MCR-73-235
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Appendix

MF

Programmatics
and
Cost

September 1973

Selected Option Data Dump

Space Tug Systems Study (Storable)

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George C. Marshall
Space Flight Center

(NASA-CR-161906) SPACE TUG SYSTEMS STUDY (STORABLE): SELECTED OPTION DATA DUMP. VOLUME 8.0 APPENDIX: PROGRAMMATICS AND COST (Martin Marietta Corp.) 173 p

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1.1 DDT&E - Data Form T is presented for Option 1, 2, 3 and 3A on the following pages for DDT&E.

DDT&E

OPTION 1

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32A	DDT&E	4181.0	76956.0	960.5	14379.3	604.0	11973.6	893.3	15228.2	554.1	10605.3	733.4	13356.5	–	94350.2	7872.3	236849.0
01-00-00-00	P. MGM'T	103.3	1904.0	669.3	10617.4	–	–	23.9	414.0	18.7	369.2	24.6	473.0	–	1429.1	839.9	15206.7
01-01-00-00	COST PERF/MGM'T	103.3	1904.0	453.7	7196.4	–	–	23.9	414.0	18.7	369.2	24.6	473.0	–	1429.1	624.2	11785.7
01-02-00-00	PROJ DIR	–	–	46.9	744.0	–	–	–	–	–	–	–	–	–	–	46.9	744.0
01-03-00-00	INFO MGM'T	–	–	168.8	2677.0	–	–	–	–	–	–	–	–	–	–	168.8	2677.0
02-00-00-00	SYSTEMS ENG & INTEG	799.9	14741.0	206.6	3278.0	–	–	–	–	47.7	942.4	19.7	378.4	–	2671.0	1074.0	22010.7
02-01-00-00	TUG SYS ENG	657.1	12109.5	132.8	2107.2	–	–	–	–	47.7	942.4	19.7	378.4	–	2574.5	857.4	18112.1
02-02-00-00	SHUTTLE INTERFACE	70.1	1292.3	22.1	351.2	–	–	–	–	–	–	–	–	–	47.0	92.3	1670.5
02-03-00-00	PAYLOAD INTERFACE	72.7	1339.2	51.7	819.5	–	–	–	–	–	–	–	–	–	49.5	124.3	2208.1
03-00-00-00	TUG VEH M.S.	1515.3	27923.8	–	–	256.6	5178.3	27.7	478.4	122.5	2418.3	105.9	2036.3	–	4788.6	2027.9	85400.1
03-01-00-00	STRUCTURES	436.2	8039.2	–	–	145.7	2940.6	–	–	36.3	716.8	–	–	–	1597.1	618.2	13293.7
03-01-01-00	FUEL TANK	47.9	882.5	–	–	33.7	680.2	–	–	8.4	165.9	–	–	–	313.8	90.0	2042.3
03-01-02-00	OX. TANK	47.9	882.5	–	–	92.3	1862.9	–	–	23.0	454.2	–	–	–	483.2	163.2	3682.8
03-01-03-00	B. STRUCT.	167.1	3079.7	–	–	9.5	191.7	–	–	2.4	47.4	–	–	–	537.6	179.0	3856.4
03-01-04-00	T. STRUCT.	14.9	275.0	–	–	5.1	102.9	–	–	1.3	25.7	–	–	–	14.2	21.3	417.9

STUDY TITLE SPACE TUG

CONTRACT NO.

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APPENDIX A

OPTION 1

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-01-05-00	METEOROID SHIELD	41.7	767.7	-	-	.2	4.0	-	-	-	-	-	-	-	25.4	41.9	797.0
03-01-06-00	PAYLOAD INTERFACE	25.3	465.4	-	-	4.9	98.9	-	-	1.2	23.7	-	-	-	125.9	31.4	713.9
03-01-07-00	INSTALLATION ASSEM&CO	91.5	1686.4	-	-	-	-	-	-	-	-	-	-	-	97.1	91.5	1783.5
03-02-00-00	THERMAL CONTROL	98.9	1822.4	-	-	4.3	86.1	-	-	1.1	22.7	-	-	-	972.8	104.3	2903.9
03-03-00-00	AVIONICS	543.1	10008.8	-	-	24.6	496.5	27.7	478.4	50.0	988.1	40.5	778.8	-	15698.5	685.9	28449.1
03-03-01-00	DATA MGMT	83.5	1538.3	-	-	6.1	122.5	8.9	153.7	5.8	114.6	6.6	126.1	-	1209.1	110.8	3264.4
03-03-01-01	DATA MGMT SOFTWARE	172.2	3173.4	-	-	-	-	-	-	-	-	-	-	-	3192.6	172.2	6366.0
03-03-02-00	GUID & NAV	68.2	1257.2	-	-	3.9	79.4	4.3	73.4	19.2	378.6	9.4	179.7	-	5428.8	104.9	7397.3
03-03-03-00	COMM.	27.5	507.7	-	-	1.5	29.8	5.4	93.6	13.6	268.8	6.9	132.4	-	4669.6	54.9	5702.0
03-03-04-00	INSTR'N	32.0	589.3	-	-	-	-	-	-	-	-	-	-	-	484.0	32.0	1073.3
03-03-05-00	E. POWER	8.2	151.1	-	-	-	-	-	-	-	-	-	-	-	200.1	8.2	351.2
03-03-06-00	POWER DISTR & CON	151.5	2791.7	-	-	13.1	264.8	9.1	157.7	11.4	226.1	17.7	340.5	-	514.2	202.9	4295.0
03-03-07-00	INSTALLATION ASSEM&CO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-04-00-00	PROPULSION	192.7	3551.1	-	-	34.3	691.8	-	-	8.6	169.2	-	-	-	28822.3	235.5	33234.4
03-04-01-00	MAIN ENG. GFE	-	-	-	-	4.1	83.0	-	-	1.0	20.3	-	-	-	24000.0	5.1	24103.3
03-04-02-00	MAIN ENG. SUP.	109.6	2018.9	-	-	13.0	262.9	-	-	3.3	64.3	-	-	-	2609.8	125.8	4955.8
03-04-03-00	ACPS ENG	8.9	163.2	-	-	.7	13.8	-	-	.2	3.4	-	-	-	1557.7	9.8	1738.1
03-04-04-00	ACPS ENG SUP	74.3	1369.1	-	-	16.5	332.1	-	-	4.1	81.2	-	-	-	654.8	94.9	2437.2

STUDY TITLE SPACE TUG VOLUME 3 OPTION 1

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
03-04-05-00	INSTALLATION ASSEM & CO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-05-00-00	ORBITER INTERF EQ	167.1	3079.7	-	-	26.7	539.5	-	-	6.6	129.6	-	-	-	775.0	200.4	4523.8
03-05-01-00	STRUCTURES (CRADLE)	84.9	1565.5	-	-	21.8	440.2	-	-	5.4	106.9	-	-	-	676.7	112.2	2789.4
03-05-02-00	INTERF. PAN	52.3	964.1	-	-	4.9	99.3	-	-	1.1	22.7	-	-	-	77.9	58.4	1163.9
03-05-03-00	PURGE PROVISION	13.1	241.8	-	-	-	-	-	-	-	-	-	-	-	-	13.1	241.8
03-05-04-00	ABORT PROVISION	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-05-05-00	INSTALLATION ASSEM & CO	16.7	308.3	-	-	-	-	-	-	-	-	-	-	-	20.4	16.7	328.7
03-07-00-00	FINAL ASSEM & CO	77.2	1422.7	-	-	21.0	423.8	-	-	19.8	392.0	65.4	1257.4	-	-	183.4	3495.9
03-07-01-00	FINAL ASSEM	52.8	973.0	-	-	21.0	423.8	-	-	5.3	103.7	7.2	138.4	-	-	86.2	1639.0
03-07-02-00	CHECK OUT	24.4	449.6	-	-	-	-	-	-	14.6	288.3	58.2	1119.0	-	-	97.2	1857.0
04-00-00-00	KICK STAGES	454.4	8374.6	-	-	119.7	2416.3	7.9	136.1	92.8	1831.7	47.9	920.7	-	12399.1	722.7	26078.6
A4-01-00-00	SMALL K/S STRUCTURE	143.2	2638.4	-	-	18.9	380.6	-	-	4.8	93.9	-	-	-	187.8	166.8	3300.8
A4-01-03-00	B. STRUCTURE	143.2	2638.4	-	-	18.9	380.6	-	-	4.8	93.9	-	-	-	187.8	166.8	3300.8
A4-02-00-00	SMALL K/S THERMAL	17.2	317.3	-	-	3.3	66.2	-	-	.8	16.2	-	-	-	131.1	21.3	530.8
A4-02-04-00	THERMAL SYS	17.2	317.3	-	-	3.3	66.2	-	-	.8	16.2	-	-	-	131.1	21.3	530.8
A4-04-00-00	SMALL K/S. PROPULSION	34.4	633.2	-	-	11.5	231.7	-	-	2.9	56.7	-	-	-	3526.5	48.7	4448.1
A4-04-01-00	MAIN ENG	6.2	114.8	-	-	-	-	-	-	-	-	-	-	-	3025.0	6.2	3139.9

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 1

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
A4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4
A4-04-03-00	ACPS ENG	3.3	60.4	–	–	1.1	23.2	–	–	.3	5.7	–	–	–	332.7	4.7	422.0
A4-04-04-00	ACPS ENG SUP	18.8	346.0	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	162.0	25.2	637.8
A4-07-00-00	SMALL K/S FACO	–	–	–	–	14.3	288.0	–	–	6.3	123.7	12.1	233.3	–	–	32.7	645.0
A4-07-01-00	FINAL ASSEM	–	–	–	–	11.8	238.3	–	–	3.5	69.9	2.3	44.1	–	–	17.6	352.1
A4-07-02-00	CHECK OUT	–	–	–	–	2.5	49.7	–	–	2.7	54.1	9.8	189.2	–	–	15.0	292.9
B4-01-00-00	LARGE K/S STRUCTURES	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	191.4	166.8	3304.4
B4-01-03-00	B STRUCTURE	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	191.4	166.8	3304.4
B4-02-00-00	LARGE K/S THERMAL	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-02-04-00	THERMAL SYS	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-03-00-00	LARGE K/S AVIONICS	64.9	1196.8	–	–	23.9	483.3	7.9	136.1	63.3	1250.7	23.6	454.1	–	469.7	183.7	3990.7
B4-03-01-00	DATA MGMT	33.6	619.6	–	–	9.5	192.0	6.2	107.8	6.6	130.2	14.3	274.3	–	223.9	70.2	1547.7
B4-03-01-01	DATA MGMT SOFTWARE	21.5	395.9	–	–	–	–	–	–	–	–	–	–	–	111.7	21.5	507.6
B4-03-05-00	E. POWER	2.5	45.3	–	–	–	–	–	–	–	–	–	–	–	60.5	2.5	105.8
B4-03-06-00	POWER DISTR'N & CON	7.4	136.0	–	–	14.4	291.3	1.6	28.4	56.7	1120.5	9.4	179.7	–	73.7	89.5	1829.6
B4-04-00-00	LARGE K/S PROPULSION	34.4	633.2	–	–	11.5	231.7	–	–	2.9	56.7	–	–	–	7761.5	48.7	8683.1
B4-04-01-00	MAIN ENG	6.2	114.8	–	–	–	–	–	–	–	–	–	–	–	7260.0	6.2	7374.9
B4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 1

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
B4-04-03-00	ACPS ENG	3.3	60.4	-	-	1.1	23.2	-	-	.3	5.7	-	-	-	332.7	4.7	422.0
B4-04-04-00	ACPS ENG SUP	18.8	346.0	-	-	5.2	104.3	-	-	1.3	25.5	-	-	-	162.0	25.2	637.8
B4-07-00-00	LARGE K/S FACO	-	-	-	-	14.3	288.0	-	-	6.3	123.7	12.1	233.3	-	-	32.7	645.0
B4-07-01-00	FINAL ASSEM	-	-	-	-	11.8	238.3	-	-	3.5	69.6	2.3	44.1	-	-	17.6	352.1
B4-07-02-00	CHECK OUT	-	-	-	-	2.5	49.7	-	-	2.7	54.1	9.8	189.2	-	-	15.0	292.9
05-00-00-00	LOGISTICS	127.8	2354.3	-	-	-	-	-	-	-	-	-	-	-	78.6	127.8	2433.0
05-01-00-00	TRAN & HAND.	2.3	42.3	-	-	-	-	-	-	-	-	-	-	-	36.3	2.3	78.6
05-02-00-00	TRAINING	93.0	1713.6	-	-	-	-	-	-	-	-	-	-	-	42.3	93.0	1756.0
05-02-01-00	SIMULATORS & EQUIP	-	-	-	-	-	-	-	-	-	-	-	-	-	42.3	-	42.3
05-02-02-00	GROUND CREW	41.3	761.6	-	-	-	-	-	-	-	-	-	-	-	-	41.3	761.6
05-02-03-00	FLT OPS CREW NASA	28.0	516.8	-	-	-	-	-	-	-	-	-	-	-	-	28.0	516.8
05-02-04-00	FLT OPS CREW DOD	23.6	435.2	-	-	-	-	-	-	-	-	-	-	-	-	23.6	435.2
05-03-00-00	INVENTORY CONT & WAREHS	32.5	598.4	-	-	-	-	-	-	-	-	-	-	-	-	32.5	598.4
06-00-00-00	FACILITIES	33.0	514.2	-	-	-	-	3.0	51.2	10.3	184.0	79.2	1318.3	-	17509.7	125.4	19577.4
06-02-00-00	TEST	11.3	208.5	-	-	-	-	3.0	51.2	-	-	-	-	-	1139.7	14.3	1399.4
06-02-01-00	DESIGN/ CONSTRUCT.	8.4	154.1	-	-	-	-	3.0	51.2	-	-	-	-	-	1139.7	11.3	1345.0

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
06-02-02-00	ACTIVATION MAINTENANCE	3.0	54.4	-	-	-	-	-	-	-	-	-	-	-	-	3.0	54.4
06-03-00-00	ETR MAINT & REFURB	7.4	97.6	-	-	-	-	-	-	7.2	138.2	60.5	1037.6	-	8100.0	75.1	9373.4
06-03-01-00	DESIGN/ CONSTRUCT.	7.4	97.6	-	-	-	-	-	-	-	-	-	-	-	8100.0	7.4	8197.6
06-03-02-00	ACTIVATION MAINTENANCE	-	-	-	-	-	-	-	-	6.6	129.5	39.5	759.9	-	-	46.1	889.5
06-03-02-00	ACTIVATION MAINT ETR	-	-	-	-	-	-	-	-	.7	8.7	21.0	277.7	-	-	21.6	286.3
06-04-00-00	ETR LAUNCH	3.4	45.6	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-01-00	DESIGN/ CONSTRUCT.	3.4	45.5	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-02-00	ACTIVATION/ MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-05-00-00	WTR MAINT & REFURB	7.4	110.8	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	5200.0	29.1	5637.3
06-05-01-00	DESIGN/ CONSTRUCT	7.4	110.8	-	-	-	-	-	-	-	-	-	-	-	5200.0	7.4	5310.8
06-05-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	-	21.7	326.5
06-06-00-00	WTR LAUNCH	3.4	51.7	-	-	-	-	-	-	-	-	-	-	-	1430.0	3.4	1481.7
06-06-01-00	DESIGN/ CONSTRUCT	3.4	51.7	-	-	-	-	-	-	-	-	-	-	-	1430.0	3.4	1481.7
06-06-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-00-00-00	GROUND SUP EQUIP	634.4	11690.6	30.5	483.9	60.6	1005.2	1656	2645.4	92.9	1516.9	139.3	2138.5	-	3942.4	1123.3	23422.9
07-01-00-00	MANUF. GSE	143.8	2650.5	-	-	30.0	545.6	69.8	1207.4	38.7	703.1	52.2	829.9	-	1666.4	334.5	7603.0
07-01-01-00	HARDWARE	-	-	-	-	21.4	432.8	69.8	1207.4	29.4	579.5	23.3	448.1	-	1666.4	143.9	4334.3

STUDY TITLE SPACE TUG

CONTRACT NO.

OPTION 1

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07-01-02-00	SITE ACTIVATION	-	-	-	-	8.5	112.8	-	-	9.4	123.7	28.9	381.8	-	-	46.7	618.2
07-01-03-00	MAINT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-01-04-00	SOFTWARE	143.8	2650.5	-	-	-	-	-	-	-	-	-	-	-	-	143.8	2650.5
07-02-00-00	ETR GSE	439.2	8094.2	-	-	-	-	-	-	10.9	163.1	43.5	652.5	-	-	493.5	8909.8
07-02-01-00	HARDWARE	398.7	7347.7	-	-	-	-	-	-	-	-	-	-	-	-	398.7	7347.7
07-02-02-00	SITE ACTIVATION	-	-	-	-	-	-	-	-	10.9	163.1	43.5	652.5	-	-	54.3	815.7
07-02-03-00	MAINT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-02-04-00	SOFTWARE	40.5	746.5	-	-	-	-	-	-	-	-	-	-	-	-	40.5	746.5
07-03-00-00	WTR GSE	-	-	-	-	30.6	459.6	95.8	1438.0	43.3	650.6	43.7	656.1	-	1396.2	213.4	4600.5
07-03-01-00	HARDWARE	-	-	-	-	30.6	459.6	95.8	1438.0	39.6	593.9	28.6	429.5	-	1396.2	194.6	4317.3
07-03-02-00	SITE ACTIVATION	-	-	-	-	-	-	-	-	3.8	56.6	15.1	226.5	-	-	18.9	283.2
07-03-03-00	MAINT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-03-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-04-00-00	FLT OPS CONTL NASA	38.4	707.2	25.1	398.0	-	-	-	-	-	-	-	-	-	443.9	63.5	1549.1
07-04-01-00	HARDWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	353.2	-	353.2
07-04-02-00	SITE ACTIVATION	2.5	45.3	-	-	-	-	-	-	-	-	-	-	-	-	2.5	45.3
07-04-03-00	MAINT.	3.0	54.4	-	-	-	-	-	-	-	-	-	-	-	-	3.0	54.4
07-04-04-00	SOFTWARE	33.0	607.5	25.1	398.0	-	-	-	-	-	-	-	-	-	90.7	58.1	1096.2

STUDY TITLE SPACE TUG VOLUME 8 D APPENDIX A OPTION 1

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07-05-00-00	FLT OPS CONTL DOD	13.0	238.8	5.4	85.9	–	–	–	–	–	–	–	–	–	435.9	18.4	760.5
07-05-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	393.9	–	393.9
07-05-02-00	SITE ACTIVATION	2.3	42.3	–	–	–	–	–	–	–	–	–	–	–	–	2.3	42.3
07-05-03-00	MAINT	2.8	51.4	–	–	–	–	–	–	–	–	–	–	–	–	2.8	51.4
07-05-04-00	SOFTWARE	7.9	145.1	5.4	85.8	–	–	–	–	–	–	–	–	–	42.0	13.3	272.9
08-00-00-00	VEH. TEST	436.2	8039.0	–	–	167.2	3373.8	665.3	11503.1	169.3	3342.8	316.8	6091.3	–	8454.5	1754.7	40804.5
08-01-00-00	GROUND TEST HDWRE	110.0	2027.7	–	–	83.3	1681.5	407.9	7052.4	6.9	136.0	11.5	220.7	–	1821.7	619.6	12940.0
08-01-01-00	HDWRE, PTV TEST/BATTLESH	25.4	468.3	–	–	19.0	384.0	33.5	578.5	3.0	58.3	7.5	145.1	–	100.7	88.4	1734.7
08-01-02-00	MAJOR TEST APT.	78.7	1450.7	–	–	64.3	1297.5	374.4	6473.9	3.9	77.7	3.9	75.7	–	1721.0	525.3	11096.5
08-01-03-00	MOCKUPS	5.9	108.8	–	–	–	–	–	–	–	–	–	–	–	–	5.9	108.8
08-02-00-00	GROUND TEST OPS	295.7	5449.1	–	–	79.0	1595.4	–	–	68.9	1360.2	206.6	3973.0	–	2654.5	650.3	15032.2
08-03-00-00	FLT TEST HARDWARE	–	–	–	–	4.8	96.9	257.4	4450.7	79.9	1577.8	53.1	1020.9	–	3971.6	395.2	11117.9
08-04-00-00	FLT TEST OPERATIONS	30.5	562.1	–	–	–	–	–	–	13.6	268.8	45.6	876.6	–	6.8	89.7	1714.3
11-00-00-00	FLT OPS FOR DOD	17.7	326.4	–	–	–	–	–	–	–	–	–	–	–	–	17.7	326.4
11-01-00-00	FLT MISSION PLANNING	8.9	163.2	–	–	–	–	–	–	–	–	–	–	–	–	8.9	163.2
11-04-00-00	FLT SUP HARDWARE	8.9	163.2	–	–	–	–	–	–	–	–	–	–	–	–	8.9	163.2

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
12-00-00-00	FLT OPS FOR NASA	59.0	1088.0	-	-	-	-	-	-	-	-	-	-	-	-	59.0	1088.0
12-01-00-00	FLT MISSION PLANNING	45.8	843.2	-	-	-	-	-	-	-	-	-	-	-	-	45.8	843.2
12-04-00-00	FLT SUP HARDWARE	13.3	244.8	-	-	-	-	-	-	-	-	-	-	-	-	13.3	244.8
TOTAL DDT&E		4181.0	76956.0	906.5	14379.3	604.0	11973.6	893.3	15228.2	554.1	10605.3	733.4	13356.5	-	94350.2	7872.3	236849.0

DDT&E

OPTION 2

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
32A	DDT&E	4485.5	82514.9	989.6	16697.7	577.7	11499.5	972.5	16584.9	574.2	11132.0	761.1	14092.7	–	146185.9	8350.5	297708.9
01-00-00-00	PROJ MGM'T COST	103.3	1904.0	728.8	11561.3	–	–	23.9	414.0	18.7	369.2	24.6	473.0	–	1214.8	899.4	15936.2
01-01-00-00	PERF MGM'T	103.3	1904.0	484.3	7682.4	–	–	23.9	414.0	18.7	369.2	24.6	473.0	–	1214.8	659.8	12057.3
01-02-00-00	PROJ DIR	–	–	59.0	936.6	–	–	–	–	–	–	–	–	–	–	59.0	936.6
01-03-00-00	INFO MGM'T	–	–	185.5	2942.4	–	–	–	–	–	–	–	–	–	–	185.5	2942.4
02-00-00-00	SYSTEMS ENG & TIMS	1041.6	19199.3	221.4	3512.1	–	–	–	–	48.1	948.9	24.3	466.7	–	3586.2	1335.3	27709.2
02-01-00-00	TUG SYS ENG	856.6	15785.2	147.6	2341.4	–	–	–	–	48.0	948.9	24.3	466.7	–	3359.9	1076.5	22902.0
02-02-00-00	SHUTTLE INTERFACE	70.2	1293.5	22.1	351.2	–	–	–	–	–	–	–	–	–	47.0	92.3	1691.7
02-03-00-00	PAYLOAD INTERFACE	114.8	2116.6	51.7	819.2	–	–	–	–	–	–	–	–	–	179.3	166.5	3114.4
03-00-00-00	SPACE TUG VEH M.S.	1640.9	30239.5	–	–	264.6	5340.9	38.2	661.0	143.5	2833.4	118.5	2279.1	–	99452.0	2205.8	140865.9
03-01-00-00	STRUCT	452.7	8342.0	–	–	145.7	2941.0	–	–	36.7	725.5	–	–	–	10398.4	635.1	20923
03-01-01-00	FUEL TANK	47.9	882.5	–	–	33.7	680.2	–	–	8.4	166.9	–	–	–	313.8	90.0	3682.8
03-01-02-00	OX TANK	47.9	882.5	–	–	92.3	1862.9	–	–	23.0	454.2	–	–	–	483.2	163.2	4197.1
03-01-03-00	B. STRUCT	180.2	3321.4	–	–	9.5	191.7	–	–	2.4	47.4	–	–	–	636.5	192.1	448.7
03-01-04-00	THRUST STRUCT	16.6	305.9	–	–	5.1	102.9	–	–	1.3	25.7	–	–	–	14.2	28.0	797.0

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 2

CONTRACT NO. APPENDIX A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
03-01-05-00	METEOROID SHIELD	41.7	767.7	–	–	.2	4.0	–	–	–	–	–	–	–	25.4	41.9	797.0
03-01-06-00	PAYLOAD INTERFACE	26.9	495.6	–	–	4.9	99.3	–	–	1.6	32.4	–	–	–	8828.2	33.5	9455.5
03-01-07-00	INSTALLATION ASSEM & CO	91.5	1686.4	–	–	–	–	–	–	–	–	–	–	–	97.1	91.5	1783.5
03-02-00-00	THERMAL CONTROL	98.9	1822.4	–	–	4.3	86.1	–	–	1.1	22.7	–	–	–	972.8	104.3	2903.9
03-03-00-00	AVIONICS	632.7	11658.9	–	–	32.6	658.7	38.2	661.0	70.6	1394.5	53.1	1021.6	–	23474.2	827.3	38868.9
03-03-01-00	DATA MGMT	92.8	1710.6	–	–	6.1	122.5	8.9	153.7	5.8	114.6	6.6	126.1	–	1209.1	120.1	3436.6
03-03-01-01	DATA MGMT SOFTWARE	172.2	3173.4	–	–	–	–	–	–	–	–	–	–	–	3192.6	172.2	6366.0
03-03-01-02	DATA MGMT SET DELTA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-03-02-01	GUID & NAV	88.2	1626.0	–	–	3.9	79.4	4.3	73.4	27.4	540.5	9.4	179.7	–	11109.9	133.1	13609.0
03-03-02-02	GUID NAV DELTA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-03-03-00	COMM	27.5	507.7	–	–	1.5	29.8	5.4	93.6	13.6	268.8	6.9	132.4	–	4669.6	54.9	5702.0
03-03-04-00	INSTR'N	32.0	589.3	–	–	–	–	–	–	–	–	–	–	–	484.0	32.0	1073.3
03-03-05-00	EL. POWER	68.4	1260.3	–	–	8.0	162.2	10.6	182.6	12.4	244.5	12.6	242.8	–	2294.6	112.0	4387.0
03-03-06-00	POWER DISTR & CON	151.5	2791.7	–	–	13.1	264.8	9.1	157.7	11.4	226.1	17.7	340.5	–	514.2	202.9	4295.0
03-03-07-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-04-00-00	PROPULSION	212.4	3913.8	–	–	34.3	691.8	–	–	8.6	169.2	–	–	–	63831.6	255.2	68606.4
03-04-01-00	MAIN ENG GFE (CME UPS)	–	–	–	–	4.1	83.0	–	–	1.0	20.3	–	–	–	59000.0	5.1	59103.3
03-04-01-01	MAIN ENG CLASS I	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
03-04-02-00	MAIN ENG SUP	118.4	2182.1	–	–	13.0	262.9	–	–	3.3	64.3	–	–	–	2615.8	134.7	5125.1
03-04-03-00	ACPS ENG	8.9	163.2	–	–	.7	13.8	–	–	.2	3.4	–	–	–	1557.7	9.7	1738.[illegible]
03-04-04-00	ACPS ENG SUP	85.1	1568.5	–	–	16.5	332.1	–	–	4.1	81.2	–	–	–	658.1	105.7	2639.9
03-04-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-00-00	ORBITER INTERFACE EG	167.1	3079.7	–	–	26.7	539.5	–	–	6.6	129.6	–	–	–	775.0	200.4	4523.8
03-05-01-00	STRUCT CRADLE	84.9	1565.5	–	–	21.8	440.2	–	–	5.4	106.9	–	–	–	676.7	112.2	2789.4
03-05-02-00	INTERFACE PANELS	52.3	964.1	–	–	4.9	99.3	–	–	1.1	22.7	–	–	–	77.9	58.4	1163.9
03-05-03-00	PURGE PROPULSION	13.1	241.8	–	–	–	–	–	–	–	–	–	–	–	–	13.1	241.8
03-05-05-00	ORBITER INT ASSEM & C/O	16.7	308.3	–	–	–	–	–	–	–	–	–	–	–	20.4	16.7	328.7
03-06-00-00	DROP TANKS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-01-00	STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-02-00	THERMAL SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-03-00	PROPULSION SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-04-00	INSTALLATIONS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-07-00-00	FINAL ASSEM & C/O	77.2	1422.7	–	–	21.0	423.8	–	–	19.8	392.0	65.4	1257.4	–	–	183.4	3495.9
03-07-01-00	FINAL ASSEMBLY	52.8	973.0	–	–	21.0	423.8	–	–	5.3	103.7	7.2	138.4	–	–	86.2	1639.0
03-07-02-00	CHECKOUT	24.4	449.6	–	–	–	–	–	–	14.6	288.3	58.2	1119.0	–	–	97.2	1857.0

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 2

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
04-00-00-00	KICK STAGES	281.8	5192.2	–	–	71.8	1449.8	7.9	136.1	78.0	1541.2	35.8	687.4	–	9044.8	475.3	18051.6
A4-01-00-00	SMALL K/S STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-01-03-00	B. STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-02-00-00	SMALL K/S THERMAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-02-04-00	THERMAL SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-04-00-00	SMALL K/S PROPULSION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-04-01-00	MAIN ENG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-04-02-00	MAIN ENG SUP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-04-03-00	ACPS ENG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-04-04-00	ACPS ENG SUP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-07-00-00	SMALL K/S FACO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-07-01-00	FINAL ASSEMBLY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-07-02-00	CHECKOUT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B4-01-00-00	LARGE K/S STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	187.8	166.8	3300.8
B4-01-03-00	B. STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	187.8	166.3	3300.8
B4-02-00-00	LARGE K/S THERMAL	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-02-04-00	THERMAL SYSTEM	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-03-00-00	LARGE K/S AVIONICS	64.9	1196.8	–	–	23.9	483.3	7.9	136.1	63.3	1250.7	23.6	454.1	–	469.7	183.7	3990.7

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX: A

OPTION 2

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
B4-03-01-00	DATA M&M'T	33.6	619.6	–	–	9.5	192.0	6.2	107.8	6.6	130.2	14.3	274.3	–	223.9	70.2	1547.7
B4-03-01-01	DATA M&M'T SOFTWARE	21.5	395.9	–	–	–	–	–	–	–	–	–	–	–	111.7	21.5	507.6
B4-03-05-00	EL POWER	2.5	45.3	–	–	–	–	–	–	–	–	–	–	–	60.5	2.5	105.8
B4-03-06-00	POWER DISTR & CONT	7.4	136.0	–	–	14.4	291.3	1.6	28.4	56.7	1120.5	9.4	179.7	–	73.7	89.5	1829.6
B4-04-00-00	LARGE K/S PROPULSION	56.4	1039.7	–	–	11.5	231.7	–	–	2.9	56.7	–	–	–	8256.3	70.8	9584.3
B4-04-01-00	MAIN ENG	6.2	114.8	–	–	–	–	–	–	–	–	–	–	–	7260.0	6.2	7374.8
B4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4
B4-04-03-00	ACPS ENG	6.6	120.9	–	–	1.1	23.2	–	–	.3	5.7	–	–	–	665.5	8.0	815.2
B4-04-04-00	ACPS ENG SUP	37.6	692.1	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	324.0	44.0	1145.9
B4-07-00-00	LARGE K/S FACO	–	–	–	–	14.3	288.0	–	–	6.3	123.7	12.1	233.3	–	–	32.7	645.0
B4-07-01-00	FINAL ASSEMBLY	–	–	–	–	11.8	238.3	–	–	3.5	69.6	2.3	44.1	–	–	17.6	352.1
B4-07-02-00	CHECKOUT	–	–	–	–	2.5	49.7	–	–	2.7	54.1	9.8	189.2	–	–	15.0	292.9
05-00-00-00	LOGISTICS	136.6	2517.5	–	–	–	–	–	–	–	–	–	–	–	78.6	136.6	2596.2
05-01-00-00	TRANS & HANDLING	2.3	42.3	–	–	–	–	–	–	–	–	–	–	–	36.3	2.3	78.6
05-02-00-00	TRAINING	101.8	1876.8	–	–	–	–	–	–	–	–	–	–	–	42.3	101.8	1919.2
05-02-01-00	SIMULATORS & EQUIP.	–	–	–	–	–	–	–	–	–	–	–	–	–	42.3	–	42.3
05-02-02-00	GND CREW	41.3	761.6	–	–	–	–	–	–	–	–	–	–	–	–	41.3	761.6

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
05-02-03-00	FLT OPS CREW NASA	31.5	580.3	-	-	-	-	-	-	-	-	-	-	-	-	31.5	580.3
05-02-04-00	FLT OPS CREW DOD	29.0	534.9	-	-	-	-	-	-	-	-	-	-	-	-	29.0	534.9
05-03-00-00	INV CONT & WAREHS	32.5	598.4	-	-	-	-	-	-	-	-	-	-	-	-	32.5	598.4
06-00-00-00	FACILITIES	33.0	514.2	-	-	-	-	3.0	51.0	10.2	184.0	79.2	1318.3	-	17509.7	125.4	19577.3
06-02-00-00	TEST	11.3	208.5	-	-	-	-	3.0	51.0	-	-	-	-	-	1139.7	14.3	1399.3
06-02-01-00	DESIGN/ CONSTR'N	8.4	154.1	-	-	-	-	3.0	51.0	-	-	-	-	-	1139.7	11.3	1344.9
06-02-02-00	ACTIVATION MAINT	3.0	54.4	-	-	-	-	-	-	-	-	-	-	-	-	3.0	54.4
06-03-00-00	ETR MAINT & REFURB	7.4	97.6	-	-	-	-	-	-	7.2	138.2	60.5	1037.6	-	8100.0	75.1	9373.4
06-03-01-00	DESIGN/ CONSTR'N	7.4	97.6	-	-	-	-	-	-	-	-	-	-	-	8100.0	7.4	8197.6
06-03-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	6.6	129.5	39.5	759.9	-	-	46.1	889.4
06-03-02-00	ACTIVATION MAINT. ETR	-	-	-	-	-	-	-	-	.6	8.7	21.0	277.7	-	-	21.6	286.4
06-04-00-00	ETR LAUNCH	3.4	45.6	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-01-00	DESIGN/ CONSTR'N	3.4	45.6	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-05-00-00	WTR MAINT & REFURB	7.4	110.8	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	5200.0	29.1	5637.3
06-05-01-00	DESIGN/ CONSTR'N	7.4	110.8	-	-	-	-	-	-	-	-	-	-	-	5200.0	7.4	5310.8
06-05-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	-	21.7	326.5

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
06-06-00-00	WTR LAUNCH	3.4	51.7	-	-	-	-	-	-	-	-	-	-	-	1430.0	3.4	1481.7
06-06-01-00	DESIGN/ CONSTR'N	3.4	51.7	-	-	-	-	-	-	-	-	-	-	-	1430.0	3.4	1481.7
06-06-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-00-00-00	GND SUP EQUIP	702.0	12886.0	39.4	629.4	65.9	1170.7	197.6	3185.6	92.7	1643.7	122.3	2207.9	-	4507.0	1219.9	26225.3
07-01-00-00	MANUFGSE	167.4	3085.0	-	-	35.0	706.0	96.1	1662.0	42.4	836.0	44.7	860.4	-	2645.1	385.6	9194.5
07-01-01-00	HARDWARE	21.3	392.1	-	-	25.5	514.1	96.1	1662.0	33.0	651.4	15.8	305.4	-	2045.1	191.7	5570.1
07-01-02-00	SITE ACTIVATION	-	-	-	-	9.5	192.0	-	-	9.4	184.6	28.9	555.0	-	-	47.8	931.6
07-01-03-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-01-04-00	SOFTWARE	146.1	2692.8	-	-	-	-	-	-	-	-	-	-	-	-	146.1	2692.8
07-02-00-00	ETR GSE	466.1	8589.2	-	-	-	-	-	-	10.9	214.8	43.5	836.4	-	-	520.5	9640.4
07-02-01-00	HARDWARE	425.6	7842.7	-	-	-	-	-	-	-	-	-	-	-	-	425.6	7842.7
07-02-02-00	SITE ACTIVATION	-	-	-	-	-	-	-	-	10.9	214.8	43.5	836.4	-	-	54.4	1051.2
07-02-03-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-02-04-00	SOFTWARE	40.5	746.5	-	-	-	-	-	-	-	-	-	-	-	-	40.5	746.5
07-03-00-00	WTR GSE	-	-	-	-	31.0	464.6	101.5	1523.7	39.5	593.0	34.0	511.1	-	1541.0	206.0	4633.4
07-03-01-00	HARDWARE	-	-	-	-	31.0	464.6	101.5	1523.7	35.7	536.3	18.9	284.3	-	1541.0	187.1	4349.9
07-03-02-00	SITE ACTIVATION	-	-	-	-	-	-	-	-	3.8	56.7	15.1	226.8	-	-	18.9	283.5

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 2

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
07-03-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-03-04-00	SOFTWARE	–		–	–		–	–	–	–	–	–	–	–		–	–
07-04-00-00	FLT OPS CONT NASA	51.2	910.5	31.5	499.5	–	–	–	–	–	–	–	–	–	452.2	82.7	1862.2
07-04-01-00	HARDWARE	–		–		–	–	–	–	–	–	–	–	–	353.2	–	353.2
07-04-02-00	SITE ACTIVATION	3.3	43.4	–	–	–	–	–	–	–		–	–	–	–	3.3	43.4
07-04-03-00	MAINT	3.0	39.0	–	–	–	–	–	–	–	–	–	–	–	–	3.0	39.0
07-04-04-00	SOFTWARE	44.9	828.1	31.5	499.5	–	–	–	–	–	–	–	–	–	99.0	76.4	1426.6
07-05-00-00	FLT OPS CONT DOD	17.4	301.3	7.9	124.9	–	–	–	–	–	–	–	–	–	463.6	25.3	894.8
07-05-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	393.9	–	393.9
07-05-02-00	SITE ACTIVATION	2.8	41.9		–	–		–	–	–	–	–	–	–		2.8	41.9
07-05-03-00	MAINT	2.8	41.9	–		–		–		–		–		–		2.8	41.9
07-05-04-00	SOFTWARE	11.8	217.5	7.9	124.9	–	–	–	–	–	–	–	–	–	74.7	19.7	417.1
08-00-00-00	VEH TEST	470.5	8670.8	–	–	175.3	3538.1	701.9	12137.1	182.9	3612.3	346.4	6660.4	–	10792.3	877.0	45411.0
08-01-00-00	GND TEST HARDWARE	122.3	2254.6	–	–	86.3	1741.0	430.3	7440.9	6.9	136.0	11.5	220.7	–	1870.7	657.3	13663.9
08-01-01-00	HDWRE, PTV TEST/BATTLE	26.6	489.6	–	–	19.0	384.0	33.5	578.5	3.0	58.3	7.5	145.0	–	100.7	89.5	1756.1
08-01-02-00	MAT TEST ARTICLES	89.7	1635.0	–	–	67.2	1337.0	396.9	6862.4	3.9	77.7	3.9	75.7	–	1770.0	560.7	11777.8
08-01-03-00	MOCK UPS	7.1	130.0	–	–	–	–	–	–	–	–	–	–	–	–	7.1	130.0

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS NTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
08-02-00-00	GND TEST OPS	315.4	5811.8	—	—	83.6	1688.1	—	—	73.0	1441.2	232.6	4471.3	—	3091.9	704.5	16504.2
08-03-00-00	FLT TEST HARDWARE	—	—	—	—	5.4	109.0	271.6	4696.2	88.3	1743.7	55.8	1072.9	—	5814.2	421.1	13435.9
08-04-00-00	FLT TEST OPS	32.8	604.4	—	—	—	—	—	—	14.8	291.5	46.6	895.5	—	15.5	94.1	1806.9
11-00-00-00	FLT OPS DOD	16.7	308.3	—	—	—	—	—	—	—	—	—	—	—	—	16.7	308.3
11-01-00-00	FLT MISSION PLANNING	7.9	145.1	—	—	—	—	—	—	—	—	—	—	—	—	7.9	145.1
11-04-00-00	FLT SUP SOFTWARE	8.9	163.2	—	—	—	—	—	—	—	—	—	—	—	—	8.9	163.2
12-00-00-00	FLT OPS FOR NASA	59.0	1088.0	—	—	—	—	—	—	—	—	—	—	—	—	59.0	1088.0
12-01-00-00	MISSION PLANNING	45.8	843.2	—	—	—	—	—	—	—	—	—	—	—	—	45.8	843.2
12-04-00-00	FLT SUP SOFTWARE	13.3	244.8	—	—	—	—	—	—	—	—	—	—	—	—	13.3	244.8
TOTAL DDT&E		4485.5	82519.9	989.6	15697.7	577.7	11499.5	972.5	16584.9	574.2	11132.8	751.1	14092.7	—	146185.4	8350.5	297707.9

DDT&E

OPTION 3

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 3

CONTRACT NO. APPENDIX A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32A	DDT&E	4912.2	90879.0	1077.0	17084.4	633.2	12751.4	989.9	17066.6	618.1	12140.1	790.1	14917.7	—	189362.9	9020.8	353702.1
01-00-00-00	PROJ MGMT COST	110.2	2030.9	789.2	12518.7	—	—	23.9	414.0	18.7	369.2	24.6	473.0	—	1536.2	966.6	17341.9
01-01-00-00	PERF MGMT	110.2	2030.9	528.7	8387.4	—	—	23.9	414.0	18.7	369.2	24.6	473.0	—	1536.2	706.2	13210.7
01-02-00-00	PROJ DIR	—	—	63.0	999.0	—	—	—	—	—	—	—	—	—	—	63.0	999.0
01-03-00-00	INFO MGMT	—	—	197.5	3132.3	—	—	—	—	—	—	—	—	—	—	197.5	3132.3
02-00-00-00	SYSTEMS ENG & INTEG	1098.1	20236.9	236.2	3746.2	—	—	—	—	51.5	1016.9	19.7	378.4	—	3714.9	1405.5	29093.3
02-01-00-00	TUG SYS ENG	889.6	16392.6	157.4	2497.5	—	—	—	—	51.5	1016.9	19.7	378.4	—	3488.5	1118.2	23773.9
02-02-00-00	SHUTTLE INTERFACE	82.7	1523.2	23.6	374.6	—	—	—	—	—	—	—	—	—	47.0	106.3	1944.8
02-03-00-00	PAYLOAD INTERFACE	125.9	2321.1	55.1	874.1	—	—	—	—	—	—	—	—	—	179.3	181.1	3374.5
03-00-00-00	SPACE TUG VEH M.S	1733.9	31952.7	—	—	264.6	5340.9	38.2	661.0	151.4	2988.9	118.5	2279.1	—	13791.5	2306.6	181138.0
03-01-00-00	STRUCT	457.2	8426.0	—	—	145.7	2941.0	—	—	36.7	725.5	—	—	—	10398.9	639.7	22490.9
03-01-01-00	FUEL TANK	47.9	882.5	—	—	33.7	680.2	—	—	8.4	165.9	—	—	—	313.8	90.0	2842.3
03-01-02-00	OX TANK	47.9	882.5	—	—	92.3	1862.9	—	—	23.0	454.2	—	—	—	483.2	163.2	3682.8
03-01-03-00	B. STRUCT	182.7	3366.8	—	—	9.5	191.7	—	—	2.4	47.4	—	—	—	636.5	194.6	4242.4
03-01-04-00	THRUST STRUCT	16.7	308.3	—	—	5.1	102.9	—	—	1.3	25.7	—	—	—	14.2	23.1	451.1

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 3

CONTRACT NO. APPENDIX A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
03-01-05-00	METEOROID SHIELD	41.7	767.7	–	–	.2	4.0	–	–	–	–	–	–	–	25.4	41.9	797.0
03-01-06-00	PAYLOAD INTERFACE	26.9	495.6	–	–	4.9	99.3	–	–	1.6	32.4	–	–	–	8828.2	33.5	9455.5
03-01-07-00	INSTALLATION ASSEM & CO	93.5	1722.7	–	–	–	–	–	–	–	–	–	–	–	97.1	93.5	1819.8
03-02-00-00	THERMAL CONTROL	108.7	2003.7	–	–	4.3	86.1	–	–	1.1	22.7	–	–	–	1032.1	114.1	3144.6
03-03-00-00	AVIONICS	684.7	12617.0	–	–	32.6	658.7	38.2	661.0	78.5	1550.0	53.1	1021.6	–	27861.0	887.1	44369.2
03-03-01-00	DATA MGMT	92.8	1710.6	–	–	6.1	122.5	8.9	153.7	5.8	114.6	6.6	126.1	–	1209.1	120.1	3436.6
03-03-01-01	DATA MGMT SOFTWARE	172.2	3173.4	–	–	–	–	–	–	–	–	–	–	–	3192.6	172.2	6366.0
03-03-01-02	DATA MGMT SET DELTA	17.2	317.3	–	–	–	–	–	–	–	–	–	–	–	319.3	17.2	636.6
03-03-02-01	GUID & NAV	68.2	1257.2	–	–	3.9	79.4	4.3	73.4	19.2	378.6	9.4	179.7	–	5428.8	104.9	7397.3
03-03-02-02	GUID NAV DELTA	54.8	1009.4	–	–	–	–	–	–	16.1	317.4	–	–	–	9748.7	70.8	11075.5
03-03-03-00	COMM	27.5	507.7	–	–	1.5	29.8	5.4	93.6	13.6	268.8	6.9	132.4	–	4669.6	54.9	5702.0
03-03-04-00	INSTR'N	32.0	589.3	–	–	–	–	–	–	–	–	–	–	–	484.0	32.0	1073.3
03-03-05-00	EL. POWER	68.4	1260.3	–	–	8.0	162.2	10.6	182.6	12.4	244.5	12.6	242.8	–	2294.6	112.0	4387.0
03-03-06-00	POWER DISTR & CON	151.5	2791.7	–	–	13.1	264.8	9.1	157.7	11.4	226.1	17.7	340.5	–	514.2	202.9	4295.0
03-03-07-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-04-00-00	PROPULSION	239.0	4403.6	–	–	34.3	691.8	–	–	8.6	169.2	–	–	–	97848.9	281.8	103113.5
03-04-01-00	MAIN ENG SFE (OME)	–	–	–	–	4.1	83.0	–	–	1.0	20.3	–	–	–	34000.0	5.1	34103.3
03-04-01-01	MAIN ENG CLASS I	–	–	–	–	–	–	–	–	–	–	–	–	–	59000.0	–	59000.0

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-04-02-00	MAIN ENG SUP	141.4	2605.2	–	–	13.0	262.9	–	–	3.3	64.3	–	–	–	2632.5	157.6	5564.9
03-04-03-00	ACPS ENG	8.9	163.2	–	–	.7	13.8	–	–	.2	3.4	–	–	–	1557.7	9.7	1738.1
03-04-04-00	ACPS ENG SUP	88.7	1635.2	–	–	16.5	332.1	–	–	4.1	81.2	–	–	–	658.7	109.3	2707.2
03-04-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-00-00	ORBITER INTERFACE EQ	167.1	3079.7	–	–	26.7	539.5	–	–	6.6	129.6	–	–	–	775.0	200.4	4523.8
03-05-01-00	STRUCT CRADLE	84.9	1565.5	–	–	21.8	440.2	–	–	5.4	106.9	–	–	–	676.7	112.2	2789.4
03-05-02-00	INTERFACE PANELS	52.3	964.1	–	–	4.9	99.3	–	–	1.1	22.7	–	–	–	77.9	58.4	1163.9
03-05-03-00	PURGE PROVISION	13.1	241.8	–	–	–	–	–	–	–	–	–	–	–	–	13.1	241.8
03-05-05-00	ORBITER INT ASSEM & C/O	16.7	308.3	–	–	–	–	–	–	–	–	–	–	–	20.4	16.7	328.7
03-06-00-00	DROP TANKS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-01-00	STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-02-00	THERMAL SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-03-00	PROPULSION SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-04-00	INSTALLATIONS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-07-00-00	FINAL ASSEM & C/O	77.2	1422.7	–	–	21.0	423.8	–	–	19.8	392.0	65.4	1257.4	–	–	183.4	3495.9
03-07-01-00	FINAL ASSEMBLY	52.8	973.0	–	–	21.0	423.8	–	–	5.3	103.7	7.2	138.4	–	–	86.2	1639.0
03-07-02-00	CHECKOUT	24.4	447.6	–	–	–	–	–	–	14.6	288.3	58.2	1119.0	–	–	97.2	1857.0

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
04-00-00-00	KICK STAGE	454.4	8374.6	–	–	119.7	2416.3	7.9	136.1	92.8	1831.7	47.9	920.7	–	12399.1	722.7	26078.6
A4-01-00-00	SMALL K/S STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	187.8	166.8	3300.8
A4-01-03-00	B. STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	187.8	166.8	3300.8
A4-02-00-00	SMALL K/S THERMAL	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
A4-02-04-00	THERMAL SYSTEM	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
A4-04-00-00	SMALL K/S PROPULSION	34.4	633.2	–	–	11.5	231.7	–	–	2.9	56.7	–	–	–	3526.5	48.7	4448.1
A4-04-01-00	MAIN ENG	6.2	114.8	–	–	–	–	–	–	–	–	–	–	–	3025.0	6.2	3139.9
A4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4
A4-04-03-00	ACPS ENG	3.3	60.4	–	–	1.1	23.2	–	–	.3	5.7	–	–	–	332.7	4.7	422.0
A4-04-04-00	ACPS ENG SUP	18.8	346.0		–	5.2	104.3	–	–	1.3	25.5	–	–	–	162.0	25.2	637.8
A4-07-00-00	SMALL K/S FACO	–	–	–	–	14.3	288.0	–	–	6.3	123.7	12.1	233.3	–	–	32.7	645.0
A4-07-01-00	FINAL ASSEMBLY	–	–		–	11.8	238.3	–	–	3.5	69.6	2.3	44.1	–	–	17.6	352.1
A4-07-02-00	CHECKOUT	–	–	–	–	2.5	49.7	–	–	2.7	54.1	9.8	189.2	–	–	15.0	292.9
B4-01-00-00	LARGE K/S STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	191.4	166.8	3304.4
B4-01-03-00	B. STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	191.4	166.8	3304.4
B4-02-00-00	LARGE K/S THERMAL	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-02-04-00	THERMAL SYSTEM	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-03-00-00	LARGE K/S AVIONICS	64.9	1196.8	–	–	23.9	483.3	7.9	136.1	63.3	1250.7	23.6	454.1	–	469.7	183.7	3990.7

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
B4-03-01-00	DATA MGMT	33.6	619.6	–	–	9.5	192.0	6.2	107.8	6.6	130.2	14.3	274.3	–	223.9	70.2	1547.7
B4-03-01-01	DATA MGMT SOFTWARE	21.5	395.9	–	–	–	–	–	–	–	–	–	–	–	111.7	21.5	507.6
B4-03-05-00	EL. POWER	2.5	45.3	–	–	–	–	–	–	–	–	–	–	–	60.5	2.5	105.8
B4-03-06-00	POWER DISTR & CON	7.4	136.0	–	–	14.4	291.3	1.6	28.4	56.7	1120.5	9.4	179.7	–	73.7	89.5	1829.6
B4-04-00-00	LARGE K/S PROPULSION	39.4	633.2	–	–	11.5	231.7	–	–	2.9	56.7	–	–	–	7761.5	48.7	8683.1
B4-04-01-00	MAIN ENG	6.2	114.8	–	–	–	–	–	–	–	–	–	–	–	7260.0	6.2	7374.9
B4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4
B4-04-03-00	ACPS ENG	3.3	60.4	–	–	1.1	23.2	–	–	.3	5.7	–	–	–	332.7	4.7	422.0
B4-04-04-00	ACPS ENG SUP	18.8	346.0	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	162.0	25.2	637.8
B4-07-00-00	LARGE K/S FACO	–	–	–	–	14.3	288.0	–	–	6.3	123.7	12.1	233.3	–	–	32.7	645.0
B4-07-01-00	FINAL ASSEMBLY	–	–	–	–	11.8	238.3	–	–	3.5	69.6	2.3	44.1	–	–	17.6	352.1
B4-07-02-00	CHECKOUT	–	–	–	–	2.5	49.7	–	–	2.7	54.1	9.8	189.2	–		15.0	292.9
05-00-00-00	LOGISTICS	151.4	2789.5	–	–	–	–	–	–	–	–	–	–	–	78.6	151.4	2868.2
05-01-00-00	TRANS & HANDLING	2.3	42.3	–	–	–	–	–	–	–	–	–	–	–	36.3	2.3	78.6
05-02-00-00	TRAINING	116.6	2148.8	–	–	–	–	–	–	–	–	–	–	–	42.3	116.6	2191.2
05-02-01-00	SIMULATORS & EQUIP	–	–	–	–	–	–	–	–	–	–	–	–	–	42.3	–	42.3
05-02-02-00	GND CREW	41.3	761.6	–	–	–	–	–	–	–	–	–	–	–	–	41.3	761.6

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 3

CONTRACT NO. APPENDIX A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
05-02-03-00	FLT OPS CREW NASA	55.6	1024.5	-	-	-	-	-	-	-	-	-	-	-	-	55.6	1024.5
05-02-04-00	FLT OPS CREW DOD	19.7	362.7	-	-	-	-	-	-	-	-	-	-	-	-	19.7	362.7
05-03-00-00	INV CONT & WAREHS	32.5	598.4	-	-	-	-	-	-	-	-	-	-	-	-	32.5	598.4
06-00-00-00	FACILITIES	33.0	519.2	-	-	-	-	3.0	51.0	10.3	184.0	79.2	1318.3	-	17509.7	125.4	19577.3
06-02-00-00	TEST	11.3	208.5	-	-	-	-	3.0	51.0	-	-	-	-	-	1139.7	14.3	1399.3
06-02-01-00	DESIGN/ CONSTR'N	8.4	154.1	-	-	-	-	3.0	51.0	-	-	-	-	-	1139.7	11.3	1344.9
06-02-02-00	ACTIVATION MAINT	3.0	54.4	-	-	-	-	-	-	-	-	-	-	-	-	3.0	54.4
06-03-00-00	ETR MAINT & REFURB	7.4	97.6	-	-	-	-	-	-	7.2	138.2	60.5	1037.6	-	8100.0	75.1	9373.4
06-03-01-00	DESIGN/ CONSTR'N	7.4	97.6	-	-	-	-	-	-	-	-	-	-	-	8100.0	7.4	8197.6
06-03-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	6.6	129.5	39.5	759.9	-	-	46.1	889.5
06-03-02-00	ACTIVATION MAINT. ETR	-	-	-	-	-	-	-	-	.7	8.7	21.0	277.7	-	-	21.6	286.3
06-04-00-00	ETR LAUNCH	3.4	45.6	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-01-00	DESIGN/ CONSTR'N	3.4	45.6	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-05-00-00	WTR MAINT & REFURB	7.4	110.8	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	5200.0	29.1	5637.3
06-05-01-00	DESIGN/ CONSTR'N	7.4	110.8	-	-	-	-	-	-	-	-	-	-	-	5200.0	7.4	5310.8
06-05-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	-	21.7	326.5

STUDY TITLE SPACE TUG VOLUME 8.2 APPENDIX A OPTION 3

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
06-06-00-00	WTR LAUNCH	3.4	51.7	–	–	–	–	–	–	–	–	–	–	–	1430.0	3.4	1481.7
06-06-01-00	DESIGN/ CONSTR'N	3.4	51.7	–	–	–	–	–	–	–	–	–	–	–	1430.0	3.4	1481.7
06-06-02-00	ACTIVATION MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-00-00-00	GND SUP EQUIP	677.0	12424.4	51.7	819.5	65.8	1298.6	206.8	3525.6	104.9	2019.3	121.5	2265.5	–	5257.8	1227.6	27610.7
07-01-00-00	MANUFGSE	140.9	2596.1	–	–	60.2	1215.1	184.9	3196.4	83.0	1639.5	61.4	1181.4	–	3633.4	530.4	13461.9
07-01-01-00	HARDWARE	–	–	–	–	51.7	1043.0	184.9	3196.4	67.3	1328.6	32.6	626.5	–	3633.4	336.4	9827.9
07-01-02-00	SITE ACTIVATION	–	–	–	–	8.5	172.1	–	–	15.7	310.9	28.9	555.0	–	–	53.1	1038.0
07-01-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-01-04-00	SOFTWARE	140.9	2596.1	–	–	–	–	–	–	–	–	–	–	–	–	140.9	2596.1
07-02-00-00	ETR GSE	457.9	8438.1	–	–	–	–	–	–	10.9	214.6	43.5	835.6	–	–	512.2	9488.3
07-02-01-00	HARDWARE	417.4	7691.6	–	–	–	–	–	–	–	–	–	–	–	–	417.4	7691.6
07-02-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	10.9	214.6	43.5	835.6	–	–	54.3	1050.2
07-02-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-02-04-00	SOFTWARE	40.5	746.5	–	–	–	–	–	–	–	–	–	–	–	–	40.5	746.5
07-03-00-00	WTR GSE	–	–	–	–	5.6	83.5	21.9	329.2	11.0	165.3	16.5	248.4	–	663.7	55.0	1490.2
07-03-01-00	HARDWARE	–	–	–	–	5.6	83.5	21.9	329.2	7.2	108.7	1.5	21.9	–	663.7	36.2	1207.0
07-03-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	3.8	56.6	15.1	226.5	–	–	18.9	283.2

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
07-03-03-00	MAINT	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
07-03-04-00	SOFTWARE	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
07-04-00-00	FLT OPS CONT NASA	62.8	1088.8	42.8	679.0	—	—	—	—	—	—	—	—	—	485.8	103.6	2253.6
07-04-01-00	HARDWARE	—	—	—	—	—	—	—	—	—	—	—	—	—	353.2	—	353.2
07-04-02-00	SITE ACTIVATION	3.3	43.4	—	—	—	—	—	—	—	—	—	—	—	—	3.3	43.4
07-04-03-00	MAINT	3.0	39.0	—	—	—	—	—	—	—	—	—	—	—	—	3.0	39.0
07-04-04-00	SOFTWARE	54.6	1006.4	42.8	679.0	—	—	—	—	—	—	—	—	—	132.6	97.4	1818.0
07-05-00-00	FLT OPS CONT DOD	17.4	301.3	8.9	140.5	—	—	—	—	—	—	—	—	—	474.8	26.2	916.6
07-05-01-00	HARDWARE	—	—	—	—	—	—	—	—	—	—	—	—	—	393.9	—	393.9
07-05-02-00	SITE ACTIVATION	2.8	41.9	—	—	—	—	—	—	—	—	—	—	—	—	2.8	41.9
07-05-03-00	MAINT	2.8	41.9	—	—	—	—	—	—	—	—	—	—	—	—	2.8	41.9
07-05-04-00	SOFTWARE	14.8	217.6	8.9	140.5	—	—	—	—	—	—	—	—	—	81.0	20.7	439.0
08-00-00-00	VEH TEST	508.6	9372.0	—	—	183.1	3695.6	710.1	12278.9	188.9	3730.0	378.8	7282.8	—	10951.2	1969.5	47310.4
08-01-00-00	GND TEST HARDWARE	131.5	2423.8	—	—	91.2	1840.3	438.5	7582.7	10.2	200.6	13.4	258.6	—	2783.7	684.9	15089.7
08-01-01-00	HDWRE, PTV TEST/BATTLE	28.2	519.8	—	—	19.0	384.0	33.5	578.5	3.0	58.3	7.5	145.1	—	104.4	91.2	1790.0
08-01-02-00	MAT TEST ARTICLES	96.3	1774.1	—	—	72.2	1456.4	405.1	7004.2	7.2	142.3	5.9	113.5	—	2679.3	586.6	13169.7
08-01-03-00	MOCK UPS	7.1	130.0	—	—	—	—	—	—	—	—	—	—	—	—	7.1	130.0

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
08-02-00-00	GND TEST OPS	325.2	5993.1	–	–	86.9	1754.3	–	–	76.9	1518.9	241.4	4641.5	–	3425.0	730.5	17232.7
08-03-00-00	FLT TEST HARDWARE	–	–	–	–	5.0	100.9	271.6	4696.2	86.4	1706.2	55.7	1070.9	–	4727.1	418.7	12301.3
08-04-00-00	FLT TEST OPS	51.8	955.0	–	–	–	–	–	–	15.4	304.4	68.2	1311.7	–	15.5	135.5	2586.6
11-00-00-00	FLT OPS DOD	53.1	979.2	–	–	–	–	–	–	–	–	–	–	–	–	53.1	979.2
11-01-00-00	FLT MISSION PLANNING	44.3	816.0	–	–	–	–	–	–	–	–	–	–	–	–	44.3	816.0
11-04-00-00	FLT SUP SOFTWARE	8.9	163.2	–	–	–	–	–	–	–	–	–	–	–	–	8.9	163.2
12-00-00-00	FLT OPS FOR NASA	92.5	1704.5	–	–	–	–	–	–	–	–	–	–	–	–	92.5	1704.5
12-01-00-00	MISSION PLANNING	72.8	1341.9	–	–	–	–	–	–	–	–	–	–	–	–	72.8	1341.9
12-04-00-00	FLT SUP SOFTWARE	19.7	362.7	–	–	–	–	–	–	–	–	–	–	–	–	19.7	362.7
TOTAL DDT&E		4912.2	90379.0	1077.0	17084.4	633.2	12751.4	989.9	17066.6	618.4	12140.1	780.1	14917.7	–	189362.9	9020.8	353702.1

DDT&E

OPTION 3A

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32A	DDT&E	5441.1	100125.5	1126.9	17876.2	745.0	15005.5	1113.7	19203.3	667.9	13116.6	820.2	15496.0	–	199252.2	9914.9	380575.3
01-00-00-00	PROJ MGM'T	194.5	3584.4	825.6	13096.2	–	–	23.9	414.0	18.7	369.2	24.6	473.0	–	1613.0	1087.3	19549.7
01-01-00-00	COST PERF MGM'T	194.5	3584.4	557.9	8850.5	–	–	23.9	414.0	18.7	369.2	24.6	473.0	–	1613.0	819.7	15304.0
01-02-00-00	PROJ DIR	–	–	66.9	1061.4	–	–	–	–	–	–	–	–	–	–	66.9	1061.4
01-03-00-00	INFO MGM'T	–	–	200.7	3184.3	–	–	–	–	–	–	–	–	–	–	200.7	3184.3
02-00-00-00	SYSTEMS ENG & INTEG	1181.5	21772.2	244.0	3871.1	–	–	–	–	51.5	1016.9	22.6	435.1	–	4034.0	1499.6	31129.4
02-01-00-00	TUG SYS ENG	972.7	17924.9	165.3	2622.4	–	–	–	–	51.5	1016.9	22.6	435.1	–	3807.6	1212.1	25807.0
02-02-00-00	SHUTTLE INTERFACE	82.7	1523.2	23.6	374.6	–	–	–	–	–	–	–	–	–	47.0	106.3	1944.8
02-03-00-00	PAYLOAD INTERFACE	126.1	2324.1	55.1	874.1	–	–	–	–	–	–	–	–	–	179.3	181.2	3377.6
03-00-00-00	SPACE TUG VEH M.S	1981.2	36510.2	–	–	364.3	7352.7	38.2	661.0	175.4	3463.6	118.5	2279.1	–	14178.5.5	2677.7	192052.0
03-01-00-00	STRUCT	553.2	10194.0	–	–	149.6	3019.8	–	–	36.8	727.4	–	–	–	10411.9	739.6	24353.0
03-01-01-00	FUEL TANK	72.5	1335.8	–	–	29.9	602.4	–	–	6.4	126.0	–	–	–	348.4	108.7	2412.7
03-01-02-00	OX TANK	72.5	1335.8	–	–	91.0	1837.0	–	–	22.8	450.2	–	–	–	517.8	186.3	4140.9
03-01-03-00	R. STRUCT	187.0	3445.4	–	–	18.5	374.0	–	–	4.7	93.1	–	–	–	558.6	210.2	4471.1
03-01-04-00	THRUST STRUCT	14.9	275.0	–	–	5.1	102.9	–	–	1.3	25.7	–	–	–	15.5	21.3	419.1

STUDY TITLE SPACE TUG VOLUME 8.0 APPE... OPTION 3A

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
03-01-05-00	METEOROID SHIELD	41.7	767.7	–	–	.2	4.0	–	–	–	–	–	–	–	25.4	41.9	797.0
03-01-06-00	PAYLOAD INTERFACE	26.9	495.6	–	–	4.9	99.3	–	–	1.6	32.4	–	–	–	8828.2	33.5	9455.5
03-01-07-00	INSTALLATION ASSEM & CO	137.8	2538.7	–	–	–	–	–	–	–	–	–	–	–	118.1	137.8	2656.8
03-02-00-00	THERMAL CONTROL	113.8	2097.4	–	–	4.3	86.1	–	–	1.1	22.7	–	–	–	1032.1	119.2	3238.3
03-03-00-00	AVIONICS	684.7	12617.0	–	–	32.6	658.7	38.2	661.0	78.5	1550.0	53.1	1021.6	–	27861.0	887.1	44369.2
03-03-01-00	DATA MGMT	92.8	1710.6	–	–	6.1	122.5	8.9	153.7	5.8	114.6	6.6	126.1	–	1209.1	120.1	3436.6
03-03-01-01	DATA MGMT SOFTWARE	172.2	3173.4	–	–	–	–	–	–	–	–	–	–	–	3192.6	172.2	6366.0
03-03-01-02	DATA MGMT SET DELTA	17.2	317.3	–	–	–	–	–	–	–	–	–	–	–	319.3	17.2	636.6
03-03-02-01	GUID & NAV	68.2	1257.2	–	–	3.9	79.4	4.3	73.4	19.2	378.6	9.4	179.7	–	5428.8	104.9	7397.3
03-03-02-02	GUID NAV DELTA	54.8	1009.4	–	–	–	–	–	–	16.1	317.4	–	–	–	9748.7	70.8	11075.5
03-03-03-00	COMM	27.5	507.7	–	–	1.5	29.8	5.4	93.6	13.6	268.8	6.9	132.4	–	4669.6	54.9	5702.0
03-03-04-00	INSTR'N	32.0	589.3	–	–	–	–	–	–	–	–	–	–	–	484.0	32.0	1073.3
03-03-05-00	EL. POWER	68.4	1260.3	–	–	8.0	162.2	10.6	182.6	12.4	244.5	12.6	242.8	–	2294.6	112.0	4387.0
03-03-06-00	POWER DISTR & CON	151.5	2791.7	–	–	13.1	264.8	9.1	157.7	11.4	226.1	17.7	340.5	–	514.2	202.9	4295.0
03-03-07-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-04-00-00	PROPULSION	254.2	4684.7	–	–	34.3	691.8	–	–	8.6	169.2	–	–	–	99018.3	297.1	104564.0
03-04-01-00	MAIN ENG SET (CLASS II)	–	–	–	–	4.1	83.0	–	–	1.0	20.3	–	–	–	34000.0	5.1	34103.3
03-04-01-01	MAIN ENG CLASS I	–	–	–	–	–	–	–	–	–	–	–	–	–	59000.0	–	59000.0

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8 O
APPENDIX A

OPTION 3A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
03-04-02-00	MAIN ENG SUP	156.6	2886.2	–	–	13.0	262.9	–	–	3.3	64.3	–	–	–	3777.7	172.9	6991.1
03-04-03-00	ACPS ENG	8.9	163.2	–	–	.7	13.8	–	–	.2	3.4	–	–	–	1557.7	9.7	1738.1
03-04-04-00	ACPS ENG SUP	88.7	1635.2	–	–	16.5	332.1	–	–	4.1	81.2	–	–	–	682.9	109.3	2731.4
03-04-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-00-00	ORBITER INTERF EQ	167.1	3079.7	–	–	26.7	539.5	–	–	6.6	129.6	–	–	–	775.0	200.4	4523.8
03-05-01-00	STRUCT CRADLE	84.9	1565.5	–	–	21.8	440.2	–	–	5.4	106.9	–	–	–	676.7	112.2	2789.4
03-05-02-00	INTERFACE PANELS	52.3	964.1	–	–	4.9	99.3	–	–	1.1	22.7	–	–	–	77.9	58.4	1163.9
03-05-03-00	PURGE PROVISION	13.1	241.8	–	–	–	–	–	–	–	–	–	–	–	–	13.1	241.8
03-05-05-00	ORBITER INT ASSEM & C/O	16.7	308.3	–	–	–	–	–	–	–	–	–	–	–	20.4	–	328.7
03-06-00-00	DROP TANKS	131.0	2414.8	–	–	95.8	1933.0	–	–	23.9	472.8	–	–	–	2687.2	250.8	7507.8
03-06-01-00	STRUCT	96.1	1771.0	–	–	77.2	1559.0	–	–	19.3	381.3	–	–	–	245.2	192.7	3956.6
03-06-02-00	THERMAL SYSTEM	11.8	217.6	–	–	–	–	–	–	–	–	–	–	–	339.5	11.8	557.1
03-06-03-00	PROPULSION SYSTEM	11.3	208.5	–	–	11.8	238.3	–	–	3.0	58.3	–	–	–	2102.4	26.1	2607.6
03-06-04-00	INSTALLATIONS	11.8	217.6	–	–	6.7	135.7	–	–	1.7	33.2	–	–	–	–	20.2	386.5
03-07-00-00	FINAL ASSEM & C/O	77.2	1422.7	–	–	21.0	423.8	–	–	19.8	392.0	65.4	1257.4	–	–	183.4	3495.9
03-07-01-00	FINAL ASSEMBLY	52.8	973.0	–	–	21.0	423.8	–	–	5.3	103.7	7.2	138.4	–	–	86.2	1639.0
03-07-02-00	CHECKOUT	24.4	449.6	–	–	–	–	–	–	14.6	288.3	58.2	1119.0	–	–	97.2	1857.0

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3A

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
04-00-00-00	KICK STAGES	454.4	8374.6	–	–	119.7	2416.3	7.9	136.1	92.8	1831.7	47.9	920.7	–	12399.1	722.7	26078.6
A4-01-00-00	SMALL K/S STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	187.8	166.8	3300.8
A4-01-03-00	B. STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	187.8	166.8	3300.8
A4-02-00-00	SMALL K/S THERMAL	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
A4-02-04-00	THERMAL SYSTEM	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
A4-04-00-00	SMALL K/S PROPULSION	34.4	633.2	–	–	11.5	231.7	–	–	2.9	56.7	–	–	–	3526.5	48.7	4448.1
A4-04-01-00	MAIN ENG	6.2	114.8	–	–	–	–	–	–	–	–	–	–	–	3025.0	6.2	3139.9
A4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4
A4-04-03-00	ACPS ENG	3.3	60.4	–	–	1.1	23.2	–	–	.3	5.7	–	–	–	332.7	4.7	422.0
A4-04-04-00	ACPS ENG SUP	18.8	346.0	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	162.0	25.2	637.8
A4-07-00-00	SMALL K/S FACO	–	–	–	–	14.3	288.0	–	–	6.3	123.7	12.1	233.3	–	–	32.7	645.0
A4-07-01-00	FINAL ASSEMBLY	–	–	–	–	11.8	238.3	–	–	3.5	69.0	2.3	44.1	–	–	17.6	352.1
A4-07-02-00	CHECK OUT	–	–	–	–	2.5	49.7	–	–	2.7	54.1	9.8	189.2	–	–	15.0	292.9
B4-01-00-00	LARGE K/S STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	191.4	166.8	3304.4
B4-01-03-00	B. STRUCT	143.2	2638.4	–	–	18.9	380.6	–	–	4.8	93.9	–	–	–	191.4	166.8	3304.4
B4-02-00-00	LARGE K/S THERMAL	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-02-04-00	THERMAL SYSTEM	17.2	317.3	–	–	3.3	66.2	–	–	.8	16.2	–	–	–	131.1	21.3	530.8
B4-03-00-00	LARGE K/S AVIONICS	64.9	1196.8	–	–	23.9	483.3	7.9	136.1	63.3	1250.7	23.6	454.1	–	469.7	183.7	3990.7

STUDY TITLE SPACE TUG VOLUME 3.0 APPENDIX A OPTION 3A

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
B4-03-01-00	DATA MGMT	33.6	619.6	–	–	9.5	192.0	6.2	102.8	6.6	130.2	14.3	274.3	–	223.9	70.2	1547.7
B4-03-01-01	DATA MGMT SOFTWARE	21.5	395.9	–	–	–	–	–	–	–	–	–	–	–	111.7	21.5	507.6
B4-03-05-00	EL. POWER	2.5	45.3	–	–	–	–	–	–	–	–	–	–	–	60.5	2.5	105.8
B4-03-06-00	POWER DISTR & CON	7.4	136.0	–	–	14.4	291.3	1.6	28.4	56.7	1120.5	9.4	179.7	–	73.7	89.5	1829.6
B4-04-00-00	LARGE K/S PROPULSION	34.4	633.2	–	–	11.5	231.7	–	–	2.9	56.7	–	–	–	7761.5	48.7	8683.1
B4-04-01-00	MAIN ENG	6.2	114.8	–	–	–	–	–	–	–	–	–	–	–	7260.0	6.2	7374.9
B4-04-02-00	MAIN ENG SUP	6.1	111.8	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	6.8	12.5	248.4
B4-04-03-00	ACPS ENG	3.3	60.4	–	–	1.1	23.2	–	–	.3	5.7	–	–	–	332.7	4.7	422.0
B4-04-04-00	ACPS ENG SUP	18.8	346.0	–	–	5.2	104.3	–	–	1.3	25.5	–	–	–	162.0	25.2	637.8
B4-07-00-00	LARGE K/S FACO	–	–	–	–	14.3	288.0	–	–	6.3	123.7	12.1	233.3	–	–	32.7	645.0
B4-07-01-00	FINAL ASSEMBLY	–	–	–	–	11.8	238.3	–	–	3.5	69.6	2.3	44.1	–	–	17.6	352.1
B4-07-02-00	CHECKOUT	–	–	–	–	2.5	49.7	–	–	2.7	54.1	9.8	189.2	–	–	15.0	292.9
05-00-00-00	LOGISTICS	165.6	3052.5	–	–	–	–	–	–	–	–	–	–	–	78.6	165.6	3131.1
05-01-00-00	TRANS & HANDLING	2.3	42.3	–	–	–	–	–	–	–	–	–	–	–	36.3	2.3	78.6
05-02-00-00	TRAINING	130.9	2411.7	–	–	–	–	–	–	–	–	–	–	–	42.3	130.9	2454.1
05-02-01-00	SIMULATORS & EQUIP	–	–	–	–	–	–	–	–	–	–	–	–	–	42.3	–	42.3
05-02-02-00	GND CREW	41.3	761.6	–	–	–	–	–	–	–	–	–	–	–	–	41.3	761.6

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8
APPENDIX A

OPTION 3A

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
05-02-03-00	FLT OPS CREW NASA	69.9	1287.5	-	-	-	-	-	-	-	-	-	-	-	-	69.9	1287.5
05-02-04-00	FLT OPS CREW DOD	19.7	362.7	-	-	-	-	-	-	-	-	-		-	-	19.7	362.7
05-03-00-00	INV CONT & WAREHS	32.5	598.4	-	-	-	-	-	-	-	-	-	-	-	-	32.5	598.4
06-00-00-00	FACILITIES	33.0	514.2	-	-	-	-	3.0	51.0	10.3	184.0	79.2	1318.3	-	17509.7	125.4	19573
06-02-00-00	TEST	11.3	208.5	-	-	-	-	3.0	51.0	-	-	-	-	-	1139.7	14.3	1399.3
06-02-01-00	DESIGN/ CONSTR'N	8.4	154.1	-	-	-	-	3.0	51.0	-	-	-	-	-	1139.7	11.3	1344.9
06-02-02-00	ACTIVATION MAINT	3.0	54.4	-	-	-	-	-	-	-	-	-	-	-	-	3.0	54.4
06-03-00-00	ETR MAINT & REFURB	7.4	97.6	-	-	-	-	-	-	7.2	138.2	60.5	1037.6	-	8100.0	75.1	9373.4
06-03-01-00	DESIGN/ CONSTR'N	7.4	97.6	-	-	-	-	-	-	-	-	-	-	-	8100.0	7.4	8197.6
06-03-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	6.6	129.5	39.5	759.9	-	-	46.1	889.5
06-03-02-00	ACTIVATION MAINT. ETR	-	-	-	-	-	-	-	-	.7	8.7	21.0	277.7	-	-	21.6	286.3
06-04-00-00	ETR LAUNCH	3.4	45.6	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-01-00	DESIGN/ CONSTR'N	3.4	45.5	-	-	-	-	-	-	-	-	-	-	-	1640.0	3.4	1685.6
06-04-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-05-00-00	WTR MAINT & REFURB	7.4	110.8	-	-	-	-	-	-	3.0	45.8	18.7	280.7	-	5200.0	29.1	5637.3
06-05-01-00	DESIGN/ CONSTR'N	7.4	110.8	-	-	-	-	-	-	-	-	-	-	-	5200.0	7.4	5310.8
06-05-02-00	ACTIVATION MAINT	-	-	-	-	-	-	-	-	3.0	45.8	18.7	280.7		-	21.7	326.5

STUDY TITLE SPACE TUG VOLUME 80 APPENDIX A OPTION 3A

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
06-06-00-00	WTR LAUNCH	3.4	51.7	–	–	–	–	–	–	–	–	–	–	–	1430.0	3.4	1481.7
06-06-01-00	DESIGN/ CONSTR'N	3.4	51.7	–	–	–	–	–	–	–	–	–	–	–	1430.0	3.4	1481.7
06-06-02-00	ACTIVATION MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-00-00-00	GND SUP EQUIP	727.8	13361.0	57.3	908.9	68.0	1341.7	215.6	3674.1	102.8	2073.9	122.0	2276.1	–	5327.1	1298.5	28962.8
07-01-00-00	MANUEGSE	142.0	2617.3	–	–	62.1	1252.6	192.2	3322.8	85.4	1687.0	61.9	1180.7	–	3692.1	543.6	13762.5
07-01-01-00	HARDWARE	–	–	–	–	53.5	1080.4	192.2	3322.8	69.7	1376.1	33.1	635.7	–	3692.1	348.2	10107.2
07-01-02-00	SITE ACTIVATION	–	–	–	–	8.5	172.1	–	–	15.7	310.9	28.9	555.0	–	–	53.1	1038.0
07-01-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-01-04-00	SOFTWARE	142.0	2617.3	–	–	–	–	–	–	–	–	–	–	–	–	142.0	2617.3
07-02-00-00	ETR GSE	497.7	9172.2	–	–	–	–	–	–	10.9	214.6	43.5	835.6	–	–	552.0	10222.4
07-02-01-00	HARDWARE	457.2	8425.7	–	–	–	–	–	–	–	–	–	–	–	–	457.2	8425.7
07-02-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	10.9	214.6	43.5	835.6	–	–	54.3	1050.2
07-02-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-02-04-00	SOFTWARE	40.5	746.5	–	–	–	–	–	–	–	–	–	–	–	–	40.5	746.5
07-03-00-00	WTR GSE	–	–	–	–	5.9	89.1	23.4	351.2	11.5	172.4	16.6	249.8	–	674.4	57.5	1537.1
07-03-01-00	HARDWARE	–	–	–	–	5.9	89.1	23.4	351.2	7.7	115.8	1.5	23.3	–	674.4	38.6	1253.9
07-03-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	3.8	56.6	15.1	226.5	–	–	18.9	283.2

STUDY TITLE SPACE TUG VOLUME 3 O APPENDIX A OPTION 3A

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07-03-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-03-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-04-00-00	FLT OPS CONT NASA	68.7	1233.9	46.5	737.2	–	–	–	–	–	–	–	–	–	485.8	115.2	2456.8
07-04-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	353.2	–	353.2
07-04-02-00	SITE ACTIVATION	3.3	43.4	–	–	–	–	–	–	–	–	–	–	–	–	3.3	43.4
07-04-03-00	MAINT	3.0	39.0	–	–	–	–	–	–	–	–	–	–	–	–	3.0	39.0
07-04-04-00	SOFTWARE	62.5	1151.5	46.5	737.2	–	–	–	–	–	–	–	–	–	132.6	108.9	2021.2
07-05-00-00	FLT OPS CONT DOD	19.4	337.6	10.8	171.7	–	–	–	–	–	–	–	–	–	474.8	30.2	984.1
07-05-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	393.9	–	393.9
07-05-02-00	SITE ACTIVATION	2.8	41.9	–	–	–	–	–	–	–	–	–	–	–	–	2.8	41.9
07-05-03-00	MAINT	2.8	41.9	–	–	–	–	–	–	–	–	–	–	–	–	2.8	41.9
07-05-04-00	SOFTWARE	13.8	253.9	10.8	171.7	–	–	–	–	–	–	–	–	–	81.0	24.6	506.5
08-00-00-00	VEH TEST	557.4	10272.6	–	–	1930	3894.6	825.1	14267.1	211.5	4177.3	4053	7793.6	–	17005.2	2192.4	57410.6
08-01-00-00	GND TEST HARDWARE	163.0	3004.1	–	–	93.6	1890.0	495.0	8558.2	11.2	220.2	13.4	258.6	–	2866.5	776.2	16797.5
08-01-01-00	HDWRE, PTV TEST/BATTLE	37.9	698.1	–	–	19.0	384.0	71.8	1242.0	3.0	58.3	7.5	145.1	–	105.7	139.2	2633.1
08-01-02-00	MAT TEST ARTICLES	115.0	2118.6	–	–	74.6	1506.0	423.1	7316.1	8.2	161.9	5.9	113.5	–	2760.8	626.8	13977.0
08-01-03-00	MOCK UPS	10.2	187.4	–	–	–	–	–	–	–	–	–	–	–	–	10.2	187.4

STUDY TITLE SPACE TUG VOLUME 3 APPENDIX A OPTION 3A

CONTRACT NO.

✓ DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
08-02-00-00	GND TEST OPS	335.1	6174.4	–	–	93.5	1886.7	–	–	83.1	1641.9	246.8	4745.6	–	8842.1	758.5	23290.7
08-03-00-00	FLT TEST HARDWARE	–	–	–	–	5.9	118.2	330.2	5708.9	101.2	1997.8	55.7	1070.9	–	5281.2	492.9	14177.0
08-04-00-00	FLT TEST OPS	59.4	1094.1	–	–	–	–	–	–	16.1	317.4	89.4	1718.5	–	15.5	164.8	3145.4
11-00-00-00	FLT OPS DOD	53.1	979.2	–	–	–	–	–	–	–	–	–	–	–	–	53.1	979.2
11-01-00-00	FLT MISSION PLANNING	44.3	816.0	–	–	–	–	–	–	–	–	–	–	–	–	44.3	816.0
11-04-00-00	FLT SUP SOFTWARE	8.9	163.2	–	–	–	–	–	–	–	–	–	–	–	–	8.9	163.2
12-00-00-00	FLT OPS FOR NASA	92.5	1704.5	–	–	–	–	–	–	–	–	–	–	–	–	92.5	1704.5
12-01-00-00	MISSION PLANNING	72.8	1341.9	–	–	–	–	–	–	–	–	–	–	–	–	72.8	1341.9
12-04-00-00	FLT SUP SOFTWARE	19.7	362.7	–	–	–	–	–	–	–	–	–	–	–	–	19.7	362.7
TOTAL DDT&E		5441.1	100125.5	1126.9	17876.2	745.0	15005.5	1113.7	19203.3	667.9	13116.6	820.2	15496.0	–	199752.2	9914.9	380525.3

1.2 Production - Data Form T is presented for Options 1, 2, 3 and 3A on the following pages for Production.

PRODUCTION

OPTION 1

STUDY TITLE SPACE TUG OPTION 1

CONTRACT NO.

DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32 B	PRODUCTION	562.8	10372.3	339.6	5387.0	269.9	5446.6	2737.2	47329.2	935.6	18475.5	555.5	10680.7	-	68378.0	5400.6	166069.4
01-00-00-00	PROJ MGMT	39.4	725.3	251.0	3982.2	-	-	29.5	510.4	29.5	582.9	39.4	756.8	-	1266.3	388.8	7824.0
01-01-00-00	COST PERF MGMT	39.4	725.3	167.4	2655.4	-	-	29.5	510.4	29.5	582.9	39.4	756.8	-	1266.3	305.1	6497.2
01-02-00-00	PROJ DIR	-	-	11.8	187.3	-	-	-	-	-	-	-	-	-	-	11.8	187.3
01-03-00-00	INFO MGMT	-	-	71.8	1139.5	-	-	-	-	-	-	-	-	-	-	71.8	1139.5
02-00-00-00	SYSTEMS ENG & INTEG	433.0	7978.7	88.6	1404.8	-	-	-	-	32.0	631.5	5.9	113.5	-	3536.0	559.4	13664.6
03-00-00-00	SPACE TUG VEH M.S.	-	-	-	-	53.6	1082.3	1981.2	34257.6	603.8	11924.3	369.3	7100.6	-	45256.4	3008.0	99621.1
03-01-00-00	STRUCTURES	-	-	-	-	25.2	508.9	1255.5	21709.3	313.9	6198.3	-	-	-	4150.8	1594.6	32567.2
03-01-01-00	FUEL TANK	-	-	-	-	6.2	125.8	340.3	5884.5	85.1	1680.1	-	-	-	507.6	431.6	8197.4
03-01-02-00	OX. TANK	-	-	-	-	9.5	192.0	521.5	9016.9	130.4	2574.5	-	-	-	845.9	661.4	12629.3
03-01-03-00	B. STRUCT.	-	-	-	-	3.0	59.6	137.2	2371.5	34.3	677.1	-	-	-	784.5	174.4	3892.8
03-01-04-00	T. STRUCT	-	-	-	-	.3	6.6	20.5	355.1	5.1	101.4	-	-	-	48.9	26.0	507.0
03-01-05-00	METEOROID SHIELD	-	-	-	-	.2	3.3	1.5	25.4	.4	7.2	-	-	-	25.5	2.0	61.5
03-01-06-00	PAYLOAD INTERFACE	-	-	-	-	6.0	121.6	234.6	4055.9	58.6	1158.0	-	-	-	1943.3	299.2	7278.8
03-01-07-00	INSTALLATION ASSEM & CO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-02-00-00	THERMAL CONTROL	-	-	-	-	.7	13.3	75.8	1310.3	18.9	374.1	-	-	-	1091.5	95.4	2789.2
03-03-00-00	AVIONICS	-	-	-	-	15.9	321.8	249.1	4308.0	119.0	2349.8	169.5	3258.5	-	22831.1	553.6	33069.2
03-03-01-00	DATA MGMT	-	-	-	-	2.9	58.3	88.2	1525.1	35.6	703.8	41.9	804.8	-	2043.8	168.6	5135.8
03-03-02-00	GUID & NAV	-	-	-	-	2.4	48.5	42.0	725.9	18.5	365.9	50.5	971.3	-	7659.8	113.4	9771.5
03-03-03-00	COMM	-	-	-	-	8.3	167.6	53.6	927.6	27.4	541.5	21.6	416.3	-	11487.8	111.0	13540.8
03-03-04-00	INSTR'N	-	-	-	-	-	-	-	-	-	-	-	-	-	265.1	-	265.1
03-03-05-00	E. POWER	-	-	-	-	-	-	-	-	-	-	-	-	-	434.3	-	434.3
03-03-06-00	POWER DISTR & CON	-	-	-	-	2.3	47.4	65.3	1129.3	37.4	738.7	55.5	1066.1	-	940.2	160.5	3921.7
03-03-07-00	INSTR ASSEM & C/O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-04-00-00	PROPULSION	-	-	-	-	4.4	89.4	192.4	3326.6	48.7	961.4	-	-	-	16642.4	245.5	21019.9
03-04-01-00	MAIN ENG GFE	-	-	-	-	.5	10.7	23.1	399.2	5.8	115.4	-	-	-	8289.5	29.5	8814.9
03-04-02-00	MAIN ENG SUP	-	-	-	-	1.7	33.9	73.1	1264.1	18.5	365.3	-	-	-	3751.6	93.3	5414.9
03-04-03-00	ACPS ENG	-	-	-	-	.1	1.8	3.8	66.6	1.0	19.3	-	-	-	3340.4	4.9	3478.0
03-04-04-00	ACPS ENG SUP	-	-	-	-	2.1	43.0	92.3	1596.7	23.4	461.5	-	-	-	1211.1	117.8	3312.1
03-04-05-00	INSTALLATION ASSEM & C/O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-05-00-00	ORBITER INTERF EQ	-	-	-	-	2.8	56.2	84.5	1461.2	25.2	496.7	14.6	280.5	-	540.6	127.0	2835.1
03-05-01-00	STRUCTURES	-	-	-	-	1.5	29.8	59.4	1026.3	15.1	298.0	-	-	-	411.9	75.9	1766.0
03-05-02-00	INTERFACE PANELS	-	-	-	-	1.3	26.4	25.1	434.9	10.1	198.7	14.6	280.5	-	128.7	51.1	1069.2

STUDY TITLE SPACE TUG VOLUME 3.0 APPENDIX A OPTION 1

CONTRACT NO.

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-05-03-00	PURGE PROVISION	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-05-04-00	ABORT PROVISION	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-05-05-00	INSTALLATION ASSEM & C/O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03-07-00-00	FINAL ASSEM & C/O	-	-	-	-	4.6	92.7	123.9	2142.2	78.2	1543.9	185.2	3561.6	-	-	391.9	7340.5
03-07-01-00	FINAL ASSEM	-	-	-	-	4.6	92.7	123.9	2142.2	44.5	878.9	52.9	1017.6	-	-	225.9	4131.4
03-07-02-00	CHECKOUT	-	-	-	-	-	-	-	-	33.7	665.1	132.3	2544.0	-	-	166.0	3209.1
S3-00-00-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	3481.4	-	3481.4
S3-S1-00-00	SPARES STRUCTURE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3-S2-00-00	THERMAL CONTROL	-	-	-	-	-	-	-	-	-	-	-	-	-	36.3	-	36.3
S3-S3-00-00	AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	2326.6	-	2326.6
S3-S4-00-00	PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	1118.6	-	1118.6
S3-S5-00-00	SPARES ORB INTERF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04-00-00-00	KICK STAGES	-	-	-	-	116.3	2346.5	334.8	5789.4	120.3	2374.7	57.1	1097.3	-	7526.0	628.4	19134.0
A4-01-00-00	SMALL K/S STRUCTURE	-	-	-	-	17.1	344.2	24.1	416.2	8.5	167.1	-	-	-	56.3	49.6	983.9
A4-01-03-00	B. STRUCT	-	-	-	-	17.1	344.2	24.1	416.2	8.5	167.1	-	-	-	56.3	49.6	983.9
A4-02-00-00	SMALL K/S THERMAL	-	-	-	-	3.9	79.4	12.0	208.1	3.6	70.7	-	-	-	8.0	19.5	366.3

STUDY TITLE SPACE TUG VOLUME 3.0 APPENDIX A OPTION 1

CONTRACT NO.

DDT&E ✓ PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
A4-02-04-00	THERMAL CONTROL	-	-	-	-	3.9	79.4	12.0	208.1	3.6	70.7	-	-	-	8.1	19.5	366.2
A4-04-00-00	SMALL K/S PROPULSION	-	-	-	-	3.8	75.9	49.6	858.5	13.4	263.7	-	-	-	3202.6	66.8	4400.7
A4-04-01-00	MAIN ENG	-	-	-	-	-	-	-	-	-	-	-	-	-	965.5	-	965.5
A4-04-02-00	MAIN ENG SUP	-	-	-	-	1.7	34.2	22.3	386.3	6.0	118.7	-	-	-	-	30.0	539.2
A4-04-03-00	ACPS ENG	-	-	-	-	.4	7.6	5.0	85.8	1.3	26.4	-	-	-	1791.0	6.7	1910.8
A4-04-04-00	ACPS ENG SUP	-	-	-	-	1.7	34.2	22.3	386.3	6.0	118.7	-	-	-	446.1	30.0	985.3
A4-07-00-00	SMALL K/S FACO	-	-	-	-	27.6	556.1	45.9	793.4	17.5	345.4	8.3	159.1	-	-	99.2	1854.0
A4-07-01-00	FINAL ASSEM	-	-	-	-	27.5	556.1	45.9	793.4	16.4	323.1	3.8	72.3	-	-	93.6	1744.9
A4-07-02-00	CHECK OUT	-	-	-	-	-	-	-	-	1.1	22.3	4.5	86.8	-	-	5.6	109.1
B4-01-00-00	LARGE K/S STRUCTURE	-	-	-	-	14.9	301.2	24.2	418.0	8.2	162.4	-	-	-	70.9	47.3	952.6
B4-01-03-00	B. STRUCT.	-	-	-	-	14.9	301.2	24.2	418.0	8.2	162.4	-	-	-	70.9	47.3	952.6
B4-02-00-00	LARGE K/S THERMAL	-	-	-	-	3.4	69.5	10.7	185.8	3.2	63.1	-	-	-	7.1	17.4	325.5
B4-02-04-00	THERMAL SYSTEM	-	-	-	-	3.4	69.5	10.7	185.8	3.2	63.1	-	-	-	7.1	17.4	325.5
B4-03-00-00	LARGE K/S AVIONICS	-	-	-	-	18.1	365.8	81.6	1411.5	38.1	752.0	41.4	796.2	-	650.2	179.3	3975.7
B4-03-01-00	DATA MGMT	-	-	-	-	6.4	129.8	55.2	954.7	22.4	442.5	21.4	412.3	-	535.6	105.5	2474.9
B4-03-01-01	DATA MGMT DEBA	-	-	-	-	1.0	19.6	4.0	69.7	2.4	47.0	3.9	74.7	-	35.2	11.3	246.1
B4-03-05-00	E. POWER	-	-	-	-	-	-	-	-	-	-	-	-	-	61.3	-	61.3
B4-03-06-00	POWER DISTR'N & CON	-	-	-	-	10.7	216.4	14.5	250.3	11.1	220.2	16.1	309.2	-	16.2	52.4	1012.3

STUDY TITLE SPACE TUG VOLUME 3.0 APPENDIX A OPTION 1

CONTRACT NO.

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
B4-03-06-01	POWER DIST & CONT DELTA	-	-	-	-	-	-	7.9	136.9	2.1	42.2	-	-	-	2.0	10.1	181.0
B4-04-00-00	LARGE K/S PROPULSION	-	-	-	-	3.4	67.8	44.3	766.4	11.9	235.4	-	-	-	3530.9	59.6	4600.4
B4-04-01-00	MAIN ENG	-	-	-	-	-	-	-	-	-	-	-	-	-	1559.7	-	1559.7
B4-04-02-00	MAIN ENG SUP	-	-	-	-	1.5	30.5	20.0	344.9	5.4	105.9	-	-	-	-	26.8	481.3
B4-04-03-00	ACPS ENG	-	-	-	-	.3	6.8	4.4	76.6	1.2	23.5	-	-	-	1578.1	6.0	1685.0
B4-04-04-00	ACPS ENG SUP	-	-	-	-	1.5	30.5	20.0	344.9	5.4	105.9	-	-	-	393.1	26.8	874.4
B4-07-00-00	LARGE K/S FACO	-	-	-	-	24.1	486.6	42.3	731.5	15.9	314.9	7.4	142.0	-	-	89.8	1675.1
B4-07-01-00	FINAL ASSEM	-	-	-	-	24.1	486.6	42.3	731.5	14.9	295.0	3.4	64.6	-	-	84.7	1577.7
B4-07-02-00	CHECK OUT	-	-	-	-	-	-	-	-	1.0	19.9	4.0	77.5	-	-	5.0	97.4
S4-00-00-00	SPARES KICK STAGES	-	-	-	-	-	-	-	-	-	-	-	-	-	705.8	-	705.8
S4-S3-S3-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	343.6	-	343.6
S4-S4-00-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	362.2	-	362.2
05-00-00-00	LOGISTICS	70.8	1305.6	-	-	-	-	-	-	-	-	-	-	-	508.2	70.8	1813.8
05-01-00-00	TRANS & HANDL	-	-	-	-	-	-	-	-	-	-	-	-	-	508.2	-	508.2
05-02-00-00	TRAINING	70.8	1305.6	-	-	-	-	-	-	-	-	-	-	-	-	70.8	1305.6
05-02-01-00	SIMULATORS & EQUIP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

SUBDIVISIONS OF WORK: DDT&E ✓ PRODUCTION OPERATIONS

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
05-02-02-00	GND CREW	70.8	1305.6	-	-	-	-	-	-	-	-	-	-	-	-	70.8	1305.6
05-03-00-00	INVENTORY CONTL & WARHS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-00-00-00	GND SUP EQUIP.	-	-	-	-	100.0	2017.8	391.6	6771.7	150.0	2962.1	83.9	1612.5	-	6097.8	725.5	19462.0
07-01-00-00	MANUF GSE	-	-	-	-	-	-	-	-	13.3	262.3	32.5	624.3	-	36.3	45.8	923.0
07-01-01-00	HARDWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-01-02-00	SITE ACTIVATION	-	-	-	-	-	-	-	-	6.9	136.0	13.8	264.9	-	19.4	20.7	420.2
07-01-03-00	MAINT.	-	-	-	-	-	-	-	-	6.4	126.3	18.7	359.5	-	16.9	25.1	502.7
07-01-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-02-00-00	ETR GSE	-	-	-	-	64.9	1310.0	245.4	4242.7	87.8	1734.7	37.9	728.1	-	3046.5	436.0	11061.9
07-02-01-00	HARDWARE	-	-	-	-	64.9	1310.0	245.4	4242.6	87.8	1734.7	37.9	728.1	-	3046.5	436.0	11061.9
07-02-03-00	MAINT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-02-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-03-00-00	WTR GSE	-	-	-	-	35.1	707.9	146.3	2529.1	48.9	965.2	13.5	260.1	-	3015.0	243.7	7477.2
07-03-01-00	HARDWARE	-	-	-	-	35.1	707.8	146.3	2529.1	48.9	965.2	13.5	260.1	-	3014.9	243.7	7477.2
07-03-03-00	MAINT.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-03-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 1

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
11-00-00-00	FLT OPS DoD	3.0	54.4	–	–	–	–	–	–	–	–	–	–	–	–	3.0	54.4
12-00-00-00	FLT OPS FOR NASA	16.7	308.3	–	–	–	–	–	–	–	–	–	–	–	–	16.7	308.3
TOTAL PRODUCTION		562.8	10372.3	339.6	5387.0	269.9	5446.6	2737.2	47329.2	935.6	18475.5	555.5	10680.7	–	68378.0	5400.6	166068.4

PRODUCTION

OPTION 2

STUDY TITLE SPACE TUG — VOLUME 8.0 APPENDIX A — OPTION 2

CONTRACT NO.

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
32 B	PRODUCTION	595.0	10964.7	370.6	5879.5	244.1	4927.1	2507.4	43355.4	871.1	17202.7	522.1	10038.6	–	76770.9	5110.4	169138.9
[illegible]-00-00-00	PROJ MGMT	39.4	725.3	277.2	4396.6	–	–	29.5	510.4	29.5	582.9	39.4	756.8	–	1076.5	414.9	8048.6
01-01-00-00	COST PROJ MGMT	39.4	725.3	167.4	2656.2	–	–	29.5	510.4	29.5	582.9	39.4	756.8	–	1076.5	305.2	6308.2
[illegible]	PROJ DIR	–	–	39.4	624.4	–	–	–	–	–	–	–	–	–	–	39.4	624.4
01-03-00-00	TECH MGMT	–	–	70.4	1116.1	–	–	–	–	–	–	–	–	–	–	70.4	1116.1
02-00-00-00	SYSTEMS ENG & INTEG	461.2	8498.5	93.5	1482.9	–	–	–	–	32.0	631.5	11.8	227.0	–	3880.9	598.4	14720.9
03-00-00-00	SPACE TUG VEH M.S.	–	–	–	–	54.0	1089.3	1754.7	30340.5	564.3	11143.3	362.7	6974.4	–	55040.2	2735.7	104587.6
03-01-00-00	STRUCT	–	–	–	–	25.2	507.6	985.9	17046.6	251.8	4973.1	–	–	–	4228.0	1262.9	26755.4
03-01-01-00	FUEL TANK	–	–	–	–	6.2	125.7	299.3	5175.7	74.8	1477.7	–	–	–	439.0	380.4	7218.1
03-01-02-00	OX TANK	–	–	–	–	9.5	192.1	458.7	7930.8	114.7	2264.4	–	–	–	731.6	582.8	11118.9
03-01-03-00	BODY STRUCT	–	–	–	–	3.0	59.6	120.6	2085.9	30.2	595.5	–	–	–	678.5	153.7	3419.6
03-01-04-00	THRUST STRUCT	–	–	–	–	.3	6.5	18.1	312.3	4.5	89.2	–	–	–	46.7	22.9	454.8
03-01-05-00	METEOROID SHIELD	–	–	–	–	.2	3.4	1.3	22.3	.3	6.4	–	–	–	22.1	1.8	54.2
03-01-06-01	P/L INTERF DP MGMT	–	–	–	–	6.0	120.4	87.9	1519.6	22.0	433.9	–	–	–	622.8	115.8	2696.6
03-01-06-02	P/L INTERF DOCK MECH	–	–	–	–	–	–	–	–	5.4	106.1	–	–	–	1687.3	5.4	1793.4

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 2

CONTRACT NO.

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
03-01-07-00	INSTALLATION ASSEM & CO	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
03-02-00-00	THERMAL CONTROL	—	—	—	—	.7	13.3	66.7	1152.5	16.7	329.0	—	—	—	944.0	84.0	2438.9
03-03-00-00	AVIONICS	—	—	—	—	16.7	336.4	311.2	5380.6	150.6	2974.4	166.5	3201.7	—	34672.0	645.0	46565.1
03-03-01-00	DATA MGMT	—	—	—	—	2.5	51.3	77.6	1341.9	31.3	617.8	36.8	707.9	—	1767.7	148.2	4486.1
03-03-02-01	GUID & NAV	—	—	—	—	2.1	42.7	36.9	638.5	20.5	405.4	45.5	874.7	—	14418.6	105.1	16379.8
03-03-02-02	GUID & NAV AV2 PEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-03-02-03	GUID & NAV AV3 PEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-03-02-04	GUID & NAV AV2 PEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-03-03-00	COMM	—	—	—	—	7.3	147.4	47.2	815.8	24.1	476.3	19.0	36[illegible].1	—	9935.7	97.7	11741.3
03-03-04-00	INSTR'N	—	—	—	—	—	—	—	—	—	—	—	—	—	229.3	—	229.3
03-03-05-00	EL POWER	—	—	—	—	2.6	53.4	92.0	1591.5	41.8	825.2	16.4	315.3	—	7507.5	152.9	10293.0
03-03-06-00	POWER DISTR & CON	—	—	—	—	2.1	41.7	57.5	993.3	32.9	649.7	48.8	937.7	—	813.2	141.2	3435.6
03-03-07-00	INSTR ASSEM & CO	—								—						—	—
03-04-00-00	PROPULSION	—	—	—	—	4.1	82.9	169.2	2925.9	42.8	845.6	—	—	—	14451.7	216.1	18306.2
03-04-01-00	MAIN ENGINE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-04-01-00	MAIN ENG SUBSYSTEM	—	—	—	—	.5	9.2	20.3	351.1	5.1	101.5	—	—	—	7227.3	25.9	7689.2
03-04-02-00	MAIN ENG SUP	—	—	—	—	1.4	29.1	64.3	1111.9	16.3	321.3	—	—	—	3244.7	82.0	4706.9
03-04-03-00	ACPS ENG	—	—	—	—	.1	1.5	3.4	58.6	.9	16.9	—	—	—	2932.3	4.3	3009.3

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-04-04-00	ACPS ENG SUP	–	–	–	–	2.1	43.1	21.8	1404.3	20.5	405.9	–	–	–	1047.4	103.9	2900.7
03-04-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-00-00	ORBITER INTERF FQ	–	–	–	–	2.8	56.2	112.8	1950.7	33.6	663.0	33.3	640.1	–	744.4	182.5	4054.5
03-05-01-00	STRUCT	–	–	–	–	1.5	29.8	79.2	1370.2	20.1	397.8	–	–	–	567.2	100.9	2364.9
03-05-02-00	INTERF PANELS	–	–	–	–	1.3	26.4	33.6	580.6	13.4	265.2	33.3	640.1	–	177.2	81.6	1689.5
03-05-03-00	PURGE PROVISION	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-04-00	ABORT PROVISION	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-06-00-00	DROP TANKS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-01-00	STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-02-00	THERMAL SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-03-00	PROPULSION SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-04-00	INSTALLATION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-07-00-00	FINAL ASSEM & C/O	–	–	–	–	4.6	92.8	109.0	1884.2	68.8	1358.0	162.9	3132.6	–	–	345.3	6467.5
03-07-01-00	FINAL ASSEMBLY	–	–	–	–	4.6	92.8	109.0	1884.2	39.1	773.0	46.5	895.0	–	–	199.3	3645.0
03-07-02-00	CHECK OUT	–	–	–	–	–	–	–	–	29.6	585.0	116.4	2237.6	–	–	146.0	2822.5
53-00-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	4353.5	–	4353.5

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
S3-S1-00-00	SPARES STRUCT	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
S3-S2-00-00	THERMAL CONTROL	—	—	—	—	—	—	—	—	—	—	—	—	—	36.3	—	36.3
S3-S3-00-00	AVIONICS	—	—	—	—	—	—	—	—	—	—	—	—	—	3158.6	—	3158.6
S3-S4-00-00	PROPULSION	—	—	—	—	—	—	—	—	—	—	—	—	—	1158.6	—	1158.6
S3-S5-00-00	SPARES CRB INTERF	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
S3-S6-S3-00	SPARES DROP TANKS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-00-00-00	KICK STAGE	—	—	—	—	40.9	825.5	123.7	2139.6	45.2	892.1	23.1	444.9	—	2904.0	233.0	7206.1
A4-01-00-00	SMALL K/S STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-01-03-00	BODY STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-02-00-00	SMALL K/S THERMAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-02-04-00	THERMAL CONTROL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-04-00-00	SMALL K/S PROPULSION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-04-01-00	MAIN ENG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-04-02-00	MAIN ENG SUP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-04-03-00	ACPS ENG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-04-04-00	ACPS ENG SUP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A4-07-00-00	SMALL K/S FACD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 2

CONTRACT NO. APPENDIX A

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
B4-07-01-00	FINAL ASSEMBLY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B4-07-02-00	CHECKOUT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B4-01-00-00	LARGE K/S STRUCT	–	–	–	–	10.7	215.1	18.1	313.1	6.2	121.7	–	–	–	51.5	34.9	701.4
B4-01-03-00	BODY STRUCT	–	–	–	–	10.7	215.1	18.1	313.1	6.2	121.7	–	–	–	51.5	34.9	701.4
B4-02-00-00	LARGE K/S THERMAL	–	–	–	–	2.5	49.6	8.0	139.2	2.4	47.2	–	–	–	5.1	12.9	241.2
B4-02-04-00	THERMAL SYSTEM	–	–	–	–	2.5	49.6	8.0	139.2	2.4	47.2	–	–	–	5.1	12.9	241.2
B4-03-00-00	LARGE K/S AVIONICS	–	–	–	–	8.0	162.4	32.7	565.3	15.7	311.0	17.6	338.5	–	283.2	74.1	1660.4
B4-03-01-00	DATA MGMT	–	–	–	–	3.0	60.9	25.9	447.9	10.5	207.6	10.1	193.4	–	247.4	49.5	1157.3
B4-03-01-01	DATA MGMT DELTA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B4-03-05-00	EL POWER	–	–	–	–	–	–	–	–	–	–	–	–	–	28.3	–	28.3
B4-03-06-00	POWER DISTR & CONV	–	–	–	–	5.0	101.5	6.8	117.4	5.2	103.3	7.6	145.1	–	7.5	24.6	474.8
B4-03-06-01	POWER DISTR & CONV DELTA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B4-04-00-00	LARGE K/S PROPULSION	–	–	–	–	2.5	50.8	33.2	574.0	8.9	176.3	–	–	–	2564.2	44.6	3365.3
B4-04-01-00	MAIN ENG	–	–	–	–	–	–	–	–	–	–	–		–	1132.7	–	1132.7
B4-04-02-00	MAIN ENG SUP	–	–	–	–	1.1	22.8	14.9	258.3	4.0	79.3	–	–	–	–	20.1	360.5
B4-04-03-00	ACPS ENG	–	–	–	–	.3	5.1	3.3	57.4	.9	17.6	–	–	–	1146.1	4.5	1226.1
B4-04-04-00	ACPS ENG SUP	–	–	–	–	1.1	22.8	14.9	258.3	4.0	79.3	–	–	–	285.5	20.1	646.0
B4-07-00-00	LARGE K/S FACO	–	–	–	–	17.2	347.5	31.7	547.9	11.9	235.9	5.5	106.4	–	–	66.4	1237.8

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
B4-07-01-00	FINAL ASSEMBLY	–	–	–	–	17.2	347.5	31.7	548.0	11.2	221.0	2.5	48.4	–	–	62.6	1164.9
B4-07-02-00	CHECKOUT	–	–	–	–	–	–	–	–	.8	14.9	3.0	58.0	–	–	3.8	72.9
S4-00-00-00	SPARES KICK STAGES	–	–	–	–	–	–	–	–	–	–	–	–	–	376.9	–	376.9
S4-S3-S3-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	286.3	–	286.3
S4-S4-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	90.6	–	90.6
05-00-00-00	LOGISTICS	74.8	1378.1	–	–	–	–	–	–	–	–	–	–	–	435.6	74.8	1813.7
05-01-00-00	TRANS & HANDLING	–	–	–	–	–	–	–	–	–	–	–	–	–	435.6	–	435.6
05-02-00-00	TRAINING	74.8	1378.1	–	–	–	–	–	–	–	–	–	–	–	–	74.8	1378.1
05-02-01-00	SIMULATOR & EQUIP	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
05-02-02-00	GND CREW	74.8	1378.1	–	–	–	–	–	–	–	–	–	–	–	–	74.8	1378.1
05-03-00-00	INVENTORY OUT & WAREHS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-00-00-00	GND SUP EQUIP	–	–	–	–	149.2	3012.3	599.4	10364.9	200.2	3952.9	85.1	1635.5	–	8703.9	1033.9	27668.9
07-01-00-00	MANUF GSE	–	–	–	–	–	–	–	–	3.9	77.7	15.7	302.7	–	24.2	19.7	404.6
07-01-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-01-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	2.0	38.9	7.9	151.4	–	12.1	9.8	202.3

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

DDT&E ✓ PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
07-01-03-00	MAINT	–	–	–	–	–	–	–	–	2.0	38.9	7.9	151.4	–	12.1	9.8	202.3
07-01-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-02-00-00	ETR GSE	–	–	–	–	91.4	1844.7	357.4	6180.4	118.0	2330.2	44.2	849.1	–	5269.4	611.0	16473.8
07-02-01-00	HARDWARE	–	–	–	–	91.4	1844.7	357.4	6180.4	118.0	2330.2	44.2	849.1	–	5269.4	611.0	16473.8
07-02-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-02-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-03-00-00	WTR GSE	–	–	–	–	57.9	1167.6	242.0	4184.5	78.2	1544.9	25.2	483.7	–	3409.8	403.2	10790.5
07-03-01-00	HARDWARE	–	–	–	–	57.9	1167.6	242.0	4184.5	78.2	1544.9	25.2	483.7	–	3409.8	403.2	10790.5
07-03-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-03-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
11-00-00-00	FLT OPS D&D	3.0	54.4	–	–	–	–	–	–	–	–	–	–	–	–	3.0	54.4
12-00-00-00	FLT OPS FOR MASS	16.7	308.3	–	–	–	–	–	–	–	–	–	–	–	–	16.7	308.3
TOTAL PRODUCTION		595.0	10964.7	370.6	5879.5	244.1	4927.1	2507.4	43355.4	871.1	17202.7	522.1	10038.6	–	76770.9	5110.4	169138.9

PRODUCTION

OPTION 3

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 3

CONTRACT NO. APPENDIX A

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
32 B	PRODUCTION	714.1	13158.8	480.2	7617.3	314.4	6245.3	3143.9	54360.1	1101.7	21755.6	644.4	12390.5	–	93696.9	6398.6	209324.6
01-00-00-00	PROJ MGMT	51.2	942.9	358.7	5689.6	–	–	29.5	510.4	29.5	582.9	39.4	756.8	–	1361.4	508.2	9844.1
01-01-00-00	COST PROJ MGMT	51.2	942.9	216.0	3426.2	–	–	29.5	510.4	29.5	582.9	39.4	756.8	–	1361.4	365.6	7580.7
01-02-00-00	PROJ DIR	–	–	51.2	811.7	–	–	–	–	–	–	–	–	–	–	51.2	811.7
01-03-00-00	PROD MGMT	–	–	91.5	1451.7	–	–	–	–	–	–	–	–	–	–	91.5	1451.7
02-00-00-00	SYSTEMS ENG & INTEG	572.4	10597.6	121.5	1927.7	–	–	–	–	41.3	816.1	5.9	113.5	–	4511.5	741.1	17916.5
03-00-00-00	SPACE TUG VEH M.S.	–	–	–	–	58.2	1174.0	2168.8	37500.3	692.4	13673.6	428.6	8241.5	–	65915.6	3348.0	126504.3
03-01-00-00	STRUCT	–	–	–	–	26.3	509.7	1245.6	21537.5	318.7	6294.0	–	–	–	5853.0	1589.6	34194.3
03-01-01-00	FUEL TANK	–	–	–	–	6.2	125.6	360.4	6231.0	90.1	1779.1	–	–	–	541.6	456.7	8677.3
03-01-02-00	OX TANK	–	–	–	–	9.5	191.9	552.2	9548.0	138.1	2726.1	–	–	–	902.7	699.8	13368.7
03-01-03-00	BODY STRUCT	–	–	–	–	3.0	59.6	145.2	2511.2	36.3	717.0	–	–	–	837.1	184.5	4125.0
03-01-04-00	THRUST STRUCT	–	–	–	–	.3	6.4	21.7	376.0	5.4	107.4	–	–	–	46.9	27.5	536.6
03-01-05-00	METEOROID SHIELD	–	–	–	–	.2	3.3	1.5	26.9	.4	7.7	–	–	–	27.2	2.1	65.1
03-01-06-01	P/L INTERF STRUCTURE	–	–	–	–	6.1	122.8	164.5	2844.4	41.1	812.1	–	–	–	1294.6	211.7	5073.9
03-01-06-02	P/L INTERF DOCK MECH	–	–	–	–	–	–	–	–	7.3	144.7	–	–	–	2202.9	7.3	2347.6

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
03-01-07-00	INSTALLATION ASSEM & CO	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-02-00-00	THERMAL CONTROL	–	–	–	–	.7	13.3	80.2	1387.5	20.1	396.1	–	–	–	1164.7	101.0	2961.7
03-03-00-00	AVIONICS	–	–	–	–	20.1	405.0	374.6	6477.7	180.5	3563.9	199.2	3830.1	–	39633.3	774.4	53910.1
03-03-01-00	DATA MGMT	–	–	–	–	3.1	61.8	93.4	1615.0	37.7	743.8	44.3	852.2	–	2180.9	178.4	5453.6
03-03-02-01	GUID & NAV	–	–	–	–	2.5	51.4	44.5	768.7	17.1	337.1	53.5	1028.6	–	2693.4	117.6	4879.1
03-03-02-02	GUID & NAV AV1 PEC	–	–	–	–	–	–	–	–	1.0	19.2	–	–	–	1644.2	1.0	1663.3
03-03-02-03	GUID & NAV AV3 PEC	–	–	–	–	–	–	–	–	2.1	42.3	–	–	–	4195.3	2.1	4237.7
03-03-02-04	GUID & NAV AV2 PEC	–	–	–	–	–	–	–	–	3.7	72.4	–	–	–	6113.0	3.7	6185.4
03-03-03-00	COMM	–	–	–	–	8.8	177.4	56.8	982.2	29.0	573.4	22.9	440.8	–	12258.0	117.6	14431.9
03-03-04-00	INSTR'N	–	–	–	–	–	–	–	–	–	–	–	–	–	282.9	–	282.9
03-03-05-00	EL POWER	–	–	–	–	3.2	64.3	110.8	1916.1	50.3	993.5	19.7	379.6	–	9262.4	184.1	12615.8
03-03-06-00	POWER DIST & CON	–	–	–	–	2.5	50.2	69.2	1195.8	39.6	782.2	58.7	1128.9	–	1003.3	170.0	4160.4
03-03-07-00	INSTR ASSEM & CO	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-04-00-00	PROPULSION	–	–	–	–	4.8	97.0	224.3	3878.4	56.8	1120.9	–	–	–	18520.2	285.9	23616.6
03-04-01-00	MAIN ENG GEE (CM)	–	–	–	–	.5	10.6	24.5	422.7	6.2	122.2	–	–	–	2667.3	31.2	3222.9
03-04-01-00	MAIN ENG GEE (CHASSI)	–	–	–	–	.4	7.8	20.6	355.9	5.2	102.9	–	–	–	6939.8	26.2	7406.3
03-04-02-00	MAIN ENG SUP	–	–	–	–	1.7	33.9	77.4	1338.6	19.6	386.8	–	–	–	4003.1	98.7	5762.9
03-04-03-00	ACPS ENG	–	–	–	–	.1	1.8	4.1	70.5	1.0	20.4	–	–	–	3617.7	5.2	3710.4

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 3

CONTRACT NO. APPENDIX A

DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-04-04-00	ACPS ENG SUP	–	–	–	–	2.1	43.0	97.8	1690.7	24.7	488.6	–	–	–	1292.2	124.7	3514.6
03-04-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-00-00	ORBITER INTERF EQ			–	–	2.8	56.2	112.8	1950.7	33.6	663.0	33.3	640.1	–	744.4	182.5	4054.5
03-05-01-00	STRUCT	–		–	–	1.5	29.8	79.2	1370.2	20.1	397.8	–	–	–	567.2	102.9	2364.9
03-05-02-00	INTERF PANELS	–	–	–	–	1.3	26.4	33.6	580.6	13.4	265.2	33.3	640.1	–	177.2	81.6	1689.5
03-05-03-00	PURGE PROVISION	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-04-00	ABORT PROVISION	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–
03-05-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-06-00-00	DROP TANKS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-01-00	STRUCT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-02-00	THERMAL SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-03-00	PROPULSION SYSTEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-06-04-00	INSTALLATION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
03-07-00-00	FINAL ASSEM & C/O	–	–	–	–	4.6	92.6	131.2	2268.4	82.8	1634.9	196.2	3771.4	–	–	414.7	7767.3
03-07-01-00	FINAL ASSEMBLY	–			–	4.6	92.6	131.2	2268.4	47.1	930.6	56.0	1077.5	–	–	238.9	4369.2
03-07-02-00	CHECK OUT	–	–	–	–	–	–	–	–	35.7	704.3	140.1	2693.8	–		175.8	3398.1
S3-00-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	4913.0	–	4913.0

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OPTION 3

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
S3-S1-00-00	SPARES STRUCT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S3-S2-00-00	THERMAL CONTROL	–	–	–	–	–	–	–	–	–	–	–	–	–	36.3	–	36.3
S3-S3-00-00	AVIONICS	–	–	–	–	–	–	–	–	–	–	–	–	–	3979.0	–	3979.0
S3-S4-00-00	PROPULSION	–	–	–	–	–	–	–	–	–	–	–	–	–	1397.7	–	1397.7
S3-S5-00-00	SPARES CPB INTERF	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S3-S6-S3-00	SPARES DROP TANKS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
04-00-00-00	KICK STAGE	–	–	–	–	104.5	2109.8	320.9	5547.9	116.2	2295.0	58.0	1114.3	–	7089.3	599.6	18156.2
A4-01-00-00	SMALL K/S STRUCT	–	–	–	–	8.5	172.1	15.5	268.7	5.5	107.9	–	–	–	30.6	29.5	579.2
A4-01-03-00	BODY STRUCT	–	–	–	–	8.5	172.1	15.5	268.7	5.5	107.9	–	–	–	30.6	29.5	579.2
A4-02-00-00	SMALL K/S THERMAL	–	–	–	–	2.0	39.7	7.8	134.3	2.3	45.6	–	–	–	4.4	12.1	224.0
A4-02-04-00	THERMAL CONTROL	–	–	–	–	2.0	39.7	7.8	134.3	2.3	45.6	–	–	–	4.4	12.1	224.0
A4-04-00-00	SMALL K/S PROPULSION	–	–	–	–	2.4	49.0	32.0	554.1	8.6	170.0	–	–	–	1738.7	43.1	2511.9
A4-04-01-00	MAIN ENG	–	–	–	–	–	–	–	–	–	–	–	–	–	524.2	–	524.2
A4-04-02-00	MAIN ENG SUP	–	–	–	–	1.1	22.0	14.4	249.4	3.9	76.6	–	–	–	–	19.4	348.0
A4-04-03-00	ACPS ENG	–	–	–	–	.2	4.9	3.2	55.4	.9	17.0	–	–	–	972.3	4.3	1049.7
A4-04-04-00	ACPS ENG SUP	–	–	–	–	1.1	22.0	14.4	249.4	3.9	76.4	–	–	–	242.2	19.4	590.0
A4-07-00-00	SMALL K/S FACO	–	–	–	–	13.8	278.0	29.6	512.2	11.3	222.9	5.3	102.7	–	–	60.0	1115.8

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WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
A4-07-01-00	FINAL ASSEMBLY	–	–	–	–	13.8	278.0	29.6	512.2	10.6	208.6	2.4	46.7	–	–	56.4	1045.4
A4-07-02-00	CHECK OUT	–	–	–	–	–	–	–	–	.7	14.4	2.9	56.0	–	–	3.6	70.4
B4-01-00-00	LARGE K/S STRUCT	–	–	–	–	19.2	387.3	29.9	517.3	10.2	201.0	–	–	–	89.9	59.3	1195.5
B4-01-03-00	BODY STRUCT	–	–	–	–	19.2	387.3	29.9	517.3	10.2	201.0	–	–	–	89.9	59.3	1195.5
B4-02-00-00	LARGE K/S THERMAL	–	–	–	–	4.4	89.4	13.3	229.9	4.0	78.1	–	–	–	9.0	21.7	406.3
B4-02-04-00	THERMAL SYSTEM	–	–	–	–	4.4	89.4	13.3	229.9	4.0	78.1	–	–	–	9.0	21.7	406.3
B4-03-00-00	LARGE K/S AVIONICS	–	–	–	–	19.1	384.8	85.5	1477.7	39.9	788.4	43.5	835.8	–	737.0	187.9	4223.8
B4-03-01-00	DATA MGMT	–	–	–	–	6.8	137.0	58.2	1007.2	23.6	466.9	22.6	434.9	–	611.5	111.3	2657.4
B4-03-01-01	DATA MGMT DELTA	–	–	–	–	1.0	19.6	4.0	69.7	2.4	47.0	3.9	74.7	–	35.2	11.3	246.1
B4-03-05-00	EL POWER	–	–	–	–	–	–	–	–	–	–	–	–	–	70.0	–	70.0
B4-03-06-00	POWER DISTR & CON	–	–	–	–	11.3	228.3	15.3	264.0	11.8	232.3	17.0	326.2	–	18.5	55.3	1069.3
B4-03-06-01	POWER DISTR & CONT DELTA	–	–	–	–	–	–	7.9	136.9	2.1	42.2	–	–	–	2.0	10.1	181.0
B4-04-00-00	LARGE K/S PROPULSION	–	–	–	–	9.2	83.9	54.8	948.4	14.8	291.3	–	–	–	4479.6	73.8	5803.2
B4-04-01-00	MAIN ENG	–	–	–	–	–	–	–	–	–	–	–	–	–	1978.8	–	1978.8
B4-04-02-00	MAIN ENG SUP	–	–	–	–	1.9	37.7	24.7	426.8	6.6	131.1	–	–	–	–	33.2	595.6
B4-04-03-00	ACPS ENG	–	–	–	–	.4	8.4	5.5	94.8	1.5	29.1	–	–	–	2002.1	7.4	2134.4
B4-04-04-00	ACPS ENG SUP	–	–	–	–	1.9	37.7	24.7	426.8	6.6	131.1	–	–	–	498.7	33.2	1094.4
B4-07-00-00	LARGE K/S FACO	–	–	–	–	31.0	625.6	52.4	905.3	19.7	389.8	9.1	175.8	–	–	112.2	2096.4

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SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
34-07-01-00	FINAL ASSEMBLY	–	–	–	–	31.0	625.6	52.4	905.3	18.5	365.1	4.2	79.9	–	–	106.0	1975.9
34-07-02-00	CHECKOUT	–	–	–	–	–	–	–	–	1.3	24.6	5.0	95.9	–	–	6.2	120.5
S4-00-00-00	SPARES WORK STAGES	–	–	–	–	–	–	–	–	–	–	–	–	–	434.1	–	434.1
S4-S3-S3-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	343.6	–	343.6
S4-S4-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	90.6	–	90.6
05-00-00-00	LOGISTICS	70.8	1305.6	–	–	–	–	–	–	–	–	–	–	–	544.5	70.8	1850.1
05-01-00-00	TRANS & HANDLING	–	–	–	–	–	–	–	–	–	–	–	–	–	544.5	–	544.5
05-02-00-00	TRAINING	70.8	1305.6	–	–	–	–	–	–	–	–	–	–	–	–	70.8	1305.6
05-02-01-00	SIMULATORS & EQUIP	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
05-02-02-00	GND CREW	70.8	1305.6	–	–	–	–	–	–	–	–	–	–	–	–	70.8	1305.6
05-03-00-00	INVENTORY OUTFITTING	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-00-00-00	GND SUP EQUIP	–	–	–	–	151.7	3061.5	624.7	10801.5	222.2	4388.6	112.6	2164.4	–	8927.5	1111.2	29343.6
07-01-00-00	MANUF GSE	–	–	–	–	–	–	–	–	10.8	213.7	43.3	832.4	–	24.2	54.1	1070.4
07-01-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-01-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	3.9	77.7	15.7	302.7	–	12.1	19.7	392.5

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CONTRACT NO.

DDT&E ✓ PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
07-01-03-00	MAINT	–	–	–	–	–	–	–	–	6.9	136.0	27.5	529.7	–	12.1	34.4	677.9
07-01-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-02-00-00	ETR GSE	–	–	–	–	90.2	1820.9	366.5	6336.9	124.7	2463.3	42.3	812.4	–	5438.4	623.7	16871.9
07-02-01-00	HARDWARE	–	–	–	–	90.2	1820.9	366.5	6336.9	124.7	2463.3	42.3	812.4	–	5438.4	623.7	16871.9
07-02-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-02-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-03-00-00	WTR GSE	–	–	–	–	61.5	1240.6	258.2	4464.7	86.7	1711.6	27.0	519.5	–	3464.9	433.4	11401.3
07-03-01-00	HARDWARE	–	–	–	–	61.5	1240.6	258.2	4464.7	86.7	1711.6	27.0	519.5	–	3464.9	433.4	11401.3
07-03-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-03-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
11-00-00-00	FLT OPS DOD	3.0	54.4	–	–	–	–	–	–	–	–	–	–	–	–	3.0	54.4
12-00-00-00	FLT OPS FOR NASA	16.7	308.3	–	–	–	–	–	–	–	–	–	–	–	–	16.7	308.3
TOTAL PRODUCTION		714.1	13158.8	480.2	7617.3	314.4	6345.3	3143.9	54360.1	1101.7	21756.6	644.4	12390.5	–	93696.9	6398.6	209324.6

PRODUCTION

OPTION 3A

STUDY TITLE SPACE TUG

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OPTION 3A

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32 B	PRODUCTION	730.9	13470.1	517.3	8205.3	381.2	7693.8	6782.7	117278.2	2034.9	40182.9	651.3	12522.7	–	188837.7	11098.2	388190.8
01-00-00-00	PROJ MGMT	51.2	942.9	395.7	6277.5	–	–	29.5	510.4	29.5	582.9	39.4	756.8	–	1906.0	545.3	10976.6
01-01-00-00	COST PERF MGMT	51.2	942.9	248.0	3933.5	–	–	29.5	510.4	29.5	582.9	39.4	756.8	–	1906.0	397.5	8632.6
01-02-00-00	PROJ DIR	–	–	54.5	863.7	–	–	–	–	–	–	–	–	–	–	54.5	863.7
01-03-00-00	INFO MGMT	–	–	93.3	1480.3	–	–	–	–	–	–	–	–	–	–	93.3	1480.3
02-00-00-00	SYSTEMS ENG & INTEG	578.4	10659.4	121.5	1927.7	–	–	–	–	41.3	816.1	5.9	113.5	–	4527.5	747.2	18044.4
03-00-00-00	SPACE TUG VEH M.S.	–	–	–	–	105.4	2127.1	5733.3	99133.7	1600.4	31604.4	428.6	8241.5	–	159774.9	7867.8	300881.6
03-01-00-00	STRUCT	–	–	–	–	23.0	465.0	1049.3	18143.5	274.9	5428.5	–	–	–	5137.2	1347.2	29174.2
03-01-01-00	FUEL TANK	–	–	–	–	5.3	106.6	278.9	4823.1	71.1	1403.2	–	–	–	290.2	355.3	6623.1
03-01-02-00	OX TANK	–	–	–	–	9.7	195.6	394.9	6827.3	101.1	1997.1	–	–	–	387.6	505.7	9407.6
03-01-03-00	BODY STRUCT	–	–	–	–	3.5	70.2	193.6	3347.6	48.8	963.1	–	–	–	976.1	245.9	5357.0
03-01-04-00	THRUST STRUCT	–	–	–	–	.3	7.1	21.7	376.0	5.5	109.0	–	–	–	28.5	27.6	520.6
03-01-05-00	METEOROID SHIELD	–	–	–	–	.2	3.5	1.5	26.9	.4	8.6	–	–	–	11.4	2.2	50.2
03-01-06-01	P/L INTERF SEP MODULE	–	–	–	–	4.1	82.0	158.6	2742.7	40.7	802.7	–	–	–	1240.6	203.3	4867.9
03-01-06-02	P/L INTERF DOCK MECH	–	–	–	–	–	–	–	–	7.3	144.7	–	–	–	2202.9	7.3	2347.6

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OPTION 3A

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-01-07-00	INSTALLATION ASSEM & CO	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-02-00-00	THERMAL CONTROL	–	–	–	–	.7	13.2	80.2	1387.5	20.1	396.1	–	–	–	1164.7	101.0	2961.5
03-03-00-00	AVIONICS	–	–	–	–	20.1	405.0	374.6	6477.7	180.5	3563.9	199.2	3830.1	–	39633.3	774.4	53910.1
03-03-01-00	DATA MGMT	–	–	–	–	3.1	61.8	93.4	1615.0	37.7	743.8	44.3	852.2	–	2180.9	178.4	5453.6
03-03-02-01	GUID & NAV	–	–	–	–	2.5	51.4	44.5	768.7	17.1	337.1	53.5	1028.6	–	2693.4	117.6	4879.1
03-03-02-02	GUID & NAV AV1 PEC	–	–	–	–	–	–	–	–	1.0	19.2	–	–	–	1644.2	1.0	1663.3
03-03-02-03	GUID & NAV AV3 PEC	–	–	–	–	–	–	–	–	2.1	42.3	–	–	–	4195.3	2.1	4237.7
03-03-02-04	GUID & NAV AV2 PEC	–	–	–	–	–	–	–	–	3.7	72.4	–	–	–	6113.0	3.7	6185.4
03-03-03-00	COMM	–	–	–	–	8.8	177.4	56.8	982.2	29.0	573.4	22.9	440.8	–	12258.0	117.6	14431.9
03-03-04-00	INSTR'N	–	–	–	–	–	–	–	–	–	–	–	–	–	282.9	–	282.9
03-03-05-00	EL POWER	–	–	–	–	3.2	64.3	110.8	1916.1	50.3	993.5	19.7	379.6	–	9262.4	184.1	12615.8
03-03-06-00	POWER DISTR & CON	–	–	–	–	2.5	50.2	69.2	1195.8	39.6	782.2	58.7	1128.9	–	1003.3	170.0	4160.4
03-03-07-00	INSTR ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-04-00-00	PROPULSION	–	–	–	–	4.8	97.0	224.3	3878.4	56.8	1120.9	–	–	–	21024.0	285.9	26120.4
03-04-01-00	MAIN ENG GFE (COMM)	–	–	–	–	.5	10.6	24.5	422.7	6.2	122.2	–	–	–	2667.3	31.2	3222.9
03-04-01-00	MAIN ENG GFE (CLASSI)	–	–	–	–	.4	7.8	20.6	355.9	5.2	102.9	–	–	–	6939.8	26.2	7406.3
03-04-02-00	MAIN ENG SUP	–	–	–	–	1.7	33.9	77.4	1338.6	19.6	386.8	–	–	–	6339.7	98.7	8099.0
03-04-03-00	ACPS ENG	–	–	–	–	.1	1.8	4.1	70.5	1.0	20.4	–	–	–	3617.7	5.2	3710.4

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CONTRACT NO.

DDT&E ✓ PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
03-04-04-00	ACPS ENG SUP	–	–	–	–	2.1	43.0	97.8	1690.7	24.7	488.6	–	–	–	1459.5	124.7	3681.9
03-04-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-00-00	ORBITER INTERF EQ	–	–	–	–	2.8	56.2	112.8	1950.7	33.6	663.0	33.3	640.1	–	744.4	182.5	4054.5
03-05-01-00	STRUCT	–	–	–	–	1.5	29.8	79.2	1370.2	20.1	397.8	–	–	–	567.2	100.9	2364.9
03-05-02-00	INTERF PANELS	–	–	–	–	1.3	26.4	33.6	580.6	13.4	265.2	33.3	640.1	–	177.2	81.6	1689.5
03-05-03-00	PURGE PROVISION	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-04-00	ABORT PROVISION	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-05-05-00	INSTALLATION ASSEM & C/O	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
03-06-00-00	DROP TANKS	–	–	–	–	49.4	998.0	3760.8	65027.4	952.5	18809.5	–	–	–	92071.3	4762.8	176906.2
03-06-01-00	STRUCT	–	–	–	–	39.2	792.2	1917.3	33151.3	489.1	9659.0	–	–	–	5784.8	2445.6	49382.3
03-06-02-00	THERMAL SYSTEM	–	–	–	–	–	–	–	–	–	–	–	–	–	18511.4	–	18511.4
03-06-03-00	PROPULSION SYSTEM	–	–	–	–	5.0	101.2	827.7	14311.8	208.2	4110.5	–	–	–	62775.0	1040.9	86298.5
03-06-04-00	INSTALLATION	–	–	–	–	5.2	104.6	1015.8	17564.3	255.2	5040.0	–	–	–	–	1276.2	22709.0
03-07-00-00	FINAL ASSEM & C/O	–	–	–	–	4.6	92.6	131.2	2268.4	82.2	1622.3	196.2	3771.4	–	–	414.1	7754.7
03-07-01-00	FINAL ASSEMBLY	–	–	–	–	4.6	92.6	131.2	2268.4	47.1	930.6	56.0	1077.5	–	–	238.9	4369.2
03-07-02-00	CHECK OUT	–	–	–	–	–	–	–	–	35.0	691.7	140.1	2693.8	–	–	175.1	3385.5
S3-00-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	5238.1	–	5238.1

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3A

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
S3-S1-00-00	SPARES STRUCT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S3-S2-00-00	THERMAL CONTROL	–	–	–	–	–	–	–	–	–	–	–	–	–	36.3	–	36.3
S3-S3-00-00	AVIONICS	–	–	–	–	–	–	–	–	–	–	–	–	–	3563.1	–	3563.1
S3-S4-00-00	PROPULSION	–	–	–	–	–	–	–	–	–	–	–	–	–	1464.4	–	1464.4
S3-S5-00-00	SPARES ORB. INTERF	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S3-S6-S3-00	SPARES DROP TANKS	–	–	–	–	–	–	–	–	–	–	–	–		174.4	–	174.4
04-00-00-00	KICK STAGES	–	–	–	–	104.5	2109.8	320.9	5547.9	116.2	2295.0	58.0	1114.3	–	7089.3	599.6	18156.2
A4-01-00-00	SMALL K/S STRUCT	–	–	–	–	8.5	172.1	15.5	268.7	5.5	107.9	–	–	–	30.6	29.5	579.2
A4-01-03-00	BODY STRUCT	–	–	–	–	8.5	172.1	15.5	268.7	5.5	107.9	–	–	–	30.6	29.5	579.2
A4-02-00-00	SMALL K/S THERMAL	–	–	–	–	2.0	39.7	7.8	134.3	2.3	45.6	–	–	–	4.4	12.0	224.0
A4-02-04-00	THERMAL CONTROL	–	–	–	–	2.0	39.7	7.8	134.3	2.3	45.6	–	–	–	4.4	12.1	224.0
A4-04-00-00	SMALL K/S PROPULSION	–	–	–	–	2.4	49.0	32.0	554.1	8.6	170.0	–	–	–	1738.7	43.1	2511.9
A4-04-01-00	MAIN ENG	–	–	–	–	–	–	–	–	–	–	–	–	–	524.2	–	524.2
A4-04-02-00	MAIN ENG SUP	–	–	–	–	1.1	22.0	14.4	249.4	3.9	76.6	–	–	–	–	19.4	348.0
A4-04-03-00	ACPS ENG	–	–	–	–	.2	4.9	3.2	55.4	.9	17.0	–	–	–	972.3	4.3	1049.7
A4-04-04-00	ACPS ENG SUP	–	–	–	–	1.1	22.0	14.4	249.4	3.9	76.4	–	–	–	242.2	19.4	590.0
A4-07-00-00	SMALL K/S FACD	–	–	–	–	13.8	278.0	29.6	512.2	11.3	222.9	5.3	102.7	–	–	60.0	1115.8

STUDY TITLE SPACE TUG — VOLUME 8.0 APPENDIX A — OPTION 3A

CONTRACT NO.

DDT&E ✓ PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
A4-07-01-00	FINAL ASSEMBLY	–	–	–	–	13.8	278.0	29.6	512.2	10.6	208.6	2.4	46.7	–	–	56.4	1045.4
A4-07-02-00	CHECKOUT	–	–	–	–	–	–	–	–	.7	14.4	2.9	56.0	–	–	3.6	70.4
B4-01-00-00	LARGE K/S STRUCT	–	–	–	–	19.2	387.3	29.9	517.3	10.2	201.0	–	–	–	89.9	59.3	1195.5
B4-01-03-00	BODY STRUCT	–	–	–	–	19.2	387.3	29.9	517.3	10.2	201.0	–	–	–	89.9	59.3	1195.6
B4-02-00-00	LARGE K/S THERMAL	–	–	–	–	4.4	89.4	13.3	229.9	4.0	78.1	–	–	–	9.0	21.7	406.3
B4-02-04-00	THERMAL SYSTEM	–	–	–	–	4.4	89.4	13.3	229.9	4.0	78.1	–	–	–	9.0	21.7	406.3
B4-03-00-00	LARGE K/S AVIONICS	–	–	–	–	19.1	384.8	85.5	1477.7	39.9	788.4	43.5	835.8	–	737.0	187.9	4223.8
B4-03-01-00	DATA MGMT	–	–	–	–	6.8	137.0	58.2	1067.2	23.6	466.9	22.6	434.9	–	611.5	111.3	2657.4
B4-03-01-01	DATA MGMT DELTA	–	–	–	–	1.0	19.6	4.0	69.7	2.4	47.0	3.9	74.7	–	35.2	11.3	246.1
B4-03-05-00	EL POWER	–	–	–	–	–	–	–	–	–	–	–	–	–	70.0	–	70.0
B4-03-06-00	POWER DISTR & CON	–	–	–	–	11.3	228.3	15.3	264.0	11.8	232.3	17.0	326.2	–	18.5	55.3	1069.3
B4-03-06-01	POWER DISTR & CONT DELTA	–	–	–	–	–	–	7.9	136.9	2.1	42.2	–	–	–	2.0	10.1	181.0
B4-04-00-00	LARGE K/S PROPULSION	–	–	–	–	4.2	83.9	54.8	948.4	14.8	291.3	–	–	–	4479.6	73.8	5803.2
B4-04-01-00	MAIN ENG	–	–	–	–	–	–	–	–	–	–	–	–	–	1978.8	–	1978.8
B4-04-02-00	MAIN ENG SUP	–	–	–	–	1.9	37.7	24.7	426.8	6.6	131.1	–	–	–	–	33.2	595.6
B4-04-03-00	ACPS ENG	–	–	–	–	.4	8.4	5.5	94.8	1.5	29.1	–	–	–	2002.1	7.4	2134.4
B4-04-04-00	ACPS ENG SUP	–	–	–	–	1.9	37.7	24.7	426.8	6.6	131.1	–	–	–	498.7	33.2	1094.4
B4-07-00-00	LARGE K/S FAC'O	–	–	–	–	31.0	625.6	52.4	905.3	19.7	389.8	9.1	175.8	–	–	112.2	2096.4

STUDY TITLE SPACE TUG VOLUME 8.0 OPTION 3A

CONTRACT NO. APPENDIX A

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
B4-07-01-00	FINAL ASSEMBLY	–	–	–	–	31.0	625.6	52.4	905.3	18.5	365.1	4.2	79.9	–	–	106.0	1975.9
B4-07-02-00	CHECKOUT	–	–	–	–	–	–	–	–	1.3	24.6	5.0	95.9	–	–	6.2	120.5
S4-00-00-00	SPARES KICK STAGES	–	–	–	–	–	–	–	–	–	–	–	–	–	434.1	–	434.1
S4-S3-S3-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	343.6	–	343.6
S4-S4-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	90.6	–	90.6
05-00-00-00	LOGISTICS	70.8	1305.6	–	–	–	–	–	–	–	–	–	–	–	544.5	70.8	1850.1
05-01-00-00	TRANS & HANDLING	–	–	–	–	–	–	–	–	–	–	–	–	–	544.5	–	544.5
05-02-00-00	TRAINING	70.8	1305.6	–	–	–	–	–	–	–	–	–	–	–	–	70.8	1305.6
05-02-01-00	SIMULATORS & EQUIP	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
05-02-02-00	GND CREW	70.8	1305.6	–	–	–	–	–	–	–	–	–	–	–	–	70.8	1305.6
05-03-00-00	INVENTORY CONT & WAREHS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-00-00-00	GND SUP EQUIP	–	–	–	–	171.3	3456.9	699.0	12086.2	247.4	4884.5	119.4	2296.6	–	9323.2	1237.1	32047.4
07-01-00-00	MANUF GSE	–	–	–	–	–	–	–	–	10.8	213.7	43.3	832.4	–	24.2	54.1	1070.4
07-01-01-00	HARDWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-01-02-00	SITE ACTIVATION	–	–	–	–	–	–	–	–	3.9	77.7	15.7	302.7	–	12.1	19.7	392.5

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3A

CONTRACT NO.

___ DDT&E ✓ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07-01-03-00	MAINT	-	-	-	-	-	-	-	-	6.9	136.0	27.5	529.7	-	12.1	34.4	677.9
07-01-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-02-00-00	ETR GSE	-	-	-	-	101.1	2039.6	407.2	7041.7	138.6	2736.8	46.3	889.6	-	5660.5	693.2	18368.1
07-02-01-00	HARDWARE	-	-	-	-	101.1	2039.6	407.2	7041.7	138.6	2736.8	46.3	889.5	-	5660.5	693.2	18368.1
07-02-03-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-02-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-03-00-00	WTR GSE	-	-	-	-	70.2	1417.4	291.7	5044.5	97.9	1933.9	29.9	574.6	-	3638.5	489.8	12608.9
07-03-01-00	HARDWARE	-	-	-	-	70.2	1417.4	291.7	5044.5	97.9	1933.9	29.9	574.6	-	3638.5	489.8	12608.9
07-03-03-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-03-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11-00-00-00	FLT OPS DOD	5.9	108.8	-	-	-	-	-	-	-	-	-	-	-	-	5.9	108.8
12-00-00-00	FLT OPS FOR NASA	24.6	453.3	-	-	-	-	-	-	-	-	-	-	-	-	24.6	453.3
TOTAL	PRODUCTION	730.9	13470.1	517.3	8205.3	381.2	7693.8	6782.2	117278.2	2034.9	40182.9	651.3	12522.7	-	185837.7	11098.2	388190.8

1.3 Operations - Data Form T is presented for Options 1, 2, 3 and 3A on the following pages for Operations.

OPERATIONS

OPTION 1

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32C	OPERATIONS	3625.8	62024.4	1209.5	19187.0	-	-	-	-	723.7	10964.5	3475.2	49013.6	-	101020.0	9034.3	242209.6
01-00-00-00	PROJ MGM'T	70.9	1305.7	1030.5	16346.2	-	-	-	-	27.6	544.1	41.3	794.6	-	17934	1170.2	20784.0
01-01-00-00	COST PERF MGM'T	70.9	1305.7	587.6	9321.9	-	-	-	-	27.6	544.1	41.3	794.6	-	1793.4	727.4	13759.7
01-01-01-00	MGM'T DEN	70.8	1305.7	318.0	5045.0	-	-	-	-	27.5	544.1	41.3	794.6	-	1793.4	457.8	9482.8
01-01-02-00	MGM'T WTR	-	-	96.4	1529.7	-	-	-	-	-	-	-	-	-	-	96.4	1529.7
01-01-03-00	MGM'T ETR	-	-	173.2	2747.2	-	-	-	-	-	-	-	-	-	-	173.2	2747.2
01-02-00-00	PROJ DIR	-	-	161.4	2560.0	-	-	-	-	-	-	-	-	-	-	161.4	2560.0
01-02-01-00	MGM'T DEN	-	-	90.5	1436.1	-	-	-	-	-	-	-	-	-	-	90.5	1436.1
01-02-02-00	MGM'T WTR	-	-	27.6	437.1	-	-	-	-	-	-	-	-	-	-	27.6	437.1
01-02-03-00	MGM'T ETR	-	-	43.3	686.8	-	-	-	-	-	-	-	-	-	-	43.3	686.8
01-03-00-00	INFO MGM'T	-	-	281.4	4464.3	-	-	-	-	-	-	-	-	-	-	281.4	4464.3
02-00-00-00	SYSTEMS ENG & INTEG.	1559.9	28746.9	141.7	2247.7	-	-	-	-	115.1	2273.4	17.7	340.3	-	12023.5	1834.4	45631.7
02-04-00-00	SUSTG. ENG	1559.9	28746.9	141.7	2247.7	-	-	-	-	115.1	2273.4	17.7	340.3	-	12023.5	1834.4	45631.7
S3-00-00-00	SPARES VEH M.S	-	-	-	-	-	-	-	-	-	-	-	-	-	13922.9	-	13922.9
S3-S1-00-00	SPARES STRUCT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

___ DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
S3-S2-00-00	SPARES THERMAL	-	-	-	-	-	-	-	-	-	-	-	-	-	142.4	-	142.4
S3-S3-00-00	SPARES AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	9306.3	-	9306.3
S3-S4-00-00	SPARES PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	4474.2	-	4474.2
S3-S5-00-00	SPARES ORB INTEM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S4-00-00-00	SPARES KICK STAGES	-	-	-	-	-	-	-	-	-	-	-	-	-	1736.5	-	1736.5
S4-S3-S3-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	1374.3	-	1374.3
S4-S4-00-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	362.2	-	362.2
05-00-00-00	LOGISTICS	245.3	4519.7	-	-	-	-	-	-	41.9	586.4	65.5	694.1	-	10.3	352.6	5810.4
05-01-00-00	TRANS & HANDL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05-02-00-00	TRAINING	178.8	3295.7	-	-	-	-	-	-	-	-	-	-	-	10.3	178.8	3306.0
05-02-01-00	SIMULATORS & EQUIP	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	-	10.3
05-02-02-00	GND CREW	29.3	539.5	-	-	-	-	-	-	-	-	-	-	-	-	29.3	539.5
05-02-03-00	FLT OPS CREW NASA	88.6	1632.0	-	-	-	-	-	-	-	-	-	-	-	-	88.6	1632.0
05-02-04-00	FLT OPS CREW DOD	61.0	1124.2	-	-	-	-	-	-	-	-	-	-	-	-	61.0	1124.2
05-03-00-00	INVENTORY CONT & WAREHS	66.4	1224.0	-	-	-	-	-	-	41.9	586.4	65.5	694.1	-	-	173.8	2504.4
05-03-01-00	INVENTORY CONT ETR	66.4	1224.0	-	-	-	-	-	-	23.6	312.4	47.2	420.1	-	-	137.3	1956.4

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
05-03-02-00	INVENTORY CONT WTR	-	-	-	-	-	-	-	-	18.2	274.0	18.2	274.0	-	-	36.5	548.0
06-00-00-00	FACILITIES	-	-	-	-	-	-	-	-	43.7	593.6	172.2	2339.3	-	1209.0	215.9	4141.9
06-01-02-00	MANUF MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-03-02-00	ETR MAINT & REFURB	-	-	-	-	-	-	-	-	35.1	464.3	137.8	1822.2	-	674.0	172.9	2960.5
06-04-02-00	ETR LAUNCH MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-05-02-00	WTR MAINT & REFURB	-	-	-	-	-	-	-	-	8.6	129.3	34.4	517.1	-	535.0	43.0	1181.4
06-06-02-00	WTR LAUNCH MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-00-00-00	GROUND SUP EQUIP	174.0	3206.5	37.4	593.1	-	-	-	-	31.5	431.4	126.0	1725.8	-	1883.0	368.8	7839.8
07-01-00-00	MANUF GSE	39.4	725.3	-	-	-	-	-	-	-	-	-	-	-	-	39.4	725.3
07-01-03-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-01-04-00	SOFTWARE	39.4	725.3	-	-	-	-	-	-	-	-	-	-	-	-	39.4	725.3
07-02-00-00	ETR GSE	59.0	1088.0	-	-	-	-	-	-	23.1	305.8	92.5	1223.5	-	423.0	174.7	3040.3
07-02-03-00	MAINT	-	-	-	-	-	-	-	-	23.1	305.8	92.5	1223.5	-	423.0	115.6	1952.3
07-02-04-00	SOFTWARE	59.0	1087.9	-	-	-	-	-	-	-	-	-	-	-	-	59.0	1087.9
07-03-00-00	WTR GSE	-	-	-	-	-	-	-	-	8.4	125.6	33.5	502.3	-	143.9	41.8	771.8
07-03-03-00	MAINT	-	-	-	-	-	-	-	-	8.4	125.6	33.5	502.3	-	143.9	41.8	771.8

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07-03-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-04-00-00	FLT OPS CONT NASA	38.7	713.1	21.6	343.4	–	–	–	–	–	–	–	–	–	521.3	60.3	1577.8
07-04-03-00	MAINT	38.7	713.1	–	–	–	–	–	–	–	–	–	–	–	492.5	38.7	1205.6
07-04-04-00	SOFTWARE	–	–	21.6	343.4	–	–	–	–	–	–	–	–	–	28.8	21.6	372.2
07-05-00-00	FLT OPS CONT DOD	36.9	680.1	15.7	249.7	–	–	–	–	–	–	–	–	–	794.8	52.6	1724.6
07-05-03-00	MAINT	36.9	680.1	–	–	–	–	–	–	–	–	–	–	–	745.3	36.9	1425.4
07-05-04-00	SOFTWARE	–	–	15.7	249.7	–	–	–	–	–	–	–	–	–	49.4	15.7	299.2
09-00-00-00	LAUNCH OPS WTR	8.5	128.1	–	–	–	–	–	–	82.5	1382.5	302.5	5053.3	–	5480.5	393.5	12044.4
09-01-00-00	LAUNCH SITE PROC	–	–	–	–	–	–	–	–	30.4	599.9	121.5	2336.5	–	–	151.9	2936.4
09-01-00-00	LAUNCH SITE SERV/SUPT	–	–	–	–	–	–	–	–	12.9	194.0	51.7	776.3	–	–	64.6	970.3
09-02-00-00	TUG/SHUTTLE MATING &C/O	1.5	22.2	–	–	–	–	–	–	8.4	125.6	27.9	418.6	–	–	37.7	566.4
09-03-00-00	PRELAUNCH C/O	2.8	41.9	–	–	–	–	–	–	12.6	189.6	41.7	625.5	–	–	51.7	857.0
09-04-00-00	COUNTDOWN	1.5	22.2	–	–	–	–	–	–	5.6	83.7	18.0	270.8	–	–	25.1	376.7
09-05-00-00	PROPELLANTS & GASSES	–	–	–	–	–	–	–	–	–	–	–	–	–	5480.5	–	5480.5
09-06-00-00	POST FLT SAFING	2.8	41.9	–	–	–	–	–	–	12.6	189.6	41.7	625.5	–	–	57.1	857.0
10-00-00-00	LAUNCH OPS ETR	11.5	151.9	–	–	–	–	–	–	184.7	2442.7	778.3	10931.5	–	12000.0	974.5	25526.1

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 1

___ DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
10-01-00-00	LAUNCH SITE SERV & SUPL	–	–	–	–	–	–	–	–	97.3	1286.5	466.2	6803.6	–	–	563.5	8090.1
10-01-01-00	DENVER C/O PROCED	–	–	–	–	–	–	–	–	–	–	106.1	2040.1	–	–	106.1	2040.1
10-01-01-00	ETR C/O PROCED	–	–	–	–	–	–	–	–	40.5	535.9	133.2	1761.4	–	–	173.7	2297.2
10-01-02-00	ETR C/O SERV & SUPT	–	–	–	–	–	–	–	–	56.7	750.6	227.0	3002.2	–	–	283.7	3752.8
10-02-00-00	TUG/SHUTTLE MATE & C/O	2.0	26.0	–	–	–	–	–	–	18.9	249.5	66.3	876.3	–	–	87.1	1151.9
10-03-00-00	PRELAUNCH C/O	3.8	49.9	–	–	–	–	–	–	28.5	377.4	102.0	1349.2	–	–	134.4	1776.5
10-04-00-00	COUNTDOWN	2.0	26.0	–	–	–	–	–	–	11.5	151.9	41.8	553.2	–	–	55.3	731.1
10-05-00-00	GASSES & PROPELLANTS	–	–	–	–	–	–	–	–	–	–	–	–	–	12000.0	–	12000.0
10-06-00-00	POST FLT SAFING	3.8	49.9	–	–	–	–	–	–	28.5	377.4	102.0	1349.2	–	–	134.3	1776.5
11-00-00-00	FLT OPS DOD	650.9	10498.8	–	–	–	–	–	–	–	–	–	–	–	3203.8	650.9	13702.6
11-01-00-00	MISSION PLANNING	177.1	3264.0	–	–	–	–	–	–	–	–	–	–	–	2669.8	177.1	5933.8
11-02-00-00	FLT CONT	438.4	6582.0	–	–	–	–	–	–	–	–	–	–	–	–	438.4	6582.0
11-03-00-00	FLT EVAL	35.4	652.8	–	–	–	–	–	–	–	–	–	–	–	534.0	35.4	1186.8
11-04-00-00	FLT SUP SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12-00-00-00	FLT OPS NASA	882.5	13153.3	–	–	–	–	–	–	–	–	–	–	–	4063.6	882.5	17216.9
12-01-00-00	MISSION PLANNING	195.2	3596.5	–	–	–	–	–	–	–	–	–	–	–	2941.7	195.2	6538.2

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 1

CONTRACT NO.

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
12-01-01-00	DATA MGMT SOFTW DELTA	50.5	930.8	–	–	–	–	–	–	–	–	–	–	–	533.6	50.5	1464.4
12-02-00-00	FLT CONT	597.8	7906.7	–	–	–	–	–	–	–	–	–	–	–	–	597.8	7906.7
12-03-00-00	FLT EVAL	39.0	719.3	–	–	–	–	–	–	–	–	–	–	–	588.3	39.0	1307.6
12-04-00-00	FLT SUP SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13-00-00-00	REFURB & INTEG WTR	9.8	146.5	–	–	–	–	–	–	60.0	901.3	589.7	8854.7	–	14303.8	659.5	24206.4
13-01-00-00	SCHD MAINT & REFURB	2.8	41.9	–	–	–	–	–	–	15.4	231.5	48.7	731.3	–	1097.3	66.9	2102.0
13-02-00-00	UNSCHD MAINT & REPAIR	1.4	20.9	–	–	–	–	–	–	8.4	125.6	23.7	355.8	–	13206.5	33.5	13708.8
13-03-00-00	POST MAINT C/O	1.4	20.9	–	–	–	–	–	–	11.1	167.4	34.8	523.3	–	–	47.4	711.6
13-04-00-00	TUG P/L MATING & C/O	4.2	62.8	–	–	–	–	–	–	25.1	376.7	81.0	1216.4	–	–	110.3	1655.9
13-05-00-00	REFURB RQMT PLANNING	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13-06-00-00	DEPOT MAINT	–	–	–	–	–	–	–	–	–	–	401.5	6028.0	–	–	401.5	6028.0
14-00-00-00	REFURB & INTEG ETR	12.6	167.0	–	–	–	–	–	–	136.8	1809.1	1382.0	18280.0	–	29389.8	1531.4	49645.9
14-01-00-00	SCHD MAINT & REFURB	3.6	47.7	–	–	–	–	–	–	35.9	475.0	120.7	1596.7	–	2442.4	160.2	4561.9
14-02-00-00	UNSCHD MAINT & REPAIR	1.8	23.9	–	–	–	–	–	–	18.0	238.6	60.4	798.3	–	26947.3	80.2	28008.2
14-03-00-00	POST MAINT C/O	1.8	23.9	–	–	–	–	–	–	26.2	347.0	90.2	1193.1	–	–	118.2	1563.9
14-04-00-00	TUG P/L MATING & C/O	5.4	71.6	–	–	–	–	–	–	56.6	748.4	205.5	2717.9	–	–	267.5	3537.9

STUDY TITLE SPACE TUG

CONTRACT NO.

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OPTION 1

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
14-05-00-00	REFURB RQMT PLANNING	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14-06-00-00	DEPOT MAINT	-	-	-	-	-	-	-	-	-	-	905.3	119740	-	-	905.3	119740
TOTAL OPERATIONS		3625.8	62024.4	1209.5	19187.0	-	-	-	-	723.7	10964.5	3475.2	49013.6	-	101020.0	9034.3	242209.6
TOTAL PROGRAM		8369.7	149352.8	2455.6	38953.3	873.9	17420.2	3630.5	62557.3	2213.4	40045.4	4764.2	73050.9	-	263748.1	22307.3	645128.0

OPERATIONS

OPTION 2

STUDY TITLE Space Tug

CONTRACT NO.

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APPENDIX A

OPTION 2

DDT&E ___ PRODUCTION ___ ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
32 C	OPERATIONS	2880.3	49555.3	987.4	15663.9	–	–	36.9	488.1	792.2	11400.0	3221.7	45789.0	–	110768.8	7918.6	233665.1
01-00-00-00	Prog Mgmt Cost	39.4	725.3	654.9	10388.0	–	–	–	–	11.8	233.2	17.7	340.5	–	1539.5	723.7	13226.6
01-01-00-00	Prog Mgmt	39.4	725.3	396.1	6282.7	–	–	–	–	11.8	233.2	17.7	340.5		1539.5	464.9	9121.3
01-01-01-00	MGMT DEN	39.4	725.3	182.0	2887.7	–	–	–	–	11.8	233.2	17.7	340.5	–	1539.5	250.9	5726.3
01-01-02-00	MGMT WTR	–	–	99.9	1584.3	–	–	–	–	–	–	–	–	–	–	99.9	1584.3
01-01-03-00	MGMT ETR	–	–	114.1	1810.7	–	–	–	–	–	–	–	–	–	–	114.1	1810.7
01-02-00-00	Prog DIR	–	–	106.3	1685.8	–	–	–	–	–	–	–	–	–	–	106.3	1685.8
01-02-01-00	MGMT DEN	–	–	49.2	780.5	–	–	–	–	–	–	–	–	–	–	49.2	780.5
01-02-02-00	MGMT WTR	–	–	28.5	452.7	–	–	–	–	–	–	–	–	–	–	28.5	452.7
01-02-03-00	MGMT ETR	–	–	28.5	452.7	–	–	–	–	–	–	–	–	–	–	28.5	452.7
01-03-00-00	INFO MGMT	–	–	152.5	2419.4	–	–	–	–	–	–	–	–	–	–	152.5	2419.4
02-00-00-00	SYSTEMS ENG & INTG	1189.4	21826.6	305.0	4838.9	–	–	–	–	64.0	1263.0	9.8	189.2	–	8079.7	1563.2	36197.4
02-04-00-00	SYS ENG	1189.4	21826.6	305.0	4838.9	–	–	–	–	64.0	1263.0	9.8	189.2	–	8079.7	1563.2	36197.4
S3-00-00-00	SPARES VOL M.S.	–	–	–	–	–	–	–	–	–	–	–	–	–	17411.4	–	17411.4
S3-S1-00-00	SPARES SPECIFIC	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

STUDY TITLE SPACE TUG

CONTRACT NO.

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OPTION 2

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
S3-S2-00-00	SPARES THERMAL	-	-	-	-	-	-	-	-	-	-	-	-	-	142.8	-	142.8
S3-S3-00-00	SPARES AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	12634.4	-	12634.4
S3-S4-00-00	SPARES PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	4634.2	-	4634.2
S3-S5-00-00	SPARES [illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3-S6-00-00	SPARES [illegible]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S4-00-00-00	SPARES [illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	1507.5	-	1507.5
S4-S3-00-00	SPARES AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	1145.3	-	1145.3
S4-S4-00-00	SPARES PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	362.2	-	362.2
05-00-00-00	[illegible]	185.5	3418.2	-	-	-	-	-	-	30.9	434.6	61.7	869.2	-	10.3	278.1	4732.3
05-01-00-00	TRANS [illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	-
05-02-00-00	TRANS [illegible]	142.7	2629.3	-	-	-	-	-	-	-	-	-	-	-	10.3	142.7	2639.6
05-02-[illegible]	TRANS [illegible] COMP	-		-	-	-	-	-	-	-	-	-	-	-	10.3	-	10.3
05-02-[illegible]	[illegible]	7.9	145.1	-	-	-	-	-	-	-	-	-	-	-	-	7.9	145.1
05-02-02-[illegible]	[illegible]	67.4	1242.1	-	-	-	-	-	-	-	-	-	-	-	-	67.4	1242.1
05-02-04-[illegible]	[illegible]	67.4	1242.1	-	-	-	-	-	-	-	-	-	-	-	-	67.4	1242.1
05-03-00-00	[illegible]	42.8	738.8	-	-	-	-	-	-	30.9	434.6	61.7	869.2	-	-	135.4	2092.6

STUDY TITLE [illegible]

CONTRACT NO.

VOLUME 8.0
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OPTION 2

DDT&E ___ PRODUCTION ___ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
05-03-01-00	INVENTORY PNT ETR	42.8	768.8	-	-	-	-	-	-	16.1	213.0	32.2	426.0	-	-	91.1	1427.8
05-03-02-00	INVENTORY PNT WTR	-	-	-	-	-	-	-	-	14.8	221.6	29.5	443.2	-	-	44.3	664.8
06-00-00-00	FACILITIES	-	-	-	-	-	-	-	-	37.1	519.5	148.6	2077.9	-	1209.0	185.7	3806.4
06-01-02-00	MANUF MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-02-02-00	ETR MAINT & REFURB	-	-	-	-	-	-	-	-	21.4	283.1	85.6	1132.3	-	674.0	107.0	2089.4
06-04-02-00	ETR LAUNCH MAINT	-	-	-	-	-	-	-	-	-	-			-	-	-	-
06-05-02-00	WTR MAINT & REFURB	-	-	-	-	-	-	-	-	15.7	236.4	63.0	945.6	-	535.0	78.7	1717.0
06-06-02-00	WTR LAUNCH MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-00-00-00	GND SUP EQUIP	117.6	2166.9	27.6	437.1	-	-	-	-	27.1	381.7	108.2	1526.7	-	1972.2	280.4	6484.5
07-01-00-00	MAINT GSE	27.6	507.7	-	-	-	-	-	-	-	-	-	-	-	-	27.6	507.7
07-01-02-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-01-04-00	SOFTWARE	27.6	507.7	-	-	-	-	-	-	-	-	-	-	-	-	27.6	507.7
07-02-00-00	ETR GSE	41.3	761.6	-	-	-	-	-	-	13.8	182.2	55.1	728.9	-	723.9	110.2	2396.6
07-02-02-00	MAINT	-	-	-	-	-	-	-	-	13.8	182.2	55.1	728.9	-	723.9	68.9	1634.9
07-02-04-00	SOFTWARE	41.3	761.6	-	-	-	-	-	-	-	-	-	-	-	-	41.3	761.6
07-03-00-00	WTR GSE	-	-	-	-	-	-	-	-	13.3	199.5	53.1	797.8	-	246.1	66.4	1243.9

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
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OPTION 2

DDT&E PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07.03	MAIN	–	–	–	–	–	–	–	–	13.3	199.5	53.1	797.8	–	246.1	66.4	1243.4
07	SOFTWARE	–	–	–	–	–	–			–	–	–	–	–	–	–	–
07	FLT OPS	24.9	459.4	13.8	218.5	–	–	–	–	–	–		–	–	331.7	38.7	1009.6
07	[illegible]	24.9	459.9	–	–	–	–	–	–	–	–	–	–	–	313.4	24.9	772.8
07	SOFTWARE	–	–	13.8	218.5	–	–	–	–	–	–	–	–	–	18.3	13.8	236.8
07	FLT OPS	23.8	438.2	13.8	218.5	–	–	–	–	–	–	–	–	–	670.5	37.6	1327.2
07	MAINT	23.8	438.2	–	–	–	–	–	–	–	–	–	–	–	652.2	23.8	1090.4
07	SOFTWARE	–	–	13.8	218.5	–	–	–		–	–	–	–	–	18.3	13.8	236.8
09	LAUNCH	7.2	108.3	–	–	–	–	–	–	106.8	1603.0	456.9	7111.7	–	7810.0	570.9	16633.1
09.01	[illegible]	–	–	–	–	–	–	–	–	–	–	59.7	1147.8	–	–	59.7	1147.8
09.01	[illegible]	–	–	–	–	–	–	–	–	25.7	386.6	83.5	1253.4	–	–	109.2	1640.0
09.01	[illegible]	–	–	–	–	–	–	–	–	27.5	413.7	110.2	1654.7	–	–	137.3	2068.4
09.0	[illegible]	1.3	19.7	–	–	–	–	–	–	11.6	174.8	40.7	610.7	–	–	53.6	805.2
09.0	[illegible]	2.3	34.5	–	–	–	–	–	–	16.2	243.8	74.9	1125.3	–	–	93.5	1403.6
09.04	[illegible]	1.3	19.7	–	–	–	–	–	–	7.2	108.3	25.6	384.1	–	–	34.1	512.2
09.05	[illegible]	–	–	–	–	–	–	–	–	–	–	–	–	–	7810.0	–	7810.0
09.06	POST FLT SAFING	2.3	34.5	–	–	–	–	–	–	18.4	275.8	62.3	935.7	–	–	83.0	1246.0

STUDY TITLE [illegible]

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

DDT&E PRODUCTION OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
10-00-00-00	LAUNCH OPS. ETR	11.0	145.3	-	-	-	-	36.9	488.1	277.7	3672.5	553.0	7708.2	-	13490.0	878.5	25504.1
10-01-00-00	LAUNCH OPS [illegible]	-	-	-	-	-	-	36.9	488.1	187.1	2475.1	172.7	2677.8	-	-	396.7	5640.9
10-01-01-00	DENVER [illegible]	-	-	-	-	-	-	-	-	-	-	65.6	1261.3	-	-	65.6	1261.3
10-01-01-00	ETR C/O [illegible]	-	-	-	-	-	-	-	-	39.5	522.8	107.1	1416.5	-	-	146.6	1939.3
10-01-02-00	ETR C/O [illegible] SUP	-	-	-	-	-	-	36.9	488.1	147.6	1952.3	-	-	-	-	184.5	2440.4
10-02-00-00	TOOLING MAT'L C/O	2.5	32.5	-	-	-	-	-	-	12.6	167.0	88.2	1167.0	-	-	103.3	1366.6
10-03-00-00	PRELAUNCH C/O	3.6	47.7	-	-	-	-	-	-	31.5	416.5	120.2	1590.0	-	-	155.3	2054.2
10-04-00-00	[illegible]	1.3	17.4	-	-	-	-	-	-	14.9	197.4	51.7	683.3	-	-	67.9	898.1
10-05-00-00	GASSES & [illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	13490.0	-	13490.0
10-06-00-00	POST FLT STAFFING	3.6	47.7	-	-	-	-	-	-	31.5	416.5	120.2	1590.0	-	-	155.3	2054.2
11-00-00-00	FLT OPS DOD	605.9	9851.1	-	-	-	-	-	-	-	-	-	-	-	3326.0	605.9	13177.0
11-01-00-00	MISSION PLANNING	183.9	3388.7	-	-	-	-	-	-	-	-	-	-	-	2771.7	183.9	6160.4
11-02-00-00	FLT CONT	385.2	5784.2	-	-	-	-	-	-	-	-	-	-	-	-	385.2	5784.2
11-03-00-00	FLT EVAL	36.8	678.2	-	-	-	-	-	-	-	-	-	-	-	554.2	36.8	1232.4
11-04-00-00	FLT SUP SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12-00-00-00	FLT OPS NASA	702.5	10941.9	-	-	-	-	-	-	-	-	-	-	-	4553.6	702.5	15495.6

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 2

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
12-01-00-00	MISSION PLANNING	222.3	4095.9	-	-	-	-	-	-	-	-	-	-	-	3350.2	222.3	7446.1
12-01-01-00	DATA MGMT [illegible]	50.5	930.8	-	-	-	-	-	-	-	-	-	-	-	533.6	50.5	1464.4
12-02-00-00	FLT CONT	385.2	5095.5	-	-	-	-	-	-	-	-	-	-	-	-	385.2	5095.5
12-03-00-00	FLT EVAL	44.5	819.7	-	-	-	-	-	-	-	-	-	-	-	669.9	44.5	1489.6
12-04-00-00	FLT SUP SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13-00-00-00	REFURB & [illegible]	8.9	133.0	-	-	-	-	-	-	88.4	1327.2	720.8	10822.3	-	17574.1	818.0	29856.6
13-01-00-00	SOLID MAINT & [illegible]	2.5	36.9	-	-	-	-	-	-	22.8	342.3	73.8	1108.1	-	1131.9	99.1	2619.2
13-02-00-00	UNSOLID MAINT & [illegible]	1.3	19.7	-	-	-	-	-	-	12.1	182.2	36.7	551.6	-	16442.2	50.2	17195.7
13-03-00-00	[illegible] MAINT CYO	1.3	19.7	-	-	-	-	-	-	16.9	253.6	55.3	829.8	-	-	73.5	1103.2
13-04-00-00	[illegible]	3.8	56.6	-	-	-	-	-	-	36.6	549.1	125.9	1891.1	-	-	166.3	2496.9
13-05-00-00	[illegible] PLANNING	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13-06-00-00	DEPOT MAINT	-			-	-	-	-	-	-	-	429.0	6441.7	-	-	429.0	6441.7
14-00-00-00	[illegible]	18.0	238.6	-	-	-	-	-	-	148.6	1965.3	1144.9	15143.3	-	32285.5	1311.5	49632.7
14-01-00-00	SOLID MAINT & [illegible]	4.8	62.9	-	-	-	-	-	-	37.6	496.7	139.7	1848.2	-	1927.2	182.0	4335.0
14-02-00-00	UNSOLID MAINT & [illegible]	2.5	32.5	-	-	-	-	-	-	19.7	260.3	70.4	930.6	-	30358.3	92.5	31581.7
14-03-00-00	FEST MAINT CYO	3.6	47.7	-	-	-	-	-	-	27.1	357.9	102.5	1355.8	-	-	133.2	1761.4

STUDY TITLE SPACE TUG

CONTRACT NO.

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OPTION 2

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
14-04-00-00	TUG FA[illegible]	7.2	95.4	–	–	–	–	–	–	64.3	850.3	239.9	3173.6	–	–	311.4	4119.3
14-05-00-00	[illegible]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
14-06-00-00	DEPOT MAINT	–	–	–	–	–	–	–	–	–	–	592.4	7835.2	–	–	592.4	7835.2
TOTAL OPERATIONS		2880.3	49555.3	987.4	15663.9	–	–	36.9	488.1	792.2	11400.0	3221.7	45789.0	–	110768.8	7918.6	233665.1
TOTAL PROGRAM		7960.8	143034.8	2347.7	37241.2	821.8	16426.6	3516.8	60428.4	2237.6	39735.5	4494.9	69920.3	–	333725.1	21379.5	700511.9

OPERATIONS

OPTION 3

STUDY TITLE SPACE [illegible]

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OPTION 3

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
32 C	OPERATIONS	4105.4	70703.1	1161.6	18426.8	–	–	54.1	715.8	1134.2	16337.9	44024	62137.5	–	47991.0	10857.8	318312.3
01-00-00-00	Prog Mgt	63.0	1160.5	982.5	15585.9	–	–	–	–	27.6	544.1	41.3	794.6	–	1927.8	1114.4	20012.9
01-01-00-00	Cost Prog Mgt	63.0	1160.5	583.0	9248.5	–	–	–	–	27.6	544.1	41.3	794.6	–	1927.8	714.9	13675.5
01-01-00	Mgt Dev	63.0	1160.5	292.2	4636.0	–	–	–	–	27.5	544.1	41.3	794.6	–	1927.8	424.1	9063.0
01-01-02-00	Mgt-WTR	–	–	113.7	1802.9	–	–	–	–	–	–	–	–	–	–	113.7	1802.9
01-01-03-00	Mgt-FTR	–	–	177.1	2809.7	–	–	–	–	–	–	–	–	–	–	177.1	2809.7
01-02-00-00	Prog Dlg	–	–	155.5	2466.3	–	–	–	–	–	–	–	–	–	–	155.5	2466.3
01-02-01-00	Mgt Dev	–	–	78.7	1248.7	–	–	–	–	–	–	–	–	–	–	78.7	1248.7
01-02-02-00	Mgt-WTR	–	–	32.5	515.1	–	–	–	–	–	–	–	–	–	–	32.5	515.1
01-02-03-00	Mgt-FTR	–	–	44.3	702.4	–	–	–	–	–	–	–	–	–	–	44.3	702.4
01-03-00-00	Tech Mgt	–	–	244.0	3871.1	–	–	–	–	–	–	–	–	–	–	244.0	3871.1
02-00-00-00	SYSTEMS ENGINEERING	1788.3	32954.5	141.7	2247.7	–	–	–	–	102.3	2020.8	15.7	302.7	–	11781.2	2048.0	49307.0
02-04-00-00	Sys Eng	1788.3	32954.5	141.7	2247.7	–	–	–	–	102.3	2020.8	15.7	302.7	–	11781.2	2048.0	49307.0
03-00-00-00	SPARES MANAGEMENT	–	–	–	–	–	–	–	–	–	–	–	–	–	19649.7	–	19649.7
03-01-00-00	SPARES	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

STUDY TITLE Space Tug

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OPTION 3

___ DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS
S3-S2-00-00	SPARES THERMAL	-	-	-	-	-	-	-	-	-	-	-	-	-	142.8	-	142.8
S3-S3-00-00	SPARES AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	13916.1	-	13916.1
S3-S4-00-00	SPARES PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	5590.8	-	5590.8
S3-S5-00-00	SPARES [illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3-S6-00-00	SPARES [illegible]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S4-00-00-00	SPARES KCK STAGES	-	-	-	-	-	-	-	-	-	-	-	-	-	1736.5	-	1736.5
S4-S3-S3-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	1374.3	-	1374.3
S4-S4-00-00	SPARES	-	-	-	-	-	-	-	-	-	-	-	-	-	362.2	-	362.2
05-00-00-00	[illegible]	245.5	4524.3	-	-	-	-	-	-	39.4	550.5	78.7	1101.0	-	10.3	363.6	6186.1
05-01-00-00	TRANS [illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05-02-00-00	TRAINING	179.1	3300.3	-	-	-	-	-	-	-	-	-	-	-	10.3	179.1	3310.6
05-02-01-00	[illegible]	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	-	10.3
05-02-02-00	[illegible]	29.5	544.0	-	-	-	-	-	-	-	-	-	-	-	-	29.5	544.0
05-02-03-00	[illegible]	74.8	1378.1	-	-	-	-	-	-	-	-	-	-	-	-	74.8	1378.1
05-02-04-00	[illegible]	74.8	1378.1	-	-	-	-	-	-	-	-	-	-	-	-	74.8	1378.1
05-03-00-00	[illegible]	66.4	1224.0	-	-	-	-	-	-	39.4	550.5	78.7	1101.0	-	-	184.5	2875.6

STUDY TITLE [illegible]

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 9

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
05-03-01-00	INVENTORY OUT ETR	66.4	1224.0	-	-	-	-	-	-	22.6	299.4	45.3	598.7	-	-	134.3	2122.1
05-03-02-00	INVENTORY OUT WTR	-	-	-	-	-	-	-	-	16.7	251.2	33.5	502.3	-	-	50.2	753.5
06-00-00-00	FACILITIES	-	-	-	-	-	-	-	-	38.4	537.5	153.4	2150.0	-	1209.0	191.9	3896.5
06-01-02-00	MANUF MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-03-02-00	ETR MAINT & [illegible]	-	-	-	-	-	-	-	-	21.6	286.3	86.6	1145.3	-	674.0	108.2	2105.7
06-04-02-00	ETR LAUNCH MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-05-02-00	WTR MAINT & [illegible]	-	-	-	-	-	-	-	-	16.7	251.2	66.9	1004.7	-	535.0	83.6	1790.8
06-06-02-00	WTR LAUNCH MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-00-00-00	GND SUP EQUIP	156.3	2880.2	37.4	593.2	-	-	-	-	38.9	544.0	155.5	2176.0	-	2286.1	388.0	8479.5
07-01-00-00	MANUF GSE	31.5	580.3	-	-	-	-	-	-	-	-	-	-	-	-	31.5	580.3
07-01-03-00	MAINT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-01-04-00	SOFTWARE	31.5	580.3	-	-	-	-	-	-	-	-	-	-	-	-	31.5	5803
07-02-00-00	ETR GSE	59.0	1088.0	-	-	-	-	-	-	22.1	292.8	88.6	1171.4	-	723.9	169.7	3276.1
07-02-03-00	MAINT	-	-	-	-	-	-	-	-	22.1	292.8	88.6	1171.4	-	723.9	110.7	2188.1
07-02-04-00	SOFTWARE	59.0	1088.0	-	-	-	-	-	-	-	-	-	-	-	-	59.0	1088.0
07-03-00-00	WTR GSE	-	-	-	-	-	-	-	-	16.7	251.2	66.9	1004.7	-	246.1	83.6	1501.9

STUDY TITLE SPACE TUG

CONTRACT NO.

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OPTION 3

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
07-03-03-00	MAINT	-	-	-	-	-	-	-	-	16.7	251.2	66.9	1004.7	-	246.1	83.6	1501.9
07-03-04-00	SOFTWARE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07-04-00-00	FLT OPS CONT TASK	38.7	713.2	21.6	343.4	-	-	-	-	-	-	-	-	-	521.3	60.4	1577.9
07-04-03-00	MAINT	38.7	713.2	-	-	-	-	-	-	-	-	-	-	-	492.5	38.7	1205.7
07-04-04-00	SOFTWARE	-	-	21.6	343.4	-	-	-	-	-	-	-	-	-	28.8	21.6	372.2
07-05-00-00	FLT OPS CONT DEV	27.1	498.7	15.7	249.7	-	-	-	-	-	-	-	-	-	794.8	42.8	1543.2
07-05-03-00	MAINT	27.1	498.7	-	-	-	-	-	-	-	-	-	-	-	745.4	27.1	1244.0
07-05-04-00	SOFTWARE	-	-	15.7	249.7	-	-	-	-	-	-	-	-	-	49.4	15.7	299.2
09-00-00-00	LAUNCH OPS MTR	8.5	128.0	-	-	-	-	-	-	120.9	1814.8	506.6	7922.1	-	9840.0	636.0	19704.9
09-01-00-00	LAUNCH SITE DEVELOPMENT	-	-	-	-	-	-	-	-	-	-	74.9	1441.0	-	-	74.9	1441.0
09-01-00-00	LAUNCH SITE [illegible]	-	-	-	-	-	-	-	-	30.8	462.9	100.4	1507.0	-	-	131.2	1968.9
09-01-00-00	LAUNCH SITE [illegible]/SUP	-	-	-	-	-	-	-	-	25.1	376.7	100.4	1507.0	-	-	125.5	1883.7
09-02-00-00	TUG/SHUTTLE [illegible] C/O	1.5	22.2	-	-	-	-	-	-	13.9	209.3	49.0	736.3	-	-	64.4	967.7
09-03-00-00	PRELAUNCH C/O	2.8	41.9	-	-	-	-	-	-	21.2	317.6	75.4	1132.7	-	-	99.4	1492.2
09-04-00-00	COUNTDOWN	1.5	22.2	-	-	-	-	-	-	8.7	130.5	31.0	465.4	-	-	41.2	618.1
09-05-00-00	PROPELLANTS & GAS	-	-	-	-	-	-	-	-	-	-	-	-	-	9840.0	-	9840.0
09-06-00-00	POST FLT SAFING	2.8	41.9	-	-	-	-	-	-	21.2	317.6	75.4	1132.7	-	-	99.4	1492.2

STUDY TITLE Space Tug

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3

SUBDIVISIONS OF WORK: DDT&E | PRODUCTION | ✓ OPERATIONS

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS
10-00-00-00	LAUNCH OPS ETR	16.9	223.4	–	–	–	–	54.1	715.8	432.6	5722.4	844.3	11762.4	–	19930.0	1347.9	38354.1
10-01-00-00	LAUNCH SITE SERV & SUPP	–	–	–	–	–	–	54.1	715.8	280.4	3709.4	248.8	3886.0	–	–	583.3	8311.2
10-01-01-00	DENVER C/O PROCESSING	–	–	–	–	–	–	–	–	–	–	99.2	1907.7	–	–	99.2	1907.7
10-01-01-00	ETR C/O PERSONNEL	–	–	–	–	–	–	–	–	64.0	846.0	149.6	1978.3	–	–	213.5	2824.3
10-01-02-00	ETR C/O GSE & SUP	–	–	–	–	–	–	54.1	715.8	216.5	2863.4	–	–	–	–	270.6	3579.2
10-02-00-00	TUG/SHUTTLE MATE C/O	3.8	49.9	–	–	–	–	–	–	32.3	427.3	128.2	1696.3	–	–	164.3	2173.6
10-03-00-00	PRELAUNCH C/O	5.6	73.8	–	–	–	–	–	–	47.2	624.7	192.4	2544.5	–	–	245.2	3243.0
10-04-00-00	CERTIFICATION	2.0	26.0	–	–	–	–	–	–	23.5	310.2	82.5	1091.1	–	–	107.9	1427.3
10-05-00-00	GASSING & PROPELLANT	–	–	–	–	–	–	–	–	–	–	–	–	–	19930.0	–	19930.0
10-06-00-00	POST FLT STATUS	5.6	73.8	–	–	–	–	–	–	49.2	650.8	192.4	2544.5	–	–	247.1	3269.0
11-00-00-00	FLT OPS DOD	745.4	12239.7	–	–	–	–	–	–	–	–	–	–	–	4627.6	745.4	16867.3
11-01-00-00	MISSION PLANNING	255.8	4714.7	–	–	–	–	–	–	–	–	–	–	–	3856.4	255.8	8571.1
11-02-00-00	FLT CONT	438.4	6582.0	–	–	–	–	–	–	–	–	–	–	–	–	438.4	6582.0
11-03-00-00	FLT EVAL	51.2	942.9	–	–	–	–	–	–	–	–	–	–	–	771.3	51.2	1714.2
11-04-00-00	FLT SUP SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12-00-00-00	FLT OPS NASA	1034.0	15945.9	–	–	–	–	–	–	–	–	–	–	–	6347.8	1034.0	22293.7

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3

___ DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
12-01-00-00	MISSION PLANNING	321.4	5923.6	–	–	–	–	–	–	–	–	–	–	–	4845.2	321.4	10768.8
12-01-01-00	DATA MGMT OPTW DEPT	50.5	930.8	–	–	–	–	–	–	–	–	–	–	–	533.6	50.5	1464.4
12-02-00-00	FLT CONT	597.8	7906.8	–	–	–	–	–	–	–	–	–	–	–	–	597.8	7906.8
12-03-00-00	FLT EVAL	64.3	1184.7	–	–	–	–	–	–	–	–	–	–	–	969.0	64.3	2153.7
12-04-00-00	FLT SUP [illegible]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13-00-00-00	REFURB & [illegible]	10.0	150.2	–	–	–	–	–	–	102.3	1536.5	810.5	12169.2	–	22653.7	922.8	36509.6
13-01-00-00	SCHD MAINT & REFURB	2.8	41.9	–	–	–	–	–	–	26.6	398.9	89.4	1342.0	–	1319.2	118.7	3101.9
13-02-00-00	UNSCHD MAINT & REFURB	1.5	22.2	–	–	–	–	–	–	13.9	209.3	44.8	672.2	–	21334.5	60.2	22238.2
13-03-00-00	POST MAINT C/O	1.5	22.2	–	–	–	–	–	–	20.0	300.4	67.1	1007.1	–	–	88.6	1329.7
13-04-00-00	[illegible]	4.3	64.0	–	–	–	–	–	–	41.8	627.9	107.4	1612.9	–	–	153.5	2304.8
13-05-00-00	REFURB REQT PLANNING	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13-06-00-00	DEPOT MAINT	–	–	–	–	–	–	–	–	–	–	501.8	7535.0	–	–	501.8	7535.0
14-00-00-00	REFURB & INTEG FTR	37.5	496.3	–	–	–	–	–	–	231.9	3067.3	1796.3	23759.4	–	47991.4	2065.7	75314.3
14-01-00-00	SCHD MAINT & REFURB	7.4	97.6	–	–	–	–	–	–	58.5	774.4	223.0	2950.1	–	2674.2	289.0	6496.4
14-02-00-00	UNSCHD MAINT & REFURB	3.8	49.9	–	–	–	–	–	–	30.8	407.8	112.3	1485.9	–	45317.1	146.9	47260.7
14-03-00-00	POST MAINT C/O	5.6	73.7	–	–	–	–	–	–	42.2	557.5	162.9	2154.0	–	–	210.6	2785.3

STUDY TITLE Space Tug

CONTRACT NO.

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OPTION 3

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
14-04-00-00	TUG P/L MATING C/O	11.1	147.5	–	–	–	–	–	–	100.4	1327.6	382.9	5065.1	–	–	494.5	6540.2
14-05-00-00	REFURBISHMENT PLANNING	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
14-06-00-00	DEPOT MAINT	9.6	127.6	–	–	–	–	–	–	–	–	915.1	12104.2	–	–	924.8	12231.8
TOTAL OPERATIONS		4105.4	70703.1	1161.6	18426.8	–	–	54.1	715.8	1134.2	16337.9	4402.4	62137.5	–	149991.0	10857.8	318312.3
TOTAL PROGRAM		9731.6	174241.0	2718.8	43128.5	947.6	19096.8	4187.9	72142.6	2854.3	50233.6	5837.0	89445.7	–	433050.8	26277.2	881339.0

OPERATIONS

OPTION 3A

STUDY TITLE SPACE TUG

CONTRACT NO.

VOLUME 8.0
APPENDIX A

OPTION 3A

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
32 C	OPERATIONS	4211.8	72682.8	1166.4	18502.2	–	–	54.1	715.8	1183.6	17001.7	4682.9	65946.3	–	147862.7	11298.7	322711.7
01-00-00-00	PROJ MGMT	63.0	1160.5	987.3	15661.3	–	–	–	–	27.6	544.1	41.3	794.6	–	2024.1	1119.1	20184.6
01-01-00-00	COST PERF MGMT	63.0	1160.5	587.8	9323.9	–	–	–	–	27.6	544.1	41.3	794.6	–	2024.1	719.6	13847.3
01-01-01-00	MGMT DEN	63.0	1160.5	297.0	4711.4	–	–	–	–	27.5	544.1	41.3	794.6	–	2024.1	428.9	9234.7
01-01-02-00	MGMT WTR	–	–	113.7	1802.9	–	–	–	–	–	–	–	–	–	–	113.7	1802.9
01-01-03-00	MGMT ETR	–	–	177.1	2809.7	–	–	–	–	–	–	–	–	–	–	177.1	2809.7
01-02-00-00	PROJ DIR	–	–	155.5	2466.3	–	–	–	–	–	–	–	–	–	–	155.5	2466.3
01-02-01-00	MGMT DEN	–	–	78.7	1248.7	–	–	–	–	–	–	–	–	–	–	78.7	1248.7
01-02-02-00	MGMT WTR	–	–	32.5	515.1	–	–	–	–	–	–	–	–	–	–	32.5	515.1
01-02-03-00	MGMT ETR	–	–	44.3	702.4	–	–	–	–	–	–	–	–	–	–	44.3	702.4
01-03-00-00	INFO MGMT	–	–	244.0	3871.1	–	–	–	–	–	–	–	–	–	–	244.0	3871.1
02-00-00-00	SYSTEMS ENG & INTEG	1828.9	33704.0	141.7	2247.7	–	–	–	–	102.3	2020.8	15.7	302.7	–	12013.1	2088.7	50288.5
02-04-00-00	SUSTS ENG	1828.9	33704.0	141.7	2247.7	–	–	–	–	102.3	2020.8	15.7	302.7	–	12013.1	2088.7	50288.5
S3-00-00-00	SPARES VEH M.S.	–	–	–	–	–	–	–	–	–	–	–	–	–	20883.1	–	20883.1
S3-S1-00-00	SPARES STRUCT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3A

CONTRACT NO.

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
S3-S2-00-00	SPARES THERMAL	-	-	-	-	-	-	-	-	-	-	-	-	-	142.8	-	142.8
S3-S3-00-00	SPARES AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	14185.3	-	14185.3
S3-S4-00-00	SPARES PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	5857.5	-	5857.5
S3-S5-00-00	SPARES ORB INTERF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3-S6-00-00	SPARES DROP TANK	-	-	-	-	-	-	-	-	-	-	-	-	-	697.4	-	697.4
S4-00-00-00	SPARES KICK STAGES	-	-	-	-	-	-	-	-	-	-	-	-	-	1736.5	-	1736.5
S4-S3-00-00	SPARES AVIONICS	-	-	-	-	-	-	-	-	-	-	-	-	-	1374.3	-	1374.3
S4-S4-00-00	SPARES PROPULSION	-	-	-	-	-	-	-	-	-	-	-	-	-	362.2	-	362.2
05-00-00-00	LOGISTICS	245.5	4524.3	-	-	-	-	-	-	39.4	550.5	78.7	1101.0	-	10.3	363.6	6186.1
05-01-00-00	TRANS & HANDLING	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05-02-00-00	TRAINING	179.1	3300.3	-	-	-	-	-	-	-	-	-	-	-	10.3	179.1	3310.6
05-02-01-00	SIMULATORS & EQUIP	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	-	10.3
05-02-02-00	GND CREW	29.5	544.0	-	-	-	-	-	-	-	-	-	-	-	-	29.5	544.0
05-02-03-00	FLT OPS CREW NASA	74.8	1378.1	-	-	-	-	-	-	-	-	-	-	-	-	74.8	1378.1
05-02-04-00	FLT OPS CREW DOD	74.8	1378.1	-	-	-	-	-	-	-	-	-	-	-	-	74.8	1378.1
05-03-00-00	INVENTORY CONT & WAREHS	66.4	1224.0	-	-	-	-	-	-	39.4	550.5	78.7	1101.0	-	-	184.5	2875.6

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3A

CONTRACT NO.

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
05-03-01-00	INVENTORY CONT ETR	66.4	1224.0	–	–	–	–	–	–	22.6	299.4	45.3	598.7	–	–	134.3	2122.1
05-03-02-00	INVENTORY CONT WTR	–	–	–	–	–	–	–	–	16.7	251.2	33.5	502.3	–	–	50.2	753.5
06-00-00-00	FACILITIES	–	–	–	–	–	–	–	–	38.4	537.5	153.5	2150.0	–	1209.0	191.9	3896.5
06-01-02-00	MANUF MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
06-03-02-00	ETR MAINT & REFURB	–	–	–	–	–	–	–	–	21.6	286.3	86.6	1145.3	–	674.0	108.2	2105.7
06-04-02-00	ETR LAUNCH MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
06-05-02-00	WTR MAINT & REFURB	–	–	–	–	–	–	–	–	16.7	251.2	66.9	1004.7	–	535.0	83.6	1790.8
06-06-02-00	WTR LAUNCH MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-00-00-00	GND SUP EQUIP	156.3	2880.2	37.4	593.2	–	–	–	–	38.9	544.0	155.5	2176.0	–	2286.1	388.0	8479.5
07-01-00-00	MANUF GSE	31.5	580.3	–	–	–	–	–	–	–	–	–	–	–	–	31.5	580.3
07-01-03-00	MAINT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-01-04-00	SOFTWARE	31.5	580.3	–	–	–	–	–	–	–	–	–	–	–	–	31.5	580.3
07-02-00-00	ETR GSE	59.0	1088.0	–	–	–	–	–	–	22.1	292.8	88.6	1171.4	–	723.9	169.7	3276.1
07-02-03-00	MAINT	–	–	–	–	–	–	–	–	22.1	292.8	88.6	1171.4	–	723.9	110.7	2188.1
07-02-04-00	SOFTWARE	59.0	1088.0	–	–	–	–	–	–	–	–	–	–	–	–	59.0	1088.0
07-03-00-00	WTR GSE	–	–	–	–	–	–	–	–	16.7	251.2	66.9	1004.7	–	246.1	83.6	1501.9

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3A

CONTRACT NO.

___ DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
07-03-03-00	MAINT	–	–	–	–	–	–	–	–	16.7	251.2	66.9	1004.7	–	246.1	83.6	1501.9
07-03-04-00	SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
07-04-00-00	FLT OPS CONT NASA	38.7	713.2	21.6	343.4	–	–	–	–	–	–	–	–	–	521.3	60.4	1577.9
07-04-03-00	MAINT	38.7	713.2	–	–	–	–	–	–	–	–	–	–	–	492.5	38.7	1205.7
07-04-04-00	SOFTWARE	–	–	21.6	343.4	–	–	–	–	–	–	–	–	–	28.8	21.6	372.2
07-05-00-00	FLT OPS CONT DOD	27.1	498.7	15.7	249.7	–	–	–	–	–	–	–	–	–	794.8	42.8	1543.2
07-05-03-00	MAINT	27.1	498.7	–	–	–	–	–	–	–	–	–	–	–	745.4	27.1	1244.0
07-05-04-00	SOFTWARE	–	–	15.7	249.7	–	–	–	–	–	–	–	–	–	49.4	15.7	299.2
09-00-00-00	LAUNCH OPS WTR	8.5	128.0	–	–	–	–	–	–	120.9	1814.8	506.6	7922.1	–	9840.0	636.0	19704.9
09-01-00-00	LAUNCH SITE PROCEDURES	–	–	–	–	–	–	–	–	–	–	74.9	1441.0	–	–	74.9	1441.0
09-01-00-00	LAUNCH SITE C/O PROCEDURE	–	–	–	–	–	–	–	–	30.8	462.9	100.4	1507.0	–	–	131.2	1969.9
09-01-00-00	LAUNCH SITE SERV/SUP	–	–	–	–	–	–	–	–	25.1	376.7	100.4	1507.0	–	–	125.5	1883.7
09-02-00-00	TUG/SHUTTLE MATING & C/O	1.5	22.2	–	–	–	–	–	–	13.9	209.3	49.0	736.3	–	–	64.4	967.7
09-03-00-00	PRELAUNCH C/O	2.8	41.9	–	–	–	–	–	–	21.2	317.6	75.4	1132.7	–	–	99.4	1492.2
09-04-00-00	COUNT DOWN	1.5	22.2	–	–	–	–	–	–	8.7	130.5	31.0	465.4	–	–	41.2	618.1
09-05-00-00	PROPELLANTS & GASSES	–	–	–	–	–	–	–	–	–	–	–	–	–	9840.0	–	9840.0
09-06-00-00	POST FLT SAFING	2.8	41.9	–	–	–	–	–	–	21.2	317.6	75.4	1132.7	–	–	99.4	1492.2

STUDY TITLE SPACE TUG VOLUME 8 U APPENDIX A OPTION 3A

CONTRACT NO.

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS IDENTIFICATION NUMBER	WBS NAME	ENGINEER'G HRS.	ENGINEER'G DLRS.	MANAGEMENT HRS.	MANAGEMENT DLRS.	TOOLING HRS.	TOOLING DLRS.	MANUFACTUR'G HRS.	MANUFACTUR'G DLRS.	QUALITY HRS.	QUALITY DLRS.	TEST HRS.	TEST DLRS.	MAT'L & S/C HRS.	MAT'L & S/C DLRS.	TOTAL HRS.	TOTAL DLRS.
10-00-00-00	LAUNCH OPS ETR	16.9	223.4	–	–	–	–	54.1	715.8	432.6	5722.4	844.3	11762.4	–	19930.0	1347.9	38354.1
10-01-00-00	LAUNCH SITE SERV & SUPL	–	–	–	–	–	–	54.1	715.8	280.4	3709.4	248.8	3886.0	–	–	583.3	8311.2
10-01-01-00	DENVER C/O PROCEDURE	–	–	–	–	–	–	–	–	–	–	99.2	1907.7	–	–	99.2	1907.7
10-01-01-00	ETR C/O PROCEDURES	–	–	–	–	–	–	–	–	64.0	846.0	149.6	1928.3	–	–	213.5	2824.3
10-01-02-00	ETR C/O SERV & SUP	–	–	–	–	–	–	54.1	715.8	216.5	2863.4	–	–	–	–	270.6	3579.2
10-02-00-00	TUG/SHUTTLE MATE & C/O	3.8	49.9	–	–	–	–	–	–	32.3	427.3	128.2	1696.3	–	–	164.3	2173.6
10-03-00-00	PRELAUNCH C/O	5.6	73.8	–	–	–	–	–	–	47.2	624.7	192.4	2544.5	–	–	245.2	3243.0
10-04-00-00	COUNTDOWN	2.0	26.0	–	–	–	–	–	–	23.5	310.2	82.5	1091.1	–	–	107.9	1427.3
10-05-00-00	GASSES & PROPELLANTS	–	–	–	–	–	–	–	–	–	–	–	–	–	19930.0	–	19930.0
10-06-00-00	POST FLT STAFING	5.6	73.8	–	–	–	–	–	–	49.2	650.8	192.4	2544.5	–	–	247.1	3269.0
11-00-00-00	FLT OPS DOD	776.1	12806.0	–	–	–	–	–	–	–	–	–	–	–	5090.3	776.1	17896.3
11-01-00-00	MISSION PLANNING	281.4	5186.2	–	–	–	–	–	–	–	–	–	–	–	4242.0	281.4	9428.2
11-02-00-00	FLT CONT	438.4	6582.0	–	–	–	–	–	–	–	–	–	–	–	–	438.4	6582.0
11-03-00-00	FLT EVAL	56.3	1037.8	–	–	–	–	–	–	–	–	–	–	–	848.3	56.3	1886.1
11-04-00-00	FLT SUP SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12-00-00-00	FLT OPS NASA	1072.6	16657.5	–	–	–	–	–	–	–	–	–	–	–	6929.1	1072.6	23586.6

STUDY TITLE SPACE TUG VOLUME 8.0 APPENDIX A OPTION 3A

CONTRACT NO.

DDT&E ___ PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
12-01-00-00	MISSION PLANNING	353.6	6516.0	–	–	–	–	–	–	–	–	–	–	–	5329.7	353.6	11845.7
12-01-01-00	DATA MGMT SETW DELTA	50.5	930.8	–	–	–	–	–	–	–	–	–	–	–	533.6	50.5	1464.4
12-02-00-00	FLT CONT	597.8	7906.8	–	–	–	–	–	–	–	–	–	–	–	–	597.8	7906.8
12-03-00-00	FLT EVAL	70.8	1303.9	–	–	–	–	–	–	–	–	–	–	–	1065.8	70.8	2369.7
12-04-00-00	FLT SUP SOFTWARE	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13-00-00-00	REFURB & INTEG WTR	10.0	150.2	–	–	–	–	–	–	108.4	1627.7	866.1	13004.0	–	21773.0	984.5	36554.9
13-01-00-00	SCHD MAINT & REFURB	2.8	41.9	–	–	–	–	–	–	28.0	421.1	106.8	1603.0	–	17739	137.6	3839.8
13-02-00-00	UNSCHD MAINT & REFUR	1.5	22.2	–	–	–	–	–	–	14.9	224.1	53.5	802.7	–	19999.2	69.9	21048.1
13-03-00-00	POST MAINT C/O	1.5	22.2	–	–	–	–	–	–	20.0	300.4	76.9	1154.9	–	–	98.4	1477.4
13-04-00-00	TUG P/L MATING & C/O	4.3	64.0	–	–	–	–	–	–	45.4	682.1	182.2	2735.7	–	–	231.9	3481.9
13-05-00-00	REFURB REQT PLANNING	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13-06-00-00	DEPOT MAINT	–	–	–	–	–	–	–	–	–	–	446.7	6706.7	–	–	446.7	6706.7
14-00-00-00	REFURB & INTEG ETR	33.9	448.6	–	–	–	–	–	–	275.2	3639.9	2021.1	26733.4	–	44138.3	2330.2	74960.2
14-01-00-00	SCHD MAINT & REFURB	3.8	49.9	–	–	–	–	–	–	66.9	885.0	281.6	3724.5	–	3595.6	352.3	8255.1
14-02-00-00	UNSCHD MAINT & REFUR	3.8	49.9	–	–	–	–	–	–	37.1	490.2	140.9	1863.3	–	40542.6	181.7	42946.1
14-03-00-00	POST MAINT C/O	5.6	73.7	–	–	–	–	–	–	52.2	689.8	203.7	2694.2	–	–	261.4	3457.7

STUDY TITLE SPACE TUG VOLUME 3.0 PART A OPTION 3A

CONTRACT NO.

DDT&E PRODUCTION ✓ OPERATIONS

SUBDIVISIONS OF WORK

WBS ENTIFICATION NUMBER	WBS NAME	ENGINEER'G		MANAGEMENT		TOOLING		MANUFACTUR'G		QUALITY		TEST		MAT'L & S/C		TOTAL	
		HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.	HRS.	DLRS.
14-04-00-00	TUG P/L MATING C/O	11.1	147.5	–	–	–	–	–	–	119.1	1574.8	479.9	6347.1	–	–	610.1	8067.5
14-05-00-00	REFURB RQM PLANNING	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
14-06-00-00	DEPOT MAINT	9.6	127.6	–	–	–	–	–	–	–	–	915.1	12104.2	–	–	924.8	12231.8
TOTAL OPERATIONS		4211.8	72682.8	1166.4	18502.2	–	–	54.1	715.8	1183.6	17001.7	4682.9	65946.3	–	147862.7	11298.7	322711.7
TOTAL PROGRAM		10383.8	186278.4	2810.5	44583.7	1126.2	22699.4	7950.5	137197.4	3886.4	70301.2	6154.4	93965.0	–	536452.7	32311.8	1091477.7

2.0 Form B (Technical Characteristics)

2.1 Option 1
Technical Characteristics for Option 1 are shown on pages A-110 through A-125

2.2 Option 2
Technical Characteristics for Option 2 are shown on pages A-127 through A-138

2.3 Option 3
Technical Characteristics for Option 3 are shown on pages A-140 through A-152

2.4 Option 3A
Tehcnical Characteristics for Option 3A are shown on pages A-154 through A-168

VOLUME 8.0
APPENDIX

2.1 Form B
Option 1

STUDY TITLE Space Tug System Study (Storable)
CONTRACT NO. _____

TECHNICAL CHARACTERISTICS DATA FORM B

OPTION #1, IA3-2
DATE _____
PAGE 1 OF 16

(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-01	Structures				
320-03-01-01	Fuel Tank & Support	166 .018 10	lb in ft	Weight Min. Gage Diam.	Titanium $\sqrt{2}$ Elliptical Domes, Isolated Tank
320-03-01-02	Oxidizer Tank & Support	257 .018 10	lb in ft	Weight Min. Gage Diam.	Titanium, $\sqrt{2}$ Domes
320-03-01-03	Body Structure	500	lb	Weight	Titanium, Composite & Aluminum
320-03-01-04	Thrust Structure	28	lb	Weight	Titanium
320-03-01-05	Meteoroid Shield	36	lb	Weight	Aluminum
320-03-01-06	P/L Interface	57	lb	Weight	5 in by 10 ft barrel section separation Module with deployment mechanism.
320-03-01-06	Squib Firing Circuit Assembly	2.5 5 x 3 x 2 200	lb in Watt	Weight Size Power	
	Detonating Cord	7.5 62.8	lb ft	Weight Length	
	Detonating Blocks	5	lb	Weight (Total)	2 Per Separation Ring
	Ordnance Squib	1	OHM	Resistance	2 Per detonating Block

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PAGE 2 OF 16

(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-02	Thermal Control	101	lb	Total Weight	
	Multilayer Insulation (MLI)	28 200	lb sq ft	Weight Size	
	Thermal Control Paint	9	lbs	Weight	
	Electric Heaters & Thermostats	19 300	lb Watts	Weight Power	
	Optical Solar Reflector (OSR)	2 48	lb sq ft	Weight Size	
	ACPS Radiation Shield	2	lb	Weight	
	Battery Heat Pipes	9	lb	Weight	
	Base Heat Shield	32	lb	Weight	

STUDY TITLE Space Tug System Study (Storable)
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-03	Avionics				
320-03-03-01	Central Processor	22	lb	Weight	1 Required
		8.5 X 12 X 8	in	Size	
		45	Watt	Power	
		8	M Bits	Storage	
		4	Memories		
		3	GP Processor		
		3	Command data, timing & C/O Process		
	Branch Boxes	8	lb	Weight/total	8 Required
		1.5 x 4 x 4	in	Size	
		8	Watt	Power	
	Dedicated, Br. Ckts				25 Required
	Encrypter/Decrypter	6	lb	Weight	1 Required GFE
		8	Watt	Power	
	Cabling & Connectors	30	lb	Weight	1 Set
	Supports	7	lb	Weight	
320-03-03-02	Guidance & Navigation and Controls	102	lb	Total Weight	Not including Hor. Sensor Weight
	Star Tracker	10	lb	Weight	1 required
		5½x6x12	in	Size	Ball Bros. CTH01
		5	Watt	Power	
		15	arc sec	Resolution	(Off-null accuracy)
	IMU	66	lb	Weight (total)	2 required
		12x12x12	in	Size	Ham Std. (RSIMU)
		160	Watt	Power	
		.01 (1σ)	o/Hr	Drift Rate (Characteristic)	
	Horizon Sensor	45	lb	Weight	1 required

STUDY TITLE Space Tug System Study (Storable)
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TECHNICAL CHARACTERISTICS DATA FORM B

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PAGE 4 OF 16

(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
		10x10x10	in	Size	Quantic 321C Mod IV
		25	Watt	Power	Provides level 1 Autonomy
		.05 (3 σ)	Degrees	Accuracy	
	Supports	6	lb	Weight	
320-03-03-02	Valve Drive Amp.				
	Tandem Integrated Actuators	20	lb	Weight	2 Required
		490	Watt	Power	Includes Control Circiutry for 16 ACPS Nozzles
		1½	in	Stroke	
		30	Rad/Sec	Max. angular accel.	Self contained main engine actuator
320-03-03-03	S-Band Transponder a) Receiver	4	lb	Weight	3 required
		2x3x5	in	Size	
		2.5	Watt	Power (Each)	
		6	db	Noise Figure	
		2	Kbit/Sec		1.7 MHz Subcarrier 2 kbit/sec FSK Mod.
	b) Transmitter	4	lb	Weight	4 required
		2x2x5	in	Size	2 narrow band STDN/ SCF Comp.
		2.5	Watt	Power (Each)	2 Wide Band 4 MHz FM Baseband Mod.
	S-Band power ampl.	4	lb	Weight	2 required
		9x10x2	in	Size	
		55	Watt	Each, input power	
320-03-03-03	Communication Antenna, Omni	2	16	Weight	
		6x6x6	in	Size	1 required
		-6	db	gain at oper. freq	skin mounted

STUDY TITLE Space Tug System Study (Storable)
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
	Antenna, hi gain	12	lb	Weight	2 Required
		30x24 deep	in	Size	Gimbal Inch Mech.
		24 - 20	db	Gain at Oper. Freq. 2250 - 2050 MHz	In Weight
	Coupling & Switching net work	3	lb	Weight	1 required Multiplex
		1x10x14	in	Size	Modes. 4X Mtrs, 3Aut. 2 Couple, 3 Receivers
	Cable Harness	5	lb	Weight	
	Bracketry	5	lb	Weight	
320-03-03-05					
	Ag-Zn Battery	324	lb	Weight	4 Required
		165	Amp. Hr.	Capacity	
	Ag-Zn Battery	36	lb	Weight	1 Required
		24	Amp. Hr.	Capacity	
320-03-03-06	Main Power Distr:	5	lb	Weight	1 Required
	Load Power Distr.	13	lb	Weight	2 Required
	Motor Driven Switch	3.5	lb	Weight	1 Required
	Wiring & Connectors	48.3	lb	Weight	1 Set
	Squib Firing Ckt Assy	2.5	lb	Weight	1 Set
		5x3x2	in	Size	
	Detonating Cord	200	Watt	Power	
		7.5	lb	Weight	
		62.8	ft	Length	
	Ordnance Squib 1 ohm Detonating Block	5	lb	Weight	2 Squibs per Detonating block

STUDY TITLE Space Tug System Study (Storable)
CONTRACT NO. _____

TECHNICAL CHARACTERISTICS DATA FORM B

OPTION #1, IA3-2
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-04-01	Main Engine			GFE	
320-03-04-02	Main Engine Support				
	Pressurization				
	Pressurization Sphere	101	lb	Weight	1 Required
		27.8	in	Inside Diam.	Composite
	He Solenoid Valve	10.4	lb	Weight	
		.5	in	Line Diam.	4 Required
	He Regulator	7	lb	Weight	2 Required
	(Series)	.5	in	Line Diam.	(2 Stage)
	He Manual Valve	1.0	lb	Weight	1 Required
		.5	in	Line Diam.	
	He Check Valve	.4	lb	Weight	2 Required
		.5	in	Line Diam.	
	Chopped Disconnect	.7	lb	Weight	1 Required
		.5	in	Line Diam.	
	Capped Self Sealing	2	lb	Weight	2 Required
	Disconnect	.5		Line Diam.	
	Burst/Relief Valve	5.6	lb	Weight	2 Required
		1	in	Line Diam.	
	Lines & FiHings	7	lb		
		.5	in	Hi-Press-Line Diam.	
		1	in	Lo-Press-Line Diam.	
	Support Panel	3	lb	Weight	
	Instrumentation				
	(1 pressure, 1 temp.)				
	Propellant Valves	8	lb	Weight	2 Required
		2½	in	size fuel valve	
		3	in	size oxidizer valve	
	Propellant Vent Valves	8	lb	Weight	4 Required
	(Quad redundant)	.25	in	Size	
	Lines	22	lb	Weight	
		2½	in	Line Diam.	Fuel Feed
		3	in	Line Diam.	Oxidizer Feed

STUDY TITLE Space Tug System Study (Storable)
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-04-02	Instrumentation	4	lb	Weight	
	Propellant Acquisition				
	Screen & Trap	30	lb	Weight	2 Required
	Propellant Dump				
	Propellant Shut-off	26	lb	Weight	4 Required
	Valve	2½	in	Line Size Fuel	
		3	in	Line Size Oxidizer	
	Propellant Shut-Off	3	lb	Weight	2 Required
	Valve	1	in	Line Size	
	Umbillical Discon.	6	lb	Weight	
		2½	in	Line Size Fuel	2 Required
		3	in	Line Size Oxidizer	
	Lines & Fittings	15	lb	Weight	
	Propellant Utilization				
	Capacitance Probe Assy	30	lb	Weight	2 Required
	Support	7	lb	Weight	
320-03-04-03	ACPS Engine				
	Thruster Assembly	52	lb	Weight	4 Required (16 Nozzles)
	Thruster Mating Assy	8	lb	Weight	4 Required
320-03-04-04	ACPS Engine Support				
	Hand Valve	1.5	lb	Weight	1 Required
	Latching Solenoid	½	in	Size	
	Latching Solenoid	10.4	lb	Weight	4 Required
	Filters	½ & ¼	in	Size	
	Filters	2	lb	Weight	4 Required
		½ & 3/4	in	Size	
	Pressure Regulators	6	lb	Weight	2 Required
	(Series)	½	in	Line Diam.	
	Burst/Relief Valve	1.3	lb	Weight	1 Required
		½	in	Line Diam.	
	Q/D With Cap	0.7	lb	Weight	1 Required

STUDY TITLE Space Tug System Study (Storable)
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TECHNICAL CHARACTERISTICS DATA FORM B

OPTION #1, IA3-2
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-04-04	Q/D With Poppet	1	lb	Weight	1 Required
	Quad Check Valve	.6	lb	Weight	1 Required
		½	in	Line Diam.	
	3 Port, 2 Way hand Use	1.6	lb	Weight	1 Required
	Prop. & Press. Lines &	17	16	Weight	
	Support	½ & 3/4	in	Line Diam.	
	Instrumentation				
	Transducer (Pres)	9	16	Weight	18 Required
	Transducer (Temp)	6	lb	Weight	2 Required
	Hydrazine Tank				
	Support	28	lb	Weight	1 Required
		5	Cu Ft	Volume	
	Helium Tank &	9.5	lb	Weight	1 Required
	Support	0.55	Cu Ft	Volume	

STUDY TITLE Space Tug System Study (Storable)
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TECHNICAL CHARACTERISTICS DATA FORM B

OPTION #1, Aux. Stage KS 1.5
DATE _____
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04	Auxiliary Stage				
320-04-01	Structure				
	Case Motor	146	lb	Weight	Spherical, Light Weight Case 1,440 lb. Propellant
320-04-01-03	Body Structure	177	lb	Weight	Aluminum, Skin-Stringer
	Skirt	10	ft	Diameter	
		5	ft	Length	
	Interface	10	ft	Diameter	Aluminum, with Separation Ordnance and P/L Deployment Mechanism
		5	in	Length	
	Separation Ordnance				
	Squib Firing Circuit Assembly	2.5	lb	Weight	1 Required
		5x3x2	in	Size	
		200	Watt	Power	
	Detonating Cord	7.5	lb	Weight	
		62.8	ft	Length	
	Detonating Block	5	lb	Weight	2 Required
	Ordnance Squibs				4 Required
320-04-01-04	Thrust Structure	105	lb	Weight	Conical, Aluminum Skin-Stringer
320-04-02	Thermal Insulation				Paint, Weight included in Skirt/Interface

STUDY TITLE Space Tug System Study (Storable)
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TECHNICAL CHARACTERISTICS DATA FORM B

OPTION #1, Aux. Stage KS 1.5
DATE
PAGE 10 OF 16

(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04-03	Avionics				
	Controls & Data Management Box	12	lb	Weight	1 Required
	Branch Boxes	2	lb	Weight (Total)	2 Required
	Wiring & Connectors	10	lb	Weight	1 Set
	Supports	3	lb	Weight	
	Electrical Power				
	Ag-Zn Battery	8 4x6x10 5	lb in AHr	Weight (Total) Size Capacity	2 Required
	Ag-Zn Battery	2.5 4x6x8 2	lb in AHr	Weight Size Capacity	1 Required for Pyro Device
	Power Distributor	6 4x4x8 10	lb in Watt	Weight (Total) Size Power (Each)	2 Required
	Wiring & Connectors	1.5	lb	Weight	

STUDY TITLE Space Tug System Study (Storable)
CONTRACT NO. _____ TECHNICAL CHARACTERISTICS DATA FORM B

OPTION #1. Aux. Stage KS 1.5
DATE _____
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04-04-03	ACPS Engine				
	Pitch & Yaw Thruster Assembly	21 25	lb lb	Weight (Total) Thrust (Each)	4 Pairs Required 2 Thrusters per pair
	Roll Thruster Assembly	7 5	lb lb	Weight (Total) Thrust (Each)	2 Pairs Required 2 Thrusters per pair
	Thruster Mating Assembly	10	lb	Weight (Total)	6 Required
320-04-04-04	ACPS Engine Support				
	Hand Valve	1.5 1/4	lb in	Weight Line	1 Required
	Latching Solenoid	5.7	lb	Weight (Total)	2 Required
	Filter	0.5 1/2	lb in	Weight Line	1 Required
	Pressure Regulator	3 1/2	lb in	Weight Line	1 Required
	Burst/Relief Valve	1.3 1/2	lb in	Weight Line	1 Required
	Q/D With Cap	.7	lb	Weight	1 Required
	Q/D With Poppet	1	lb	Weight	1 Required

STUDY TITLE Space Tug System Study (Storable)
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TECHNICAL CHARACTERISTICS DATA FORM B

OPTION#1, Aux. Stage KS 1.5
DATE _____
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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
	3 Port, 2 Way Hand Valve	1.6 1/2	lb in	Weight Line	1 Required
	Propulsion and Pressurization Lines & Support	10	lb	Weight	1/4 - 3/4 Inch
	Hydrazine Tank & Support	20 22.14	lb in	Weight Inside Diameter	
	Nitrogen Tank & Support	10 10	lb in	Weight Inside Diameter	
	Instrumentation, Pressure & Temperature	3.6	lb	Weight (Total)	8 Required

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04	Auxiliary Stage Structure				
	Case Motor	900	lb	Weight	Spherical, Light Weight Case, 10,000 lb Propellant
320-04-01-03	Body Structure, Skirt	288 10 6-5	lb ft ft - in	Weight Diameter Length	Conical Aluminum Skin-Stringer
	Interface	10 5	ft in	Diameter Length	Aluminum, with separation ordnance and P/L deployment mechanism
	Separation Ordnance				
	Squib Firing Circuit Assembly	2.5 5x3x2 200	lb in Watt	Weight Size Power	1 Required
	Detonating Cord	7.5 62.8	lb ft	Weight Length	
	Detonating Block Ordnance Squibs	5	lb	Weight	2 Required 4 Required
320-04-01-04	Thrust Structure	125	lb	Weight	Conical, Aluminum Skin-Stringer
320-04-02	Thermal Insulation				Paint, Weight included in Skirt/Interface

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04-03	Avionics				
	Controls & Data Management Box	12	lb	Weight	1 Required
	Branch Boxes	2	lb	Weight (Total)	2 Required
	Wiring & Connectors	10	lb	Weight	1 Set
	Supports	3	lb	Weight	
	Electrical Power				
	Ag-Zn Battery	8 4x6x10 5	lb in AHr	Weight (Total) Size Capacity	2 Required
	Ag-Zn Battery	2.5 4x6x8 2	lb in AHr	Weight Size Capacity	1 Required for Pyro Device
	Power Distributor	6 4x4x8 10	lb in Watt	Weight (Total) Size Power (Each)	2 Required
	Wiring & Connectors	1.5	lb	Weight	

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04-04-03	ACPS Engine				
	Pitch & Yaw Thruster Assembly	21	lb	Weight (Total)	4 Pairs Required
		25	lb	Thrust (Each)	2 Thrusters per pair
	Roll Thruster Assembly	7	lb	Weight (Total)	2 Pairs Required
		5	lb	Thrust (Each)	2 Thrusters per pair
	Thruster Mating Assembly	10	lb	Weight (Total)	6 Required
320-04-04-04	ACPS Engine Support				
	Hand Valve	1.5	lb	Weight	1 Required
		1/4	in	Line	
	Latching Solenoid	5.7	lb	Weight (Total)	2 Required
	Filter	0.5	lb	Weight	1 Required
		1/2	in	Line	
	Pressure Regulator	3	lb	Weight	1 Required
		1/2	in	Line	
	Burst/Relief Valve	1.3	lb	Weight	1 Required
		1/2	in	Line	
	Q/D With Cap	.7	lb	Weight	1 Required
	Q/D With Poppet	1	lb	Weight	1 Required

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
	3 Port, 2 Way Hand Valve	1.6 1/2	lb in	Weight Line	1 Required
	Propulsion and Pressurization Lines & Support	10	lb	Weight	1/4 - 3/4 Inch
	Hydrazine Tank & Support	20 22.14	lb in	Weight Inside Diameter	
	Nitrogen Tank & Support	10 10	lb in	Weight Inside Diameter	
	Instrumentation, Pressure & Temperature	3.6	lb	Weight (Total)	8 Required

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320-03-01	Structures				
320-03-01-01	Fuel Tank & Support	170 .018 10	lb in ft	Weight Min. Gage Diam.	Titanium $\sqrt{2}$ Elliptical Domes, Isolated Tank
320-03-01-02	Oxidizer Tank & Support	272 .018 10	lb in ft	Weight Min. Gage Diam.	Titanium, $\sqrt{2}$ Domes
320-03-01-03	Body Structure	500	lb	Weight	Titanium, Composite & Aluminum
320-03-01-04	Thrust Structure	28	lb	Weight	Titanium
320-03-01-05	Meteoroid Shield	36	lb	Weight	Aluminum
320-03-01-06	P/L Interface	57	lb	Weight	5 in by 10 ft barrel section separation Module with deployment mechanism used in deployment mode only.
320-03-01-06	Squib Firing Circuit Assembly	2.5 5x3x2 200	lb in Watt	Weight Size Power	
	Detonating Cord	7.5 62.8	lb ft	Weight Length	
	Detonating Blocks	5	lb	Weight (Total)	2 Per Separation Ring

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-01-06	Ordnance Squib	1	OHM	Resistance	2 Per detonating Block
	P/L Interface	170	lb	Weight	Docking Adapter used only in retrieve mode. Extend approximately 36 inches, attenuate energy, retract, support and provide electrical interfacing for a satellite. Aluminum

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320-03-02	Thermal Control	101	lb	Total Weight	
	Multilayer Insulation (MLI)	28 200	lb sq ft	Weight Size	
	Thermal Control Paint	9	lbs	Weight	
	Electric Heaters & Thermostats	19 300	lb Watts	Weight Power	
	Optical Solar Reflector (OSR)	2 48	lb sq ft	Weight Size	
	ACPS Radiation Shield	2	lb	Weight	
	Battery Heat Pipes	9	lb	Weight	
	Base Heat Shield	32	lb	Weight	

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320-03-03	Avionics				
	Data Management				
320-03-03-01	Central Processor	22	lb	Weight	1 Required
		8.5x12x8	in	Size	
		45	Watt	Power	
		8	M Bits	Storage	
		4	Memories		
		3	GP Processers		
		3	Command Data, Timing & C/O Processers		
	Branch Boxes	8	lb	Weight	8 Required
		1.5x4x4	in	Size	
		8	Watt	Power	
	Encrypter/Decrypter	6	lb	Weight	1 Required GFE
		8	Watt	Power	
	Cabling & Connectors	30	lb	Weight	1 Set
	Supports	7	lb	Weight	
320-03-03-02	Star Tracker	10	lb	Weight 1 Required	
		5½x6x12	in	Size	Ball Bros CTH01
		5	Watt	Power	
		15	Arc-Sec	Resolution	(Off Null Accuracy)
	IMU	20	lb	Weight	
		6x6x6	in	Size	2 Required
		10	Watt	Power	Ham. Std. (RSIMU)
		25	Watt	Power	Mod IV
		.05 (1σ)	Degrees	Accuracy	Provides Level 1 Auton

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320-03-03-02	Supports	5	lb	Weight	(8 lb. in retrieve mode)
	Rendezvous Scanning Laser Radar	60 6x9x21 50	lb. in Watts	Weight Size Power	1 Required (ITT) (used only in retrieve mode)
	Video Subsystem	13 16	lb Watt	Weight Power	1 Required RCA Apollo 15/16 (used only in retrieve mode)
	Tandem Integrated Actuators	20 470 1 1/2 30	lb Watt in Rad/Sec	Weight Power Stroke Max. angular accel.	2 Required Includes control Circuitry for 16 ACPS Nozzles. Self contained main engine actuator.
320-03-03-03	S-Band Transponder a) Receiver	4 2x3x5 2.5 6 2	lb in Watt db Kbit/Sec	Weight Size Power (each) Noise Figure	3 Required 1.7 MHz Subcarrier 2 kbit/sec FSK Mod.
	b) Transmitter	4 2x2x2 2.5	lb in Watt	Weight Size Power (each)	4 Required 2 narrow band STDN/ SCF Comp. 2 wide band 4 MHz FM Baseband Mod.

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320-03-03-03	S-Band Power Ampl.	4 2x10x2 55	lb in Watt	Weight Size Each, input	2 Required
	Antenna, OMNI	2 6x6x6	lb in	Weight Size Gain at Oper Freq.	1 Required Skin mounted.
	Antenna, Hi Gain	12 30x24 deep 24-20	lb in db	Weight Size Gain at Oper Freq 2250 - 2050 MHz	2 Required Gimbal mech.incl. in weight
	Coupling & Switching Network	3 1x10x14	lb in	Weight Size	1 Required. Multiple Modes
	Cable Harness	5	lb	Weight	
	Bracketry	5	lb	Weight	
	Emergency & 1 Way Doppler Receiver				1 Required Frequency sweep and mode controlled by Data Management Center Unit
320-03-03-05	Solar Array Assembly	104 10dia.x 48 1180	lb in watt	Weight size power	2 Required (includes panel, drum, cushion, reel and drive mech).
	Solar Array Orientation Assembly	44	lb	Weight	2 Required

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-03-05	Charger	6	lb	Weight	1 Required
	Regulator	28	lb	Weight	2 Required
	Ag-Zn Battery	36 13.5x9.2x 7.2 .5 25	lb in cu in amp hr	Weight Size Volume Capacity	1 Required
	Ag-Zn Battery	81 10.2x17x 8.2 .8 165	lb in cu ft amp hr	Weight Size Volume Capacity	1 Required
320-03-03-06	Power Distributor	18	lb	Weight	3 Required
	Wiring & Connectors	50	lb	Weight	1 Set
	Solar Array Instrumentation Assembly	4.5	lb	Weight	1 Required
	Motor Driven Switch	3.5 1.3x1.5x 2.5	lb in	Weight Size	1 Required
	Supports	36	lb	Weight	

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320-03-04-01	Main Engine			GFE	
320-03-04-02	Main Engine Support Pressurization				
	Pressurization Sphere	119 28.8	lb in	Weight Inside Diam.	1 Required Composite
	He Solenoid Valve	10.4 .5	lb in	Weight Line Diam.	4 Required
	He Regulator (Series)	7 .5	lb in	Weight Line Diam.	2 Required (2 Stage)
	He Manual Valve	1.0 .5	lb in	Weight Line Diam	1 Required
	He Check Valve	.4 .5	lb in	Weight Line Diam.	2 Required
	Capped Disconnect	.7 .5	lb in	Weight Line Diam.	1 Required
	Capped Self Sealing Disconnect	2 .5	lb Line Diam.	Weight	2 Required
	Burst/Relief Valve	5.6 1	lb in	Weight Line Diam.	2 Required
	Lines & Fittings	7 .5 1	lb in in	 Hi-Press. Line Diam. Lo-Press. Line Diam.	

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320-03-04-02	Support Panel	3	lb	Weight	
	Instrumentation (1 Pressure, 1 Temp.)	1	lb	Weight	
	Propellant Feed				
	Propellant Valves	8	lb	Weight	2 Required
		2.5	in	Size Fuel Valve	
		3	in	Size Oxidizer Valve	
	Propellant Vent Valves	8	lb	Weight	4 Required
		.25	in	Size	
	Lines	22	lb	Weight	
		2.5	in	Line Diam. Fuel Valve	
		3	in	Line Diam. Oxid Feed	
	Instrumentation	4	lb	Weight	
	Propellant Acquisition				
	Screen and Trap	30	lb	Weight	2 Required
	Propellant Dump				
	Propellant Shut-Off Valve	26	lb	Weight	4 Required
		2.5	in	Line Size Fuel	
		3	in	Line Size Oxidizer	
	Propellant Shut-Off Valve	3	lb	Weight	2 Required
		1	in	Line Size	
	Umbillical Disconnect	6	lb	Weight	2 Required
		2.5	in	Line Size Fuel	
		3	in	Line Size Oxidizer	

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-04-02	Lines & Fittings	15	lb	Weight	
	Propellant Utilization				
	Capacitance Probe Assy.	30	lb	Weight	2 Required
	Support	7	lb	Weight	
320-03-04-03	ACPS Engine				
	Thruster Assembly	52	lb	Weight	4 Required (16 nozzles)
	Thruster Mating Assy.	8	lb	Weight	4 Required
320-03-04-04	ACPS Engine Support				
	Hand Valve	1.5 1.5	lb in	Weight Size	1 Required
	Latching Solenoid	10.4 ½ & ¼	lb in	Weight Size	4 Required
	Filters	2 ½ & 3/4	lb in	Weight Size	4 Required
	Pressure Regulator (Series)	6 1.5	lb in	Weight Line Diameter	2 Required
	Burst/Relief Valve	1.3 1.5	lb in	Weight Line Diameter	1 Required
	Q/D With Cap	0.7	lb	Weight	1 Required

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320-03-04-04	Q/D With Poppet	1	lb	Weight	1 Required
	Quad Check Valve	.6 1.5	lb in	Weight Line Diameter	1 Required
	3 Port, 2 Way, Hand use	1.6 1.5	lb in	Weight Size	1 Required
	Prop. & Press. Lines & Support	17 1.5 & 3.4	lb in	Weight Line Diameter	
	Instrumentation				
	Transducer (Press.)	9	lb	Weight	18 Required
	Transducer (Temp.)	.6	lb	Weight	2 Required
	Hydrazine Tank & Support	28 5	lb cu. ft.	Weight Volume	1 Required
	Helium Tank & Support	19.5 1.0	lb cu. ft.	Weight Volume	1 Required

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04	Auxiliary Stage			See Option #1	

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Option 3

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-01	Structures				
320-03-01-01	Fuel Tank & Support	170 .018 10	lb in ft	Weight Min. Gage Diameter	Titanium $\sqrt{2}$ Elliptical Domes, Isolated Tank
320-03-01-02	Oxidizer Tank & Support	272 .018 10	lb in ft	Weight Min. Gage Diameter	Titanium, $\sqrt{2}$ Domes
320-03-01-03	Body Structure	500	lb	Weight	Titanium, Composite & Aluminum
320-03-01-04	Thrust Structure	28	lb	Weight	Titanium
320-03-01-05	Meteoroid Shield	36	lb	Weight	Aluminum
320-03-01-06	P/L Interface	57	lb	Weight	5 in by 10 ft aluminum barrel section separation Module with deployment mechanism. Use in deployment mode only.
320-03-01-06	Squib Firing Circuit Assembly	2.5 5x3x2 200	lb in Watt	Weight Size Power	
	Detonating Cord	7.5 62.8	lb ft	Weight Length	

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320-03-01-06	Detonating Blocks	5	lb	Weight (Total)	2 Per Separation Ring
	Ordnance Squib	1	OHM	Resistance	2 Per Detonating Block
320-03-01-06	P/L Interface	170	lb	Weight	Docking system adapter used in retrieve mode only. Truss structure with spin/despin probe mechanism, shock absorbers, latches and docking avionics. Basic Structure Aluminum

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-02	Thermal Control	101	lb	Total Weight	
	Multilayer Insulation (MLI)	28 200	lb sq ft	Weight Size	20 Layers
	Thermal Control Paint	9	lbs	Weight	
	Electric Heaters & Thermostats	19 300	lb Watts	Weight Power	
	Optical Solar Reflector (OSR)	2 48	lb sq ft	Weight Weight	
	ACPS Radiation Shield	2	lb	Weight	
	Battery Heat Pipes	9	lb	Weight	
	Base Heat Shield	32	lb	Weight	

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-03	Avionics				
	Data Management				
320-03-03-01	Central Processor	22	lb	Weight	1 Required
		8.5x12x8	in	Size	
		45	Watt	Power	
		8	M Bits	Storage	
		4	Memories		
		3	GP Processor		
		3	Command data, Timing & C/O Process		
	Branch Boxes	8	lb	Weight/Total	8 Required
		1.5x4x4	in	Size	
		8	Watt	Power	
	Dedicated, Br. Ckts.				25 Required
	Encrypter/Decrypter	6	lb	Weight	1 Required GFE
		8	Watt	Power	
	Cabling & Connectors	30	lb	Weight	1 Set
	Supports	7	lb	Weight	
320-03-03-02	Guidance & Navigation and Controls	102	lb	Weight	Not including Horizon Sensor Weight
	Star Tracker	10	lb	Weight	1 Required
		5.5x6x12	in	Size	Ball Bros CTH01
		5	Watt	Power	
		15	arc sec	Resolution	(Off Null Accuracy)

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-03-03-02	IMU	66 12x12x12 160 .01 (1 σ)	lb in Watt o/Hr	Weight (Total) Size Power Drift Rate(Characteristic)	2 Required Ham. Std. (RSIMU) Used in IA2-8,phased to unit below.
	IMU	20 6x6x6 10 0.01 (1σ)	lb in Watt o/Hr	Weight (Total) Size Power (Each) Drift Rate	2 Required Phased from above unit in IA2-8 to IA2-4,3
320-03-03-02	Rendezvous SLR (Scanning Laser Radar)	60 6x9x21	lb in Watt	Weight Size Power	1 Required Phased into IA2-3
	Video Subsystem	13 12x6x4 16	lb in Watt	Weight Size Power	1 Required Phased into IA2-3
320-03-03-02	Tandem Integrated Actuator	20 1 1/2 30 470	lb in rad/sec Watts	Weight (Total) Stroke Max.Angular Accel. Power	2 Required Self contained main engine actuator includes control circuitry for 16 ACPS nozzles.
	Horizon Sensor	45 10x10x10 25 .05 (3σ)	lb in Watt Degrees	Weight Size Power Accuracy	1 Required Quantic 321C Mod IV Provides Level 1 Autonomy

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320-03-03-02	Supports	6	lb	Weight	
320-03-03-02	Valve Drive Amp. Tandem Integrated Actuators	20	lb	Weight	2 Required
		490	Watt	Power	Includes Control Circuitry for 16 ACPS Nozzles
		1.1/5	in	Stroke	
		30	Rad/Sec	Max. Angular Accel.	Self Contained Main Engine Actuator
320-03-03-03	S-Band Transponder				
	a) Receiver	4	lb	Weight	3 Required
		2x3x5	in	Size	1.7 MHz Subcarrier
		2.5	Watt	Power (Each)	2 kbit/sec FSK Mod.
		6	db	Noise Figure	
		2	Kbit/Sec		
	b) Transmitter	4	lb	Weight	4 Required
		2x2x5	in	Size	2 Narrow Band STDN/ SCF Comp.
		2.5	Watt	Power (Each)	2 Wide Band 4 MHz FM Baseband Mod.
	S-Band Power Ampl.	4	lb	Weight	2 Required
		9x10x2	in	Size	
		55	Watt	Input Power (Each)	
320-03-03-03	Communication Antenna, Omni	2	lb	Weight	
		6x6x6	in	Size	1 Required
		-6	db	Gain at Oper. Freq.	Skin Mounted

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	Antenna, Hi Gain	12 30x24 deep 24 - 20	lb in db	Weight Size Gain at Oper. Freq. 2250 - 2050 MHz	2 Required Gimbal Mechanism Incl. In Weight
	Coupling & Switching Net Work	3 1x10x14	lb in	Weight Size	1 Required Multiplex Modes. 4X Mtrs, 3 Ant, 2 Ampl, 3 Receivers
	Cable Harness	5	lb	Weight	
	Bracketry	5	lb	Weight	
320-03-03-05	Solar Array Assembly	104 120 1180	lb sq ft watt	Weight (total) Size Power (each)	2 Required (includes panel, drum, cushion, reel and drive mech.). Drum 10 dia x 33 in.
	Solar Array Orientation Assembly.	44	lb	Weight	2 Required
	Charger	6	lb	Weight	1 Required
	Regulator	28	lb	Weight	2 Required
	Ag-Zn Battery	36 13.5x8.2x 7.2 .5 25	lb in cu in amp hr	Weight Size Volume Charge	1 Required

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320-03-03-05	Ag-Zn Battery	81	lb	Weight	1 Required
		10.2 x 17 x 8.2			
		.8	cu ft	Volume	
		165	amp hr	Charge	
320-03-03-06	Power Distributor	18	lb	Weight	3 Required
	Wiring & Connectors	50	lb	Weight	1 Set
	Solar Array Instrumentation Assembly	4.5	lb	Weight	1 Required
	Motor Driven Switch	3.5	lb	Weight	1 Required
		1.3 x 1.5 x 2.5			
	Supports	36	lb	Weight	

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320-03-04-01	Main Engine			GFE	OME 240 PC Phases to Class I, 800 PC
320-03-04-02	Main Engine Support				
	Pressurization				
	Pressurization Sphere	117 27.8	lb in	Weight Inside Diameter	1 Required Composite
	He Solenoid Valve	10.4 .5	lb in	Weight Line Diameter	4 Required
	He Regulator (Series)	7 .5	lb in	Weight Line Diameter	2 Required (2 Stage)
	He Manual Valve	1.0 .5	lb in	Weight Line Diameter	1 Required
	He Check Valve	.4 .5	lb in	Weight Line Diameter	2 Required
	Chopped Disconnect	.7 .5	lb in	Weight Line Diameter	1 Required
	Capped Self Sealing Disconnect	2 .5	lb	Weight Line Diameter	2 Required
	Burst/Relief Valve	5.6 1	lb in	Weight Line Diameter	2 Required

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320-03-04-02	Lines & Fittings	7	lb		
		.5	in	Hi-Press-Line Diameter	
		1	in	Lo-Press-Line Diameter	
	Support Panel Instrumentation (1 Pressure, 1 Temp.)	3	lb	Weight	
	Propellant Feed				
	Propellant Valves	1	lb	Weight	2 Required
		8	lb	Weight	
		2 1/5	in	Size Fuel Valve	
		3	in	Size Oxidizer Valve	
	Propellant Vent Valves (Quad Redundant)	8	lb	Weight	4 Required
		.25	in	Size	
	Lines	22	lb	Weight	
		2 1/2	in	Line Diameter	Fuel Feed
		3	in	Line Diameter	Oxidizer Feed
320-03-04-02	Instrumentation	4	lb	Weight	
	Propellant Acquisition				
	Screen & Trap	30	lb	Weight	2 Required
	Propellant Dump				
	Propellant Shut-Off Valve	26	lb	Weight	4 Required
		2 1/2	in	Line Size Fuel	

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
	Umbillical Discon.	6	lb	Weight	
		2 1/2	in	Line Size Fuel	2 Required
		3	in	Line Size Oxidizer	
	Lines & Fittings	15	lb	Weight	
	Propellant Utilization				
	Capacitance Probe Assy	30	lb	Weight	2 Required
	Support	7	lb	Weight	
320-03-04-03	ACPS Engine				
	Thruster Assembly	52	lb	Weight	4 Required (16 Nozzles)
	Thruster Mating Assy	8	lb	Weight	4 Required
320-03-04-04	ACPS Engine Support				
	Hand Valve	1.5	lb	Weight	1 Required
	Latching Solenoid	1/2	in	Size	
	Latching Solenoid	10.4	lb	Weight	4 Required
	Filters	1/2 & 1/4	in	Size	
	Filters	2	lb	Weight	4 Required
		1/2 & 3/4	in	Size	
	Pressure Regulators	6	lb	Weight	2 Required
	(Series)	1/2	in	Line Diameter	
	Burst/Relief Valve	1.3	lb	Weight	1 Required
		1/2	in	Line Diameter	
	Q/D With Cap	0.7	lb	Weight	1 Required
	Q/D With Poppet	1	lb	Weight	1 Required
	Quad Check Valve	.6	lb	Weight	1 Required
		1/2	in	Line Diameter	

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	3 Port, 2 Way Hand Use Prop. & Press. Line & Support	1.6 17 1/2 & 3/4	lb lb in	Weight Weight Line Diameter	1 Required
	Instrumentation				
	Transducer (Pres)	9	lb	Weight (Total	18 Required
	Transducer (Temp)	.6	lb	Weight (Total)	2 Required
	Hydrazine Tank Support	28 5	lb Cu Ft	Weight Volume	1 Required
	Helium Tank & Support	9.5 0.55	lb Cu Ft	Weight Volume	1 Required

NOTE: IN CONVERTING FROM IA2-8 TO IA2-4,3 MAIN ENGINE, THERE WILL ALSO BE SLIGHT CHANGES IN THE ENGINE/SUPPORT INTERFACE.

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320-04	Auxiliary Stage			See Option #1	

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320-03-01	Structures				
320-03-01-01	Fuel Tank & Support	89 .018 6	lb in ft	Weight Min. Gage Diameter	Core Stage, Titanium √2 Elliptical Domes, Isolated Tank
320-03-01-02	Oxidizer Tank & Support	110 .018 6	lb in ft	Weight Min. Gage Diameter	Core Stage, Titanium √2 Domes
320-03-01-03	Body Structure	583	lb	Weight	Core Stage, Aluminum
320-03-01-04	Thrust Structure	17	lb	Weight	Aluminum
320-03-01-05	Meteoroid Shield	15	lb	Weight	Aluminum
320-03-01-06	P/L Interface	35	lb	Weight	5 in by 6 ft barrel section separation Module with deployment mechanism. Aluminum
320-03-01-06	Squib Firing Circuit Assembly	2.5 5x3x2 200	lb in Watt	Weight Size Power	
	Detonating Cord	7.5 62.8	lb ft	Weight Length	
	Detonating Blocks	5	lb	Weight (Total)	2 Per Separation Ring
	Ordnance Squib	1	OHM	Resistance	2 Per Detonating Block

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320-03-02	Thermal Control				
	Multilayer Insulation (MLI)	40 200	lb sq ft	Weight Size	20 Layers
	Thermal Control Paint	5	lbs	Weight	
	Electric Heaters & Thermostats	15 300	lb Watts	Weight (Total) Power	4 Required
	Optical Solar Reflector (OSR)	2 48	lb sq ft	Weight Size	
	ACPS Radiation Shield	4	lb	Weight (Total)	4 Required
	Base Heat Shield	20	lb	Weight	

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320-03-0 3	Avionics				
	Data Management				
320-03-03-01	Central Processor	22	lb	Weight	1 Required
		8.5x12x8	in	Size	
		45	Watt	Power	
		8	M Bits	Storage	
		4	Memories		
		3	GP Process		
		3	Command data, Timing & C/O Process		
	Branch Boxes	8	lb	Weight/Total	8 Required
		1.5x4x4	in	Size	
		8	Watt	Power	
	Dedicated, Br. Ckts.				25 Required
	Encrypter/Decrypter	6	lb	Weight	1 Required GFE
		8	Watt	Power	
	Cabling & Connectors	30	lb	Weight	1 Set
	Supports	7	lb	Weight	
320-03-03-02	Guidance & Navigation and Controls	102	lb	Weight	Not including Hor. Sensor Weight
	Star Tracker	10	lb	Weight	1 Required
		5.5x6x12	in	Size	Ball Bros CTH01
		5	Watt	Power	
		15	arc sec	Resolution	(Off Null Accuracy)

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320-03-03-02	IMU	66 12x12x12 160 .01 (1 σ)	lb in Watt o/Hr	Weight (Total) Size Power Drift Rate(Characteristic)	2 Required Ham. Std. (RSIMU) Used in IA2-8,phased to unit below.
	IMU	20 6x6x6 10 0.01 (1 σ)	lb in Watt o/Hr	Weight (Total) Size Power (Each) Drift Rate	2 Required Phased from above unit in IA2-8 to IA2-4,3
320-03-03-02	Rendezvous SLR (Scanning Laser Radar)	60 6x9x21	lb in Watt	Weight Size Power	1 Required Phased into IA2-3
	Video Subsystem	13 12x6x4 16	lb in Watt	Weight Size Power	1 Required Phased into IA2-3
320-03-03-02	Tandem Integrated Actuator	20 1 1/2 30 470	lb in rad/sec Watts	Weight (Total) Stroke Max.Angular Accel. Power	2 Required Self contained main engine actuator includes control circuitry for 16 ACPS nozzles.
	Horizon Sensor	45 10x10x10 25 .05 (3 σ)	lb in Watt Degrees	Weight Size Power Accuracy	1 Required Quantic 321C Mod IV Provides Level 1 Autonomy

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320-03-03-02	Supports	6	lb	Weight	
320-03-03-02	Valve Drive Amp. Tandem Integrated Actuators	20	lb	Weight	2 Required
		490	Watt	Power	Includes Control Circuitry for 16 ACPS Nozzles
		1.1/5	in	Stroke	
		30	Rad/Sec	Max. Angular Accel.	Self Contained Main Engine Actuator
320-03-03-03	S-Band Transponder				
	a) Receiver	4	lb	Weight	3 Required
		2x3x5	in	Size	1.7 MHz Subcarrier
		2.5	Watt	Power (Each)	2 kbit/sec FSK Mod.
		6	db	Noise Figure	
		2	Kbit/Sec		
	b) Transmitter	4	lb	Weight	4 Required
		2x2x5	in	Size	2 Narrow Band STDN/ SCF Comp.
		2.5	Watt	Power (Each)	2 Wide Band 4 MHz FM Baseband Mod.
	S-Band Power Ampl.	4	lb	Weight	2 Required
		9x10x2	in	Size	
		55	Watt	Input Power (Each)	
320-03-03-03	Communication Antenna, Omni	2	lb	Weight	
		6x6x6	in	Size	1 Required
		-6	db	Gain at Oper. Freq.	Skin Mounted

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	Antenna, Hi Gain	12 30x24 deep 24 - 20	lb in db	Weight Size Gain at Oper. Freq. 2250 - 2050 MHz	2 Required Gimbal Mechanism Incl. In Weight
	Coupling & Switching Net Work	3 1x10x14	lb in	Weight Size	1 Required Multiplex Modes. 4X Mtrs, 3 Ant. 2 Ampl., 3 Receivers
	Cable Harness	5	lb	Weight	
	Bracketry	5	lb	Weight	
320-03-03-05	Solar Array Assembly	104 120 1180	lb sq ft watt	Weight Size Power	2 Required (includes panel, drum, cushion, reel and drive mech.).
	Solar Array Orientation Assembly.	44	lb	Weight	2 Required
	Changer	6	lb	Weight	1 Required
	Regulator	28	lb	Weight	2 Required
	Ag-Zn Battery	36 13.5x8.2x 7.2 .5 25	lb in cu in amp hr	Weight Size Volume Charge	1 Required

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320-03-03-05	Ag-Zn Battery	81	lb	Weight	1 Required
		10.2 x 17 x 8.2			
		.8	cu ft	Volume	
		165	amp hr	Charge	
320-03-03-06	Power Distributor	18	lb	Weight	3 Required
	Wiring & Connectors	50	lb	Weight	1 Set
	Solar Array Instrumentation Assembly	4.5	lb	Weight	1 Required
	Motor Driven Switch	3.5	lb	Weight	1 Required
		1.3 x 1.5 x 2.5			
	Supports	36	lb	Weight	

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320-03-04-02	Main Engine Support				
	Helium Sphere	31	lb	Weight	3600 psia, 44 lb He
		18.4	in	Diameter	Composite
	He Solenoid Value	10.4	lb	Weight (total)	4 Required
		30	watt	Power (total)	22-30 volts, 1 amp ea., during main engine burn
	He Regulator	7	lb	Weight (total)	4 Required
	He Manual Valve	1	lb	Weight	1 Required
	He Check Valve	0.4	lb	Weight (total)	2 Required
	Capped Disconnect	0.7	lb	Weight	1 Required
	Capped, Self-Sealing Q/D	2	lb	Weight (total)	2 Required
		All Valves Above		have 1/2 inch line	
	Burst/Relief Valve	5.6	lb	Weight (total_	2 Required, 1 inch line
	Lines & Fittings, Supp. & Instr	11	lb	Weight	1/2 in hi.pressure, 1 in. low pressure
	Prop. Cross Feed				
	Propellant Valve, Fuel	8	lb	Weight	2 Required
		2	inch	Size	
		1	watt	Power (each)	
	Propellant Valve, Ox	10	lb	Weight	2 Required
		2 1/4	inch	Size	
		3	watt	Peak Power (each)	
	Cross Feed Line	6	lb	Weight	2 Required, 2 inch
	Q/D Half - Fuel	6	lb	Weight	2 Required, 2 inch

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-320-03-04-02 (Cont)					
	Q/D Half Oxid	6	lb	Weight	2 Required, 2 1/4 inch
	Propellant Feed				
	Propellant Valves	8	lb	Weight	2 Required, 2 & 3 inch
		1	watt	Power (each)	
	Propellant Valves	18	lb	Weight	4 Required
	(Dump)	3	watt	Peak Power (each	
	Engine Vent Valves	8	lb	Weight	8 Required, 1/4 inch
	Lines & Fittings	15	lb	Weight	2 & 3 1/4 inch
	Propellant Acquisition				
	Screen & Trap	30	lb	Weight (total)	2 Required
	Propellant Dump				
	Prop. Shutoff Valve	18	lb	Weight (total)	4 Required 2x2 1/4 in.
		1	watt	Ave Power (each)	
	Horizontal Dump	4	lb	Weight (total)	2 Required, 1 inch.
		3	watt	Peak Power (each)	
	Umbilical Disconnect	6	lb	Weight (total)	2 Required, 3 inch
	Horizontal Q/D Half	8	lb	Weight (total)	4 Required, 1 inch
	Lines & Fittings	12	lb	Weight	2 1/4 x 3 in.
	Propellant Utilization				
	Capacitance Probes	24	lb	Weight (total)	2 Required

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320-03-06	Drop Tanks				
320-03-06-01	Structures				
	Fuel Tank & Support	356	lb	Weight (total)	2 Required, Aluminum
		0.028	in.	Dome Thickness	Isolated, Hemispherical Domes
		0.050	in.	Barrel Thickness	
	Oxidizer, Tank & Supp	409	lb	Weight (total)	2 Required, Alumin.
		0.028	in.	Dome Thickness	Isolated, Spherical Domes
		0.053	in.	Barrel Thickness	
	Body Structure & Supp	114	lb	Weight	Aluminum
	Power Distrib Control	20	lb	Weight	
	Separation Ordnance	20	lb	Weight	

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320-03-06-03					
	Propulsion Support System				
	Pressurization				
	He Sphere	122	lb	Weight (total)	2 Required, 3600 psi
		27.6	in.	Diameter	17:6 lb He, Composite
	He Solenoid Valve	21	lb	Weight (total)	8 Required
	He Regulator	14	lb	Weight (total)	8 Required
	He Manual Valve	2	lb	Weight (total)	2 Required
	He Check Valve	0.8	lb	Weight (total)	4 Required
	Capped Disconnect	1.4	lb	Weight (total)	2 Required
	Capped Self-Seal Q/D	4	lb	Weight (total)	4 Required
		All Above 1/2 inch line			
	Burst/Relief Valve	11.2	lb	Weight (total)	4 Required, 1 in. line
	Lines & Fittings, Supp & Instrumentation	22	lb	Weight	1/2 in. hi-pressure; 1 in. low pressure
	Propellant Crossfeed				
	Q/D Half	16	lb	Weight (total)	4 Required, 2x2 1/4 in.
	Propellant Feed				
	Lines & Fittings	30	lb	Weight	2 1/2 & 3 in.
	Instr & Wiring	10	lb	Weight	
	Propellant Acquisition				
	Vortex Baffles	10	lb	Weight	

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320-03-06-03	Propellant Dump				
(Continued)	Shutoff Valve	8	lb	Weight (total)	4 Required, 1 in.
	Umbilical Q/D	8	lb	Weight (total)	4 Required, 1 in.
	Lines & Fittings	27	lb	Weight	1 in.
	Prop Utilization				
	Capacitance Probes	36	lb	Weight (total)	4 Required

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320-03-06-03	ACPS Engine				
	Thruster Assembly	52	lb	Weight (total)	4 Required (16 nozzles)
	Thruster Mating Assy	8	lb	Weight (total)	4 Required
320-03-06-04	ACPS Engine Support				
	Hydrazine Tank & Supp	28	lb	Weight	Config IVG-1
		5	cu ft	Volume	Phased to Config below in retrieve mode
	Hydrazine Tank & Supp	50	lb	Weight	Config IVG-2
		10	cu ft	Volume	Retrieve Mode Only
	Helium Tank & Supp	9.5	lb	Weight	Config IVG-1
		0.55	cu ft	Volume	Phase to Config Below
	Helium Tank & Supp	19.5	lb	Weight	Config IVG-3,2
		1	cu ft	Volume	Deploy and Retrieve
	Hand Valve	1.5	lb	Weight	1 Required, 1/2 in.
	Latching Solenoid	10.4	lb	Weight (total)	4 Required, 1/2 & 3/4in.
	Filters	2	lb	Weight (total_	4 Required
	Redundant Press Reg	6	lb	Weight (total)	2 REquired, 1/2 in.
	Burst/Relief Valve	1.3	lb	Weight	1 Required, 1/2 in.
	Q/D with Cap	0.7	lb	Weight	1 Required
	Q/D with Poppet	1	lb	Weight	1 Required
	Quad Check Valve	0.6	lb	Weight	1 Required, 1/2 inch
	3 Port, 2-Way Hand Use	1.6	lb	Weight	1 Required, 1/2 in.

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320-03-06-04 (Continued)	Propellant & Press Lines & Support	17	lb	Weight	1/2 & 3/4 in
	Instrumentation				
	Transducer (Press)	9	lb	Weight (total)	18 Required
	Transducer (Temp)	0.6	lb	Weight (total)	2 Required

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(1) WBS IDENTIFICATION NUMBER	(2) WBS IDENTIFICATION	(3) QUANTITY OR VALUE	(4) UNITS OF MEASURE	(5) CHARACTERISTICS	(6) NOTES
320-04	Auxiliary Stage			See Option #1	