	280.153	547.664	200.000	200.000	15.125	0.025	15.125
EXPENDED TDAT	7020.012	1123.424	200.000	200.000	370.119	5.868	370.119
UNEXPENDED EAT	119665.376	960.526	199.944	200.100	4066.711	144.514	4066.586
PROPELLANT	1217663.813	913.566	200.000	200.000	31428.524	872.007	31428.524
EXPENDED PAT	26343.836	957.672	200.000	200.000	1033.113	6.357	1033.113
FORWARD DOME	6433.527	402.553	200.000	200.000	5.081	2.844	5.081
CENTER SEGMENT 1	3612.808	609.250	200.000	200.000	5.337	0.594	5.337
CENTER SEGMENT 2	3612.808	890.750	200.000	200.000	5.337	0.594	5.337
CENTER SEGMENT 3	3612.808	1172.250	200.000	200.000	5.337	0.594	5.337
AFT SEGMENT	5459.076	1416.445	200.000	200.000	4.813	1.138	4.813
EXPENDED TDAT	1194932.785	914.227	200.000	200.000	30617.115	866.243	30617.115
FORWARD SEGMENT	143916.255	388.102	200.000	200.000	115.206	100.406	115.206
CENTER SEGMENT 1	286149.568	609.220	200.000	200.000	499.427	208.189	499.427
CENTER SEGMENT 2	286149.568	890.720	200.000	200.000	499.427	208.189	499.427
CENTER SEGMENT 3	286149.568	1172.220	200.000	200.000	499.427	208.189	499.427
AFT SEGMENT	192567.827	1412.220	200.000	200.000	206.667	141.269	206.667
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
FORWARD SEGMENT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 1	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 2	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 3	0.0	0.0	200.000	200.000	0.0	0.0	0.0
AFT SEGMENT	0.0	0.0	200.000	200.000	0.0	0.0	0.0

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VII. (Cont) MASS PROPERTIES SUMMARY PART III

LASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
MOTOR ASSEMELY	1344629.354	918.765	199.995	200.009	36004.419	1022.414	36004.294
EXPENDED PAT	23011.180	874.795	200.000	200.000	827.051	5.789	827.051
EXPENDED TOAT	1201952.797	915.449	200.000	200.000	31053.157	872.111	31053.157
UNEXPENDED EAT	119665.376	960.526	199.944	200.100	4066.711	144.514	4066.586
MASS FRACTION	0.906						
NOSE CONE	9274.550	235.079	202.628	200.338	11.410	6.264	11.380
AFT SKIRT	12112.415	1557.996	203.802	200.038	15.529	15.461	13.733
STAGE ATTACH PROVISIONS	5176.540	376.470	256.587	203.831	159.184	6.948	154.991
INSTRUMENTATION	551.995	411.190	232.144	248.984	0.064	0.215	0.167
STAGE INERTS	27115.500	856.600	214.054	201.861	2527.097	31.767	2523.496
TOTAL STAGE INERTS	154081.041	948.908	202.430	200.405	7088.304	183.148	7085.522
EXPENDED PAT	280.153	547.664	200.000	200.000	15.125	0.025	15.125
EXPENDED TOAT	7020.012	1123.424	200.000	200.000	370.119	5.868	370.119
UNEXPENDED EAT	146780.877	941.327	202.551	200.425	6645.357	177.245	6642.566
TOTAL STAGE	1371744.854	917.536	200.273	200.046	38553.706	1055.334	38551.094
EXPENDED PAT	23011.180	874.795	200.000	200.000	827.051	5.789	827.051
EXPENDED TOAT	1201952.797	915.449	200.000	200.000	31053.157	872.111	31053.157
UNEXPENDED EAT	146780.877	941.327	202.551	200.425	6645.357	177.245	6642.566
MASS FRACTION	0.888						
TOTAL STAGE 2 EA.	2743489.707	917.536	450.273	200.046	77107.412	39120.389	114111.908
EXPENDED PAT	46022.360	874.795	450.000	200.000	1654.102	632.420	2274.944
EXPENDED TOAT	2403905.594	915.449	450.000	200.000	62106.314	34172.948	94535.039
UNEXPENDED EAT	293561.753	941.327	452.551	200.425	13290.714	4314.643	17245.285

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VIII. MASS PROPERTIES SUMMARY PART III

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CASE	102723.980	918.314	200.000	200.000	2949.030	130.752	2949.030
FORWARD SEGMENT	14395.715	382.327	200.000	200.000	16.934	17.215	16.934
CENTER SEGMENT 1	22943.254	609.375	200.000	200.000	49.373	29.955	49.373
CENTER SEGMENT 2	22943.254	890.875	200.000	200.000	49.373	29.955	49.373
CENTER SEGMENT 3	22943.254	1172.375	200.000	200.000	49.373	29.955	49.373
AFT SEGMENT	18950.505	1425.955	200.000	200.000	29.052	22.953	29.052
INSULATION	11905.618	925.203	200.000	200.000	595.198	13.010	595.198
EXPENDED PAT	0.949	286.019	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	4076.941	920.789	200.000	200.000	199.781	4.404	199.781
FORWARD SEGMENT	1300.023	374.124	200.000	200.000	1.549	1.413	1.549
CENTER SEGMENT 1	468.640	636.018	200.000	200.000	1.862	0.587	1.862
CENTER SEGMENT 2	468.640	887.518	200.000	200.000	1.862	0.587	1.862
CENTER SEGMENT 3	468.640	1169.018	200.000	200.000	1.862	0.587	1.862
AFT SEGMENT	1370.999	1473.273	200.000	200.000	2.100	1.231	2.100
UNEXPENDED EAT	7827.727	927.579	200.000	200.000	395.307	8.605	395.307
FORWARD SEGMENT	2612.546	379.002	200.000	200.000	2.858	2.948	2.858
CENTER SEGMENT 1	827.304	609.736	200.000	200.000	2.355	1.075	2.355
CENTER SEGMENT 2	827.304	891.236	200.000	200.000	2.355	1.075	2.355
CENTER SEGMENT 3	827.304	1172.736	200.000	200.000	2.355	1.075	2.355
AFT SEGMENT	2733.269	1484.927	200.000	200.000	3.422	2.433	3.422
LINER	1277.973	912.128	200.000	200.000	36.395	1.582	36.395
EXPENDED PAT	3.370	878.975	200.000	200.000	0.098	0.004	0.098
FORWARD SEGMENT	0.534	388.281	200.000	200.000	0.001	0.000	0.001
CENTER SEGMENT 1	0.745	581.755	200.000	200.000	0.003	0.001	0.003
CENTER SEGMENT 2	0.745	863.265	200.000	200.000	0.003	0.001	0.003
CENTER SEGMENT 3	0.745	1144.755	200.000	200.000	0.003	0.001	0.003
AFT SEGMENT	0.603	1371.510	200.000	200.000	0.001	0.001	0.001
EXPENDED TDAT	636.271	888.673	200.000	200.000	25.759	0.754	25.759
FORWARD SEGMENT	180.724	377.361	200.000	200.000	0.203	0.199	0.203
CENTER SEGMENT 1	95.697	609.371	200.000	200.000	0.341	0.120	0.341
CENTER SEGMENT 2	95.697	890.871	200.000	200.000	0.341	0.120	0.341
CENTER SEGMENT 3	95.697	1172.371	200.000	200.000	0.341	0.120	0.341
AFT SEGMENT	168.456	1433.475	200.000	200.000	0.270	0.194	0.270
UNEXPENDED EAT	638.333	935.683	200.000	200.000	10.385	0.825	10.385
FORWARD SEGMENT	1.430	390.570	200.000	200.000	0.001	0.002	0.001
CENTER SEGMENT 1	192.927	609.259	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 2	192.927	890.759	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 3	192.927	1172.259	200.000	200.000	0.244	0.249	0.244
AFT SEGMENT	58.120	1396.475	200.000	200.000	0.045	0.075	0.045

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VIII. (Cont) MASS PROPERTIES SUMMARY PART III

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
IGNITER ASSEMBLY	570.867	295.486	199.999	199.998	0.371	0.692	0.371
EXPENDED PAT	222.372	297.798	200.000	200.000	0.006	0.002	0.006
EXPENDED TDAT	31.500	300.694	200.000	200.000	0.001	0.001	0.001
UNEXPENDED EAT	316.995	293.347	199.999	199.996	0.364	0.690	0.364
RACEWAY ASSEMBLY	171.200	934.313	161.000	270.000	4.649	0.001	4.649
FORWARD SEGMENT	24.900	401.000	161.000	270.000	0.017	0.000	0.017
CENTER SEGMENT 1	38.600	638.250	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 2	38.600	919.750	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 3	38.600	1201.250	161.000	270.000	0.055	0.000	0.055
AFT SEGMENT	30.500	1425.000	161.000	270.000	0.028	0.000	0.028
NOZZLE ASSEMBLY	11862.340	1558.736	200.000	200.000	7.943	4.365	7.943
FIXED PART	2627.926	1525.529	200.000	200.000	0.420	0.770	0.420
EXPENDED PAT	5.557	1518.812	200.000	200.000	0.001	0.002	0.001
EXPENDED TDAT	244.553	1518.812	200.000	200.000	0.038	0.071	0.038
UNEXPENDED EAT	2377.815	1526.235	200.000	200.000	0.378	0.697	0.378
MOVABLE PART	9097.414	1568.677	200.000	200.000	6.666	3.551	6.666
EXPENDED PAT	51.731	1574.769	200.000	200.000	0.041	0.021	0.041
EXPENDED TDAT	2276.379	1574.769	200.000	200.000	1.792	0.914	1.792
UNEXPENDED EAT	9534.231	1554.821	200.000	200.000	5.950	3.430	5.950
TVC SYSTEM	2154.043	1465.983	215.680	191.661	24.911	2.092	25.171
THRUST TERMINATION SYSTEM	661.300	268.939	201.181	199.456	0.513	1.007	0.516
TOTAL MOTOR INERT PARTS	131327.322	979.752	200.212	199.952	4809.921	153.884	4810.141
EXPENDED PAT	283.980	561.167	200.000	200.000	16.135	0.028	16.135
EXPENDED TDAT	7164.424	1136.141	200.000	200.000	381.558	6.014	381.558
UNEXPENDED EAT	123878.918	971.667	200.225	199.949	4361.920	147.842	4362.140

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VIII.(Cont) MASS PROPERTIES SUMMARY PART III

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
PROPELLANT	1214327.141	915.235	200.000	200.000	31161.484	871.088	31161.484
EXPENDED PAT	24167.414	918.796	200.000	200.000	933.930	5.996	944.211
FORWARD DOME	6425.090	402.836	200.000	200.000	5.026	2.896	15.307
CENTER SEGMENT 1	3612.808	609.250	200.000	200.000	5.337	0.594	5.337
CENTER SEGMENT 2	3612.808	890.750	200.000	200.000	5.337	0.594	5.337
CENTER SEGMENT 3	3612.808	1172.250	200.000	200.000	5.337	0.594	5.337
AFT SEGMENT	3291.091	1431.206	200.000	200.000	3.276	0.724	3.276
EXPENDED TDAT	1193772.535	916.792	200.000	200.000	30458.338	865.686	30448.057
FORWARD SEGMENT	140588.020	390.032	200.000	200.000	109.601	99.435	99.320
CENTER SEGMENT 1	286149.568	609.220	200.000	200.000	499.427	208.189	499.427
CENTER SEGMENT 2	286149.568	890.720	200.000	200.000	499.427	208.189	499.427
CENTER SEGMENT 3	286149.568	1172.220	200.000	200.000	499.427	208.189	499.427
AFT SEGMENT	194735.812	1412.017	200.000	200.000	207.968	141.683	207.968
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
MOTOR ASSEMBLY	1345654.463	921.531	200.021	199.995	36077.877	1024.973	36078.098
EXPENDED PAT	20838.585	821.177	200.000	200.000	686.549	5.430	696.830
EXPENDED TDAT	1200936.959	918.101	200.000	200.000	30913.854	871.700	30903.573
UNEXPENDED EAT	124089.618	971.219	200.207	200.052	4372.935	148.124	4373.077
MASS FRACTION	0.902						
NOSE CONE	9268.770	235.116	202.609	200.339	11.405	6.263	11.374
AFT SKIRT	12112.415	1557.996	203.802	200.038	15.529	15.461	13.733
STAGE ATTACH PROVISIONS	5176.540	376.470	256.587	203.831	159.184	6.948	154.991
INSTRUMENTATION	551.995	411.190	232.144	248.984	0.064	0.215	0.167

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE VIII. (Cont) MASS PROPERTIES SUMMARY PART III

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
DESTRUCT SYSTEM	210.700	707.977	189.756	260.746	7.690	0.110	7.776
SAFE AND ARMING DEVICE	5.000	307.000	192.735	275.164	0.000	0.000	0.000
BATTERY	53.000	307.000	267.634	232.970	0.000	0.000	0.000
DESTRUCT SYSTEM	152.700	860.280	162.629	269.914	4.901	0.004	4.905
FORWARD SEGMENT	33.100	345.056	168.514	269.605	0.023	0.004	0.026
CENTER SEGMENT 1	31.500	609.250	161.000	270.000	0.045	0.000	0.045
CENTER SEGMENT 2	31.500	890.750	161.000	270.000	0.045	0.000	0.045
CENTER SEGMENT 3	31.500	1172.250	161.000	270.000	0.045	0.000	0.045
AFT SEGMENT	25.100	1425.000	161.000	270.000	0.023	0.000	0.023
STAGING MOTORS	296.000	922.750	150.250	248.000	25.503	0.006	25.503
RECOVERY SYSTEM	11133.000	1586.741	195.743	235.712	71.775	15.120	73.497
STAGE INERTS	38538.720	1068.132	208.272	211.995	3534.934	49.714	3531.806
TOTAL STAGE INERTS	169866.042	999.803	202.041	202.684	8396.020	204.949	8392.597
EXPENDED PAT	283.980	561.157	200.000	200.000	15.135	0.028	16.135
EXPENDED TDAT	7164.424	1136.141	200.000	200.000	381.558	6.014	381.558
UNEXPENDED EAT	162417.638	994.555	202.134	202.807	7956.813	198.887	7953.395
TOTAL STAGE	1384403.883	925.580	200.249	200.339	39797.781	1076.683	39794.184
EXPENDED PAT	20838.585	821.177	200.000	200.000	686.549	5.430	696.830
EXPENDED TDAT	1200936.959	918.101	200.000	200.000	30913.854	871.700	30903.573
UNEXPENDED EAT	162628.338	994.185	202.118	202.882	7968.386	199.157	7964.908
MASS FRACTION	0.877						
1							
TOTAL STAGE 2 EA.	2768807.765	925.580	450.249	200.339	79595.562	39504.628	116939.630
EXPENDED PAT	41677.171	821.177	450.000	200.000	1373.097	573.086	1955.885
EXPENDED TDAT	2401873.918	918.101	450.000	200.000	61827.707	34144.718	94208.463
UNEXPENDED EAT	325256.676	994.185	452.118	202.882	15936.772	4786.031	20317.534

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE IX. MASS PROPERTIES SUMMARY PART III

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CASE	123244.370	905.090	100.000	209.700	5148.067	157.543	5148.067
FORWARD SEGMENT	15110.007	231.512	100.000	209.700	19.169	18.148	19.169
CENTER SEGMENT 1	22427.376	479.124	100.000	209.700	46.764	29.282	46.764
CENTER SEGMENT 2	22427.376	754.124	100.000	209.700	46.764	29.282	46.764
CENTER SEGMENT 3	22427.376	1029.124	100.000	209.700	46.764	29.282	46.764
CENTER SEGMENT 4	22427.376	1304.124	100.000	209.700	46.764	29.282	46.764
AFT SEGMENT	17739.859	1547.479	100.000	209.700	25.308	21.371	25.308
INSULATION	13149.442	906.521	100.000	209.700	946.167	14.604	946.167
EXPENDED PAT	0.949	130.019	100.000	209.700	0.000	0.000	0.000
EXPENDED TDAT	4590.242	899.056	100.000	209.700	322.234	5.049	322.234
FORWARD SEGMENT	1359.681	224.819	100.000	209.700	1.842	1.490	1.842
CENTER SEGMENT 1	468.640	475.835	100.000	209.700	1.781	0.587	1.781
CENTER SEGMENT 2	468.640	750.835	100.000	209.700	1.781	0.587	1.781
CENTER SEGMENT 3	468.640	1025.835	100.000	209.700	1.781	0.587	1.781
CENTER SEGMENT 4	468.640	1300.835	100.000	209.700	1.781	0.587	1.781
AFT SEGMENT	1356.002	1589.944	100.000	209.700	1.856	1.211	1.856
UNEXPENDED EAT	8558.251	910.612	100.000	209.700	623.723	9.555	623.723
FORWARD SEGMENT	2612.546	224.562	100.000	209.700	3.025	2.948	3.025
CENTER SEGMENT 1	816.168	479.484	100.000	209.700	2.243	1.060	2.243
CENTER SEGMENT 2	816.168	754.484	100.000	209.700	2.243	1.060	2.243
CENTER SEGMENT 3	816.168	1029.484	100.000	209.700	2.243	1.060	2.243
CENTER SEGMENT 4	816.168	1304.484	100.000	209.700	2.243	1.060	2.243
AFT SEGMENT	2681.031	1601.820	100.000	209.700	2.995	2.365	2.995
LINER	1553.966	890.760	100.000	209.700	65.003	1.934	65.003
EXPENDED PAT	4.114	877.260	100.000	209.700	0.172	0.005	0.172
FORWARD SEGMENT	0.534	248.511	100.000	209.700	0.001	0.000	0.001
CENTER SEGMENT 1	0.745	452.158	100.000	209.700	0.003	0.001	0.003
CENTER SEGMENT 2	0.745	727.158	100.000	209.700	0.003	0.001	0.003
CENTER SEGMENT 3	0.745	1002.158	100.000	209.700	0.003	0.001	0.003
CENTER SEGMENT 4	0.745	1277.158	100.000	209.700	0.003	0.001	0.003
AFT SEGMENT	0.603	1496.038	100.000	209.700	0.001	0.001	0.001
EXPENDED TDAT	760.748	857.025	100.000	209.700	44.698	0.910	44.698
FORWARD SEGMENT	209.504	235.776	100.000	209.700	0.280	0.234	0.280
CENTER SEGMENT 1	95.697	479.118	100.000	209.700	0.325	0.120	0.325
CENTER SEGMENT 2	95.697	754.118	100.000	209.700	0.325	0.120	0.325
CENTER SEGMENT 3	95.697	1029.118	100.000	209.700	0.325	0.120	0.325
CENTER SEGMENT 4	95.697	1304.118	100.000	209.700	0.325	0.120	0.325
AFT SEGMENT	168.456	1551.046	100.000	209.700	0.241	0.194	0.241

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE IX. (Cont) MASS PROPERTIES SUMMARY PART III

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
UNEXPENDED EAT	789.104	923.354	100.000	209.700	19.765	1.019	19.765
FORWARD SEGMENT	2.226	249.070	100.000	209.700	0.002	0.003	0.002
CENTER SEGMENT 1	186.157	479.009	100.000	209.700	0.227	0.241	0.227
CENTER SEGMENT 2	186.157	754.009	100.000	209.700	0.227	0.241	0.227
CENTER SEGMENT 3	186.157	1029.009	100.000	209.700	0.227	0.241	0.227
CENTER SEGMENT 4	186.157	1304.009	100.000	209.700	0.227	0.241	0.227
AFT SEGMENT	42.249	1520.140	100.000	209.700	0.031	0.054	0.031
IGNITER ASSEMBLY	660.229	138.401	99.999	209.698	0.379	0.693	0.379
EXPENDED PAT	271.067	140.848	100.000	209.700	0.009	0.003	0.009
EXPENDED TDAT	37.699	143.803	100.000	209.700	0.001	0.001	0.001
UNEXPENDED EAT	351.463	135.933	99.999	209.696	0.368	0.690	0.368
RACEWAY ASSEMBLY	213.400	899.665	61.000	279.700	8.785	0.001	8.785
FORWARD SEGMENT	30.300	245.350	61.000	279.700	0.028	0.000	0.028
CENTER SEGMENT 1	38.600	495.800	61.000	279.700	0.053	0.000	0.053
CENTER SEGMENT 2	38.600	770.800	61.000	279.700	0.053	0.000	0.053
CENTER SEGMENT 3	38.600	1045.800	61.000	279.700	0.053	0.000	0.053
CENTER SEGMENT 4	38.600	1320.800	61.000	279.700	0.053	0.000	0.053
AFT SEGMENT	28.700	1544.000	61.000	279.700	0.022	0.000	0.022
TVC SYSTEM	2259.639	1554.153	117.355	201.751	49.520	2.199	49.839
NOZZLE ASSEMBLY	12723.745	1767.587	100.000	209.700	43.574	5.292	43.574
FIXED PART	2756.824	1634.964	100.000	209.700	0.503	0.934	0.503
EXPENDED PAT	5.732	1628.414	100.000	209.700	0.001	0.002	0.001
EXPENDED TDAT	252.256	1628.414	100.000	209.700	0.045	0.085	0.045
UNEXPENDED EAT	2498.836	1635.641	100.000	209.700	0.455	0.848	0.455
MOVABLE PART	9829.922	1806.491	100.000	209.700	28.926	4.313	28.926
EXPENDED PAT	55.177	1678.157	100.000	209.700	0.042	0.023	0.042
EXPENDED TDAT	2428.044	1678.157	100.000	209.700	1.827	1.028	1.827
UNEXPENDED EAT	10240.525	1789.272	100.000	209.700	36.380	4.241	36.380
TOTAL MOTOR INERT PARTS	153804.791	982.656	100.201	209.680	8394.302	182.738	8394.580
EXPENDED PAT	337.041	426.782	100.000	209.700	25.641	0.033	25.641
EXPENDED TDAT	7982.765	1144.430	100.000	209.700	609.025	6.960	609.025
UNEXPENDED EAT	145484.986	975.067	100.212	209.679	7690.257	175.745	7690.535

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE IX. (Cont) MASS PROPERTIES SUMMARY PART III

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
PROPELLANT	1500625.185	903.010	100.000	209.700	57112.844	1075.685	57112.844
EXPENDED PAT	21685.810	861.817	100.000	209.700	993.156	3.742	993.156
FORWARD DOME	4156.139	236.272	100.000	209.700	3.560	0.683	3.560
CENTER SEGMENT 1	3612.808	482.250	100.000	209.700	5.337	0.594	5.337
CENTER SEGMENT 2	3612.808	757.250	100.000	209.700	5.337	0.594	5.337
CENTER SEGMENT 3	3612.808	1032.250	100.000	209.700	5.337	0.594	5.337
CENTER SEGMENT 4	3612.808	1307.250	100.000	209.700	5.337	0.594	5.337
AFT SEGMENT	3078.439	1551.751	100.000	209.700	2.695	0.684	2.695
EXPENDED TDAT	1478939.374	903.614	100.000	209.700	56111.630	1071.943	56111.630
FORWARD SEGMENT	154983.295	239.636	100.000	209.700	145.204	108.933	145.204
CENTER SEGMENT 1	286149.568	480.995	100.000	209.700	482.747	208.189	482.747
CENTER SEGMENT 2	286149.568	755.995	100.000	209.700	482.747	208.189	482.747
CENTER SEGMENT 3	286149.568	1030.995	100.000	209.700	482.747	208.189	482.747
CENTER SEGMENT 4	286149.568	1305.995	100.000	209.700	482.747	208.189	482.747
AFT SEGMENT	179357.809	1541.932	100.000	209.700	134.945	130.253	134.945
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
FORWARD SEGMENT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 1	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 2	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 3	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 4	0.000	0.000	100.000	209.700	0.000	0.0	0.000
AFT SEGMENT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
MOTOR ASSEMBLY	1654429.976	910.414	100.019	209.698	65698.157	1258.425	65698.437
EXPENDED PAT	22022.851	855.159	100.000	209.700	1032.354	3.775	1032.354
EXPENDED TDAT	1486922.139	904.906	100.000	209.700	56820.039	1078.903	56820.039
UNEXPENDED EAT	145484.986	975.067	100.212	209.679	7690.257	175.745	7690.535
3 EA MOTOR ASSY	4963289.928	910.414	100.019	99.998	203540.383	16666.706	203540.831
EXPENDED PAT	66068.552	855.159	100.000	100.003	3182.860	182.923	3182.861
EXPENDED TDAT	4460766.418	904.906	100.000	100.003	176253.039	14822.557	176253.041
UNEXPENDED EAT	436454.958	975.067	100.212	99.983	23637.568	1660.831	23638.402
MASS FRACTION	0.907						
FORWARD THRUST STRUCTURE	34806.000	123.441	100.000	209.700	44.147	100.630	44.147

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE IX. (Cont) MASS PROPERTIES SUMMARY PART III

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SKIRT	31215.500	1722.049	100.000	100.700	147.192	256.066	147.192
INSTRUMENTATION	1655.985	139.090	132.144	148.987	2.343	4.947	2.651
STAGE INERTS	67677.485	861.164	100.787	157.939	9504.228	404.234	9462.666
TOTAL STAGE INERTS	529091.860	967.116	100.276	107.397	35517.164	2193.663	35433.652
EXPENDED PAT	1011.122	426.782	100.000	100.000	78.236	2.724	78.236
EXPENDED TDAT	23948.295	1144.430	100.000	100.003	1858.174	83.081	1858.174
UNEXPENDED EAT	504132.443	959.776	100.289	107.763	33348.350	2107.548	33265.147
TOTAL STAGE	5030967.414	909.751	100.029	100.781	213127.549	17118.931	213038.460
EXPENDED PAT	66068.552	855.159	100.000	100.003	3182.860	182.923	3182.861
EXPENDED TDAT	4460766.418	904.906	100.000	100.003	176253.039	14822.557	176253.041
UNEXPENDED EAT	504132.443	959.776	100.289	107.763	33348.351	2107.548	33265.147
MASS FRACTION	0.895						

TABLE X. DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY			MOMENT OF INERTIA		
		LONG.	LAT.	VERT.	PITCH	ROLL	YAW
CASE ASSEMBLY	102754.980	918.487	200.000	200.000	2951.267	130.792	2951.267
FORWARD SEGMENT	14395.715	382.327	200.000	200.000	16.934	17.215	16.934
FORWARD CLOSURE	5827.543	329.384	200.000	200.000	3.649	6.033	3.649
IGNITER BOSS	50.879	282.480	200.000	200.000	0.000	0.001	0.000
FORWARD SKIRT	2017.368	339.235	200.000	200.000	1.410	2.644	1.410
BASIC SHELL	3759.296	324.732	200.000	200.000	2.155	3.388	2.155
CYLINDER	8568.172	418.336	200.000	200.000	7.361	11.183	7.361
BASIC SHELL	8031.024	415.095	200.000	200.000	6.723	10.489	6.723
ATTACH FLANGE-FEMALE	537.148	466.797	200.000	200.000	0.347	0.694	0.347
CENTER SEGMENT NO. 1	22943.254	609.375	200.000	200.000	49.373	29.955	49.373
ATTACH FLANGE-MALE	64.637	469.449	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	22341.469	606.440	200.000	200.000	46.433	29.179	46.433
ATTACH FLANGE-FEMALE	537.148	748.297	200.000	200.000	0.347	0.694	0.347
CENTER SEGMENT NO. 2	22943.254	890.875	200.000	200.000	49.373	29.955	49.373
ATTACH FLANGE-MALE	64.637	750.949	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	22341.469	887.940	200.000	200.000	46.433	29.179	46.433
ATTACH FLANGE-FEMALE	537.148	1029.797	200.000	200.000	0.347	0.694	0.347
CENTER SEGMENT NO. 3	22943.254	1172.375	200.000	200.000	49.373	29.955	49.373
ATTACH FLANGE-MALE	64.637	1032.449	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	22341.469	1169.440	200.000	200.000	46.433	29.179	46.433
ATTACH FLANGE-FEMALE	537.148	1311.297	200.000	200.000	0.347	0.694	0.347
AFT SEGMENT	18950.505	1425.965	200.000	200.000	29.052	22.953	29.052
CYLINDER	12744.432	1389.686	200.000	200.000	14.223	16.643	14.223
ATTACH FLANGE-MALE	64.637	1313.949	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	12679.795	1390.072	200.000	200.000	14.101	16.560	14.101
AFT CLOSURE	6206.072	1500.465	200.000	200.000	3.774	6.310	3.774
BASIC SHELL	3110.185	1456.589	200.000	200.000	1.781	3.042	1.781
AFT SKIRT	2113.739	1490.292	200.000	200.000	1.436	2.765	1.436
NOZZLE BOSS	982.148	1534.634	200.000	200.000	0.252	0.503	0.252
SEGMENT ATTACH PROVISIONS	579.000	921.929	200.000	200.000	14.409	0.758	14.409
PINS	307.200	889.350	200.000	200.000	6.770	0.404	6.770
RETAINERS	82.800	889.350	200.000	200.000	1.825	0.109	1.825
BOLTS	34.000	889.350	200.000	200.000	0.749	0.045	0.749
SEALANT	155.000	1011.050	200.000	200.000	4.702	0.200	4.702

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
INSULATION-INTERNAL	11905.618	925.203	200.000	200.000	595.198	13.010	595.198
FORWARD SEGMENT	3913.519	377.359	200.000	200.000	4.413	4.362	4.413
FORWARD CLOSURE	1549.934	323.109	200.000	200.000	0.847	1.330	0.847
EXPENDED PAT	0.949	286.019	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	592.968	322.332	200.000	200.000	0.323	0.506	0.323
UNEXPENDED EAT	956.017	323.629	200.000	200.000	0.524	0.824	0.524
CYLINDER	2070.789	406.350	200.000	200.000	1.591	2.660	1.591
EXPENDED TDAT	554.820	406.350	200.000	200.000	0.428	0.716	0.428
UNEXPENDED EAT	1515.970	406.350	200.000	200.000	1.163	1.944	1.163
JOINT	292.795	459.497	200.000	200.000	0.188	0.372	0.188
EXPENDED TDAT	152.235	458.413	200.000	200.000	0.096	0.191	0.096
UNEXPENDED EAT	140.560	460.671	200.000	200.000	0.091	0.181	0.091
CENTER SEGMENT 1	1295.944	608.391	200.000	200.000	4.217	1.661	4.217
FORWARD JOINT	503.157	487.616	200.000	200.000	0.346	0.644	0.346
EXPENDED PAT	239.122	484.580	200.000	200.000	0.157	0.299	0.157
UNEXPENDED TDAT	264.035	490.365	200.000	200.000	0.188	0.345	0.188
CYLINDER - UNEXPENDED EAT	297.235	609.250	200.000	200.000	0.353	0.385	0.353
AFT JOINT	495.552	730.505	200.000	200.000	0.339	0.633	0.339
EXPENDED TDAT	229.518	732.538	200.000	200.000	0.151	0.288	0.151
UNEXPENDED EAT	266.034	728.751	200.000	200.000	0.188	0.345	0.188
CENTER SEGMENT 2	1295.944	889.891	200.000	200.000	4.217	1.661	4.217
FORWARD JOINT	503.157	769.116	200.000	200.000	0.346	0.644	0.346
EXPENDED TDAT	239.122	766.080	200.000	200.000	0.157	0.299	0.157
UNEXPENDED EAT	264.035	771.865	200.000	200.000	0.188	0.345	0.188
CYLINDER - UNEXPENDED	297.235	890.750	200.000	200.000	0.353	0.385	0.353
AFT JOINT	495.552	1012.005	200.000	200.000	0.339	0.633	0.339
EXPENDED TDAT	229.518	1014.038	200.000	200.000	0.151	0.288	0.151
UNEXPENDED EAT	266.034	1010.251	200.000	200.000	0.188	0.345	0.188
CENTER SEGMENT 3	1295.944	1171.391	200.000	200.000	4.217	1.661	4.217
FORWARD JOINT	503.157	1050.616	200.000	200.000	0.346	0.644	0.346
EXPENDED TDAT	239.122	1047.580	200.000	200.000	0.157	0.299	0.157
UNEXPENDED EAT	264.035	1053.365	200.000	200.000	0.188	0.345	0.188
CYLINDER-UNEXPENDED	297.235	1172.250	200.000	200.000	0.353	0.385	0.353
AFT JOINT	495.552	1293.505	200.000	200.000	0.339	0.633	0.339
EXPENDED TDAT	229.518	1295.538	200.000	200.000	0.151	0.288	0.151
UNEXPENDED EAT	266.034	1291.751	200.000	200.000	0.188	0.345	0.188

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SEGMENT	4104.268	1481.034	200.000	200.000	5.549	3.664	5.549
JOINT	503.157	1332.116	200.000	200.000	0.346	0.644	0.346
EXPENDED TDAT	239.122	1329.080	200.000	200.000	0.157	0.299	0.157
UNEXPENDED EAT	264.035	1334.865	200.000	200.000	0.188	0.345	0.188
CYLINDER	453.793	1422.304	200.000	200.000	0.378	0.587	0.378
EXPENDED TDAT	101.220	1435.633	200.000	200.000	0.078	0.131	0.078
UNEXPENDED EAT	352.573	1418.477	200.000	200.000	0.295	0.456	0.295
AFT CLOSURE	3147.318	1513.309	200.000	200.000	1.371	2.433	1.371
EXPENDED TDAT	1030.657	1510.423	200.000	200.000	0.454	0.802	0.454
UNEXPENDED EAT	2116.661	1514.714	200.000	200.000	0.914	1.632	0.914
LINER	1277.973	912.128	200.000	200.000	36.395	1.582	36.395
FORWARD SEGMENT	182.688	377.496	200.000	200.000	0.205	0.201	0.205
FORWARD CLOSURE	78.152	326.495	200.000	200.000	0.044	0.071	0.044
EXPENDED PAT	0.235	288.734	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	77.917	326.609	200.000	200.000	0.044	0.071	0.044
CYLINDER	104.536	415.624	200.000	200.000	0.085	0.130	0.085
EXPENDED PAT	0.299	466.607	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	102.807	415.825	200.000	200.000	0.083	0.127	0.083
UNEXPENDED	1.430	390.570	200.000	200.000	0.001	0.002	0.001
CENTER SEGMENT 1	289.369	609.225	200.000	200.000	0.588	0.371	0.588
EXPENDED PAT	0.745	581.765	200.000	200.000	0.003	0.001	0.003
EXPENDED TDAT	95.697	609.371	200.000	200.000	0.341	0.120	0.341
UNEXPENDED EAT	192.927	609.259	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 2	289.369	890.725	200.000	200.000	0.588	0.371	0.588
EXPENDED PAT	0.745	863.265	200.000	200.000	0.003	0.001	0.003
EXPANDED TDAT	95.697	890.871	200.000	200.000	0.341	0.120	0.341
UNEXPENDED EAT	192.927	890.759	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 3	289.369	1172.225	200.000	200.000	0.588	0.371	0.588
EXPENDED PAT	0.745	1144.765	200.000	200.000	0.003	0.001	0.003
EXPENDED TDAT	95.697	1172.371	200.000	200.000	0.341	0.120	0.341
UNEXPENDED EAT	192.927	1172.259	200.000	200.000	0.244	0.249	0.244

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SEGMENT	227.179	1423.845	200.000	200.000	0.330	0.269	0.330
CYLINDER	161.477	1392.291	200.000	200.000	0.174	0.207	0.174
EXPENDED PAT	0.446	1314.874	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	102.910	1390.263	200.000	200.000	0.127	0.131	0.127
UNEXPENDED EAT	58.120	1396.475	200.000	200.000	0.045	0.075	0.045
AFT CLOSURE	65.703	1501.395	200.000	200.000	0.036	0.063	0.036
EXPENDED PAT	0.157	1532.479	200.000	200.000	0.000	0.000	0.000
UNEXPENDED EAT	65.546	1501.320	200.000	200.000	0.036	0.063	0.036
IGNITER ASSEMBLY	569.777	295.444	199.999	199.998	0.371	0.692	0.371
LOADED CASE ASSEMBLY	497.206	297.189	200.000	200.000	0.012	0.007	0.012
CASE	208.488	295.200	200.000	200.000	0.006	0.004	0.006
NOZZLE RING	2.323	313.698	200.000	200.000	0.000	0.000	0.000
EXTERNAL INSULATION	64.431	300.694	200.000	200.000	0.002	0.001	0.002
EXPENDED PAT	0.715	300.694	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	31.500	300.694	200.000	200.000	0.001	0.001	0.001
UNEXPENDED EAT	32.215	300.694	200.000	200.000	0.001	0.001	0.001
INSULATION-INTERNAL	5.507	299.488	200.000	200.000	0.000	0.000	0.000
EXPENDED PAT	2.753	299.488	200.000	200.000	0.000	0.000	0.000
UNEXPENDED EAT	2.753	299.488	200.000	200.000	0.000	0.000	0.000
LINER - EXPENDED PAT	1.668	299.492	200.000	200.000	0.000	0.000	0.000
PROPELLANT - EXPENDED PAT	214.790	297.813	200.000	200.000	0.004	0.002	0.004
INSULATED CAP	36.559	282.490	200.000	200.000	0.000	0.000	0.000
CAP	35.285	282.509	200.000	200.000	0.000	0.000	0.000
INSULATION	1.274	281.986	200.000	200.000	0.000	0.000	0.000
EXPENDED PAT	0.637	281.986	200.000	200.000	0.000	0.000	0.000
UNEXPENDED EAT	0.637	281.986	200.000	200.000	0.000	0.000	0.000
INITIATOR	11.871	287.040	200.000	199.997	0.064	0.108	0.064
CASE	3.879	286.811	200.000	200.000	0.008	0.001	0.008
LINER-EXPENDED PAT	0.029	286.747	200.000	200.000	0.000	0.0	0.000
PROPELLANT-EXPENDED PAT	1.234	287.070	200.000	200.000	0.002	0.0	0.002
NOZZLE	0.615	291.475	200.000	200.000	0.000	0.0	0.000
ATTACH PROVISIONS	6.114	286.734	200.000	199.994	0.054	0.107	0.054
BOOSTER	0.481	280.588	200.000	200.016	0.000	0.000	0.000
SAFE AND ARMING ASSEMBLY	4.780	278.750	199.905	199.714	0.002	0.003	0.002
SAFE AND ARMING DEVICE	4.550	278.687	199.900	199.700	0.002	0.003	0.002
ATTACH PROVISIONS	0.230	280.003	200.000	200.000	0.000	0.0	0.000
IGNITER ATTACH PROVISIONS	18.879	284.440	200.000	200.000	0.290	0.574	0.290
BOLTS	17.282	284.137	200.000	200.000	0.271	0.537	0.271
SEALANT	1.358	288.269	200.000	200.000	0.016	0.031	0.016
O RING	0.239	284.582	200.000	200.000	0.003	0.006	0.003

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
NOZZLE ASSEMBLY	10285.993	1564.586	200.000	200.000	6.836	4.093	6.836
NOSE INSULATION	520.588	1508.156	200.000	200.000	0.057	0.102	0.057
EXPENDED PAT	5.296	1505.334	200.000	200.000	0.001	0.001	0.001
EXPENDED TDAT	233.056	1505.334	200.000	200.000	0.025	0.046	0.025
UNEXPENDED EAT	282.236	1510.540	200.000	200.000	0.030	0.055	0.030
INSERT	108.812	1502.298	200.000	200.000	0.008	0.017	0.008
EXPENDED PAT	2.190	1502.567	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	96.368	1502.567	200.000	200.000	0.007	0.015	0.007
UNEXPENDED EAT	10.254	1499.713	200.000	200.000	0.001	0.002	0.001
THROAT INSULATION	416.145	1510.720	200.000	200.000	0.029	0.056	0.029
EXPENDED PAT	5.588	1511.098	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	245.913	1511.098	200.000	200.000	0.016	0.031	0.016
UNEXPENDED EAT	164.643	1510.143	200.000	200.000	0.012	0.024	0.012
THROAT LINER	73.804	1512.026	200.000	200.000	0.006	0.012	0.006
BACK LINER	247.811	1512.758	200.000	200.000	0.024	0.044	0.024
BACK INSULATION	460.779	1530.539	200.000	200.000	0.054	0.105	0.054
EXPENDED PAT	2.546	1527.626	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	112.037	1527.626	200.000	200.000	0.013	0.025	0.013
UNEXPENDED EAT	346.196	1531.503	200.000	200.000	0.040	0.079	0.040
STRUCTURE	3214.905	1542.713	200.000	200.000	0.662	0.869	0.662
EXIT CONE LINER-FORWARD	374.430	1544.823	200.000	200.000	0.066	0.096	0.066
EXIT CONE INSULATION-FWD	1122.274	1543.570	200.000	200.000	0.183	0.261	0.183
EXPENDED PAT	18.898	1541.111	200.000	200.000	0.003	0.004	0.003
EXPENDED TDAT	831.616	1541.111	200.000	200.000	0.130	0.183	0.130
UNEXPENDED EAT	271.759	1551.265	200.000	200.000	0.046	0.074	0.046
EXIT CONE INSULATION-CENTER	794.307	1585.447	200.000	200.000	0.192	0.351	0.192
EXPENDED PAT	7.949	1583.133	200.000	200.000	0.002	0.003	0.002
EXPENDED TDAT	349.811	1583.133	200.000	200.000	0.081	0.148	0.081
UNEXPENDED EAT	436.546	1587.344	200.000	200.000	0.108	0.200	0.108
EXIT CONE STRUCTURE	977.403	1616.429	200.000	200.000	0.542	0.671	0.542
EXIT CONE INSULATION-AFT	1837.735	1634.790	200.000	200.000	0.887	1.465	0.887
EXPENDED PAT	11.538	1632.919	200.000	200.000	0.005	0.009	0.005
EXPENDED TDAT	507.718	1632.919	200.000	200.000	0.237	0.392	0.237
UNEXPENDED EAT	1318.479	1635.526	200.000	200.000	0.644	1.064	0.644
NOZZLE ATTACH PROVISIONS	137.000	1535.586	200.000	200.000	0.022	0.044	0.022
BOLTS	111.000	1536.250	200.000	200.000	0.018	0.036	0.018
SEALANT	26.000	1532.750	200.000	200.000	0.004	0.008	0.004

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
RACEWAY ASSEMBLY	171.200	934.313	161.000	270.000	4.649	0.001	4.649
FORWARD SEGMENT	24.900	401.000	161.000	270.000	0.017	0.000	0.017
CENTER SEGMENT 1	38.600	638.250	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 2	38.600	919.750	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 3	38.600	1201.250	161.000	270.000	0.055	0.000	0.055
AFT SEGMENT	30.500	1425.000	161.000	270.000	0.028	0.000	0.028
TOTAL MOTOR INERT PARTS	126965.541	968.621	199.947	200.094	4500.673	150.407	4500.548
EXPENDED PAT	280.153	547.664	200.000	200.000	15.125	0.025	15.125
EXPENDED TDAT	7020.012	1123.424	200.000	200.000	370.119	5.868	370.119
UNEXPENDED EAT	119665.376	960.526	199.944	200.100	4066.711	144.514	4066.586
PROPELLANT	1217663.813	913.566	200.000	200.000	31428.524	872.007	31428.524
FORWARD SEGMENT	150349.782	388.720	200.000	200.000	120.564	103.250	120.564
FORWARD CLOSURE	50531.789	335.590	200.000	200.000	19.336	31.107	19.336
EXPENDED PAT	1631.030	331.318	200.000	200.000	0.349	0.490	0.349
EXPENDED TDAT	48900.759	335.732	200.000	200.000	18.980	30.617	18.980
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CYLINDER	99817.993	415.617	200.000	200.000	54.854	72.143	54.854
EXPENDED PAT	4802.497	426.746	200.000	200.000	2.339	2.354	2.339
EXPENDED TDAT	95015.496	415.055	200.000	200.000	52.380	69.789	52.380
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 1	289762.376	609.220	200.000	200.000	504.764	208.783	504.764
EXPENDED PAT	3612.808	605.250	200.000	200.000	5.337	0.594	5.337
EXPENDED TDAT	286149.568	609.220	200.000	200.000	499.427	208.189	499.427
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 2	289762.376	890.720	200.000	200.000	504.764	208.783	504.764
EXPENDED PAT	3612.808	890.750	200.000	200.000	5.337	0.594	5.337
EXPENDED TDAT	286149.568	890.720	200.000	200.000	499.427	208.189	499.427
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 3	289762.376	1172.220	200.000	200.000	504.764	208.783	504.764
EXPENDED PAT	3612.808	1172.250	200.000	200.000	5.337	0.594	5.337
EXPENDED TDAT	286149.568	1172.220	200.000	200.000	499.427	208.189	499.427
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SEGMENT	198026.903	1412.336	200.000	200.000	211.501	142.408	211.501
CYLINDER	157995.928	1391.957	200.000	200.000	126.183	115.770	126.183
EXPENDED PAT	4336.724	1394.028	200.000	200.000	2.296	0.828	2.296
EXPENDED TDAT	153659.205	1391.899	200.000	200.000	123.883	114.942	123.883
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
AFT CLOSURE	40030.975	1492.768	200.000	200.000	15.258	26.638	15.258
EXPENDED PAT	1122.353	1503.061	200.000	200.000	0.229	0.310	0.229
EXPENDED TDAT	38908.623	1492.471	200.000	200.000	15.003	26.327	15.003
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
MOTOR ASSEMBLY	1344629.354	918.765	199.995	200.009	36004.419	1022.414	36004.294
EXPENDED PAT	23011.180	874.795	200.000	200.000	827.051	5.789	827.051
EXPENDED TDAT	1201952.797	915.449	200.000	200.000	31053.157	872.111	31053.157
UNEXPENDED EAT	119665.376	960.526	199.944	200.100	4066.711	144.514	4066.586
MASS FRACTION	0.906						
NOSE CONE	9274.550	235.079	202.628	200.338	11.410	6.264	11.380
BASIC SHELL	946.489	231.895	200.000	200.000	0.986	0.632	0.986
I BEAMS-FORWARD	236.244	138.150	200.000	200.000	0.023	0.026	0.023
I BEAMS-AFT	1580.544	244.500	200.000	200.000	1.077	1.223	1.077
U BAR-FORWARD	3097.777	172.337	200.000	200.000	0.377	0.694	0.377
U BARS-AFT	590.455	249.614	200.000	200.000	0.210	0.331	0.210
STAGE ATTACH BRACKETS	760.796	277.078	232.042	204.121	1.151	0.655	0.969
AFT RING	2062.246	315.017	200.000	200.000	1.279	2.546	1.279
AFT SKIRT	12112.415	1557.996	203.802	200.038	15.529	15.461	13.733
BASIC SHELL	3376.718	1555.761	200.000	200.000	3.180	4.464	3.180
ANGLE BRACES	176.067	1531.560	200.000	200.000	0.111	0.221	0.111
FORWARD RING	3551.377	1504.919	200.000	200.000	2.170	4.324	2.170
CENTER RING	652.931	1578.703	200.000	200.000	0.418	0.833	0.418
STAGE ATTACH BRACKETS	643.717	1579.058	271.534	200.716	0.268	0.153	0.190
AFT RING	351.944	1657.492	200.000	200.000	0.229	0.459	0.229
STRUTS	2714.026	1619.354	200.000	200.000	3.218	3.524	0.826
ATTACH PROVISIONS	645.635	1514.745	200.000	200.000	0.407	0.810	0.407

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE X. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
STAGE ATTACH PROVISIONS	5176.540	376.470	256.587	203.831	159.184	6.948	154.991
FORWARD STRUTS	4685.580	257.346	259.504	204.232	7.209	5.573	2.841
LATERAL	514.000	320.500	262.500	200.000	0.932	0.984	0.052
SWAY	132.000	320.500	287.000	200.000	0.091	0.091	0.001
MAIN	3966.000	247.750	258.750	205.000	5.408	4.391	2.003
ATTACH PROVISIONS	73.580	220.115	229.865	200.000	0.118	0.067	0.091
AFT STRUTS	224.960	1523.474	262.746	200.000	0.362	0.336	0.069
LATERAL	56.000	1500.050	256.000	200.000	0.068	0.072	0.004
SWAY	44.000	1500.050	275.000	200.000	0.033	0.033	0.000
MAIN	91.000	1551.550	258.000	200.000	0.178	0.173	0.018
ATTACH PROVISIONS	33.960	1517.217	270.708	200.000	0.056	0.055	0.016
AFT ATTACH BRKT	266.000	1504.800	200.000	200.000	0.285	0.843	0.560
INSTRUMENTATION	551.995	411.190	232.144	248.984	0.064	0.215	0.167
PRESSURE TRANSDUCER	1.600	378.500	195.000	195.000	0.000	0.000	0.000
SIGNAL CONDITIONER	35.000	407.000	272.471	220.647	0.000	0.000	0.000
INSTRUMENTATION BATTERY	35.000	407.000	258.633	247.557	0.000	0.000	0.000
POWER DISTRIBUTION BOX	50.000	407.000	239.419	263.658	0.000	0.001	0.001
ATTACH PROVISIONS	324.295	412.892	242.532	251.676	0.041	0.096	0.057
CABLES	106.100	411.217	175.482	244.471	0.012	0.008	0.008
STAGE PROVISIONS	27115.500	856.600	214.054	201.861	2527.097	31.767	2523.496
TOTAL STAGE INERT PARTS	154081.041	948.908	202.430	200.405	7088.304	183.148	7085.522
EXPENDED PAT	280.153	547.664	200.000	200.000	15.125	0.025	15.125
EXPENDED TDAT	7020.012	1123.424	200.000	200.000	370.119	5.868	370.119
UNEXPENDED EAT	146780.877	941.327	202.551	200.425	6645.357	177.245	6642.566
TOTAL STAGE	1371744.854	917.536	200.273	200.046	38553.706	1055.334	38551.094
EXPENDED PAT	23011.180	874.795	200.000	200.000	827.051	5.789	827.051
EXPENDED TDAT	1201952.797	915.449	200.000	200.000	31053.157	872.111	31053.157
UNEXPENDED EAT	146780.877	941.327	202.551	200.425	6645.357	177.245	6642.566
STAGE MASS FRACTION	0.888						
TOTAL STAGE--2 EA	2743489.707	917.536	450.273	200.046	77107.412	39120.389	114111.908
EXPENDED PAT	46022.360	874.795	450.000	200.000	1654.102	632.420	2274.944
EXPENDED TDAT	2403905.594	915.449	450.000	200.000	62106.314	34172.948	94535.039
UNEXPENDED EAT	293561.753	941.327	452.551	200.425	13290.714	4314.643	17245.285

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE XI. DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CASE ASSEMBLY	102723.980	918.314	200.000	200.000	2949.030	130.752	2949.030
FORWARD SEGMENT	14395.715	382.327	200.000	200.000	16.934	17.215	16.934
FORWARD CLOSURE	5827.543	329.384	200.000	200.000	3.649	6.033	3.649
IGNITER BOSS	50.879	282.480	200.000	200.000	0.000	0.001	0.000
FORWARD SKIRT	2017.368	339.235	200.000	200.000	1.410	2.644	1.410
BASIC SHELL	3759.296	324.732	200.000	200.000	2.155	3.388	2.155
CYLINDER	8568.172	418.335	200.000	200.000	7.361	11.183	7.361
BASIC SHELL	8031.024	415.095	200.000	200.000	6.723	10.489	6.723
ATTACH FLANGE-FEMALE	537.148	466.797	200.000	200.000	0.347	0.694	0.347
CENTER SEGMENT NO. 1	22943.254	609.375	200.000	200.000	49.373	29.955	49.373
ATTACH FLANGE-MALE	64.637	459.449	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	22341.469	606.440	200.000	200.000	46.433	29.179	46.433
ATTACH FLANGE-FEMALE	537.148	748.297	200.000	200.000	0.347	0.694	0.347
CENTER SEGMENT NO. 2	22943.254	890.875	200.000	200.000	49.373	29.955	49.373
ATTACH FLANGE-MALE	64.637	750.949	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	22341.469	887.940	200.000	200.000	46.433	29.179	46.433
ATTACH FLANGE-FEMALE	537.148	1029.797	200.000	200.000	0.347	0.694	0.347
CENTER SEGMENT NO. 3	22943.254	1172.375	200.000	200.000	49.373	29.955	49.373
ATTACH FLANGE-MALE	64.637	1032.449	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	22341.469	1169.440	200.000	200.000	46.433	29.179	46.433
ATTACH FLANGE-FEMALE	537.148	1311.297	200.000	200.000	0.347	0.694	0.347
AFT SEGMENT	18950.505	1425.965	200.000	200.000	29.052	22.953	29.052
CYLINDER	12744.432	1389.686	200.000	200.000	14.223	16.643	14.223
ATTACH FLANGE-MALE	64.637	1313.949	200.000	200.000	0.041	0.083	0.041
BASIC SHELL	12679.795	1390.072	200.000	200.000	14.101	16.560	14.101
AFT CLOSURE	6206.072	1500.465	200.000	200.000	3.774	6.310	3.774
BASIC SHELL	3110.185	1496.589	200.000	200.000	1.781	3.042	1.781
AFT SKIRT	2113.739	1490.292	200.000	200.000	1.436	2.765	1.436
NOZZLE BOSS	982.148	1534.634	200.000	200.000	0.252	0.503	0.252
SEGMENT ATTACH PROVISIONS	548.000	889.555	200.000	200.000	12.075	0.718	12.075
PINS	307.200	889.350	200.000	200.000	6.770	0.404	6.770
RETAINERS	82.800	889.350	200.000	200.000	1.825	0.109	1.825
BOLTS	34.000	889.350	200.000	200.000	0.749	0.045	0.749
SEALANT	124.000	890.300	200.000	200.000	2.731	0.160	2.731

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
INSULATION-INTERNAL	11905.618	925.203	200.000	200.000	595.198	13.010	595.198
FORWARD SEGMENT	3913.519	377.359	200.000	200.000	4.413	4.362	4.413
EXPENDED PAT	0.949	286.019	200.000	200.000	0.000	0.000	0.000
FORWARD CLOSURE	1549.934	323.109	200.000	200.000	0.847	1.330	0.847
EXPENDED TDAT	592.968	322.332	200.000	200.000	0.323	0.506	0.323
UNEXPENDED EAT	956.017	323.629	200.000	200.000	0.524	0.824	0.524
CYLINDER	2070.789	406.350	200.000	200.000	1.591	2.660	1.591
EXPENDED TDAT	554.820	406.350	200.000	200.000	0.428	0.716	0.428
UNEXPENDED EAT	1515.970	406.350	200.000	200.000	1.163	1.944	1.163
JOINT	292.795	459.497	200.000	200.000	0.188	0.372	0.188
EXPENDED TDAT	152.235	458.413	200.000	200.000	0.096	0.191	0.096
UNEXPENDED EAT	140.560	460.671	200.000	200.000	0.091	0.181	0.091
CENTER SEGMENT 1	1295.944	608.391	200.000	200.000	4.217	1.661	4.217
FORWARD JOINT	503.157	487.616	200.000	200.000	0.346	0.644	0.346
EXPENDED PAT	239.122	484.580	200.000	200.000	0.157	0.299	0.157
UNEXPENDED TDAT	264.035	490.365	200.000	200.000	0.188	0.345	0.188
CYLINDER - UNEXPENDED EAT	297.235	609.250	200.000	200.000	0.353	0.385	0.353
AFT JOINT	495.552	730.505	200.000	200.000	0.339	0.633	0.339
EXPENDED TDAT	229.518	732.538	200.000	200.000	0.151	0.288	0.151
UNEXPENDED EAT	266.034	728.751	200.000	200.000	0.188	0.345	0.188
CENTER SEGMENT 2	1295.944	889.891	200.000	200.000	4.217	1.661	4.217
FORWARD JOINT	503.157	759.116	200.000	200.000	0.346	0.644	0.346
EXPENDED TDAT	239.122	766.080	200.000	200.000	0.157	0.299	0.157
UNEXPENDED EAT	264.035	771.865	200.000	200.000	0.188	0.345	0.188
CYLINDER - UNEXPENDED	297.235	890.750	200.000	200.000	0.353	0.385	0.353
AFT JOINT	495.552	1012.005	200.000	200.000	0.339	0.633	0.339
EXPENDED TDAT	229.518	1014.038	200.000	200.000	0.151	0.288	0.151
UNEXPENDED EAT	266.034	1010.251	200.000	200.000	0.188	0.345	0.188
CENTER SEGMENT 3	1295.944	1171.391	200.000	200.000	4.217	1.661	4.217
FORWARD JOINT	503.157	1050.615	200.000	200.000	0.346	0.644	0.346
EXPENDED TDAT	239.122	1047.580	200.000	200.000	0.157	0.299	0.157
UNEXPENDED EAT	264.035	1053.355	200.000	200.000	0.188	0.345	0.188
CYLINDER-UNEXPENDED	297.235	1172.250	200.000	200.000	0.353	0.385	0.353
AFT JOINT	495.552	1293.505	200.000	200.000	0.339	0.633	0.339
EXPENDED TDAT	229.518	1295.538	200.000	200.000	0.151	0.288	0.151
UNEXPENDED EAT	266.034	1291.751	200.000	200.000	0.188	0.345	0.188

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SEGMENT	4104.268	1481.034	200.000	200.000	5.549	3.664	5.549
JOINT	503.157	1332.116	200.000	200.000	0.346	0.644	0.346
EXPENDED TDAT	239.122	1329.080	200.000	200.000	0.157	0.299	0.157
UNEXPENDED EAT	264.035	1334.865	200.000	200.000	0.188	0.345	0.188
CYLINDER	453.793	1422.304	200.000	200.000	0.378	0.587	0.378
EXPENDED TDAT	101.220	1435.633	200.000	200.000	0.078	0.131	0.078
UNEXPENDED EAT	352.573	1418.477	200.000	200.000	0.295	0.456	0.295
AFT CLOSURE	3147.318	1513.309	200.000	200.000	1.371	2.433	1.371
EXPENDED TDAT	1030.657	1510.423	200.000	200.000	0.454	0.802	0.454
UNEXPENDED EAT	2116.661	1514.714	200.000	200.000	0.914	1.632	0.914
LINER	1277.973	912.128	200.000	200.000	36.395	1.582	36.395
FORWARD SEGMENT	182.688	377.496	200.000	200.000	0.205	0.201	0.205
FORWARD CLOSURE	78.152	326.495	200.000	200.000	0.044	0.071	0.044
EXPENDED PAT	0.235	288.734	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	77.917	326.609	200.000	200.000	0.044	0.071	0.044
CYLINDER	104.536	415.624	200.000	200.000	0.085	0.130	0.085
EXPENDED PAT	0.299	466.607	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	102.807	415.825	200.000	200.000	0.083	0.127	0.083
UNEXPENDED	1.430	390.570	200.000	200.000	0.001	0.002	0.001
CENTER SEGMENT 1	289.369	609.225	200.000	200.000	0.588	0.371	0.588
EXPENDED PAT	0.745	581.765	200.000	200.000	0.003	0.001	0.003
EXPENDED TDAT	95.697	609.371	200.000	200.000	0.341	0.120	0.341
UNEXPENDED EAT	192.927	609.259	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 2	289.369	890.725	200.000	200.000	0.588	0.371	0.588
EXPENDED PAT	0.745	863.265	200.000	200.000	0.003	0.001	0.003
EXPANDED TDAT	95.697	890.871	200.000	200.000	0.341	0.120	0.341
UNEXPENDED EAT	192.927	890.759	200.000	200.000	0.244	0.249	0.244
CENTER SEGMENT 3	289.369	1172.225	200.000	200.000	0.588	0.371	0.588
EXPENDED PAT	0.745	1144.755	200.000	200.000	0.003	0.001	0.003
EXPENDED TDAT	95.697	1172.371	200.000	200.000	0.341	0.120	0.341
UNEXPENDED EAT	192.927	1172.259	200.000	200.000	0.244	0.249	0.244

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SEGMENT	227.179	1423.845	200.000	200.000	0.330	0.269	0.330
CYLINDER	161.477	1392.291	200.000	200.000	0.174	0.207	0.174
EXPENDED PAT	0.446	1314.874	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	102.910	1390.263	200.000	200.000	0.127	0.131	0.127
UNEXPENDED EAT	58.120	1396.475	200.000	200.000	0.045	0.075	0.045
AFT CLOSURE	65.703	1501.395	200.000	200.000	0.036	0.063	0.036
EXPENDED PAT	0.157	1532.479	200.000	200.000	0.000	0.000	0.000
UNEXPENDED EAT	65.546	1501.320	200.000	200.000	0.036	0.063	0.036
IGNITER ASSEMBLY	570.867	295.486	199.999	199.998	0.371	0.692	0.371
LOADED CASE ASSEMBLY	498.297	297.234	200.000	200.000	0.012	0.007	0.012
CASE	208.488	295.200	200.000	200.000	0.006	0.004	0.006
NOZZLE RING	2.323	313.698	200.000	200.000	0.000	0.000	0.000
EXTERNAL INSULATION	64.431	300.694	200.000	200.000	0.002	0.001	0.002
EXPENDED PAT	0.715	300.694	200.000	200.000	0.000	0.000	0.000
EXPENDED TDAT	31.500	300.694	200.000	200.000	0.001	0.001	0.001
UNEXPENDED EAT	32.215	300.694	200.000	200.000	0.001	0.001	0.001
INSULATION-INTERNAL	6.597	302.494	200.000	200.000	0.000	0.000	0.000
EXPENDED PAT	3.299	302.494	200.000	200.000	0.000	0.000	0.000
UNEXPENDED EAT	3.299	302.494	200.000	200.000	0.000	0.000	0.000
LINER - EXPENDED PAT	1.668	299.492	200.000	200.000	0.000	0.000	0.000
PROPELLANT - EXPENDED PAT	214.790	297.813	200.000	200.000	0.004	0.002	0.004
INSULATED CAP	36.559	282.490	200.000	200.000	0.000	0.000	0.000
CAP	35.285	282.509	200.000	200.000	0.000	0.000	0.000
INSULATION	1.274	281.986	200.000	200.000	0.000	0.000	0.000
EXPENDED PAT	0.637	281.986	200.000	200.000	0.000	0.000	0.000
UNEXPENDED EAT	0.637	281.986	200.000	200.000	0.000	0.000	0.000
INITIATOR	11.871	287.040	200.000	199.997	0.064	0.108	0.064
CASE	3.879	286.811	200.000	200.000	0.008	0.001	0.008
LINER-EXPENDED PAT	0.029	286.747	200.000	200.000	0.000	0.0	0.000
PROPELLANT-EXPENDED PAT	1.234	287.070	200.000	200.000	0.002	0.0	0.002
NOZZLE	0.615	291.475	200.000	200.000	0.000	0.0	0.000
ATTACH PROVISIONS	6.114	286.734	200.000	199.994	0.054	0.107	0.054
BOOSTER	0.481	280.588	200.000	200.016	0.000	0.000	0.000
SAFE AND ARMING ASSEMBLY	4.780	278.750	199.905	199.714	0.002	0.003	0.002
SAFE AND ARMING DEVICE	4.550	278.687	199.900	199.700	0.002	0.003	0.002
ATTACH PROVISIONS	0.230	280.003	200.000	200.000	0.000	0.0	0.000
IGNITER ATTACH PROVISIONS	18.879	284.440	200.000	200.000	0.290	0.574	0.290
BOLTS	17.282	284.137	200.000	200.000	0.271	0.537	0.271
SEALANT	1.358	288.269	200.000	200.000	0.016	0.031	0.016
O RING	0.239	284.582	200.000	200.000	0.003	0.006	0.003

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
NOZZLE ASSEMBLY	11862.340	1558.736	200.000	200.000	7.943	4.365	7.943
FIXED PART	2627.926	1525.529	200.000	200.000	0.420	0.770	0.420
STRUCTURE	1788.675	1527.092	200.000	200.000	0.282	0.521	0.282
FLEXSEAL ADAPTER	305.466	1517.799	200.000	200.000	0.035	0.071	0.035
NOZZLE ATTACH FLANGE	1483.209	1529.005	200.000	200.000	0.239	0.451	0.239
INSULATION	836.918	1522.180	200.000	200.000	0.135	0.247	0.135
EXPENDED PAT	5.557	1518.812	200.000	200.000	0.001	0.002	0.001
EXPENDED TDAT	244.553	1518.812	200.000	200.000	0.038	0.071	0.038
UNEXPENDED EAT	586.807	1523.615	200.000	200.000	0.095	0.174	0.095
O RINGS	2.333	1528.941	200.000	200.000	0.000	0.001	0.000
MOVABLE PART	9097.414	1568.677	200.000	200.000	6.666	3.551	6.666
STRUCTURE	3616.036	1567.349	200.000	200.000	2.238	1.360	2.238
FLEXSEAL ADAPTER	457.032	1512.732	200.000	200.000	0.043	0.085	0.043
BASIC SHELL	2217.305	1552.950	200.000	200.000	0.511	0.609	0.511
ACTUATOR ATTACH RING	0.0	0.0	200.000	200.000	0.0	0.0	0.0
EXIT CONE GLASS	941.699	1627.760	200.000	200.000	0.549	0.666	0.549
NOSE INSULATION	193.825	1506.052	200.000	200.000	0.028	0.056	0.028
EXPENDED PAT	3.076	1503.780	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	135.364	1503.780	200.000	200.000	0.016	0.031	0.016
UNEXPENDED EAT	55.385	1511.731	200.000	200.000	0.011	0.023	0.011
BACK INSULATION	370.821	1508.514	200.000	200.000	0.030	0.060	0.030
EXPENDED EAT	3.711	1508.348	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	163.299	1508.348	200.000	200.000	0.013	0.026	0.013
UNEXPENDED EAT	203.811	1508.649	200.000	200.000	0.017	0.033	0.017
THROAT INSULATION	365.127	1518.319	200.000	200.000	0.025	0.048	0.025
EXPENDED PAT	4.631	1518.841	200.000	200.000	0.000	0.001	0.000
EXPENDED TDAT	203.784	1518.841	200.000	200.000	0.013	0.024	0.013
UNEXPENDED EAT	156.712	1517.625	200.000	200.000	0.012	0.024	0.012
NOSE LINER	63.246	1509.905	200.000	200.000	0.006	0.012	0.006
THROAT LINER	88.724	1518.372	200.000	200.000	0.007	0.014	0.007
EXIT CONE INSUL. FWD	1294.696	1549.576	200.000	200.000	0.205	0.291	0.205
EXPENDED PAT	17.315	1549.592	200.000	200.000	0.003	0.004	0.003
EXPENDED TDAT	761.922	1549.592	200.000	200.000	0.117	0.165	0.117
UNEXPENDED EAT	515.460	1549.551	200.000	200.000	0.085	0.123	0.085
EXIT CONE INSUL. CENTER	723.506	1592.299	200.000	200.000	0.174	0.316	0.174
EXPENDED PAT	8.305	1592.760	200.000	200.000	0.002	0.004	0.002
EXPENDED TDAT	365.436	1592.760	200.000	200.000	0.085	0.155	0.085
UNEXPENDED EAT	349.765	1591.806	200.000	200.000	0.087	0.158	0.087

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
EXIT CONE INSUL. AFT	1515.459	1642.242	200.000	200.000	0.728	1.204	0.728
EXPENDED PAT	14.693	1643.533	200.000	200.000	0.007	0.012	0.007
EXPENDED TDAT	646.574	1643.533	200.000	200.000	0.317	0.513	0.317
UNEXPENDED EAT	854.191	1641.242	200.000	200.000	0.403	0.680	0.403
EXIT CONE LINER	214.536	1552.138	200.000	200.000	0.037	0.055	0.037
O RINGS	2.727	1555.076	200.000	200.000	0.001	0.001	0.001
FLEXSEAL	622.594	1515.658	200.000	200.000	0.065	0.129	0.065
RUBBER SEAL	26.118	1513.772	200.000	200.000	0.003	0.006	0.003
NOZZLE ATTACH PROVISIONS	137.000	1535.586	200.000	200.000	0.022	0.044	0.022
BOLTS	111.000	1536.250	200.000	200.000	0.018	0.036	0.018
SEALANT	26.000	1532.750	200.000	200.000	0.004	0.008	0.004
RACEWAY ASSEMBLY	171.200	934.313	161.000	270.000	4.649	0.001	4.649
FORWARD SEGMENT	24.900	401.000	161.000	270.000	0.017	0.000	0.017
CENTER SEGMENT 1	38.600	638.250	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 2	38.600	919.750	161.000	270.000	0.055	0.000	0.055
CENTER SEGMENT 3	38.600	1201.250	161.000	270.000	0.055	0.000	0.055
AFT SEGMENT	30.500	1425.000	161.000	270.000	0.028	0.000	0.028
THRUST VECTOR CONTROL SYSTEM	2154.043	1465.983	215.680	191.661	24.911	2.092	25.171
HPU CONCORDE UNITS	144.000	1535.000	225.000	167.333	0.026	0.054	0.029
MONOFUEL TANKS	250.000	1530.000	244.750	175.500	0.115	0.141	0.039
HYDRAULIC RES. AND ACCUM.	92.000	1537.000	210.152	148.739	0.002	0.056	0.054
TVC CONTROLLER	40.000	1537.000	126.500	208.000	0.000	0.000	0.000
TANDEM ACTUATORS	312.000	1545.786	171.415	228.585	0.067	0.113	0.067
HPU SUPPORTS	50.000	1535.000	237.000	163.000	0.015	0.030	0.015
HYDRAULIC TUBING AND FLUID	157.000	1513.000	200.000	200.000	0.100	0.200	0.100
ELECTRICAL CABLING	660.000	1301.101	227.819	200.000	18.588	0.747	18.790
HYDRAULIC PUMPS	60.000	1531.500	229.500	173.500	0.011	0.020	0.009
NOZZLE ATTACH RING	165.043	1574.650	200.000	200.000	0.031	0.062	0.031
RING	147.586	1575.100	200.000	200.000	0.027	0.055	0.027
BRACKET	17.457	1570.850	200.000	200.000	0.003	0.007	0.003
MISC. SUPPORTS & EQUIPMENT	224.000	1537.000	235.407	163.326	0.065	0.126	0.061

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
THRUST TERMINATION SYSTEM	661.300	268.939	201.181	199.456	0.513	1.007	0.516
STACKS	531.000	266.052	200.000	200.000	0.461	0.915	0.461
CHARGE RETAINER MOUNT	23.600	288.500	200.000	200.000	0.006	0.012	0.006
CHARGE RETAINER ASSEMBLY	2.400	288.500	200.000	200.000	0.001	0.001	0.001
CONNECTOR ASSEMBLY	7.400	293.445	249.620	200.000	0.002	0.003	0.001
ARM-DISARM & SAFE ARM	5.000	287.000	236.500	163.500	0.000	0.000	0.000
CABLE ASSY	1.400	287.000	258.500	180.500	0.000	0.000	0.000
STACK INSULATION	86.400	276.500	200.000	200.000	0.034	0.066	0.034
ATTACH PROVISIONS	2.200	287.000	236.500	163.500	0.000	0.000	0.000
TOTAL MOTOR INERT PARTS	131327.322	979.752	200.212	199.952	4809.921	153.884	4810.141
EXPENDED PAT	283.980	561.167	200.000	200.000	16.135	0.028	16.135
EXPENDED TDAT	7164.424	1136.141	200.000	200.000	381.558	6.014	381.558
UNEXPENDED EAT	123878.918	971.667	200.225	199.949	4361.920	147.842	4362.140
PROPELLANT	1214327.141	915.235	200.000	200.000	31161.484	871.088	31161.484
FORWARD SEGMENT	147013.110	390.591	200.000	200.000	114.845	102.331	114.845
FORWARD CLOSURE	47195.117	337.662	200.000	200.000	17.960	30.188	17.960
EXPENDED PAT	1622.593	332.067	200.000	200.000	0.341	0.542	10.622
EXPENDED TDAT	45572.524	337.861	200.000	200.000	17.608	29.646	7.327
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CYLINDER	99817.993	415.617	200.000	200.000	54.854	72.143	54.854
EXPENDED PAT	4802.497	426.746	200.000	200.000	2.339	2.354	2.339
EXPENDED TDAT	95015.496	415.055	200.000	200.000	52.380	69.789	52.380
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 1	289762.376	609.220	200.000	200.000	504.764	208.783	504.764
EXPENDED PAT	3612.808	609.250	200.000	200.000	5.337	0.594	5.337
EXPENDED TDAT	286149.568	609.220	200.000	200.000	499.427	208.189	499.427
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CENTER SEGMENT 2	289762.376	890.720	200.000	200.000	504.764	208.783	504.764
EXPENDED PAT	3612.808	890.750	200.000	200.000	5.337	0.594	5.337
EXPENDED TDAT	286149.568	890.720	200.000	200.000	499.427	208.189	499.427
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
CENTER SEGMENT 3	289762.376	1172.220	200.000	200.000	504.764	208.783	504.764
EXPENDED PAT	3612.808	1172.250	200.000	200.000	5.337	0.594	5.337
EXPENDED TDAT	286149.568	1172.220	200.000	200.000	499.427	208.189	499.427
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
AFT SEGMENT	198026.903	1412.335	200.000	200.000	211.501	142.408	211.501
CYLINDER	157995.928	1391.957	200.000	200.000	126.183	115.770	126.183
EXPENDED PAT	2168.739	1394.020	200.000	200.000	1.148	0.414	1.148
EXPENDED TDAT	155827.189	1391.929	200.000	200.000	125.033	115.356	125.033
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
AFT CLOSURE	40030.975	1492.758	200.000	200.000	15.258	26.638	15.258
EXPENDED PAT	1122.353	1503.061	200.000	200.000	0.229	0.310	0.229
EXPENDED TDAT	38908.623	1492.471	200.000	200.000	15.003	26.327	15.003
UNEXPENDED EAT	0.0	0.0	200.000	200.000	0.0	0.0	0.0
MOTOR ASSEMBLY	1345654.463	921.531	200.021	199.995	36077.877	1024.973	36078.098
EXPENDED PAT	20838.585	821.177	200.000	200.000	686.549	5.430	696.830
EXPENDED TDAT	1200936.959	918.101	200.000	200.000	30913.854	871.700	30903.573
UNEXPENDED FAT	124089.618	971.219	200.207	200.052	4372.935	148.124	4373.077
MASS FRACTION	0.902						
NOSE CONE	9268.770	235.116	202.609	200.339	11.405	6.263	11.374
BASIC SHELL	946.489	231.895	200.000	200.000	0.986	0.632	0.986
I BEAMS-FORWARD	236.244	138.150	200.000	200.000	0.023	0.026	0.023
I BEAMS-AFT	1580.544	244.500	200.000	200.000	1.077	1.223	1.077
U BAR-FORWARD	3097.777	172.337	200.000	200.000	0.377	0.694	0.377
U BARS-AFT	590.455	249.614	200.000	200.000	0.210	0.331	0.210
STAGE ATTACH BRACKETS	755.015	277.852	232.024	204.165	1.138	0.655	0.956
AFT RING	2062.246	315.017	200.000	200.000	1.279	2.546	1.279

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
AFT SKIRT	12112.415	1557.995	203.802	200.038	15.529	15.461	13.733
BASIC SHELL	3376.718	1555.761	200.000	200.000	3.180	4.464	3.180
ANGLE BRACES	176.067	1531.560	200.000	200.000	0.111	0.221	0.111
FORWARD RING	3551.377	1504.919	200.000	200.000	2.170	4.324	2.170
CENTER RING	652.931	1578.703	200.000	200.000	0.418	0.833	0.418
STAGE ATTACH BRACKETS	643.717	1579.058	271.534	200.716	0.268	0.153	0.190
AFT RING	351.944	1657.492	200.000	200.000	0.229	0.459	0.229
STRUTS	2714.026	1619.354	200.000	200.000	3.218	3.524	0.826
ATTACH PROVISIONS	645.635	1514.745	200.000	200.000	0.407	0.810	0.407
STAGE ATTACH PROVISIONS	5176.540	376.470	256.587	203.831	159.184	6.948	154.991
FORWARD STRUTS	4685.580	257.346	259.504	204.232	7.209	5.573	2.841
LATERAL	514.000	320.500	262.500	200.000	0.932	0.984	0.052
SWAY	132.000	320.500	287.000	200.000	0.091	0.091	0.001
MAIN	3966.000	247.750	258.750	205.000	5.408	4.391	2.003
ATTACH PROVISIONS	73.580	220.115	229.865	200.000	0.118	0.067	0.091
AFT STRUTS	224.960	1523.474	262.746	200.000	0.362	0.336	0.069
LATERAL	56.000	1500.050	256.000	200.000	0.068	0.072	0.004
SWAY	44.000	1500.050	275.000	200.000	0.033	0.033	0.000
MAIN	91.000	1551.550	258.000	200.000	0.178	0.173	0.018
ATTACH PROVISIONS	33.960	1517.217	270.708	200.000	0.056	0.055	0.016
AFT ATTACH BRKT	266.000	1504.800	200.000	200.000	0.285	0.843	0.560
INSTRUMENTATION	551.995	411.190	232.144	248.984	0.064	0.215	0.167
PRESSURE TRANSDUCER	1.600	378.500	195.000	195.000	0.000	0.000	0.000
SIGNAL CONDITIONER	35.000	407.000	272.471	220.647	0.000	0.000	0.000
INSTRUMENTATION BATTERY	35.000	407.000	258.633	247.557	0.000	0.000	0.000
POWER DISTRIBUTION BOX	50.000	407.000	239.419	263.658	0.000	0.001	0.001
ATTACH PROVISIONS	324.295	412.892	242.532	251.676	0.041	0.096	0.057
CABLES	106.100	411.217	175.482	244.471	0.012	0.008	0.008

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
DESTRUCT SYSTEM	210.700	707.977	189.756	260.746	7.690	0.110	7.776
SAFE AND ARMING DEVICE	5.000	307.000	192.735	275.164	0.000	0.000	0.000
BATTERY	53.000	307.000	267.634	232.970	0.000	0.000	0.000
DESTRUCT SYSTEM	152.700	860.280	162.629	269.914	4.901	0.004	4.905
FORWARD SEGMENT	33.100	345.056	168.514	269.605	0.023	0.004	0.026
CENTER SEGMENT 1	31.500	609.250	161.000	270.000	0.045	0.000	0.045
CENTER SEGMENT 2	31.500	890.750	161.000	270.000	0.045	0.000	0.045
CENTER SEGMENT 3	31.500	1172.250	161.000	270.000	0.045	0.000	0.045
AFT SEGMENT	25.100	1425.000	161.000	270.000	0.023	0.000	0.023
STAGING MOTORS	296.000	922.750	150.250	248.000	25.503	0.006	25.503
RECOVERY SYSTEM	11133.000	1586.741	195.743	235.712	71.775	15.120	73.497
MAIN PARACHUTE	3873.000	1604.487	177.236	239.112	2.335	4.582	3.598
DROGUE PARACHUTE	2330.000	1604.328	222.316	270.888	0.542	0.963	1.237
MAIN RISER BRIDLE	435.000	1654.000	200.000	200.000	0.415	0.830	0.415
DROGUE RISER BRIDLE	445.000	1656.000	200.000	200.000	0.434	0.867	0.434
SEQ. REEFER CUTTER AND MISC	1000.000	1610.712	194.894	244.706	0.692	1.219	0.953
PILOT CHUTE DROGUE	20.000	1630.000	200.000	286.000	0.000	0.000	0.000
PILOT CHUTE MAIN	90.000	1630.000	200.000	157.000	0.001	0.108	0.109
DROGUE MORTAR	47.000	1610.000	200.000	282.000	0.000	0.000	0.000
MAIN MORTAR	97.000	1610.000	200.000	159.000	0.001	0.106	0.106
ATTACH AND COMP. STRUCTURE	1000.000	1620.000	200.000	180.250	0.531	1.504	1.030
INFLATION SYSTEM	238.000	937.668	200.000	229.269	20.738	0.303	20.522
ORIENTATION SYSTEM	130.000	362.500	200.000	200.000	0.174	0.174	0.043
MAIN CHUTE FLOATATION	90.000	1630.000	200.000	286.000	0.001	0.000	0.001
DROGUE CHUTE FLOATATION	18.000	1630.000	200.000	157.000	0.000	0.022	0.022
BEACON LIGHT - SMOKE FLARE	122.000	925.700	200.000	200.000	0.084	0.169	0.084
CONTINGENCY	1436.000	1586.741	195.743	235.712	9.258	1.950	9.480
STAGE PROVISIONS	38538.720	1068.132	208.272	211.995	3534.934	49.714	3531.806
TOTAL STAGE INERT PARTS	169866.042	999.803	202.041	202.684	8396.020	204.949	8392.597
EXPENDED PAT	283.980	551.167	200.000	200.000	16.135	0.028	16.135
EXPENDED TDAT	7164.424	1136.141	200.000	200.000	381.558	6.014	381.558
UNEXPENDED EAT	162417.638	994.556	202.134	202.807	7956.813	198.887	7953.395

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE XI. (Cont) DETAIL MASS PROPERTIES SUMMARY

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
TOTAL STAGE	1384403.883	925.580	200.249	200.339	39797.781	1076.683	39794.184
EXPENDED PAT	20838.585	821.177	200.000	200.000	686.549	5.430	696.830
EXPENDED TDAT	1200936.959	918.101	200.000	200.000	30913.854	871.700	30903.573
UNEXPENDED EAT	162628.338	994.185	202.118	202.882	7968.386	199.157	7964.908
STAGE MASS FRACTION	0.877						
TOTAL STAGE--2 EA	2768807.765	925.580	450.249	200.339	79595.562	39504.628	116939.630
EXPENDED PAT	41677.171	821.177	450.000	200.000	1373.097	573.086	1955.885
EXPENDED TDAT	2401873.918	918.101	450.000	200.000	61827.707	34144.718	94208.463
UNEXPENDED EAT	325256.676	994.185	452.118	202.882	15936.772	4786.031	20317.534

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY			MOMENT OF INERTIA		
		LONG.	LAT.	VERT.	PITCH	ROLL	YAW
CASE ASSEMBLY	123244.370	905.090	100.000	209.700	5148.067	157.543	5148.067
FORWARD SEGMENT	15110.007	231.512	100.000	209.700	19.169	18.148	19.169
FORWARD CLOSURE	5827.543	173.384	100.000	209.700	3.649	6.033	3.649
IGNITER BOSS	50.879	126.480	100.000	209.700	0.000	0.001	0.000
FORWARD SKIRT	2017.368	183.235	100.000	209.700	1.410	2.644	1.410
BASIC SHELL	3759.296	168.732	100.000	209.700	2.155	3.388	2.155
CYLINDER	9282.464	268.005	100.000	209.700	8.602	12.116	8.602
BASIC SHELL	8745.316	263.595	100.000	209.700	7.621	11.422	7.621
ATTACH FLANGE-FEMALE	537.148	339.797	100.000	209.700	0.347	0.694	0.347
CENTER SEGMENT NO. 1	22427.376	479.124	100.000	209.700	46.764	29.282	46.764
ATTACH FLANGE-MALE	64.637	342.449	100.000	209.700	0.041	0.083	0.041
BASIC SHELL	21825.591	476.190	100.000	209.700	43.940	28.505	43.940
ATTACH FLANGE-FEMALE	537.148	614.797	100.000	209.700	0.347	0.694	0.347
CENTER SEGMENT NO. 2	22427.376	754.124	100.000	209.700	46.764	29.282	46.764
ATTACH FLANGE-MALE	64.637	617.449	100.000	209.700	0.041	0.083	0.041
BASIC SHELL	21825.591	751.190	100.000	209.700	43.940	28.505	43.940
ATTACH FLANGE-FEMALE	537.148	889.797	100.000	209.700	0.347	0.694	0.347
CENTER SEGMENT NO. 3	22427.376	1029.124	100.000	209.700	46.764	29.282	46.764
ATTACH FLANGE-MALE	64.637	892.449	100.000	209.700	0.041	0.083	0.041
BASIC SHELL	21825.591	1026.190	100.000	209.700	43.940	28.505	43.940
ATTACH FLANGE-FEMALE	537.148	1164.797	100.000	209.700	0.347	0.694	0.347
CENTER SEGMENT NO. 4	22427.376	1304.124	100.000	209.700	46.764	29.282	46.764
ATTACH FLANGE-MALE	64.637	1167.449	100.000	209.700	0.041	0.083	0.041
BASIC SHELL	21825.591	1301.190	100.000	209.700	43.940	28.505	43.940
ATTACH FLANGE-FEMALE	537.148	1439.797	100.000	209.700	0.347	0.694	0.347
AFT SEGMENT	17735.859	1547.479	100.000	209.700	25.308	21.371	25.308
CYLINDER	11533.787	1510.561	100.000	209.700	11.904	15.062	11.904
ATTACH FLANGE-MALE	64.637	1442.449	100.000	209.700	0.041	0.083	0.041
BASIC SHELL	11469.150	1510.945	100.000	209.700	11.798	14.979	11.798
AFT CLOSURE	6206.072	1616.089	100.000	209.700	3.705	6.310	3.705
BASIC SHELL	3110.185	1615.830	100.000	209.700	1.781	3.042	1.781
AFT SKIRT	2113.739	1603.533	100.000	209.700	1.436	2.765	1.436
NOZZLE BOSS	982.148	1643.934	100.000	209.700	0.252	0.503	0.252

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
SEGMENT ATTACH PROVISIONS	685.000	890.315	100.000	209.700	22.811	0.897	22.811
PINS	384.000	890.100	100.000	209.700	12.788	0.505	12.788
RETAINERS	103.500	890.100	100.000	209.700	3.447	0.136	3.447
BOLTS	42.500	890.100	100.000	209.700	1.415	0.056	1.415
SEALANT	155.000	891.050	100.000	209.700	5.160	0.200	5.160
INSULATION-INTERNAL	13149.442	906.521	100.000	209.700	946.167	14.604	946.167
FORWARD SEGMENT	3973.177	224.628	100.000	209.700	4.869	4.439	4.869
FORWARD CLOSURE	1549.934	167.109	100.000	209.700	0.847	1.330	0.847
EXPENDED PAT	0.949	130.019	100.000	209.700	0.000	0.000	0.000
EXPENDED TDAT	592.968	166.332	100.000	209.700	0.323	0.506	0.323
UNEXPENDED EAT	956.017	167.629	100.000	209.700	0.524	0.824	0.524
CYLINDER	2130.447	251.648	100.000	209.700	1.657	2.737	1.657
EXPENDED TDAT	614.478	254.850	100.000	209.700	0.492	0.793	0.492
UNEXPENDED EAT	1515.970	250.350	100.000	209.700	1.163	1.944	1.163
JOINT	292.795	332.497	100.000	209.700	0.188	0.372	0.188
EXPENDED TDAT	152.235	331.413	100.000	209.700	0.096	0.191	0.096
UNEXPENDED EAT	140.560	333.671	100.000	209.700	0.091	0.181	0.091
CENTER SEGMENT 1	1284.808	478.153	100.000	209.700	4.025	1.647	4.025
FORWARD JOINT	503.157	360.616	100.000	209.700	0.346	0.644	0.346
EXPENDED PAT	239.122	357.580	100.000	209.700	0.157	0.299	0.157
UNEXPENDED TDAT	264.035	363.365	100.000	209.700	0.188	0.345	0.188
CYLINDER - UNEXPENDED EAT	286.099	479.000	100.000	209.700	0.329	0.371	0.329
AFT JOINT	495.552	597.005	100.000	209.700	0.339	0.633	0.339
EXPENDED TDAT	229.518	595.038	100.000	209.700	0.151	0.288	0.151
UNEXPENDED EAT	266.034	595.251	100.000	209.700	0.188	0.345	0.188
CENTER SEGMENT 2	1284.808	753.153	100.000	209.700	4.025	1.647	4.025
FORWARD JOINT	503.157	635.616	100.000	209.700	0.346	0.644	0.346
EXPENDED TDAT	239.122	632.580	100.000	209.700	0.157	0.299	0.157
UNEXPENDED EAT	264.035	638.365	100.000	209.700	0.188	0.345	0.188
CYLINDER - UNEXPENDED	286.099	754.000	100.000	209.700	0.329	0.371	0.329
AFT JOINT	495.552	872.005	100.000	209.700	0.339	0.633	0.339
EXPENDED TDAT	229.518	874.038	100.000	209.700	0.151	0.288	0.151
UNEXPENDED EAT	266.034	870.251	100.000	209.700	0.188	0.345	0.188

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CENTER SEGMENT 3	1284.808	1028.153	100.000	209.700	4.025	1.647	4.025
FORWARD JOINT	503.157	910.616	100.000	209.700	0.346	0.644	0.346
EXPENDED TDAT	239.122	907.580	100.000	209.700	0.157	0.299	0.157
UNEXPENDED EAT	264.035	913.365	100.000	209.700	0.188	0.345	0.188
CYLINDER-UNEXPENDED	286.099	1029.000	100.000	209.700	0.329	0.371	0.329
AFT JOINT	495.552	1147.005	100.000	209.700	0.339	0.633	0.339
EXPENDED TDAT	229.518	1149.038	100.000	209.700	0.151	0.288	0.151
UNEXPENDED EAT	266.034	1145.251	100.000	209.700	0.188	0.345	0.188
CENTER SEGMENT 4	1284.808	1303.153	100.000	209.700	4.025	1.647	4.025
FORWARD JOINT	503.157	1185.616	100.000	209.700	0.346	0.644	0.346
EXPENDED TDAT	239.122	1182.580	100.000	209.700	0.157	0.299	0.157
UNEXPENDED EAT	264.035	1188.365	100.000	209.700	0.188	0.345	0.188
CYLINDER - UNEXPENDED EAT	286.099	1304.000	100.000	209.700	0.329	0.371	0.329
AFT JOINT	495.552	1422.005	100.000	209.700	0.339	0.633	0.339
EXPENDED TDAT	229.518	1424.038	100.000	209.700	0.151	0.288	0.151
UNEXPENDED EAT	266.034	1420.251	100.000	209.700	0.188	0.345	0.188
AFT SEGMENT	4037.032	1597.831	100.000	209.700	4.878	3.577	4.878
JOINT	503.157	1460.616	100.000	209.700	0.346	0.644	0.346
EXPENDED TDAT	239.122	1457.580	100.000	209.700	0.157	0.299	0.157
UNEXPENDED EAT	264.035	1463.365	100.000	209.700	0.188	0.345	0.188
CYLINDER	386.557	1542.610	100.000	209.700	0.302	0.500	0.302
EXPENDED TDAT	86.223	1553.964	100.000	209.700	0.064	0.111	0.064
UNEXPENDED EAT	300.335	1539.350	100.000	209.700	0.236	0.389	0.236
AFT CLOSURE	3147.318	1626.549	100.000	209.700	1.371	2.433	1.371
EXPENDED TDAT	1030.657	1623.663	100.000	209.700	0.454	0.802	0.454
UNEXPENDED EAT	2116.661	1627.954	100.000	209.700	0.914	1.632	0.914
LINER	1553.966	890.760	100.000	209.700	65.003	1.934	65.003
FORWARD SEGMENT	212.263	235.948	100.000	209.700	0.283	0.238	0.283
FORWARD CLOSURE	78.152	170.495	100.000	209.700	0.044	0.071	0.044
EXPENDED PAT	0.235	132.734	100.000	209.700	0.000	0.000	0.000
EXPENDED TDAT	77.917	170.609	100.000	209.700	0.044	0.071	0.044
CYLINDER	134.112	274.089	100.000	209.700	0.125	0.166	0.125
EXPENDED PAT	0.299	339.607	100.000	209.700	0.000	0.000	0.000
EXPENDED TDAT	131.587	274.364	100.000	209.700	0.122	0.163	0.122
UNEXPENDED	2.226	249.070	100.000	209.700	0.002	0.003	0.002

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CENTER SEGMENT 1	282.599	478.975	100.000	209.700	0.556	0.362	0.556
EXPENDED PAT	0.745	452.158	100.000	209.700	0.003	0.001	0.003
EXPENDED TDAT	95.697	479.118	100.000	209.700	0.325	0.120	0.325
UNEXPENDED EAT	186.157	479.009	100.000	209.700	0.227	0.241	0.227
CENTER SEGMENT 2	282.599	753.975	100.000	209.700	0.556	0.362	0.556
EXPENDED PAT	0.745	727.158	100.000	209.700	0.003	0.001	0.003
EXPANDED TDAT	95.697	754.118	100.000	209.700	0.325	0.120	0.325
UNEXPENDED EAT	186.157	754.009	100.000	209.700	0.227	0.241	0.227
CENTER SEGMENT 3	282.599	1028.975	100.000	209.700	0.556	0.362	0.556
EXPENDED PAT	0.745	1002.158	100.000	209.700	0.003	0.001	0.003
EXPENDED TDAT	95.697	1029.118	100.000	209.700	0.325	0.120	0.325
UNEXPENDED EAT	186.157	1029.009	100.000	209.700	0.227	0.241	0.227
CENTER SEGMENT 4	282.599	1303.975	100.000	209.700	0.556	0.362	0.556
EXPENDED PAT	0.745	1277.158	100.000	209.700	0.003	0.001	0.003
EXPENDED TDAT	95.697	1304.118	100.000	209.700	0.325	0.120	0.325
UNEXPENDED EAT	186.157	1304.009	100.000	209.700	0.227	0.241	0.227
AFT SEGMENT	211.308	1544.710	100.000	209.700	0.281	0.249	0.281
CYLINDER	145.605	1513.157	100.000	209.700	0.145	0.186	0.145
EXPENDED PAT	0.446	1443.374	100.000	209.700	0.000	0.001	0.000
EXPENDED TDAT	102.910	1510.592	100.000	209.700	0.112	0.131	0.112
UNEXPENDED EAT	42.249	1520.140	100.000	209.700	0.031	0.054	0.031
AFT CLOSURE	65.703	1614.635	100.000	209.700	0.036	0.063	0.036
EXPENDED PAT	0.157	1645.719	100.000	209.700	0.000	0.000	0.000
UNEXPENDED EAT	65.546	1614.560	100.000	209.700	0.036	0.063	0.036
IGNITER ASSEMBLY	660.229	138.401	99.999	209.698	0.379	0.693	0.379
LOADED CASE ASSEMBLY	587.658	140.230	100.000	209.700	0.019	0.008	0.019
CASE	236.617	138.028	100.000	209.700	0.009	0.004	0.009
NOZZLE RING	2.323	159.798	100.000	209.700	0.000	0.000	0.000
EXTERNAL INSULATION	77.109	143.803	100.000	209.700	0.002	0.001	0.002
EXPENDED PAT	0.856	143.803	100.000	209.700	0.000	0.000	0.000
EXPENDED TDAT	37.699	143.803	100.000	209.700	0.001	0.001	0.001
UNEXPENDED EAT	38.555	143.803	100.000	209.700	0.001	0.001	0.001
INSULATION-INTERNAL	6.597	142.594	100.000	209.700	0.000	0.000	0.000
EXPENDED PAT	3.299	142.594	100.000	209.700	0.000	0.000	0.000
UNEXPENDED EAT	3.299	142.594	100.000	209.700	0.000	0.000	0.000

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
LINER - EXPENDED PAT	2.186	142.598	100.000	209.700	0.000	0.000	0.000
PROPELLANT - EXPENDED PAT	262.826	140.913	100.000	209.700	0.006	0.002	0.006
INSULATED CAP	36.559	122.590	100.000	209.700	0.000	0.000	0.000
CAP	35.285	122.609	100.000	209.700	0.000	0.000	0.000
INSULATION	1.274	122.086	100.000	209.700	0.000	0.000	0.000
EXPENDED PAT	0.637	122.086	100.000	209.700	0.000	0.000	0.000
UNEXPENDED EAT	0.637	122.086	100.000	209.700	0.000	0.000	0.000
INITIATOR	11.871	127.140	100.000	209.697	0.064	0.108	0.064
CASE	3.879	126.911	100.000	209.700	0.008	0.001	0.008
LINER-EXPENDED PAT	0.029	126.847	100.000	209.700	0.000	0.0	0.000
PROPELLANT-EXPENDED PAT	1.234	127.170	100.000	209.700	0.002	0.0	0.002
NOZZLE	0.615	131.575	100.000	209.700	0.000	0.0	0.000
ATTACH PROVISIONS	6.114	126.834	100.000	209.694	0.054	0.107	0.054
BOOSTER	0.481	120.688	100.000	209.716	0.000	0.000	0.000
SAFE AND ARMING ASSEMBLY	4.780	118.850	99.905	209.414	0.002	0.003	0.002
SAFE AND ARMING DEVICE	4.550	118.787	99.900	209.400	0.002	0.003	0.002
ATTACH PROVISIONS	0.230	120.103	100.000	209.700	0.000	0.0	0.000
IGNITER ATTACH PROVISIONS	18.879	124.540	100.000	209.700	0.290	0.574	0.290
BOLTS	17.282	124.237	100.000	209.700	0.271	0.537	0.271
SEALANT	1.358	128.369	100.000	209.700	0.016	0.031	0.016
O RING	0.239	124.682	100.000	209.700	0.003	0.006	0.003
NOZZLE ASSEMBLY	12723.745	1767.587	100.000	209.700	43.574	5.292	43.574
FIXED PART	2756.824	1634.964	100.000	209.700	0.503	0.934	0.503
STRUCTURE	1947.225	1636.489	100.000	209.700	0.353	0.659	0.353
FLEXSEAL ADAPTER	326.482	1627.194	100.000	209.700	0.045	0.089	0.045
NOZZLE ATTACH FLANGE	1620.744	1638.362	100.000	209.700	0.301	0.570	0.301
INSULATION	806.289	1631.273	100.000	209.700	0.147	0.274	0.147
EXPENDED PAT	5.732	1628.414	100.000	209.700	0.001	0.002	0.001
EXPENDED TDAT	252.256	1628.414	100.000	209.700	0.045	0.085	0.045
UNEXPENDED EAT	548.300	1632.619	100.000	209.700	0.100	0.188	0.100
O RINGS	3.310	1637.007	100.000	209.700	0.001	0.001	0.001
MOVABLE PART	9829.922	1806.491	100.000	209.700	28.926	4.313	28.926
STRUCTURE	4046.155	1826.655	100.000	209.700	7.566	1.732	7.566
FLEXSEAL ADAPTER	508.585	1621.897	100.000	209.700	0.058	0.115	0.058
BASIC SHELL	2517.623	1833.320	100.000	209.700	0.630	0.793	0.630
EXIT CONE GLASS	1019.947	1912.303	100.000	209.700	0.636	0.824	0.636

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
NOSE INSULATION	401.610	1616.507	100.000	209.700	0.055	0.109	0.055
EXPENDED PAT	3.737	1614.596	100.000	209.700	0.001	0.001	0.001
EXPENDED TDAT	164.432	1614.596	100.000	209.700	0.022	0.045	0.022
UNEXPENDED EAT	233.442	1617.883	100.000	209.700	0.032	0.063	0.032
BACK INSULATION	228.494	1618.126	100.000	209.700	0.023	0.045	0.023
EXPENDED EAT	4.362	1617.767	100.000	209.700	0.000	0.001	0.000
EXPENDED TDAT	191.942	1617.767	100.000	209.700	0.019	0.038	0.019
UNEXPENDED EAT	32.190	1620.314	100.000	209.700	0.003	0.007	0.003
THROAT INSULATION	411.572	1627.774	100.000	209.700	0.035	0.068	0.035
EXPENDED PAT	5.908	1627.802	100.000	209.700	0.000	0.001	0.000
EXPENDED TDAT	259.960	1627.802	100.000	209.700	0.022	0.042	0.022
UNEXPENDED EAT	145.705	1627.723	100.000	209.700	0.013	0.026	0.013
NOSE LINER	65.976	1619.385	100.000	209.700	0.007	0.015	0.007
THROAT LINER	95.356	1627.827	100.000	209.700	0.009	0.018	0.009
EXIT CONE INSUL. FWD	1419.733	1831.055	100.000	209.700	0.254	0.378	0.254
EXPENDED PAT	19.074	1658.605	100.000	209.700	0.003	0.005	0.003
EXPENDED TDAT	839.337	1658.605	100.000	209.700	0.147	0.216	0.147
UNEXPENDED EAT	561.322	2094.776	100.000	209.700	-13.832	0.156	-13.832
EXIT CONE INSUL. CENTER	947.575	1879.671	100.000	209.700	0.293	0.508	0.293
EXPENDED PAT	11.665	1707.457	100.000	209.700	0.004	0.006	0.004
EXPENDED TDAT	513.328	1707.457	100.000	209.700	0.154	0.269	0.154
UNEXPENDED EAT	422.582	2093.620	100.000	209.700	-7.401	0.233	-7.401
EXIT CONE INSUL. AFT	1268.948	1931.617	100.000	209.700	0.675	1.192	0.675
EXPENDED PAT	10.432	1757.679	100.000	209.700	0.005	0.009	0.005
EXPENDED TDAT	459.045	1757.679	100.000	209.700	0.235	0.418	0.235
UNEXPENDED EAT	799.471	2033.760	100.000	209.700	-4.432	0.765	-4.432
EXIT CONE LINER	232.761	1833.406	100.000	209.700	0.046	0.069	0.046
O RINGS	3.161	1833.199	100.000	209.700	0.001	0.001	0.001
FLEXSEAL	674.707	1625.001	100.000	209.700	0.084	0.167	0.084
RUBBER SEAL	33.873	1623.263	100.000	209.700	0.005	0.009	0.005
NOZZLE ATTACH PROVISIONS	137.000	1644.886	100.000	209.700	0.022	0.044	0.022
BOLTS	111.000	1645.550	100.000	209.700	0.018	0.036	0.018
SEALANT	26.000	1642.050	100.000	209.700	0.004	0.008	0.004
RACEWAY ASSEMBLY	213.400	899.665	61.000	279.700	8.785	0.001	8.785
FORWARD SEGMENT	30.300	245.350	61.000	279.700	0.028	0.000	0.028
CENTER SEGMENT 1	38.600	495.800	61.000	279.700	0.053	0.000	0.053
CENTER SEGMENT 2	38.600	770.800	61.000	279.700	0.053	0.000	0.053
CENTER SEGMENT 3	38.600	1045.800	61.000	279.700	0.053	0.000	0.053
CENTER SEGMENT 4	38.600	1320.800	61.000	279.700	0.053	0.000	0.053
AFT SEGMENT	28.700	1544.000	61.000	279.700	0.022	0.000	0.022

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
THRUST VECTOR CONTROL SYSTEM	2259.639	1554.153	117.355	201.751	49.520	2.199	49.839
HPU CONCORDE UNITS	144.000	1644.300	125.000	177.033	0.026	0.054	0.029
MONOFUEL TANKS	250.000	1639.300	144.750	185.200	0.115	0.141	0.039
HYDRAULIC RES. AND ACCUM.	92.000	1646.300	110.152	158.439	0.002	0.056	0.054
TVC CONTROLLER	40.000	1646.300	26.500	217.700	0.000	0.000	0.000
TANDEM ACTUATORS	312.000	1655.086	71.415	238.285	0.067	0.113	0.067
HPU SUPPORTS	50.000	1644.300	137.000	172.700	0.015	0.030	0.015
HYDRAULIC TUBING AND FLUID	157.000	1622.300	100.000	209.700	0.100	0.200	0.100
ELECTRICAL CABLING	753.800	1325.532	131.575	209.700	34.545	0.819	34.789
HYDRAULIC PUMPS	60.000	1640.800	129.500	183.200	0.011	0.020	0.009
NOZZLE ATTACH RING	176.839	1855.929	100.000	209.700	0.038	0.076	0.038
RING	157.899	1856.400	100.000	209.700	0.034	0.067	0.034
BRACKET	18.940	1852.006	100.000	209.700	0.004	0.008	0.004
MISC. SUPPORTS & EQUIPMENT	224.000	1646.300	135.407	173.026	0.065	0.126	0.061
TOTAL MOTOR INERT PARTS	153804.791	982.656	100.201	209.680	8394.302	182.738	8394.580
EXPENDED PAT	337.041	426.782	100.000	209.700	25.641	0.033	25.641
EXPENDED TDAT	7982.765	1144.430	100.000	209.700	609.025	6.960	609.025
UNEXPENDED EAT	145484.986	975.067	100.212	209.679	7690.257	175.745	7690.535
PROPELLANT	1500625.185	903.010	100.000	209.700	57112.844	1075.685	57112.844
FORWARD SEGMENT	159139.434	239.548	100.000	209.700	148.775	109.616	148.775
FORWARD CLOSURE	50531.789	179.590	100.000	209.700	19.336	31.107	19.336
EXPENDED PAT	1521.819	170.510	100.000	209.700	0.283	0.250	0.283
EXPENDED TDAT	49009.971	179.872	100.000	209.700	19.025	30.857	19.025
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CYLINDER	108607.645	267.444	100.000	209.700	71.987	78.509	71.987
EXPENDED PAT	2634.320	274.262	100.000	209.700	1.036	0.433	1.036
EXPENDED TDAT	105973.324	267.275	100.000	209.700	70.923	78.076	70.923
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 1	289762.376	481.010	100.000	209.700	488.085	208.783	488.085
EXPENDED PAT	3612.808	482.250	100.000	209.700	5.337	0.594	5.337
EXPENDED TDAT	286149.568	480.995	100.000	209.700	482.747	208.189	482.747
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
CENTER SEGMENT 2	289762.376	756.010	100.000	209.700	488.085	208.783	488.085
EXPENDED PAT	3612.808	757.250	100.000	209.700	5.337	0.594	5.337
EXPENDED TDAT	286149.568	755.995	100.000	209.700	482.747	208.189	482.747
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 3	289762.376	1031.010	100.000	209.700	488.085	208.783	488.085
EXPENDED PAT	3612.808	1032.250	100.000	209.700	5.337	0.594	5.337
EXPENDED TDAT	286149.568	1030.995	100.000	209.700	482.747	208.189	482.747
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
CENTER SEGMENT 4	289762.376	1306.010	100.000	209.700	488.085	208.783	488.085
EXPENDED PAT	3612.808	1307.250	100.000	209.700	5.337	0.594	5.337
EXPENDED TDAT	286149.568	1305.995	100.000	209.700	482.747	208.189	482.747
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
AFT SEGMENT	182436.248	1542.098	100.000	209.700	137.703	130.936	137.703
CYLINDER	142405.272	1524.133	100.000	209.700	77.233	104.299	77.233
EXPENDED PAT	1956.086	1514.714	100.000	209.700	0.877	0.373	0.877
EXPENDED TDAT	140449.186	1524.264	100.000	209.700	76.318	103.925	76.318
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
AFT CLOSURE	40030.975	1606.008	100.000	209.700	15.258	26.638	15.258
EXPENDED PAT	1122.353	1616.301	100.000	209.700	0.229	0.310	0.229
EXPENDED TDAT	38908.623	1605.711	100.000	209.700	15.003	26.327	15.003
UNEXPENDED EAT	0.000	0.000	100.000	209.700	0.000	0.0	0.000
MOTOR ASSEMBLY	1654429.976	910.414	100.019	209.698	65698.157	1258.425	65698.437
EXPENDED PAT	22022.851	855.159	100.000	209.700	1032.354	3.775	1032.354
EXPENDED TDAT	1486922.139	904.906	100.000	209.700	56820.039	1078.903	56820.039
UNEXPENDED EAT	145484.986	975.067	100.212	209.679	7690.257	175.745	7690.535
MASS FRACTION	0.907						
3 EA MOTOR ASSY	4963289.928	910.414	100.019	99.998	203540.383	16666.706	203540.831
EXPENDED PAT	66068.552	855.159	100.000	100.003	3182.860	182.923	3182.861
EXPENDED TDAT	4460766.418	904.906	100.000	100.003	176253.039	14822.557	176253.041
UNEXPENDED EAT	436454.958	975.067	100.212	99.983	23637.568	1660.831	23638.402

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
FORWARD THRUST STRUCTURE	34806.000	123.441	100.000	209.700	44.147	100.630	44.147
BOX BEAMS	4469.000	106.000	100.000	209.700	4.727	11.345	4.727
BEAM DOUBLERS	565.000	106.000	100.000	209.700	0.000	0.0	0.000
BEAM GUSSETTS	760.000	106.000	100.000	209.700	0.000	0.0	0.000
ORBITER-MOTOR ATTACH BRKTS	4319.000	100.700	100.000	209.700	14.010	33.626	14.010
THRUST CONES	16062.000	129.100	100.000	209.700	17.382	41.719	17.382
SKIRT RING	7031.000	140.600	100.000	209.700	4.414	8.771	4.414
PARTIAL SKIRT	938.000	121.500	100.000	209.700	2.152	5.169	2.152
SKIRT T BAR	264.000	100.000	100.000	209.700	0.000	0.0	0.000
ANGLE BRACES	398.000	112.700	100.000	209.700	0.000	0.0	0.000
AFT SKIRT	31215.500	1722.049	100.000	100.700	147.192	256.066	147.192
AFT RING	5208.000	1795.300	100.000	100.700	25.153	50.297	25.153
CENTER SKIRT RING	5261.000	1708.800	100.000	100.700	22.380	44.753	22.380
BASIC SHELL	10682.000	1710.812	100.000	100.700	53.115	93.798	53.115
DOUBLERS	7413.900	1692.481	100.000	100.700	36.035	64.370	36.035
CENTER BRACKETS	846.200	1701.800	100.000	100.700	0.093	0.185	0.093
OUTSIDE BRACKETS	936.700	1701.800	100.000	100.700	0.102	0.205	0.102
WEDGES	867.700	1795.300	100.000	100.700	1.230	2.458	1.230
INSTRUMENTATION 3 EACH	1655.985	139.090	132.144	148.987	2.343	4.947	2.651
INSTRUMENTATION	551.995	139.090	132.144	258.684	0.064	0.215	0.167
PRESURE TRANSDUCER	1.600	106.400	95.000	204.700	0.000	0.000	0.000
SIGNAL CONDITIONER	35.000	134.900	172.471	230.347	0.000	0.000	0.000
INSTRUMENTATION BATTERY	35.000	134.900	158.633	257.257	0.000	0.000	0.000
POWER DISTRUBUTION BOX	50.000	134.900	139.419	273.358	0.000	0.001	0.001
ATTACH PROVISIONS	324.295	140.792	142.532	261.376	0.041	0.096	0.057
CABLES	106.100	139.117	75.482	254.171	0.012	0.008	0.008
STAGE PROVISIONS	67677.485	861.164	100.787	157.939	9504.228	404.234	9462.666

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XII. (Cont) DETAIL MASS PROPERTIES SUMMARY

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY LONG.	LAT.	VERT.	MOMENT OF INERTIA PITCH	ROLL	YAW
TOTAL STAGE INERT PARTS	529091.860	967.116	100.276	107.397	35517.164	2193.663	35433.652
EXPENDED PAT	1011.122	426.782	100.000	100.000	78.236	2.724	78.236
EXPENDED TDAT	23948.295	1144.430	100.000	100.003	1858.174	83.081	1858.174
UNEXPENDED EAT	504132.443	959.776	100.289	107.763	33348.350	2107.548	33265.147
TOTAL STAGE	5030967.414	909.751	100.029	100.781	213127.549	17118.931	213038.460
EXPENDED PAT	66068.552	855.159	100.000	100.003	3182.860	182.923	3182.861
EXPENDED TDAT	4460766.418	904.906	100.000	100.003	176253.039	14822.557	176253.041
UNEXPENDED EAT	504132.443	959.776	100.289	107.763	33348.351	2107.548	33265.147
STAGE MASS FRACTION	0.895						

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XIII. SEQUENCED MASS PROPERTIES DATA

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY			MOMENT OF INERTIA		
		LONG.	LAT.	VERT.	PITCH	ROLL	YAW
LAUNCH TIME 0.00	1371744.854	917.536	200.273	200.046	38553.706	1055.334	38551.094
BEGIN ACTION TIME TIME = 3.00	1343271.996	918.657	200.279	200.046	37710.543	1043.589	37707.931
10 PERCENT TIME = 13.42	1246382.606	922.957	200.300	200.050	34799.927	1003.587	34797.313
20 PERCENT TIME = 26.84	1115974.479	928.900	200.336	200.056	30918.134	943.825	30915.517
30 PERCENT TIME = 40.26	985073.030	933.897	200.380	200.063	27163.359	877.719	27160.739
40 PERCENT TIME = 53.68	854314.116	938.100	200.438	200.073	23534.930	803.722	23532.305
50 PERCENT TIME = 67.10	724800.541	941.443	200.517	200.086	20063.679	720.812	20061.048
60 PERCENT TIME = 80.51	597716.784	943.741	200.627	200.105	16780.959	628.420	16778.320
70 PERCENT TIME = 93.93	474068.236	944.406	200.790	200.132	13712.709	526.046	13710.057
80 PERCENT TIME = 107.35	354974.226	941.986	201.056	200.176	10881.106	413.741	10878.433
90 PERCENT TIME = 120.77	241932.028	932.926	201.551	200.259	8345.499	292.360	8342.786
END OF ACTION TIME TIME 134.80	146780.877	941.327	202.551	200.425	6645.357	177.245	6642.566

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XIV. SEQUENCED MASS PROPERTIES DATA

OPTIONAL SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-PARALLEL BURN

	WEIGHT (LBS)	CENTER OF GRAVITY			MOMENT OF INERTIA		
		LONG.	LAT.	VERT.	PITCH	ROLL	YAW
LAUNCH TIME 0.00	1384403.883	925.580	200.249	200.339	39797.781	1076.683	39794.184
BEGIN ACTION TIME TIME = 3.00	1355724.935	926.887	200.256	200.336	38939.295	1064.602	38935.774
10 PERCENT TIME = 13.42	1259028.002	931.665	200.275	200.362	36023.386	1024.480	36019.866
20 PERCENT TIME = 26.84	1129099.220	938.255	200.307	200.404	32153.588	964.687	32150.070
30 PERCENT TIME = 40.26	998607.909	944.126	200.347	200.457	28409.876	898.560	28406.360
40 PERCENT TIME = 53.68	868269.669	949.464	200.399	200.525	24797.292	824.600	24793.779
50 PERCENT TIME = 67.10	739185.009	954.331	200.469	200.617	21346.147	741.798	21342.638
60 PERCENT TIME = 80.51	612521.803	958.769	200.566	200.745	18086.254	649.584	18082.750
70 PERCENT TIME = 93.93	489259.695	962.665	200.709	200.932	15042.184	547.440	15038.689
80 PERCENT TIME = 107.35	370462.385	965.648	200.937	201.232	12234.189	435.357	12230.706
90 PERCENT TIME = 120.77	257537.885	967.182	201.348	201.773	9695.851	314.076	9692.390
END OF ACTION TIME TIME 134.80	162628.338	994.185	202.118	202.882	7968.386	199.157	7964.908

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES
THRU THE CENTER OF GRAVITY

TABLE XV. SEQUENCED MASS PROPERTIES DATA

BASELINE SOLID ROCKET MOTOR SPACE SHUTTLE 156 IN BOOSTER-SERIES BURN

	WEIGHT (LBS)	CENTER OF GRAVITY			MOMENT OF INERTIA		
		LONG.	LAT.	VERT.	PITCH	ROLL	YAW
LAUNCH TIME 0.00	1654429.976	910.414	100.019	209.698	65698.157	1258.425	65698.437
BEGIN ACTION TIME TIME = 3.00	1623464.723	911.897	100.019	209.698	65752.804	1248.609	65753.083
10 PERCENT TIME = 13.42	1506519.699	916.669	100.021	209.698	60476.662	1200.633	60476.942
20 PERCENT TIME = 26.84	1349127.676	923.254	100.023	209.698	53472.359	1129.023	53472.638
30 PERCENT TIME = 40.26	1189671.503	928.882	100.026	209.697	46615.535	1049.157	46615.814
40 PERCENT TIME = 53.68	1029890.445	934.031	100.030	209.697	39973.346	959.126	39973.625
50 PERCENT TIME = 67.10	870470.761	938.374	100.036	209.697	33548.115	857.611	33548.395
60 PERCENT TIME = 80.51	713475.514	942.232	100.043	209.696	27432.188	743.868	27432.467
70 PERCENT TIME = 93.93	559731.461	945.140	100.055	209.695	21666.519	616.997	21666.798
80 PERCENT TIME = 107.35	411097.390	946.227	100.075	209.693	16242.076	477.254	16242.355
90 PERCENT TIME = 120.77	268901.158	944.347	100.115	209.689	11301.537	324.996	11301.815
END OF ACTION TIME TIME 134.80	145484.986	975.067	100.212	209.679	7690.257	175.745	7690.535

MOMENT OF INERTIA IS IN SLUG FEET SQUARED DIVIDED BY 1000 ABOUT AXES THRU THE CENTER OF GRAVITY

SEQUENCIAL DATA IS BASED ON ONE MOTOR DATA

TABLE XVI

PROPELLANT PARAMETERS

Type	PBAN
Thiokol designation	TP-H1011
Composition (%)	
Aluminum	16.0
Ammonium perchlorate	70.0
Binder	14.0
Burn rate catalyst (Fe_2O_3)	0.0
Plasticizer (DOA)	0.0
Theoretical thermochemical data (reference conditions)	
Characteristic velocity (fps)	5,186
C*-P_c exponent	0.0057
Burning rate coefficient exponent	0.25
Expansion ratio	10
Chamber specific heat ratio	1.143
Exit pressure (lb/sq in.)	15.1
Chamber pressure (lb/sq in.)	1,000
P_c temperature sensitivity (π_K/deg)	0.0015
Temperature exponent	0.0248
Density (lb/cu in.)	0.064
Theoretical vacuum specific impulse (sec)	286.2
Chamber temperature (° K)	3,462
Molecular weight of exhaust gas	28.59
Physical properties	
Stress (psi)	95
Strain at maximum stress (%)	31
Modulus (psi)	431
Strain (%)	39

TABLE XVII

MASS PROPERTIES DEPENDENT DESIGN INFORMATION

Item	Parallel Baseline	Parallel Optional	Series Baseline
Structure - Case			
Material	D6AC Steel	D6AC Steel	D6AC Steel
Ultimate strength (psi)	200,000	200,000	200,000
Yield strength (psi)	180,000	180,000	180,000
KIC	110	110	110
Weld efficiency	1.00	1.00	1.00
Density	0.283	0.283	0.283
Design safety factor	1.4	1.4	1.4
MEOP	996	996	996
Elastic modulus (psi)	29×10^6	29×10^6	29×10^6
Dome safety factor	1.54	1.54	1.54
Insulation			
Material	Asbestos/silica filled NBR	Asbestos/silica filled NBR	Asbestos/silica filled NBR
Density (lb/cu in.)	0.0464	0.0464	0.0464
Tensile strength (psi)	1,600	1,600	1,600
Hardness (Shore A)	80	80	80
Design safety factor	2.0	2.0	2.0
Nozzle			
Type	Fixed	Submerged flex bearing	Submerged flex bearing
Submergence (%)	14.5	10	9.6
Expansion ratio	10:1	10:1	8.7:1
Half angle (deg)	17.5	17.5	17.5
Structural safety factor	1.4	1.4	1.4
Ablative safety factor	2.0	2.0	2.0
Ballistics			
Delivered vac I_{sp} (sec)	272	272	
Burn time (sec)	134.1	134.1	
Avg vac thrust (lb)	2.47×10^{-6}	2.47×10^{-6}	
Avg chamber pressure (psi)	830	830	
Propellant burn rate at 1,000 psia (ips)	0.403	0.403	
Avg expansion ratio	10	10	
Avg throat diameter (in.)	45.04	45.04	
TVC			
Deflection (deg)	NA	5.0	5.0
Slew rate (deg/sec)	NA	5	5
Torque (million in-lb)	NA	2.45	3.08
Each actuator load at max torque (lb)	NA	34,000	43,000
APU horsepower	NA	87	87

APPENDIX C

THIOKOL SRM STAGE AND MOTOR CI SPECIFICATIONS

THIOKOL CHEMICAL CORPORATION
WASATCH DIVISION
BRIGHAM CITY, UTAH

SPECIFICATION

ROCKET MOTOR, SOLID PROPELLANT
TU 742/03

1. SCOPE

This specification establishes the requirements for performance, design and qualification of one mission-design-series of equipment designated as Solid Rocket Motor, TU-742/03 Configuration Item (CI) number (TBD).

The CI consists of a forward sigment, three cylindrical segments and an aft segment, is 1393 inches (116 feet) long, has a nominal diameter of 156 inches, weighs 1.3 million pounds, with 1.2 million pounds of propellant and has a mass fraction, excluding the hydraulic power unit (HPU) and aft skirt extension, of 0.917.

2. APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced here and other detail content of Sections 3 and 4, the details of Sections 3 and 4 shall be considered as superseding requirements.

SYSTEM PROGRAM DOCUMENTS

NASA Exhibits

(TBD)

SPECIFICATIONS

NASA

(TBD)

THIOKOL CHEMICAL CORPORATION (THIOKOL)

(TBD) Propellant, Solid, PBAN, TP-H1011
(TBD) Liner, Elastomeric UF-2121
(TBD) Hydraulic Power Unit (HPU)
(TBD) Thrust Termination System (TT)
(TBD) Nozzle, Flex Joint
(TBD) Igniter
(TBD) Safety and Arming Device
(TBD) Case Assembly
(TBD) Arm/Disarm Mechanism
(TBD) Thrust Vector Control System
(TBD) Malfunction Detection System
(TBD) Destruct System

STANDARDS

NASA

(TBD)

PUBLICATIONS

NASA

(TBD)

Code of Federal Regulations

49 CFR 173.92 List of Explosives and Other Dangerous Articles . . . .

(Copies of specifications, standards, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Performance. The performance ratings and curves discussed in this section are based on the terms and standard conditions defined in this specification.

3.1.1 Functional Characteristics.

3.1.1.1 Primary Functional Characteristics. Upon receipt of command signal, the CI shall ignite and provide thrust within the limits as specified herein.

3.1.1.1.1 Performance Ratings. Nominal performance ratings for the SRM, at vacuum conditions and with the propellant grain nominal temperature at 70 degrees F, shall be as specified in Table I.

TABLE I

PERFORMANCE
156-INCH DIAMETER MOTOR

MEOP - 1000 psia

Ballistics:

Delivered Vacuum Specific Impulse, lbf-sec/lbm	270.9
Burntime, sec	135
Average Vacuum Thrust, $X10^{-6}$, lb	2.4
Average Chamber Pressure, psia	830
Propellant Burn Rate @ 1000 psia, in/sec	0.41
Average Nozzle Expansion Ratio	10
Average Nozzle Throat Diameter, in.	46.7
Motor Ignition Delay to 75% Pmax., sec. (max.)	0.8

3.1.1.2 Secondary Performance Characteristics

3.1.1.2.1 Thrust Versus Time Curves. Instantaneous thrust as a function of time, at ambient pressure of 14.7 psia and with the propellant grain at 70 degrees F, shall be as shown in Figure 1.

3.1.1.2.2 Propellant Parameters. Nominal parameters of the cured solid propellant shall be as specified in Table II.

TABLE II

PROPELLANT PARAMETERS, NOMINAL

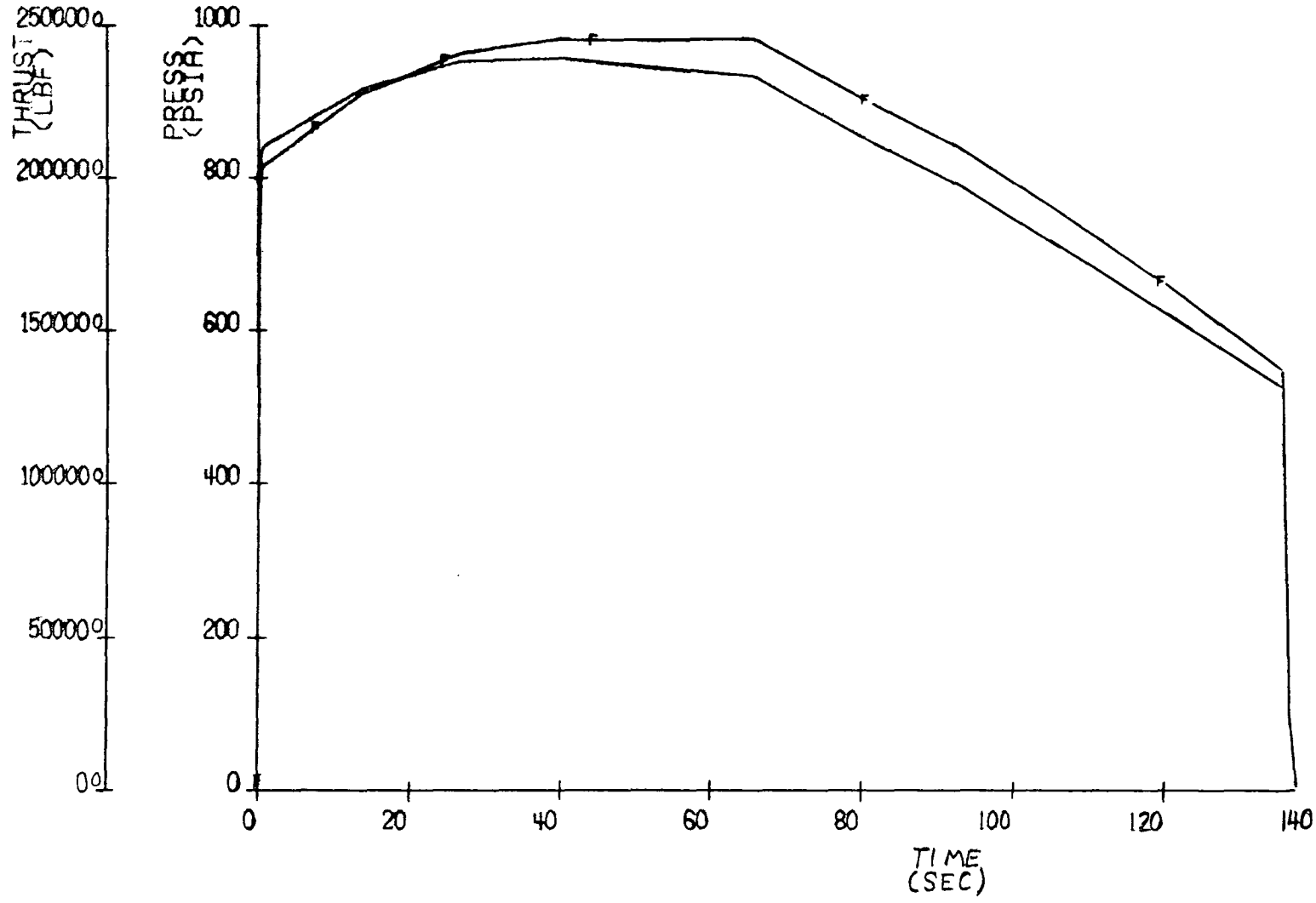
PROPELLANT	PARAMETER
Type	PBAN
Thiokol Designation	TP-H1011
Composition:	
Aluminum, %	16.0
Ammonium Perchlorate, %	70.0
Binder, %	14.0
Theoretical Thermochemical Data (reference conditions):	
Characteristic Velocity, ft/sec	5186
C*-Pc Exponent	0.0057
Burning Rate Coefficient Exponent	0.31
Expansion Ratio	10
Chamber Specific Heat Ratio	1.143
Exit Pressure, lb/in^2	15.1
Chamber Pressure, lb/in^2	1000
P_c Temperature Sensitivity, π_k /deg	0.0015
Temperature Exponent	0.0248
Density, lb/in^3	0.064
Theoretical Vacuum Specific Impulse, sec	286.2
Chamber Temperature, deg-K	3462
Molecular Weight of Exhaust Gas	28.59
Physical Properties:	
Stress (psi)	95
Strain at Maximum Stress (%)	31
Modulus (psi)	431
Strain (%)	39

FIGURE 1

THRUST VS. TIME

AMBIENT PRESSURE 14.70

GRAIN TEMPERATURE 70.00



3.1.1.2.3 Thrust Vector Control Actuation System. The thrust vector control (TVC) actuation system shall consist of a dual hydraulic power unit system having redundant power supply provisions and tandem actuators with full redundant servo control provisions. Each of the TVC tandem actuators is an operate/fail/operate actuator and employs an intrasystem monitoring capability. Internal detection and correction technique reduces large vehicle transients that would be due to external sensing of attitude rate since the detection of error is ahead of the power ram. Other requirements shall be as follows:

a. Vectoring angle: $\pm$ 5°

b. Maximum vectoring torque: 3.08×10^6 in-lbs

c. Peak slew rate: 5° per second

d. Vehicle steering: 60° per second plus 0.20° at 0.2 cps.

e. Operational duration: 140 seconds flight plus 10 seconds prelaunch

f. Component functional ground checkout: 100%

3.1.1.2.4 Hydraulic Power Units (HPU). Each HPU shall consist of a monofuel gas turbine, a gearbox, a variable displacement hydraulic pump, associated hydraulic equipment, controller plus arm/disarm provisions, dual ignition, fuel tank, and supply system. The hydraulic power units will be mounted on the SRM stub skirt. No access doors will be required for maintenance or ground checkout. The arm/disarm device for each HPU shall be capable of being armed only by the launch control sequence circuitry. When started by the proper voltage signal, the HPU shall be capable of providing up to 8 minutes of full power output. Dual start capabilities for the units are provided.

3.1.1.2.5 Nozzle. The nozzle shall be a partly submerged, flexible bearing, movable configuration and shall provide a minimum of plus or minus 5 degrees thrust vector. The structural margin of safety shall be not less than 1.4 and the ablative margin of safety shall be not less than 2.0.

3.1.1.2.6 Malfunction Detection System. The malfunction detection system shall provide, through solid state electronic circuits, a means for detection of differences in chamber pressure between the two SRM's. Three pressure transducers will be located on the head end of each SRM and three shall be located on the aft end of each SRM. The indications from the two nearest the same level of pressure from each group of three transducers shall be fed into the differential comparitor circuit which will detect and indicate to the pilot the deviations of chamber pressure between the SRM's. The system may be "enabled" or "disabled" by a command signal from the orbiter.

3.1.1.2.7 Thrust Termination. The thrust termination system shall be equipped with a safety and arming device which shall be armed before launch and will be ready to fire when required. The shaped charges at the center of the cross in each stack shall open the ports within 350 to 450 microseconds after the detonator fires. As the detonator delay time is in the range of 200 to 300 microseconds, the total functioning time of the entire system will be less than 1 millisecond.

3.1.1.2.8 Destruct System. The destruct system shall be initiated by the detonators in an explosive train safety and arming device. The safety and arming device shall be identical to the thrust termination safety and arming device except that the firing connectors shall be keyed differently to avoid switching firing lines during final assembly. There shall be two parallel, 250 grain/foot RDX aluminum sheathed linear shaped charges in the SRM raceway located on the cylindrical section of each segment. The shaped charges will be designed to cut through the case and approximately half-way through the internal case insulation so that an advertent firing of the destruct system on an unignited motor will not result in ignition of the motor propellant. This system will provide destruct capability at low as well as at high motor pressures. The shaped charges will be connected to the safety and arming device and to each other by explosive leads. There will be an explosive lead crossover between the charges at each motor segment.

Mounting clips will be provided in the raceway for the shaped charges. The shaped charges will be shipped separately from the motor segments. The safety and arming device and explosive leads will be installed on each SRM prior to shipment. The shaped charges will be assembled to the SRM at the launch site.

3.1.2 Operability

3.1.2.1 Reliability. The design reliability for the SRM shall be (TBD) .

3.1.2.1.1 Availability. The SRM shall have a reaction time of (TBD) hours minimum for launch aborts. The SRM shall be capable of holding at T-31 seconds for a minimum of (TBD) days with a (TBD) launch reaction time.

3.1.2.2 Maintainability. The maintainability requirements for the CI shall be in accordance with (TBD) . Mean times required for maintenance actions which shall be performed within the following mean maintenance and repair cycles:

a. Scheduled Maintenance None

b. Unscheduled Maintenance To be determined later.

3.1.2.2.2 Service and Access. Access shall be provided so that all interface connections can be made using standard tools. The ignition system shall be designed so that replacements can be made using standard tools.

3.1.2.3 Useful Life. The CI shall have a combined service and storage life of not less than 5 years. During this time the CI shall suffer no deterioration or loss of performance beyond the limits of this specification when maintained in accordance with the requirements of 3.1.2.2 and 3.1.2.2.1. Storage life and service life are defined as follows:

a. Storage life is the period during which the CI is stored in a controlled environment and begins with the date of casting.

b. Service life is the period beginning when the CI is removed from a controlled environment storage, whether the CI is assembled to a space shuttle vehicle or not. During this period the CI may be subjected to any combination of environmental conditions specified herein.

3.1.2.4 Environmental Conditions

3.1.2.4.1 Ground Environments. The SRM shall meet the performance requirements of this specification after being subjected to any of the following listed environments treated singly or in a combination:

a. Temperatures of from 60 to 100 degrees F for a maximum of (TBD).

b. Temperatures of from 30 to 60 degrees for not more than (TBD)

c. Relative humidities as follows:

(1) 60 percent at 60 degrees F for indefinite times.

(2) 45 percent at 80 degrees F for indefinite times.

(3) 80 percent at 80 degrees F for up to 90 days.

d. Twenty percent salt fog for not more than (TBD) hours.

e. Wind at 46.5 miles per hour for not more than 2 hours.

f. Rain at (TBD) inches per hour for not more than 2 hours.

g. Sand and dust at (TBD) feet per minute for not more than 2 hours.

h. Sunshine

3.1.2.4.2 Resonance Conditions. The CI shall meet the performance requirements of this specification after being subjected to the following resonance conditions:

Transverse (TBD)

Longitudinal (TBD)

3.1.2.4.3 Vibration. The CI shall meet the performance requirements of this specification after being subjected to transportation vibrations as follows: (TBD)

3.1.2.4.4 Explosive Atmosphere. The CI , prior to ignition shall not ignite a gaseous explosive mixture.

3.1.2.4.5 Propellant Compatibility. The performance and the physical properties of exposed materials of the CI shall not be degraded after exposure to liquid propellant as follows:

a. Propellant fumes for not more than (TBD).

b. Propellant splashing for not more than (TBD).

3.1.2.5 Transportability. The CI shall be transported as specified in the contract. During transportation, the temperature to which the CI will be subjected will be between -40 and + 150 degrees F; and the maximum acceleration imposed on the CI shall not exceed 3g's longitudinally, 3 g's vertically and .5g transversely.

3.1.2.6 Human Performance (To be determined later.)

3.1.2.7 Safety. The CI shall be handled and transported as having a Military Explosive Classification of (TBD) in accordance with NASA (TBD) and an ICC Explosive Classification of Class B in accordance with CFR-49, 173.92.

3.2 CI Definitions

3.2.1 Interface Requirements. Interfaces for this CI are as follows:

Interface With	Definition
a. Adapter Kit	Structural Connections
b. Command and Inadvertent Separation Destruct System	Provide Mounting Provisions For
c. Electrical Circuits	Electrical Connections to Cabling

3.2.1.1 Schematic Arrangement. General arrangement and dimensions of the CI with ignition system installed shall be as shown on the drawing.

3.2.1.2 Detailed Interface Definition. All interfaces shall conform to interface control drawings prepared and approved in accordance with the contract provisions.

3.2.2 Component Identification

3.2.2.1 Government-Furnished Property List (Not Applicable)

3.2.2.2 Engineering Critical Components List. Engineering critical components shall include:

a. Segments
b. Forward Dome
c. Igniter
d. Propellant
e. Safety and Arming Device (Motor Ignition)
f. Arm/Disarm Mechanism (TVC Ignition)
g. Aft Dome
h. Nozzle
i. Hydraulic Power Unit
j. Thrust Vector Control System
k. Thrust Termination System
l. Malfunction Detection System
m. Destruct System

3.2.2.3 Logistics Critical Components. (To be determined later.)

3.3 Design and Construction

3.3.1 General Design Features

3.3.1.1 Ignition System. The ignition system shall be capable of being remotely armed or safed upon receipt of a command signal consisting of from 25 to 31 vdc at 3 amperes maximum for a period of from 2 to 5 seconds.

The arm or safe condition of the ignition system shall be verified by closure of a circuit rated at 28 vdc at 200 milliamperes.

3.3.1.2 Nozzles

a. The TU-742/03 shall have a flex nozzle.

3.3.1.3 Performance Sensing Instrumentation. Performance sensing instrumentation shall be provided for monitoring thrust, aerodynamic heat, temperature and motor burnout. Instrumentation shall be capable of the following:

a. Sensing thrust of from 0 to (TBD) lbf for approximately 135 seconds with an accuracy of 10 percent.

b. Sensing motor burnout when thrust has decreased to less than (TBD) ibf.

The exciting power for sensing, conditioning, and transmitting signals for instrumentation listed above shall be 28 plus or minus 3 vdc. A means of verifying instrumentation circuitry shall be provided.

3.3.2 Selection of Specifications and Standards. Selection and use of specifications and standards shall be in accordance with (TBD), except as provided in 3.3.4.

3.3.3 Materials, Parts, and Processes. Commercial parts having suitable properties may be used where, on the date of invitation for bids, there are no standard parts. In any case, commercial utility parts (screws, bolts, nuts, cotter pins, etc.) having suitable properties may be used provided:

a. They can be replaced by the standard parts (MS and AND) with alteration.

b. The corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawings.

Except as specified above, AND and MS standard parts shall be used where they suit the purpose. They shall be identified on drawings by their part numbers.

3.3.5 Moisture and Fungus Resistance. The CI shall function as specified herein during and after exposure to the following environments:

a. 80 percent relative humidity at 80 degrees F for 90 days

b. 28 days exposure to selected fungi in a fungus chamber as specified in Specification (TBD).

If possible, the use of materials known to be fungus nutrients shall be avoided in the construction of the CI.

3.3.6 Corrosion of Metal Parts. Materials used in the CI that will be subjected to corrosive environments shall be protected from such corrosion in a manner which will not interfere with the required function of the CI.

3.3.6.1 Dissimilar Metals. Dissimilar metals, as defined in (TBD) shall not be placed in contact unless properly protected against galvanic action. For the purpose of this specification, aluminum shall be classed as (TBD).

3.3.7 Interchangeability and Replaceability. The CI and its component parts shall be designed to be interchangeable or replaceable in accordance with the definitions set forth in Standard (TBD).

3.3.8 Workmanship. Workmanship shall be in accordance with the best industrial practice for this type of equipment. Whenever contractual documents fail to clearly state the required quality of any work, the interpretation requiring the best quality of workmanship shall be followed.

3.3.9 Electromagnetic Interference. Design of the CI shall comply with the applicable requirements of Specification (TBD).

3.3.10 Identification and Marking. Identification of the CI , subassemblies, and components, with assigned part numbers shall be in accordance with Standard (TBD). Name plates shall be in accordance with (TBD). Serialization shall be in accordance with (TBD).

3.3.11 Storage. The CI shall be capable of withstanding indoor storage under controlled temperature and humidity conditions. Packaging for storage shall be in accordance with NASA requirements.

4. QUALITY ASSURANCE PROVISIONS

4.1 Category I Test (If Applicable)

4.1.1 Engineering Test and Evaluation. (Not Applicable)

4.1.2 Preliminary Qualification Tests (Not Applicable)

4.1.3 Formal Qualification Test. The following subparagraphs specify the requirements of Section 3 for, and methods of, formally verifying that each requirement in Section 3 has been satisfied. Verification will be accomplished with a review of analytical data, test results, and demonstrated performance.

4.1.3.1 Inspection. The following requirements of Section 3 shall be verified by an inspection of the CI at time and place of qualification testing:

a. 3.1.2.2.2 Service and Access

b. 3.2.1.1 Schematic Arrangement

c. 3.3.8 Workmanship

d. 3.3.10 Identification and Marking

4.1.3.2 Analyses. The following requirements of Section 3 shall be verified by review of analytical data:

a. 3.1.1.1.1 Performance Ratings

b. 3.1.1.2.1 Thrust Versus Time Curves

c. 3.1.2.1 Reliability

d. 3.1.2.1.1 Availability

e. 3.1.2.2 Maintainability

f. 3.1.2.2.1 Maintainance and Repair Cycles

g. 3.1.2.3 Useful Life

h. 3.1.2.4.1 Ground Environments

i. 3.1.2.4.2 Resonance Conditions

j. 3.1.2.4.3 Vibration

k. 3.1.2.4.4 Explosive Atmosphere

l. 3.1.2.4.5 Propellant Compatibility

m. 3.1.2.5 Transportability

n. 3.1.2.7 Safety

o. 3.2.1 Interface Requirements

p. 3.2.1.2 Detailed Interface Definition

q. 3.3.1.1 Ignition System

4.	3.3.1.2	Nozzles
s.	3.3.1.3	Performance Sensing Instrumentation
t.	(TBD)	(TBD)
u.	3.3.2	Selection of Specifications & Standards
v.	3.3.4	Standard and Commercial Part
w.	3.3.5	Moisture and Fungus Resistance
x.	3.3.6	Corrosion of Metal Parts
y.	3.3.6.1	Dissimilar Metals
z.	3.3.7	Interchangeability and Replaceability
aa.	3.3.9	Electromagnetic Interference

4.1.3.3 Demonstrations. Conformance to the requirements of 3.1.2.2.2 shall be demonstrated.

4.1.3.4 Tests. (Not applicable).

4.1.4 Reliability Test and Analyses. The requirements of 3.1.1.1.1, 3.1.2.1, and 3.3.1.2 shall be verified by review of past test results of nozzles and the demonstrated performance of the nozzles in their normal application. In addition, a series of (TBD) nozzles, minimum, shall be tested to demonstrate feasibility and (TBD) nozzles, minimum shall be used to demonstrate reliability and performance. All tests and demonstrations shall be conducted with the nozzle assembled to the CEI.

4.1.5 Engineering Critical Component Qualification

(TBD)

4.2 Category II Test Program.

(TBD)

5. PREPARATION FOR DELIVERY (TBD)

6. NOTES

6.1 Supplemental Information.

(TBD)

6.2 Alternate Source Qualification

(TBD)

6.3 Definitions. Performance requirements as specified herein are based on terms defined as follows:

a. Action Time. Action time begins when the chamber pressure reaches psia on the rise (corresponding to a (TBD) thrust at sea level) and ends when the chamber has decreased to psia (corresponding to a (TBD) thrust at vacuum conditions).

b. Ignition Delay Time. Ignition delay time is the time from switch closure (ignition signal) to beginning of action time.

CODE IDENT
NO. 07703

CPWI-978
9 March 1972

THIOKOL CHEMICAL CORPORATION
WASATCH DIVISION
BRIGHAM CITY, UTAH

SPECIFICATION

SOLID ROCKET MOTOR STAGE, TU-742

1. SCOPE. This specification establishes the requirements for performance, design, test, and qualification of one mission-design-series of equipment identified as:

Solid Rocket Motor Stage, CI No. (TBD)

This configuration item (CI) consists of two TU-742 Solid-Propellant Rocket Motors (SRM), together with providions for attachment to a liquid-propellant space shuttle vehicle. This CI provides a nominal average thrust at vacuum conditions of 4,860,000 pounds-force (LBF) over 135 seconds (sec) action time.

2. APPLICABLE DOCUMENTS. The following documents, of the exact issues shown, form a part of this specification to the extent specified herein. In the event of conflict between documents referenced here and detail content of Sections 3 and 4, the detail requirements of Section 3 and 4 shall govern.

SYSTEM PROGRAM DOCUMENTS

SPECIFICATIONS

NASA (TBD)

Thiokol Chemical Corporation

CPW1-977	Solid Rocket Motor, TU-742
(TBD)	Staging System
(TBD)	Interstage Structure
(TBD)	Nose Cone
(TBD)	Aft Fairing
(TBD)	Recovery System

STANDARDS

NASA (TBD)

DRAWINGS

NASA (TBD)

OTHER PUBLICATIONS

(TBD)

Code of Federal Regulations (ICC)

49 CFR 173.92 List of Explosives and Other Dangerous Articles . . . .

3. REQUIREMENTS

3.1 Performance. The performance ratings and curves discussed in this section are based on the terms and standard conditions defined in this specification (see 6.3).

3.1.1 Functional Characteristics

3.1.1.1 Primary Performance Characteristics. Upon receipt of command signals transmitted from the space shuttle vehicle, the CI shall ignite, provide thrust to the space shuttle vehicle, and separate from the core within the limits as specified herein.

3.1.1.1.1 Ratings. Performance ratings at vacuum conditions shall be within the limits specified in Table I at a motor temperature of 70 degrees Fahrenheit (F).

Table I

Primary Performance Ratings, Solid Rocket Motor
Stage at 70°F 1/ and Vacuum Conditions

Parameter	Unit	Nominal	Limits 2/ Minimum	Limits 2/ Maximum
Average thrust 3/ (action time)	lbf	4,860,000	(TBD)	(TBD)
Total impulse 3/ (action time)	lbf-sec	658,000,000	(TBD)	(TBD)
Action time	sec	135	(TBD)	(TBD)
Ignition delay time	sec	0.118	(TBD)	(TBD)

1/ Thrust values at other temperatures may be determined from the equation:

$$F_T = F_{70°} \left[1 + 0.00102 \left(T - 70°\right)\right]$$

Time values at other temperatures may be determined from the equation:

$$t_T = \frac{t_{70°}}{1 + 0.00102 \left(T - 70°\right)}$$

2/ Limits specified can be expected to encompass 99 percent of the population with a certainty of 95 percent.

3/ Summation of two motors. Thrust values given are the thrust vectors along SRM longitudinal centerlines.

3.1.1.1.2 Variation Between Motors. The variation in performance at 70 degrees F between two motors comprising a single solid rocket stage shall not exceed the following limits:

a. Average vacuum thrust, lbf ± (TBD)

b. Total vacuum impulse, lbf-sec ± (TBD)

c. Action time, sec ± (TBD)

d. Ignition delay time ± (TBD)

3.1.1.2 Secondary Performance Characteristics

3.1.1.2.1 Thrust-Time Curves. Instantaneous thrust as a function of time, at vacuum conditions, with the propellant grains of both motors conditioned to 70 degrees F, shall be not less than shown in Figure 1.

3.1.1.2.2 Thrust-Time Variation Between Motors. The variation in thrust versus time at 70 degrees F between two motors comprising a single stage shall not exceed (TBD).

3.1.1.2.3 Staging System. The staging system shall provide the capabilities for separating each SRM subsystem from the space shuttle vehicle.

a. The staging ordnance shall arm upon receipt of a (TBD) voltage at (TBD) amperes for a period of (TBD) second.

b. The staging system shall react to the command to separate within (TBD) second.

c. The staging system shall cause the SRM's to separate from the space shuttle vehicle without damaging the space shuttle vehicle or the SCM hardware.

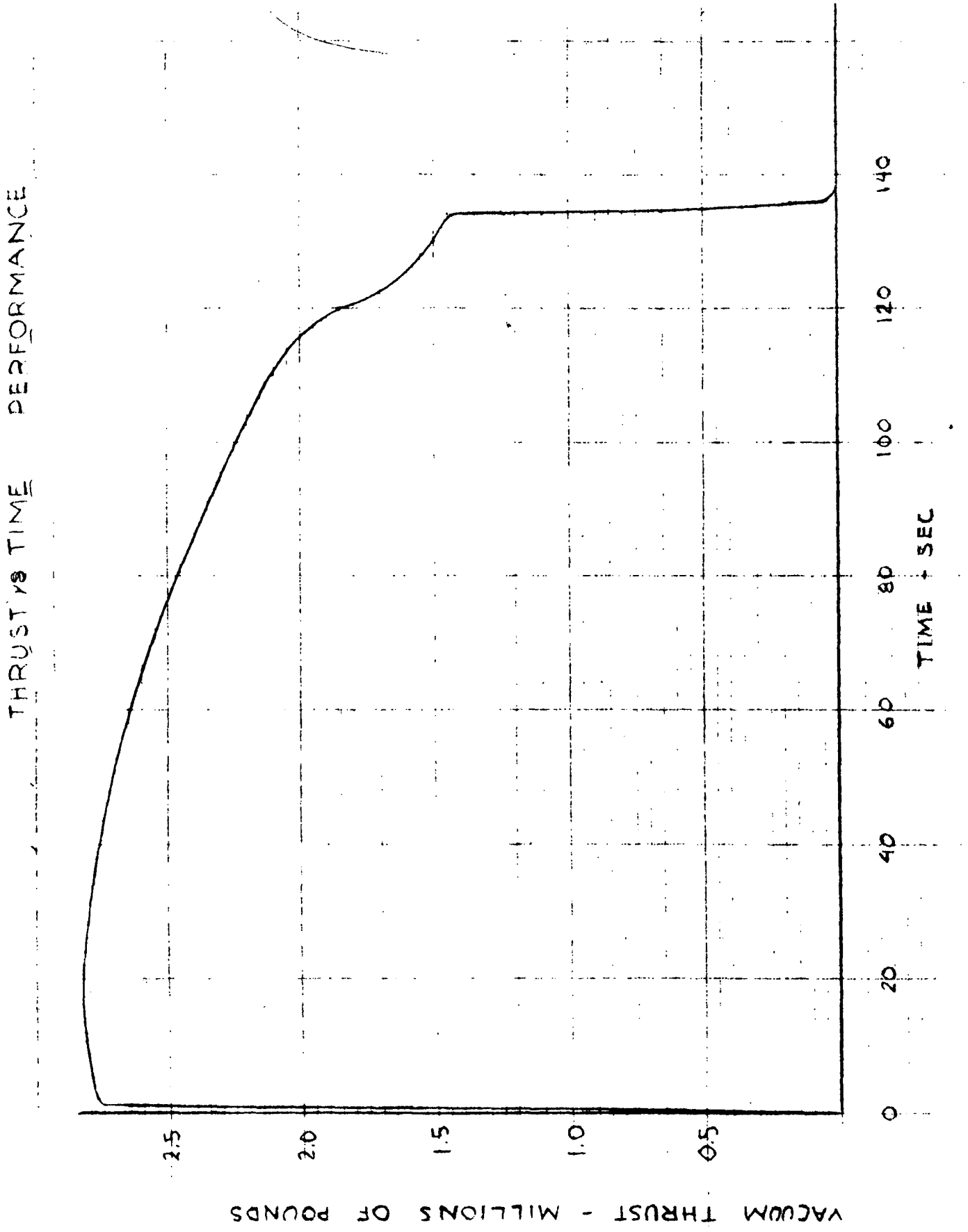
3.1.1.2.4 Interstage Structure. The interstage structure shall attach the SRM's to the space shuttle vehicle.

a. The interstage structure shall support the weight of the space shuttle vehicle on the launch pad.

b. The interstage structure shall transmit the SRM stage thrust forces to the space shuttle vehicle.

FIGURE 1

THRUST VS. TIME PERFORMANCE



3.1.1.2.5 Nose Cone . Each SRM nose cone shall provide structural attach points for the forward interstage structure and shall have an aerodynamic configuration for improved flight characteristics.

a. The nose cone shall support a (TBD) percentage of the weight of the space shuttle vehicle through the attach structure while on the launch pad.

b. The nose cone shall transmit the SRM thrust froces to the attach structure.

c. The nose cone shall withstand the force of the expended SRM striking the ocean.

3.1.1.2.6 Aft Fairing . The SRM aft fairing shall provide structural attach points for the aft interstage structure and structural support of the space shuttle vehicle while on the launch pad.

a. The aft fairing shall support a (TBD) percentage of the weight of the space shuttle vehicle through the attach structure while on the launch pad.

b. The aft fairing shall support the combined weight of the space shuttle vehicle and the SRM stage while on the launch pad.

c. The aft fairing shall withstand the forces required to hold the SRM stage and the space shuttle vehicle on the launch pad from SRM ignition until release on the hold down structures.

3.1.1.2.7 Recovery System. The SRM stage shall contain provisions for recovering the expended SRM's after each SRM has been separated from the space shuttle vehicle.

a. The recovery system shall lower each SRM to the ocean at a speed not to exceed (TBD) feet per second.

b. The SRM hardware must withstand the splashdown forces without damage to the case, aft fairing, hydraulic power units, power supply, and nozzle.

c. The recovery system shall prevent the expended SRM from sinking into the ocean.

3.1.2 Operability

3.1.2.1 Reliability. The total reliability of this CI for terminal countdown, launch, and flight shall be (TBD) percent at a confidence level of 50 percent. This reliability shall be apportioned as follows:

a. Perform terminal countdown and launch: (TBD) percent at (TBD) percent confidence.

b. Perform flight function: (TBD) percent at (TBD) percent confidence.

3.1.2.1.1 Availability. The CI shall have a reaction time capability of (TBD) for launch aborts caused by conditions external to the CI. The CI shall be capable of holding at T-31 sec for (TBD) with a (TBD) launch reaction time.

3.1.2.2 Maintainability. The CI shall be designed so that repairs can be made within the following mean times:

a. Launch Pad Unscheduled Maintenance	(TBD)
b. Launch Pad Scheduled Maintenance	None
c. Other Unscheduled Maintenance	(TBD)
d. Other Scheduled Maintenance	None

3.1.2.2.1 Maintainability and Repair Cycle. Maintenance and repair shall be limited to systems checkout and test following assembly and prior to terminal countdown and launch.

3.1.2.2.2 Service and Access

3.1.2.2.2.1 Erection and Alignment. The SRM stage shall require two SRM subsystems. The components of each SRM subsystem will be transported to the vehicle assembly building and assembled into an SRM. Identification of the SRM centerline will be required for alignment.

NOTE: After two SRM subsystems are erected, the space shuttle fuel/oxidizer tank is attached to the SRM's. Weight of tank and space shuttle vehicle itself are carried on the SRM's.

3.1.2.2.2.2 Ground Test Capability. The CI shall contain provisions for connecting test devices. The following checkout and test provisions are required:

a. Test ordnance circuits for stray voltage and continuity after space shuttle propellant has been loaded and before ordnance devices are connected.

b. Test ordnance circuits through the SRM stage/space shuttle interface without the use of ordnance devices. This includes transmission of command signals and verification of properly completed arm, safe, ignite or destruct commands.

c. Verify that the instrumentation system and the inadvertent separation destruct system (ISDS) power is available at the proper level. This includes enabling the power, verifying that power is at proper level, and disabling the power with verification that the power is disabled.

d. Verify the following SRM stage circuitry through the SRM stage/space shuttle interface:

1. Nozzle command and position (pitch and yaw).
2. Hydraulic system pressure.
3. SRM chamber pressure indication circuits.
4. SRM ignition indication circuits

3.1.2.2.2.3 Access. The CI shall contain access provisions for connecting, installing, and removing ordnance devices and safeing and test devices.

3.1.2.3 Useful Life. Useful life shall be a minimum of 60 months combined storage and service life.

3.1.2.4 Environmental

3.1.2.4.1 Vehicle Flight. The CI shall withstand all flight environments encountered from lift-off through separation of the CI from the space shuttle vehicle.

3.1.2.4.1.1 Flight Loads. The CI shall meet all flight-imposed loads from lift-off to separation of the CI from the space shuttle vehicle.

3.1.2.4.1.2 Vibration. (TBD).

3.1.2.4.2 Ground Environments. The CI shall meet performance requirements as specified herein after being subjected to the environments listed as follows, either singly or in combination, during erection, attaching to the space vehicle, servicing, maintaining readiness, and for launch.

a. Temperature: 30 to 100°F

b. Humidity: 0 to 80% RH

c. Salt fog: Equivalent to 50-hour exposure to 20% salt fog solution

d. Wind: The maximum wind loading will be at 30 ft above ground @ 46.5 mph. The NASA 99.9 wind curve shall apply

e. Rain: Open areas, 4 in/hr for 2 hours

f. Fungus: Equivalent to 28 days in a fungus chamber

g. Sand and dust: 2300 $\pm$ 500 fpm for 2 hours

h. Explosive atmosphere: Equipment on the launch/test stand and at propellant handling areas shall not ignite a gaseous explosive mixture

i. Liquid propellant compatibility; The CI surfaces shall withstand exposure to propellant fumes for (TBD), or splashing by the propellants for (TBD). For materials which are normally in contact with the propellants, the degradation of physical properties after an exposure to the propellants for 3 months shall be within design limits.

j. Sunshine

k. Thermal environment caused by space shuttle vehicle plume.

3.1.2.5 Transportability. During all transportation functions, the applicable requirements of (TBD) shall apply.

3.1.2.6 Human Performance. (TBD)

3.1.2.7 Safety

3.1.2.7.1 Flight Safety. The CI shall incorporate provisions for automatic destruction of an SRM subsystem upon inadvertent separation of the subsystem from the orbiter. The CI shall also incorporate provisions for destruction upon receipt of a command signal issued from the orbiter.

3.2 CI Definition. This CI consists of two SRM subsystems each of which is assembled from the following CI's plus an electrical cable assembly (see 3.2.2.2) and attaching hardware:

Quantity	CI Numbers	Nomenclature	Specification No.
2		Solid Rocket Motor	CPW1-977
2		Staging System	(TBD)
1		Interstage Structure	(TBD)
2		Nose Cones	(TBD)
2		Aft Fairings	(TBD)
1		Recovery System	(TBD)

3.2.1 Interface Requirements

3.2.1.1 Schematic Arrangement. General arrangement of the CI shall conform to the applicable drawing.

3.2.1.2 Detailed Interface Definition. All interfaces shall conform to interface control drawings (ICD) prepared and approved in accordance with contract provisions.

3.2.1.2.1 Space Shuttle Vehicle Interfaces.

3.2.1.2.1.1 Functional Interfaces. The functional interfaces with the vehicle core are as follows:

a. The SRM centerline of each SRM/Subsystem shall be parallel to the space shuttle vehicle centerline within (TBD) degree in both the pitch and yaw planes.

3.2.1.2.1.2 Mechanical Interfaces. Mechanical interface with the space shuttle vehicle shall be as follows: (TBD)

3.2.1.2.1.3 Electrical Interfaces. Electrical interfaces shall be as shown in Drawing . Power requirements of electrical interfaces for each SRM shall be as shown in Table II.

Table II

Electrical Interface Requirements

Interface Definition	Voltage	Amperage	Duration
a. Ignition			
Arm signal	28 ± 3 vdc	3.0 max.	2-5 sec
Verify armed condition	28 ± 3 vdc	0.200	Continuous
Disarm signal	28 ± 3 vdc	3.0	2-5 sec
Verify disarmed condition	28 ± 3 vdc	0.200	Continuous
Ignition signal	28 ± 3 vdc	9^{+2}_{-0}	500 ± 250 msec
Verify ignition	28 ± 3 vdc	0.200	---
b. Performance Sensing			
Thrust sensing, conditioned signal		---	Continuous

Table II (Continued)

Interface Definition	Voltage	Amperage	Duration
Aerodynamic heat sensing, conditioned signal Temperatures of critical areas sensing, conditioned signal. Motor burnout, conditioned signal Acceleration	(TBD)	(TBD)	(TBD)

3.2.2 Component Definition

3.2.2.1 Government-furnished Property List. (To be determined later.)

3.2.2.2 Engineering Critical Components. Engineering critical compenents of this CI will be as follows:

Specification No.	Title
(TBD)	Solid Rocket Motor
(TBD)	Staging System
(TBD)	Interstage Structure
(TBD)	Nose Cone
(TBD)	Aft Fairing
(TBD)	Recovery System
(TBD)	Electrical Cable Assembly

3.2.2.3 Logistics Critical Components List. There are no logistics critical components which are part of this CI .

3.3 Design and Constructuion

3.3.1 General Design Features

3.3.1.1 System Design Requirements. Except for those equipments which have been designed, tested, and produced under provisions of other programs, design of this CI shall meet general design requirements as specified herein and in the contract.

3.3.1.2 Stage Performance. The CI shall incorporate provisions for verifying stage performance from ignition to motor burnout. Information for stage performance shall be gained by monitoring the following:

a. Thrust of each SRM

b. Aerodynamic heat buildup

c. Temperatures in critical areas

d. Acceleration

3.3.1.3 Safety Factor. All structures transmitting loads between the SRM and the core shall have a minimum structural safety factor of 1.4.

3.3.2 Selection of Specification and Standards. Selection and use of specifications and standards shall be in accordance with (TBD) except as provided in 3.3.4.

3.3.3 Materials, Parts and Processes. (To be determined later.)

3.3.4 Standard and Commercial Parts. Commercial parts having suitable properties may be used where, on the date of invitation for bids, there are no standard parts. In any case, such parts may be used provided:

a. They can be replaced by the standard parts (MS or AND) without alteration

b. The corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawings

Except as specified above, AND and MS standard parts shall be used where they suit the purpose. They shall be identified on drawings by their part numbers.

3.3.5 Moisture and Fungus Resistance. Except for those equipments which have been designed, tested, and produced under provisions of other programs, materials which are nutrient to fungus shall be avoided in the construction of the CI , or shall be suitably protected therefrom.

3.3.6 Corrosion of Metal Parts. Metal parts which are subject to corrosion when exposed to environments listed herein shall be protected against such corrosion in any a manner which will not interfere with specified function of the CI .

3.3.6.1 Dissimilar Metals. Dissimilar metals, as defined in (TBD) . , shall not placed in contact unless properly protected against galvanic action. For the purpose of this specification, aluminum shall be classed as (TBD) .

3.3.7 Interchangeability and Replaceability. The CI and component parts shall be designed to be interchangeable or replaceable in accordance with the definitions set forth in

3.3.8 Workmanship. Workmanship shall be in accordance with the best industrial practice for this type of equipment. Whenever contractual documents fail to clearly state the required quality of any work, the interpretation requiring the best quality of workmanship shall be followed.

3.3.9 Electromagnetic Interference. Design of the CI shall comply with applicable requirements of Specification (TBD) .

3.3.10 Identification and Marking. Identification of the CI , subassemblies, and components, with assigned part numbers, shall be in accordance with Standard (TBD) . Name plates shall be in accordance with (TBD) . Serialization shall be in accordance with (TBD) .

3.3.11 Storage. The CI shall be capable of withstanding indoor storage under controlled temperature and humidity conditions for a period of (TBD) years. Packaging for storage shall be in accordance with Thiokol standard procedure.

4. QUALITY ASSURANCE PROVISIONS

4.1 Category I Test (If Applicable)

4.1.1 Engineering Test and Evaluation. (Not applicable.)

4.1.2 Preliminary Qualification Tests. (Not applicable.)

4.1.3 Formal Qualification Tests. Except for the inspections, analyses, and demonstrations set forth in the following paragraphs, qualification of the CI's listed below shall satisfy the requirements for qualification of this CI:

CEI Number	Nomenclature	Specification No.
(TBD)	Solid Rocket Motor	CPW1- 977
(TBD)	Interstage Structure	(TBD)
(TBD)	Staging System	(TBD)
(TBD)	Nose Cones	(TBD)
(TBD)	Aft Fairings	(TBD)
(TBD)	Recovery System	(TBD)
(TBD)	Electrical Cable Assembly	(TBD)

4.1.3.1 Inspection. The following requirements of Section 3 shall be verified by an inspection of the CI at time and place of qualification testing:

a. Paragraph 3.1.2.2.2.2 Ground Test Capability

b. Paragraph 3.2.1.1. Schematic Arrangement

c. Paragraph 3.3.8 Workmanship

d. Paragraph 3.3.10 Identification and Marking

4.1.3.2 Analyses. The following requirements of Section 3 shall be verified by review of analytical data:

a. Paragraph 3.1.1.1.1 Ratings

b. Paragraph 3.1.1.1.2 Variation Between Motors

c.	Paragraph 3.1.1.2.1	Thrust-Time Curves
d.	Paragraph 3.1.1.2.2	Thrust-Time Variation Between Motors
e.	Paragraph 3.1.1.2.3	Staging System
f.	Paragraph 3.1.1.2.4	Interstage Structure
g.	Paragraph 3.1.1.2.5	Nose Cones
h.	Paragraph 3.1.1.2.6	Aft Fairings
i.	Paragraph 3.1.1.2.7	Recovery System
j.	Paragraph 3.1.2.1	Reliability
k.	Paragraph 3.1.2.1.1	Availability
l.	Paragraph 3.1.2.2	Maintainability
m.	Paragraph 3.1.2.2.1	Maintenance and Repair Cycle
n.	Paragraph 3.1.2.3	Useful Life
o.	Paragraph 3.1.2.4.1	Missile Flight
p.	Paragraph 3.1.2.4.1.1	Flight Loads
q.	Paragraph 3.1.2.4.1.2	Vibration
r.	Paragraph 3.1.2.4.1.3	Staging
s.	Paragraph 3.1.2.4.2	Ground Environments
t.	Paragraph 3.1.2.5	Transportability
u.	Paragraph 3.1.2.7.1	Flight Safety
v.	Paragraph 3.1.2.7.2	Ground Safety
w.	Paragraph 3.1.2.7.5.2	Explosive Hazard Classification
x.	Paragraph 3.2.1.2	Detailed Interface Definition
y.	Paragraph 3.2.1.2.1.1	Functional Interfaces
z.	Paragraph 3.2.1.2.1.2	Mechanical Interfaces
aa.	Paragraph 3.2.1.2.1.3	Electrical Interfaces

bb.	Paragraph 3.3.1.1	System Design Requirements
cc.	Paragraph 3.3.1.3	Safety Factor
dd.	Paragraph 3.3.2	Selection of Specification and Standards
ee.	Paragraph 3.3.4	Standard and Commercial Parts
ff.	Paragraph 3.3.5	Moisture and Fungus Resistance
gg.	Paragraph 3.3.6	Corrosion of Metal Parts
hh.	Paragraph 3.3.7	Interchangeability and Replaceability
ii.	Paragraph 3.3.9	Electromagnetic Interference
jj.	Paragraph 3.3.11	Storage

4.1.3.4 Tests. (Not applicable.)

4.1.4 Reliability Test and Analysis. (Not Applicable.)

4.1.5 Engineering Critical Component Qualification. Qualification of engineering critical components is covered by the following listed specifications:

Specification No.	Title
(TBD)	Solid Rocket Motor
(TBD)	Staging System
(TBD)	Interstage Structure
(TBD)	Nose Cones
(TBD)	Aft Fairings
(TBD)	Recovery System
(TBD)	Electrical Cable Assembly

4.2 Category II Test Program. The following requirements of Section 3 shall be verified when the CI is assembled and operated with other system equipment:

a.	Paragraph 3.1.1.1	Primary Performance Characteristics

b.	Paragraph 3.1.1.1.1	Ratings
c.	Paragraph 3.1.1.1.2	Variation Between Motors
d.	Paragraph 3.1.1.2.1	Thrust-Time Curves
e.	Paragraph 3.1.1.2.2	Thrust-Time Variation Between Motors
f.	Paragraph 3.1.2.4.1	Missile Flight
g.	Paragraph 3.1.2.4.1.1	Flight Loads
h.	Paragraph 3.1.2.4.1.2	Vibration
i.	Paragraph 3.1.2.7.5.1	Safety and Arming Provisions
j.	Paragraph 3.2.1.2.1.1	Functional Interfaces
k..	Paragraph 3.2.1.2.1.2	Mechanical Interfaces
l.	Paragraph 3.2.1.2.1.3	Electrical Interfaces
m.	Paragraph 3.3.1.2	Stage Performance

5. PREPARATION FOR DELIVERY

(Not Applicable.)

6. NOTES

6.1 Supplemental Information. (Not applicable.)

6.2 Alternate Source Qualification. (Not applicable.)

6.3 Definitions. Performance requirements as specified in this specification are based on terms defined as follows:

a. Action Time. Action time begins when the chamber pressure reaches 96 pounds per square inch absolute (psia) on the rise (corresponding to a 283,000-lbf thrust at sea level for one motor, and ends when the chamber pressure has decreased to 84 psia (corresponding to a 283,000-lbf thrust at vacuum conditions for one motor).

b. Ignition Delay Time, Ignition delay time is the time from switch closure (ignition signal) to beginning of action time.

APPENDIX D

DRAWINGS, BILLS OF MATERIALS, AND PRELIMINARY INTERFACE CONTROL DRAWINGS

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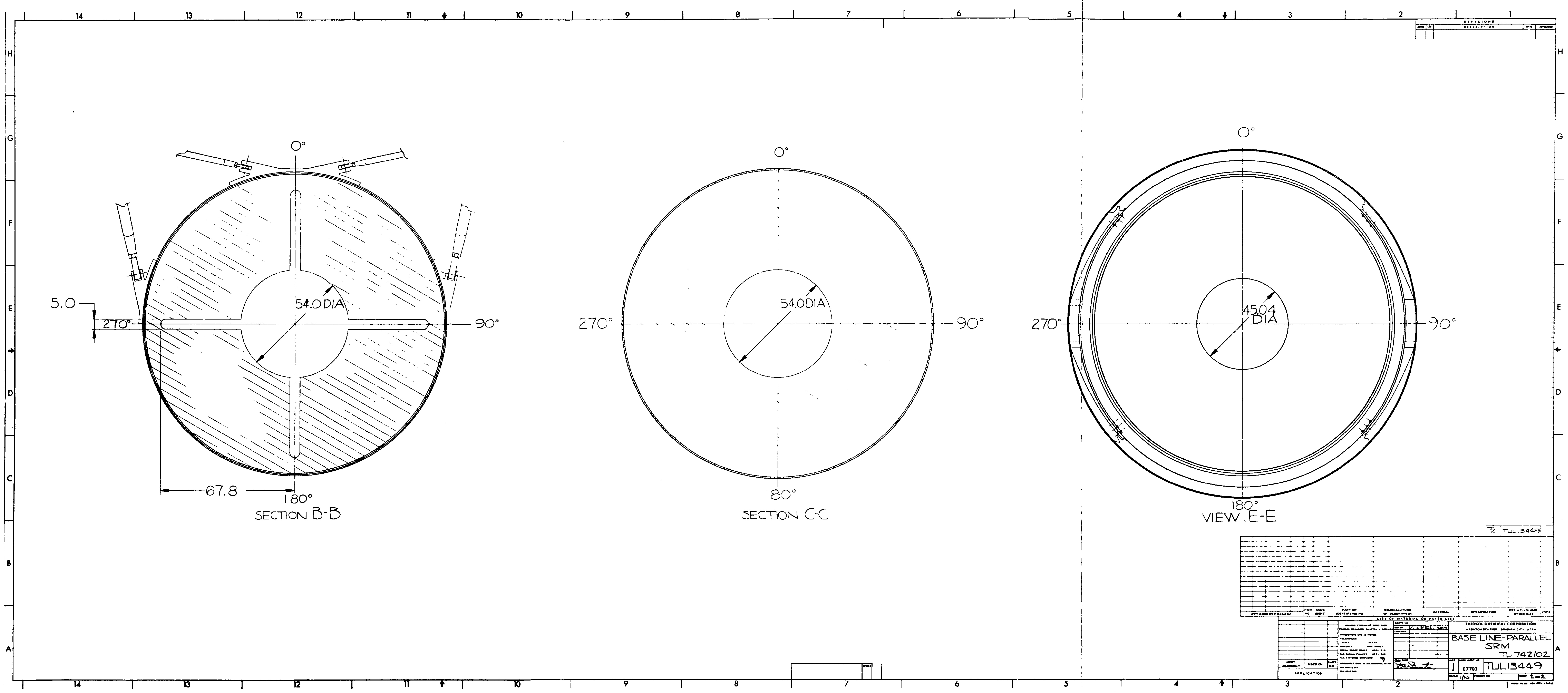
FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3



0°
5.0
270°
54.0 DIA
90°
67.8
180°
SECTION B-B
0°
270°
54.0 DIA
90°
80°
SECTION C-C
0°
270°
45.04 DIA
90°
180°
VIEW E-E
2 TUL 13449
ITEM NO
CODE IDENT
PART OR IDENTIFYING NO
NOMENCLATURE OR DESCRIPTION
MATERIAL
SPECIFICATION
EST WT/VOLUME STOCK SIZE
ZONE
QTY REQD PER DASH NO.
LIST OF MATERIAL OR PARTS LIST
NEXT ASSEMBLY
USED ON
PART NO.
APPLICATION
THIOKOL CHEMICAL CORPORATION
WASATCH DIVISION BRIGHAM CITY, UTAH
BASE LINE-PARALLEL
SRM
TU 742/02
J
07703
TUL13449
1/10
2 of 2

Baseline Parallel SRM ... 2 of 2 Sheet 2

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 0178[illegible]

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/02	SPACE SHUTTLE					0	1
TITLE BASELINE-PARALLEL SRM 156"	**EFFECTIVITY**		**AUTHORIZATION**			**DATE** 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
	TU742/02 BASELINE-PARALLEL SRM 156"			1.0000 MAKE	EA			NR			
1	. CASE ASSY LOADED			1.0000 MAKE	EA			S			
2	.. CASE, FWD SEG			1.0000 BUY	EA			S			
3	.. CASE, CYL SEGMENT			3.0000 BUY	EA			S			
4	.. CASE, AFT SEGMENT			1.0000 BUY	EA			S			
5	..TP-H1011 PROPELLANT			AR MAKE				NR			
6	...9404 HB POLYMER			AR BUY				NR	NA		
7	...9015 AP 200 MICRON			AR BUY				NR	NA		
8	...9020 SPEC COARSE AP			AR BUY				NR	NA		
9	...9008 ALUM POWDER TYPE II			AR BUY				NR	NA		

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01782

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/02	SPACE SHUTTLE					0	2

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASELINE-PARALLEL SRM 156"			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
10	..V-44 INSULATION			AR BUY				NR			
11	..UF2121 LINER			AR MAKE				L			
12	...9407 HC POLY			AR BUY				NR			
13	...9607 MAPO			AR BUY				NR			
14	...9267 ERL-500			AR BUY				NR			
15	...9861 THIXCIN E			AR BUY				NR			
16	...9455 IRON OCT.			AR BUY				NR			
17	...9069 ASBESTOS			AR BUY				NR			
18	.. ZINC CHROMATE PUTTY			AR BUY				NR			
19	.. RETAINER			1000.0000 BUY	EA			NR			
20	.. PIN			1000.0000 BUY	EA			NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO.

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/02	SPACE SHUTTLE					0	3

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASELINE-PARALLEL SRM 156"			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
21	.. O-RING			8.0000 BUY	EA			NR			
22	. FIXED NOZZLE			1.0000 BUY	EA			S			
23	. AFT SKIRT			1.0000 BUY	EA			S			
24	. AFT ATTACH STRUCTURE			2.0000 BUY	EA			NR			
25	. FWD ATTACH STRUCTURE			2.0000 BUY	EA			NR			
26	. IGNITER ASSY			1.0000 MAKE	EA			S			
27	.. CASE			1.0000 BUY	EA			S			
28	..UF2123 LINER			AR MAKE				L			
29	...9407 HC POLYMER			AR BUY				NR			
30	...9607 MAPO			AR BUY				NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01782

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/02	SPACE SHUTTLE					0	4
TITLE BASELINE-PARALLEL SRM 156"	EFFECTIVITY		AUTHORIZATION			DATE 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
31	...9861 THIVOTROPIC POWDEER			AR BUY				NR			
32	...9267 EPOXY RESIN			AR BUY				NR			
33	...9016 ASBESTOS FLOATS			AR BUY				NR			
34	...9455 IRON OCTOATE			AR BUY				NR			
35	..TP-H1076 PROPELLANT			AR MAKE				L			
36	...9015 AMMONIUM PERCH.			AR BUY				L		CLASSIFIED	
37	...9451 FERRIC OXIDE			AR BUY				L		CLASSIFIED	
38	...9407 HC POLYMER			AR BUY				L		CLASSIFIED	
39	...9004 ALUMINUM POWDER			AR BUY				L		CLASSIFIED	
40	...9607 MAPO			AR BUY				L		CLASSIFIED	
41	...9285 ERL-0510			AR BUY				L		CLASSIFIED	

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01782

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/02	SPACE SHUTTLE					0	5

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASELINE-PARALLEL SRM 156"			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
42	...9456 IRON LINOLEATE			AR BUY				L		CLASSIFIED	
43	...9854 TP-90B			AR BUY				L		CLASSIFIED	
44	. S AND A			1.0000 BUY				S			
45	. NOSE CONE			1.0000 BUY				S			

FORM TC NO. 2086

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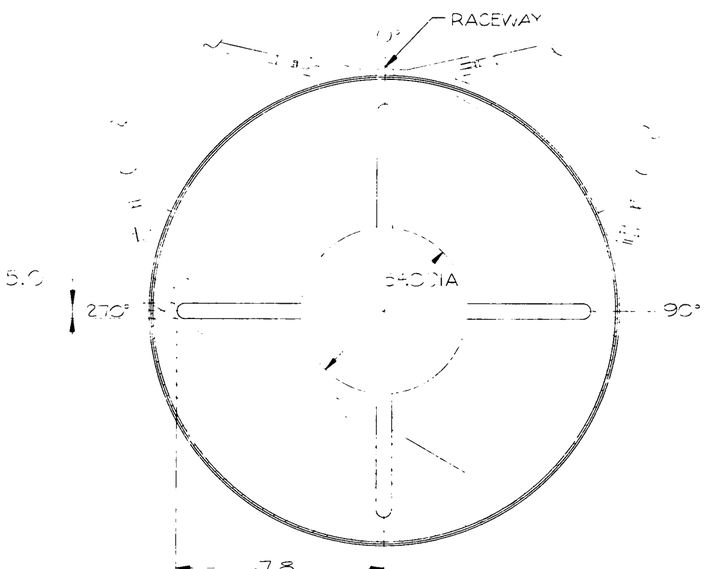
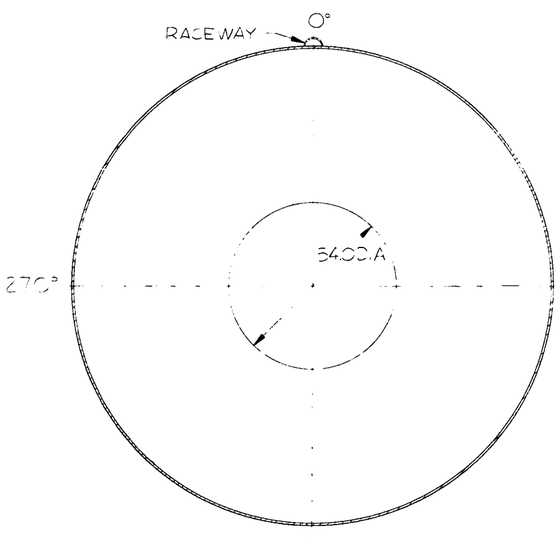
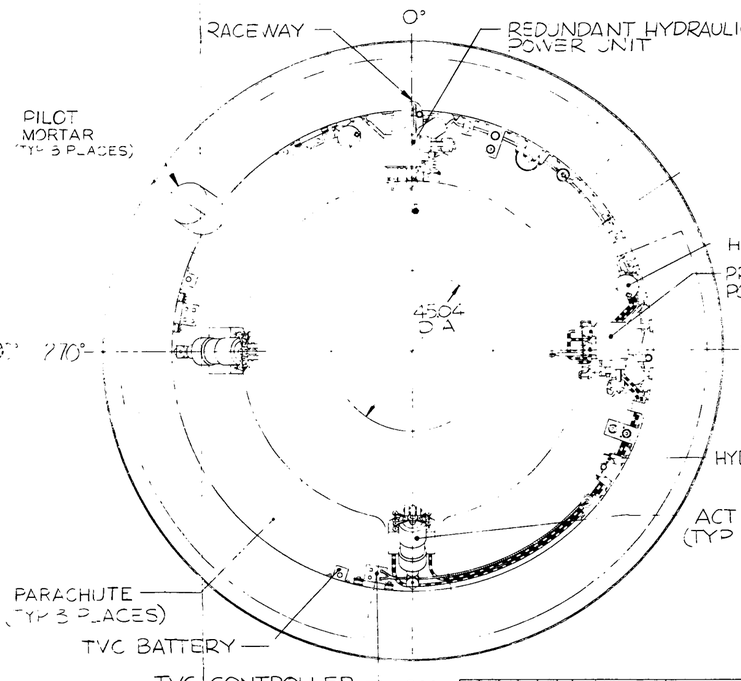
FOLDOUT FRAME 3



SECTION B-B



SECTION C-C



VIEW F-F

TUL13466

ITEM	CODE IDENT NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	QTY PER ASSY	UNIT OF MEASURE	ASSY WT/VOLUME STOCK SIZE	ZONE

LIST OF MATERIAL OR PARTS LIST

NEXT ASSEMBLY — USED ON — APPLICATION

THIOKOL CHEMICAL CORPORATION
WASATCH DIVISION BRIGHAM CITY, UTAH

PARALLEL 156" SRM
INCLUDING ALL OPTIONS
TU 742/03

SIZE	CAGE IDENT NO	DRAWING NO
J	07703	TUL13466

SCALE 1/0 — WEIGHT NO — SHEET 2 OF 2

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01783

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/03	SPACE SHUTTLE					0	1

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
PARALLEL 156" SRM (W/OPTIONS)			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
	TU742/03 PARALLEL 156" SRM			1.0000 MAKE	EA			NR			
1	. CASE ASSY LOADED			1.0000 MAKE	EA			S			
2	.. CASE, FWD SEG			1.0000 BUY	EA			S			
3	.. CASE, CYL SEGMENT			3.0000 BUY	EA			S			
4	.. CASE, AFT SEGMENT			1.0000 BUY	EA			S			
5	..TP-H1011 PROPELLANT			AR MAKE				NR			
6	...9904 HB POLYMER			AR BUY				NR	NA		
7	...9015 AP 200 MICRON			AR BUY				NR	NA		
8	...9020 SPEC COARSE AP			AR BUY				NR	NA		
9	...9008 ALUM POWDER TYPE II			AR BUY				NR	NA		

10

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01783

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/03	SPACE SHUTTLE					0	2

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
PARALLEL 156" SRM (W/OPTIONS)			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
10	..V-44 INSULATION			AR BUY				NR			
11	.. .065 LINER			AR MAKE				L			
12	.. ZINC CHROMATE PUTTY			AR BUY				NR			
13	.. RETAINER			1000.0000 BUY	EA			NR			
14	.. PIN			1000.0000 BUY	EA			NR			
15	.. O-RING			8.0000 BUY	EA			NR			
16	. NOZZLE			1.0000 BUY	EA			S			
17	. ACTUATOR			4.0000 BUY	EA			S			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01783

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/03	SPACE SHUTTLE					0	3
TITLE: PARALLEL 156" SRM (W/OPTIONS)	EFFECTIVITY		AUTHORIZATION			DATE: 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
18	• LINEAR SHAPED CHARGE (NOZZLE)			1.0000 BUY	EA			S			
19	• HYDRAULIC POWER UNIT			2.0000 BUY	EA			NR			
20	• RACEWAY ASSY			1.0000 BUY	EA			S			
21	• AFT ATTACH STRUCTURE			2.0000 BUY	EA			NR			
22	• SEPARATION MOTORS			8.0000 BUY	EA			S			
23	• AFT SKIRT			1.0000 BUY	EA			S			
24	• FWD ATTACH STRUCTURE			2.0000 BUY	EA			NR			
25	• IGNITER ASSY			1.0000 MAKE	EA			S			
26	•• CASE			1.0000 BUY	EA			S			
27	•• LINER			AR MAKE				L			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01783

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/03	SPACE SHUTTLE					0	4
TITLE: PARALLEL 156" SRM (W/OPTIONS)	EFFECTIVITY		AUTHORIZATION			DATE: 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
28	..TP-H1076 PROPELLANT			AR MAKE				L			
29	...9015 AMMONIUM PERCH.			AR BUY				L		CLASSIFIED	
30	...9451 FERRIC OXIDE			AR BUY				L		CLASSIFIED	
31	...9407 HC POLYMER			AR BUY				L		CLASSIFIED	
32	...9004 ALUMINUM POWDER			AR BUY				L		CLASSIFIED	
33	...9607 MAPO			AR BUY				L		CLASSIFIED	
34	...9285 ERL-0510			AR BUY				L		CLASSIFIED	
35	...9456 IRON LINOLEATE			AR BUY				L		CLASSIFIED	
36	...9854 TP-90B			AR BUY				L		CLASSIFIED	
37	. S AND A			1.0000 BUY	EA			S			
38	. PILOT MORTOR			3.0000 BUY	EA			NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01783

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/03	SPACE SHUTTLE					0	5

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
PARALLEL 156" SRM (W/OPTIONS)			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
39	• PARACHUTE ASSY			3.0000 BUY	EA			S			
40	• THRUST TERMINATION			2.0000 MAKE	EA			S			
41	•• INSULATION			AR BUY				L			
42	•• MICRO BALLOONS			AR BUY				L			
43	•• LINEAR SHAPED CHARGE			1.0000 BUY	EA			NR			
44	•• SAFE & ARM UNIT			1.0000 BUY	EA			S			
45	•• DESTRUCT SAFE & ARM UNIT			1.0000 BUY	EA			S			
46	• NOSE CONE			1.0000 BUY	EA			S			
47	• HYDRAULIC TANK			2.0000 BUY	EA			S			
48	• HYDRAULIC RESERVOIR			2.0000 BUY	EA			NR			
49	• ACTIVATOR			2.0000 BUY	EA			NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01783

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/03	SPACE SHUTTLE					0	6
TITLE: PARALLEL 156" SRM (W/OPTIONS)	EFFECTIVITY		AUTHORIZATION			DATE: 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
50	• TVC BATTERY			3.0000 BUY	EA			NR			
51	• PREPACKAGED WIRING HARNESS			1.0000 BUY	EA			NR			
52	• SIGNAL CONDITIONING UNIT			1.0000 BUY	EA			NR			
53	• POWER DISTRIBUTION BOX			1.0000 BUY	EA			NR			
54	• BATTERIES-DESTRUCT INSTR. FLIGHT			2.0000 BUY	EA			NR			
55	• PRESSURE TRANSDUCER LEADS			AR BUY				NR			
56	• TVC CONTROLLER			2.0000 BUY	EA			NR			

FORM TC NO. 2086

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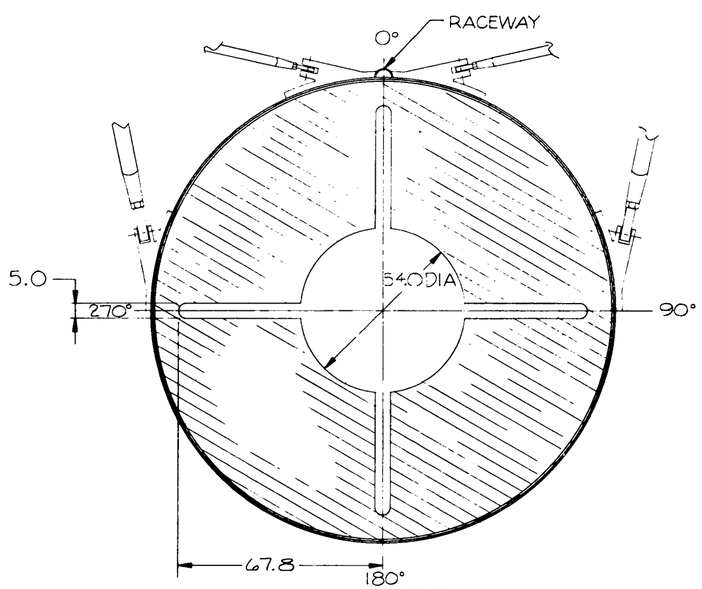
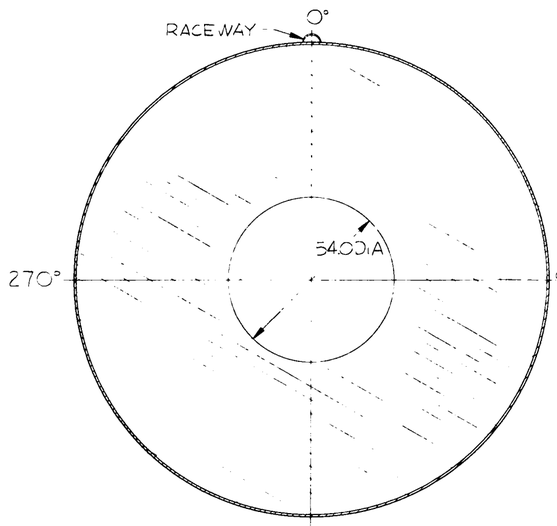
FOLDOUT FRAME 1

FOLDOUT FRAME 2

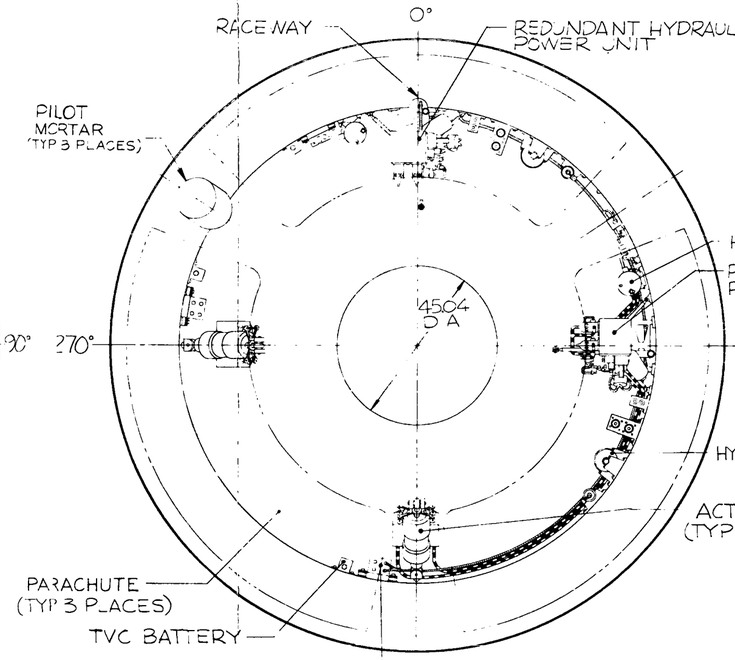
FOLDOUT FRAME 3



SECTION B-B



SECTION C-C



VIEW F-F

QTY PARTS PER ASSY NO.	ITEM NO.	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	QTY PER VEHICLE	REMARKS

LIST OF MATERIAL OR PARTS LIST

THIOKOL CHEMICAL CORPORATION
WASATCH DIVISION BRIGHAM CITY, UTAH

PARALLEL 156" SRM
WITH T.V.C. & T.T.
TU 742/04

NEXT ASSEMBLY	USED ON	PART NO.
APPLICATION		

SIZE	CODE IDENT NO.	DRAWING NO.
J	07703	TUL 13493

SCALE 1/0 WEIGHT LBS SHEET 2 OF 8

2 of 2 TUL 13493

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01784

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/04	SPACE SHUTTLE					0	1

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
PARALLEL 156" SRM (W/OPTIONS)			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
	TU742/04 PARALLEL 156" SRM			1.0000 MAKE	EA			NR			
1	. CASE ASSY LOADED			1.0000 MAKE	EA			S			
2	.. CASE, FWD SEG			1.0000 BUY	EA			S			
3	.. CASE, CYL SEGMENT			3.0000 BUY	EA			S			
4	.. CASE, AFT SEGMENT			1.0000 BUY	EA			S			
5	..TP-H1011 PROPELLANT			AR MAKE				NR			
6	...9904 HB POLYMER			AR BUY				NR	NA		
7	...9015 AP 200 MICRON			AR BUY				NR	NA		
8	...9020 SPEC COARSE AP			AR BUY				NR	NA		
9	...9008 ALUM POWDER TYPE II			AR BUY				NR	NA		

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01784

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/04	SPACE SHUTTLE					0	2

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
PARALLEL 156" SRM (W/OPTIONS)			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
10	..V-44 INSULATION			AR BUY				NR			
11	.. .065 LINER			AR MAKE				L			
12	.. ZINC CHROMATE PUTTY			AR BUY				NR			
13	.. RETAINER			1000.0000 BUY	EA			NR			
14	.. PIN			1000.0000 BUY	EA			NR			
15	.. O-RING			8.0000 BUY	EA			NR			
16	. NOZZLE			1.0000 BUY	EA			S			
17	. ACTUATOR			4.0000 BUY				S			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01784

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/04	SPACE SHUTTLE					0	3
TITLE PARALLEL 156" SRM (W/OPTIONS)	EFFECTIVITY		AUTHORIZATION			DATE 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP. CODE	REMARKS-EFFECTIVITY	ACT
18	. LINEAR SHAPED CHARGE (NOZZLE)			1.0000 BUY	EA			S			
19	. HYDRAULIC POWER UNIT			2.0000 BUY	EA			NR			
20	. RACEWAY ASSY			1.0000 BUY	EA			S			
21	. AFT ATTACH STRUCTURE			2.0000 BUY	EA			NR			
22	. AFT SKIRT			1.0000 BUY	EA			S			
23	. FWD ATTACH STRUCTURE			2.0000 BUY	EA			NR			
24	. IGNITER ASSY			1.0000 MAKE	EA			S			
25	.. CASE			1.0000 BUY	EA			S			
26	.. LINER			AR MAKE				L			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01784

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/04	SPACE SHUTTLE					0	4

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
PARALLEL 156" SRM (W/OPTIONS)			29 FEB 72

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
27	..TP-H1076 PROPELLANT			AR MAKE				L			
28	...9015 AMMONIUM PERCH.			AR BUY				L		CLASSIFIED	
29	...9451 FERRIC OXIDE			AR BUY				L		CLASSIFIED	
30	...9407 HC POLYMER			AR BUY				L		CLASSIFIED	
31	...9004 ALUMINUM POWDER			AR BUY				L		CLASSIFIED	
32	...9607 MAPO			AR BUY				L		CLASSIFIED	
33	...9285 ERL-0510			AR BUY				L		CLASSIFIED	
34	...9456 IRON LINOLEATE			AR BUY				L		CLASSIFIED	
35	...9854 TP-90B			AR BUY				L		CLASSIFIED	
36	. S AND A			1.0000 BUY	EA			S			
37	. PILOT MORTOR			3.0000 BUY	EA			NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01784

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/04	SPACE SHUTTLE					0	5
TITLE: PARALLEL 156" SRM (W/OPTIONS)	EFFECTIVITY		AUTHORIZATION			DATE: 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
38	• PARACHUTE ASSY			3.0000 BUY	EA			S			
39	• THRUST TERMINATION			2.0000 MAKE	EA			S			
40	•• INSULATION			AR BUY				L			
41	•• MICRO BALLOONS			AR BUY				L			
42	•• LINEAR SHAPED CHARGE			1.0000 BUY	EA			NR			
43	•• SAFE & ARM UNIT			1.0000 BUY	EA			S			
44	•• DESTRUCT SAFE & ARM UNIT			1.0000 BUY	EA			S			
45	• NOSE CONE			1.0000 BUY	EA			S			
46	• HYDRAULIC TANK			2.0000 BUY	EA			S			
47	• HYDRAULIC RESERVOIR			2.0000 BUY	EA			NR			
48	• ACTIVATOR			2.0000 BUY	EA			NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01784

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU742/04	SPACE SHUTTLE					0	6
TITLE: PARALLEL 156" SRM (W/OPTIONS)	EFFECTIVITY		AUTHORIZATION			DATE: 29 FEB 72	

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
49	• TVC BATTERY			3.0000 BUY	EA			NR			
50	• PREPACKAGED WIRING HARNESS			1.0000 BUY	EA			NR			
51	• SIGNAL CONDITIONING UNIT			1.0000 BUY	EA			NR			
52	• POWER DISTRIBUTION BOX			1.0000 BUY	EA			NR			
53	• BATTERIES-DESTRUCT INSTR. FLIGHT			2.0000 BUY	EA			NR			
54	• PRESSURE TRANSDUCER LEADS			AR BUY				NR			
55	• TVC CONTROLLER			2.0000 BUY	EA			NR			

FORM TC NO. 2086

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END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01785

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU800/01	SPACE SHUTTLE					0	1

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASE LINE-SERIES BURN SRM 156"			29 FEB. 1972

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
	TU800/01 BASELINE-SERIES BURN SRM 156"			1.0000 MAKE	EA			NR			
1	. CASE ASSY LOADED			1.0000 MAKE	EA			S			
2	.. CASE, FWD SEG			1.0000 BUY	EA			S			
3	.. CASE, CYL SEGMENT			4.0000 BUY	EA			S			
4	.. CASE, AFT SEGMENT			1.0000 BUY	EA			S			
5	..TP-H1011 PROPELLANT			AR MAKE				NR			
6	...9404 HB POLYMER			AR BUY				NR	NA		
7	...9015 AP 200 MICRON			AR BUY				NR	NA		
8	...9020 SPEC COARSE AP			AR BUY				NR	NA		
9	...9008 ALUM POWDER TYPE II			AR BUY				NR	NA		

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01785

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU800/01	SPACE SHUTTLE					0	2

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASE LINE-SERIES BURN SRM 156"			29 FEB. 1972

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
10	..V-44 INSULATION			AR BUY				NR			
11	..UF2121 LINER			AR MAKE				L			
12	...9407 HC POLY			AR BUY				NR			
13	...9607 MAPO			AR BUY				NR			
14	...9267 ERL-500			AR BUY				NR			
15	...9861 THIXCIN E			AR BUY				NR			
16	...9455 IRON OCT.			AR BUY				NR			
17	...9069 ASBESTOS			AR BUY				NR			
18	.. ZINC CHROMATE PUTTY			AR BUY				NR			
19	.. RETAINER			1000.0000 BUY	EA			NR			
20	.. PIN			1000.0000 BUY	EA			NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01785

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU800/01	SPACE SHUTTLE					0	3

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASE LINE-SERIES BURN SRM 156"			29 FEB. 1972

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
21	.. O-RING			8.0000 BUY	EA			NR			
22	. FIXED NOZZLE			1.0000 BUY	EA			S			
23	. AFT SKIRT			1.0000 BUY	EA			S			
24	. FWD SKIRT			1.0000 BUY	EA			S			
25	. IGNITER ASSY			1.0000 MAKE	EA			S			
26	.. CASE			1.0000 BUY	EA			S			
27	..UF2123 LINER			AR MAKE				L			
28	...9407 HC POLYMER			AR BUY				NR			
29	...9607 MAPO			AR BUY				NR			

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01785

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU800/01	SPACE SHUTTLE					0	4

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASE LINE-SERIES BURN SRM 156"			29 FEB. 1972

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
30	...9861 THIVOTROPIC POWDEE			AR BUY				NR			
31	...9267 EPOXY RESIN			AR BUY				NR			
32	...9016 ASBESTOS FLOATS			AR				NR			
33	...9455 IRON OCTOATE			AR BUY				NR			
34	..TP-H1076 PROPELLANT			AR MAKE				L			
35	...9015 AMMONIUM PERCH.			AR BUY				L		CLASSIFIED	
36	...9451 FERRIC OXIDE			AR BUY				L		CLASSIFIED	
37	...9407 HC POLYMER			AR BUY				L		CLASSIFIED	
38	...9004 ALUMINUM POWDER			AR BUY				L		CLASSIFIED	
39	...9607 MAPO			AR BUY				L		CLASSIFIED	
40	...9285 ERL-0510			AR BUY				L		CLASSIFIED	

FORM TC NO. 2086

END ITEM BILL OF MATERIAL

B/M SERIAL NO. 01785

PART IDENTIFICATION NO.	PROGRAM	CONTRACT	SEC	APPROVED BY	RELEASED BY	REV	SHEET
TU800/01	SPACE SHUTTLE					0	5

TITLE	EFFECTIVITY	AUTHORIZATION	DATE
BASE LINE-SERIES BURN SRM 156"			29 FEB. 1972

ITEM	PART NO. / NAME	DWG CHG	LAST ECO	QTY-NA / SOURCE	UNIT OF MEAS	PROJ-TASK-ST	CPI NO.	SL	PDL INSP CODE	REMARKS-EFFECTIVITY	ACT
41	...9456 IRON LINOLEATE			AR BUY				L		CLASSIFIED	
42	...9854 TP-90B			AR BUY				L		CLASSIFIED	
43	. S AND A			1.0000 BUY				S			

FORM TC NO. 2086