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JUNE 1980

GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY

FINAL REPORT
VOLUME IIA APPENDIXES
BOOK 1 OF 2

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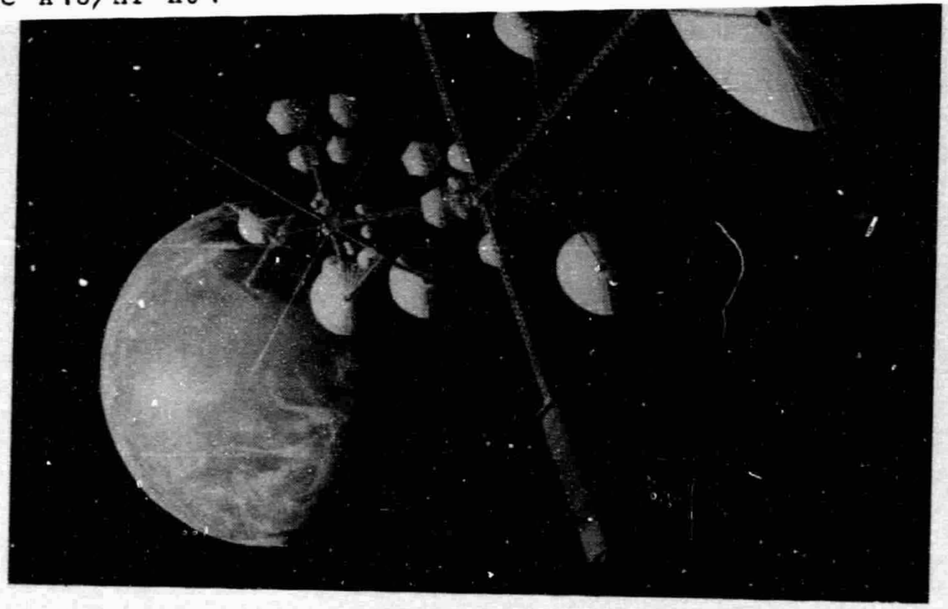

Prepared by

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for the

National Aeronautics and Space Administration
GEORGE C. MARSHALL SPACE FLIGHT CENTER
Huntsville, Alabama

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FINAL REPORT

GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY

VOLUME IIA APPENDIXES
BOOK 1 OF 2

JUNE 1980

Submitted to
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GEOSTATIONARY PLATFORM SYSTEMS
CONCEPTS DEFINITION STUDY
FINAL REPORT

VOLUME I	EXECUTIVE SUMMARY
VOLUME II	TECHNICAL ANALYSIS, TASKS 1 – 5, 3A
BOOK 1 OF 3	TASKS 1 AND 2
BOOK 2 OF 3	TASK 3
BOOK 3 OF 3	TASKS 4, 5, AND 3A
VOLUME II(A)	TECHNICAL APPENDIXES
➧ BOOK 1 OF 2	APPENDIX A – G
BOOK 2 OF 2	APPENDIX H – L
VOLUME III	COSTS AND SCHEDULES, TASK 6

This report is submitted in fulfillment of NASA/MSFC Contract NAS8-33527.

William T. Carey

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1 July 1980

CONTENTS

APPENDIX		Page
A	COMMUNICATIONS PLATFORM TRAFFIC REQUIREMENTS	A-1
B	VIDEO CONFERENCING FORECAST	B-1
C	INTERSATELLITE LINK CAPACITY REQUIREMENTS	C-1
D	LINK BUDGETS	D-1
E	PAYLOAD DATA SHEETS	E-1
F	PAYLOAD ASSIGNMENTS	F-1
G	PLATFORM SYNTHESIS	G-1
H	SERVICING FLIGHT ANALYSIS	H-1
I	GEOSTATIONARY PLATFORM COST MODEL RUNS	I-1
J	FUNDING SPREAD ANALYSIS	J-1
K	RADIATION ENVIRONMENT OF INTELSAT V	K-1
L	THE SPACE RADIATION AT SYNCHRONOUS ALTITUDE AND ITS EFFECTS ON COMMUNICATIONS SATELLITES	L-1

APPENDIX A

COMMUNICATIONS PLATFORM TRAFFIC REQUIREMENTS

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	A-2
2	DOMESTIC AND REGIONAL SERVICES	A-3
3	ATLANTIC INTELSAT SERVICES	A-7
4	MOBILE AND AERONAUTICAL REQUIREMENTS	A-9
5	TRAFFIC FORECAST	A-12

SECTION 1
INTRODUCTION

In support of the geostationary platform systems concepts definition study for Marshall Space Flight Center, General Dynamics requires traffic forecasts, covering the 1990 to the year 2000 time frame. The requirements are for high volume trunking and direct-to-the-user communications services for platforms located appropriately so as to serve North America, South America, Mid-Atlantic, Western Europe and Africa. Traffic has to include domestic and regional satellite services, INTELSAT services, maritime and aeronautical services.

SECTION 2
DOMESTIC AND REGIONAL SERVICES

Future Systems Incorporated (FSI) developed a 10-year traffic forecast for domestic and regional satellite communications. The forecast includes telephone and data services. Satellite service requirements are expressed in terms of equivalent 40 MHz transponders. Table A-1 shows the number of transponders for 1990, 1995 and the year 2000 for North America, South America, Western Europe, Middle East and Africa.

The projections for Western European countries should be viewed with some caution. We believe that our traffic model overestimates the actual traffic for the following reasons:

1. The European GNP/km^2 is high, leading to a very economical terrestrial communications system. Microwave systems are used extensively, and fiber optics will be added in the future.

2. As a result of extensive use of both C-band and Ku-band for terrestrial communications, the frequency coordination for earth stations is much more difficult than in the U.S., thus preventing the easy proliferation of earth stations.

3. In Europe, telecommunications is generally a government monopoly, and the telephone administrations of many European countries have generally been opposed to satellite communications for domestic applications and specifically for private corporate networks.

In addition, most European countries have a strict policy of requiring high local content for government controlled procurement.

It must also be noted that this model shows Iran using approximately 30 percent of the satellite traffic requirements for the Middle East. This may or may not be on the high side since the policy of the new government in Iran towards satellite communications is not yet known.

Table A-1

Satellite Traffic Requirements

	1990	1995	2000
North America	544	707	874
United States	455	574	688
Canada	47	59	71
Mexico	28	50	78
Central America	14	24	37
South America	113	199	309
Brazil	61	107	166
Colombia	7	13	20
Argentina	12	20	32
Chile	3	6	9
Venezuela	11	19	30
Others	19	34	52
Western Europe	438	568	690
France	81	104	127
Germany	110	142	172
Spain	22	28	34
United Kingdom	52	67	81
Others	173	227	276
Africa	36	62	95
Ivory Coast	3	5	8
Nigeria	15	25	38
Liberia	.4	.7	1.1
Sudan	15	25	38
Zaire	2	3	4
Others	1	3	6

Table A-1 (Continued)

Satellite Traffic Requirements

	1990	1995	2000
Middle East	129	215	322
Algeria	9	14	21
Egypt	8	14	20
Saudi Arabia	30	50	75
Iran	40	66	99
Others	42	71	107

SECTION 3
ATLANTIC INTELSAT SERVICES

The requirements for INTELSAT service for 1990, 1995 and the year 2000 for the Atlantic Ocean area are shown in Table A-2. This informatior is derived from INTELSAT's traffic data base and forecast and an extension thereof.

Table A-2

Traffic Model for

INTELSAT Atlantic Ocean Region Traffic

Year End	Number of Equivalent Voice Circuits
1990	54,780
1991	63,540
1992	73,710
1993	85,500
1994	99,180
1995	115,050
1996	133,460
1997	154,810
1998	179,580
1999	208,320
2000	241,650

SECTION 4

MOBILE AND AERONAUTICAL REQUIREMENTS

Figure A-1 shows an estimate of voice channel requirements for maritime communications for the Atlantic Ocean area. This forecast is based on data provided by the IMCO Panel of Experts, Ref. A(1) as shown in the dashed line. The 1985 IMCO data point was then extended at annual rates of increase of 10, 15, and 20 percent. The median estimate of 15 percent reaches a requirement for 200 voice channels by the year 2000.

A forecast for aeronautical requirements was prepared by ARINC Research Corporation, Ref. A(2) in 1975. Table A-3 shows the ARINC estimates for the year 2000 forward and return channels. We have used this information to develop the traffic requirements presented in Figure A-2. The ARINC estimate corresponds to our low estimate. It excludes public correspondence service. The high estimate includes public correspondence service. A median estimate has also been generated.

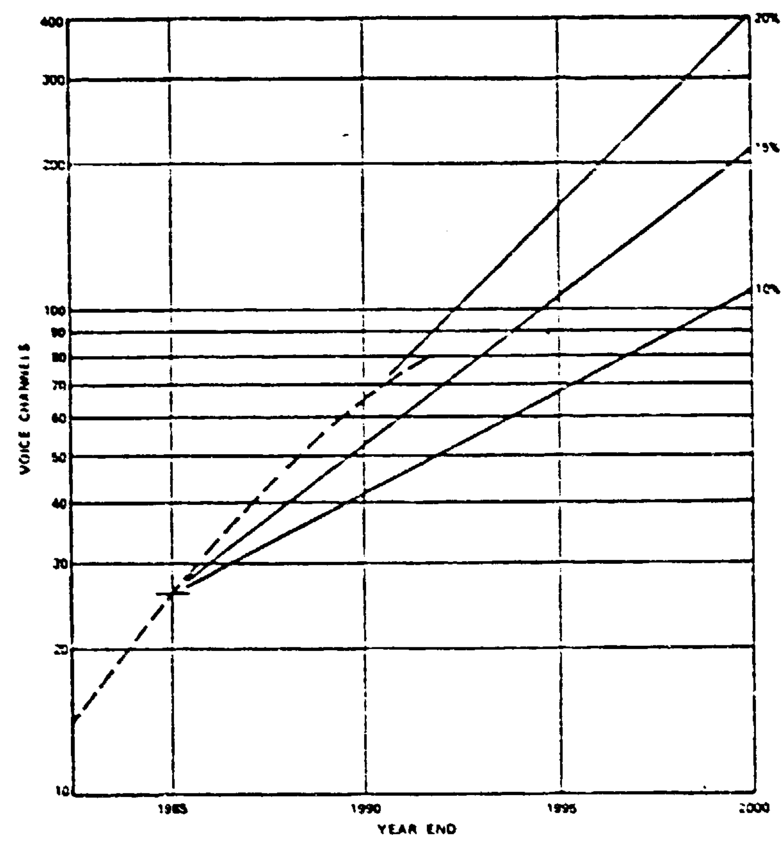

Figure A-1
ATLANTIC OCEAN
MARITIME REQUIREMENTS

Table A-3

YEAR 2000 TRAFFIC ESTIMATES BY ARINC
FOR AERONAUTIC COMMUNICATIONS

Ocean Area	Forward Channels	Return Channels
Atlantic	6	9
Pacific	7	8
Indian	5	8

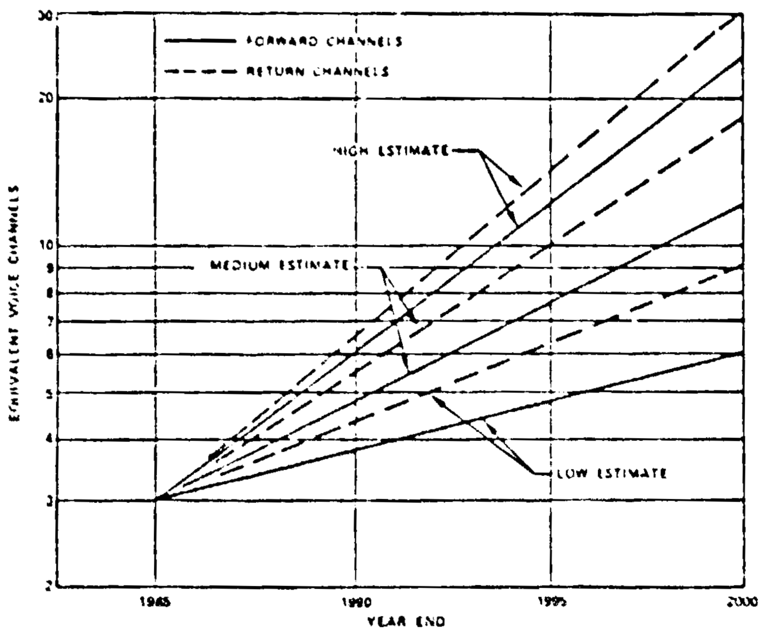

Figure A-2
ATLANTIC OCEAN
AERONAUTIC REQUIREMENTS

SECTION 5

TRAFFIC FORECAST

FSI has developed a 10-year traffic forecast for domestic and regional satellite communications. This forecast includes conventional telephony traffic and new data services traffic.

I. Telephony Traffic

Since there is extensive background of conventional telephone telecommunications, the model for telephony satellite traffic is based on correlation factors which have been derived from historical data, and which are applied to forecasts of future population and GNP numbers.

Tables A-4 and A-5 show the 11 world model zones and the countries that make up each zone. The current populations and GNP/capita for each zone is also given. This information is used in developing the population and GNP/capita forecast shown in Tables A-6 and A-7. When these two tables are multiplied the result is the total GNP, this is shown in Table A-8.

Table A-9 shows the number of long distance calls per $1,000 GNP for each of the world model zones. The telephone use per unit GNP is shown to increase with time, as it has in the past. However, the model shows that for the developed countries this trend starts to level off in the 1900s. Table A-10 shows the total number of long distance calls per year in the same format. This table results from multiplication of the data in Tables A-8 and A-9 (Long Distance Calls Per $1,000 GNP).

Table A-4

Population and GNP Per Capita

World Regions	1979 Population (Millions)	Current Population Growth (% Per Year)	Current Inflation (% Per Year)	1979 GNP/Capita (1979 Dollars)	Current GNP/Capita Growth (% Per Year)
North America	244	0.9	7.7	$10,980	1.4
Western Europe	416	0.8	9.6	6,590	2.3
U.S.S.R.	264	0.9	6.4	3,480	3.0
Eastern Europe	112	0.7	8.7	4,000	4.1
Japan	117	1.3	10.7	8,310	2.5
Group I Total	1,152	0.9	8.7	6,730	2.21
Latin America	349	2.8	34.4	1,520	5.5
Middle East*	174	2.8	11.4	2,260	11.9
China	927	1.8		470	4.1
Asia**	1,295	2.6	11.8	300	2.7
Africa***	330	2.9	14.4	380	1.0
Group II Total	3,073	2.4	20.2	610	5.6
Other Countries	67	2.1	11.3	3,580	2.5
World Total	4,292	2.0	10.4	$ 2,300	2.9

*Includes North Africa
**Excludes Japan and China
***Excludes South Africa and North Africa

Table A-5

World Model Zones

Group I

North America

- Canada
- United States

Western Europe

- Andorra
- Austria
- Belgium
- Denmark
- Federal Republic of Germany
- Finland
- France
- Great Britain
- Greece
- Iceland
- Ireland
- Italy
- Liechtenstein
- Luxembourg
- Malta
- Monaco
- Netherlands
- Norway
- Portugal
- San Marino
- Spain
- Sweden
- Switzerland
- Turkey
- Yugoslavia

USSR

Eastern Europe

- Albania
- Bulgaria
- Czechoslovakia
- German Democratic Republic
- Hungary
- Poland
- Rumania

Japan

Table A-5, Continued

World Model Zones

Group II

Latin America

Argentina	Haiti
Barbados	Honduras
Bolivia	Jamaica
British Honduras	Mexico
Brazil	Nicaragua
Chile	Panama
Colombia	Paraguay
Costa Rica	Peru
Cuba	Surinam
Dominican Republic	Trinidad & Tobago
Ecuador	Uraguay
El Salvador	Venezuela
French Guiana	
Guyana	

Middle East

Algeria	Lebanon
Bahrain	Morocco
Cyprus	Oman
Egypt	Qatar
Iran	Saudi Arabia
Iraq	Syria
Jordan	Tunisia
Kuwait	Yemen, A.R.
Libya	Yemen, P.D.R.

China

Asia

Afganistan	North Korea
Bangladesh	Nepal
Burma	Pakistan
India	Philippines
Indonesia	South Korea
Kampuchea	Taiwan
Malaysia	Thailand
Mongolia	Vietnam
Laos	

Table A-5, Continued

World Model Zones

Group II, Continued

Africa

Angola
Benin
Burandi
Cameroon
Central African Republic
Chan
Cape Verde
Djibouti
Ethiopia
Equitorial Guinea
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Ivory Coast
Kenya
Lesotho
Liberia
Malagasy Republic
Malawi
Mali
Mauitania
Mauritus
Mozambique
Niger
Nigeria
Republic of Congo
Reunion
Rodesia
Rwanda
Senegal
Sierra Leone
Somalia
Sudan
Swaziland
Tanzania
Togo
Uganda
Upper Volta
Zaire
Zambia

Other Countries

Antigua
Australia
Bahamas
Bhutan
British Soloman
Brunei
Burmuda
Canal Zone
Dominica
Fiji
French Polynesia
Grenada
Guadeloupe
Guam
Hong Kong
Israel
Maldive Islands
New Caladonia
New Guinea
New Hebrides
New Zealand
Portuguese Timor
Singapore
South Africa
St. Lucia
St. Vincent
Tonga
Virgin Islands
West Samoa

Table A-6

POPULATION (MILLIONS)

	1990	1995	2000
NORTH AMERICA	264.58	274.09	284.72
WESTERN EUROPE	449.40	464.25	478.63
U.S.S.R.	291.13	304.47	318.42
EASTERN EUROPE	120.19	124.14	128.23
JAPAN	133.37	139.71	143.91
TOTAL GROUP I	1259	1307	1354
LATIN AMERICA	451.73	500.29	550.63
MIDDLE EAST*	226.58	251.47	274.29
CHINA	1092.30	1176.72	1267.66
ASIA**	1627.74	1780.49	1928.16
AFRICA***	435.93	487.90	540.01
TOTAL GROUP II	3834	4197	4561
OTHERS	74.04	72.64	70.72
TOTAL	5166.98	5576.16	5985.39

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
***EXCLUDES SOUTH AFRICA AND NORTH AFRICA

Table A-7

GNP Per Capita (Dollars)

	1990	1995	2000
North America	13362	14608	15971
Western Europe	8460	9479	10620
U.S.S.R.	4660	5324	6082
Eastern Europe	5834	6929	8229
Japan	10907	12341	13962
Total Group I	8620	9650	10807
Latin America	2341	2849	3466
Middle East*	3666	4568	5693
China	728	890	1088
Asia**	411	471	541
Africa***	503	569	643
Total Group II	931	1129	1368
Others	4700	5317	6016
Total	2858	3180	3558

*Includes North Africa
**Excludes Japan and China
***Excludes South Africa and North Africa

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Others	4700	5317	6016
Total	2858	3180	3558

*Includes North Africa
**Excludes Japan and China
***Excludes South Africa and North Africa

Table A-8

GNP (Billions of Dollars)

	1990	1995	2000
North America	3535	4004	4547
Western Europe	3802	4401	5083
U.S.S.R.	1357	1621	1937
Eastern Europe	701	860	1055
Japan	1455	1724	2009
Total Group I	10850	12610	14632
Latin America	1058	1425	1908
Middle East*	831	1149	1562
China	795	1047	1379
Asia**	668	839	1043
Africa***	219	277	347
Total Group II	3571	4738	6240
Others	348	386	425
Total	14769	17734	21298

*Includes North Africa
**Excludes Japan and China
***Excludes South Africa and North Africa

Table A-9

Long Distance Calls per $1000 GNP

	1990	1995	2000
North America	8.70	9.47	9.98
Western Europe	11.24	11.69	12.10
U.S.S.R.	8.70	9.47	9.98
Eastern Europe	8.70	9.47	9.98
Japan	11.24	11.69	12.10
Latin America	8.70	9.47	9.98
Middle East*	8.70	9.47	9.98
China	5.43	6.95	8.23
Asia**	5.43	6.95	8.23
Africa***	5.43	6.95	8.23
Others	8.70	9.47	9.96

*Includes North Africa
**Excludes Japan and China
***Excludes South Africa and North Africa

Table A-10

TOTAL LONG DISTANCE CALLS (MILLIONS)

	1990	1995	2000
NORTH AMERICA	30763	37919	45404
WESTERN EUROPE	42728	51462	61487
U.S.S.R.	11805	15350	19337
EASTERN EUROPE	6102	8146	10537
JAPAN	16348	20162	24305
TOTAL GROUP I	107745	133040	161069
LATIN AMERICA	9204	13497	19055
MIDDLE EAST*	7228	10880	15592
CHINA	4319	7276	11347
ASIA**	3629	5829	8583
AFRICA***	1190	1927	2858
TOTAL GROUP II	25570	39409	57435
OTHERS	3028	3658	4248
TOTAL	136343	176107	222752

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
***EXCLUDES SOUTH AFRICA AND NORTH AFRICA

The next step in generating transponder requirements consists of translating long distance calls into satellite call minutes. An average call duration of 9 minutes was used for this calculation, which was based on a summary of international statistics. Then, Table A-11 shows the percentage of long distance calls which will be carried on communications satellites during the 10-year study period for each of the world model zones. Table A-11 is then multiplied by 9 and then multiplied by Table A-10 to give Table A-12 which shows millions of satellite call minutes per year.

Traffic requirements are expressed in terms of typical domestic C-band transponders with an EIRP of about 33 dBW and a bandwidth of about 40 MHz and being able to carry about 1,000 multiple access one-way telephone channels as a weighted average for domestic applications. This measure was chosen merely as a convenient reference with which everyone is familiar. Actual domestic satellite systems of the future will use a variety of other arrangements.

Table A-13 shows the resulting telephone traffic in transponders or units of 1,000 one-way voice channels. This information is found by multiplying the data of Table A-12 by 17.4. The derivation of the factor of 17.4 is shown below:

a. It was assumed that the total traffic is distributed over the equivalent of 2,400 busy hours per year. On this basis the Erland load is calculated as:

   1 billion call minutes/2,400 hours x 60 = 6,944 Erlangs

b. The trunk distribution and grade of service are such that the required ratio of Erlangs to circuits is 0.8. Therefore, one billion call minutes per year require 8,680 circuits.

c. One reference transponder handles 1,000 one-way channels or 500 two-way circuits. Therefore, one billion call minutes per year requires 17.4 transponders.

Table A-11

PERCENT OF TRAFFIC CARRIED VIA SATELLITE

	1990	1995	2000
NORTH AMERICA	7.69	7.91	7.97
WESTERN EUROPE	4.61	4.88	4.96
U.S.S.R.	7.51	7.82	7.93
EASTERN EUROPE	6.38	7.41	7.78
JAPAN	4.60	4.86	4.95
LATIN AMERICA	9.78	11.70	12.91
MIDDLE EAST*	9.95	11.09	11.65
CHINA	10.79	12.94	13.99
ASIA**	14.12	14.55	14.77
AFRICA***	17.99	19.05	19.55
OTHERS	7.59	9.32	10.38

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
***EXCLUDES SOUTH AFRICA AND NORTH AFRICA

Table A-12

TOTAL SATELLITE CALL-MINUTES (MILLIONS)

	1990	1995	2000
NORTH AMERICA	21284	26993	32583
WESTERN EUROPE	17720	22581	27450
U.S.S.R.	7983	10805	13808
EASTERN EUROPE	3506	5430	7379
JAPAN	6769	8827	10836
TOTAL GROUP I	57262	74635	92057
LATIN AMERICA	8099	14211	22146
MIDDLE EAST*	6472	10856	16347
CHINA	4196	8474	14290
ASIA**	4612	7635	11411
AFRICA***	1926	3303	5027
TOTAL GROUP II	25306	44480	69222
OTHERS	2067	3069	3967
TOTAL	84635	122184	165246

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
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Table A-13

TOTAL SATELLITE TELEPHONY TRAFFIC
(IN THOUSANDS OF VOICE CHANNELS OR TRANSPONDERS)

	1990	1995	2000
NORTH AMERICA	370.35	469.67	566.95
WESTERN EUROPE	308.33	392.91	477.64
U.S.S.R.	138.90	188.00	240.26
EASTERN EUROPE	61.01	94.48	128.39
JAPAN	117.78	153.59	188.55
TOTAL GROUP I	996.36	1298.65	1601.79
LATIN AMERICA	140.93	247.27	385.34
MIDDLE EAST*	112.62	188.90	284.44
CHINA	73.00	147.45	248.64
ASIA**	80.25	132.85	198.56
AFRICA***	33.52	57.48	87.48
TOTAL GROUP II	440.32	773.95	1204.46
OTHERS	35.97	53.40	69.03
TOTAL	1472.65	2126.00	2875.28

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
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2. Data Transmission-Domestic and Regional

Advances in computer technology and application have introduced new data transmission services which will be in extensive use by the year 2000. These services will require space segment capacity in addition to that which has been extrapolated from the historical use of the telephone system.

In a filing with the U.S. Federal Communications Commission (FCC) of April 1976, Satellite Business Systems (SBS) shows that 415 major U.S. corporations will create a market for satellite data transmission equivalent to 100,000 voice circuits by 1985. At 1,000 one-way channels per transponder, this corresponds to 200 equivalent C-band transponders. SBS states that the market is further increased by requirements from smaller corporations and from government agencies. To be conservative we have cut this forecast in half and applied it to each country or region in proportion with projected GNP growth.

The final correlation factor is about one transponder per $20 billion GNP. The resulting transponder requirements are shown in Table A-14. The world total for the year 2000 is approximately 800 transponders.

Table A-15 shows total transponder requirements for each of the world model zones during the 10-year period of the study.

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Table A-14

NEW DATA TRANSMISSION REQUIREMENTS (TRANSPONDERS)

	1990	1995	2000
NORTH AMERICA	131.08	163.15	191.43
WESTERN EUROPE	130.12	174.69	212.02
U.S.S.R.	46.43	64.34	80.78
EASTERN EUROPE	24.00	34.15	44.02
JAPAN	49.78	68.44	83.81
TOTAL GROUP I	381.41	504.77	612.05
LATIN AMERICA	14.27	25.41	39.03
MIDDLE EAST*	16.24	26.06	37.22
CHINA	27.22	41.58	57.54
ASIA**	15.78	26.18	37.35
AFRICA***	2.96	4.94	7.10
TOTAL GROUP II	76.47	124.17	178.24
OTHERS	4.70	6.89	8.70
TOTAL	462.57	635.82	798.99

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
***EXCLUDES SOUTH AFRICA AND NORTH AFRICA

Table A-15

TOTAL REQUIREMENTS (TRANSPONDERS)

	1990	1995	2000
NORTH AMERICA	501.43	632.82	758.38
WESTERN EUROPE	438.45	567.60	689.66
U.S.S.R.	185.33	252.35	321.04
EASTERN EUROPE	85.01	128.62	172.41
JAPAN	167.56	222.03	272.36
TOTAL GROUP I	1377.77	1803.42	2213.84
LATIN AMERICA	155.20	272.68	424.38
MIDDLE EAST*	128.86	214.96	321.66
CHINA	100.22	189.03	306.17
ASIA**	96.03	159.03	235.90
AFRICA***	36.47	62.42	94.58
TOTAL GROUP II	516.79	898.12	1382.70
OTHERS	40.67	60.29	77.73
TOTAL	1935.23	2761.83	3674.27

*INCLUDES NORTH AFRICA
**EXCLUDES JAPAN AND CHINA
***EXCLUDES SOUTH AFRICA AND NORTH AFRICA

LIST OF REFERENCES

A(1) IMCO Panel of Experts on Maritime Satellites, Report to the International Conference on the Establishment of an International Maritime Satellite System. September 1974.

A(2) A study of communications requirements for a 1985 to 2000 operational aeronautical satellite system, Volume 1, Atlantic Ocean Area, May 1975. Prepared for U.S. Department of Transportation by ARINC Research Corporation, Report No. FAA-RD 75-80.

APPENDIX B

VIDEO CONFERENCING FORECAST

September 6, 1979

VIDEO CONFERENCING FORECAST *

If an effort is made to provide inexpensive space segment, video conferencing will be an attractive substitute for travel. In addition, the availability of video conferencing will stimulate its use for conferences which would have been held over the standard audio-only telephone system. This will be especially true for transoceanic conferencing.

Since video conferencing will substitute for travel, we have used reliable data on airline travel as a basis for our forecast of video conferencing requirements. Data on the number of man- flights per year was obtained from the F.A.A. Statistical handbook. Although the data is for the U.S. only, a strong correlation exists between the number of man- flights and the GNP per capita. We used this correlation to scale the U.S. data for other countries and regions. The relations are as follows:

$$\text{Air Trips/1000 population} = 10^{(A \log x + B)}$$

where

x	=	GNP per capita, 1979 dollars
A	=	0.96 for international traffic
	=	1.42 for domestic traffic
B	=	1.8 for international traffic
		2.6 for domestic traffic

Next it was necessary to separate out the business travel since we assumed that the use of video conferencing as a substitute for personal travel would be negligible. We therefore assumed (in the absence of data) that business travel was 50 percent of the total. We further assumed that every four airline trips (i.e., two round trips) replaced would require one 2-hour video conference. In an efficient system, one video conferencing circuit could accommodate 1600 conference hours per year. This is about 31 hours per week of actual use.

*Prepared for General Dynamics by Future Systems, Inc.

In addition to replacement of airline travel, video conferencing would serve to replace some auto travel and would stimulate some video conferences where no trip would have taken place. In order to account for these other factors, we have arbitrarily introduced a multiplier of 1.5. Thus, the traffic forecast by the airline travel replacement is increased by 50 percent to take in these other factors.

We have chosen a conservative fraction as the portion of airline travel replaced and have varied it in order to show a range of possibilities. As with the introduction of any new service, the transition is likely to follow an "S" shaped curve, as shown in Figure B-1. The onset of video conferencing in the other areas of the world is likely to occur later than in the U.S. This effect is also shown.

The median assumptions have about 4.3 percent of U.S. air travel for business being replaced by video conferences in 1990. This increases to 9 percent by the year 2000. Corresponding factors for other regions are 1 percent in 1990 and 2.7 percent in the year 2000. The video conferencing forecast for this median model is shown in Table B-1.

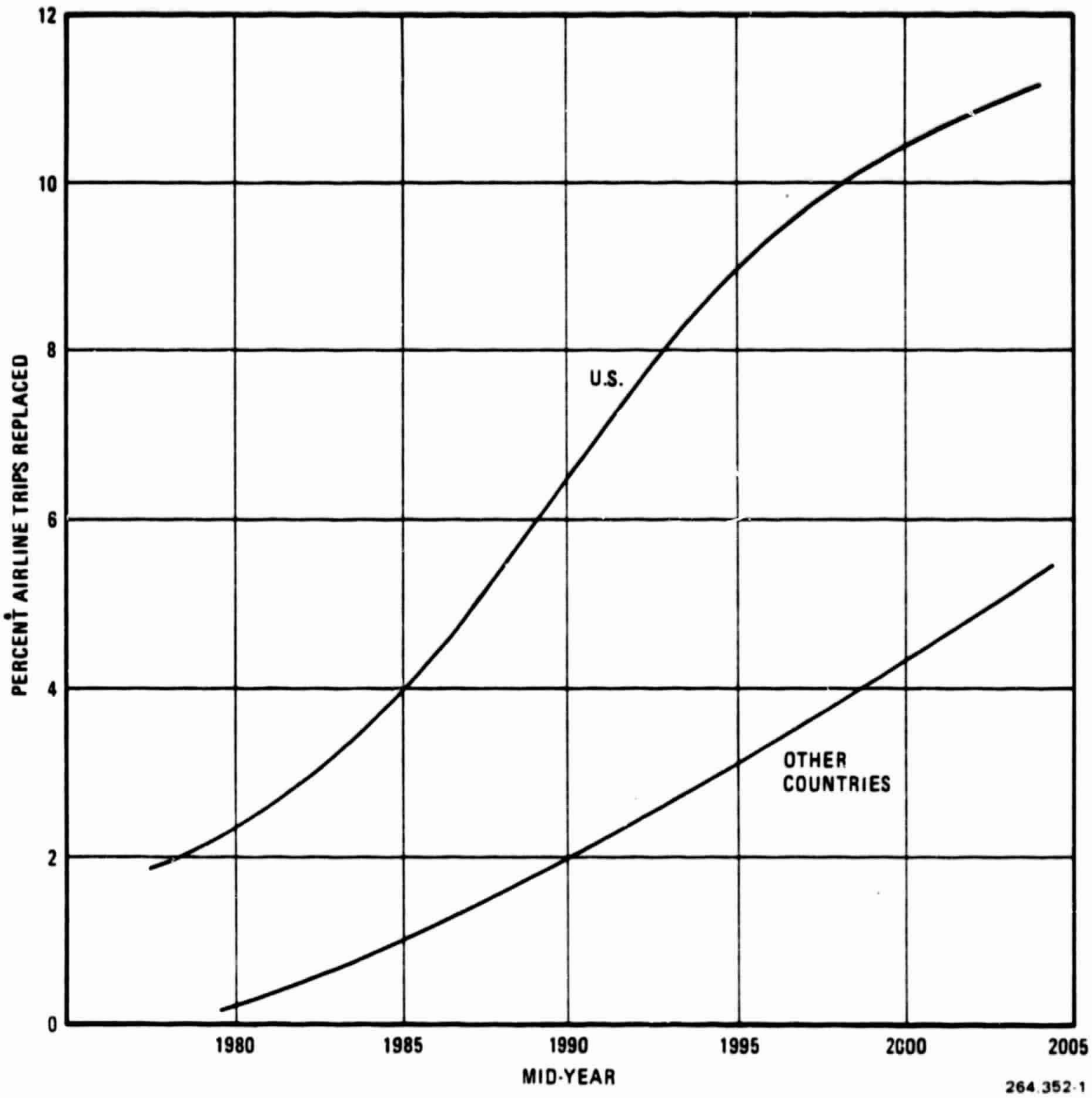

Figure B-1. Transition Curves for Video Conferencing

Table B-1

Median Forecast of Video Conferencing

Region	Video Conferencing Circuits in 1000's 1990	1995	2000
North America	4.4	8.2	12.8
Western Europe	0.9	2.3	3.8
Latin America	0.2	0.5	0.9
Middle East	0.2	0.5	0.9

The low estimate was derived by halving the median, and the high estimate by doubling the median. These forecasts are shown in Tables B-2 and B-3, respectively.

While there can be some argument concerning the exact numbers selected in the assumptions, the main thrust of the forecast is not the prediction of the actual future. The primary conclusion is that even if a rather small fraction of the airline travel is replaced by video conferencing, the number of video circuits required is quite large. Of course, the implicit assumption which underlies our forecast is that the video conferencing circuits and facilities be made available in sufficient quantity and at a low cost so as to stimulate the growth of the market. The quality must also be high enough to overcome objections to this form of conferencing.

Table B-2

Low Forecast of Video Conferencing

Region	Video Conferencing Circuits in 1000's		
	1990	1995	2000
North America	2.2	4.1	6.4
Western Europe	0.5	1.1	1.9
Latin America	0.1	0.2	0.5
Middle East	0.1	0.2	0.5

Table B-3

High Forecast of Video Conferencing

Region	Video Conferencing Circuits in 1000's		
	1990	1995	2000
North America	8.81	16.38	25.65
Western Europe	1.88	4.53	7.52
Latin America	0.33	0.95	1.88
Middle East	0.30	0.90	1.83

APPENDIX C

INTERSATELLITE LINK CAPACITY REQUIREMENTS

FSI Report No. 238

INTERSATELLITE LINK
CAPACITY REQUIREMENTS

February 4, 1980

Prepared for:

General Dynamics
Convair Division
P.O. Box 80847
San Diego, California 92138

Prepared by:

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INTERSATELLITE LINK CAPACITY REQUIREMENTS

SUMMARY

Interconnection of communications platforms by means of intersatellite links may be used in two categories of applications:

1. Wide Platform Separation for Increased Coverage Area

   An example for this application is the interconnection of a U.S. domestic platform with an Atlantic INTELSAT platform. An intersatellite link increases the coverage area for all earth stations accessing either platform with single hop operation. Transmission delay increases with platform separation as shown in Figure C-1.

2. Small Platform Separation for Increased Systems Capacity

   When a single platform does not provide adequate capacity for a given coverage area, two or more platforms may be deployed with small angular separations, e.g. U.S. domestic platforms with 4 degrees separation.

Typical requirements for intersatellite links for the two applications are derived in the analysis which follows, and are summarized below.

Case 1 Wide Platform Separation

A typical ratio for domestic to international traffic is 50 to 1. On this basis one would conclude that the intersatellite link connecting the U.S. domestic with an Atlantic INTELSAT platform would require a capacity equal to about 2 percent of the U.S. domestic system. However, this ratio would be modified by the following considerations:

1. A large portion of the international traffic originates or terminates in the New York and Washington areas, and most of this traffic may not enter the domestic satellite system and therefore does not contribute to the intersatellite link requirements.

2. The short haul portion of the U.S. domestic traffic may not be a candidate for satellite transmissions; thus the ratio of domestic satellite to international satellite traffic may be lower than 50 to 1.

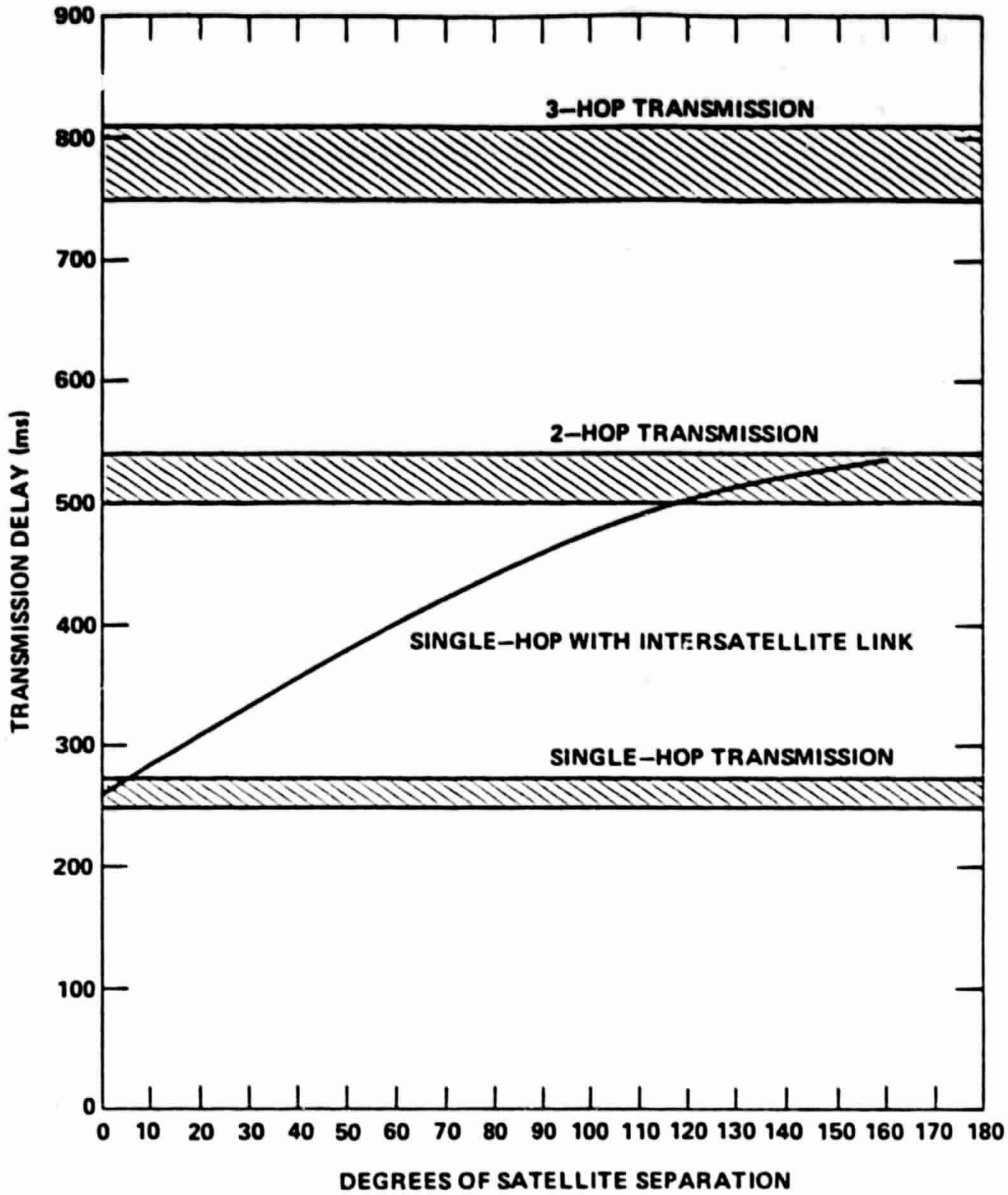


Figure C-1

TRANSMISSION DELAY

More precise evaluation of the intersatellite link requirements would require generation of a systems model with assumptions concerning the distribution of terrestrial versus satellite traffic both for the domestic and the international systems. With such assumptions made, the intersatellite link requirements can be determined from current traffic distributions in the INTELSAT traffic data base and current cable transmission plans.

In the absence of more detailed analysis, we recommend that intersatellite link capacities in the range of 2 to 10 percent of the platform capacity be assumed.

Case 2 Small Platform Separation

In a fully homogeneous system with two platforms of equal capacity, the intersatellite link would have to handle traffic equal to 50 percent of the individual platform capacity. If an attempt is made to segregate user communities on each platform, the intersatellite link requirements are reduced depending on specific traffic plan assumptions. Intersatellite link capacities of 10 to 20 percent will probably be adequate for most practical applications.

INTERSATELLITE LINK MODEL ANALYSIS

The FSI intersatellite link model contains equations to satisfy both homogenous and non-homogeneous satellite systems. The model will be applied to three particular systems:

U.S. to U.S. System

U.S. to Trans-Atlantic System

U.S. to South American System

For a satellite system to approach a homogeneous mix of traffic, it would almost have to consist of a single countries domestic traffic. Of these three examples only the U.S. to U.S. scenario would be of a homogeneous nature. In a homogeneous system there is an equal likelihood of any one customer calling any other customer; in such a case the following equation can be used.

$$A \times B = L$$

where:

A - fraction of total traffic on satellite A

B - fraction of total traffic on satellite B

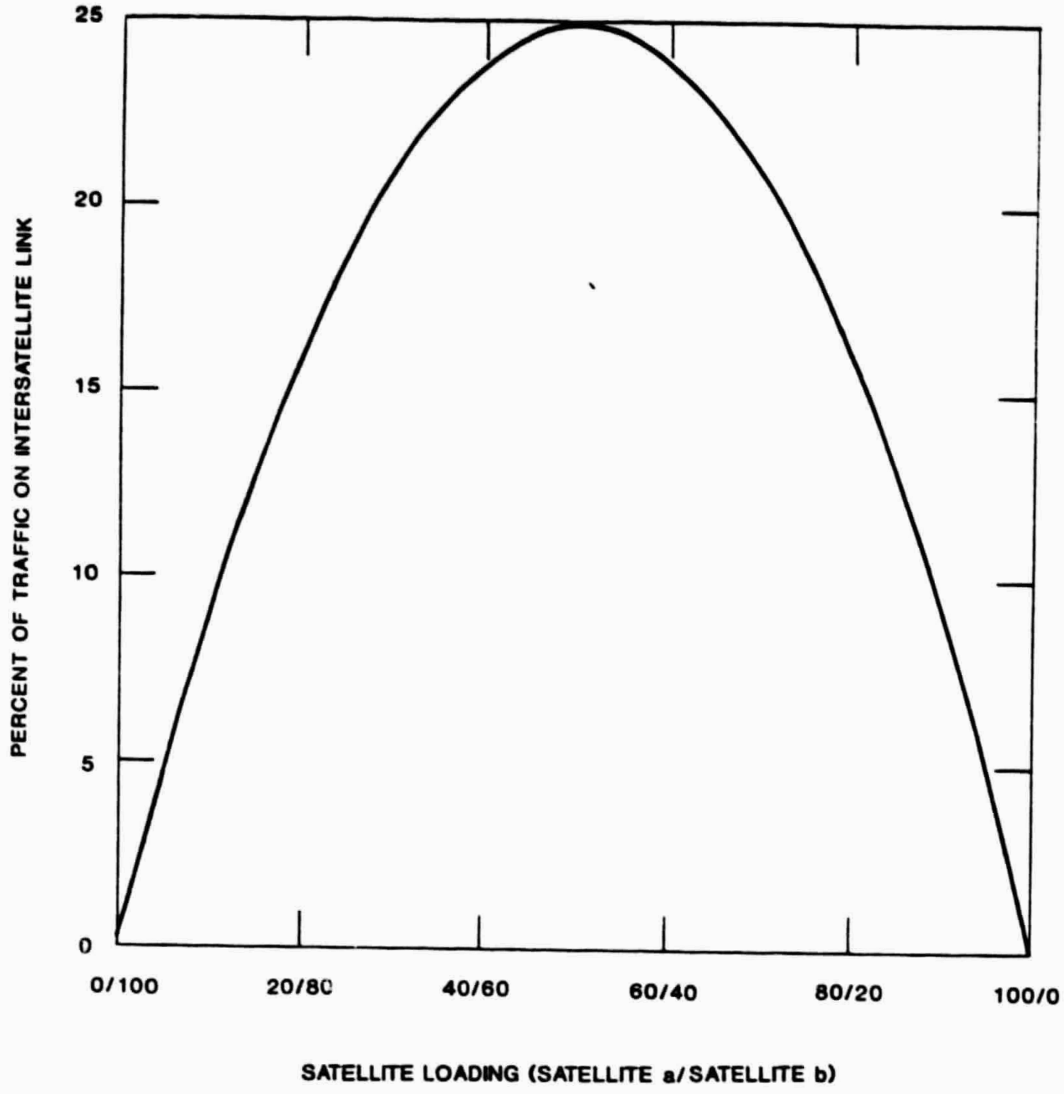
L - fraction of total traffic on intersatellite link

Figure C-2 shows how the percentage of traffic over the intersatellite link varies with different loadings of the two satellites. This figure shows that the maximum amount of traffic to be carried on the intersatellite link is 25 percent. This will occur only when both satellites are equally loaded.

A similar equation can be used for non-homogeneous traffic or traffic that is of the point-to-point type. This would be the case for main-office to branch-office communications. Since this type of user would not need to access all other possible users, a reduction in the amount of traffic carried over the intersatellite link would be realized.

FIGURE C-2

PERCENT OF TRAFFIC ON INTERSATELLITE LINK
VERSUS SATELLITE LOADING



The following equation takes into account the above mentioned private line services and the fact that their increased use will reduce the intersatellite link requirements.

$$A \times B \times (1-P) = L$$

where:

A - fraction of traffic on satellite A

B - fraction of traffic on satellite B

P - fraction of traffic that is private line services

L - fraction of traffic on intersatellite link

This equation will now be applied to the low traffic scenario where this scenario consists of a single major path satellite interconnecting 20 high traffic cities and two platforms servicing the entire U.S. The two platforms would need to be interconnected by an intersatellite link so that multiple antennas would not be required at the earth stations. The necessary values for "A" and "B" are given in the system description along with the capacities of the platforms.

System Description: U.S. to U.S.

Two platforms, each with a maximum capacity of 1,092 transponders (Bandwidth = 36 MHz per transponder), will be configured as follows and use the frequencies given to attain this capacity.

Configuration:

39 spot beams covering CONUS bandwidth split three ways yielding 13 times frequency reuse

Frequency bands:

4/6 GHz

11/14 GHz

18/30 GHz

Capacity:

4/6 GHz	=	12 transponders x 13 frequency reuse = 156 transponders
11/14 GHz	=	12 transponders x 13 frequency reuse = 156 transponders
18/30 GHz	=	60 transponders x 13 frequency reuse = 780 transponders
		Platform Capacity 1,092

	Percent of Traffic
Major path (pipeline satellite)	17.2
Platform A	49.7
Platform B	33.1
	100.0 %

The traffic percentages for Platforms A and B were developed as follows: The remaining satellite traffic, after the major path or pipeline satellite had its 17.2 percent, would be split 60/40 between the two platforms.

100% - 17.2% = 82.8% remaining traffic

For Platform A

82.8% x 60% = 49.7

For Platform B

82.8% x 40% = 33.1

In this non-homogenous case we need to use the second equation to calculate the intersatellite link requirement. A value for "P" must be chosen to represent a reasonable portion of the traffic that will not need to use the intersatellite link. In this scenario it is assumed that an effort will be made to assign common users to the same platform. For this reason the value 0.5 has been assigned to "P" yielding the following results:

.497 x .321 x (1 - .5) = 8.0%

The intersatellite link traffic will be 8.0 percent of the total U.S. traffic.

Up to now the discussion has revolved around the development of the theoretical technique for estimating the intersatellite link requirements; therefore, we consistantly referred to percentages of total traffic so that it would be easy to compare the requirements for different scenarios. The FSI traffic forecast for a system of this size deployed in the mid to late 1980's is 1,128 transponders. Going by the system description percentages given before the transponder requirements will be as follows:

	Number of Transponders
Major Path (pipeline satellite)	194
Platform A	561
Platform B	373
Total	1,128

The intersatellite link requirements will be

1,128 x 8.0% = 90 transponders

System Description U.S. to Trans-Oceanic and U.S. to South American Traffic

The following ratios have been used to develop this model for a U.S. to trans-oceanic satellite intersatellite link. These ratios have been derived from actual figures obtained from international and domestic carriers.

Ratio of domestic to international messages:

50.6 to 1

Ratio of total international to trans-oceanic messages:

1.4 to 1

Using these ratios and domestic traffic as 1,128, as given before, the trans-oceanic traffic can be calculated.

$$\frac{1,128}{50.5} = 22.3 \text{ transponders of international traffic}$$

$$\frac{22.3}{1.4} = 15.9 \text{ transponders of trans-oceanic traffic}$$

The remaining 6.4 transponders would be for communicationswith South America.

$$\text{International Traffic} = \frac{1,128}{36.5} = 30.9 \text{ transponders}$$

$$\text{Trans-Oceanic Traffic} = \frac{30.9}{1.4} = 22.1 \text{ transponders}$$

The remaining 8.8 transponders of traffic would be directed for South American communications with the United States.

APPENDIX D

LINK BUDGETS

PLATFORM COMMUNICATIONS PAYLOAD LINK BUDGETS

A major factor affecting the sizing and support requirements of the platform communications payloads or any payload requiring dedicated links to an earth segment is the integrity of the transmission link budgets. The primary parameters which determine transmission link integrity are EIRP (Effective Isotropic Radiated Power) and G/T (Ratio of Antenna Gain to Receive System Noise Temperature). Given the characteristics of the earth stations needed to interface with the platform payloads the link equations can be used to determine the payload EIRP and G/T parameters. These parameters must be such to compensate for link losses due to path attenuation, atmospheric loss, circuit loss, etc.

The link analyses for communications payloads Nos. 4 through 12 are contained in the COMSAT report on mission and payload requirements. The payload #3 link budget is provided in the Aerospace report on platform feasibility.

Direct to User Network & High Volume Trunking Link Budgets - Payloads for the Direct to User and High Volume Trunking Systems have been described and discussed in the Geostationary Platform Feasiblity Study by the Aerospace Corporation. To meet the expanded traffic requirements generated by Task 1 these payloads were extensively modified. The modifications increased payload capacity, introduced higher frequency bands, and had considerable impact on payload weight and power. To accommodate these modifications, the existing link budgets were revised and extended. The resulting DTU and HVT link budgets are based on the following assumptions:

1. All traffic on the links is digital with transmission at specified bit rates.
2. Up and down links are isolated in the sense that the received messages are demodulated, regenerated, buffered, and switched, etc. onboard the platform. Processed messages are modulated on to downlink carriers.
3. Each downlink carrier has its own high power amplifier or directly modulated power source, eliminating the need for back-off.
4. Rain margins are provided where necessary and supplemented by site diversity for HVT services.

5. Adaptive polarization techniques are used to compensate for the effects of atmospheric depolarization.

6. Link availability under atmospheric outage conditions will be:

   a. DTU (14/12 GHz & 30/20 GHz) - 99.5 percent

   b. HVT (6/4 GHz with adaptive polarization) - 99.99 percent

   c. HVT (30/20 GHz with site diversity) - 99.99 percent

Tables D-1 and D-2 show the up and down link budgets for the 14/12 GHz and 30/20 GHz DTU payloads.

Tables D-3 and D-4 show the up and down link budgets for the 6/4 GHz HVT payload using deplarization correction.

Tables D-5 and D-6 show the up and down link budgets for the 30/20 GHz HVT payload site diversity with 35 km separation.

Table D-7 summarizes the link margins.

Table D-1. DTU Up-Links

Frequency	GHz	14.0	30.0
XMT Power	W/dBW	200/23	200/23
Feed Loss	dB	1.0	1.0
ET Antenna Size	Meters	7.0	7.0
Surface Tol.	Mil	20.0	20.0
ET Antenna Effic.		60.0	60.0
ET Antenna Gain (Axial)	dB	58.0	64.5
EIRP	dBW	80.0	86.5
Pointing Loss	dB	0.5	1.5
Availability		99.5	99.5
Total Attenuation	dB	2.1	9.8
Path Loss	dB	207.7	214.1
Rcvd Power	dBW	-130.3	-138.9
Sat. Ant. Diameter	Meters	6.0	4.0
Sat. Ant. Beamwidth	Degree	0.35	0.35
Sat. Ant. Efficiency		50.0	50.0
Sat. Ant. EOB Gain	dB	50.0	50.0
Noise Temperature	°K/dB	1,000/30	1,000/30
G/T	dB/°K	20.0	20.0
C/N_o - up	dB/Hz	118.3	109.7
Polarization		Dual	Single
Depolarization - C/I	dB	32.0	--
C/I - multibeam	dB	22.5	22.0
C/I - Total	dB	22.0	22.0
XPDR BW	MHz/dB	40/76	40/76
C/I_o - Total	dB/Hz	98.0	98.0
$C/(N_o + I_o)$	dB/Hz	98.0	97.7
Bit Rate	Mbs/dB	64.78.1	64.78.1
Modem Loss	dB	2.0	2.0
Available E_b/N_o	dB/Hz	17.9	17.6
Required E_b/N_o	dB/Hz	8.8	8.8
Margin - up	dB	9.1	8.8

Table D-2. DTU Down-links

Frequency	GHz	12.0	20.0
XMT PWR	W/dBW	2.0/3.0	5.0/7.0
Feed Loss	dB	2.0	3.0
Sat. Ant. Diameter	Meters	6.0	4.0
Sat. Ant. Beamwidth	Degree	0.35	0.35
Sat. Ant. Pointing	Degree	0.03	0.03
Sat. Ant. Efficiency		50.0	50.0
Sat. Ant. EOB Gain	dB	50.0	50.0
EIRP	dBW	51.0	54.0
Pointing Loss	dB	0.2	0.2
Availability		99.5	99.5
Total Attenuation	dB	1.4	5.7
Path Loss	dB	206.6	210.5
Rcvd Power	dBW	-157.2	-162.4
ET Ant. Diameter	Meters	7.0	7.0
ET Ant. Efficiency		60.0	60.0
ET Ant. Axial Gain	dB	56.5	61.0
Noise Temperature	°k/dB	225/23.5	400/26
G/T	dB/K	33.0	35.0
C/N_o - down	dB/Hz	104.4	101.2
Polarization		Dual	Single
Depolarization C/I	dB	36.0	--
C/I - multibeam	dB	22.0	22.0
C/I - Total	dB	21.8	22.0
C/I_o	dB/Hz	97.8	98.0
$C/(N_o + I_o)$	dB/Hz	96.9	96.3
With Regeneration			
Available E_b/N_o	dB/Hz	16.8	16.2
Required E_b/N_o	dB/Hz	8.8	8.8
Margin	dB	8.0	7.4

Table D-3. HVT 6/4 GHz Uplink
(With Depolarization Correction)

Frequency	Ghz	6.0
XMT Power	W/dBW	50/17
Feed Loss	dB	1.0
ET Antenna Size	Meters	12.0
Surface Tol.	Mil	20.0
ET Antenna Effic.		75.0
ET Antenna Gain (Axial)	dB	56.0
EIRP	dBW	72.0
Pointing Loss	dB	0.5
Availability		99.99
Total Attenuation	dB	5.5
Path Loss	dB	200.0
Rcvd Power	dBW	-134.0
Sat. Ant. Diameter	Meters	15.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Efficiency		50.0
Sat. Ant. EOB Gain	dB	50.0
Noise Temperature	°K/dB	1,000/30
G/T	dB/°K	20.0
C/N_o - up	dB/Hz	114.6
Polarization		Dual
Depolarization - C/I	dB	22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
XPDR BW	MHz/dB	160/82
C/I_o - Total	dB/Hz	101.9
$C/(N_o + I_o)$	dB/Hz	101.7
Bit Rate	Mbs/dB	256/84.1
Modem Loss	dB	2.0
Available E_b/N_o	dB/Hz	15.6
Required E_b/No	dB/Hz	11.1
Margin - up	dB	4.5

Table D-4. HVT 6/4 GHz Downlink
(With Depolarization Correction)

Frequency	GHz	4.0
XMT PWR	W/dBW	1.0/0.0
Feed Loss	dB	2.0
Sat. Ant. Diameter	Meters	15.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Pointing	Degree	0.03
Sat. Ant. Efficiency		50.0
Sat. Ant. EOB Gain	dB	50.0
EIRP	dBW	48.0
Pointing Loss	dB	0.2
Availability		99.99
Total Attenuation	dB	1.0
Path Loss	dB	196.7
Rcvd Power	dBW	-149.7
ET Ant. Diameter	Meters	12.0
ET Ant. Efficiency		75.0
ET Ant. Axial Gain	dB	52.5
Noise Temperature	°K/dB	214.8/23.3
G/T	dB/K	29.2
C/N_o - down	dB/Hz	108.1
Polarization		Dual
Depolarization C/I	dB	22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
C/I_o	dB/Hz	101.9
$C/(N_o + I_o)$	dB/Hz	101.0
With Regeneration		
Available E_b/N_o	dB/Hz	14.9
Required E_b/N_o	dB/Hz	11.1
Margin	dB	3.8

Table D-5. HVT 30/20 GHz Uplink
(With Site Diversity)

Frequency	Ghz	30.0
XMT Power	W/dBW	300/24.8
Feed Loss	dB	1.0
ET Antenna Size	Meters	12.0
Surface Tol.	Mil	$<$ 20.0
ET Antenna Effic.		70.0
ET Antenna Gain (Axial)	dB	69.2
EIRP	dBW	93.0
Pointing Loss	dB	1.5
Availability		99.99
Total Attenuation	dB	20.0
Path Loss	dB	214.1
Rcvd Power	dBW	142.6
Sat. Ant. Diameter	Meters	4.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Efficiency		50.0
Sat. Ant. EOB Gain	dB	50.0
Noise Temperature	$^\circ$K/dB	1,000/30
G/T	dB/$^\circ$K	20.0
C/N_o - up	dB/Hz	106.0
Polarization		Dual
Depolarization - C/I dB		22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
XPDR BW	MHz/dB	200/83
C/I_o - Total	dB/Hz	102.9
$C/(N_o + I_o)$	dB/Hz	100.9
Bit Rate	Mbs/dB	256/84.1
Modem Loss	dB	2.0
Available E_bN_o	dB/Hz	14.9
Required E_bN_o	dB/Hz	11.1
Margin - up	dB	3.7

Table D-6. HVT 30/20 GHz Downlink
(With Site Diversity)

Frequency	GHz	20.0
XMT PWR	W/dBW	10.0/10/0
Feed Loss	dB	3.0
Sat. Ant. Diameter	Meters	4.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Pointing	Degree	0.03
Sat. Ant. Efficiency		50.00
Sat. Ant. EOB Gain	dB	50.0
EIRP	dBW	57.0
Pointing Loss	dB	0.2
Availability		99.99
Total Attenuation	dB	10.0
Path Loss	dB	210.5
Rcvd Power	dBW	-163.7
ET Ant. Diameter	Meters	12.0
ET Ant. Efficiency		70.0
ET Ant. Axial Gain	dB	66.0
Noise Temperature	°K/dB	467/26.7
G/T	dB/K	39.3
C/N_o - down	dB/Hz	104.2
Polarization		Dual
Depolarization C/I	dB	22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
C/I	dB/Hz	102.9
$C/(N_o + I_o)$	dB/Hz	100.3
With Regeneration		
Available E_b/N_o	dB/Hz	14.2
Required E_b/N_o	dB/Hz	11.1
Margin	dB	3.1

Table D-7. Summary of Link Margins

Service	Frequency (GHz)	Margins (dB) Up	Down	Availability %
DTU	14/12	9.1	8.0	99.5
	30/20	8.8	7.4	99.5
HVT	6/4*	4.5	3.8	99.99
	30/20**	3.7	3.1	99.99

*With Depolarization Correction
**With Site Diversity

Link Budget Item Notes

1. Total attenuation includes atmospheric and precipitation losses. It is assumed that rain-induced outages will occur 0.5% of the time for DTU traffic and 0.01% of the time for HVT traffic.

2. Cross polarization interference can be aggravated by rain-induced depolarization of dual polarized beams. Cancellation techniques have been developed which substantially reduce the effect.

3. The multibeam C/I for a contiguous beam DTU system with a 3 segment frequency distribution is derived from a consideration of sidelobe interference into a central beam from surrounding rings of beams. A C/I of 22db assumes C/I contributions of 25 db from the first and second rings. This level of interference would be produced by first ring sidelobes of -33db and second ring sidelobes of -36db.

   An HVT beam system with beams isolated into singles and groups experiences reduced interference due to the smaller number of interferers and can count on a C/I of 24db or better.

   It should be noted that these C/I estimates assume worst case gaussian interference.. Coherent sinusoidal interference could result in significantly greater C/I ratios.

4. The link performance requirements are given below. At all times a 3dB performance margin is the minimum acceptable.

	Link Bit Error Rates		
Service	Total BER	Up/Down BER	Eb/No(db)
DTU	1×10^{-4}	5×10^{-5}	8.8
HVT	1×10^{-6}	5×10^{-7}	11.1

APPENDIX E

PAYLOAD DATA SHEETS

Payload # 1.1

Candidate Payload Data Summary - Sheet 1 Date: 6/30/80

Code No: COM 1.1 (WH/NTM)

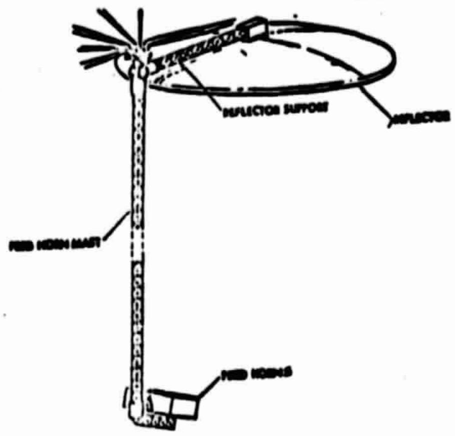
Name: Direct to User Networks

Category: Communications

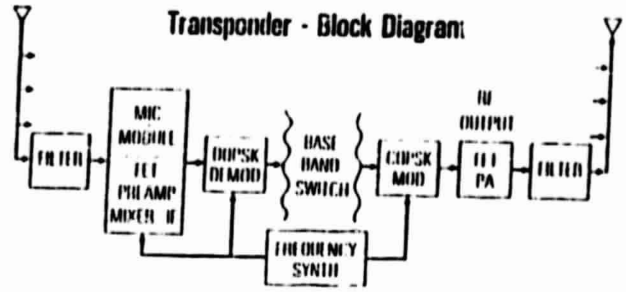
Orbital Location(s): 110° W

Description: Provides direct communication between users at Ku Band frequencies via roof-top antennas.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. TBD
2. Type: Offset fed parabolic reflector
3. Size: 6 meter
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: 260*
6. Pattern/Beamwidth: 0.35° per beam
7. Max. Pointing Error: ± 0.03°
8. Sensitivity (G/T): 20 dB/K
9. /EOC Gain: 50 dB EOC
10. Other:

*See attachment for coverage pattern.

D. Transponder/Processor Data

1. No. 400 40 MHz Transponders
2. Type: Regenerative
3. Transmit Frequency: 12 GHz
4. Receive Frequency: 14 GHz
5. Bandwidth(s)/Data Rate(s): 40 MHz
6. Transmit Power(s)/EIRP: 2 watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/TOMA
9. On-Board Switching: (M× N) 400 × 400
10. Other:

Payload # 1.1

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E. Weight/Power Estimates	Weight (Kg)	Power (W)
1. Antennas/Sensors	100	-
2. Receivers:	450	200
3. Transmitters:	200	1800
4. Processors:	150	250
5. Switch Matrix:	240	4000
6. Power Converters:	50	100
7. Cabling, Harness etc.	50	150
8. Totals:	1240	6500

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 6500
2. Sunlight/Eclipse, Heat Loss: 5700
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: TBD
6. Payload Volume: TBD
7. T, T&C/Avionics: TBD Yes No
8. Mission Duration: 10 yrs.
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: 6000 plus
2. Antenna Size(s): 4.5/7.0 meter
3. Beamwidth(s):
4. Peak Gain(s): 58 dB
5. Noise Temperature: 225°K
6. Receive Frequencies: 12 GHz
7. Transmit Frequencies: 14 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 200 watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: TBD
3. Ground Segment Cost: TBD
4. Estimated Revenue/Yr: ---
5. User Communities: Business, Institutions
6. Technology Availability Date: 1990
7. Market Need Date: 1990
8. Other:

Payload #1.1

Candidate Payload Data Summary - Sheet 3 Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Multi-beam antennas
2. Large capacity digital matrix switch
3. Solid state transmitters
4. Low noise pre-amplifiers
5. Large scale integration of microwave circuits.
6. Optical path transmission & switching

K. Special Requirements/Constraints

1. Data also applies to DTU payload at 15 degrees W orbital location.
2. Payload capacity sized to meet requirements of the nominal traffic model.
3. Atlantic location coverage pattern TBD.

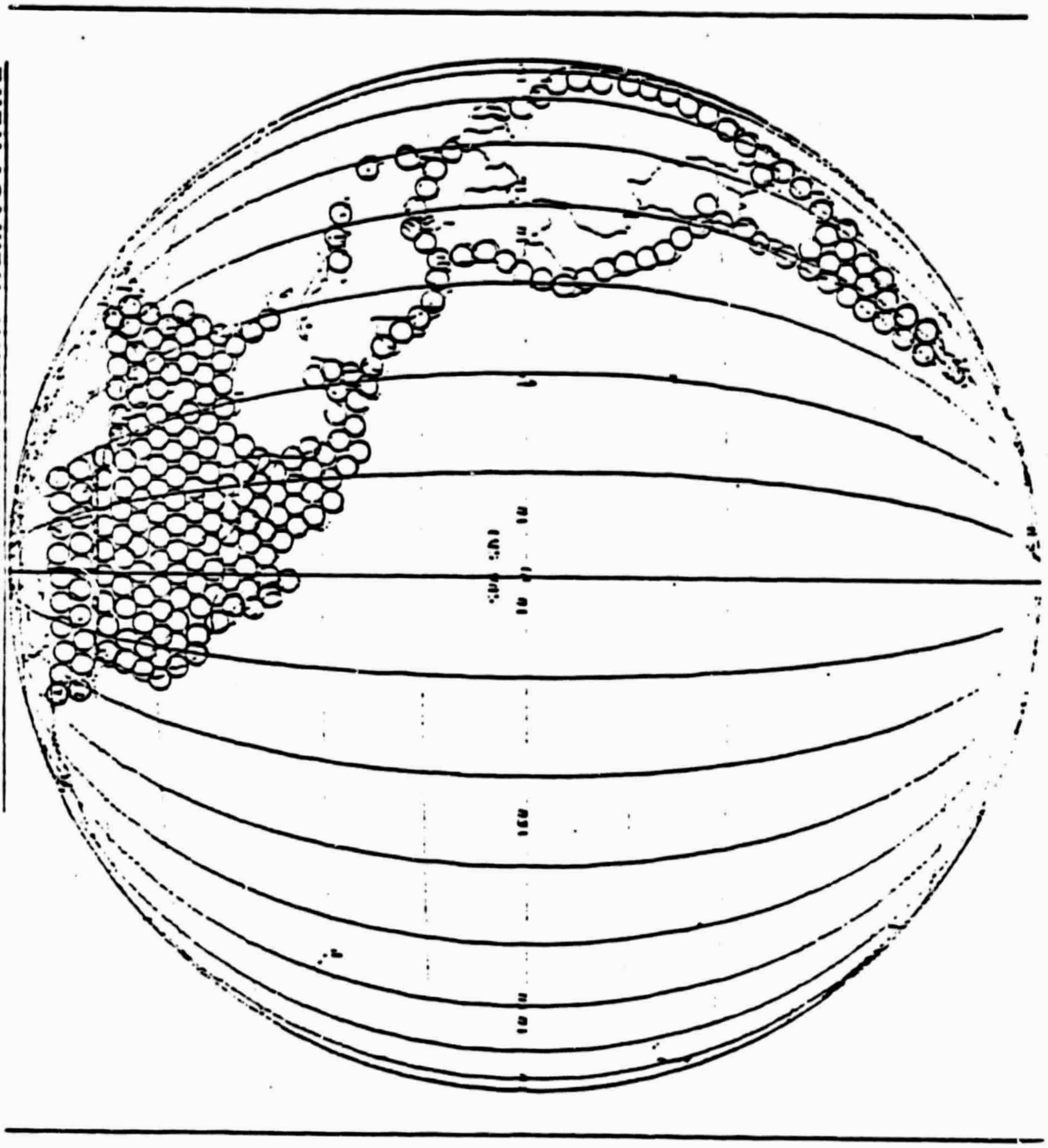
Payload #1.1

Date: 6/30/80

Apr 80

No. of Beams	
Canada	25
U.S.	120
Mexico	40
Central Am	15
South Am	60
Total	260

DTU COVERAGE WESTERN HEMISPHERE



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Payload # 1.2

Candidate Payload Data Summary - Sheet 1

Date: 6/30/80

Code No: COM 1.2 (WH/NTM)

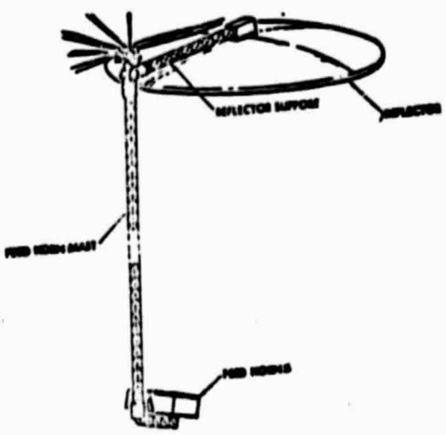
Name: Direct to User Networks

Category: Communications

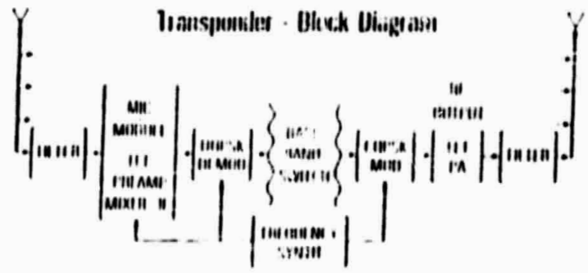
Orbital Location(s): 110°W

Description: Provides direct communications between users at Ka Band frequencies via roof-top antennas.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna Sensor Data

1. No. 3 reflectors
2. Type: Offset fed
3. Size: 4 meters
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: 100*
6. Pattern/Beamwidth: 0.35° per beam
7. Max. Pointing Error: ± 0.03°
8. Sensitivity (G/T): 20 dB/k
9. Peak/EOC Gain: 50 dB EOC
10. Other:

*Provides supplemental coverage of areas served by payload COM 1.1.

D. Transponder/Processor Data

1. No. 400
2. Type: Regenerative
3. Transmit Frequency: 20 GHz
4. Receive Frequency: 30 GHz
5. Bandwidth(s)/Data Rate(s): 40 MHz
6. Transmit Power(s)/EIRP: 5 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/TDMA
9. On-Board Switching: (M× N) 400 × 400
10. Other:

Payload # 1.2

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E.	Weight/Power Estimates	Weight (Kg)	Power (W)
1.	Antennas/Sensors	80	-
2.	Receivers:	450	500
3.	Transmitters:	450	6000
4.	Processors:	100	500
5.	Switch Matrix:	240	4000
6.	Power Converters:	50	300
7.	Cabling, Harness etc.	50	200
8.	Totals:	1420	11,500
9.	Notes:		

F. Support Requirements

1. Sunlight/Eclipse Power: 11,500 Watts
2. Sunlight/Eclipse, Heat Loss: 9000 Watts
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 - 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 8 Yrs.
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users:
2. Antenna Size(s): 4.5/7.0 meter
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature: 400° K
6. Receive Frequencies: 20 GHz
7. Transmit Frequencies: 30 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 200 Watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: TBD
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Business Institutions
6. Technology Availability Date: 1995
7. Market Need Date: 2000
8. Other:

Payload # 1.2

Candidate Payload Data Summary - Sheet 3 Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Multi-beam antennas
2. High capacity digital matrix switch
3. High efficiency TWTS
4. Low noise preamplifiers
5. Large scale integration of microwave circuits
6. Optical path transmission and switching

K. Special Requirements/Constraints

1. Data also applies to DTU payload at 15° W orbital location.
2. Payload capacity sized to meet requirements of the Nominal Traffic Model.
3. Atlantic location coverage pattern TBD.

Payload # 2.1

Candidate Payload Data Summary - Sheet 1 | Date: 6/30/80

Code No: COM 2.1 — WH/NTM

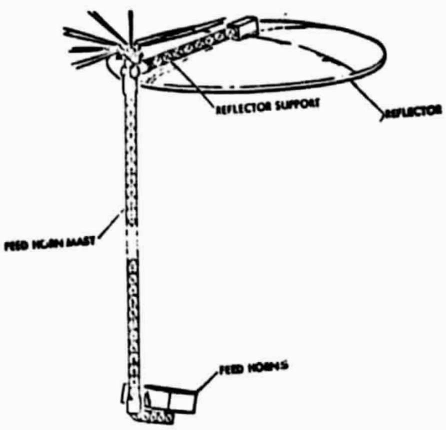
Name: Domestic, Regional & Transocean Trunking

Category: Communications

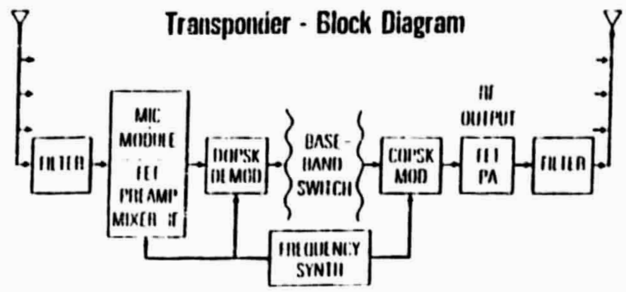
Orbital Location(s): 110° W

Description: Provides high volume communications for domestic, regional and intercontinental traffic.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 1
2. Type: Offset fed cassegrain dish
3. Size: 15 Meters
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: 65*
6. Pattern/Beamwidth: 0.35° beams
7. Max. Pointing Error: ± 0.03°
8. Sensitivity (G/T): 20 dB/K
9. Peak/EOC Gain: 50 dB peak
10. Other:

*See attachment for coverage pattern.

D. Transponder/Processor Data

1. No. 125
2. Type: Regenerative
3. Transmit Frequency: 4 GHz
4. Receive Frequency: 6 GHz
5. Bandwidth(s)/Data Rate(s): 160 MHz
6. Transmit Power(s)/EIRP: 1.0 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/TDMA
9. On-Board Switching: (M× N) 125 × 125
10. Other:

Payload # 2.1

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E. Weight/Power Estimates

	Item	Weight (Kg)	Power (W)
1.	Antennas/Sensors	100	-
2.	Receivers:	150	50
3.	Transmitters:	80	300
4.	Processors:	50	50
5.	Switch Matrix:	30	250
6.	Power Converters:	20	30
7.	Cabling, Harness etc.	20	20
8.	Totals:	450	700

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 700 Watts
2. Sunlight/Eclipse, Heat Loss: 550 Watts
3. Platform Attitude Control: ± 0.1
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 - 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 8 Yrs.
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: TBD
2. Antenna Size(s): 12 Meters
3. Beamwidth(s):
4. Peak Gain(s): 56 dB
5. Noise Temperature: 214°K
6. Receive Frequencies: 4 GHz
7. Transmit Frequencies: 6 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 50 Watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: TBD
3. Ground Segment Cost: TBD
4. Estimated Revenue/Yr:
5. User Communities: PTT Agencies
6. Technology Availability Date: 1990
7. Market Need Date: 1990
8. Other:

Payload # 2.1

Candidate Payload Data Summary - Sheet 3

Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Multi-beam Antenna
2. Large capacity digital matrix switch
3. Solid state transmitters
4. Low noise preamplifiers
5. Large scale integration of microwave circuits
6. Optical path transmission and switching

K. Special Requirements/Constraints

1. Data also applies to HVT payload at 15° W location.
2. Payload capacity sized to meet requirements of Nominal Traffic Model.
3. Atlantic coverage patterns TBD.

Payload # 2.2

Candidate Payload Data Summary - Sheet 1

Date: 6/30/80

Code No: COM 2.2 — NTM

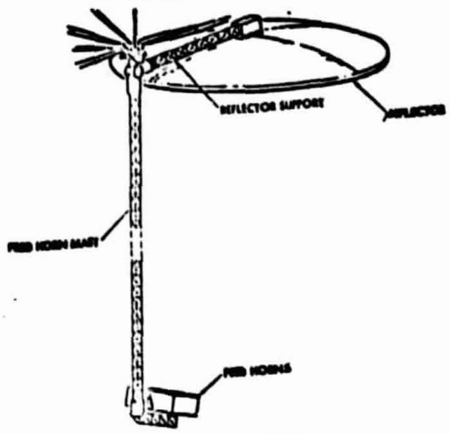
Name: Domestic/Regional

Category: Communications

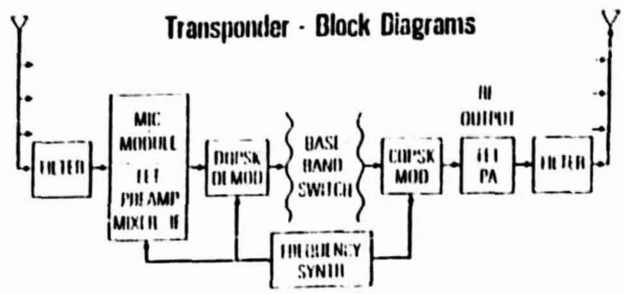
Orbital Location(s): 110° W

Description: Provides high volume communications for domestic and regional and intercontinental traffic.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 1
2. Type: Offset fed reflector
3. Size: 6 Meters
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: 35* approx.
6. Pattern/Beamwidth: 0.35° beams
7. Max. Pointing Error: ± 0.03°
8. Sensitivity (G/T): 20 dB/K
9. Peak/EOC Gain: 50 dB EOC
10. Other:

*See attachment for coverage pattern.

D. Transponder/Processor Data

1. No. 100
2. Type: Regenerative
3. Transmit Frequency: 20 GHz
4. Receive Frequency: 30 GHz
5. Bandwidth(s)/Data Rate(s): 200 MHz
6. Transmit Power(s)/EIRP: 10 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/TDMA
9. On-Board Switching: (M× N) 100 × 100
10. Other:

Payload # 2.2

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E. Weight/Power Estimates

		Weight (Kg)	Power (W)
1.	Antennas/Sensors	30	-
2.	Receivers:	100	100
3.	Transmitters:	140	2500
4.	Processors:	40	100
5.	Switch Matrix:	30	250
6.	Power Converters:	20	150
7.	Cabling, Harness etc.	20	100
8.	Totals:	380	3200
9.	Notes:		

F. Support Requirements

1. Sunlight/Eclipse Power: 3200
2. Sunlight/Eclipse, Heat Loss: 2200
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 - 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 8 Yrs.
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users:
2. Antenna Size(s): 12 Meters
3. Beamwidth(s):
4. Peak Gain(s): 69 dB
5. Noise Temperature: 478°K
6. Receive Frequencies: 20 GHz
7. Transmit Frequencies: 30 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 300 Watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: TBD
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: PTT Agencies
6. Technology Availability Date: 1990
7. Market Need Date: 1990
8. Other:

Payload # 2.2

Candidate Payload Data Summary - Sheet 3 Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Multi-beam Antenna
2. Satellite Switch
3. Multi-level TWTs
4. Low Noise Preamplifiers
5. Large scale integration of microwave circuits
6. Optical path transmission & switching

K. Special Requirements/Constraints

1. Data also applies to HVT payload at 15° W orbital location.
2. Payload capacity sized to meet requirements of the Nominal Traffic Model.
3. Atlantic Region coverage patterns TBD.

Payload #1.1 HTM

Candidate Payload Data Summary - Sheet 1

Date: 6-30-80

Code No: 1.1 — HTM

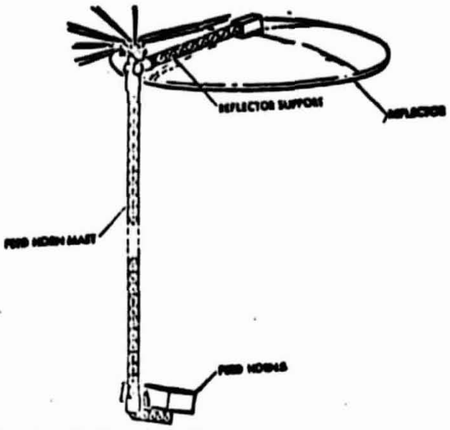
Name: Direct-to-User Networks

Category: Communications

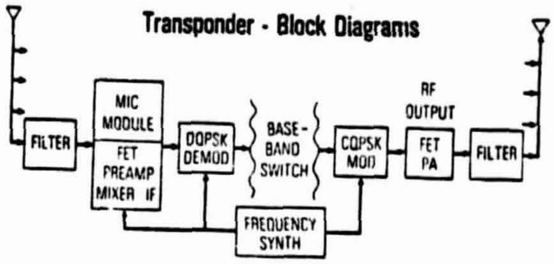
Orbital Location(s): 110° W

Description: Provides direct communication between users at Ku Band frequencies via root-top antennas.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 2
2. Type: Offset fed reflector
3. Size: 20 Meters
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: TBD
6. Pattern/Beamwidth: 0.1° per beam
7. Max. Pointing Error: 0.01°
8. Sensitivity (G/T): 30 dB/°K
9. Peak/EOC Gain: 60 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 500 40 MHz transponders
2. Type: Regenerative
3. Transmit Frequency: 12 GHz
4. Receive Frequency: 14 GHz
5. Bandwidth(s)/Data Rate(s): 40 MHz
6. Transmit Power(s)/EIRP: 2 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/TDMA
9. On-Board Switching: (M× N) 500 × 500
10. Other:

Payload # 1.1 HTM

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E. Weight/Power Estimates

		Weight (Kg)	Power (W)
1.	Antennas/Sensors	200	—
2.	Receivers:	300	200
3.	Transmitters:	450	2800
4.	Processors:	150	150
5.	Switch Matrix:	240	4000
6.	Power Converters:	50	100
7.	Cabling, Harness etc.	50	150
8.	Totals:	1440	7500

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 6500
2. Sunlight/Eclipse, Heat Loss: 5700
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: TBD
6. Payload Volume: TBD
7. T, T&C/Avionics: Yes No
8. Mission Duration: 10 Years
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: —
2. Antenna Size(s): 4.5/7.0 Meters
3. Beamwidth(s): —
4. Peak Gain(s): 58 dB
5. Noise Temperature: 225°K
6. Receive Frequencies: 12 GHz
7. Transmit Frequencies: 14 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 200 Watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Business Institutions
6. Technology Availability Date: 1995
7. Market Need Date: 1995
8. Other:

Payload # 1.1 HTM

Candidate Payload Data Summary - Sheet 3

Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Large multi-beam antennas
2. Large digital matrix switch
3. Solid state transmitters
4. Low noise preamplifiers
5. Large scale integration of microwave circuits
6. Optical path transmission & switching

K. Special Requirements/Constraints

1. This payload has been designed to provide a capacity of 1000 equivalent 40 MHz transponders.

2. Two payloads of this capacity are needed to meet the requirements of the High Traffic Model at the Western Hemisphere orbital location (110° W).

3. One payload of this capacity is needed to meet the requirements of the High Traffic Model at the Atlantic orbital location (15° W).

4. Antenna coverage patterns are TBD.

Payload # 1.2 HTM

Candidate Payload Data Summary - Sheet 1

Date: 6/30/80

Code No: 1.2 - HTM

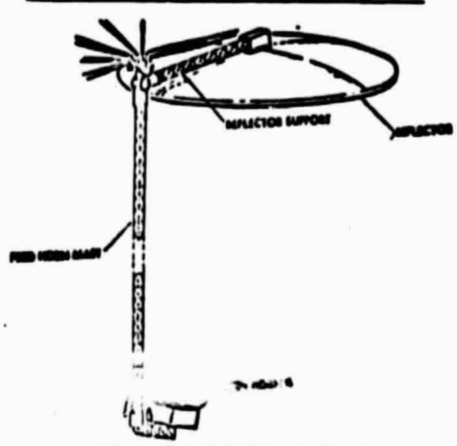
Name: Direct-to-User Networks

Category: Communications

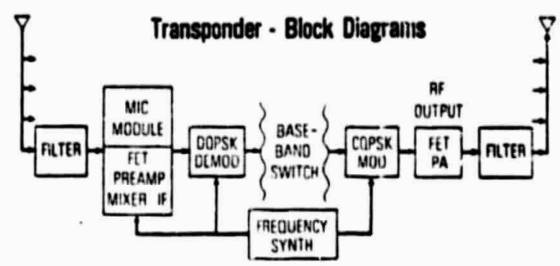
Orbital Location(s): 110° W

Description: Provides direct communication between users at Ka Band frequencies via roof-top antennas.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 2
2. Type: Offset fed reflector
3. Size: 10 Meters
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: TBD
6. Pattern/Beamwidth: 0.1° per beam
7. Max. Pointing Error: 0.01°
8. Sensitivity (G/T): 30 dB/°K
9. Peak/EOC Gain: 60 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 500
2. Type: Regenerative
3. Transmit Frequency: 20 GHz
4. Receive Frequency: 30 GHz
5. Bandwidth(s)/Data Rate(s): 40 MHz
6. Transmit Power(s)/EIRP: 5 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/TDMA
9. On-Board Switching: (M× N) 500 × 500
10. Other:

Payload # 1.2 HTM

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E. Weight/Power Estimates

	Item	Weight (Kg)	Power (W)
1.	Antennas/Sensors	100	-
2.	Receivers:	450	1,000
3.	Transmitters:	450	8,000
4.	Processors:	100	500
5.	Switch Matrix:	240	4,000
6.	Power Converters:	50	300
7.	Cabling, Harness etc.	50	200
8.	Totals:	1,440	14,000

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 14,000
2. Sunlight/Eclipse, Heat Loss: 11,500
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 - 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 8 Years
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users:
2. Antenna Size(s): 4.5/7.0 Meters
3. Beamwidth(s): —
4. Peak Gain(s): —
5. Noise Temperature: 400°K
6. Receive Frequencies: 20 GHz
7. Transmit Frequencies: 30 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 200 Watts
10. Other:

H. Economic Data

1. Traffic Capacity: —
2. Space Segment Cost: —
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Business Institutions
6. Technology Availability Date: 1995
7. Market Need Date: 2000
8. Other:

Payload # 1.2 HTM

Candidate Payload Data Summary - Sheet 3 Date: 6/30/80

I. Payload Development Schedule		J. Supporting Research & Technology Needs
Item	Calendar Year	1. Multi-beam antennas
		2. High capacity matrix switch
1. Design		3. Solid state transmitters
2. Development		4. Low noise premplifiers
3. Fabrication		5. Large scale integration of microwave circuits
4. Integration		6. Optical path transmission and switching
5. Test		

K. Special Requirements/Constraints

1. This payload has been designed to provide a capacity of 1000 equivalent 40 MHz transponders.

2. Two payloads of this capacity are needed to meet the requirements of the High Traffic Model at the Western Hemisphere orbital location.

3. One payload of this capacity is needed to meet the requirements of the High Traffic Model at the Atlantic orbital location.

4. Antenna coverage patterns are TBD.

Payload # 2.1-HTM

Candidate Payload Data Summary - Sheet 1

Date: 6/30/80

Code No: COM 2.1-HTM

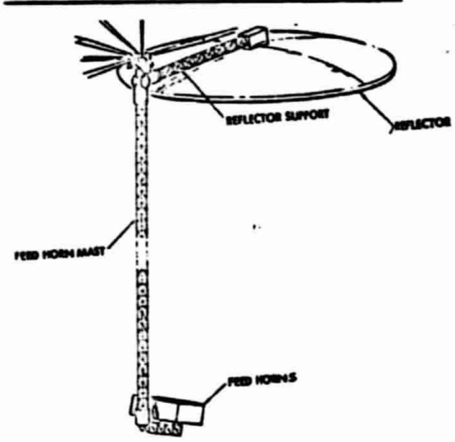
Name: Domestic, Regional & Transocean Trunking

Category: Communications

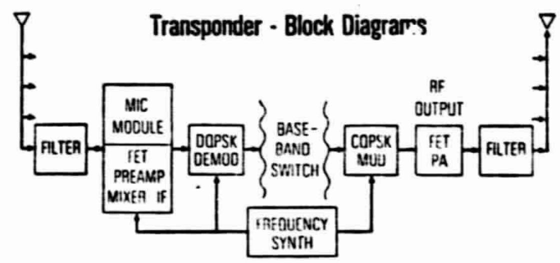
Orbital Location(s): 110°W -

Description: Provides high volume communications for domestic, regional and intercontinental traffic.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 1
2. Type: Offset-fed reflector
3. Size: 60 meters
4. Coverage/FOV: -
5. No. of Beams/Feeds: TBD
6. Pattern/Beamwidth: 0.1° per beam
7. Max. Pointing Error: 0.01°
8. Sensitivity (G/T): 30 dB/°K
9. Peak/EOC Gain: 60 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 125
2. Type: Regenerative
3. Transmit Frequency: 4 GHz
4. Receive Frequency: 6 GHz
5. Bandwidth(s)/Data Rate(s): 160 MHz
6. Transmit Power(s)/EIRP: 1.0 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: FDMA/tdma
9. On-Board Switching: (M× N) 125 × 125
10. Other:

Payload # 2.1-HTM

Candidate Payload Data Summary - Sheet 2

Date: 6/30/80

E. Weight/Power Estimates	Weight (Kg)	Power (W)
1. Antennas/Sensors	500	-
2. Receivers:	150	100
3. Transmitters:	80	500
4. Processors:	50	100
5. Switch Matrix:	30	400
6. Power Converters:	20	50
7. Cabling, Harness etc.	20	50
8. Totals:	850	1200

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 1200
2. Sunlight/Eclipse, Heat Loss: 1050
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 - 40°C
6. Payload Volume: TBD
7. T, T&C/Avionics: Yes No
8. Mission Duration: 8 Years
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N)
11. Other:

G. Ground Segment

1. No. of Stations/Users: -
2. Antenna Size(s): 12 meters
3. Beamwidth(s): -
4. Peak Gain(s): 56 dB
5. Noise Temperature: 214°K
6. Receive Frequencies: 4 GHz
7. Transmit Frequencies: 6 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 50 Watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: PTT Agencies
6. Technology Availability Date: 1990
7. Market Need Date: 1990
8. Other:

Payload # 2.1-HTM

Candidate Payload Data Summary - Sheet 3

Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Dev[illegible]ment	
3. Fabr[illegible]tion	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Multibeam Antenna
2. Large Capacity Matrix Switch
3. Solid State Transmitters
4. Low Noise Preamplifiers
5. Large Scale Integration of Microwave Circuits
6. Optical Path Transmission & Switching

K. Special Requirements/Constraints

1. Data also applies to HVT payload at 15°W location.

2. Payload capacity sized to meet requirements of the High Traffic Model.

3. Coverage patterns TBD.

Payload # 2.2-HTM

Candidate Payload Data Summary - Sheet 1

Date: 6/30/80

Code No: COM-2.2-HTM

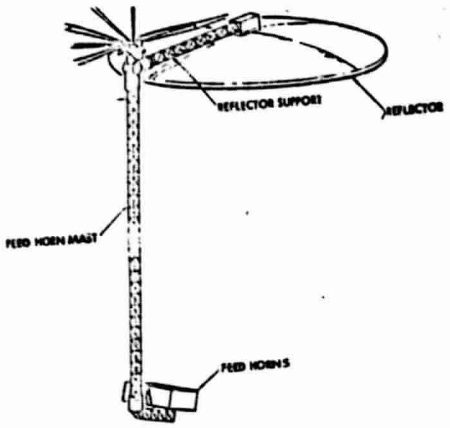
Name: Domestic, Regional & Transocean Trunking

Category: Communications

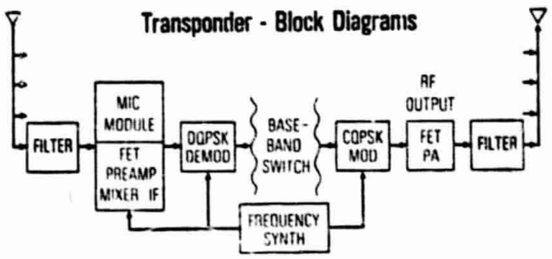
Orbital Location(s): 110°

Description: Provides high volume communications for domestic, regional and intercontinental traffic.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 1
2. Type: Offset fed reflector
3. Size: 10 meters
4. Coverage/FOV: Western Hemisphere
5. No. of Beams/Feeds: -
6. Pattern/Beamwidth: 0.1° per beam
7. Max. Pointing Error: 0.01°
8. Sensitivity (G/T): 30 dB/K
9. Peak/EOC Gain: 60 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 100
2. Type: Regenerative
3. Transmit Frequency: 20 GHz
4. Receive Frequency: 30 GHz
5. Bandwidth(s)/Data Rate(s): 200 MHz
6. Transmit Power(s)/EIRP: 10 Watts
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: TDMA
9. On-Board Switching: (M× N) 100 × 100
10. Other:

Payload # 2.2-HTM

Candidate Payload Data Summary - Sheet 2

Date: ____________

E. Weight/Power Estimates

		Weight (Kg)	Power (W)
1.	Antennas/Sensors	100	
2.	Receivers:	100	100
3.	Transmitters:	140	3000
4.	Processors:	40	100
5.	Switch Matrix:	30	400
6.	Power Converters:	20	300
7.	Cabling, Harness etc.	20	100
8.	Totals:	450	4000

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 4000
2. Sunlight/Eclipse, Heat Loss: 3000
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0-40°C
6. Payload Volume: -
7. T, T&C/Avionics: X Yes ___ No
8. Mission Duration: 8 Years
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: -
2. Antenna Size(s): 12 meters
3. Beamwidth(s): -
4. Peak Gain(s): 69 dB
5. Noise Temperature: 478°K
6. Receive Frequencies: 20 GHz
7. Transmit Frequencies: 30 GHz
8. Modulation/Access: TDMA
9. Transmit Power: 300 Watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: PTT Agencies
6. Technology Availability Date: 1990
7. Market Need Date: 1990
8. Other:

Payload # 2.2-HTM

Candidate Payload Data Summary - Sheet 3

Date: 6/30/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	-

J. Supporting Research & Technology Needs

1. Multibeam Antenna
2. High Capacity Matrix Switch
3. Solid State Transmitters
4. Low Noise Preamplifiers
5. Large Scale Integration of Microwave Circuits
6. Optical Path Transmission & Switching

K. Special Requirements/Constraints

1. Data also applies to HVT payload at 15°W location.
2. Payload capacity sized to meet requirements of the High Traffic Model.
3. Coverage Patterns TBD.

Payload # 3

Candidate Payload Data Summary - Sheet 1

Date: 3-14-80

Code No: COM 3 - WH

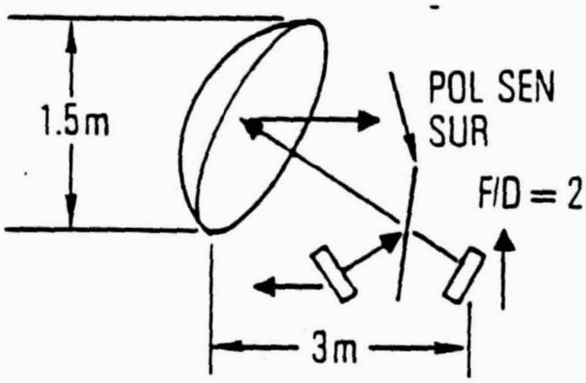
Name: TV Distribution

Category: Communications

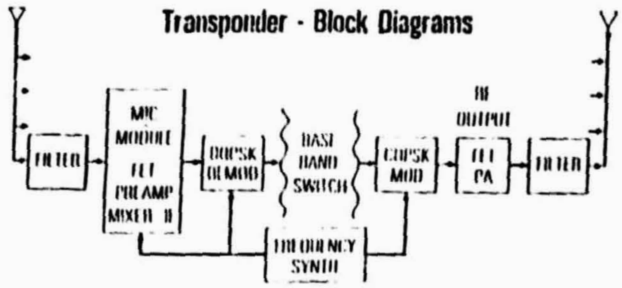
Orbital Location(s): 110° W

Description: Provides TV program distribution for Network Broadcasts, CATV and other video transmissions

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration



C. Antenna/Sensor Data

1. No. 2
2. Type: Offset-fed reflector
3. Size: 1.5 meters
4. Coverage/FOV: North/South America
5. No. of Beams/Feeds: 65
6. Pattern/Beamwidth: 1.0°
7. Max. Pointing Error: ± 0.1°
8. Sensitivity (G/T): 10 DbK
9. Peak/EOC Gain: 40 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 75
2. Type: Regenerative Repeater
3. Transmit Frequency: 12.2 - 12.7 GHz
4. Receive Frequency: 17.1 - 17.6 GHz
5. Bandwidth(s)/Data Rate(s): 40 MHz
6. Transmit Power(s)/EIRP: 10W/53 dBW
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: QPSK/SSTDMA
9. On-Board Switching: (M× N) 50 x 50
10. Other:

Payload # 3

Candidate Payload Data Summary - Sheet 2

Date: 3-14-80

E. Weight/Power Estimates

	Weight (Kg)	Power (W)
1. Antennas/Sensors	20	-
2. Receivers:	50	200
3. Transmitters:	300	3200
4. Processors:	25	200
5. Switch Matrix:	5	50
6. Power Converters:	10	200
7. Cabling, Harness etc.	10	150
8. Totals:	400	4000

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 4000 Watts
2. Sunlight/Eclipse, Heat Loss: 3250 Watts
3. Platform Attitude Control: ± 0.5°
4. Stationkeeping: ±0.1°
5. Thermal Control: 0 - 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 8 Years
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: -
2. Antenna Size(s): 4.5 meters
3. Beamwidth(s): 0.5°
4. Peak Gain(s): 52 dB
5. Noise Temperature: 220° K
6. Receive Frequencies: 12.2 - 12.7 GHz
7. Transmit Frequencies: 17.1 - 17.6 GHz
8. Modulation/Access: QPSK/TDMA
9. Transmit Power: 60 Watts
10. Other:

H. Economic Data

1. Traffic Capacity: 1600 channels
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Networks, CATV
6. Technology Availability Date: 1985
7. Market Need Date: 1987
8. Other:

Payload # 3

Candidate Payload Data Summary - Sheet 3

Date: 3/14/80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Multi-beam Antenna
2. Digital Matrix Switch
3. Solid State Transmitters
4. Low Noise Preamplifiers

K. Special Requirements/Constraints

1. Data also applied to payload at 15°W location. Antenna coverage patterns TBD.

Payload # 4

Candidate Payload Data Summary - Sheet 1

Date: 3-18-80

Code No: COM 4 - WH

Name: Tracking & Data Relay

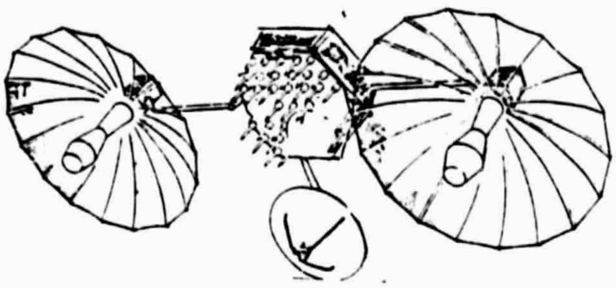
Category: Communications

Orbital Location(s): 15° W & 110°W

Description: This payload relays data from low orbit and other satellites to a central earth station in CONUS.

See also Attachment # 1

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration

See Attachment #2

C. Antenna/Sensor Data

1. No. 4
2. Type: Centerfed reflectors/Phased array
3. Size: 5m (2) 2m (1), Array (10 elements)
4. Coverage/FOV: Spot and area
5. No. of Beams/Feeds: 4
6. Pattern/Beamwidth: -
7. Max. Pointing Error: ± 0.5°
8. Sensitivity (G/T): 21/27 (K), -6/12(S) dB/K
9. Peak/EOC Gain: -
10. Other:

D. Transponder/Processor Data

1. No. 4
2. Type: Processing
3. Transmit Frequency: 13.7 & 2.1 GH_z
4. Receive Frequency: 14.7 & 15 GH_z
5. Bandwidth(s)/Data Rate(s): 50 MH_z (K)
6. Transmit Power(s)/EIRP: 1.6/30(K), 26/30 (S)
7. Noise Figure/Temperature: -
8. Type of Access/Modulation: FDMA/TDMA
9. On-Board Switching: (M× N) TBD
10. Other:

Payload # 4

Candidate Payload Data Summary - Sheet 2

Date: 3-18-80

E. Weight/Power Estimates

		Weight (Kg)	Power (W)
1.	Antennas/Sensors	90	--
2.	Receivers:	80	150
3.	Transmitters:	70	200
4.	Processors:	40	150
5.	Switch Matrix:	--	--
6.	Power Converters:	20	100
7.	Cabling, Harness etc.	30	80
8.	Totals:	330	680

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 680 Watts
2. Sunlight/Eclipse Heat Loss: 620 Watts
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: NA
5. Thermal Control: TBD
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 10 Years
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: 1
2. Antenna Size(s): 18 meter
3. Beamwidth(s): 0.1°
4. Peak Gain(s): 64 dB
5. Noise Temperature: 450° K
6. Receive Frequencies: 13.7 GH_Z
7. Transmit Frequencies: 14.7 GH_Z
8. Modulation/Access: FDMA/TDMA
9. Transmit Power: 5.0 Watts
10. Other: See Section K for low orbit satellite

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: NASA, DoD
6. Technology Availability Date: Now
7. Market Need Date: 1990
8. Other:

Payload # 4

Candidate Payload Data Summary - Sheet 3

Date: 3-31-80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

N/A

K. Special Requirements/Constraints

1. This mission is based on the current TDR requirements. It includes both fixed (phased array) and moving (center fed) antennas to track one or multiple low-orbit satellites. Up- and down-links are in the NASA S and K bands.

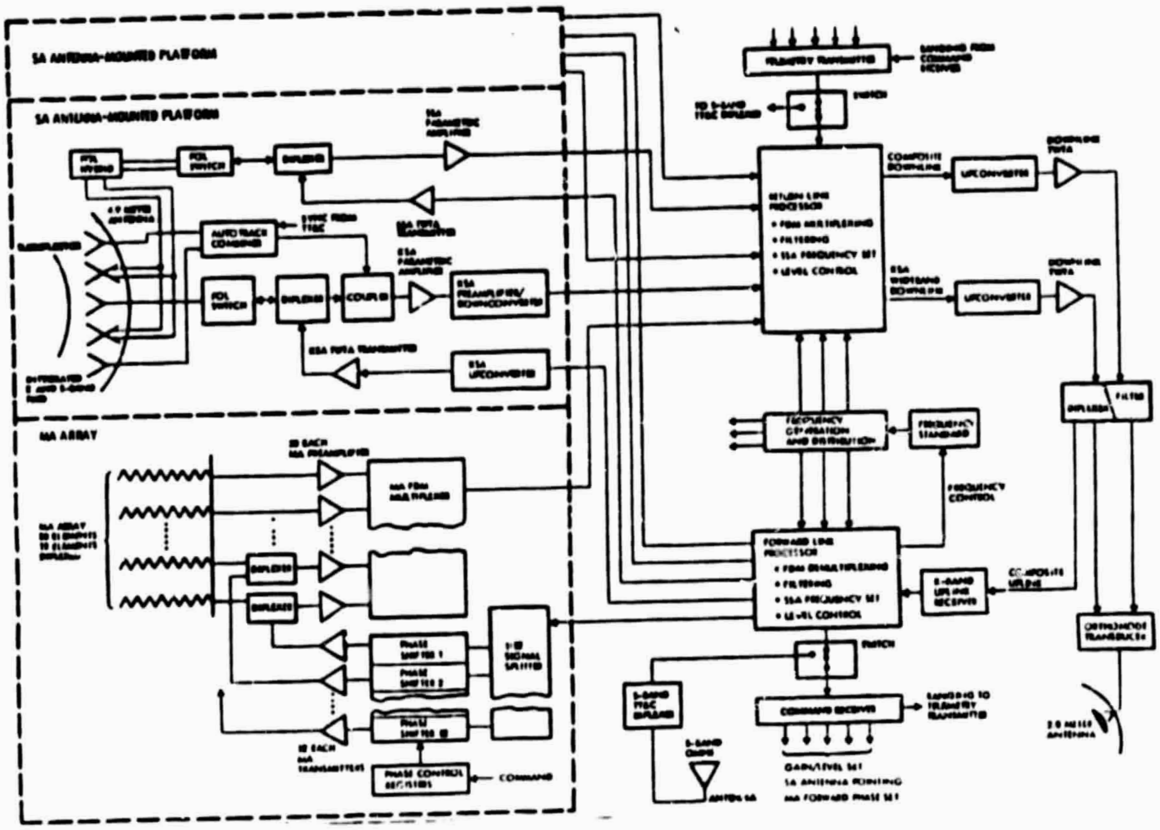
   If relay via a distant Geostationary Platform is needed (thus providing global coverage without "blind spots"), it is via another service (ISL) link.

2. Low orbit satellite terminal.

Antenna: -1.5 meter dish	
Transmit Frequency:	2.25, 2.2875 & 15.0034 GHz
Receive Frequency:	2.05, 2.10G41 & 13.775 GHz
Bandwidth:	50 kHz, 12 MHz & 25 MHz
System Noise Temperature:	450°K
Modulation/Multiple Access:	SCPC/TDMA

3. Data also applies to payload at 15°W orbital location.

Candidate Payload Data Summary - Sheet 4



TDRSS Communication Subsystem Simplified Block Diagram

Payload # 5

Candidate Payload Data Summary - Sheet 1

Date: 3-24-80

Code No: COM 5 - WH

Name: Educational Television

Category: Communications

Orbital Location(s): 110° W

Description: Provides access to learning resource centers by remote schools, colleges and other interested groups

See also Attachment 1.

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 8
2. Type: Fixed Offset fed reflectors
3. Size: 3.0m (4) & 1.5m (4)
4. Coverage/FOV: No. America/So. America
5. No. of Beams/Feeds: 8
6. Pattern/Beamwidth: 3.5°/5.5°
7. Max. Pointing Error: ± 0.1°
8. Sensitivity (G/T): 17 dB/K
9. Peak/EOC Gain: 30 dB
10. Other:

D. Transponder/Processor Data

1. No. 16
2. Type: Translating
3. Transmit Frequency: 2.5 GHz
4. Receive Frequency: 14 GHz
5. Bandwidth(s)/Data Rate(s): 35 MHz
6. Transmit Power(s)/EIRP: 6W/36 dBW
7. Noise Figure/Temperature: 100°K
8. Type of Access/Modulation: FM/SCPT
9. On-Board Switching: (M× N) NA
10. Other:

Payload # 5

Candidate Payload Data Summary - Sheet 2

Date: March 24, 1980

E. Weight/Power Estimates	Weight (Kg)	Power (W)
1. Antennas/Sensors	55	-
2. Receivers:	50	50
3. Transmitters:	350	320
4. Processors:	–	-
5. Switch Matrix:	–	-
6. Power Converters:	25	30
7. Cabling, Harness etc.		
8. Totals:	480	400

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 400/0
2. Sunlight/Eclipse, Heat Loss: 300/0
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 to 40° C.
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 10 Years
9. Mission Duty Cycle: Off during eclipse
10. Interconnect Switch: (M×N) N/A
11. Other:

G. Ground Segment Transmit (Receive)

1. No. of Stations/Users: -
2. Antenna Size(s): 5 m (3 m)
3. Beamwidth(s): 1° - (3°)
4. Peak Gain(s): 55 db (35 db)
5. Noise Temperature: (100° K)
6. Receive Frequencies: (2.5 GH_Z)
7. Transmit Frequencies: 14 GH_Z
8. Modulation/Access: FM/SCPT
9. Transmit Power: 2W per channel
10. Other: G/T = 15 dB/K

H. Economic Data

1. Traffic Capacity: 32 Channels
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Educational Institution
6. Technology Availability Date: Now
7. Market Need Date: 1980
8. Other:

C-2

Payload # 5

Candidate Payload Data Summary - Sheet 3 Date: 3-24-80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

N/A

K. Special Requirements/Constraints

1. Time zone down-link beams are used in the USA, Canada and Mexico. Regional spot beams are used in South and Central America. These missions may be turned off during Eclipse.

2. Data also applies to payload at 15°W orbital location.

Payload # 6

Candidate Payload Data Summary - Sheet 1

Date: July 24, 1979

Code No: COM 6 - WH

Name: Direct to Home TV

Category: Communications

Orbital Location(s): 110° W-

Description: Relays color TV programs directly to the home owner.

See also Attachment #1

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 2
2. Type: Centerfed reflectors
3. Size: 1.5 m (Ku) & 10 m (UHF)
4. Coverage/FOV: Regional
5. No. of Beams/Feeds: 4
6. Pattern/Beamwidth: 3° x 4° (UHF)
7. Max. Pointing Error: ± 0.1°
8. Sensitivity (G/T): 18.5 dB/K
9. Peak/EOC Gain: 30 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 8
2. Type: Frequency Translating
3. Transmit Frequency: 700 MHz
4. Receive Frequency: 14.25 GHz
5. Bandwidth(s)/Data Rate(s): 40 MHz
6. Transmit Power(s)/EIRP: 100W/51.3 dBW
7. Noise Figure/Temperature: 379° K
8. Type of Access/Modulation: TV/FM
9. On-Board Switching: (M× N) N.A.
10. Other:

Payload # 6

Candidate Payload Data Summary - Sheet 2

Date: 3-25-80

E. Weight/Power Estimates	Weight (Kg)	Power (W)
1. Antennas/Sensors	40	-
2. Receivers:	20	100
3. Transmitters:	290	1850
4. Processors:	-	-
5. Switch Matrix:	-	-
6. Power Converters:	30	100
7. Cabling, Harness etc.	20	50
8. Totals:	400	2100
9. Notes:		

F. Support Requirements

1. Sunlight/Eclipse Power: 2100/250
2. Sunlight/Eclipse, Heat Loss: 1600/250
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: ± 0.1°
5. Thermal Control: 0 to 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 10 yrs.
9. Mission Duty Cycle: Not during eclipse
10. Interconnect Switch: (M×N) N.A.
11. Other:

G. Ground Segment Receive (Transmit)

1. No. of Stations/Users:
2. Antenna Size(s): 2.5 m (4.5 m)
3. Beamwidth(s): 10° (0.5°)
4. Peak Gain(s): 25 dB (50 dB)
5. Noise Temperature: 1000° K
6. Receive Frequencies: 700 MH_z
7. Transmit Frequencies: (14.25 GH_z)
8. Modulation/Access: TV/FM
9. Transmit Power: (15 W)
10. Other:

H. Economic Data

1. Traffic Capacity: 8 channels
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Govt., Pay TV, Movie Cos.
6. Technology Availability Date: Now
7. Market Need Date: 1987
8. Other:

Payload # 6

Candidate Payload Data Summary - Sheet 3 Date: July 24, 1979

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

1. During eclipse it may be possible to turn off transmitters to reduce DC power storage needs.

2. Data also applies to payload at 15°W orbital location.

Payload #7

Candidate Payload Data Summary - Sheet 1

Date: March 27, 1980

Code No: COM 7 - WH

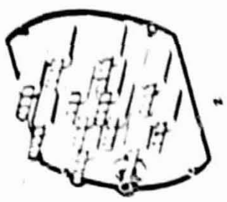
Name: Mobile Air

Category: Communications

Orbital Location(s): -

Description: Provides communications and navigation to/from commercial aircraft.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 2
2. Type: 12 Helix array & horn
3. Size: One meter
4. Coverage/FOV: Global
5. No. of Beams/Feeds: 2
6. Pattern/Beamwidth: Earth coverage
7. Max. Pointing Error: ± 0.1°
8. Sensitivity (G/T) -11.3 (L), -16.5 (C) dB/K
9. EOC Gain: 16.4 dB (L), -15.5 dB (C)
10. Other:

D. Transponder/Processor Data

1. No. 4
2. Type: Translating
3. Transmit Frequency: 1.6, (5.88 GHz)
4. Receive Frequency: 1.5, (5.125 GHz)
5. Bandwidth(s)/Data Rate(s): 80 kHz (0.4 MHz)
6. Transmit Power(s)/EIRP: 100W(L), 10W(C)
7. Noise Figure/Temperature: 354° K
8. Type of Access/Modulation: SCPC PM
9. On-Board Switching: (M× N) N.A.
10. Other:

Payload # 7

Candidate Payload Data Summary - Sheet 2

Date: March 27, 1980

E. Weight/Power Estimates	Weight (Kg)	Power (W)
1. Antennas/Sensors	50	-
2. Receivers:	20	100
3. Transmitters:	110	1000
4. Processors:	-	-
5. Switch Matrix:	-	-
6. Power Converters:	5	50
7. Cabling, Harness etc.	5	50
8. Totals:	200	1200

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 1200 Watts
2. Sunlight/Eclipse, Heat Loss: 800
3. Platform Attitude Control:
4. Stationkeeping: N.A.
5. Thermal Control: 0 to 40° C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: 8 Yrs.
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment Land (A/C)

1. No. of Stations/Users:
2. Antenna Size(s): 7 meter (0.8 meter)
3. Beamwidth(s): 0.5° (17°)
4. Peak Gain(s): 48 dB (20 dB)
5. Noise Temperature: 194 (354)°K
6. Receive Frequencies: 5.125 (1.5) GHz
7. Transmit Frequencies: 5.88 (1.6) GHz
8. Modulation/Access: SCPC/PM
9. Transmit Power: 50W (220W)
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Airlines & Gov't.
6. Technology Availability Date: Now
7. Market Need Date: 1985
8. Other:

Payload # 7

Candidate Payload Data Summary - Sheet 3

Date: March 27, 1980

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

1. Links to and from commercial aircraft are provided at 1.6/1.5 GHz in internationally allocated aeronautical mobile satellite bands. At the platform the signals are converted to the 5 GHz band for connection to air traffic control and navigation centers.

2. Data also applies to payload at 15°W orbital location.

Payload # 8

Candidate Payload Data Summary - Sheet 1

Date: March 27, 1980

Code No: COM 8 - WH

Name: Sea Mobile

Category: Communications

Orbital Location(s): 15W

Description: Provides communications between ships and shore stations. Can be linked to terrestrial network.

See also Attachment #1

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 2
2. Type: Reflector, 12 helix array*
3. Size: 14 meter, 1 meter
4. Coverage/FOV: Spot & Global
5. No. of Beams/Feeds: 4
6. Pattern/Beamwidth: 1° & 19°
7. Max. Pointing Error: ± 0.1°
8. Sensitivity (G/T): 10 dB/°K, -17 dB/°K(L)
9. EOC Gain: 41 dB, 15 dB (L)
10. Other:

*Shared with air mobile service

D. Transponder/Processor Data

1. No. 4
2. Type: Processing Repeater
3. Transmit Frequency: 1.6 GHz
4. Receive Frequency: 1.5 GHz
5. Bandwidth(s)/Data Rate(s): 5 MHz
6. Transmit Power(s): 2W, 60W
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: SCPC/PM
9. On-Board Switching: (M× N) N.A.
10. Other:

Payload # 7

Candidate Payload Data Summary - Sheet 3

Date: March 27, 1980

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

1. Links to and from commercial aircraft are provided at 1.6/1.5 GHz in internationally allocated aeronautical mobile satellite bands. At the platform the signals are converted to the 5 GHz band for connection to air traffic control and navigation centers.

2. Data also applies to payload at 15°W orbital location.

Payload # 8

Candidate Payload Data Summary - Sheet 1

Date: March 27, 1980

Code No: COM 8 - WH

Name: Sea Mobile

Category: Communications

Orbital Location(s): 15W

Description: Provides communications between ships and shore stations. Can be linked to terrestrial network.

See also Attachment #1

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 2
2. Type: Reflector, 12 helix array*
3. Size: 14 meter, 1 meter
4. Coverage/FOV: Spot & Global
5. No. of Beams/Feeds: 4
6. Pattern/Beamwidth: 1° & 19°
7. Max. Pointing Error: ± 0.1°
8. Sensitivity (G/T): 10 dB/°K, -17 dB/°K(L)
9. EOC Gain: 41 dB, 15 dB (L)
10. Other:

*Shared with air mobile service

D. Transponder/Processor Data

1. No. 4
2. Type: Processing Repeater
3. Transmit Frequency: 1.6 GHz
4. Receive Frequency: 1.5 GHz
5. Bandwidth(s)/Data Rate(s): 5 MHz
6. Transmit Power(s): 2W, 60W
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: SCPC/PM
9. On-Board Switching: (M× N) N.A.
10. Other:

Payload # 8

Candidate Payload Data Summary - Sheet 2

Date: March 27, 1980

E. Weight/Power Estimates

		Weight (Kg)	Power (W)
1.	Antennas/Sensors	300	-
2.	Receivers:	10	80
3.	Transmitters:	50	400
4.	Processors:	-	50
5.	Switch Matrix:	-	-
6.	Power Converters:	20	50
7.	Cabling, Harness etc.	20	20
8.	Totals:	400	600

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 600
2. Sunlight/Eclipse, Heat Loss: 460W
3. Platform Attitude Control: ± 0.1°
4. Stationkeeping: N.A.
5. Thermal Control: TBD °C to TBD °C
6. Payload Volume: TBD
7. T, T&C/Avionics: X Yes No
8. Mission Duration: TBD
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: 1000 +
2. Antenna Size(s): 1.2 meters
3. Beamwidth(s): 10°
4. Peak Gain(s): 23.5 dB
5. Noise Temperature: 500° K
6. Receive Frequencies: 1.5 GHz
7. Transmit Frequencies: 1.6 GHz
8. Modulation/Access: SCPC/PM
9. Transmit Power: 4 Watts
10. Other:

H. Economic Data

1. Traffic Capacity: 100 channels
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: All shipping
6. Technology Availability Date: Now
7. Market Need Date: 1985
8. Other:

Payload #8

Candidate Payload Data Summary - Sheet 3

Date: March 27, 1980

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

Shore station links are carried by the point to point communication payload via an interconnect link with the sea mobile payload.

Payload #9

Candidate Payload Data Summary - Sheet 1 Date: 3-31-80

Code No: COM 9 - NTM

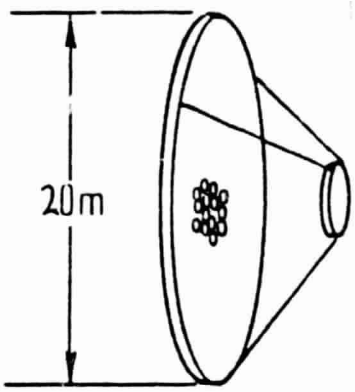
Name: Land Mobile

Category: Communications

Orbital Location(s): 110°W

Description: Payload provides substantially increased and improved communication services to mobile users.

A. Antenna/Sensor Configuration



B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 1
2. Type: MBA - cassegrain dish
3. Size: 20 meters
4. Coverage/FOV: Regional
5. No. of Beams/Feeds: 30
6. Pattern/Beamwidth: 1.0°
7. Max. Pointing Error: ±0.1°
8. Sensitivity (G/T): 16 dB/°K
9. EOC Gain: 40 dB
10. Other:

D. Transponder/Processor Data

1. No. 30
2. Type: On-board switching
3. Transmit Frequency: 881-902 MHz
4. Receive Frequency: 928-947 MHz
5. Bandwidth(s)/Data Rate(s): 30 KHz/channel
6. Transmit Power(s)/EIRP: 40 watts
7. Noise Figure/Temperature: 750°K
8. Type of Access/Modulation: FM/FDMA
9. On-Board Switching: TBD
10. Other: 20 channels per transponder

Payload #9

Candidate Payload Data Summary - Sheet 2

Date: 3-31-80

E. Weight/Power Estimates	Weight (Kg)	Power (W)
1. Antennas/Sensors	300	-
2. Receivers:	50	100
3. Transmitters:	120	3600
4. Processors:	–	–
5. Switch Matrix:	–	–
6. Power Converters:	30	200
7. Cabling, Harness etc.	30	100
8. Totals:	530	4000

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 4000
2. Sunlight/Eclipse, Heat Loss: 2800
3. Platform Attitude Control: ±0.1°
4. Stationkeeping: NA
5. Thermal Control: 0–40°C
6. Payload Volume: TBD
7. T, T&C/Avionics: ✓ Yes No
8. Mission Duration: 8 yrs
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: 8000 plus
2. Antenna Size(s): 0.5 meter
3. Beamwidth(s): 50°
4. Peak Gain(s): 10dB
5. Noise Temperature: 1000°K
6. Receive Frequencies: 881-902 MHz
7. Transmit Frequencies: 928-947 MHz
8. Modulation/Access: SCPC/FDMA
9. Transmit Power: 5 watts
10. Other:

H. Economic Data

1. Traffic Capacity: 600 channel/beam
2. Space Segment Cost: $25M
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Govt. & Commercial
6. Technology Availability Date: 1990
7. Market Need Date: Now
8. Other:

Payload # 9

Candidate Payload Data Summary - Sheet 3 Date: 3-31-80

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

1. Large multi-beam antenna.

K. Special Requirements/Constraints

1. Small, simple earth stations are placed on moving or transportable objects on the earth's surface. Voice and low-speed data services may be provided. Navigation information is obtained by relaying an Omega receiver raw output to a remote computer for decoding and ambiguity resolution. The return link provides the location.

2. A cluster of beams is used to subdivide the country (CONUS) for frequency reuse. Beams of 1° are used to synthesize a (CONUS) 48-state coverage. In South America, 1° spot beams illuminate populated areas or bush areas of special interest (e.g., oil exploration or mineral extraction). There are 20 beams in the U.S. and 10 in South America.

3. Data also applies to payload at 15°W location. Atlantic region coverage patterns TBD.

4. High traffic model version of this payload would incorporate a 60 meter diameter antenna with 0.5° footprints.

Payload #10

Candidate Payload Data Summary - Sheet 1

Date: 3-31-80

Code No: COM 10

Name: Intercontinental Trunking *

Category: Communications

Orbital Location(s): 15°W

Description: Provides transoceanic and intercontinental communications to link domestic and regional areas of common interest. *

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No.
2. Type:
3. Size:
4. Coverage/FOV:
5. No. of Beams/Feeds:
6. Pattern/Beamwidth:
7. Max. Pointing Error:
8. Sensitivity (G/T):
9. Peak/EOC Gain:
10. Other:

*Functions incorporated in Payloads 2.1 and 2.2

D. Transponder/Processor Data

1. No.
2. Type:
3. Transmit Frequency:
4. Receive Frequency:
5. Bandwidth(s)/Data Rate(s):
6. Transmit Power(s)/EIRP:
7. Noise Figure/Temperature:
8. Type of Access/Modulation:
9. On-Board Switching: (M× N)
10. Other:

Payload # 11

Candidate Payload Data Summary - Sheet 1

Date: March 28, 1980

Code No: COM 11

Name: Inter-Satellite Links

Category: Communications

Orbital Location(s): 15°W & 110°W

Description: Provides direct platform to platform links.

See also attachment #1

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 2 per link
2. Type: Center fed reflectors
3. Size: 3 meters
4. Coverage/FOV:
5. No. of Beams/Feeds: 2
6. Pattern/Beamwidth: 0.3°
7. Max. Pointing Error: ±0.03°
8. Sensitivity (G/T): 33 dB/K
9. Peak/EOC Gain: 60 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 2
2. Type: Processing
3. Transmit Frequency: 55 GHz
4. Receive Frequency: 62 GHz
5. Bandwidth(s)/Data Rate(s): 1 GHz
6. Transmit Power(s)/EIRP: 65 watts
7. Noise Figure/Temperature:
8. Type of Access/Modulation:
9. On-Board Switching: (M× N)
10. Other:

Payload #11

Candidate Payload Data Summary - Sheet 2

Date: March 28, 1980

E.	Weight/Power Estimates	Weight (Kg)	Power (W)
1.	Antennas/Sensors	40	
2.	Receivers:	10	10
3.	Transmitters:	40	250
4.	Processors:		
5.	Switch Matrix:		
6.	Power Converters:	5	20
7.	Cabling, Harness etc.	5	20
8.	Totals:	100	300
9.	Notes:		

F. Support Requirements

1. Sunlight/Eclipse Power: 300 watts
2. Sunlight/Eclipse, Heat Loss: 230 watts
3. Platform Attitude Control: ±0.1°
4. Stationkeeping: ±0.1°
5. Thermal Control: 0 to 40°C
6. Payload Volume: TBD
7. T, T&C/Avionics: ✓ Yes No
8. Mission Duration: 8 yrs
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment Not applicable

1. No. of Stations/Users:
2. Antenna Size(s):
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature:
6. Receive Frequencies:
7. Transmit Frequencies:
8. Modulation/Access:
9. Transmit Power:
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Platform Payloads
6. Technology Availability Date: 1985
7. Market Need Date: 1990
8. Other:

Payload #11

Candidate Payload Data Summary - Sheet 3

Date: March 28, 1980

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

High power 55 GHz transmitters.

K. Special Requirements/Constraints

1. To avoid confusion with the tracking and data relay (TDR) mission (which has links between low-earth orbit satellites and a geostationary platform), the term inter-platform link (IPL) has been coined for traffic between platforms.

2. This link may be used to control remotely located platforms from the U.S.

3. The lowest presently allocated frequency is 55 GHz. As an alternative an optical link may be used.

A 25.25- to 26.25-GHz band has been porposed to the SWARC for this service. For a given antenna aperture, the beamwidth (and pointing accuracy requirements) doubles.

Payload #12

Candidate Payload Data Summary - Sheet 1

Date: March 28, 1980

Code No: COM 12

Name: Data Collection

Category: Communications

Orbital Location(s): 15° & 110°W

Description: Provides a data collection and relay capability to facilitate acquisition of data from instruments on or near the earth's surface.

See also attachment #1

A. Antenna/Sensor Configuration

TBD

B. Transponder/Processor Configuration

TBD

C. Antenna/Sensor Data

1. No. 1
2. Type: Centerfed reflector
3. Size: 10 meters
4. Coverage/FOV: Regional
5. No. of Beams/Feeds: 4
6. Pattern/Beamwidth: 5°
7. Max. Pointing Error: 0.1°
8. Sensitivity (G/T): -3 dB/K
9. Peak/EOC Gain: 27 dB EOC
10. Other:

D. Transponder/Processor Data

1. No. 4
2. Type: Processing transponder
3. Transmit Frequency: 400-402 MHz
4. Receive Frequency: 402-403 MHz
5. Bandwidth(s)/Data Rate(s): 30/3 kHz
6. Transmit Power/EIRP: 1W
7. Noise Figure/Temperature: 1000°K
8. Type of Access/Modulation: PSK/TDMA
9. On-Board Switching: (M× N) NA
10. Other:

Payload #12

Candidate Payload Data Summary - Sheet 2

Date: March 28, 1980

E.	Weight/Power Estimates	Weight (Kg)	Power (W)
1.	Antennas/Sensors	30	
2.	Receivers:	20	20
3.	Transmitters:	20	50
4.	Processors:	10	20
5.	Switch Matrix:		
6.	Power Converters:	10	5
7.	Cabling, Harness etc.	10	5
8.	Totals:	100	100
9.	Notes:		

F. Support Requirements

1. Sunlight/Eclipse Power: 100 watts
2. Sunlight/Eclipse, Heat Loss: 340 watts
3. Platform Attitude Control: ±0.5°
4. Stationkeeping: ±0.1°
5. Thermal Control: 0-40°C (Radiative)
6. Payload Volume: TBD
7. T, T&C/Avionics: √ Yes No
8. Mission Duration: 8 yrs
9. Mission Duty Cycle: Not during eclipse
10. Interconnect Switch: (M×N) TBD
11. Other:

G. Ground Segment

1. No. of Stations/Users: 50,000+
2. Antenna Size(s): 1 meter
3. Beamwidth(s): 20°
4. Peak Gain(s): 10 dB
5. Noise Temperatur..: 500°K
6. Receive Frequencies: 400-402 MHz
7. Transmit Frequencies: 402-403 MHz
8. Modulation/Access: SCPT/PM
9. Transmit Power: 10 watts
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: $23M
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Government
6. Technology Availability Date: Now
7. Market Need Date: 1986
8. Other:

Payload # 12

Candidate Payload Data Summary - Sheet 3

Date: March 28, 1980

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

Sensors are placed at strategically selected locations; and the data are accumulated for subsequent burst transmission to the geostationary platform. These burst transmissions may be either on a random multiple access basis (using one or several reservation schemes) or upon request from an interrogating signal from the geostationary platform. Due to the wide range in types of data, both types of transmissions are envisioned.

For some forms of data, very infrequent transmissions may be adequate (e.g., the total rainfall per day). In others (e.g., an intrusion into an area), real time is important. Occasionally, burst frequency may vary depending on local activity (seismic) or the instantaneous needs of the data user (flood stage).

The collected data are switched to a down-link in another service (e.g., high-volume trunking) for transmission to the data user's facility.

Payload #17

Candidate Payload Data Summary - Sheet 1

Date: 8-3-79

Code No: EO 1

Name: Lightning Mapper

Category: Environmental/Observation

Orbital Location(s): –

Description: Payload for detection and measurement of visible IR, and RF radiation produced by lightning strokes.

A. Antenna/Sensor Configuration

TBD

B. Transponder/Processor Configuration

TBD

C. Antenna/Sensor Data

1. No. 8
2. Type: Optical Telescope & RF Helices
3. Size:
4. Coverage/FOV: Global
5. No. of Beams/Feeds: 2
6. Pattern/Beamwidth: RF interferometer
7. Max. Pointing Error: 2 sec (V/IR)
8. Sensitivity (G/T):
9. Peak/EOC Gain:
10. Other:

D. Transponder/Processor Data

1. No. 1
2. Type: Processor
3. Transmit Frequency: Platform Service
4. Receive Frequency: Visible/IR/L-Band
5. Bandwidth(s)/Data Rate(s): 3 MBps
6. Transmit Power(s)/EIRP: Platform Service
7. Noise Figure/Temperature:
8. Type of Access/Modulation:
9. On-Board Switching: (M× N)
10. Other:

Payload # 17

Candidate Payload Data Summary - Sheet 2

Date: 8-3-79

E.	Weight/Power Estimates	Weight (Kg)	Power (W)
1.	Antennas/Sensors		
2.	Receivers:		
3.	Transmitters:		
4.	Processors:		
5.	Switch Matrix:		
6.	Power Converters:		
7.	Cabling, Harness etc.		
8.	Totals:	320	300
9.	Notes:		

F. Support Requirements

1. Sunlight/Eclipse Power: 300 watts
2. Sunlight/Eclipse, Heat Loss: 300 watts
3. Platform Attitude Control: ±0.5°
4. Stationkeeping: ±0.1°
5. Thermal Control: Radiative Cooling
6. Payload Volume: 4 cu. meters
7. T, T&C/Avionics: ✓ Yes No
8. Mission Duration: 2 yrs.
9. Mission Duty Cycle:
10. Interconnect Switch: (M×N)
11. Other:

G. Ground Segment Platform Service

1. No. of Stations/Users:
2. Antenna Size(s):
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature:
6. Receive Frequencies:
7. Transmit Frequencies:
8. Modulation/Access:
9. Transmit Power:
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Utilities, Forestry, Airlines
6. Technology Availability Date: 1985
7. Market Need Date: Now
8. Other:

Payload #17

Candidate Payload Data Summary - Sheet 3

Date: 8-3-79

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

Payload #18

Candidate Payload Data Summary - Sheet 1

Date: 8-3-79

Code No: EO 2

Name: Atmospheric Sounder

Category: Environmental/Observation

Orbital Location(s): -

Description: Payload collects mesoscale meteorology data as related to: hurricanes, toronados, air pollution, frost, etc.

See also attachment #1

A. Antenna/Sensor Configuration

See attachment #2

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 1
2. Type: Sounding & Imaging Radiometer
3. Size: 40 cm Aperture
4. Coverage/FOV: Global
5. No. of Beams/Feeds: 1
6. Pattern/Beamwidth: High resolution scanner
7. Max. Pointing Error:
8. Sensitivity (G/T):
9. Peak/EOC Gain:
10. Other:

D. Transponder/Processor Data

1. No. 1
2. Type: Processor
3. Transmit Frequency: Platform Service
4. Receive Frequency: Visible & IR
5. Bandwidth(s)/Data Rate(s): 3 MBps
6. Transmit Power(s)/EIRP: Platform Service
7. Noise Figure/Temperature:
8. Type of Access/Modulation:
9. On-Board Switching: (M× N)
10. Other:

Payload #18

Candidate Payload Data Summary - Sheet 2

Date: 8-3-79

E. Weight/Power Estimates

	Weight (Kg)	Power (W)
1. Antennas/Sensors		
2. Receivers:	185	50
3. Transmitters:		
4. Processors:	15	50
5. Switch Matrix:		
6. Power Converters:		
7. Cabling, Harness etc.		
8. Totals:	185	100

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 50 watts
2. Sunlight/Eclipse, Heat Loss: 50 watts
3. Platform Attitude Control: ±0.5°
4. Stationkeeping:
5. Thermal Control: Radiative Cooling
6. Payload Volume: 1 cu meter
7. T, T&C/Avionics: ✓ Yes No
8. Mission Duration: 2 yrs
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N)
11. Other:

G. Ground Segment Platform Service

1. No. of Stations/Users:
2. Antenna Size(s):
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature:
6. Receive Frequencies:
7. Transmit Frequencies:
8. Modulation/Access:
9. Transmit Power:
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: $10M
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: NOAA & Weather Centers
6. Technology Availability Date: 1985
7. Market Need Date: Now
8. Other:

Payload #18

Candidate Payload Data Summary - Sheet 3 Date: ______

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

ADVANCED ATMOSPHERIC SOUNDING AND IMAGING RADIOMETER

OBJECTIVE/MISSION DESCRIPTION

The objective of this mission to collect mesoscale meterology data continuously as related to:

a. Clear air turbulence

b. Hurricanes

c. Flash floods

d. Severe storms and tornadoes

e. Frost

f. Wind

g. Air pollution

The availability of this data will aid in the prevention of loss of life and property caused by the occurrence of these phenomena.

The mission will consist of analyzing the data obtained from launching the Advanced Atmospheric Sounding and Imaging Radiometer and provide warning to localities of pending storms. A model of this instrument is shown in Figure 1.

The infrared sounder, complemented by the microwave sounder, will allow the study of the temperature profiles and other phenomena in the mesosphere as related to the probability of occurrence of severe weather conditions. To attain the stated objective, continuous data is required.

The Advanced Atmospheric Sounding and Imaging Radiometer will provide either raw or pre-processed data to small earth stations in localities needing the information for their own warning and protection. The number of users for this system will increase rapidly and will eventually be unlimited and the data provided will be continuous.

JUSTIFICATION/NEED

The mission will provide a vital source of previously unattainable information needed to understand and forecast weather conditions more accurately by:

a. Improved access to the vertical dimension

b. Filling time and space gaps in present observations

c. Complementing TIROS, GOES, and other weather satellite and balloon measurements and observations.

With data from the Advanced Atmospheric Sounding and Imaging Radiometer localized weather phenomena can be predicted in a timely manner. Present systems, although greatly improved over the past 10 years, produce predictions at 4-6 hour intervals covering areas of 800 x 800 km. This type of time and space coverage is of little value to predicting sudden, small area weather conditions needed for localized storms such as tornadoes, flash floods, etc. With the proposed system, time will be reduced to 5-15 minutes and area to 20 x 30 km. Very substantial reduction in loss of life and property can result from the use of this system.

USER COMMUNITY

Primary users will be NOAA and state weather watch centers. Other users will include USDA, universities, maritime shipping, and fisheries, to name a few.

The tornado occurring localities would benefit greatly from implementation of this system.

Payload #19

Candidate Payload Data Summary - Sheet 1

Date: 8-1-79

Code No: EO 3

Name: Visual & IR Radiometer

Category: Environmental/Observation

Orbital Location(s): TBD

Description: High resolution optical scanning radiometer for weather imaging as an aid to severe storm forecasting

A. Antenna/Sensor Configuration

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 1
2. Type: Imaging Radiometer
3. Size: 1 meter aperture
4. Coverage/FOV: Global
5. No. of Beams/Feeds: 1
6. Pattern/Beamwidth: High resolution scanner
7. Max. Pointing Error: 0.5 micro-radians
8. Sensitivity (G/T):
9. Peak/EOC Gain:
10. Other:

D. Transponder/Processor Data

1. No. 1
2. Type: Processor
3. Transmit Frequency: Platform Service
4. Receive Frequency: 3-15 micrometers
5. Bandwidth(s)/Data Rate(s): 6 Mbps
6. Transmit Power(s)/EIRP: Platform Service
7. Noise Figure/Temperature:
8. Type of Access/Modulation: PSK
9. On-Board Switching: (M× N) TBD
10. Other:

Payload # 19

Candidate Payload Data Summary - Sheet 2

Date: 8-1-79

E. Weight/Power Estimates

	Weight (Kg)	Power (W)
1. Antennas/Sensors		
2. Receivers:		
3. Transmitters:		
4. Processors:		
5. Switch Matrix:		
6. Power Converters:		
7. Cabling, Harness etc.		
8. Totals:	500	100

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 100 watts
2. Sunlight/Eclipse, Heat Loss: 100 watts
3. Platform Attitude Control:
4. Stationkeeping: Orbit determination within 300 m.
5. Thermal Control: Radiative cooling
6. Payload Volume: TBD
7. T, T&C/Avionics: ✓ Yes No
8. Mission Duration: TBD
9. Mission Duty Cycle:
10. Interconnect Switch: (M×N)
11. Other:

G. Ground Segment

1. No. of Stations/Users: Platform Service
2. Antenna Size(s):
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature:
6. Receive Frequencies:
7. Transmit Frequencies:
8. Modulation/Access:
9. Transmit Power:
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost:
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Government/Academic
6. Technology Availability Date: Now
7. Market Need Date: Now
8. Other:

Candidate Payload Data Summary - Sheet 3 Date: 8-1-79

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements/Constraints

Payload #20

Candidate Payload Data Summary - Sheet 1

Date: 8-7-79

Code No: EO4

Name: Microwave Radiometer

Category: Environmental/Observation

Orbital Location(s): TBD

Description: High resolution microwave imaging radiometer for research into severe storm forecasting.

also see attachment #1

A. Antenna/Sensor Configuration

See attachment #2

B. Transponder/Processor Configuration

See attachment #3

C. Antenna/Sensor Data

1. No. 1
2. Type: Offset fed reflector
3. Size: 4.4 meters
4. Coverage/FOV: Global
5. No. of Beams/Feeds: 1
6. Pattern/Beamwidth: 0.03° scanning beam
7. Max. Pointing Error: 0.03°
8. Sensitivity (G/T):
9. Peak/EOC Gain:
10. Other:

D. Transponder/Processor Data

1. No. 1
2. Type: Processor
3. Transmit Frequency: Platform Service
4. Receive Frequency: 118/183 GHz
5. Bandwidth(s)/Data Rate(s): 500 Bps
6. Transmit Power(s)/EIRP: Platform Service
7. Noise Figure/Temperature:
8. Type of Access/Modulation: PSK
9. On-Board Switching: (M× N) TBD
10. Other:

Payload #20

Candidate Payload Data Summary - Sheet 2

Date: 8-7-79

E. Weight/Power Estimates

	Weight (Kg)	Power (W)
1. Antennas/Sensors	56	20
2. Receivers:	50	130
3. Transmitters:		
4. Processors:	30	
5. Switch Matrix:		
6. Power Converters:		
7. Cabling, Harness etc.		
8. Totals:	136	150

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 150 watts
2. Sunlight/Eclipse, Heat Loss: 150
3. Platform Attitude Control:
4. Stationkeeping: Orbit determination within 300 meters
5. Thermal Control: Radiative cooling
6. Payload Volume:
7. T, T&C/Avionics: ✓ Yes No
8. Mission Duration: 2 yrs.
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N)
11. Other:

G. Ground Segment

1. No. of Stations/Users: Platform Service
2. Antenna Size(s):
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature:
6. Receive Frequencies:
7. Transmit Frequencies:
8. Modulation/Access:
9. Transmit Power:
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: $15M
3. Ground Segment Cost:
4. Estimated Revenue/Yr: ---
5. User Communities: Government & Academic
6. Technology Availability Date: Now
7. Market Need Date: Now
8. Other:

Payload #20

Candidate Payload Data Summary - Sheet 3 Date: 8-7-79

I. Payload Development Schedule

Item	Calendar Year
1. Design	
2. Development	
3. Fabrication	
4. Integration	
5. Test	

J. Supporting Research & Technology Needs

K. Special Requirements Constraints

MICROWAVE ATMOSPHERIC SOUNDING RADIOMETER

OBJECTIVE/MISSION DESCRIPTION

The objective of this payload is to monitor and predict trends in the severity of thunderstorms and tropical cyclones by continous measurement of three-dimensional atmospheric temperature and relative humidity.

The mission will consist of a microwave radiometer. Thermal radiance of the atmosphere will be determined using the 118 GHz oxygen absorption line. Humidity will be determined from the 183 GHz H_2O vapor line. The experimental data will be transmitted to Earth using existing geosynchronous platform communication channels. Likewise, command and control will use existing sub-system of the platform.

JUSTIFICATION/NEED

Severe storms analysis and prediction require rapid observation cycle (of the order of 1 hour or less) which can only be obtained from geosynchronous platforms or a large fleet of lower Earth orbiting satellites. Current geosynchronous meteorological satellites have only IR and visible channels which are useless for severe storm observation, because there will always be extended cloudy areas.

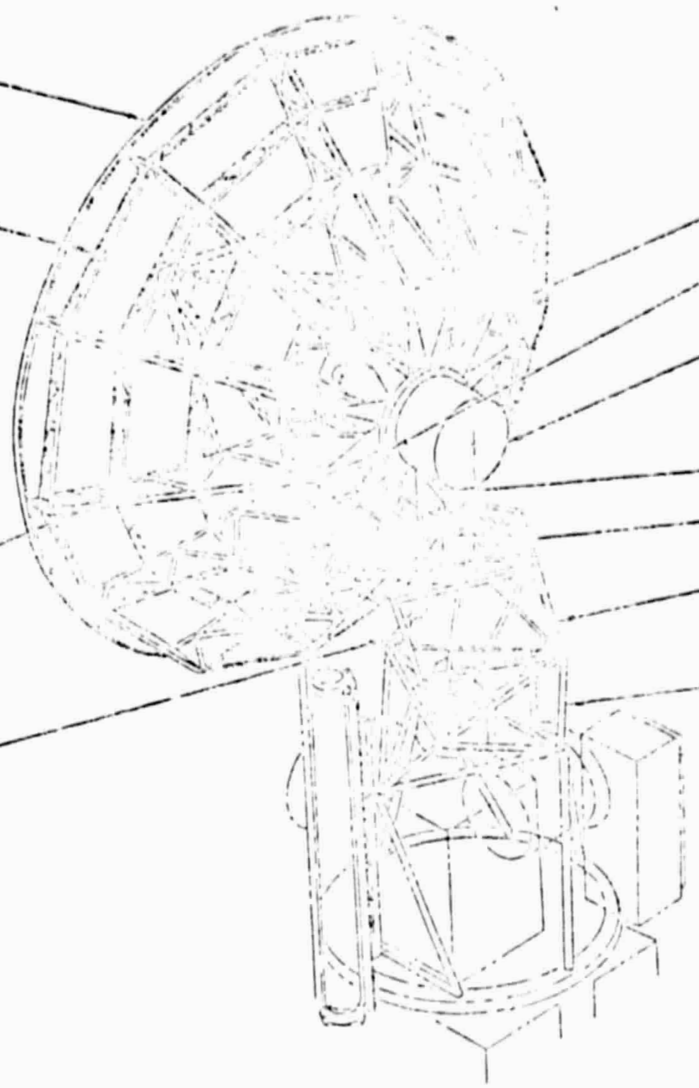
Microwaves can "see through" most of non-raining clouds. Microwave radiometry can be used to measure atmopsheric temperature profiles and humidity profiles. It can also be used to infer wind velocity field from temperature measurements. The "temperature anomally" or "hot spot" near the eye of a storm or hurricane, is a good indicator of the storm system. These indicators can only be measured by a microwave system described here.

USER COMMUNITY

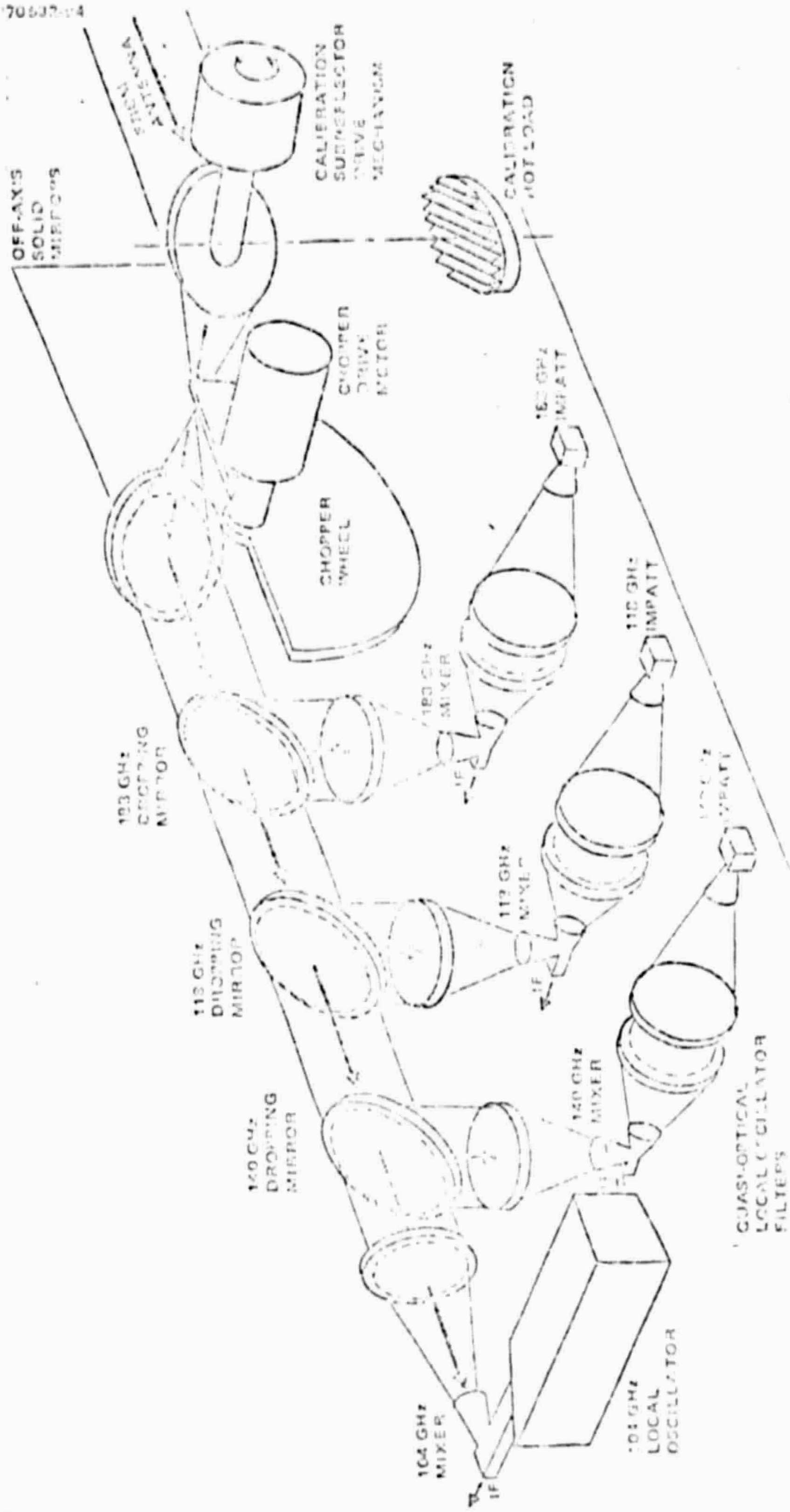
The meteorological data will be used by NASA, NOAA, DOD, and universities involved in atmospheric and meteorological research. Of principal interest is the application of these data to monitoring and forecasting of hurricane and severe thunderstorm activity.

Candidate Payload Data Summary - Sheet 5

Payload #20



MASR baseline antenna system



MASR OPTOMECHANICAL ASSEMBLY - ISOMETRIC VIEW

Payload #27

Candidate Payload Data Summary - Sheet 1

Date: 8-2-79

Code No: EO 5

Name: R. F. interferometer

Category: Environmental/Observation

Orbital Location(s): TBD

Description: Provides a facility for tracking balloons, buoys, land vehicles and ships to an accuracy of 1 Km.

See also attachment #1

A. Antenna/Sensor Configuration

See attachment #2

B. Transponder/Processor Configuration

C. Antenna/Sensor Data

1. No. 7
2. Type: Helices
3. Size:
4. Coverage/FOV: Global
5. No. of Beams/Feeds: 7
6. Pattern/Beamwidth: 22°
7. Max. Pointing Error: ±0.1°
8. Sensitivity (G/T):
9. Peak/EOC Gain: 17.5 dB
10. Other:

D. Transponder/Processor Data

1. No. 1
2. Type: Processor
3. Transmit Frequency: Platform Service
4. Receive Frequency: 1.2 GHz
5. Bandwidth(s)/Data Rate(s): TBD
6. Transmit Power(s)/EIRP: Platform Service
7. Noise Figure/Temperature:
8. Type of Access/Modulation:
9. On-Board Switching: (M× N)
10. Other:

Payload #27

Candidate Payload Data Summary - Sheet 2

Date: 8-2-79

E. Weight/Power Estimates

	Weight (Kg)	Power (W)
1. Antennas/Sensors	7	
2. Receivers:	50	200
3. Transmitters:		
4. Processors:	5	15
5. Switch Matrix:		
6. Power Converters:		
7. Cabling, Harness etc.	50	
8. Totals:	112	215

9. Notes:

F. Support Requirements

1. Sunlight/Eclipse Power: 215
2. Sunlight/Eclipse, Heat Loss: 215
3. Platform Attitude Control: ±0.5°
4. Stationkeeping: Orbit determination within 300 meters.
5. Thermal Control: Radiative cooling
6. Payload Volume: 1.5 cu. M
7. T, T&C/Avionics: / Yes No
8. Mission Duration:
9. Mission Duty Cycle: 100%
10. Interconnect Switch: (M×N)
11. Other:

G. Ground Segment

1. No. of Stations/Users: Platform Service
2. Antenna Size(s):
3. Beamwidth(s):
4. Peak Gain(s):
5. Noise Temperature:
6. Receive Frequencies:
7. Transmit Frequencies:
8. Modulation/Access:
9. Transmit Power:
10. Other:

H. Economic Data

1. Traffic Capacity:
2. Space Segment Cost: $15M
3. Ground Segment Cost:
4. Estimated Revenue/Yr:
5. User Communities: Government, Academic
6. Technology Availability Date: Now
7. Market Need Date: Now
8. Other:

Candidate Payload Data Summary - Sheet 4

INTERFEROMETER

OBJECTIVE/MISSION

The objective of the interferometer is to provide an on-board facility at L-band for tracking balloons, drifting buoys, land vehicles, and ships to an accuracy of 1 km.

There is an urgent need by meteorologists to determine wind velocity at a constant altitude to an accuracy of 1 km per hour in order to predict weather conditions more accurately. The system could accommodate up to 1500 balloons containing beacons and moving at a constant altitude. The balloons would also have temperature and pressure readouts on the 1 watt beacon.

The passage of Public Law 94-265, the Fishery Conservation and Management Act of 1976, extended U.S. responsibility for fisheries management to a 200-nautical mile zone covering 2.2 million square miles of ocean along an 6,700-mile perimeter. The Tanker and Vessel Safety Act of 1977 provides for major amendments to the Ports and Waterways Safety Act of 1972 which call for increased navigational safety within a 200-nautical mile marine safety zone.

MISSION PAYLOAD DESCRIPTION

a. Functional

Four helical antennas will be spaced as far apart as possible on the earth viewing side of the structure forming a large cross as shown in Figure 1. Three more will be spaced closer together on the structure to resolve ambiguity. These circularly polarized antennas will have a 22 degree beamwidth and 17.5 dB gain at L-band. The interferometer systems functional diagram is shown in Figure 2.

The beacon signal from the Earth containing the I.D. code, the temperature and pressure, is of 8 second duration and is turned on every two hours by the beacon timer. An inexpensive oscillator operates as a free running clock with low accuracy which enhances operation of the random multiple access mode to the platform.

The advantages of an interferometer are that the spacecraft electronics system is simplified. It employs a simple oscillator such that maintaining stability is not a problem. The spacecraft needs no auxillary equipment on-board and uses a one way transmission only. Only one spacecraft is used; therefore, it provides coverage for the entire Earth disc (field of view).

NOTE: Although the above describes the balloon system, the interferometer applications for buoys, aircraft, ships, and land-mobile are similar.

Candidate Payload Data Summary - Sheet 5

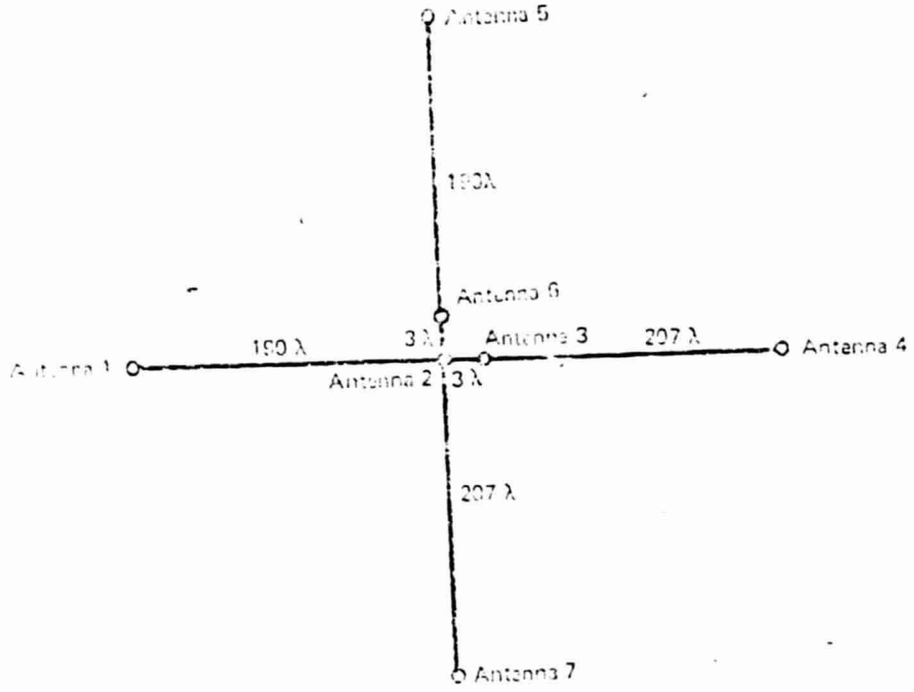


Figure 1 . Baselines

DOD Candidate Payloads for the Geostationary Platform

Payload #31

Mission Name: Defense Meterological Satellite Program Data Relay

Mission Description: This payload is designed to relay 2-3 MBPS from 3 satellites in 450 n.m. sun synchronous orbits (98.7° inclincation). The payload will operate in the 1-3 GHz frequency band. Maximum of 30 minutes delay in data reception. Desired IOC of 1985.

Platform Interface Requirements:

Weight: 150 Kg
Power: 100 watts
Volume:
Thermal Control:
Pointing Accuracy: ±0.3°
Other:

Experimenter: Capt. Ed Merz
Organization: SAMSO
Telephone No.: (213) 643-0708

DOD Candidate Payloads for the Geostationary Platform

Payload #31

Mission Name: Defense Meterological Satellite Program Data Relay

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Weight: 150 Kg
Power: 100 watts
Volume:
Thermal Control:
Pointing Accuracy: ±0.3°
Other:

Experimenter: Capt. Ed Merz
Organization: SAMSO
Telephone No.: (213) 643-0708

DOD Candidate Payloads for the Geostationary Platform

Payload #32

Mission Name: Advanced Operations Linescan System Cloud Imager

Mission Description: Will provide mosaic storage of cloud images.

Platform Interface Requirements:

Weight: 150 Kg
Power: 150 watts
Volume:
Thermal Control: Radiative cooling of IR detector
Pointing Accuracy: ± 0.01°
Other:

Experimenter: Capt. Ed Merz
Organization: SAMSO
Telephone No.: (213) 643-0708

DOD Candidate Payloads for the Geostationary Platform

Payload #33

Mission Name: Materials Exposure/Unrecovered

Mission Description: Will monitor on orbit failure of electronic devices. Effects will be correlated with the output of a charged particle monitor.

Platform Interface Requirements:

Weight: 10 Kb
Power: 25 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #34

Mission Name: Adaptive Control of Space Structures Demonstration

Mission Description: Will demonstrate ability to satisfy HALO requirements by active control of a 4 meter diameter test structure. Disturbance and high rate slewing motions will be simulated. Structure orientation will be varied from earth to black space to check albeds effects.

Platform Interface Requirements:

Weight: 1200 Kg
Power: 500 watts
Volume:
Thermal Control:
Pointing Accuracy: ±0.030°
Other: Drift <0.2 microradians
Jitter <0.02 microradians

Experimenter: Tom Pitts
Organization: RADC
Telephone No.: (315) 330-3148

DOD Candidate Payloads for the Geostationary Platform

Payload #35

Mission Name: Mirror Control Experiment (HALO)

Mission Description: Will determine the line of sight stability of a 2-3 meter segmented mirror. The mirror will be cryogenically cooled, possibly combined with integral cooling to 100-150°K.

Platform Interface Requirements:

Weight: 1200 Kg
Power: 300 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Tom Pitts
Organization: RADC
Telephone No.: (315) 330-3148

DOD Candidate Payloads for the Geostationary Platform

Payload #36

Mission Name: Advanced On-Board Signal Processor

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: John McNamara/Tom Pitts
Organization: RADC
Telephone No.: (315) 330-4437/3148

DOD Candidate Payloads for the Geostationary Platform

Payload #37

Mission Name: Pulsed Plasma Propulsion

Mission Description: Will test suitability of pulsed plasma propulsion units for space vehicle attitude control and north/south station keeping.

Platform Interface Requirements:

Weight: 360 Kg
Power: 680 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other: Possible RF compatibility problem due to radiation from arc.

Experimenter: Jerry Sayles
Organization: AFRPL
Telephone No.: (805) 277-5342

DOD Candidate Payloads for the Geostationary Platform

Payload #38

Mission Name: Aerosol & Cloud Height Sensor

Mission Description: Downward-looking scanning telescope covering earth's disc which uses filtered back scattered sunlight to sense altitudes of water vapor and gas layers.

Platform Interface Requirements:

Weight: 50 Kg
Power: 100 watts (27 volts)
Volume: 0.75 cu meter
Thermal Control:
Pointing Accuracy: ±0.1°
Other: 1 year mission life

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #39

Mission Name: Solar Flare Monitor

Mission Description: Will provide x-ray and gamma ray imaging of the solar surface. The results will be correlated with in-situ measurements of charged particles (protons, electrons, etc.).

Platform Interface Requirements:

Weight: 100 Kg
Power: 100 watts (27 volts)
Volume: 0.75 cu. meter
Thermal Control:
Pointing Accuracy: ±1.0°
Other: Sun-orientation
6 month to 1 year mission life

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #40

Mission Name: Solar Flare Isotope Monitor

Mission Description:

Platform Interface Requirements:

Weight: 13 Kg
Power: 6 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: J. A. Simpson
Organization: University of Chicago
Telephone No.: (312) 753-8541

DOD Candidate Payloads for the Geostationary Platform

Payload #41

Mission Name: Energetic Proton & Heavy Ion Sensor

Mission Description:

Platform Interface Requirements:

Weight: 8 Kg
Power: 6 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: R. D. Sharp
Organization: Lockheed
Telephone No.: (415) 493-4411, Ext. 45884

DOD Candidate Payloads for the Geostationary Platform

Payload #42

Mission Name: Global Ultraviolet Radiance

Mission Description: Will use imaging sensors (digicon) at the focal plane of an ultraviolet spectrometer to obtain spatial correlation. The sensors will scan the earth's disc from nadir to limb.

Platform Interface Requirements:

Weight: 50 Kg
Power: 20 watts (27 volts)
Volume: 0.4 cu. meter
Thermal Control:
Pointing Accuracy: ±0.1°
Other: 1 month minimum mission duration

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #43

Mission Name: Magnetic Substorm Monitor

Mission Description: Will use particle sensors and magnetometers to measure fluxes and fields. Spinning sensor required.

Platform Interface Requirements:

Weight: 5 Kg
Power: 5 watts (27 volts)
Volume: 0.1 cu. meter
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #44

Mission Name: Charged Particle Monitor

Mission Description: Will measure particles with energies in the range 1 eV to 100 eV and provide a time-history of particle flux levels. Monitor will be oriented along the platform velocity vector and will require 2000 sq. meters of conducting surface.

Platform Interface Requirements:

Weight: 5 Kg
Power: 10 watts
Volume: 0.1 cu. meter
Thermal Control:
Pointing Accuracy: ± 0.1°
Other: 6 Months to 1 year mission duration

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #45

Mission Name: Materials Exposure/Recovered

Mission Description: Will monitor on-orbit degradation/failure of solid state device fabrication materials, multilayer insulation, thermal control coatings, and conductive charge control elements. The payload must be retrievable.

Platform Interface Requirements:

Weight: 140 Kg
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Mr. Bill Lehn
Organization: AFML
Telephone No.: (573) 255-3028

DOD Candidate Payloads for the Geostationary Platform

Payload #46

Mission Name: Solar Ultraviolet Irradiance

Mission Description: Will monitor solar ultraviolet radiance with two spectrometers which require annual recalibration. The spectrometers will operate for 5 minutes/day for 1-11 years.

Platform Interface Requirements:

Weight: 50 Kg
Power: 10 watts (27 volts)
Volume: 95 × 26 × 12 cm.
Thermal Control:
Pointing Accuracy: ±1° (at sun)
Other: Requires periodic retrieval

Experimenter: AFGL
Organization:
Telephone No.:

Payload #47

Mission Name: Cosmic Ray Monitor

Mission Description: Will measure isotopic composition of cosmic rays with active (electronic) and passive (plastic/emulsion) detectors. Exposure in the ecliptic plane required.

Platform Interface Requirements:

Weight: 250 Kg
Power:
Volume: 0.75 cu. meter
Thermal Control:
Pointing Accuracy:
Other: 1 month to 1 year mission duration

Experimenter: AFGL
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #48

Mission Name: Mini-High Altitude Large Optics Program

Mission Description:

Platform Interface Requirements:

Weight: 700 Kg
Power: 1000 watts
Volume:
Thermal Control:
Pointing Accuracy: ±0.03°
Other: Drift <0.5 microrad/sec
Jitter <0.05 microrad RMS (0.1 to 1 Hz)

Experimenter:
Organization: DARPA
Telephone No.: (202) 494-3007

DOD Candidate Payloads for the Geostationary Platform

Payload #49

Mission Name: Mosaic Sensor Program

Mission Description:

Platform Interface Requirements:

Weight: 900 Kg
Power: 650 watts
Volume:
Thermal Control:
Pointing Accuracy: ±0.03°
Other: Stabilization to 0.1 arc sec/sec in a 0.1 to 5 Hz frequency band

Experimenter: Lt Col Tom May
Organization: SAMSO/YCD
Telephone No.: (213) 643-1262

DOD Candidate Payloads for the Geostationary Platform

Payload #50

Mission Name: Space Based Radar Experiment/Demonstration

Mission Description: Will demonstrate SBR performance characteristics by deploying a 20 meter or more diameter antenna, to permit pattern measurements with 100 or more T/R modules. Line of sight aperture sensing tests and clutter measurements will also be performed.

Platform Interface Requirements:

Weight: 900 Kg
Power: 20,000 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Lt Col Tom May
Organization: SAMSO/YCD
Telephone No.: (213) 643-1262

DOD Candidate Payloads for the Geostationary Platform

Payload #51

Mission Name: Cryogenic Infrared Radiator

Mission Description: Measure the performance of a large very low temperature radiator which would be used to passively cool infrared sensor components.

Platform Interface Requirements:

Weight: 120 Kg
Power:
Volume: Radiating surface area 10 sq. meters
Thermal Control:
Pointing Accuracy:
Other: Black space orientation

Experimenter: Bill Haskin
Organization: AFFDL
Telephone No.: (513) 255-4853

DOD Candidate Payloads for the Geostationary Platform

Payload #52

Mission Name: BOSS Evaluation

Mission Description: Will provide IR surveillance from space using a 0.5 meter diameter telescope with an optics temperature of 200°K and a detector temperature of 77°K. Telescope will scan ±30° from the nadir.

Platform Interface Requirements:

Weight: 150 Kg
Power: 400 watts (27 volts)
Volume: 1 cu. meter
Thermal Control:
Pointing Accuracy: ±5 arc secs
Other: Minimum mission duration of 2 weeks. Optical systems need protection from contaminants.

Experimenter: Rene Cormier
Organization: AFFDL
Telephone No.: (513) 255-4853

Payload #53

Mission Name: GEMINI Evaluation

Mission Description: Will provide IR surveillance from space using two 0.5 meter diameter telescopes with a 5 meter separation. The telescopes will scan ±30° from the nadir Telescope optics temperature of 200°K and a detector temperature of 77°K is required.

Platform Interface Requirements:

Weight: 820 Kg
Power: 1800 watts
Volume: 20 cu. meters
Thermal Control:
Pointing Accuracy: ±5 arc secs.
Other: Minimum mission duration of 2 weeks. Optical systems need protection from contamination.

Experimenter: Rene Cormier
Organization: AFGL
Telephone No.: (617) 861-3606

DOD Candidate Payloads for the Geostationary Platform

Payload #54

Mission Name: EHF System

Mission Description:

Platform Interface Requirements:

Weight: 230 Kg
Power: 500 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Maj Jerry Fjetland
Organization: SAMSO
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #55

Mission Name: Aircraft Laser Relay

Mission Description:

Platform Interface Requirements:

Weight: 320 Kg
Power: 550 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Maj Jerry Fjetland
Organization: SAMSO
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #56

Mission Name: Fiber Optics Demonstration

Mission Description:

Platform Interface Requirements:

Weight: 12 Kg
Power: 30 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other: Requires a 1 MBps Digital Data Link

Experimenter: Dave Zann
Organization: AFAL
Telephone No.: 785-4594

DOD Candidate Payloads for the Geostationary Platform

Payload #57

Mission Name: Space Sextant

Mission Description: Demonstrate space sextant performance characteristics, e.g., non radiating, autonomous operation, immune to ground based jamming, self calibrating.

Platform Interface Requirements:

Weight: 85 Kg
Power: 220 watts
Volume:
Thermal Control: -40°F +10°
Pointing Accuracy: ±10°
Other: Field of view must include sky and moon.

Experimenter: Barbara Corn/Lt James/Capt Roberts
Organization: SAMSO/YCD
Telephone No.: (213) 643-7044/643-1414

DOD Candidate Payloads for the Geostationary Platform

Payload #58

Mission Name: Passively Damped Structure

Mission Description: Demonstrate a structure with integral passive damping such as would be required for a precision pointing and tracking system or a stable platform.

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Dr. Lynn Rogers
Organization: AFFLD
Telephone No.: (513) 255-2967

DOD Candidate Payloads for the Geostationary Platform

Payload #59

Mission Name: Thermally Stable Structure

Mission Description: Demonstrate a thermally stable structure which can provide precise alignment with limited deflections due to thermal gradients.

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Jack Wood
Organization: AFFDL
Telephone No.: (513) 255-3736

DOD Candidate Payloads for the Geostationary Platform

Payload #60

Mission Name: Electronic Counter Counter Measures Processing TDMA

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter: Tom Treadway
Organization: RADC
Telephone No.: (315) 330-3046

DOD Candidate Payloads for the Geostationary Platform

Payload #61

Mission Name: Lasercom - Space to Ground

Mission Description:

Platform Interface Requirements:

Weight: 250 Kg
Power: 830 watts
Volume:
Thermal Control:
Pointing Accuracy: ±0.1°
Other:

Experimenter:
Organization: SAMSO/SKX
Telephone No.: (213) 643-1761

DOD Candidate Payloads for the Geostationary Platform

Payload #62

Mission Name: Enhanced IR Emissions

Mission Description:

Platform Interface Requirements:

Weight: 480 Kg
Power: 500 watts
Volume:
Thermal Control:
Pointing Accuracy: $\pm 0.1°$
Other:

Experimenter: Dr. Stair
Organization: AFGL
Telephone No.: (   ) 861-4910

DOD Candidate Payloads for the Geostationary Platform

Payload #63

Mission Name: AIRGLOW Far - UV Radiometers

Mission Description:

Platform Interface Requirements:

Weight: 20 Kg
Power: 1 watt
Volume:
Thermal Control:
Pointing Accuracy: ±10°
Other:

Experimenter: C.B. Opal
Organization: NRL
Telephone No.: (202) 767-2764

DOD Candidate Payloads for the Geostationary Platform

Payload #64

Mission Name: Particle Beam - Emission System

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #65

Mission Name: **Particle Beam - Ionospheric Effects**

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #66

Mission Name: Particle Beam - Plasma Precipitation

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #67

Mission Name: Dynamic Power System

Mission Description:

Platform Interface Requirements:

Weight: 250 Kg
Power: 200 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #68

Mission Name: Battlefield Illumination

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

DOD Candidate Payloads for the Geostationary Platform

Payload #69

Mission Name: Battlefield Cloud/Fog Dissipation

Mission Description:

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #71

Mission Name: Earth Viewing Optical Telescope

Mission Objectives:

1. High resolution studies of atmospheric structure.
2. Studies of wind velocity and flow regions.
3. Investigations of variations of major and minor constituents of the earth's atmosphere.
4. Small scale density and temperature structure and dynamics.
5. Transition regions structure and dynamics.

Platform Interface Requirements:

Weight:	1100 Kg
Power:	2000 watts
Volume:	1.5m × 2m
Thermal Control:	
Pointing Accuracy:	± 1.0 arc sec.
Other:	

Experimenter:
Organization: NASA-OSS
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #72

Mission Name: Particle Beam Injection Facility

Mission Objectives:

1. Studies of the effects of controlled energy injections in the auroral zones.
2. Active investigations of sub-storm onset conditions.
3. Investigations of the effects of induced ionization paths to release magnetotail energy.
4. Determination of the location, extent, and conditions for magentospheric electric fields.

Platform Interface Requirements:

Weight:	500 Kg
Power:	1000 watts
Volume:	$0.5 \times 1.0 \times 2.5$ meters
Thermal Control:	
Pointing Accuracy:	$\pm 1°$
Other:	

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #73

Mission Name: Chemical Release Module Observations

Mission Objectives:

1. Determine entry points in the magnetosphere for the solar wind plasma.
2. Investigate the transport paths and mechanisms for magnetospheric plasmas.
3. Investigate acceleration processes for magnetospheric plasmas.

Platform Interface Requirements:

Weight:	200 Kg
Power:	250 watts
Volume:	0.5m × 1.5m
Thermal Control:	
Pointing Accuracy:	± 0.01°
Other:	

Experimenter:
Organization:
Telephone No.

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #74

Mission Name: Plasma Diagnostic Satellite

Mission Objectives:

1. To provide a remote, maneuverable, free flying platform to make correlative measurements of particles and fields perturbed by wave injections and particle injections.

2. To provide background information on the unperturbed environment which may be used to calibrate the effects of perturbations.

3. To carry instruments away from the perturbation source to increase the spatial experiment coverage.

Platform Interface Requirements:

Weight:	1000 Kg
Power:	100 watts
Volume:	1.5m × 2m
Thermal Control:	
Pointing Accuracy:	± 0.01°
Other:	

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #75

Mission Name: Imaging Spectrometric Observatory

Mission Objectives:

1. Determination of distributions of atmospheric constituents (0_2, N_2, NO, O, H_2^+, O^+)
2. Studies of atmospheric motions and flow patterns.
3. Investigations of atmospheric constituent variations on a global scale.
4. Dynamics of auroral and airglare phenomena.

Platform Interface Requirements:

Weight.	350 Kg
Power:	150 watts
Volume:	1.5m × 1.5m × 2.0m
Thermal Control:	
Pointing Accuracy:	±0.1°
Other:	

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #76

Mission Name: Fabry-Perot Interferometer/Photometer

Mission Objectives:

1. Obtain high resolution interferometric observations to provide doppler velocity and temperature measurements of specific constituents.
2. Perform high resolution, high throughput photometry.
3. To determine the prevailing wind structure of the atmosphere on a global basis.

Platform Interface Requirements:

Weight:	150 Kg
Power:	200 watts
Volume:	0.5m dia × 2.5m
Thermal Control:	
Pointing Accuracy:	± 1 sec of arc.
Other:	

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #77

Mission Name: IR Occultation Instrument

Mission Objectives:

1. Obtain high resolution spectra of the atmosphere seen in absorption, with the sun as the source.
2. To determine densities and distributions of trace gases in the atmosphere.
3. To gather high resolution spectra of radiation reflected from the lower atmosphere.

Platform Interface Requirements:

Weight:	200 Kg
Power:	400 watts
Volume:	0.5m × 1.0m × 2.5m
Thermal Control:	
Pointing Accuracy:	±0.1°
Other:	

Experimenter:
Organization:
Telephone No.:

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NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #78

Mission Name: Cryogenically Cooled Limb Scanner

Mission Objectives:

1. Determine atmospheric constituent concentrations.
2. Determine global atmospheric temperature profiles.
3. Determine relaxation times by measuring spatial distributions of infrared radiation from the earth's limb.

Platform Interface Requirements:

Weight:	250 Kg
Power:	500 watts
Volume:	1m dia × 3m
Thermal Control:	
Pointing Accuracy:	± 1min of arc.
Other:	

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #79

Mission Name: Low Light Television

Mission Objectives:

1. Investigation of natural and induced auroral and airglare emissions.
2. Determination of global wind systems.
3. Measurements of excitation cross sections for atmospheric constituents.
4. Determination of atmospheric temperature.

Platform Interface Requirements:

Weight:	300 Kg
Power:	1000 watts
Volume:	1.0m dia × 2.5m
Thermal Control:	
Pointing Accuracy:	± 1 minute of arc.
Other:	

Experimenter:
Organization:
Telephone No.:

Payload #80

Mission Name: Plasma Wave Injection Facility

Mission Objectives:

1. Studies of wave-particle interactions.
2. Generation and propagation of magnetic pulsations.
3. Investigations of plasma instabilities.
4. Measurements of the electron distributions in the inner magnetosphere.
5. Interactions of turbulence with magnetic fields.
6. Acceleration of energetic particles.

Platform Interface Requirements:

Weight:	750 Kg
Power:	5000 watts
Volume:	
Thermal Control:	
Pointing Accuracy:	± 0.50
Other:	

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #81

Mission Name: Microwave Sounder

Mission Objectives:

1. General purpose receiving system for cm and mm wavelength emissions from the earth and sun.
2. Global mapping of atmospheric constituents such as precipitable water vapor.
3. Mapping of dispersion patterns of certain atmospheric pollutants with emission lines in the mm.
4. Measurements of ocean surface perturbations.

Platform Interface Requirements:

Weight: 100 Kg
Power: 200 watts
Volume:
Thermal Control:
Pointing Accuracy:
Other:

Experimenter:
Organization:
Telephone No.:

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #82

Mission Name: Soft X-Ray Telescope

Mission Objectives:

1. Simultaneous measurements of the hard and soft X-ray emission characteristics of the earth's Aurora with high spatial resolution (1 arc sec or 175 meters) and high temporal resolution (~ 1 millisecond).
2. Investigations of the morphology and evolution of the daytime aurora.
3. Investigate size and spatial distribution of electron precipitation regions.
4. Investigate spectra of X-ray emissions from electron precipitation regions with coarse spectral resolution.
5. Investigate size and motion effects in microburst precipitation.
6. Investigate with high time resolution temporal variations and periodicities of hard and soft X-ray emissions from microburst precipitations.
7. Investigate resonance scattering of plasmosphere at He^+ 304 A and 584 A emission from neutral helium.

Platform Interface Requirements:

Weight:	400 Kg
Power:	3000 watts
Volume:	0.5m dia × 3.5m
Thermal Control:	
Pointing Accuracy:	± 1 minute of arc.
Other:	

Experimenter:
Organization:
Telephone No.:

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Payload #83

Mission Name: Hard X-Ray Telescope

Mission Objectives:

See Payload #82

Platform Interface Requirements:

Weight:
Power:
Volume:
Thermal Control:
Pointing Accuracy:
Other:

See Payload #82

Experimenter:
Organization:
Telephone No.

NASA-OSS Candidate Payloads for the Geostationary Platform

Payload #84

Mission Name: Bistatic Forward Incoherent-Scatter Radar

Mission Objectives:

1. Measurement of ionospheric ion and electron temperatures, density, velocity and composition on a diurnal basis above selected transmitting sites.
2. Studies of natural perturbations of the medium created by current driven, drift, crossed-field or other instabilities.
3. Measurements of the natural propagation of plasma irregularities by sensing transmissions from spatially separated ground-based transmitters.
4. Measurement of density distribution along field lines.

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Platform Interface Requirements:

Weight:	700 Kg
Power:	100 watts
Volume:	
Thermal Control:	
Pointing Accuracy:	± 1.0°
Other:	

Experimenter:
Organization:
Telephone No.:

C-3

APPENDIX F

PAYLOAD ASSIGNMENTS

APPENDIX F

PAYLOAD ASSIGNMENTS

APPENDIX F

PAYLOAD ALLOCATION

NOMINAL TRAFFIC MODEL

Specific payload allocations were made to all 72 platform sets (Items 1 -72) and for the individual satellite mode using the common bus (Item 145). The payload assignments to each of the platforms in each set are tabulated in Table F-1. The payload mass and power requirements for each platform bus are also tallied.

HIGH TRAFFIC MODEL

Specific payload allocation to platform sets were made for the 12 most promising concepts (Items 73 - 84) and for the individual satellite mode (Item 148). These assignments are tabulated in Table F-2.

Table F-1. Payload Assignments - Nominal Traffic Model

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS: COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE											P/L MASS, kg	P/L POWER, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
1	51aC	67	1-33	X'	X'									X'																																				322	1300
			34-36			X'								X'																																				284	1800
			37-39						X'					X'																																				284	992
			40-45									X'		X'																																				297	1450
			46															X'					X																											310	71
			47															X'													X																			310	51
			48															X'																				X												310	76
			49, 50				X'							X'																																				322	512
			51, 52													X'																																		258	200
			53					X																		X																								322	300
			54							X																				X																				322	920
			55												X						X																													322	200
			56														X																																	245	50
			57																X	X																														335	370
			58																		X	X																												287	250
			59, 60																																	X'														284	330
			61																																X															297	500
			62																														X																	194	400
			63-67																																			X'												322	600
2	31qC	39	1-18	X'	X'									X'																																				439	1840
			19			X'									X																																			426	2400
			20			X'																				X				X																				426	2420
			21				X																																											426	680
			22					X											X																															439	350
			23, 24						X'					X																																				361	1308
			25							X										X																														413	1120
			26-28									X'		X																																				439	2275
			29													X																																		413	300
			30														X				X																													439	150

Table F-1. Payload Assignments - Nominal

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS: COMMUNICATIONS 1	2	3	4	5	6	7	8	9	10	11	12	ENVL. SCI. 17	18	19	20	27	21	22	23	24	25	26	30
1	SlaC	67	1-33	X'	X'									X'													
			34-36			X'								X'													
			37-39						X'					X'													
			40-45									X'		X'													
			46															X'					X				
			47															X'									
			48															X'									
			49, 50				X'							X'													
			51, 52													X'											
			53					X																		X	
			54							X																	
			55												X						X						
			56														X										
			57																X	X							
			58																		X	X					
			59, 60																								
			61																								
			62																								
			63-67																								
2	31qC	30	1-18	X'	X'									X'													
			19			X'									X												
			20			X'																				X	
			21				X																				
			22					X											X								
			23, 24						X'					X													
			25							X										X							
			26-28									X'		X													
			29													X											
			30														X				X						

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS																																												P/L MASS, kg	P/L POWER, W
				COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
2	31qC Contd	39	31, 32															X'													X							X												426	120
			33																																	X														297	500
			34																																		X													413	550
			35																			X												X																387	550
			36-39																																				X'											387	600
3	52aC'	31	1-14	X'	X'									X'																																				516	2160
			15, 16									X'		X																																				529	2745
			17												X			X'																																516	160
			18															X'		X																														542	280
			19			X																																												516	4000
			20				X							X																																				503	800
			21					X		X																																								516	1100
			22						X																																									516	2100
			23													X										X				X																				542	420
			24														X				X																													439	150
			25																X																	X														477	650
			26																																		X													413	550
			27																			X	X								X			X				X												426	610
			28-31																																				X'											452	700
4	32rC	26	1-14	X'	X'									X'																																				516	2092
			15			X									X																																			645	4103
			16				X														X		X								X																			645	810
			17					X											X			X																X												645	530
			18						X																	X				X																				645	2220
			19							X						X																																		671	1200
			20									X																																						684	4000
			21														X																				X													658	600
			22															X																																645	100
			23																	X														X		X														645	1120

Table F-1. Payload Assignments – Nomi[illegible]

LOCATION(S): [illegible]

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	COMMUNICATIONS 1	2	3	4	5	6	7	8	9	10	11	12	[illegible]
2	31qC Contd	39	31, 32													[illegible]
			33													[illegible]
			34													[illegible]
			35													[illegible]
			36-39													[illegible]
3	32sC'	31	1-14	X'	X'									X'		[illegible]
			15, 16									X'		X		[illegible]
			17												X	[illegible]
			18													[illegible]
			19			X										[illegible]
			20				X							X		[illegible]
			21					X		X						[illegible]
			22						X							[illegible]
			23													[illegible]
			24													[illegible]
			25													[illegible]
			26													[illegible]
			27													[illegible]
			28-31													[illegible]
4	32rC	36	1-14	X'	X'									X'		[illegible]
			15			X									X	[illegible]
			16				X									[illegible]
			17					X								[illegible]
			18						X							[illegible]
			19							X						[illegible]
			20									X				[illegible]
			21													[illegible]
			22													[illegible]
			23													[illegible]

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): [X] W. HEMISPHERE; [ ] ATLANTIC

ITEM NO.	CONCEPT I.J.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS: COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE											P/L MASS, kg	P/L POWER, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
4	32rC Contd	26	24-26																																				X'											516	700
5	33aE	19	1-9	X'	X'									X'																																				619	3020
			10			X															X										X																			630	4105
			11				X								X							X																												652	930
			12					X	X																																									675	2300
			13							X							X													X																				664	1370
			14									X		X'																																				652	4100
			15													X			X	X																														652	670
			16															X								X																								619	200
			17																				X													X	X	X												641	1105
			18, 19																																				X'											652	1000
6	33pC	19	-			SAME AS ITEM #5																																													
7	33qC'	19				SAME AS ITEM #5																																													
8	34aB	16	1-7	X'	X'									X'																																				680	3720
			8			X		X																																										600	4200
			9				X										X					X																												670	880
			10						X											X			X			X					X							X												600	2480
			11							X					X	X														X																				670	1320
			12									X									X																													680	4100
			13															X																X																550	500
			14																X																	X	X													690	1200
			15, 16																																				X'											580	1000
9	34bC	16	-			SAME AS ITEM #8																																													
10	34fC	16				SAME AS ITEM #8																																													
11	55qE	15	1	X'	X'									X'									X																											866	4225
			2	X'	X'									X'																																				866	4205
			3	X'	X'									X'																								X												866	4230
			4-6	X'	X'									X'																																				855	4200

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS																																														P/L MASS, kg	P/L POWER, W
				COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
11	55qE Contd	15	7			X		X													X																													844	4300
			8				X		X																	X																								878	2880
			9							X		X																								X														855	4500
			10															X												X																				844	1020
			11														X		X	X																	X													868	970
			12													X					X	X												X																866	950
			13												X																					X														371	600
			14, 15																																				X'											788	1400
12	55vC	15				SAME AS ITEM #11																																													
13	35qB	14	1	X'	X'									X'	X																																			860	4300
			2	X'	X'									X'												X																								810	4300
			3	X'	X'									X'																X																				810	4220
			4	X'	X'									X'									X																											770	4225
			5	X'	X'									X'																	X																			770	4205
			6	X'	X'									X'																							X													770	4230
			7			X		X									X																																	790	4250
			8				X		X											X																														850	3000
			9							X		X																																						730	4900
			10													X		X																																820	400
			11																		X															X	X													840	1300
			12																			X												X																300	550
			13, 14																																				X'											580	1000
14	35eC	14				SAME AS ITEM #13																																													
15	53cC	13	1	X'	X'									X'	X																																			1109	1620
			2	X'	X'									X'												X				X																				1109	1640
			3	X'	X'									X'						X																														1135	1740
			4	X'	X'									X'									X								X						X													1019	1580
			5, 6	X'	X'									X'																																				980	1520
			7					X																												X														1071	4700

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS																																										P/L MASS, kg	P/L POWER, W
				COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
15	53cC Contd	13	8				X		X										X																															1122	2930
			9									X				X																																		1096	4300
			10							X								X			X																													1096	1100
			11														X					X												X			X													1045	1150
			12, 13																																				X'											1032	1600
16	36rC'	12	1	X'	X'									X'									X																											1161	4965
			2	X'	X'									X'																	X																			1161	4945
			3	X'	X'									X'																								X												1161	4970
			4, 5	X'	X'									X'																																				1148	4940
			6			X	X														X																													1135	4780
			7					X	X	X					X																																			1161	3300
			8									X				X										X																								1161	4400
			9														X	X	X	X																														1225	520
			10																			X								X				X		X	X													1161	1620
			11, 12																																				X'											748	1000
17	37pC'	9	1	X'	X'									X									X			X				X	X							X												1406	5540
			2	X'	X'									X																																				1419	6200
			3	X'	X'									X																																				1419	6200
			4	X'	X'									X						X																														1393	5580
			5			X	X	X													X																													1393	4980
			6						X	X								X																																1419	3100
			7										X	X'		X	X																																	1406	4450
			8												X				X			X												X		X	X													1406	1850
			9																																				X											1419	2000
18	54bC'	10	1	X'	X'									X												X																								1367	5760
			2	X'	X'									X																X																				1367	5680
			3	X'	X'									X									X																											1367	5925
			4	X'	X'									X																	X																			1367	5905
			5			X	X	X												X																														1354	5100

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PAYLOAD ASSIGNMENTS TO PLATFORMS																																														P/L MASS, kg	P/L POWER, W
			PLATFORM NUMBERS	COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
18	54bC' Contd	10	6						X									X			X																	X												1367	2330
			7									X				X	X																																	1342	4350
			8																X			X												X		X	X													1277	1750
			9							X					X																																			387	1000
			10																																				X											1419	2000
19	37dC	9				SAME AS ITEM #17																																													
20	38oC	9	1	X'	X'									X					X																															1509	5930
			2	X'	X'									X						X																														1484	6000
			3	X'	X'									X	X								X															X												1484	5935
			4	X'	X'									X							X																													1522	5880
			5			X		X																																										774	4200
			6						X							X	X					X												X																1561	3000
			7									X		X				X																																1393	4200
			8			X	X			X				X																						X	X													1522	2830
			9																																				X											1419	2000
21	38rE	9				SAME AS ITEM #20																																													
22	38fC'	9				SAME AS ITEM #20																																												-	
23	38rB	9				SAME AS ITEM #20																																													
24	39cC'	8	1-3	X'	X'									X																																				1703	7520
			4			X	X	X							X		X									X				X																				1703	5150
			5						X	X						X			X	X	X																													1716	3770
			6									X		X				X																X																1587	4600
			7																			X														X	X													903	1200
			8																				X								X							X	X											1458	2160
25	39bE	8				SAME AS ITEM #24																																													
26	39pE	8				SAME AS ITEM #24																																													
27	56bB	7	1	X'	X'									X												X																								1370	7620
			2	X'	X'									X																X																				1370	7340
			3	X'	X'									X									X								X							X												1350	7580

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): ☒ W. HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE											P/L MASS, kg	P/L POWER, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
27	56bB Contd	7	4																		X	X																	X											1400	2250
			5							X		X						X																X																1380	5400
			6			X	X		X										X	X																														1389	7150
			7					X							X	X	X																			X	X													1360	1700
28	56pB	7				SAME AS ITEM #27																																													
29	56eC'	7				SAME AS ITEM #27																																													
30	56vC'	7				SAME AS ITEM #27																																													
31	56gC	7				SAME AS ITEM #27																																													
32	40nC	6	1	X'	X'									X												X										X														2064	8120
			2	X'	X'									X					X	X			X								X																			2064	7920
			3	X'	X'			X						X																X								X												2038	2770
			4			X	X								X	X					X															X														1974	5680
			5						X	X		X						X																																2103	7100
			6														X					X															X		X											2270	2750
33	40cE	6				SAME AS ITEM #32																																													
34	40dC'	6				SAME AS ITEM #32																																													
35	40fE	6				SAME AS ITEM #32																																													
36	40cB	6				SAME AS ITEM #32																																													
37	40fB	6				SAME AS ITEM #32																																													
38	41hC	5	1	X'	X'		X							X					X	X			X								X							X												2503	8630
			2	X'	X'									X	X	X	X																																	2490	7970
			3	X'	X'									X								X																												2541	7770
			4			X		X	X												X					X				X				X		X	X													2516	7970
			5							X		X		X																									X											2490	7100
39	41eE	5				SAME AS ITEM #38																																													
40	41eB	5				SAME AS ITEM #38																																													
41	41oC'	5				SAME AS ITEM #38																																													
42	41dE	5				SAME AS ITEM #38																																													
43	41vE	5				SAME AS ITEM #38																																													

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): ☒ W HEMISPHERE; ☐ ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS: COMMUNICATIONS 1	2	3	4	5	6	7	8	9	10	11	12	ENVL. OBS. 17	18	19	20	27	MILITARY 31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	SCIENCE 71	73	75	76	77	78	79	81	82	83	84	P/L MASS, kg	P/L POWER, W
44	41vB	5				SAME AS ITEM #38																																													
45	41dB	5				SAME AS ITEM #38																																													
46	42gC'	5	1	X'	X'		X							X					X	X			X								X							X												2,503	8,630
			2	X'	X'									X	X	X	X																																	2,490	7,970
			3	X'	X									X				X				X																												2,541	7,770
			4			X		X	X												X					X				X				X		X	X													2,516	7,970
			5							X		X		X																										X												2,490	7,100
47	43nC'	4	1	X'	X'									X																						X			X											3,418	10,020
			2	X'	X'		X		X					X		X			X	X			X								X																			3,418	11,000
			3	X'	X'									X	X		X	X				X				X											X	X												3,406	8,600
			4			X		X		X		X		X							X									X				X																2,296	9,820
48	43oE	4				SAME AS ITEM #47																																													
49	43oB	4				SAME AS ITEM #47																																													
50	43lC	4				SAME AS ITEM #47																																													
51	43hC'	4				SAME AS ITEM #47																																													
52	43gE	4				SAME AS ITEM #47																																													
53	43gB	4				SAME AS ITEM #47																																													
54	43jC	4				SAME AS ITEM #47																																													
55	44nB	3	1	X'	X'	X		X		X				X																						X			X											3,450	15,120
			2	X'	X'		X		X			X		X		X			X	X	X		X								X			X																3,480	15,500
			3	X'	X'									X	X		X	X				X				X				X							X	X												2,790	8,820
56	44nE	3				SAME AS ITEM #55																																													
57	44hB	3				SAME AS ITEM #55																																													
58	44hE	3				SAME AS ITEM #55																																													
59	47jC'	2	1	X'	X'	X		X		X				X	X							X				X				X						X	X	X	X											6,269	20,050
			2	X'	X'		X		X			X		X		X	X	X	X	X			X								X			X																6,321	19,630
60	47lC'	2				SAME AS ITEM #59																																													
61	45kC	3	1	X'	X'	X		X		X				X																						X			X											4,450	15,120
			2	X'	X'		X		X			X		X		X			X	X	X		X								X			X																4,489	15,500
			3	X'	X'									X	X		X	X				X				X				X							X	X												3,599	8,820

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

LOCATION(S): [X] W. HEMISPHERE; [ ] ATLANTIC

ITEM NO.	CONCEPT NO.	NO. OF PLATFORMS IN SET	PAYLOAD ASSIGNMENTS TO PLATFORMS: PLATFORM NUMBERS	COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE											P/L MASS, kg	P/L POWER, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
62	46mC	2	1	X'	X'	X		X		X				X	X							X				X			X	X						X	X	X	X											6,269	20,050
			2	X'	X'		X		X			X		X		X	X	X	X	X	X		X								X			X																6,321	19,630
63	47jB	2	1	X'	X'	X		X		X				X	X							X				X				X						X	X	X	X											4,860	20,050
			.	X'	X'		X		X			X		X		X	X	X	X	X			X								X			X																4,900	19,630
64	47jE	2		SAME AS ITEM #63																																															
65	47lB	2		SAME AS ITEM #63																																															
66	47lF	2		SAME AS ITSM #63																																															
67	48kC'	2	1	X'	X'	X		X		X				X	X							X				X				X						X	X	X	X											6,269	20,050
			2	X'	X'		X		X			X		X		X	X	X	X	X	X		X								X			X																6,321	19,630
68	48mC'	2		SAME AS ITEM #67																																															
69	49hB	2	1	X'	X'	X		X		X				X	X							X					X			X						X	X	X	X											4,860	20,050
			2	X'	X'		X		X			X		X		X	X	X	X	X	X		X								X		X																	4,900	19,630
70	49kE	2		SAME AS ITEM #69																																															
71	50mB	1	1	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X			X				X	X		X	X		X	X	X	X											9,250	27,780
72	50mE	1	1	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X			X				X	X		X	X		X	X	X	X											10,406	37,780
115	31sB	39	1-18	X'	X'									X'																																				340	1,840
			19			X'									X																																			330	2,400
			20			X'																				X				X																				330	2,470
			21				X																																											330	680
			22					X											X																															340	350
			23, 24						X'					X																																				280	1,308
			25							X										X																														320	1,120
			26-28									X'		X																																				340	2,275
			29													X																																		320	300
			30														X				X																													340	150
			31, 32															X'					X							X								X												330	120
			33																																	X														230	500
			34																																		X													320	550
			35																			X												X																300	550
			36-39																																				X'											300	600

Table F-2. Payload Assignments - High Traffic Model

LOCATION(S): [X] W. HEMISPHERE, [X'] ATLANTIC

ITEM NO	CONCEPT NO	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS: COMMUNICATIONS												ENVL. OBS.					MILITARY																		SCIENCE											P/L MASS, kg	P/L POWER, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
73	60bC'	34	1-12	X	X									X																																				1,367	4,300
			13			X	X	X												X																														1,393	5,130
			14						X									X			X																													1,354	2,306
			15									X				X	X																																	1,612	4,350
			16																X			X														X											X	X		1,200	3,800
	W. Hemisphere		17																																				X											1,419	2,000
			18							X					X								X			X	X	X	X	X	X	X						X		X			X							1,264	1,980
			19																					X																										1,419	500
			20																														X	X			X							X						1,342	6,950
			21																						X																								X	1,354	890
			22																																X											X				1,251	2,050
			23-30	X'	X'								X'	X																																				1,329	3,500
			31			X	X	X												X																														1,393	5,130
	Atlantic		32						X												X																				X	X								1,354	2,550
			33									X				X	X																																	1,612	4,350
			34						X	X				X	X																														X					1,380	2,720
74	61dC	33	1-12	X'	X'									X																																				1,367	4,300
			13			X	X	X												X																														1,393	5,130
			14						X									X			X																													1,354	2,300
			15									X				X	X																																	1,612	4,350
			16																X			X																												1,200	3,800
	W. Hemisphere		17																																				X											1,419	2,000
			18							X					X								X			X	X	X	X	X	X	X						X		X			X							1,264	1,980
			19																					X																										1,419	500
			20																														X	X			X							X						1,342	6,950
			21																						X																								X	1,354	800
			22																															X												X				1,251	2,050
	Atlantic		23-29	X'	X'								X'	X																																				1,406	3,200
			30			X	X	X												X																														1,393	5,130

Figure F-2. Payload Assignments - High Traffic Model, Contd

LOCATION(S): [X]W. HEMISPHERE; [X] ATLANTIC

ITEM NO	CONCEPT NO	NO OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS																																														P/L MASS, kg	P/L POWER, W
				COMMUNICATIONS												ENVL OBS					MILITARY																	SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	5:	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
74	61dC Contd	33	31					X													X																				X	X								1,354	2,550
	Atlantic		32									X				X	X																																	1,612	4,350
			33							X	X			X	X																														X					1,380	2,720
75	62cC'	26	1-8	X'	X'									X																																				1,703	6,400
			9			X		X	X					X								X				X				X																				1,703	6,690
			10				X			X		X		X																																				1,677	5,700
			11												X	X	X	X	X																															1,677	700
			12																	X	X															X	X										X	X		1,619	4,400
	W. Hemisphere		13																				X	X							X			X				X												1,651	970
			14																						X		X	X	X			X			X															1,703	2,650
			15																																				X	X										1,677	2,250
			16																													X									X	X	X	X						1,638	6,750
			17																																										X	X			X	1,484	1,350
			18																																												X	X		516	3,000
			19-23	X'	X'								X'	X																																				1,664	5,600
			24			X		X	X					X			X																																	1,638	6,470
	Atlantic		25							X	X			X		X				X	X																													1,703	2,270
			26				X					X		X	X																																			1,548	4,900
76	63dC'	20	1-6	X'	X'									X																																				2,051	8,500
			7			X	X	X	X					X			X																																	2,064	7,150
			8							X	X	X		X	X					X																														2,090	5,970
	W. Hemisphere		9													X					X		X				X	X	X		X	X		X		X	X	X				X								1,974	2,270
			10																					X	X																					X				2,064	1,450
			11																														X		X									X						1,793	7,800
			12																																				X						X					1,806	3,000
			13																																												X	X	X	1,419	3,100
			14	X'	X'								X'	X	X																																			2,012	7,100
	Atlantic		15	X'	X'								X'	X						X																														2,077	7,250
			16	X'	X'								X'	X							X																													2,077	7,100

Table F-2. Payload Assignments - High Traffic Model, Contd

LOCATION(S) [X] W. HEMISPHERE, [X] ATLANTIC

ITEM NO	CONCEPT NO	NO. OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS																																														P/L MASS, kg	P/L POWER, W
				COMMUNICATIONS												ENVL. OBS					MILITARY																		SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
76	63dC' Contd	20	17	X'	X'								X'	X'					X																															2,077	7,150
			18			X	X	X	X					X			X																																	2,064	7,150
	Atlantic		19							X	X	X		X								X				X				X																				2,090	5,890
			20													X		X																						X	X		X							2,064	1,200
77	64gC'	14	1-4	X'	X'									X																																				2,722	12,600
			5			X	X	X	X					X		X		X																																2,902	7,500
	W. Hemisphere		6							X	X	X		X	X		X		X	X		X	X			X				X	X							X												2,902	6,510
			7																		X						X	X	X			X		X		X	X		X			X								2,902	3,800
			8																					X	X								X							X				X						2,864	7,450
			9																																X						X		X		X	X	X	X		2,864	6,600
			10																																														X	903	100
			11	X'	X'			X					X'	X						X	X																													2,890	7,850
			12	X'	X'	X							X'	X	X																																			2,890	13,400
	Atlantic		13	X'	X'				X				X'	X																																				2,761	11,400
			14				X			X	X	X		X		X	X																																	2,902	6,650
78	65IC	12	1	X'	X'	X								X																																				3,238	16,600
			2	X'	X'		X	X						X																																				3,406	13,480
			3	X'	X'				X					X	X																																			3,367	14,800
	W. Hemisphere		4	X'	X'									X			X			X	X																													3,367	13,000
			5							X		X		X		X		X	X							X				X						X	X													3,380	6,740
			6																			X	X	X	X		X	X	X		X	X	X	X				X						X		X				3,418	8,220
			7																																X					X	X	X								1,961	2,400
			8																																								X		X		X	X	X	2,064	4,500
			9	X'	X'		X						X'	X																																				3,418	14,380
	Atlantic		10	X'	X'			X					X'	X	X																																			3,380	14,000
			11			X			X	X	X	X		X		X																																		3,251	12,020
			12														X			X	X																		X											2,064	2,400
79	66IC'	7	1	X'	X'									X																																				5,031	25,000
	W. Hemisphere		2	X'	X'									X																																				5,031	25,000

Table F-2. Payload Assignments - High Traffic Model, Contd

LOCATION(S): [X] W. HEMISPHERE, [X] ATLANTIC

Item No.	Concept No.	No. of Platforms in Set	Platform Numbers	Payload Assignments to Platforms: Communications												Envl Obs				Military																			Science											P/L Mass, kg	P/L Power, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
79	66IC' Contd	7	3			X	X	X	X	X		X		X	X	X	X	X	X		X															X	X													5,5[illegible]7	13,850
	W. Hemisphere		4																	X		X	X	X	X	X	X	X	X	X	X	X		X	X			X	X											5,[illegible]	6,140
			5																														X									X	X	X	X	X	X	X	X	3,186	10,956
	Atlantic		6	X	X								X	X																																				5,328	24,900
			7			X	X	X	X	X	X	X		X	X	X	X			X	X																			X	X									5,418	13,800
80	67mC	6	1	X'	X'	X		X						X																																				5,805	29,200
	W. Hemisphere		2	X'	X'					X	X			X	X																																			5,934	28,100
			3				X					X		X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X		X	X	X												6,231	8,190
			4																						X								X		X								X	X	X	X	X	X	X	4,502	13,250
	Atlantic		5	X	X	X		X					X	X																																				6,102	29,100
			6				X		X	X	X	X		X	X	X	X			X	X																		X	X	X	X								6,256	11,800
81	68IB	6	1	X'	X'	X		X	X					X	X	X																																		5,350	31,200
	W. Hemisphere		2	X'	X'					X		X		X																																				4,800	29,900
			3				X										X	X	X	X	X	X	X			X	X	X	X	X	X	X		X		X	X	X												2,610	3,270
			4																					X	X								X		X									X		X			X	3,690	9,350
	Atlantic		5	X	X	X		X	X				X	X																																				5,130	31,200
			6				X			X	X	X		X	X	X	X			X	X																		X	X	X	X	X		X		X	X		5,350	14,100
82	69mC' W. Hemisphere	4	1	X	X		X							X																																				9,468	46,080
			2			X		X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X	X		X		X				8,507	22,110
	Atlantic		3	X	X	X		X	X	X	X	X	X	X	X	X	X			X	X																													9,520	37,500
			4				X																												X				X	X			X		X		X	X	X	5,224	9,250
83	70mB W. Hemisphere	3	1	X	X	X	X	X	X	X		X		X																																				9,240	57,280
			2												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X	X	X	7,620	16,690
	Atlantic		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X																		X	X			X							9,210	40,830
84	70mE W. Hemisphere	3	1	X	X	X	X	X	X	X		X		X																																				10,385	57,280
			2												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X	X	X	8,572	16,690
	Atlantic		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X																		X	X			X							10,361	40,830
14- (1.5 Mode)	71sB W. Hemisphere	163	1-57	X'	X'									X'																																				350	1,050
			58, 59			X'								X																																				290	2,100
			60				X																																											330	680

Table F-2. Payload Assignments - High Traffic Model, Contd

LOCATION(S) [X] W HEMISPHERE, [X] ATLANTIC

ITEM NO	CONCEPT NO	NO OF PLATFORMS IN SET	PAYLOAD ASSIGNMENTS TO PLATFORMS																																														P/L MASS, kg	P/L POWER, W
			PLATFORM NUMBERS	COMMUNICATIONS												ENVL OBS					MILITARY																		SCIENCE												
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
148	71sB Contd	163	61					X							X																																			300	300
			62, 63						X'																																									240	1,050
			64							X				X																																				250	1,000
			65-68									X'																																						330	2,000
			69													X																																		350	30[illegible]
			70														X																																	200	5[illegible]
			71, 72															X'																																320	5[illegible]
			73																X	X																														270	400
			74																		X																													150	100
			75																																	X														230	500
			76																																		X													320	55[illegible]
	W. Hemisphere		77																			X				X				X																				250	27[illegible]
			78																				X				X	X	X		X	X		X				X												330	620
			79																						X																									350	700
			80, 81																													X												X'						120	3,000
			82-84																																X'															345	600
			85-88																																				X'											330	600
			89																																					X										200	250
			90																																						X									350	150
			91																																							X	X							350	600
			92																																										X					300	1,000
			93																																											X	X			250	1,250
			94, 95																																														X'	350	120
			96																																													X		300	2,000
			97-142	X'	X'								X'	X'																																				350	745
			143, 144			X'								X																																				290	2,100
	Atlantic		145				X							X																																				330	680
			146					X							X																																			300	300
			147, 148						X																																									240	1,050

Table F-2. Payload Assignments - High Traffic Model, Contd

LOCATION(S): ☒ W. HEMISPHERE. ☒ ATLANTIC

ITEM NO	CONCEPT NO	NO OF PLATFORMS IN SET	PLATFORM NUMBERS	PAYLOAD ASSIGNMENTS TO PLATFORMS: COMMUNICATIONS												ENVL OBS					MILITARY																		SCIENCE											P/L MASS, kg	P/L POWER, W
				1	2	3	4	5	6	7	8	9	10	11	12	17	18	19	20	27	31	32	33	34	36	38	39	40	41	42	43	44	51	52	53	54	55	56	71	73	75	76	77	78	79	81	82	83	84		
148	71aB Contd	163	149							X				X																																				250	1,000
			150, 151								X'			X																																				300	400
			152-155									X'																																						330	2,000
	Atlantic		156													X																																		350	300
			157														X																																	200	50
			158																	X	X																													270	350
			159-163																					X'																										264	120

APPENDIX G

PLATFORM SYNTHESIS

APPENDIX G

PLATFORM SYNTHESIS

Parametric platform design concepts were developed for each of 72 sets for Mission Sets N and V. For each set, a standard platform bus was parametrically designed to accommodate the maximum weight and maximum power requirements of each payload group. Based upon payload weight and power requirements, the platform structure and supporting subsystems were sized, taking into account redundancy and modularity appropriate for each operational mode. The structural weight estimates included the impact of high T/W ratios. Then the total platform weight, including payloads, was calculated and a 15% contingency factor included.

The parametric platform designs were developed using scaling factors and weight estimating relationships developed from the preliminary trade studies for each of the operational modes. A series of point designs were developed that spanned a wide range of payload mass and power support requirements for each of the 4 candidate operational modes. These designs were then used to develop scaling factors for synthesizing the 144 platform sets used in the basic system trade studies. These scaling factors are listed in Table G-1.

These scaling factors were then used to set up a platform synthesis model to define the parametric platform designs. A set of data sheets was developed for each operational mode which contains all of the mass and power estimating relationships for the platform structure and subsystems. The data sheets employ the previously defined scaling factors plus a 15% contingency factor to estimate platform mass and power as a function of payload mass and power.

Table G-2 contains the platform mass and power estimating data sheets for the 144 platform system concepts that were developed for Buildup Mode K.

Table G-1. Platform Subsystem Scaling Factors

Parameter	Oper. Mode	Mass Range, kg	Equation $(Y = mx + b)$
Structure Mass* (M_s)	B	$M_{PY} \geq 2200$	$M_s = 0.29\ M_{PY} + 300$ kg
(*Does not include mass penalty for high T/W ratio)	B	$M_{PY} < 2200$	$M_s = 0.396\ M_{PY} + 50$ kg
	C, C'	$M_{PY} \geq 3000$	$M_s = 0.225\ M_{PY} + 300$ kg
	C, C'	$M_{PY} < 3000$	$M_s = 0.31\ M_{PY} + 50$ kg
	E	$M_{PY} \geq 2700$	$M_s = 0.259\ M_{PY} + 300$ kg
	E	$M_{PY} < 2700$	$M_s = 0.35\ M_{PY} + 50$ kg
TCC Mass (M_T)	B	$M_{PY} \geq 4400$	$M_T = 0.026\ M_{PY} + 60$ kg
	B	$M_{PY} < 4400$	$M_T = 0.0306\ M_{PY} + 40$ kg
	C, C'	$M_{PY} \geq 4400$	$M_T = 0.0263\ M_{PY} + 77$ kg
	C, C'	$M_{PY} < 4400$	$M_T = 0.0319\ M_{PY} + 52$ kg
	E	$M_{PY} \geq 4400$	$M_T = 0.0262\ M_{PY} + 68$ kg
	E	$M_{PY} < 4400$	$M_T = 0.0317\ M_{PY} + 45$ kg
TCS Mass (M_H)	B	All	$M_H = 0.0175\ M_{PY} + 40$ kg
	C, C'	All	$M_H = 0.0175\ M_{PY} + 52$ kg
	E	All	$M_H = 0.0175\ M_{PY} + 45$ kg

Table G-1. Platform Subsystem Scaling Factors, Contd

Parameter	Oper. Mode	Mass Range, kg	Equation ($Y = mx + b$)
Rendezvous and Docking Mass (M_{RD})	E	$M_{PY} \geq 2600$	$M_{RD} = 0.0388\ M_{PY} + 400$ kg
	E	$M_{PY} < 2600$	$M_{RD} = 0.1175\ M_{PY} + 200$ kg
	C'	All	$M_{RD} = 0.0193\ M_{PY} + 200$ kg
EPS Mass (M_E)	B	All	$M_E = 0.055\ P_o + 187$ kg
	C	All	$M_E = 0.0713\ P_o + 240$ kg
	E	All	$M_E = 0.0620\ P_o + 210$ kg
	C'	All	$M_E = 0.0609\ P_o + 200$ kg
ACS Mass (M_A)	B	All	$M_A = 0.0228\ M_{PL} + 50$ kg
	C, C'	All	$M_A = 0.0294\ M_{PL} + 64$ kg
	E	All	$M_A = 0.0258\ M_{PL} + 56$ kg
EPS Power Losses and Battery Charge (P_E)	All	All	$P_E = 0.067\ P_o + 100$ W
ACS Power (P_A)	All	All	$P_A = 0.011\ M_{PL} + 30$ W
RCS Power (P_R)	All	All	$P_R = 0.008\ M_{PY} + 20$ W
TCC Power (P_T)	All	All	$P_T = 0.0195\ M_{PY} + 40$ W

Table G-1. Platform Subsystem Scaling Factors, Contd

Parameter	Oper. Mode	Mass Range, kg	Equation ($Y = mx + b$)
TCS Power (P_H)	All	All	$P_H = 0.0438\ M_{PY} + 100$ W
Rendezvous and Docking Equipment Power (P_{RD})	E, C'	All	$P_{RD} = 200$ W
RCS Dry Weight (M_R)	All	All	$M_R = 0.2\ M_P$
Propellant Mass (M_P)	B	All	$M_P = 0.1660\ M_{PL}$
	C	All	$M_P = 0.3320\ M_{PL}$
	C'	All	$M_P = 0.1660\ M_{PL}$
	E	All	$M_P = 0.0623\ M_{PL}$

M_{PY} = Payload Mass, kg

P_o = EPS Output Power, watts

M_{PL} = Platform Mass, kg

Table G-2. Platform Mass and Power Estimating Data Sheets

PLATFORM MASS & POWER ESTIMATES PLATFORM NO. 51aC

OTV: OTV, L.T. Reusable OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 1 Case: II (M_{PY} < 3000)	1,800	322
2. Structure - Basic	$M_S = 0.31\ (M_{PY}) + 50 = 150$ kg	0	165
- Secondary	10% of $M_S = 15$ kg		
- T/W Penalty	T/W = 0.13: Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 430$ kg		430
	$P_E = 0.067\ (P_o) + 100 = 279$ W	279	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 137$ kg		137
	$P_A = 0.011\ (M_{PL}) + 30 = 57$ W	57	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_P = 1.2\ (M_P) = 1.2 \times (825) = 990$ kg		990
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 23$ W	23	
	(M_{PY} < 4400)		
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 56$ kg		56
	$P_T = 0.0195\ (M_{PY}) + 40 = 46$ W	46	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 58$ kg		58
	$P_H = 0.0438\ (M_{PY}) + 100 = 114$ W	114	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	2,319	2,158
9. Contingency and Integration	15% of the above power and mass	348	324
		P_o	M_{PL}
NO. OF PLATFORMS: 67	TOTALS:	2,667	2,482

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 31qC

OTV: OTV, Reusable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 2 Case: II ($M_{PY} < 3000$)	2,420	439
2. Structure - Basic	M_s 0.31 (M_{PY}) + 50 = 186 kg		352
- Secondary	10% of M_s = 19 kg	0	
- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 487$ kg		487
	$P_E = 0.067\ (P_o) + 100 = 332$ W	332	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 162$ kg		162
	$P_A = 0.011\ (M_{PL}) + 30 = 67$ W	67	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1106) = 1328$ kg		1,328
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 24$ W ($M_{PY} < 4400$)	24	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 66$ kg		55
	$P_T = 0.0195\ (M_{PY}) + 40 = 49$ W	49	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 60$ kg		60
	$P_H = 0.0438\ (M_{PY}) + 100 = 119$ W	119	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	3,009	2,894
9. Contingency and Integration	15% of the above power and mass	451	434
		P_o	M_{PL}
NO. OF PLATFORMS: 39	TOTALS:	3,461	3,328

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 52aC'

OTV: OTV, L.T. Reusable

OPER. MODE: C' – Non-serviced, 16 year life, consumables replenished at 8 years

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 3 Case: II ($M_{PY} < 3000$)	4,000	516
2. Structure – Basic	$M_s = 0.31\ (M_{PY}) + 50 = 210$ kg		231
– Secondary	10% of $M_s = 21$ kg		
– T/W Penalty	T/W = 0.13; Penalty – 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 546$ kg		546
	$P_E = 0.067\ (P_o) + 100 = 480$ W	480	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 142$ kg		142
	$P_A = 0.011\ (M_{PL}) + 30 = 59$ W	59	
5. RCS M_P 0.166 (M_{PL})	$M_R = 1.2\ (M_P) = 1.2 \times (440) = 528$ kg		528
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 24$ W ($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 68$ kg		68
	$P_T = 0.0195\ (M_{PY}) + 40 = 50$ W	50	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 61$ kg		61
	$P_H = 0.0438\ (M_{PY}) + 100 = 123$ W	123	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 210$ kg		210
	$P_{RD} = 200$ W	200	
	Sub Tot	4,936	2,301
9. Contingency and Integration	15% of the above power and mass	740	345
		P_o	M_{PL}
NO. OF PLATFORMS: 31	**TOTALS:**	5,677	2,646

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 32rC

OTV: Centaur, Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 4 Case: II (M_{PY} < 3000)	4,100	684
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 262$ kg	0	688
- Secondary	10% of M_s = 26 kg		
- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 639$ kg		639
	$P_E = 0.067\ (P_o) + 100 = 475$ W	475	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 212$ kg		212
	$P_A = 0.011\ (M_{PL}) + 30 = 85$ W	85	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1666) = 1999$ kg		1,999
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 25$ W	25	
	(M_{PY} < 4400)		
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 74$ kg		74
	$P_T = 0.0195\ (M_{PY}) + 40 = 53$ W	53	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 64$ kg		64
	$P_H = 0.0438\ (M_{PY}) + 100 = 130$ W	130	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	4,869	4,360
9. Contingency and Integration	15% of the above power and mass	730	654
		P_o	M_{PL}
NO. OF PLATFORMS: 26	TOTALS:	5,6900	5,014

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, L.T. Reusable

PLATFORM NO. 33aE

OPER. MODE: E-Serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 5 Case: II ($M_{PY} < 2700$)	4,105	675
2. Structure - Basic	$M_s = 0.35\ (M_{PY}) + 50 = 286$ kg	0	315
- Secondary	10% of $M_s = 29$ kg		
- T/W Penalty	T/W = 0.13; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 571$ kg		571
	$P_E = 0.067\ (P_o) + 100 = 490$ W	490	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 124$ kg		124
	$P_A = 0.011\ (M_{PL}) + 30 = 59$ W	59	
5. RCS $M_P = 0.0623\ (M_{PL})$ $M_R = M_P + 0.2\ M_P$	$M_R = 0.2\ (M_P) + 1.2 \times (164) = 197$ kg		197
6. TCC	$P_R = 0.008\ (M_{PY}) + 20 = 25$ W ($M_{PY} < 4400$)	25	
	$M_T = 0.0317\ (M_{PY}) + 45 = 66$ kg		66
7. TCS	$P_T = 0.0195\ (M_{PY}) + 40 = 53$ W	53	
	$M_H = 0.0175\ (M_{PY}) + 45 = 57$ kg		57
8. Rendezvous and Docking	$P_H = 0.0438\ (M_{PY}) + 100 = 130$ W ($M_{PY} < 2600$)	130	
	$M_{RD} = 0.1175\ (M_{PY}) + 200 = 279$ kg		279
	$P_{RD} = 200$ W	200	
	Sub Tot	5,062	2,284
9. Contingency and Integration	15% of the above power and mass	759	343
NO. OF PLATFORMS: 19	TOTALS:	P_o 5,821	M_{PL} 2,626

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 33kC

OTV: OTV, Reusable

OPER. MODE: C-Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 6 Case: III ($M_{PY} < 3000$)	4,105	774
2. Structure - Basic	$M_s = 0.31 (M_{PY}) + 50 = 281$ kg	0	722
- Secondary	10% of $M_s = 28$ kg		
- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3. EPS	$M_E = 0.0713 (P_o) + 240 = 641$ kg		641
	$P_E = 0.067 (P_o) + 100 = 476$ W	476	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 220$ kg		220
	$P_A = 0.011 (M_{PL}) + 30 = 88$ W	88	
5. RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1764) = 2117$ kg		2,117
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 26$ W	26	
	($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 77$ kg		77
	$P_T = 0.0195 (M_{PY}) + 40 = 55$ W	55	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 66$ kg		66
	$P_H = 0.0438 (M_{PY}) + 100 = 134$ W	134	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	4,885	4,616
9. Contingency and Integration	15% of the above power and mass	733	692
		P_o	M_{PL}
NO. OF PLATFORMS: 19	TOTALS:	5,617	5,309

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 33qC'

OTV: OTV, Reusable

OPER. MODE: C' - Non-serviced, 16 year life, consumables ~~replenished at 8 years~~

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 7 Case: II ($M_{PY} < 3000$)	4,105	774
2. Structure - Basic	$M_S = 0.31\ (M_{PY}) + 50 = 290$ kg	0	466
- Secondary	10% of $M_S = 29$ kg		
- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 556$ kg		556
	$P_E = 0.067\ (P_o) + 100 = 491$ W	491	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 166$ kg		166
	$P_A = 0.011\ (M_{PL}) + 30 = 68$ W	68	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (575) = 690$ kg		690
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 26$ W ($M_{PY} < 4400$)	26	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 77$ kg		77
	$P_T = 0.0195\ (M_{PY}) + 40 = 55$ W	55	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 66$ kg		66
	$P_H = 0.0438\ (M_{PY}) + 100 = 134$ W	134	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 215$ kg		215
	$P_{RD} = 200$ W	200	
	Sub Tot	5,079	3,008
9. Contingency and Integration	15% of the above power and mass	762	451
		P_o	M_{PL}
NO. OF PLATFORMS: 19	TOTALS:	5,841	3,460

PLATFORM NO. 34aB

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, L.T. Reusable — OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 8 Case: II ($M_{PY} < 2200$)	4,200	690
2. Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 323$ kg	0	356
- Secondary	10% of $M_s = 32$ kg		
- T/W Penalty	T/W = 0.13; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 500$ kg		500
	$P_E = 0.067\ (P_o) + 100 = 481$ W	481	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 110$ kg		110
	$P_A = 0.011\ (M_{PL}) + 30 = 59$ W	59	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (439) = 527$ kg		527
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 26$ W ($M_{PY} < 4400$)	26	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 61$ kg		61
	$P_T = 0.0195\ (M_{PY}) + 40 = 53$ W	53	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 52$ kg		52
	$P_H = 0.0438\ (M_{PY}) + 100 = 130$ W	130	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	4,949	2,296
9. Contingency and Integration	15% of the above power and mass	742	344
		P_o	M_{PL}
	TOTALS:	5,692	2,640

NO. OF PLATFORMS: 16

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 34bC

OTV: Centaur, L.T. Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 9 Case: II ($M_{PY} < 3000$)	4,200	890
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 326$ kg	0	358
- Secondary	10% of $M_s = 33$ kg		
- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 649$ kg		649
	$P_E = 0.067\ (P_o) + 100 = 484$ W	484	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 205$ kg		205
	$P_A = 0.011\ (M_{PL})\ 30 = 83$ W	83	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1589) = 1907$ kg		1,907
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 27$ W	27	
	($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 80$ kg		80
	$P_T = 0.0195\ (M_{PY}) + 40 = 57$ W	57	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 68$ kg		68
	$P_H = 0.0438\ (M_{PY}) + 100 = 139$ W	139	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	4,990	4,159
9. Contingency and Integration	15% of the above power and mass	749	623
		P_o	M_{PL}
NO. OF PLATFORMS: 16	TOTALS:	5,739	4,780

PLATFORM MASS & POWER ESTIMATES **PLATFORM NO.** 34fC

OTV: IOTV, Expendable **OPER. MODE:** C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 10 Case: II (M_{PY} < 3000)	4,200	890
2.	Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 326$ kg	0	806
	- Secondary	10% of $M_S = 33$ kg		
	- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3.	EPS	$M_E = 0.0713 (P_o) + 240 = 650$ kg		650
		$P_E = 0.067 (P_o) + 100 = 485$ W	485	
4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 234$ kg		234
		$P_A = 0.011 (M_{PL}) + 30 = 94$ W	94	
5.	RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1925) = 2310$ kg		2,310
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 27$ W (M_{PY} < 4400)	27	
6.	TCC	$M_T = 0.0319 (M_{PY}) + 52 = 80$ kg		80
		$P_T = 0.0195 (M_{PY}) + 40 = 57$ W	57	
7.	TCS	$M_H = 0.0175 (M_{PY}) + 52 = 68$ kg		68
		$P_H = 0.0438 (M_{PY}) + 100 = 139$ W	139	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	5,002	5,039
9.	Contingency and Integration	15% of the above power and mass	750	756
			P_o	M_{PL}
	NO. OF PLATFORMS: 16	**TOTALS:**	5,752	5,795

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 55qE

OTV: OTV, Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 11 Case: II (M_{PY} < 2700)	4,230	866
2. Structure - Basic	M_S = 0.35 (M_{PY}) + 50 = 318 kg	0	497
- Secondary	10% of M_S = 32 kg		
- T/W Penalty	T/W = 108; Penalty = 147 kg		
3. EPS	M_E = 0.0620 (P_o) + 210 = 528 kg		582
	P_E = 0.067 (P_o) + 100 = 502 W	502	
4. ACS	M_A = 0.0258 (M_{PL}) + 56 = 138 kg		138
	P_A = 0.011 (M_{PL}) + 30 = 65 W	65	
5. RCS M_P = 0.0623 (M_{PL})	M_R = 1.2 (M_P) + 1.2 × (197) = 237 kg		237
M_R = M_P + 0.2 M_P	P_R = 0.008 (M_{PY}) + 20 = 27 W (M_{PY} < 4400)	27	
6. TCC	M_T = 0.0317 (M_{PY}) + 45 = 72 kg		72
	P_T = 0.0195 (M_{PY}) + 40 = 57 W	57	
7. TCS	M_H = 0.0175 (M_{PY}) + 45 = 60 kg		60
	P_H = 0.0438 (M_{PY}) + 100 = 138 W (M_{PY} < 2600)	138	
8. Rendezvous and Docking	M_{RD} = 0.1175 (M_{PY}) + 200 = 302 kg		302
	P_{RD} = 200 W	200	
	Sub Tot	5,219	2,754
9. Contingency and Integration	15% of the above power and mass	783	413
		P_o	M_{PL}
NO. OF PLATFORMS: 15	TOTALS:	6,002	3,167

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 55vC

OTV: 4 STG IUS (2L,2L)

OPER. MODE: C-Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 12 Case: III ($M_{PY} < 3000$)	4,230	993
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 358$ kg	0	1,251
- Secondary	10% of $M_s = 36$ kg		
- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 655$ kg		655
	$P_E = 0.067\ (P_o) + 100 = 490$ W	490	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 272$ kg		272
	$P_A = 0.011\ (M_{PL}) + 30 = 108$ W	108	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2344) = 2812$ kg		2,812
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 28$ W ($M_{PY} < 4400$)	28	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 84$ kg		84
	$P_T = 0.0195\ (M_{PY}) + 40 = 59$ W	59	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 69$ kg		69
	$P_H = 0.0438\ (M_{PY}) + 100 = 143$ W	143	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	5,057	6,136
9. Contingency and Integration	15% of the above power and mass	759	920
		P_o	M_{PL}
NO. OF PLATFORMS: 15	TOTALS:	5,816	7,056

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 35qB

OTV: OTV, Reusable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 13 Case: II (M_{PY} < 2200)	4,900	860
2. Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 391$ kg	0	577
- Secondary	10% of $M_s = 39$ kg		
- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 549$ kg		549
	$P_E = 0.067\ (P_o) + 100 = 541$ W	541	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 126$ kg		126
	$P_A = 0.011\ (M_{PL}) + 30 = 67$ W	67	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (554) = 665$ kg		665
$N_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 27$ W ($M_{PY} < 4400$)	27	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 \doteq 66$ kg		66
	$P_T = 0.0195\ (M_{PY}) + 40 = 57$ W	57	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 55$ kg		55
	$P_H = 0.0438\ (M_{PY}) + 100 = 138$ W	138	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Total	5,729	2,898
9. Contingency and Integration	15% of the above power and mass	859	435
		P_o	M_{PL}
NO. OF PLATFORMS: 14	TOTALS:	6,588	3,333

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 35eC

OTV: OTV, Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 14 Case: II (M_{PY} < 3000)	4,900	1,109
2. Structure Basic	$M_s = 0.31\ (M_{PY}) + 50 = 394$ kg	0	925
- Secondary	10% of $M_s = 39$ kg		
- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 715$ kg		715
	$P_E = 0.067\ (P_o) + 100 = 546$ W	546	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 262$ kg		262
	$P_A = 0.011\ (M_{PL}) + 30 = 104$ W	104	
5. RCS $M_P = 0.232\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2235) - 2682$ kg		2,682
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 29$ W (M_{PY} < 4400)	29	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 62 = 87$ kg		87
	$P_T = 0.0195\ (M_{PY}) + 40 = 62$ W	62	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 71$ kg		71
	$P_H = 0.0438\ (M_{PY}) + 100 = 149$ W	149	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	5,788	5,852
9. Contingency and Integration	15% of the above power and mass	868	878
		P_o	M_{PL}
NO. OF PLATFORMS: 14	TOTALS:	6,657	6,730

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 53cC

OTV: IOTV, L.T. Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 15 Case: II ($M_{PY} < 3000$)	4,700	1,109
2. Structure - Basic	$M_S = 0.31\ (M_{PY}) + 50 = 394$ kg	0	433
- Secondary	10% of $M_S = 39$ kg		
- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 696$ kg		696
	$P_E = 0.067\ (P_o) + 100 = 528$ W	528	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 228$ kg		228
	$P_A = 0.011\ (M_{PL}) + 30 = 91$ W	91	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (1851) = 2221$ kg		2,221
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 29$ W ($M_{PY} < 4400$)	29	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 87$ kg		87
	$P_T = 0.0195\ (M_{PY}) + 40 = 62$ W	62	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 71$ kg		71
	$P_H = 0.0438\ (M_{PY}) + 100 = 149$ W	149	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	5,560	4,845
9. Contingency and Integration	15% of the above power and mass	834	727
		P_o	M_{PL}
	TOTALS:	6,394	5,572

NO. OF PLATFORMS: 13

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 36rC'

OTV: Centaur, Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 16 Case: II ($M_{PY} < 3000$)	4,970	1,225
2.	Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 430$ kg	0	873
	- Secondary	10% of $M_s = 43$ kg		
	- T/W Penalty	T/W = 1.76: Penalty = 400 kg		
3.	EPS	$M_E = 0.0609\ (P_o) + 200 = 625$ kg		625
		$P_E = 0.067\ (P_o) + 100 = 568$ W	568	
4.	ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 210$ kg		210
		$P_A = 0.011\ (M_{PL}) + 30 = 85$ W	85	
5.	RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (823) = 987$ kg		987
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 30$ W ($M_{PY} < 4400$)	30	
6.	TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 91$ kg		91
		$P_T = 0.0195\ (M_{PY}) + 40 = 64$ W	64	
7.	TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 73$ kg		73
		$P_H = 0.0438\ (M_{PY}) + 100 = 154$ W	154	
8.	Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 224$ kg		224
		$P_{RD} = 200$ W	200	
		Sub Tot	6,069	4,309
9.	Contingency and Integration	15% of the above power and mass	910	646
			P_o	M_{PL}
	NO. OF PLATFORMS: 12	TOTALS:	6,980	4,956

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 37pC'

OTV: OTV, Reusable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 17 Case: III (M_{PY} < 3000)	6,200	1,419
2. Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 490$ kg	0	952
- Structure	10% of $M_S = 49$ kg		
- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3. EPS	$M_E = 0.0609 (P_o) + 200 = 720$ kg		720
	$P_E = 0.067 (P_o) + 100 = 672$ W	672	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 227$ kg		227
	$P_A = 0.011 (M_{PL}) + 30 = 91$ W	91	
5. RCS $M_F = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (921) = 1106$ kg		1,106
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 31$ W (M_{PY} < 4400)	31	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 97$ kg		97
	$P_T = 0.0195 (M_{PY}) + 40 = 68$ W	68	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 77$ kg		77
	$P_H = 0.0438 (M_{PY}) + 100 = 162$ W	162	
8. Rendezvous and Docking	$M_{RD} = 0.0193 (M_{PY}) + 200 = 227$ kg		227
	$P_{RD} = 200$ W	200	
	Sub Tot	7,424	4,825
9. Contingency and Integration	15% of the above power and mass	1,114	724
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	8,538	5,548

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 54bC'

OTV: Centaur, L.T. Expendable

OPER. MODE: C' - Non-serviced ? yr life, consumables replenished at 8 y

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 18 Case: II ($M_{PY} < 3000$)	5,925	1,367
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 474$ kg	0	521
- Secondary	10% of $M_s = 47$ kg		
- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 698$ kg		698
	$P_E = 0.067\ (P_o) + 100 = 648$ W	648	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 204$ kg		204
	$P_A = 0.011\ (M_{PL}) + 30 = 82$ W	82	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (790) = 948$ kg		948
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PR}) + 20 = 31$ W ($M_{PY} < 4400$)	31	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 96$ kg		96
	$P_T = 0.0195\ (M_{PY}) + 40 = 67$ W	67	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 76$ kg		76
	$P_H = 0.0438\ (M_{PY}) + 100 = 160$ W	160	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 226$ kg		226
	$P_{RD} = 200$ W	200	
	Sub Tot	7,113	4,136
9. Contingency and Integration	15% of the above power and mass	1,067	620
NO. OF PLATFORMS: 10	TOTALS:	P_o 8,180	M_{PL} 4,756

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 37dC

OTV: OTV, L.T. Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 19 Case: II ($M_{PY} < 3000$)	6,200	1,419
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 490$ kg	0	539
- Secondary	10% of $M_s = 49$ kg		
- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 832$ kg		832
	$P_E = 0.067\ (P_o) + 100 = 657$ W	657	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 266$ kg		266
	$P_A = 0.011\ (M_{PL}) + 30 = 105$ W	105	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2778) = 2733$ kg		2,733
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 31$ W	31	
	($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 97$ kg		97
	$P_T = 0.0195\ (M_{PY}) + 40 = 68$ W	68	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 77$ kg		77
	$P_H = 0.0438\ (M_{PY}) + 100 = 162$ W	162	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	7,223	5,963
9. Contingency and Integration	15% of the above power and mass	1,083	894
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	8,306	6,857

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 380C

OTV: IOTV, Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 20 Case: III (M_{PY} < 3000)	6,000	1,561
2. Structure - Basic	$M_s = 0.31 (M_{PY}) + 50 = 534$ kg	0	1,199
- Secondary	10% of $M_s = 53$ kg		
- T/W Penalty	T/W = 0.61; Penalty = 612 kg		
3. EPS	$M_E = 0.0713 (P_o) + 240 = 817$ kg		817
	$P_E = 0.067 (P_o) + 100 = 642$ W	642	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 319$ kg		319
	$P_A = 0.011 (M_{PL}) + 30 = 125$ W	125	
5. RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (2876) = 3451$ kg		3,451
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 32$ W	32	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 102$ kg		102
	$P_T = 0.0195 (M_{PY}) + 40 = 70$ W	70	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 79$ kg		79
	$P_H = 0.0438 (M_{PY}) + 100 = 168$ W	168	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	7,039	7,527
9. Contingency and Integration	15% of the above power and mass	1,056	1,129
NO. OF PLATFORMS: 9	TOTALS:	P_o 8,094	M_{PL} 8,657

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 38rE

OTV: Centaur, Expendable

OPER. MODE: E - serviced, 16 yr life, 3 year consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 21 Case: II (M_{PY} < 2700)	6,000	1,361
2. Structure - Basic	$M_s = 0.35\,(M_{PY}) + 50 = 526$ kg	0	979
- Secondary	10% of $M_s = 53$ kg		
- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
3. EPS	$M_E = 0.0620\,(P_o) + 210 = 723$ kg		723
	$P_E = 0.067\,(P_o) + 100 = 654$ W	654	
4. ACS	$M_A = 0.0258\,(M_{PL}) + 56 = 178$ kg		178
	$P_A = 0.011\,(M_{PL}) + 30 = 82$ W	82	
5. RCS $M_P = 0.0623\,(M_{PL})$	$M_R = 1.2\,(M_P) = 1.2 \times (295) = 354$ kg		354
$M_R = M_P + 0.2\,M_P$	$P_R = 0.068\,(M_{PY}) + 20 = 31$ W ($M_{PY} < 4400$)	31	
6. TCC	$M_T = 0.0317\,(M_{PY}) + 45 = 88$ kg		88
	$P_T = 0.0195\,(M_{PY}) + 40 = 67$ W	67	
7. TCS	$M_H = 0.0175\,(M_{PY}) + 45 = 69$ kg		69
	$P_H = 0.0438\,(M_{PY}) + 100 = 160$ W ($M_{PY} < 2600$)	160	
8. Rendezvous and Docking	$M_{RD} = 0.1175\,(M_{PY}) + 200 = 360$ kg		360
	$P_{RD} = 200$ W	200	
	Sub Tot	7,193	4,112
9. Contingency and Integration	15% of the above power and mass	1,079	617
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	8,272	4,728

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 37fC'

OTV: IOTV, Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 22 Case: II ($M_{PY} < 3000$)	6,000	1,561
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 534$ kg	0	1,035
- Secondary	10% of $M_s = 53$ kg		
- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 706$ kg		706
	$P_E = 0.067\ (P_o) + 100 = 656$ W	656	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 237$ kg		237
	$P_A = 0.011\ (M_{PL}) + 30 = 95$ W	95	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (979) = 1174$ kg		1,174
$M_R = M_P + 0.2\ M_P$	$P_R = 0.0008\ (M_{PY}) + 20 = 32$ W ($M_{PY} < 4400$)	32	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 102$ kg		102
	$P_T = 0.0195\ (M_{PY}) + 40 = 70$ W	70	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 79$ kg		79
	$P_H = 0.0438\ (M_{PY}) + 100 = 168$ W	168	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 230$ kg		230
	$P_{RD} = 200$ W	200	
	Sub Tot	7,222	5,124
9. Contingency and Integration	15% of the above power and mass	1,083	769
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	8,306	5,893

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 38rB

OTV: Centaur, Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 23 Case: II ($M_{PY} < 2200$)	6,000	1,210
2. Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 529$ kg	0	982
- Secondary	10% of $M_s = 53$ kg		
- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 627$ kg		627
	$P_E = 0.067\ (P_o) + 100 = 637$ W	637	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 156$ kg		156
	$P_A = 0.011\ (M_{PL}) + 30 = 81$ W	81	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P)\ 1.2 \times (771) = 925$ kg		925
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 30$W	30	
	($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 77$ kg		77
	$P_T = 0.0195\ (M_{PY}) + 40 = 64$ W	64	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 61$ kg		61
	$P_H = 0.0438\ (M_{PY}) + 100 = 153$ W	153	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	6,964	4,039
9. Contingency and Integration	15% of the above power and mass	1,045	606
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	8,008	4,645

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 39cC'

OTV: IOTV, L.T. Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 24 Case: II (M_{PY} < 3000)	7,520	1,703
2. Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 578$ kg	0	636
- Secondary	10% of $M_S = 58$ kg		
- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
3. EPS	$M_E = 0.0609 (P_o) + 200 = 822$ kg		822
	$P_E = 0.067 (P_o) + 100 = 784$ W	784	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 231$ kg		231
	$P_A = 0.011 (M_{PL}) + 30 = 93$ W	93	
5. RCS $M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (945) = 1,134$ kg		1,134
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 34$ W (M_{PY} < 4400)	34	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 106$ kg		106
	$P_T = 0.0195 (M_{PY}) + 40 = 73$ W	73	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 82$ kg		82
	$P_H = 0.0438 (M_{PY}) + 100 = 175$ W	175	
8. Rendezvous and Docking	$M_{RD} = 0.0193 (M_{PY}) + 200 = 233$ kg		233
	$P_{RD} = 200$ W	200	
	Sub Tot	8,879	4,947
9. Contingency and Integration	15% of the above power and mass	1,332	742
NO. OF PLATFORMS: 8	TOTALS:	P_o 10,210	M_{PL} 5,689

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 39bE

OTV: Centaur, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 25 Case: II (M_{PY} < 2700)	7,520	1,496
2. Structure - Basic	$M_s = 0.35\ (M_{PY}) + 50 = 574$ kg	0	631
- Secondary	10% of $M_s = 57$ kg		
- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 841$ kg		841
	$P_E = 0.067\ (P_o) + 100 = 782$ W	782	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 176$ kg		176
	$P_A = 0.011\ (M_{PL}) + 30 = 81$ W	81	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (289) = 347$ kg		347
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 32$ W ($M_{PY} < 4400$)	32	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 92$ kg		92
	$P_T = 0.0195\ (M_{PY}) + 40 = 69$ W	69	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 71$ kg		71
	$P_H = 0.0438\ (M_{PY}) + 100 = 166$ W ($M_{PY} < 2600$)	166	
8. Rendezvous and Docking	$M_{RD} = 0.1175\ (M_{PY}) + 200 = 376$ kg		376
	$P_{RD} = 200$ W	200	
	Sub Tot	8,850	4,031
9. Contingency and Integration	15% of the above power and mass	1,327	605
		P_o	M_{PL}
	TOTALS:	10,177	4,635

NO. OF PLATFORMS: 8

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 39pE

OTV: OTV, Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 29 Case: III (M_{PY} < 2700)	7,520	1,496
2. Structure - Basic	$M_s = 0.35\ (M_{PY}) + 50 = 574$ kg	0	1,044
- Secondary	10% of $M_s = 57$ kg		
- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 841$ kg		841
	$P_E = 0.067\ (P_o) + 100 = 782$ W	782	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 190$ kg		190
	$P_A = 0.011\ (M_{PL}) + 30 = 87$ W	87	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (322) = 387$ kg		387
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 32$ W (M_{PY} < 4400)	32	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 92$ kg		92
	$P_T = 0.0195\ (M_{PY}) + 40 = 69$ W	69	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 71$ kg		71
	$P_H = 0.0438\ (M_{PY}) + 100 = 166$ W (M_{PY} < 2600)	166	
8. Rendezvous and Docking	$M_{RD} = 0.1175\ (M_{PY}) + 200 = 376$ kg		376
	$P_{RD} = 200$ W	200	
	Sub Tot	8,856	4,498
9. Contingency and Integration	15% of the above power and mass	1,328	675
		P_o	M_{PL}
NO. OF PLATFORMS: 8	TOTALS:	10,185	5,173

PLATFORM MASS & POWER ESTIMATES

OTV: Centaur, L.T. Expendable

PLATFORM NO. 56bB

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 27 Case: II ($M_{PY} < 2200$)	7,620	1,399
2. Structure - Basic	$M_s = 0.396 (M_{PY}) + 50 = 600$ kg	0	660
- Secondary	10% of $M_s = 60$ kg		
- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
3. EPS	$M_E = 0.055 (P_o) + 187 = 739$ kg		739
	$P_E = 0.067 (P_o) + 100 = 773$ W	773	
4. ACS	$M_A = 0.0228 (M_{PL}) + 50 = 155$ kg		155
	$P_A = 0.011 (M_{PL}) + 30 = 81$ W	81	
5. RCS $M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (766) = 919$ kg		919
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 31$ W	31	
	($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0306 (M_{PY}) + 40 = 83$ kg		83
	$P_T = 0.0195 (M_{PY}) + 40 = 67$ W	67	
7. TCS	$M_H = 0.0175 (M_{PY}) + 40 = 64$ kg		64
	$P_H = 0.0438 (M_{PY}) + 100 = 161$ W	161	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	8,733	4,011
9. Contingency and Integration	15% of the abofe power and mass	1,310	602
		P_o	M_{PL}
NO. OF PLATFORMS: 7	TOTALS:	10,042	4,612

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 56pB

OTV: OTV, Reusable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 28 Case: III (M_{PY} < 2200)	7,620	1,390
2. Structure - Basic	$M_S = 0.396 (M_{PY}) + 50 = 600$ kg	0	1,073
- Secondary	10% of $M_S = 60$ kg		
- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3. EPS	$M_E = 0.055 (P_o) + 187 = 740$ kg		740
	$P_E = 0.067 (P_o) + 100 = 773$ W	773	
4. ACS	$M_A = 0.0228 (M_{PL}) + 50 = 170$ kg		170
	$P_A = 0.011 (M_{PL}) + 30 = 88$ W	88	
5. RCS $M_P = 0.116 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (872) = 1046$ kg		1,046
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 31$ W	31	
	(M_{PY} < 4400)		
6. TCC	$M_T = 0.0306 (M_{PY}) + 40 = 83$ kg		83
	$P_T = 0.0195 (M_{PY}) + 40 = 67$ W	67	
7. TCS	$M_H = 0.0175 (M_{PY}) + 40 = 64$ kg		64
	$P_H = 0.0438 (M_{PY}) + 100 = 161$ W	161	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	8,740	4,566
9. Contingency and Integration	15% of the above power and mass	1,311	685
		P_o	M_{PL}
	TOTALS:	10,051	5,251

NO. OF PLATFORMS: 7

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

PLATFORM NO. 56eC'

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 3 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 29 Case: II (M_{PY} < 3000)	7,620	1,793
2. Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 606$ kg	0	1,158
- Secondary	10% of M_S = 61 kg		
- T/W Penalty	T/W = 064; Penalty = 492 kg		
3. EPS	$M_E = 0.0609 (P_o) + 200 = 831$ kg		831
	$P_E = 0.067 (P_o) + 100 = 794$ W	794	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 260$ kg		260
	$P_A = 0.011 (M_{PL}) + 30 = 103$ W	103	
5. RCS $M_P + 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1107) = 1329$ kg		1,329
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 34$ W (M_{PY} < 4400)	34	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 109$ kg		109
	$P_T = 0.0195 (M_{PY}) + 40 = 75$ W	75	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 83$ kg		83
	$P_H = 0.0438 (M_{PY}) + 100 = 179$ W	179	
8. Rendezvous and Docking	$M_{RD} = 0.0193 (M_{PY}) + 200 = 235$ kg		235
	P_{RD} = 200 W	200	
	Sub Tot	9,095	5,797
9. Contingency and Integration	15% of the above power and mass	1,351	870
NO. OF PLATFORMS: 7	TOTALS:	P_o 10,355	M_{PL} 6,667

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 56vC'

OTV: 4 STG, IUS (2L, 2L)

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 30 Case; III ($M_{PY} < 3000$)	7,620	1,793
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 666$ kg	0	1,523
- Secondary	10% of $M_s = 61$ kg		
- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 831$ kg		831
	$P_E = 0.067\ (P_o) + 100 = 794$ W	794	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 277$ kg		277
	$P_A = 0.011\ (M_{PL}) + 30 = 110$ W	110	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_P = 1.2\ (M_P) = 1.2 \times (1202) = 1442$ kg		1,442
$M_R = M_P = 0.1\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 34$ W ($M_{PY} < 4400$)	34	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 109$ kg		109
	$P_T = 0.0195\ (M_{PY}) + 40 = 75$ W	75	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 83$ kg		83
	$P_H = 0.0438\ (M_{PY}) + 100 = 179$ W	179	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 235$ kg		235
	$P_{RD} = 200$ W	200	
	Sub Tot	9,012	6,293
9. Contingency and Integration	15% of the above power and mass	1,352	944
		P_o	M_{PL}
NO. OF PLATFORMS: 7	TOTALS:	10,364	7,237

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, L.T. Expendable

PLATFORM NO. 56gC

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 31 Case: III ($M_{PY} < 3000$)	7,620	1,793
2. Structure - Basic	$M_S = 0.31\ (M_{PY}) + 50 = 606$ kg	0	666
- Secondary	10% of $M_S = 61$ kg		
- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 962$ kg		962
	$P_E = 0.067\ (P_o) + 100 = 779$ W	779	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 309$ kg		309
	$P_A = 0.011\ (M_{PL}) + 30 = 122$ W	122	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (2766) = 3319$ kg		3,319
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 34$ W ($M_{PY} < 4400$)	34	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 109$ kg		109
	$P_T = 0.0195\ (M_{PY}) + 40 = 75$ W	75	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 83$ kg		83
	$P_H = 0.0438\ (M_{PY}) + 100 = 179$ W	179	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	8,808	7,241
9. Contingency and Integration	15% of the above power and mass	1,321	1,086
		P_o	M_{PL}
NO. OF PLATFORMS: 7	TOTALS:	10,130	8,327

PLATFORM MASS & POWER ESTIMATES **PLATFORM NO.** 40mC

OTV: OTV, Expendable **OPER. MODE:** C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 32 Case: III (M_{PY} < 3000)	8,120	2,270
2. Structure - Basic	$M_S = 0.31\ (M_{PY}) + 50 = 754$ kg	0	1,545
- Secondary	10% of $M_S = 75$ kg		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 1013$ kg		1,013
	$P_E = 0.067\ (P_o) + 100 = 826$ W	826	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 404$ kg		404
	$P_A = 0.011\ (M_{PL}) + 30 = 157$ W	157	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (3841) = 4609$ kg		4,609
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 38$ W (M_{PY} < 4400)	38	
6. TCC	M_T $0.0319\ (M_{PY}) + 52 = 124$ kg		124
	$P_T = 0.0195\ (M_{PY}) + 40 = 84$ W	84	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 62 = 92$ kg		92
	$P_H = 0.0438\ (M_{PY}) + 100 = 199$ W	199	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	9,425	10,057
9. Contingency and Integration	15% of the above power and mass	1,414	1,509
		P_o	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	10,839	11,566

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 40cE

OTV: IOTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, supply yr consumables

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 33 Case: II (M_{PY} < 2700)	8,120	1,980
2. Structure - Basic	$M_s = 0.35 (M_{PY}) + 50 = 743$ kg	0	817
- Secondary	10% of $M_s = 74$ kg		
- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
3. EPS	$M_E = 0.0620 (P_o) + 210 = 891$ kg		891
	$P_E = 0.067 (P_o) + 100 = 836$ W	836	
4. ACS	$M_A = 0.0258 (M_{PL}) + 56 = 203$ kg		203
	$P_A = 0.011 (M_{PL}) + 30 = 92$ W	92	
5. RCS $M_P = 0.0623 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (354) = 425$ kg		425
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC	$M_T = 0.0317 (M_{PY}) + 45 = 108$ kg		108
	$P_T = 0.0195 (M_{PY}) + 40 = 79$ W	79	
7. TCS	$M_H = 0.0175 (M_{PY}) + 45 = 80$ kg		80
	$P_H = 0.0438 (M_{PY}) + 100 = 187$ W ($M_{PY} < 2600$)	187	
8. Rendezvous and Docking	$M_{RD} = 0.1175 (M_{PY}) + 200 = 433$ kg		433
	$P_{RD} = 200$ W	200	
	Sub Tot	9,549	4,935
9. Contingency and Integration	15% of the above power and mass	1,432	740
		P_o	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	10,982	5,676

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 40dC'

OTV: OTV, L.T. Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 34 Case: II ($M_{PY} < 3000$)	8,120	2,103
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 702$ kg	0	772
- Secondary	10% of $M_s = 70$ kg		
- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 870$ kg		870
	$P_E = 0.067\ (P_o) + 100 = 837$ W	837	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 259$ kg		259
	$P_A = 0.011\ (M_{PL}) + 30 = 103$ W	103	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1104) = 1324$ kg		1,324
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 37$ W ($M_{PY} < 4400$)	37	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 119$ kg		119
	$P_T = 0.0195\ (M_{PY}) + 40 = 81$ W	81	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 89$ kg		89
	$P_H = 0.0438\ (M_{PY}) + 100 = 192$ W	192	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 241$ kg		241
	$P_{RD} = 200$ W	200	
	Sub Tot	9,571	5,778
9. Contingency and Integration	15% of the above power and mass	1,436	867
		P_o	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	11,006	6,645

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 40fE

OTV: IOTV, Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 35 Case: II ($M_{PY} < 2700$)	8,120	1,980
2. Structure - Basic	$M_S = 0.35\ (M_{PY}) + 50 = 743$ kg	0	1,265
- Secondary	10% of $M_S = 74$ kg		
- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3. EPS	$M_E = 0.0620\ (P_O) + 210 = 891$ kg		891
	$P_E = 0.067\ (P_O) + 100 = 836$ W	836	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 218$ kg		218
	$P_A = 0.011\ (M_{PL}) + 30 = 99$ W	99	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (390) = 468$ kg		468
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 108$ kg		108
	$P_T = 0.1095\ (M_{PY}) + 40 = 79$ W	79	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 80$ kg		80
	$P_H = 0.0438\ (M_{PY}) + 100 = 187$ W ($M_{PY} < 2600$)	187	
8. Rendezvous and Docking	$M_{RD} = 0.1175\ (M_{PY}) + 200 = 433$ kg		433
	$P_{RD} = 200$ W	200	
	Sub Tot	9,556	5,442
9. Contingency and Integration	15% of the above power and mass	1,433	816
		P_O	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	10,990	6,259

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 40cB

OTV: IOTV, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 36 Case: II ($M_{PY} < 2200$)	8,120	1,630
2. Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 695$ kg	0	765
- Secondary			
- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 775$ kg		775
	$P_E = 0.067\ (P_o) + 100 = 817$ W	817	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 169$ kg		169
	$P_A = 0.011\ (M_{PL}) + 30 = 87$ W	87	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (866) = 1040$ kg		1,040
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 33$ W ($M_{PY} < 4400$)	33	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 90$ kg		90
	$P_T = 0.0195\ (M_{PY}) + 40 = 72$ W	72	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 69$ kg		69
	$P_H = 0.0438\ (M_{PY}) + 100 = 171$ W	171	
8. Rendezvous and Docking	N/A	N/A	N/A
		9,300	4,537
9. Contingency and Integration	15% of the above power and mass	1,395	681
		P_o	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	10,695	5,218

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, Expendable

PLATFORM NO. 40fB

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 37 Case: II (M_{PY} < 2200)	8,120	1,630
2. Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 695$ kg	0	1,213
- Secondary	10% of $M_s = 70$ kg		
- T/W Penalty	T/W = 0.69; Penalty = 488 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 776$ kg		776
	$P_E = 0.067\ (P_o) + 100 = 817$ W	817	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 185$ kg		185
	$P_A = 0.011\ (M_{PL}) + 30 = 95$ W	95	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (981) = 1178$ kg		1,178
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 33$ W (M_{PY} < 4400)	33	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 90$ kg		90
	$P_T = 0.0195\ (M_{PY}) + 40 = 72$ W	72	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 69$ kg		69
	$P_H = 0.0438\ (M_{PY}) + 100 = 171$ W	171	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	9,308	5,139
9. Contingency and Integration	15% of the above power and mass	1,396	771
		P_o	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	10,704	5,910

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 41hC

OTV: OTV, L.T. Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 38 Case: III ($M_{PY} < 3000$)	8,630	2,541
2. Structure - Basic	$M_s = 0.31 (M_{PY}) + 50 = 838$ kg	0	921
- Secondary	10% of $M_s = 84$ kg		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_E = 0.0713 (P_o) + 240 = 1059$ kg		1,059
	$P_E = 0.067 (P_o) + 100 = 870$ W	870	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 385$ kg		385
	$P_A = 0.011 (M_{PL}) + 30 = 150$ W	150	
5. RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (3620) = 4345$ kg	4,345	
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 40$ W	40	
	($M_{PY} < 4400$)		
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 133$ kg		133
	$P_T = 0.0195 (M_{PY}) + 40 = 90$ W	90	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 96$ kg		96
	$P_H = 0.0438 (M_{PY}) + 100 = 211$ W	211	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	9.991	9,480
9. Contingency and Integration	15% of the above power and mass	1,499	1,422
		P_o	M_{PL}
NO. OF PLATFORMS: 5	TOTALS:	11,489	10,902

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 41eE

OTV: OTV, Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 39 Case: II ($M_{PY} < 2700$)	8,630	2,216
2. Structure - Basic	$M_s = 0.35\ (M_{PY}) + 50 = 826$ kg	0	1,400
- Secondary	10% of $M_s = 83$ kg		
- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 917$ kg		917
	$P_E = 0.067\ (P_o) + 100 = 864$ W	864	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 232$ kg		232
	$P_A = 0.011\ (M_{PL}) + 30 = 105$ W	105	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (426) = 511$ kg		511
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 38$ W ($M_{PY} < 4400$)	38	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 115$ kg		115
	$P_T = 0.0195\ (M_{PY}) + 40 = 83$ W	83	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 84$ kg		84
	$P_H = 0.0438\ (M_{PY}) + 100 = 197$ W ($M_{PY} < 2600$)	197	
8. Rendezvous and Docking	$M_{RD} = 0.1175\ (M_{PY}) + 200 = 460$ kg		460
	$P_{RD} = 200$ W	200	
	Sub Tot	9.917	5,935
9. Contingency and Integration	15% of the above power and mass	1,488	890
		P_o	M_{PL}
NO. OF PLATFORMS: 5	TOTALS:	11,405	6,825

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

PLATFORM NO. 41eB

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 40 Case: II ($M_{PY} < 2200$)	8,630	1,970
2. Structure - Basic	$M_s = 0.396 (M_{PY}) + 50 = 830$ kg	0	1,405
- Secondary	10% of $M_s = 83$ kg		
- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3. EPS	$M_E = 0.055 (P_o) + 187 = 813$ kg		813
	$P_E = 0.067 (P_o) + 100 = 863$ W	863	
4. ACS	$M_A = 0.0228 (M_{PL}) + 50 = 205$ kg		205
	$P_A = 0.011 (M_{PL}) + 30 = 105$ W	105	
5. RCS $M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1132) = 1358$ kg		1,358
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC	$M_T = 0.0306 (M_{PY}) + 40 = 100$ kg		100
	$P_T = 0.0195 (M_{PY}) + 40 = 78$ W	78	
7. TCS	$M_H = 0.0175 (M_{PY}) + 40 = 74$ kg		74
	$P_H = 0.0438 (M_{PY}) + 100 = 186$ W	186	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	9,898	5,927
9. Contingency and Integration	15% of the above power and mass	1,485	889
		P_o	M_{PL}
NO. OF PLATFORMS: 5	TOTALS:	11,382	6,816

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, Expendable

PLATFORM NO. 41oC'

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 41 Case: III (M_{PY} < 3000)	8,630	2,541
2. Structure - Basic	$M_s = 0.31\ (M_{PY}) + 50 = 838$ kg	0	1,533
- Secondary	10% of $M_s = 84$ kg		
- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 913$ kg		913
	$P_E = 0.067\ (P_o) + 100 = 884$ W	884	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 318$ kg		318
	$P_A = 0.011\ (M_{PL}) + 30 = 125$ W	125	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1433) = 1720$ kg		1,720
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 40$ W ($M_{PY} < 4400$)	40	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 133$ kg		133
	$P_T = 0.0195\ (M_{PY}) + 40 = 90$ W	90	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 96$ kg		96
	$P_H = 0.0438\ (M_{PY}) + 100 = 211$ W	211	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 249$ kg		249
	$P_{RD} = 200$ W	200	
	Sub Tot	10,180	7,503
9. Contingency and Integration	15% of the above power and mass	1,525	1,126
		P_o	M_{PL}
NO. OF PLATFORMS: 5	TOTALS:	11,707	8,629

PLATFORM NO. 41dE

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumable supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
	Item: 42 Case II ($M_{PY} < 2700$)	8,630	2,216
1. Payload Equipment		0	908
2. Structure - Basic	$M_S = 0.35 (M_{PY}) + 50 = 826$ kg		
- Secondary	10% of $M_S = 83$ kg		
- T/W Penalty	T/W = 0.07; Penalty = 0 kg		932
3. EPS	$M_E = 0.0620 (P_o) + 210 = 932$ kg		
	$P_E = 0.067 (P_o) + 100 = 880$ W	880	
4. ACS	$M_A = 0.0258 (M_{PL}) + 56 = 216$ kg		216
	$P_A = 0.011 (M_{PL}) + 30 = 98$ W	98	
5. RCS $M_P = 0.0623 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (387) = 464$ kg		464
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 38$ W ($M_{PY} < 4400$)	38	
6. TCC	$M_T = 0.0317 (M_{PY}) + 45 = 115$ kg		115
	$P_T = 0.0195 (M_{PY}) + 40 = 83$ W	83	
7. TCS	$M_H = 0.0175 (M_{PY}) + 45 = 84$ kg		84
	$P_H = 0.0438 (M_{PY}) + 100 = 197$ W ($M_{PY} < 2600$)	197	
8. Rendezvous and Docking	$M_{RD} = 0.1176 (M_{PY}) + 200 = 460$ kg		460
	$P_{RD} = 200$ W	200	
	Sub Tot	10,127	5,396
9. Contingency and Integration	15% of the above power and mass	1,519 P_o	809 M_{PL}
	TOTALS:	11,646	6,205

NO. OF PLATFORMS: 5

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 41vE

OTV: 4 STG. IUS (2L, 2L)

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 43 Case: III ($M_{PY} < 2700$)	8,630	2,216
2. Structure - Basic	$M_s = 0.35\ (M_{PY}) + 50 = 826$ kg	0	1,765
- Secondary	10% of $M_s = 83$ kg		
- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 933$ kg		933
	$P_E = 0.067\ (P_o) + 100 = 881$ W	881	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 245$ kg		245
	$P_A = 0.011\ (M_{PL}) + 30 = 111$ W	111	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (456) = 548$ kg		548
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 38$ W ($M_{PY} < 4400$)	38	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 115$ kg		115
	$P_T = 0.0195\ (M_{PY}) + 40 = 83$ W	83	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 84$ kg		84
	$P_H = 0.0438\ (M_{PY}) + 100 = 197$ W ($M_{PY} < 2600$)	197	
8. Rendezvous and Docking	$M_{RD} = 0.1175\ (M_{PY}) + 200 = 460$ kg		460
	$P_{RD} = 200$ W	200	
	Sub Tot	10,140	6,366
9. Contingency and Integration	15% of the above power and mass	1,521	955
		P_o	M_{PL}
NO. OF PLATFORMS: 5	TOTALS:	11,661	7,321

PLATFORM MASS & POWER ESTIMATES **PLATFORM NO.** 41vB

OTV: 4 STG, IUS (2L, 2L) **OPER. MODE:** B - Non-serviced, 8 year life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 44 Case: III ($M_{PY} < 2200$)	8,630	1,970
2.	Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 830$ kg	0	1,770
	- Secondary	10% of $M_s = 83$ kg		
	- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3.	EPS	$M_E = 0.055\ (P_o) + 187 = 813$ kg		813
		$P_E = 0.067\ (P_o) + 100 = 863$ W	863	
4.	ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 218$ kg		218
		$P_A = 0.011\ (M_{PL}) + 30 = 111$ W	111	
5.	RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1225) = 1471$ kg		1,471
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W	36	
6.	TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 100$ kg		100
		$P_T = 0.0195\ (M_{PY}) + 400 = 78$ W	78	
7.	TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 74$ kg		74
		$P_H = 0.0438\ (M_{PY}) + 100 = 186$ W	186	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	9,904	6,417
9.	Contingency and Integration	15% of the above power and mass	1,486	963
			P_o	M_{PL}
	NO. OF PLATFORMS: 5	**TOTALS:**	11,390	7,380

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 41dB

OTV: OTV, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 45 Case: II ($M_{PY} < 2200$)	8,630	2,970
2. Structure - Basic	$M_s = 0.396\ (M_{PY}) + 50 = 830$ kg	0	913
- Secondary	10% of $M_s = 83$ kg		
- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 812$ kg		812
	$P_E = 0.067\ (P_o) + 100 = 862$ W	862	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 188$ kg		188
	$P_A = 0.011\ (M_{PL}) + 30 = 97$ W	97	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1006) = 1207$ kg		1,207
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 100$ kg		100
	$P_T = 0.0195\ (M_{PY}) + 40 = 78$ W	78	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 74$ kg		74
	$P_H = 0.0438\ (M_{PY}) + 100 = 186$ W	186	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	9,889	5,265
9. Contingency and Integration	15% of the above power and mass	1,483	790
		P_o	M_{PL}
NO. OF PLATFORMS: 5	TOTALS:	11,372	6,055

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, L.T. Expendable

PLATFORM NO. 42gC'

OPER. MODE: C' - Non-serviced, 16 yr life, consumables ~~replenished at 8 yrs~~

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 46 Case: III ($M_{PY} < 3000$)	8,630	2,541
2. Structure - Basic	$M_S = 0.31\ (M_{PY}) + 50 = 838$ kg	0	921
- Secondary	10% of $M_S = 84$ kg		
- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 912$ kg		912
	$P_E = 0.067\ (P_o) + 100 = 884$ W	884	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 290$ kg		290
	$P_A = 0.011\ (M_{PL}) + 30 = 114$ W	114	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1274) = 1529$ kg		1,529
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 40$ W ($M_{PY} < 4400$)	40	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 133$ kg		133
	$P_T = 0.0195\ (M_{PY}) + 40 = 90$ W	90	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 96$ kg		96
	$P_H = 0.0438\ (M_{PY}) + 100 = 211$ W	211	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 249$ kg		249
	$P_{RD} = 200$ W	200	
	Sub Tot	10,169	6,672
9. Contingency and Integration	15% of the above power and mass	1,525 P_o	1,001 M_{PL}
	TOTALS:	11,694	7,673

NO. OF PLATFORMS: 5

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

PLATFORM NO. 43nC'

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Playload Equipment	Item: 47 Case: III ($M_{PY} \geq 3000$)	11,000	3,418
2. Structure - Basic	$M_s = 0.225\ (M_{PY}) + 300 = 1069$ kg	0	1,892
- Secondary	10% of $M_s = 107$ kg		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 1100$ kg		1,100
	$P_E = 0.067\ (P_o) + 100 = 1090$ W	1,090	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 386$ kg		386
	$P_A = 0.011\ (M_{PL}) + 30 = 150$ W	150	
5. RCS $M_P = 0.166\ (M_{PL})$ $M_R = M_P + 0.2\ M_P$	$M_R = 1.2\ (M_P) = 1.2 \times (1817) = 2181$ kg		2,181
	$P_R = 0.008\ (M_{PY}) + 20 = 47$ W ($M_{PY} < 4400$)	47	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 161$ kg		161
	$P_T = 0.0195\ (M_{PY}) + 40 = 107$ W	107	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 112$ kg		112
	$P_H = 0.0438\ (M_{PY}) + 100 = 250$ W	250	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 266$ kg		266
	$P_{RD} = 200$ W	200	
	Sub Tot	12,844	9,515
9. Contingency and Integration	15% of the above power and mass	1,927	1,427
NO. OF PLATFORMS: 4	TOTALS:	P_o 14,771	M_{PL} 10,942

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 430E

OTV: IOTV, Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 48 Case: III ($M_{PY} \geq 2700$)	11,000	2,981
2. Structure - Basic	$M_S = 0.259\ (M_{PY}) + 300 = 1072$ kg	0	1,791
- Secondary	10% of $M_S = 107$ kg		
- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1122$ kg		1,122
	$P_E = 0.067\ (P_o) + 100 = 1085$ W	1,085	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 281$ kg		281
	$P_A = 0.011\ (M_{PL}) + 30 = 126$ W	126	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (544) = 652$ kg		652
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 44$ W ($M_{PY} < 4400$)	44	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 139$ kg		139
	$P_T = 0.0195\ (M_{PY}) + 40 = 98$ W	98	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 97$ kg		97
	$P_H = 0.0438\ (M_{PY}) + 100 = 231$ W ($M_{PY} \geq 2600$)	231	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 516$ kg		516
	$P_{RD} = 200$ W	200	
	Sub Tot	12,784	7,580
9. Contingency and Integration	15% of the above power and mass	1,918	1,137
		P_o	M_{PL}
NO. OF PLATFORMS: 4	TOTALS:	14,702	8,717

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 43oB

OTV: IOTV, Expendable — OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 49 Case: III ($M_{PY} \geq 2200$)	11,000	2,650
2. Structure - Basic	$M_s = 0.29 (M_{PY}) + 300 = 1069$ kg	0	1,787
- Secondary	10% of $M_s = 107$ kg		
- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3. EPS	$M_E = 0.055 (P_o) + 187 = 980$ kg		980
	$P_E = 0.067 (P_o) + 100 = 1066$ W	1,066	
4. ACS	$M_A = 0.0228 (M_{PL}) + 50 = 250$ kg		250
	$P_A = 0.011 (M_{PL}) + 30 = 126$ W	126	
5. RCS $M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1455) = 1746$ kg		1,746
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 41$ W ($M_{PY} < 4400$)	41	
6. TCC	$M_T = 0.0306 (M_{PY}) + 40 = 121$ kg		121
	$P_T = 0.0195 (M_{PY}) + 40 = 92$ W	92	
7. TCS	$M_H = 0.0175 (M_{PY}) + 40 = 86$ kg		86
	$P_H = 0.0438 (M_{PY}) + 100 = 216$ W	216	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	12,542	7,621
9. Contingency and Integration	15% of the above power and mass	1,881	1,143
		P_o	M_{PL}
NO. OF PLATFORMS: 4	TOTALS:	14,423	8,764

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 431C

OTV: 2 STG. OTV, Reusable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 50 Case: III ($M_{PY} \geq 3000$)	11,000	3,418
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 1069$ kg	0	1,956
- Secondary	10% of $M_S = 107$ kg		
- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 1280$ kg		1,280
	$P_E = 0.067\ (P_o) + 100 = 1077$ W	1,077	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 529$ kg		529
	$P_A = 0.011\ (M_{PL}) + 30 = 204$ W	204	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (5256) = 6307$ kg		6,307
$M_R = M_P = 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 47$ W ($M_{PY} < 4400$)	47	
6. TCC	$M_T = 0.0319\ (M_{PY}) + 52 = 161$ kg		161
	$P_T = 0.0195\ (M_{PY}) + 40 = 107$ W	107	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 112$ kg		112
	$P_H = 0.0438\ (M_{PY}) + 100 = 250$ W	250	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	12,686	13,764
9. Contingency and Integration	15% of the above power and mass	1,903	2,065
		P_o	M_{PL}
NO. OF PLATFORMS: 4	TOTALS:	14,588	15,829

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 43hC'

OTV: OTV, L.T. Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 51 Case: III ($M_{PY} \geq 3000$)	11,000	3,418
2. Structure - Basic	$M_s = 0.225\ (M_{PY}) + 300 = 1069$ kg	0	1,176
- Secondary	10% of $M_s = 107$ kg		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 1083$ kg		1,083
	$P_E = 0.067\ (P_o) + 100 = 1072$ W	1,072	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 352$ kg		352
	$P_A = 0.011\ (M_{PL}) + 30 = 138$ W	138	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_p) = 1.2 \times (1627) = 1952$ kg		1,952
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 47$ W ($M_{PY} \geq 4400$)	47	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 161$ kg		161
	$P_T = 0.0195\ (M_{PY}) + 40 = 107$ W	107	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 112$ kg		112
	$P_H = 0.0438\ (M_{PY}) + 100 = 250$ W	250	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 266$ kg		260
	$P_{RD} = 200$ W	200	
	Sub Tot	12,614	8,521
9. Contingency and Integration	15% of the above power and mass	1,892	1,278
		P_o	M_{PL}
NO. OF PLATFORMS: 4	TOTALS:	14,506	9,799

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 43gE

OTV: IOTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 52 Case: III ($M_{PY} \geq 2700$)	11,000	2,981
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1072$ kg	0	1,179
- Secondary	10% of $M_s = 107$ kg		
- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1121$ kg		1,121
	$P_E = 0.067\ (P_o) + 100 = 1084$ W	1,084	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 260$ kg		260
	$P_A = 0.011\ (M_{PL}) + 30 = 117$ W	117	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (493) = 592$ kg		592
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 44$ W ($M_{PY} < 4400$)	44	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 139$ kg		139
	$P_T = 0.0195\ (M_{PY}) + 40 = 98$ W	98	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 97$ kg		97
	$P_H = 0.0438\ (M_{PY}) + 100 = 231$ W ($M_{PY} \geq 2600$)	231	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 516$ kg		516
	$P_{RD} = 200$ W	200	
	Sub Tot	12,774	6,886
9. Contingency and Integration	15% of the above power and mass	1,916	1,033
NO. OF PLATFORMS: 4	TOTALS:	P_o 14,691	M_{PL} 7,919

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, L.T. Expendable

PLATFORM NO. 43gB

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 53 Case: III ($M_{PY} \geq 2200$)	11,000	2,650
2. Structure - Basic	$M_s = 0.29\ (M_{PY}) + 300 = 1069$ kg	0	1,175
- Secon ary	10% of $M_s = 107$ kg		
- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 980$ kg		980
	$P_E = 0.067\ (P_o) + 100 = 1065$ W	1,065	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 228$ kg		228
	$P_A = 0.011\ (M_{PL}) + 30 = 116$ W	116	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1298) = 1558$ kg		1,558
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 41$ W ($M_{PY} < 4400$)	41	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 121$ kg		121
	$P_T = 0.0195\ (M_{PY}) + 40 = 92$ W		
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 86$ kg		86
	$P_H = 0.0438\ (M_{PY}) + 100 = 216$ W	216	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	12,530	6,798
9. Contingency and Integration	15% of the above power and mass	1,880	1,020
NO. OF PLATFORMS: 4	TOTALS:	P_o 14,410	M_{PL} 7,817

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 43jC

OTV: 2 STG. OTV, L.T. Reusable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 54 Case: III ($M_{PY} \geq 3000$)	11,000	3,418
2. Structure - Basic	$M_s = 0.225 (M_{PY}) + 300 = 1069$ kg	0	1,176
- Secondary	10% of $M_s = 107$ kg		
- T/W Penalty	T/W = 0.03; Penalty = 0 kg		
3. EPS	$M_E = 0.0713 (P_o) + 240 = 1278$ kg		1,278
	$P_E = 0.067 (P_o) + 100 = 1076$ W	1,076	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 477$ kg		477
	$P_A = 0.011 (M_{PL}) + 30 = 185$ W	185	
5. RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (4669) = 5603$ kg		5,603
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 26 = 47$ W ($M_{PY} < 4400$)	47	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 161$ kg		161
	$P_T = 0.0195 (M_{PY}) + 40 = 107$ W	107	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 112$ kg		112
	$P_H = 0.0438 (M_{PY}) + 100 = 250$ W	250	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	12,664	12,226
9. Contingency and Integration	15% of the above power and mass	1,900	1,834
		P_o	M_{PL}
NO. OF PLATFORMS: 4	TOTALS:	14,564	14,059

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 44hB

OTV: OTV, Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 55 Case: III ($M_{PY} \geq 2200$)	15,500	3,480
2. Structure - Basic	$M_S = 0.29\ (M_{PY}) + 300 = 1309$ kg	0	2,156
- Secondary	10% of M_S = 131 kg		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_E = 0.055\ (P_O) + 187 = 1295$ kg		1,295
	$P_E = 0.067\ (P_O) + 100 = 1449$ W	1,449	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 305$ kg		305
	$P_A = 0.011\ (M_{PL}) + 30 = 153$ W	153	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (1854) = 2224$ kg		2,224
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 48$ W ($M_{PY} < 4400$)	48	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 146$ kg		146
	$P_T = 0.0195\ (M_{PY}) + 40 = 108$ W	108	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 101$ kg		101
	$P_H = 0.0438\ (M_{PY}) + 100 = 252$ W	252	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	17,510	9,707
9. Contingency and Integration	15% of the above power and mass	2,626	1,456
NO. OF PLATFORMS: 3	TOTALS:	20,136	11,163

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 44hE

OTV: OTV, Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 56 Case: III ($M_{PY} \geq 2700$)	15,500	3,915
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1314$ kg	0	2,161
- Secondary	10% of $M_s = 131$ kg		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1476$ kg		1,476
	$P_E = 0.067\ (P_o) + 100 = 1468$ W	1,468	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 339$ kg		339
	$P_A = 0.011\ (M_{PL}) + 30 = 151$ W	151	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (684) = 821$ kg		821
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 51$ W ($M_{PY} < 4400$)	51	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 169$ kg		169
	$P_T = 0.0195\ (M_{PY}) + 40 = 116$ W	116	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 114$ kg		114
	$P_H = 0.0438\ (M_{PY}) + 100 = 271$ W ($M_{PY} \geq 2600$)	271	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 552$ kg		552
	$P_{RD} = 200$ W	200	
	Sub Tot	17,758	9,547
9. Contingency and Integration	15% of the above power and mass	2,664	1,432
		P_o	M_{PL}
NO. OF PLATFORMS: 3	TOTALS:	20,422	10,980

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 44hB

OTV: OTV, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 57 Case: III ($M_{PY} \geq 2200$)	15,500	3,480
2. Structure - Basic	$M_S = 0.29\ (M_{PY}) + 300 = 1309$ kg	0	1,440
- Secondary	10% of $M_S = 131$ kg		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 1294$ kg		1,294
	$P_E = 0.067\ (P_o) + 100 = 1448$ W	1,448	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 279$ kg		279
	$P_A = 0.011\ (M_{PL}) + 30 = 141$ W	141	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1670) = 2004$ kg		2,004
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 48$ W ($M_{PY} < 4400$)	48	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 146$ kg		146
	$P_T = 0.0195\ (M_{PY}) + 40 = 108$W	108	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 101$ kg		101
	$P_H = 0.0438\ (M_{PY}) + 100 = 252$ W	252	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	17,497	8,744
9. Contingency and Integration	15% of the above power and mass	2,625	1,312
		P_o	M_{PL}
NO. OF PLATFORMS: 3	TOTALS:	20,121	10,056

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 44hE

OTV: OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 58 Case: III ($M_{PY} \geq 2700$)	15,500	3,915
2. Structure - Basic	$M_S = 0.259 (M_{PY}) + 300 = 1314$ kg	0	1,445
- Secondary	10% of $M_S = 131$ kg		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_E = 0.0620 (P_O) + 210 = 1475$ kg		1,475
	$P_E = 0.067 (P_O) + 100 = 1467$ W	1,467	
4. ACS	$M_A = 0.0258 (M_{PL}) + 56 = 315$ kg		315
	$P_A = 0.011 (M_{PL}) + 30 = 141$ W	141	
5. RCS $M_P = 0.0623 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (626) = 751$ kg		751
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 51$ W ($M_{PY} < 4400$)	51	
6. TCC	$M_T = 0.0317 (M_{PY}) + 45 = 169$ kg		169
	$P_T = 0.0195 (M_{PY}) + 40 = 116$ W	116	
7. TCS	$M_H = 0.0175 (M_{PY}) + 45 = 114$ kg		114
	$P_H = 0.0438 (M_{PY}) + 100 = 271$ W ($M_{PY} \geq 2600$)	271	
8. Rendezvous and Docking	$M_{RD} = 0.0388 (M_{PY}) + 400 = 552$ kg		552
	$P_{RD} = 200$ W	200	
	Sub Tot	17,747	8,737
9. Contingency and Integration	15% of the above power and mass	2,662	1,311
		P_O	M_{PL}
NO. OF PLATFORMS: 3	TOTALS:	20,409	10,047

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 47jC'

OTV: 2 STG. OTV, L.T. Reusable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
	Item: 59 Case: III ($M_{PY} \geq 3000$)	20,050	6,321
1. Payload Equipment		0	1,894
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 1722$ kg		
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.035; Penalty = 0 kg		1,807
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 1807$ kg		
	$P_E = 0.067\ (P_o) + 100 = 1868$ W	1,868	560
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 560$ kg		
	$P_A = 0.011\ (M_{PL}) + 30 = 216$ W	216	3,361
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2801) = 3361$ kg		
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 71$ W ($M_{PY} \geq 4400$)	71	243
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 243$ kg		
	$P_T = 0.0195\ (M_{PY}) + 40 = 163$ W	163	163
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 163$ kg		
	$P_H = 0.0438\ (M_{PY}) + 100 = 377$ W	377	322
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 322$ kg		
	$P_{RD} = 200$ W	200	
	Sub Tot	22,944	14,671
9. Contingency and Integration	15% of the above power and mass	3,442	2,201
		P_o	M_{PL}
	TOTALS:	26,386	16,872

NO. OF PLATFORMS: 2

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 471C'

OTV: 2 STG. OTV, Reusable — OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 60 Case: III ($M_{PY} \geq 3000$)	20,050	6,321
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 1722$ kg	0	2,674
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 1808$ kg		1,808
	$P_E = 0.067\ (P_o) + 100 = 1869$ W	1,869	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 596$ kg		596
	$P_A = 0.011\ (M_{PL}) + 30 = 229$ W	229	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (3003) = 3604$ kg		3,604
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 71$ W ($M_{PY} \geq 4400$)	71	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 243$ kg		243
	$P_T = 0.0195\ (M_{PY}) + 40 = 163$ W	163	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 163$ kg		163
	$P_H = 0.0438\ (M_{PY}) + 100 = 377$ W	377	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 322$ kg		322
	$P_{RD} = 200$ W	200	
	Sub Tot	22,959	15,730
9. Contingency and Integration	15% of the above power and mass	3,444	2,360
		P_o	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	26,403	18,090

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 45kC

OTV: 2 STG. OTV, L.T. Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 61 Case: III ($M_{PY} \geq 3000$)	15,500	4,489
2. Structure - Basic	$M_w = 0.225\ (M_{PY}) + 300 = 1310$ kg	0	1,441
- Secondary	10% of $M_s = 131$ kg		
- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 1689$ kg		1,689
	$P_E = 0.067\ (P_o) + 100 = 1462$ W	1,462	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 597$ kg		597
	$P_A = 0.011\ (M_{PL}) + 30 = 229$ W	229	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (6022) = 7227$ kg		7,227
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 56$ W ($M_{PY} \geq 4400$)	56	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 195$ kg		195
	$P_T = 0.0195\ (M_{PY}) + 40 = 128$ W	128	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 131$ kg		131
	$P_H = 0.0438\ (M_{PY}) + 100 = 297$ W	297	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	17,671	15,769
9. Contingency and Integration	15% of the above power and mass	2,651	2,365
		P_o	M_{PL}
NO. OF PLATFORMS: 3	TOTALS:	20,322	18,134

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 46mC

OTV: 2 STG. OTV Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 62 Case: III ($M_{PY} \geq 3000$)	20,050	6,321
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 1722$ kg	0	1,894
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 2111$ kg		2,111
	$P_E = 0.067\ (P_o) + 100 = 1858$ W	1,858	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 783$ kg		783
	$P_A = 0.011\ (M_{PL}) + 30 = 299$ W	299	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (8116) = 9739$ kg		9,739
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 71$ W ($M_{PY} \geq 4400$)	71	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 243$ kg		243
	$P_T = 0.0195\ (M_{PY}) + 40 = 163$ W	163	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 163$ kg		163
	$P_H = 0.0438\ (M_{PY}) + 100 = 377$ W	377	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	22,818	21,254
9. Contingency and Integration	15% of the above power and mass	3,423	3,188
		P_o	M_{PL}
	TOTALS:	26,241	24,442

NO. OF PLATFORMS: 2

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 47jB

OTV: 2 STG. CTV, L.T. Reusable

OPER. MODE: B - Non-serviced, 8 yr life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 63 Case: III ($M_{PY} \geq 2200$)	20,050	4,900
2. Structure - Basic	$M_S = 0.29\ (M_{PY}) + 300 = 1721$ kg	0	1,893
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.03; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 1615$ kg		1,615
	$P_E = 0.067\ (P_o) + 100 = 1840$ W	1,840	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 359$ kg		359
	$P_A = 0.011\ (M_{PL}) + 30 = 179$ W	179	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2249) = 2699$ kg		2,699
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 59$ W ($M_{PY} \geq 4400$)	59	
6. TCC	$M_T = 0.026\ (M_{PY}) + 60 = 187$ kg		187
	$P_T = 0.0195\ (M_{PY}) + 40 = 136$ W	136	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 126$ kg		126
	$P_H = 0.0438\ (M_{PY}) + 100 = 315$ W	315	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	22,578	11,778
9. Contingency and Integration	15% of the above power and mass	3,387	1,767
		P_o	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	25,964	13,545

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG. OTV, L.T. Reusable

PLATFORM NO. 47jE

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 64 Case: III ($M_{PY} \geq 2700$)	20,050	5,512
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1728$ kg	0	1,900
- Secondary	10% of $M_s = 173$ kg		
- T/W Penalty	$T/W = 0.03$; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1838$ kg		
	$P_E = 0.067\ (P_o) + 100 = 1860$ W		1,838
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 401$ kg	1,860	
	$P_A = 0.011\ (M_{PL}) + 30 = 177$ W		401
5. RCS $M_P = 0.0623\ (M_{PL})$; $M_R = M_P + 0.2\ M_P$	$M_R = 1.2\ (M_P) = 1.2 \times (833) = 999$ kg	177	
6. TCC	$P_R = 0.008\ (M_{PY}) + 20 = 64$ W ($M_{PY} \geq 4400$)		999
	$M_T = 0.0262\ (M_{PY}) + 68 = 212$ kg	64	
7. TCS	$P_T = 0.0195\ (M_{PY}) + 40 = 147$ W		212
	$M_H = 0.0175\ (M_{PY}) + 45 = 141$ kg	147	
8. Rendezvous and Docking	$P_H = 0.0438\ (M_{PY}) + 100 = 341$ W ($M_{PY} \geq 2600$)		141
	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 614$ kg	341	
	$P_{RD} = 200$ W		614
		200	
	Sub Tot	22,840	11,618
9. Contingency and Integration	15% of the above power and mass	3,426	1,743
		P_o	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	26,266	13,361

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG. OTV, Reusable

PLATFORM NO. 471B

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 65 Case: III ($M_{PY} \geq 2200$)	20,050	4,900
. Structure - Basic	$M_s = 0.9\ (M_{PY}) + 300 - 1721$ kg	0	2,673
- Secondary	10% of M_s = 172 kg		
- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 1616$ kg		1,616
	$P_E = 0.067\ (P_o) + 100 = 1841$ W	1,841	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 386$ kg		386
	$P_A = 0.011\ (M_{PL}) + 30 = 192$ W	192	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) + 1.2 \times (2449) = 2939$ kg		2,939
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 59$ W ($M_{PY} \geq 4400$)	59	
6. TCC	$M_T = 0.026\ (M_{PY}) + 60 = 187$ kg		187
	$P_T = 0.0195\ (M_{PY}) + 40 = 136$ W	136	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 126$ kg		126
	$P_H = 0.0438\ (M_{PY}) + 100 = 315$ W	315	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	22,592	12,827
9. Contingency and Integraiton	15% of the above power and mass	3,389	1,924
		P_o	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	25,981	14,751

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 471E

OTV: 2 STG. OTV, Reusable

OPER. MODE: E-serviced, 16 yr life, ~~3 yr consumables supply~~

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 66 Case: III ($M_{PY} \geq 2700$)	20,050	5,512
2.	Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1728$ kg	0	2,680
	- Secondary	10% of $M_s = 173$ kg		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3.	EPS	$M_E = 0.0620\ (P_o) + 210 = 1839$ kg		1,839
		$P_E = 0.067\ (P_o) + 100 = 1861$ W	1,861	
4.	ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 427$ kg		427
		$P_A = 0.011\ (M_{PL}) + 30 = 188$ W	188	
5.	RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (896) = 1075$ kg		1,075
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 64$ W ($M_{PY} \geq 4400$)	64	
6.	TCC	$M_T = 0.0262\ (M_{PY}) + 68 = 212$ kg		212
		$P_T = 0.0195\ (M_{PY}) + 40 = 147$ W	147	
7.	TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 141$ kg		141
		$P_H = 0.0438\ (M_{PY}) + 100 = 341$ W ($M_{PY} \geq 2600$)	341	
8.	Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 614$ kg		614
		$P_{RD} = 200$ W	200	
		Sub Tot	22,852	12,501
9.	Contingency and Integration	15% of the above power and mass	3,428	1,875
			P_o	M_{PL}
	NO. OF PLATFORMS: 2	TOTALS:	26,280	14,377

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 48kC'

OTV: 2 STG OTV, L.T. Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 67 Case: III ($M_{PY} \geq 3000$)	20,050	6,321
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 1722$ kg	0	1,894
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.92; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_O) + 200 = 1807$ kg		1,807
	$P_E = 0.067\ (P_O) + 100 = 1868$ W	1,868	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 560$ kg		560
	$P_A = 0.011\ (M_{PL}) + 30 = 216$ W	216	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2801) = 3361$ kg		3,361
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 71$ W ($M_{PY} \geq 4400$)	71	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 243$ kg		243
	$P_T = 0.0195\ (M_{PY}) + 40 = 163$ W	163	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 163$ kg		163
	$P_H = 0.0438\ (M_{PY}) + 100 = 377$ W	377	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 322$ kg		322
	$P_{RD} = 209$ W	200	
	Sub Tot	22,944	14,672
9. Contingency and Integration	15% of the above power and mass	3,442	2,201
		P_O	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	26,386	16,872

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 48mC'

OTV: 2 STG. OTV, Expendable — OPER. MODE: C' - Non-serviced, 16 yr life, consumables ~~replenished at 8 yrs~~

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 68 Case: III ($M_{PY} \geq 3000$)	20,050	6,321
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 1722$ kg	0	1,894
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_O) + 200 = 1807$ kg		1,807
	$P_E = 0.067\ (P_O) + 100 = 1868$ W	1,868	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 560$ kg		560
	$P_A = 0.011\ (M_{PL}) + 30 = 216$ W	216	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2801) = 3361$ kg		3,361
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 71$ W ($M_{PY} \geq 4400$)	71	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 243$ kg		243
	$P_T = 0.0195\ (M_{PY}) + 40 = 163$ W	163	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 163$ kg		163
	$P_H = 0.0438\ (M_{PY}) + 100 = 377$ W	377	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 322$ kg		322
	$P_{RD} = 200$ W	200	
	Sub Total	22,944	14,672
9. Contingency and Integration	15% of the above power and mass	3,442	2,201
		P_O	M_O
NO. OF PLATFORMS: 2	TOTALS:	26,386	16,872

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 49kB

OTV: 2 STG. OTV, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 yr life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 69 Case: III ($M_{PY} \geq 2200$)	20,050	4,900
2. Structure - Basic	$M_S = 0.29 (M_{PY}) + 300 = 1721$ kg	0	1,893
- Secondary	10% of $M_S = 172$ kg		
- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
3. EPS	$M_E = 0.055 (P_o) + 187 = 1615$ kg		1,615
	$P_E = 0.067 (P_o) + 100 = 1840$ W	1,840	
4. ACS	$M_A = 0.0228 (M_{PL}) + 50 = 359$ kg		359
	$P_A = 0.011 (M_{PL}) + 30 = 179$ W	179	
5. RCS $M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (2249) = 2699$ kg		2,699
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 59$ W ($M_{PY} \geq 4400$)	59	
6. TCC	$M_T = 0.026 (M_{PY}) + 60 = 187$ kg		187
	$P_T = 0.0195 (M_{PY}) + 40 = 136$ W	136	
7. TCS	$M_H = 0.0175 (M_{PY}) + 40 = 126$ kg		126
	$P_H = 0.0438 (M_{PY}) + 100 = 315$ W	315	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	22,578	11,778
9. Contingency and Integration	15% of the above power and mass	3,387	1,767
		P_o	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	25,964	13,545

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 49kE

OTV: 2 STG. OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 70 Case: III ($M_{PY} \geq 2700$)	20,050	5,512
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1728$ kg	0	1,900
- Secondary	10% of $M_s = 173$ kg		
- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1838$ kg		1,838
	$P_E = 0.067\ (P_o) + 100 = 1860$ W	1,860	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 401$ kg		401
	P_A 0.011 $(M_{PL}) + 30 = 177$ W	177	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (833) = 999$ kg		999
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 64$ W ($M_{PY} \geq 440$[illegible])	64	
6. TCC	$M_T = 0.0262\ (M_{PY}) + 68 = 212$ kg		212
	$P_T = 0.0195\ (M_{PY}) + 40 = 147$ W	147	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 141$ kg		141
	$P_H = 0.0438\ (M_{PY}) + 100 = 341$ W ($M_{PY} \geq 2600$)	341	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 614$ kg		614
	$P_{RD} = 200$ W	200	
	Sub Tot	22,840	11,618
9. Contingency and Integration	15% of the above power and mass	3,426	1,743
		P_o	M_{PL}
NO. OF PLATFORMS: 2	TOTALS:	26,266	13,361

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 50mB

OTV: 2 STG. OTV, Expendable — OPER. MODE: B - Non-serviced, 8 year life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 71 Case: II ($M_{PY} \geq 2200$)	37,780	9,250
2.	Structure - Basic	$M_s = 0.29 (M_{PY}) + 300 = 2983$ kg	0	3,281
	- Secondary	10% of $M_s = 298$ kg		
	- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3.	EPS	$M_E = 0.055 (P_o) + 187 = 2860$ kg		2,860
		$P_E = 0.067 (P_o) + 100 = 3356$ W	3,356	
4.	ACS	$M_A = 0.0228 (M_{PL}) + 50 = 611$ kg		611
		$P_A = 0.011 (M_{PL}) + 30 = 301$ W	301	
5.	RCS $M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (4088) = 4905$ kg		4,905
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 94$ W ($M_{PY} \geq 4400$)	94	
6.	TCC	$M_T = 0.026 (M_{PY}) + 60 = 301$ kg		301
		$P_T = 0.0195 (M_{PY}) + 40 = 220$ W	220	
7.	TCS	$M_H = 0.0175 (M_{PY}) + 40 = 202$ kg		202
		$P_H = 0.0438 (M_{PY}) + 100 = 505$ W	505	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	42,257	21,409
9.	Contingency and Integration	15% of the above power and mass	6,339	3,211
			P_o	M_{PL}
	NO. OF PLATFORMS: 1	TOTALS:	48,595	24,621

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG. OTV, Expendable

PLATFORM NO. 50mE

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 72 Case: III ($M_{PY} \geq 2700$)	37,780	10,406
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 2995$ kg	0	3,295
- Secondary	10% of $M_s = 300$ kg		
- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 3244$ kg		3,244
	$P_E = 0.067\ (P_o) + 100 = 3379$ W	3,379	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 673$ kg		673
	$P_A = 0.011\ (M_{PL}) + 30 = 293$ W	293	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1489) = 1787$ kg		1,787
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 103$ W ($M_{PY} \geq 4400$)	103	
6. TCC	$M_T\ 0.0262\ (M_{PY}) + 68 = 341$ kg		341
	$P_T = 0.0195\ (M_{PY}) + 40 = 243$ W	243	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 227$ kg		227
	$P_H = 0.0438\ (M_{PY}) + 100 = 556$ W ($M_{PY} \geq 2600$)	556	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 804$ kg		804
	$P_{RD} = 200$ W	200	
	Sub Tot	42,554	20,776
9. Contingency and Integration	15% of the above power and mass	6,383	3,116
NO. OF PLATFORMS: 1	TOTALS:	P_o 48,937	M_{PL} 23,893

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 606C'

OTV: Centaur, L. T. Expendable

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 73 Case: II ($M_{PY} < 3000$)	6,000	1,367
2. Structure - Basic		$M_S = 0.31 (M_{PY}) + 50 = 474$ kg	0	521
- Secondary		10% of $M_S = 47$ kg		
- T/W Penalty		T/W = 0.19; Penalty = 0 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 704$ kg		704
		$P_E = 0.067 (P_o) + 100 = 654$ W	654	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 204$ kg		204
		$P_A = 0.011 (M_{PL}) + 30 = 82$ W	82	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (791) = 949$ kg		949
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 31$ W ($M_{PY} < 4400$)	31	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 96$ kg		96
		$P_T = 0.0195 (M_{PY}) + 40 = 67$ W	67	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 76$ kg		76
		$P_H = 0.0438 (M_{PY}) + 100 = 160$ W	160	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 226$ kg		226
		$P_{RD} = 200$ W	200	
		Sub Tot:	7,194	4,143
9. Contingency & Integration		15% of the above power and mass	1,079	621
			P_o	M_{PL}
NO. OF PLATFORMS: 34		TOTALS:	8,273	4,765

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 61dC

OTV: OTV, L. T. Expendable

OPER. MODE: C – Non-serviced, 16 year lift

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 74 Case: II (M_{PY} < 3000)	6,000	1,419
2. Structure -- Basic		M_S = 0.31 (M_{PY}) + 50 = 490 kg	0	539
– Secondary		10% of M_S = 49 kg		
– T/W Penalty		T/W = 0.07; Penalty = 0 kg		
3. EPS		M_E = 0.713 (P_o) + 240 = 814 kg		814
		P_E = 0.067 (P_o) + 100 = 640 W	640	
4. ACS		M_A = 0.0294 (M_{PL}) + 64 = 264 kg		264
		P_A = 0.011 (M_{PL}) + 30 = 105 W	105	
5. RCS	M_P = 0.332 (M_{PL})	M_R = 1.2 (M_P) = 1.2 × (2223) = 2715 kg		2,715
	M_R = M_P + 0.2 M_P	P_R = 0.008 (M_{PY}) + 20 = 31 W (M_{PY} < 4400)	31	
6. TCC		M_T = 0.0319 (M_{PY}) + 52 = 97 kg		97
		P_T = 0.0195 (M_{PY}) + 40 = 68 W	68	
7. TCS		M_H = 0.0175 (M_{PY}) + 52 = 77 kg		77
		P_H = 0.0438 (M_{PY}) + 100 = 162W	162	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	7,006	5,926
9. Contingency & Integration		15% of the above power and mass	1,051	889
			P_o	M_{PL}
NO. OF PLATFORMS: 33		TOTALS:	8,057	6,815

C-4

PLATFORM MASS & POWER ESTIMATES — C' – Non-serviced, **PLATFORM NO.** 62cC'

OTV: L. T. Expendable — OPER. MODE: 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 75 Case: II ($M_{PY} < 3000$)	6,690	1,703
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 578$ kg	0	636
– Secondary		10% of $M_S = 58$ kg		
– T/W Penalty		T/W = 0.08; Penalty = 0 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 759$ kg		759
		$P_E = 0.067 (P_o) + 100 = 715$ W	715	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 228$ kg		228
		$P_A = 0.011 (M_{PL}) + 30 = 91$ W	91	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (928) = 1114$ kg		1,114
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 34$ W ($M_{PY} < 4400$)	34	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 106$ kg		106
		$P_T = 0.0195 (M_{PY}) + 40 = 73$ W	73	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 82$ kg		82
		$P_H = 0.0438 (M_{PY}) + 100 = 175$ W	175	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 233$ kg		233
		$P_{RD} = 200$ W	200	
		Sub Tot:	7,977	4,861
9. Contingency & Integration		15% of the above power and mass	1,197	729
			P_o	M_{PL}
NO. OF PLATFORMS: 26		TOTALS:	9,174	5,590

PLATFORM MASS & POWER ESTIMATES

C' – Non-serviced, PLATFORM NO. 63dC'

OTV: OTV, L. T. Expendable

OPER. MODE: 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 76 Case: II (M_{PY} < 3000)	8,500	2,051
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 686$ kg	0	754
– Secondary		10% of $M_S = 69$ kg		
– T/W Penalty		T/W 0.07; Penalty = 0 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 899$ kg		899
		$P_E = 0.067\ (P_o) + 100 = 869$ W	869	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 257$ kg		257
		$P_A = 0.011\ (M_{PL}) + 30 = 102$ W	102	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1092) = 1310$ kg		1,310
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 117$ kg		117
		$P_T = 0.0195\ (M_{PY}) + 40 = 80$ W	80	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 88$ kg		88
		$P_H = 0.0438\ (M_{PY}) + 100 = 190$ W	190	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 240$ kg		240
		$P_{RD} = 200$ W	200	
		Sub Tot:	9,977	5,716
9. Contingency & Integration		15% of the above power and mass	1,497	857
			P_o	M_{PL}
NO. OF PLATFORMS: 20		TOTALS:	11,474	6,574

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, L. T. Expendable

C' – Non-serviced, PLATFORM NO. 64gC'

OPER. MODE: 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 77 Case: III (M_{PY} <3000)	13,400	2,890
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 946$ kg	0	1,040
– Secondary		10% of $M_S = 95$ kg		
– T/W Penalty		T/W = 0.06; Penalty = 0 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 1277$ kg		1,277
		$P_E = 0.057 (P_o) \div 100 = 1285$ W	1,285	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 329$ kg		329
		$P_A = 0.011 (M_{PL}) + 30 = 129$ W	129	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1496) = 1796$ kg		1,796
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 43$ W ($M_{PY} < 4400$)	43	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 144$ kg		144
		$P_T = 0.0195 (M_{PY}) + 40 = 96$ W	96	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 103$ kg		103
		$P_H = 0.0438 (M_{PY}) + 100 = 227$ W	227	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 256$ kg		256
		$P_{RD} = 200$ W	200	
		Sub Tot:	15,380	7,835
9. Contingency & Integration		15% of the above power and mass	2,307	1,175
			P_o	M_{PL}
NO. OF PLATFORMS: 14		TOTALS:	17,687	9,010

PLATFORM MASS & POWER ESTIMATES PLATFORM NO. 651C

OTV: 2 STG, OTV, Reusable OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 78 Case: III (M_{PY} ± 3000)	16,600	3,413
2. Structure – Basic		$M_S = 0.225\ (M_{PY}) + 300 = 1069$ kg	0	1,956
– Secondary		10% of $M_S = 107$ kg		
– T/W Penalty		T/W = 0.31; Penalty = 780 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 1779$ kg		1,779
		$P_E = 0.067\ (P_o) + 100 = 1546$ W	1,546	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 562$ kg		562
		$P_A = 0.011\ (M_{PL}) + 30 = 217$ W	217	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (5629) = 6755$ kg		6,755
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 47$ W	47	
		($M_{PY} < 4400$)		
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 161$ kg		161
		$P_T = 0.0195\ (M_{PY}) + 40 = 107$ W	107	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 112$ kg		112
		$P_H = 0.0438\ (M_{PY}) + 100 = 250$ W	250	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	18,766	14,743
9. Contingency & Integration		15% of the above power and mass	2,815	2,212
			P_o	M_{PL}
NO. OF PLATFORMS: 12		TOTALS:	21,581	16,955

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG OTV, Reusable

C' – Non-serviced, PLATFORM NO. 661C'

OPER. MODE: 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 79 Case: III ($M_{PY} \geq 3000$)	25,000	5,031
2. Structure – Basic		$M_S = 0.225\ (M_{PY}) + 300 = 1432$ kg	0	2,355
– Secondary		10% of $M_S = 143$ kg		
– T/W Penalty		T/W = 0.31; Penalty = 780 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 2175$ kg		2,175
		$P_E = 0.067\ (P_o) + 100 = 2273$ W	2,273	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 535$ kg		535
		$P_A = 0.011\ (M_{PL}) + 30 = 206$ W	206	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2661) = 3199$ kg		3,199
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 60$ W ($M_{PY} \geq 4400$)	60	
6. TCC		$M_T = 0.0263\ (M_{PY}) + 77 = 209$ kg		209
		$P_T = 0.0195\ (M_{PY}) + 40 = 138$ W	138	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 140$ kg		140
		$P_H = 0.0438\ (M_{PY}) + 100 = 320$ W	320	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 297$ kg		297
		$P_{RD} = 200$ W	200	
		Sub Tot:	28,198	13,936
9. Contingency & Integration		15% of the above power and mass	4,230	2,090
			P_o	M_{PL}
NO. OF PLATFORMS: 7		TOTALS:	32,428	16,025

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 67mC

OTV: 2 STG OTV, Expendable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 80 Case: III ($M_{PY} \geq 3000$)	29,200	6,102
2. Structure – Basic		$M_S = 0.225\ (M_{PY}) + 300 = 1673$ kg	0	1,840
– Secondary		10% of $M_S = 167$ kg		
– T/W Penalty		T/W = 0.22; Penalty = 0 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 2940$ kg		2,940
		$P_E = 0.067\ (P_o) + 100 = 2637$ W	2,637	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 819$ kg		819
		$P_A = 0.011\ (M_{PL}) + 30 = 312$ W	312	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (8525) = 10,230$ kg		10,230
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 69$ W ($M_{PY} \geq 4400$)	69	
6. TCC		$M_T = 0.0263\ (M_{PY}) + 77 = 237$ kg		237
		$P_T = 0.0195\ (M_{PY}) + 40 = 159$ W	159	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 159$ kg		159
		$P_H = 0.0438\ (M_{PY}) + 100 = 367$ W	367	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	32,924	22,327
9. Contingency & Integration		15% of the above power and mass	4,939	3,349
NO. OF PLATFORMS: 6		TOTALS:	P_o 37,863	M_{PL} 25,676

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 681B

OTV: 2 STG OTV Reusable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 81 Case: III ($M_{PY} \geq 2200$)	31,700	5,350
2. Structure – Basic		$M_S = 0.29\ (M_{PY}) + 300 = 1852$ kg	0	2,817
– Secondary		10% of $M_S = 185$ kg		
– T/W Penalty		T/W = 0.31; Penalty = 780 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 2418$ kg		2,413
		$P_E = 0.067\ (P_o) + 100 = 2818$ W	2,818	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 436$ kg		436
		$P_A = 0.011\ (M_{PL}) + 30 = 216$ W	216	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2811) = 3374$ kg		3,374
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 63$ W	63	
		($M_{PY} \geq 4400$)		
6. TCC		$M_T = 0.026\ (M_{PY}) + 60 = 199$ kg		199
		$P_T = 0.0195\ (M_{PY}) + 40 = 144$ W	144	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 134$ kg		134
		$P_H = 0.0438\ (M_{PY}) + 100 = 334$ W	334	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	35,275	14,727
9. Contingency & Integration		15% of the above power and mass	5,291	2,209
			P_O	M_{PL}
NO. OF PLATFORMS: 6		TOTALS:	40,567	16,936

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG OTV, Expendable

PLATFORM NO. 69mC'

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 82 Case: III ($M_{PY} \geq 3000$)	46,080	9,469
2. Structure – Basic		$M_S = 0.225\ (M_{PY}) + 300 = 2431$ kg		2,674
– Secondary		10% of $M_S = 243$ kg		
– T/W Penalty		T/W = 0.22; Penalty = 0 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 3807$ kg		3,807
		$P_E = 0.067\ (P_o) + 100 = 4068$ W	4,068	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 841$ kg		841
		$P_A = 0.011\ (M_{PL}) + 30 = 321$ W	321	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (4388) = 5266$ kg		5,266
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 96$ W ($M_{PY} \geq 4400$)	96	
6. TCC		$M_T = 0.0263\ (M_{PY}) + 77 = 326$ kg		326
		$P_T = 0.0195\ (M_{PY}) + 40 = 225$ W	225	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 218$ kg		218
		$P_H = 0.0438\ (M_{PY}) + 100 = 515$ W	515	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 383$ kg		383
		$P_{RD} = 200$ W	200	
		Sub Tot:	51,504	22,983
9. Contingency & Integration		15% of the above power and mass	7,726	3,447
			P_o	M_{PL}
NO. OF PLATFORMS: 4		TOTALS:	59,230	26,430

PLATFORM MASS & POWER ESTIMATES **PLATFORM NO.** 70mB

OTV: 2 STG, OTV, Expendable **OPER. MODE:** B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 83 Case: III ($M_{PY} \geq 2200$)	57,280	9,240
2. Structure	– Basic	$M_S = 0.29\ (M_{PY}) + 300 = 2980$ kg	0	3,278
	– Secondary	10% of $M_S = 298$ kg		
	– T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 4198$ kg		4,198
		$P_E = 0.067\ (P_o) + 100 = 4986$ W	4,986	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 658$ kg		658
		$P_A = 0.011\ (M_{PL}) + 30 = 323$ W	323	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P)\ 1.2 \times (4427) = 5312$ kg		5,312
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 94$ W	94	
		($M_{PY} \geq 4400$)		
6. TCC		$M_T = 0.026\ (M_{PY}) + 60 = 300$ kg		300
		$P_T = 0.0195\ (M_{PY}) + 40 = 220$ W	220	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 202$ kg		202
		$P_H = 0.0438\ (M_{PY}) + 100 = 505$ W	505	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	63,408	23,188
9. Contingency & Integration		15% of the above power and mass	9,511	3,478
			P_o	M_{PL}
NO. OF PLATFORMS: 3		TOTALS:	72,919	26,666

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 70mE

OTV: 2 STG OTV, Expendable

OPER. MODE: E-Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 84 Case: III ($M_{PY} \geq 2700$)	57,280	10,395
2. Structure – Basic		$M_S = 0.259 (M_{PY}) + 300 = 2992$ kg	0	3,292
– Secondary		10% of $M_S = 299$ kg		
– T/W Penalty		T/W = 0.22; Penalty = 0 kg		
3. EPS		$M_E = 0.0620 (P_o) + 210 = 4752$ kg		4,752
		$P_E = 0.067 (P_o) + 100 = 5008$ W	5,008	
4. ACS		$M_A = 0.0258 (M_{PL}) + 56 = 722$ kg		722
		$P_A = 0.011 (M_{PL}) + 30 = 314$ W	314	
5. RCS	$M_P = 0.0623 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1609) = 1931$ kg		1,931
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 103$ W ($M_{PY} \geq 4400$)	103	
6. TCC		$M_T = 0.0262 (M_{PY}) + 68 = 340$ kg		340
		$P_T = 0.0195 (M_{PY}) + 40 = 243$ W	243	
7. TCS		$M_H = 0.0175 (M_{PY}) + 45 = 227$ kg		227
		$P_H = 0.0438 (M_{PY}) + 100 = 555$ W ($M_{PY} \geq 2600$)	555	
8. Rendezvous & Docking		$M_{RD} = 0.0388 (M_{PY}) + 400 = 803$ kg		803
		$P_{RD} = 200$ W	200	
		Sub Tot:	63,704	22,463
9. Contingency & Integration		15% of the above power and mass	9,556	3,369
NO. OF PLATFORMS: 3		TOTALS:	P_o 73,259	M_{PL} 25,832

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 72aC

OTV: OTV, L. T. Reusable — OPER. MODE: C - Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item. 85 Case: II ($M_{PY} < 3000$)	1,800	320
2. Structure - Basic		$M_S = 0.31\ (M_{PY}) + 50 = 149$ kg	0	164
- Secondary		10% of $M_S = 15$ kg		
- T/W Penalty		T/W = 0.13; Penalty = 0 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 430$ kg		430
		$P_E = 0.067\ (P_o) + 100 = 279$ W	279	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 137$ kg		137
		$P_A = 0.011\ (M_{PL}) + 30 = 57$ W	57	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (826) = 991$ kg		991
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 23$ W ($M_{PY} < 4400$)	23	
6. TCC		$M_T = 0.039\ (M_{PY}) + 52 = 62$ kg		62
		$P_T = 0.0195\ (M_{PY}) + 40 = 46$ W	46	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 58$ kg		58
		$P_H = 0.0438\ (M_{PY}) + 100 = 114$ W	114	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	2,319	2,163
9. Contingency & Integration		15% of the above power and mass	348	324
			P_o	M_{PL}
NO. OF PLATFORMS: 225		TOTALS:	2,667	2,487

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 73qC

OTV: OTV, Reusable

OPER. MODE: C– Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 86 ase II (M_{PY} < 3000)	2,420	439
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 186$ kg	0	352
– Secondary		10% of $M_S = 19$ kg		
– T/W Penalty		T/W = 1.08; Penalty = 147 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 487$ kg		487
		$P_E = 0.067\ (P_o) + 100 = 332$ W	332	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 162$ kg		162
		$P_A = 0.011\ (M_{PL}) + 30 = 67$ W	67	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1103) = 1324$ kg		1,324
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 24$ W ($M_{PY} < 4400$)	24	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 66$ kg		66
		$P_T = 0.0195\ (M_{PY}) + 40 = 49$ W	49	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 60$ kg		60
		$P_H = 0.0438\ (M_{PY}) + 100 = 119$ W	119	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	3,009	3,888
9. Contingency & Integration		15% of the above power and mass	451	433
			P_o	M_{PL}
		TOTALS:	3,461	3,321

NO. OF PLATFORMS: 163

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 74aC'

OTV: OTV, L. T. Reusable

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 87 Case: II ($M_{PY} < 3000$)	4,110	530
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 214$ kg	0	236
– Secondary		10% of $M_S = 21$ kg		
– T/W Penalty		T/W = 0.13; Penalty = 0 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 554$ kg		554
		$P_E = 0.067 (P_o) + 100 = 490$ W	490	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 143$ kg		143
		$P_A = 0.011 (M_{PL}) + 30 = 60$ W	60	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (447) = 536$ kg		536
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 24$ W ($M_{PY} < 4400$)	24	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 69$ kg		69
		$P_T = 0.0195 (M_{PY}) + 40 = 50$ W	50	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 61$ kg		61
		$P_H = 0.0438 (M_{PY}) + 100 = 123$ W	123	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 210$ kg		210
		$P_{RD} = 200$ W	200	
		Sub Tot:	5,057	2,340
9. Contingency & Integration		15% of the above power and mass	759	351
			P_o	M_{PL}
NO. OF PLATFORMS: 145		TOTALS:	5,816	2,690

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 75rC

OTV: Centaur, Expendable

OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 88 Case: II ($M_{PY} < 3000$)	3,865	645
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) = 50 = 250$ kg		675
– Secondary		10% of $M_S = 25$ kg		
– T/W Penalty		T/W = 1.76; Penalty = 400 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 618$ kg		618
		$P_E = 0.067\ (P_o) + 100 = 455$ W	455	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 206$ kg		206
		$P_A = 0.011\ (M_{PL}) + 30 = 83$ W	83	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1608) = 1929$ kg		1,929
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 25$ W ($M_{PY} < 4400$)	25	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 73$ kg		73
		$P_T = 0.0195\ (M_{PY}) + 40 = 53$ W	53	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 63$ kg		63
		$P_H = 0.0438\ (M_{PY}) + 100 = 128$ W	128	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	4,609	4,210
9. Contingency & Integration		15% of the above power and mass	691	631
			P_o	M_{PL}
NO. OF PLATFORMS: 121		TOTALS:	5,301	4,841

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 76aE

OTV: OTV, L. T. Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 89 Case: II ($M_{PY} < 2700$)	3,970	653
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 729$ kg	0	801
– Secondary		10% of $M_S = 73$ kg		
– T/W Penalty		T/W = 0.13; Penalty = 0 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 561$ kg		561
		$P_E = 0.067\ (P_o) + 100 = 479$ W	479	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 139$ kg		139
		$P_A = 0.011\ (M_{PL}) + 30 = 65$ W	65	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (200) = 240$ kg		240
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 25$ W ($M_{PY} < 4400$)	25	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 66$ kg		66
		$P_T = 0.0195\ (M_{PY}) + 40 = 53$ W	53	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 56$ kg		56
		$P_H = 0.0438\ (M_{PY}) + 100 = 129$ W ($M_{PY} < 2600$)	129	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 277$ kg		277
		$P_{RD} = 200$ W	200	
		Sub Tot:	4,922	2,793
9. Contingency & Integration		15% of the above power and mass	738	419
			P_o	M_{PL}
NO. OF PLATFORMS: 95		TOTALS:	5,660	3,212

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 77pC

OTV: OTV, Reusable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 90 Case: III (M_{PY} < 3000)	4,040	762
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 286$ kg	0	728
– Secondary		10% of M_S = 29 kg		
– T/W Penalty		$T/W = 0.0713\ (P_o) + 240 = 413$ kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 635$ kg		635
		$P_E = 0.067\ (P_o) + 100 = 471$ W	471	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 219$ kg		219
		$P_A = 0.011\ (M_{PL}) + 30 = 88$ W	88	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1752) = 2102$ kg		2,102
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 26$ W (M_{PY} < 4400)	26	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 76$ kg		76
		$P_T = 0.0195\ (M_{PY}) + 40 = 55$ W	55	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 65$ kg		65
		$P_H = 0.0438\ (M_{PY}) + 100 = 133$ W	133	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	4,813	4,587
9. Contingency & Integration		15% of the above power and mass	722	688
			P_o	M_{PL}
NO. OF PLATFORMS: 90		TOTALS:	5,535	5,275

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 78qC'

OTV: OTV, Reusable

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 91 Case: II (M_{PY} < 3000)	4,150	793
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 296$ kg	0	472
– Secondary		10% of $M_S = 30$ kg		
– T/W Penalty		T/W = 1.08; Penalty = 147 kg		
3. EPS		$M_E = 0.0609\ (P_O) + 200 = 563$ kg		563
		$P_E = 0.067\ (P_O) + 100 = 500$ W	500	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 167$ kg		167
		$P_A = 0.011\ (M_{PL}) + 30 = 69$ W	69	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (583) = 700$ kg		700
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 26$ W (M_{PY} < 4400)	26	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 77$ kg		77
		$P_T = 0.0195\ (M_{PY}) + 40 = 55$ W	55	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 66$ kg		66
		$P_H = 0.0438\ (M_{PY}) + 100 = 135$ W	135	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 215$ kg		215
		$P_{RD} = 200$ W	200	
		Sub Tot:	5,185	3,054
9. Contingency & Integration		15% of the above power and mass	778	458
			P_O	M_{PL}
NO. OF PLATFORMS: 87		TOTALS:	5,963	3,512

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 79aB

OTV: OTV, L. T. Reusable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 92 Case: II ($M_{PY} < 2200$)	4,200	690
2. Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 323$ kg	0	356
– Secondary		10% of $M_S = 32$ kg		
– T/W Penalty		T/W = 0.13; Penalty = 0 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 500$ kg		500
		$P_E = 0.067\ (P_o) + 100 = 481$ W	481	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 110$ kg		110
		$P_A = 0.011\ (M_{PL}) + 30 = 59$ W	59	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (438) = 526$ kg		526
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 26$ W	26	
		($M_{PY} < 4400$)		
6. TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 61$ kg		61
		$P_T = 0.0195\ (M_{PY}) + 40 = 53$ W	53	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 52$ kg		52
		$P_H = 0.0438\ (M_{PY}) + 100 = 130$ W	130	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	4,949	2,295
9. Contingency & Integration		15% of the above power and mass	742	344
NO. OF PLATFORMS: 79		TOTALS:	P_o 5,692	M_{PL} 2,639

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 80bC

OTV: Centaur, L. T. Expendable — OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 93 Case: II ($M_{PY} < 3000$)	4,250	942
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 342$ kg	0	376
– Secondary		10% of $M_S = 34$ kg		
– T/W Penalty		T/W = 0.19; Penalty = 0 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 654$ kg		654
		$P_E = 0.067\ (P_o) + 100 = 489$ W	489	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 210$ kg		210
		$P_A = 0.011\ (M_{PL}) + 30 = 84$ W	84	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1645) = 1974$ kg		1,974
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 28$ W ($M_{PY} < 4400$)	28	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 82$ kg		82
		$P_T = 0.0195\ (M_{PY}) + 40 = 58$ W	58	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 68$ kg		68
		$P_H = 0.0438\ (M_{PY}) + 100 = 141$ W	141	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	5,051	4,306
9. Contingency & Integration		15% of the above power and mass	758	646
			P_o	M_{PL}
NO. OF PLATFORMS: 70		TOTALS:	5,808	4,952

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 80fC

OTV: IOTV, Expendable

OPER. MODE: C -- Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 94 Case: II ($M_{PY} < 3000$)	4,250	942
2. Structure – Basic	$M_S = 0.31 (M_{PY}) + 50 = 342$ kg	0	824
– Secondary	10% of $M_S = 34$ kg		
– T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3. EPS	$M_E = 0.0713 (P_o) + 240 = 672$ kg		672
	$P_E = 0.067 (P_o) + 100 = 506$ W	506	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 241$ kg		241
	$P_A = 0.011 (M_{PL}) + 30 = 96$ W	96	
5. RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1995) = 2394$ kg		2,394
$M_R = M_p + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 28$ W ($M_{PY} < 4400$)	28	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 82$ kg		82
	$P_T = 0.0195 (M_{PY}) + 40 = 58$ W	58	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 68$ kg		68
	$P_H = 0.0438 (M_{PY}) + 100 = 141$ W	141	
8. Rendezvous & Docking	N/A	N/A	N/A
	Sub Tot:	5,274	5,224
9. Contingency & Integration	15% of the above power and mass	791	784
		P_o	M_{PL}
NO. OF PLATFORMS: 70	TOTALS:	6,066	6,608

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Reusable

PLATFORM NO. 81qE

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		ITEM: 95 Case: II ($M_{PY} < 2700$)	4,285	878
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 807$ kg	0	1,035
– Secondary		10% of $M_S = 81$ kg		
– T/W Penalty		T/W = 1.08; Penalty = 147 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 587$ kg		587
		$P_E = 0.067\ (P_o) + 100 = 507$ W	507	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 156$ kg		156
		$P_A = 0.011\ (M_{PL}) + 30 = 73$ W	73	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (242) = 291$ kg		291
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 27$ W ($M_{PY} < 4400$)	27	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 73$ kg		73
		$P_T = 0.0195\ (M_{PY}) + 40 = 57$ W	57	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 60$ kg		60
		$P_H = 0.0438\ (M_{PY}) + 100 = 138$ W ($M_{PY} < 2600$)	138	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 303$ kg		303
		$P_{RD} = 200$ W	200	
		Sub Tot:	5,288	3,383
9. Contingency & Integration		15% of the above power and mass	793	508
			P_o	M_{PL}
NO. OF PLATFORMS: 62		TOTALS:	6,082	3,891

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 82vC

OTV: 4 STG IUS (2L, 2L)

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 96 Case: III ($M_{PY} < 3000$)	4,330	1,017
2. Structure – Basic		$M_S = 0.31\,(M_{PY}) + 50 = 365$ kg	0	1,259
– Secondary		10% of $M_S = 37$ kg		
– T/W Penalty		T/W = 1.93; Penalty = 857 kg		
3. EPS		$M_E = 0.0713\,(P_o) + 240 = 664$ kg		664
		$P_E = 0.067\,(P_o) + 100 = 498$ W	498	
4. ACS		$M_A = 0.0294\,(M_{PL}) + 64 = 274$ kg		274
		$P_A = 0.011\,(M_{PL}) + 30 = 109$ W	109	
5. RCS	$M_P = 0.332\,(M_{PL})$	$M_R = 1.2\,(M_P) = 1.2 \times (2374) = 2849$ kg		2,849
	$M_R = M_P + 0.2\,M_P$	$P_R = 0.008\,(M_{PY}) + 20 = 28$ W ($M_{PY} < 4400$)	28	
6. TCC		$M_T = 0.0319\,(M_{PY}) + 52 = 84$ kg		84
		$P_T = 0.0195\,(M_{PY}) + 40 = 60$ W	60	
7. TCS		$M_H = 0.0175\,(M_{PY}) + 52 = 70$ kg		70
		$P_H = 0.0438\,(M_{PY}) + 100 = 145$ W	145	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	5,170	6,217
9. Contingency & Integration		15% of the above power and mass	776	933
			P_o	M_{PL}
NO. OF PLATFORMS: 58		TOTALS:	5,946	7,150

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 83qB

OTV: OTV, Reusable — OPER. MODE: B – Non-serviced, 8 year life replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 97 Case: II (M_{PY} < 2200)	4,700	860
2. Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 391$ kg	0	577
– Secondary		10% of $M_S = 39$ kg		
– T/W Penalty		T/W = 1.08; Penalty = 147 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 536$ kg		536
		$P_E = 0.067\ (P_o) + 100 = 525$ W	525	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 126$ kg		126
		$P_A = 0.011\ (M_{PL}) + 30 = 66$ W	0	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (550) = 660$ kg		660
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 27$ W (M_{PY} < 4400)	27	
6. TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 66$ kg		66
		$P_T = 0.0195\ (M_{PY}) + 40 = 57$ W	57	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 55$ kg		55
		$P_H = 0.0438\ (M_{PY}) + 100 = 138$ W	138	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	5,512	2,879
9. Contingency & Integration		15% of the above power and mass	827	432
			P_o	M_{PL}
NO. OF PLATFORMS: 52		TOTALS:	6,339	3,311

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 84eC

OTV: OTV, Expendable

OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 98 Case: II ($M_{PY} < 3000$)	4,740	1,120
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 397$ kg	0	929
– Secondary		10% of $M_S = 40$ kg		
– T/W Penalty		T/W = 0.64; Penalty = 492 kg		
3. EPS		$M_E = 0.0713 (P_o) + 240 = 701$ kg		701
		$P_E = 0.067 (P_o) + 100 = 533$ W	533	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 262$ kg		262
		$P_A = 0.011 (M_{PL}) + 30 = 104$ W	104	
5. RCS	$M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (2235) = 2682$ kg		2,682
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 29$ W ($M_{PY} < 4400$)	29	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 88$ kg		88
		$P_T = 0.0195 (M_{PY}) + 40 = 62$ W	62	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 72$ kg		72
		$P_H = 0.0438 (M_{PY}) + 100 = 149$ W	149	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	5,617	5,852
9. Contingency & Integration		15% of the above power and mass	843	878
NO. OF PLATFORMS: 51		TOTALS:	P_o 6,459	M_{PL} 6,730

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 85cC

OTV: IOTV, L. T. Expendable

OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 99 Case: II ($M_{PY} < 3000$)	4,780	1,130
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 400$ kg	0	440
– Secondary		10% of $M_S = 40$ kg		
– T/W Penalty		T/W = 0.08; Penalty = 0 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 703$ kg		703
		$P_E = 0.067\ (P_o) + 100 = 535$ W	535	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 230$ kg		230
		$P_A = 0.011\ (M_{PL}) + 30 = 92$ W	92	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1878) = 2254$ kg		2,254
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 29$ W ($M_{PY} < 4400$)	29	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 88$ kg		88
		$P_T = 0.0195\ (M_{PY}) + 40 = 62$ W	62	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 72$ kg		72
		$P_H = 0.0438\ (M_{PY}) + 100 = 149$ W	149	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	5,648	4,917
9. Contingency & Integration		15% of the above power and mass	847	738
NO. OF PLATFORMS: 50		TOTALS:	P_C 6,496	M_{PL} 5,655

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 36rC'

OTV: Centaur, Expendable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 100 Case: II ($M_{PY} < 3000$)	4,960	1,161
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 410$ kg	0	851
– Secondary		10% of $M_S = 41$ kg		
– T/W Penalty		T/W = 1.76; Penalty = 400 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 624$ kg		624
		$P_E = 0.067\ (P_o) + 100 = 566$ W	556	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 206$ kg		206
		$P_A = 0.011\ (M_{PL}) + 30 = 83$ W	83	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (799) = 959$ kg		959
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 29$ W ($M_{PY} < 4400$)	29	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 89$ kg		89
		$P_T = 0.0195\ (M_{PY}) + 40 = 63$ W	63	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 72$ kg		72
		$P_H = 0.0438\ (M_{PY}) + 100 = 151$ W	151	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 222$ kg		222
		$P_{RD} = 200$ W	200	
		Sub Tot:	6,052	4,184
9. Contingency & Integration		15% of the above power and mass	908	628
			P_o	M_{PL}
NO. OF PLATFORMS: 47		TOTALS:	6,960	4,812

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Reusable

PLATFORM NO. 61pC'

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 101 Case: III (M_{PY} < 3000)	6,950	1,419
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 490$ kg	0	952
– Secondary		10% of $M_S = 49$ kg		
– T/W Penalty		T/W = 0.78; Penalty = 413 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 777$ kg		777
		$P_E = 0.067 (P_o) + 100 = 735$ W	735	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 230$ kg		230
		$P_A = 0.011 (M_{PL}) + 30 = 92$ W	92	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (936) = 1123$ kg		1,123
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 31$ W (M_{PY} < 4400)	31	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 97$ kg		97
		$P_T = 0.0195 (M_{PY}) + 40 = 68$ W	68	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 77$ kg		77
		$P_H = 0.0438 (M_{PY}) + 100 = 162$ W	162	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 227$ kg		227
		P_{RD} = 200W	200	
		Sub Tot:	8,238	4,902
9. Contingency & Integration		15% of the above power and mass	1,236	735
NO. OF PLATFORMS: 33		TOTALS:	P_o 9,473	M_{PL} 5,637

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 87oC

OTV: IOTV, Expendable

OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 102 Case: III ($M_{PY} < 3000$)	6,400	1,561
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 534$ kg	0	1,199
– Secondary		10% of $M_S = 53$ kg		
– T/W Penalty		T/W = 0.51; Penalty = 612 kg		
3. EPS		$M_E = 0.0713 (P_o) + 240 = 853$ kg		853
		$P_E = 0.067 (P_o) + 100 = 676$ W	676	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 321$ kg		321
		$P_A = 0.011 (M_{PL}) + 30 = 126$ W	126	
5. RCS	$M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (2900) = 3480$ kg		3,480
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 32$ W ($M_{PY} < 4400$)	32	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 102$ kg		102
		$P_T = 0.0195 (M_{PY}) + 40 = 70$ W	70	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 79$ kg		79
		$P_H = 0.0438 (M_{PY}) + 100 = 168$ W	168	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	7,473	7,594
9. Contingency & Integration		15% of the above power and mass	1,121	1,139
			P_o	M_{PL}
NO. OF PLATFORMS: 30		TOTALS:	8,594	8,734

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 87rE

OTV: Centaur, Expendable

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 103 Case II ($M_{PY} < 2700$)	6,400	1,361
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 976$ kg	0	1,474
– Secondary		10% of $M_S = 98$ kg		
– T/W Penalty		T/W = 1.76; Penalty = 400 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 754$ kg		754
		$P_E = 0.067\ (P_o) + 100 = 688$ W	688	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 196$ kg		196
		$P_A = 0.011\ (M_{PL}) + 30 = 90$ W	90	
5. RCS	$M_P \doteq 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (337) = 405$ kg		405
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 31$ W ($M_{PY} < 4400$)	31	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 88$ kg		88
		$P_T = 0.0195\ (M_{PY}) + 40 = 67$ W	67	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 69$ kg		69
		$P_H = 0.0438\ (M_{PY}) + 100 = 160$ W ($M_{PY} < 2600$)	160	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 360$ kg		360
		$P_{RD} = 200$ W	200	
		Sub Tot:	7,635	4,707
9. Contingency & Integration		15% of the above power and mass	1,145	706
NO. OF PLATFORMS: 30		TOTALS:	P_o 8,780	M_{PL} 5,413

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 88fC'

OTV: IOTV, Expendable

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 104 Case: II ($M_{PY} < 3000$)	6,470	1,600
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 546$ kg	0	1,049
– Secondary		10% of $M_S = 55$ kg		
– T/W Penalty		T/W = 0.69; Penalty = 448 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 742$ kg		742
		$P_E = 0.067 (P_o) + 100 = 696$ W	696	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 241$ kg		241
		$P_A = 0.011 (M_{PL}) + 30 = 96$ W	96	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1002) = 1203$ kg		1,203
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 33$ W ($M_{PY} < 4400$)	33	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 103$ kg		103
		$P_T = 0.0195 (M_{PY}) + 40 = 71$ W	71	
7. TCC		$M_H = 0.0175 (M_{PY}) + 52 = 80$ kg		80
		$P_H = 0.0438 (M_{PY}) + 100 = 170$ W	170	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 231$ kg		231
		$P_{RD} = 200$ W	200	
		Sub Tot:	7,736	5,249
9. Contingency & Integration		15% of the above power and mass	1,160	787
			P_o	M_{PL}
NO. OF PLATFORMS: 29		TOTALS:	8,897	6,036

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 89rB

OTV: Centaur, Expendable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 105 Case: II ($M_{PY} < 2200$)	6,620	1,280
2. Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 557$ kg	0	1,013
– Secondary		10% of $M_S = 56$ kg		
– T/W Penalty		T/W = 1.76; Penalty = 400 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 670$ kg		670
		$P_E = 0.067\ (P_o) + 100 = 689$ W	689	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 161$ kg		161
		$P_A = 0.011\ (M_{PL}) + 30 = 84$ W	84	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (809) = 970$ kg		970
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 30$ W ($M_{PY} < 4400$)	30	
6. TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 79$ kg		79
		$P_T = 0.0195\ (M_{PY}) + 40 = 65$ W	65	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 62$ kg		62
		$P_H = 0.0438\ (M_{PY}) + 100 = 156$ W	156	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	7,644	4,236
9. Contingency & Integration		15% of the above power and mass	1,147	635
			P_o	M_{PL}
		TOTALS:	8,790	4,871

NO. OF PLATFORMS: 27

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 62bE

OTV: Centaur, L. T. Expendable

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 106 Case II ($M_{PY} < 2700$)	6,690	1,485
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 570$ kg	0	627
– Secondary		10% of $M_S = 57$ kg		
– T/W Penalty		T/W = 0.19; Penalty = 0 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 777$ kg		777
		$P_E = 0.067\ (P_o) + 100 = 712$ W	712	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 173$ kg		173
		$P_A = 0.011\ (M_{PL}) + 30 = 80$ W	80	
5. RCS	$M_P \doteq 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (282) = 338$ kg		338
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 32$ W ($M_{PY} < 4400$)	32	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 92$ kg		92
		$P_T = 0.0195\ (M_{PY}) + 40 = 69$ W	69	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 71$ kg		71
		$P_H = 0.0438\ (M_{PY}) + 100 = 165$ W ($M_{PY} < 2600$)	165	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 374$ kg		374
		$P_{RD} = 200$ W	200	
		Sub Tot:	7,947	3,937
9. Contingency & Integration		15% of the above power and mass	1,192	591
NO. OF PLATFORMS: 26		TOTALS:	P_o 9,139	M_{PL} 4,527

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 90pE

OTV: OTV, Reusable

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 107 Case: III ($M_{PY} < 2700$)	6,990	1,530
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 1036$ kg	0	1,552
– Secondary		10% of $M_S = 104$ kg		
– T/W Penalty		T/W = 0.78; Penalty = 413 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 801$ kg		801
		$P_E = 0.067\ (P_o) + 100 = 739$ W	739	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 206$ kg		206
		$P_A = 0.011\ (M_{PL}) + 30 = 94$ W	94	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (363) = 436$ kg		436
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 32$ W ($M_{PY} < 4400$)	32	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 94$ kg		94
		$P_T = 0.0195\ (M_{PY}) + 40 = 70$ W	70	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 72$ kg		72
		$P_H = 0.0438\ (M_{PY}) + 100 = 167$ W ($M_{PY} < 2600$)	167	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 380$ kg		380
		$P_{RD} = 200$ W	200	
		Sub Tot:	8,292	5,071
9. Contingency & Integration		15% of the above power and mass	1,244	761
			P_o	M_{PL}
		TOTALS:	9,536	5,831

NO. OF PLATFORMS: 25

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 90bB

OTV: Centaur, L. T. Expendable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 108 Case: II ($M_{PY} < 2200$)	6,990	1,400
2. Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 604$ kg	0	665
– Secondary		10% of $M_S = 60$ kg		
– T/W Penalty		T/W = 0.19; Penalty = 0 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 696$ kg		696
		$P_E = 0.067\ (P_o) + 100 = 720$ W	720	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 154$ kg		154
		$P_A = 0.011\ (M_{PL}) + 30 = 80$ W	80	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (758) = 910$ kg		910
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 31$ W ($M_{PY} < 4400$)	31	
6. TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 83$ kg		83
		$P_T = 0.0195\ (M_{PY}) + 40 = 67$ W	67	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 65$ kg		65
		$P_H = 0.0438\ (M_{PY}) + 100 = 161$ W	161	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	8,051	3,972
9. Contingency & Integration		15% of the above power and mass	1,208	596
			P_o	M_{PL}
NO. OF PLATFORMS: 25		TOTALS:	9,258	4,568

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 91pB

OTV: OTV, Reusable — OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 109 Case III (M_{PY} < 2200)	7,290	1,420
2. Structure – Basic		$M_S = 0.396 (M_{PY}) + 50 = 612$ kg	0	1,087
– Secondary		10% of $M_S = 61$ kg		
– T/W Penalty		T/W = 0.78; Penalty = 413 kg		
3. EPS		$M_E = 0.055 (P_o) + 187 = 717$ kg		717
		$P_E = 0.067 (P_o) + 100 = 746$ W	746	
4. ACS		$M_A = 0.0228 (M_{PL}) + 50 = 171$ kg		171
		$P_A = 0.011 (M_{PL}) + 30 = 88$ W	88	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (877) = 1053$ kg		1,053
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 31$ W (M_{PY} < 4400)	31	
6. TCC		$M_T = 0.0306 (M_{PY}) + 40 = 83$ kg		83
		$P_T = 0.0195 (M_{PY}) + 40 = 68$ W	68	
7. TCS		$M_H = 0.0175 (M_{PY}) + 40 = 65$ kg		65
		$P_H = 0.0438 (M_{PY}) + 100 = 162$ W	162	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	8,385	4,596
9. Contingency & Integration		15% of the above power and mass	1,258	689
			P_o	M_{PL}
NO. OF PLATFORMS: 24		TOTALS:	9,645	5,285

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

PLATFORM NO. 91eC'

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 110 Case: II ($M_{PY} < 3000$)	7,290	1,858
2. Structure – Basic		$M_S = 0.31 (M_{PY}) + 50 = 626$ kg	0	1,181
– Secondary		10% of $M_S = 63$ kg		
– T/W Penalty		T/W = 0.64; Penalty = 492 kg		
3. EPS		$M_E = 0.0609 (P_o) + 200 = 806$ kg		806
		$P_E = 0.067 (P_o) + 100 = 767$ W	767	
4. ACS		$M_A = 0.0294 (M_{PL}) + 64 = 263$ kg		263
		$P_A = 0.011 (M_{PL}) + 30 = 104$ W	104	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1124) = 1349$ kg		1,349
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 35$ W ($M_{PY} < 4400$)	35	
6. TCC		$M_T = 0.0319 (M_{PY}) + 52 = 111$ kg		111
		$P_T = 0.0195 (M_{PY}) + 40 = 76$ W	76	
7. TCS		$M_H = 0.0175 (M_{PY}) + 52 = 85$ kg		85
		$P_H = 0.0438 (M_{PY}) + 100 = 181$ W	181	
8. Rendezvous & Docking		$M_{RD} = 0.0193 (M_{PY}) + 200 = 236$ kg		236
		$P_{RD} = 200$ W	200	
		Sub Tot:	8,653	5,888
9. Contingency & Integration		15% of the above power and mass	1,298	883
			P_o	M_{PL}
NO. OF PLATFORMS: 24		TOTALS:	9,951	6,771

PLATFORM MASS & POWER ESTIMATES

OTV: 4 STG IUS, (2L, 2L)

PLATFORM NO. 92vC'

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 111 Case: III ($M_{PY} < 3000$)	7,600	1,896
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 638$ kg	0	1,559
– Secondary		10% of $M_S = 64$ kg		
– T/W Penalty		T/W = 1.93; Penalty = 857 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 830$ kg		830
		$P_E = 0.067\ (P_o) + 100 = 793$ W	793	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 283$ kg		283
		$P_A = 0.011\ (M_{PL}) + 30 = 112$ W	112	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1239) = 1487$ kg		1,487
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 35$ W ($M_{PY} < 4400$)	35	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 112$ kg		112
		$P_T = 0.0195\ (M_{PY}) + 40 = 77$ W	77	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 85$ kg		85
		$P_H = 0.0438\ (M_{PY}) + 100 = 183$ W	183	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 237$ kg		237
		$P_{RD} = 200$ W	200	
		Sub Tot:	9,001	6,490
9. Contingency & Integration		15% of the above power and mass	1,350	973
NO. OF PLATFORMS: 23		TOTALS:	P_o 10,351	M_{PL} 7,463

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 93gC

OTV: IOTV, L. T. Expendable

OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 112 Case: III (M_{PY} < 5000)	7,900	1,954
2. Structure	– Basic	$M_S = 0.31\ (M_{PY}) + 50 = 656$ kg	0	721
	– Secondary	10% of $M_S = 66$ kg		
	– T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 989$ kg		989
		$P_E = 0.067\ (P_o) + 100 = 803$ W	803	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 326$ kg		326
		$P_A = 0.011\ (M_{PL}) + 30 = 128$ W	128	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2954) = 3544$ kg		3,544
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 114$ kg		114
		$P_T = 0.0195\ (M_{PY}) + 40 = 78$ W	78	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 86$ kg		86
		$P_H = 0.0438\ (M_{PY}) + 100 = 186$ W	186	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	9,130	7,735
9. Contingency & Integration		15% of the above power and mass	1,370	1,160
			P_o	M_{PL}
NO. OF PLATFORMS: 22		TOTALS:	10,500	8,895

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 63nC

OTV: OTV, Expendable

OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 113 Case: III ($M_{PY} < 3000$)	8,500	2,051
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 686$ kg	0	1,471
– Secondary		10% of $M_S = 69$ kg		
– T/W Penalty		T/W = 0.43; Penalty = 716 kg		
3. EPS		$M_E = 0.0713\ (P_o) + 240 = 1045$ kg		1,045
		$P_E = 0.067\ (P_o) + 100 = 856$ W	856	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 386$ kg		386
		$P_A = 0.011\ (M_{PL}) + 30 = 150$ W	150	
5. RCS	$M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (3635) = 4362$ kg		4,362
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PT}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 117$ kg		117
		$P_T = 0.0195\ (M_{PY}) + 40 = 80$ W	80	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 88$ kg		88
		$P_H = 0.0438\ (M_{PY}) + 100 = 190$ W	190	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	9,812	9,519
9. Contingency & Integration		15% of the above power and mass	1,472	1,428
NO. OF PLATFORMS: 20		TOTALS:	P_o 11,284	M_{PL} 10,947

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 63cE

OTV: IOTV, L. T. Expendable

OPER. MODE: E – Serviced, 16 yr life, 3 consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 114 Case: II (M_{PY} < 2700)	8,500	1,822
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 688$ kg	0	756
– Secondary		10% of M_S = 69 kg		
– T/W Penalty		T/W = 0.08; Penalty = 0 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 919$ kg		919
		$P_E = 0.067\ (P_o) + 100 = 866$ W	866	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 195$ kg		195
		$P_A = 0.011\ (M_{PL})$ [illegible] $30 = 89$ W	89	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (336) = 403$ kg		403
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 35$ W (M_{PY} < 4400)	35	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 103$ kg		103
		$P_T = 0.0195\ (M_{PY}) + 40 = 76$ W	76	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 77$ kg		77
		$P_H = 0.0438\ (M_{PY}) + 100 = 180$ W (M_{PY} < 2600)	180	
[illegible] Rendezvous & Docking		[illegible]$_{RD} = 0.1175\ (M_{PY}) + 200 = 414$ kg		414
		$P_{RD} = 200$ W	200	
		Sub Tot:	9,946	4,689
9. Contingency & Integration		15% of the above power and mass	1,492	[illegible]
			P_o	M_{PL}
NO. OF PLATFORMS: 20		TOTALS:	11,437	5,393

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 63fE

OTV: IOTV, Expendable

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 115 Case: II ($M_{PY} < 2700$)	8,500	1,822
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 1138$ kg	0	1,699
– Secondary		10% of $M_S = 114$ kg		
– T/W Penalty		T/W = 0.69; Penalty = 448 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 920$ kg		920
		$P_E = 0.067\ (P_o) + 100 = 867$ W	867	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 227$ kg		227
		$P_A = 0.011\ (M_{PL}) + 30 = 103$ W	103	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (413) = 495$ kg		495
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 35$ W ($M_{PY} < 4400$)	35	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 103$ kg		103
		$P_T = 0.0195\ (M_{PY}) + 40 = 76$ W	76	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 77$ kg		77
		$P_H = 0.0438\ (M_{PY}) + 100 = 180$ W ($M_{PY} < 2600$)	180	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 414$ kg		414
		$P_{RD} = 200$ W	200	
		Sub Tot:	9,960	5,757
9. Contingency & Integration		15% of the above power and mass	1,494	864
			P_o	M_{PL}
NO. OF PLATFORMS: 20		TOTALS:	11,454	6,621

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 63cB

OTV: IOTV, L. T. Expendable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 116 Case: II ($M_{PY} < 2200$)	8,500	1,620
2. Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 692$ kg	0	761
– Secondary		10% of $M_S = 69$ kg		
– T/W Penalty		T/W = 0.08; Penalty = 0 kg		
3. EPS		$M_E = 0.55\ (P_o) + 187 = 801$ kg		801
		$P_E = 0.067\ (P_o) + 100 = 848$ W	848	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 169$ kg		169
		$P_A = 0.011\ (M_{PL}) + 30 = 88$ W	88	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (869) = 1043$ kg		1,043
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 33$ W ($M_{PY} < 4400$)	33	
6. TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 90$ kg		90
		$P_T = 0.0195\ (M_{PY}) + 40 = 72$ W	72	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 68$ kg		68
		$P_H = 0.0438\ (M_{PY}) + 100 = 171$ W	171	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	9,712	4,553
9. Contingency & Integration		15% of the above power and mass	1,457	683
			P_o	M_{PL}
NO. OF PLATFORMS: 20		TOTALS:	11,169	5,236

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 101fB

OTV: IOTV, Expendable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 117 Case: II ($M_{PY} < 2200$)	9,235	1,760
2. Structure – Basic		$M_S = 0.396 (M_{PY}) + 50 = 747$ kg	0	1,270
– Secondary		10% of $M_S = 75$ kg		
– T/W Penalty		T/W = 0.69; Penalty = 448 kg		
3. EPS		$M_E = 0.055 (P_o) + 187 = 853$ kg		853
		$P_E = 0.067 (P_o) + 100 = 911$ W	911	
4. ACS		$M_A = 0.0228 (M_{PL}) + 50 = 194$ kg		194
		$P_A = 0.011 (M_{PL}) + 30 = 100$ W	100	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1050) = 1260$ kg		1,260
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 34$ W ($M_{PY} < 4400$)	34	
6. TCC		$M_T = 0.0306 (M_{PY}) + 40 = 94$ kg		94
		$P_T = 0.0195 (M_{PY}) + 40 = 74$ W	74	
7. TCS		$M_H = 0.0175 (M_{PY}) + 40 = 71$ kg		71
		$P_H = 0.0438 (M_{PY}) + 100 = 177$ W	177	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	10,531	5,502
9. Contingency & Integration		15% of the above power and mass	1,580	825
			P_o	M_{PL}
NO. OF PLATFORMS: 20		TOTALS:	12,111	6,327

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 94hC

OTV: OTV, L. T. Expendable — OPER. MODE: C – Non-serviced, 16 year life

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 118 Case: III ($M_{PY} < 3000$)	12,200	2,541
2. Structure – Basic		$M_S = 0.31\,(M_{PY}) + 50 = 838$ kg	0	921
– Secondary		10% of $M_S = 84$ kg		
– T/W Penalty		$T/W = 0.05$; Penalty = 0 kg		
3. EPS		$M_E = 0.0713\,(P_o) + 240 = 1371$ kg		1,371
		$P_E = 0.067\,(P_o) + 100 = 1168$ W	1,168	
4. ACS		$M_A = 0.0294\,(M_{PL}) + 64 = 406$ kg		406
		$P_A = 0.011\,(M_{PL}) + 30 = 158$ W	158	
5. RCS	$M_P = 0.332\,(M_{PL})$	$M_R = 1.2\,(M_P) = 1.2 \times (3858) = 4630$ kg		4,630
	$M_R = M_P + 0.2\,M_P$	$P_R = 0.008\,(M_{PY}) + 20 = 40$ W ($M_{PY} < 4400$)	40	
6. TCC		$M_T = 0.0319\,(M_{PY}) + 52 = 133$ kg		133
		$P_T = 0.0195\,(M_{PY}) + 40 = 90$ W	90	
7. TCS		$M_H = 0.0175\,(M_{PY}) + 52 = 96$ kg		96
		$P_H = 0.0438\,(M_{PY}) + 100 = 211$ W	211	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	13,867	10,105
9. Contingency & Integration		15% of the above power and mass	2,080	1,516
			P_o	M_{PL}
NO. OF PLATFORMS: 17		TOTALS:	15,947	11,621

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

PLATFORM NO. 94eE

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 119 Case: II ($M_{PY} < 2700$)	12,200	2,216
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 1276$ kg	0	1,895
– Secondary		10% of $M_S = 128$ kg		
– T/W Penalty		T/W = 0.64; Penalty = 492 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 1209$ kg		1,209
		$P_E = 0.067\ (P_o) + 100 = 1180$ W	1,180	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 259$ kg		259
		$P_A = 0.011\ (M_{PL}) + 30 = 116$ W	116	
5. RCS	$M_P \mp 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (498) = 587$ kg		587
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 38$ W ($M_{PY} < 4400$)	38	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 115$ kg		115
		$P_T = 0.0195\ (M_{PY}) + 40 = 83$ W	83	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 84$ kg		84
		$P_H = 0.0438\ (M_{PY}) + 100 = 197$ W ($M_{PY} < 2600$)	197	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 460$ kg		460
		$P_{RD} = 200$ W	200	
		Sub Tot:	14,014	6,826
9. Contingency & Integration		15% of the above power and mass	2,102	1,024
			P_o	M_{PL}
NO. OF PLATFORMS: 17		TOTALS:	16,116	7,849

PLATFORM MASS & POWER ESTIMATES　　　　PLATFORM NO. 94eB

OTV: OTV, Expendable　　　　OPER. MODE: B – Non-serviced, 8 year life, replaced

	Platform Elements		Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment		Item: 120 Case: II ($M_{PY} < 2200$)	12,200	1,970
2.	Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 830$ kg	0	1,405
	– Secondary		10% of $M_S = 83$ kg		
	– T/W Penalty		T/W = 0.64; Penalty = 492 kg		
3.	EPS		$M_E = 0.055\ (P_o) + 187 = 1058$ kg		1,058
			$P_E = 0.067\ (P_o) + 100 = 1161$ W	1,161	
4.	ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 214$ kg		214
			$P_A = 0.011\ (M_{PL}) + 30 = 109$ W	109	
5.	RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1194) = 1433$ kg		1,433
		$M_F = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6.	TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 100$ kg		100
			$P_T = 0.0195\ (M_{PY}) + 40 = 78$ W	78	
7.	TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 74$ kg		74
			$P_H = 0.0438\ (M_{PY}) + 100 = 186$ W	186	
8.	Rendezvous & Docking		N/A	N/A	N/A
			Sub Tot:	13,770	6,255
9.	Contingency & Integration		15% of the above power and mass	2,066	938
				P_o	M_{PL}
NO. OF PLATFORMS: 17			TOTALS:	15,836	7,193

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, Expendable

PLATFORM NO. 940C'

OPER. MODE: C' – Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 121 Case: III ($M_{PY} < 3000$)	12,200	2,541
2. Structure – Basic		$M_S = 0.31\ (M_{PY}) + 50 = 838$ kg		
– Secondary		10% of $M_S = 84$ kg	0	1,533
– T/W Penalty		T/W = 0.51; Penalty = 612 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 1184$ kg		1,184
		$P_E = 0.067\ (P_o) + 100 = 1183$ W	1,183	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 330$ kg		330
		$P_A = 0.011\ (M_{PL}) + 30 = 130$ W	130	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1503) = 1803$ kg		1,803
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 40$ W ($M_{PY} < 4400$)	40	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 133$ kg		133
		$P_T = 0.0195\ (M_{PY}) + 40 = 90$ W	90	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 96$ kg		96
		$P_H = 0.0438\ (M_{PY}) + 100 = 211$ W	211	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 249$ kg		249
		$P_{RD} = 200$ W	200	
		Sub Tot:	14,053	7,871
9. Contingency & Integration		15% of the above power and mass	2,108	1,181
			P_o	M_{PL}
		TOTALS:	16,161	9,051

NO. OF PLATFORMS: 17

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 95dE

OTV: OTV, L. T. Expendable

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 122 Case: II ($M_{PY} < 2700$)	12,700	2,306
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 1307$ kg	0	1,438
– Secondary		10% of $M_S = 131$ kg		
– T/W Penalty		T/W = 0.07; Penalty = 0 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 1248$ kg		1,248
		$P_E = 0.067\ (P_o) + 100 = 1222$ W	1,222	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 248$ kg		248
		$P_A = 0.011\ (M_{PL}) + 30 = 112$ W	112	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (464) = 556$ kg		556
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 38$ W ($M_{PY} < 4400$)	38	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 118$ kg		118
		$P_T = 0.0195\ (M_{PY}) + 40 = 85$ W	85	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 85$ kg		85
		$P_H = 0.0438\ (M_{PY}) + 100 = 201$ W ($M_{PY} < 2600$)	201	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 471$ kg		471
		$P_{RD} = 200$ W	200	
		Sub Tot:	14,558	6,470
9. Contingency & Integration		15% of the above power and mass	2,184	971
			P_o	M_{PL}
NO. OF PLATFORMS: 16		TOTALS:	16,741	7,441

PLATFORM MASS & POWER ESTIMATES

OTV: 4 STD IUS, (2L, 2L)

PLATFORM NO. 95vE

OPER. MODE: E – Serviced, 16 yr life, 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 123 Case: II ($M_{PY} < 2700$)	12,700	2,306
2. Structure – Basic		$M_S = 0.35\ (M_{PY}) + 50 = 1307$ kg	0	2,295
– Secondary		10% of $M_S = 131$ kg		
– T/W Penalty		T/W = 1.93; Penalty = 857 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 1249$ kg		1,249
		$P_E = 0.067\ (P_o) + 100 = 1223$ W	1,223	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 277$ kg		277
		$P_A = 0.011\ (M_{PL}) + 30 = 124$ W	124	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (533) = 640$ kg		640
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 38$ W ($M_{PY} < 4400$)	38	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 118$ kg		118
		$P_T = 0.0195\ (M_{PY}) + 40 = 85$ W	85	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 85$ kg		85
		$P_H = 0.0438\ (M_{PY}) + 100 = 201$ W ($M_{PY} < 2600$)	201	
8. Rendezvous & Docking		$M_{RD} = 0.1175\ (M_{PY}) + 200 = 471$ kg		471
		$P_{RD} = 200$ W	200	
		Sub Tot:	14,571	7,440
9. Contingency & Integration		15% of the above power and mass	2,186	1,116
NO. OF PLATFORMS: 16		TOTALS:	P_o 16,756	M_{PL} 8,556

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 95vB

OTV: 4 STG IUS (2L, 2L)

OPER. MODE: B – Non-servided, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 124 Case: III ($M_{PY} < 2200$)	12,700	2,050
2. Structure – Basic		$M_S = 0.396\ (M_{PY}) + 50 = 862$ kg	0	1,805
– Secondary		10% of $M_S = 86$ kg		
– T/W Penalty		T/W = 1.93; Penalty = 857 kg		
3. EPS		$M_E = 0.055\ (P_o) + 187 = 1093$ kg		1,093
		$P_E = 0.067\ (P_o) + 100 = 1204$ W	1,204	
4. ACS		$M_A = 0.0228\ (M_{PL}) + 50 = 232$ kg		232
		$P_A = 0.011\ (M_{PL}) + 30 = 118$ W	118	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1327) = 1593$ kg		1,593
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC		$M_T = 0.0306\ (M_{PY}) + 40 = 103$ kg		103
		$P_T = 0.0195\ (M_{PY}) + 40 = 80$ W	80	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 40 = 76$ kg		76
		$P_H = 0.0438\ (M_{PY}) + 100 = 190$ W	190	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	14,328	6,952
9. Contingency & Integration		15% of the above power and mass	2,149	1,043
			P_o	M_{PL}
NO. OF PLATFORMS: 16		TOTALS:	16,477	7,995

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 95dB

OTV: OTV, L. T. Expendable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 125 Case: II ($M_{PY} < 2200$)	12,700	2,050
2. Structure – Basic		$M_S = 0.396 (M_{PY}) + 50 = 862$ kg	0	948
– Secondary		10% of $M_S = 86$ kg		
– T/W Penalty		T/W = 0.07; Penalty = 0 kg		
3. EPS		$M_E = 0.055 (P_o) + 187 = 1092$ kg		1,092
		$P_E = 0.067 (P_o) + 100 = 1203$ W	1,203	
4. ACS		$M_A = 0.0228 (M_{PL}) + 50 = 202$ kg		202
		$P_A = 0.011 (M_{PL}) + 30 = 103$ W	103	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1107) = 1329$ kg		1,329
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 36$ W ($M_{PY} < 4400$)	36	
6. TCC		$M_T = 0.0306 (M_{PY}) + 40 = 103$ kg		103
		$P_T = 0.0195 (M_{PY}) + 40 = 80$ W	80	
7. TCS		$M_H = 0.0175 (M_{PY}) + 40 = 76$ kg		76
		$P_H = 0.0438 (M_{PY}) + 100 = 190$ W	190	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	14,312	5,800
9. Contingency & Integration		15% of the above power and mass	2,147	870
			P_o	M_{PL}
NO. OF PLATFORMS: 16		TOTALS:	16,459	6,670

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

OPER. MODE: C' -- Non-serviced, 16 yr life, consumables replenished at 8 yrs

PLATFORM NO. 64nC'

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 126 Case: III ($M_{PY} \geq 3000$)	16,600	3,418
2. Structure -- Basic		$M_S = 0.225\ (M_{PY}) + 300 = 1069$ kg	0	1,892
-- Secondary		10% of $M_S = 107$ kg		
-- T/W Penalty		T/W = 0.43; Penalty = 716 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 1525$ kg		1,525
		$P_E = 0.067\ (P_o) + 100 = 1558$ W	1,558	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 405$ kg		405
		$P_A = 0.011\ (M_{PL}) + 30 = 158$ W	158	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1925) = 2312$ kg		2,312
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 47$ W ($M_{PY} < 4400$)	47	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 161$ kg		161
		$P_T = 0.0195\ (M_{PY}) + 40 = 107$ W	107	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 112$ kg		112
		$P_H = 0.0438\ (M_{PY}) + 100 = 250$ W	250	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 266$ kg		266
		$P_{RD} = 200$ W	200	
		Sub Tot:	18,919	10,091
9. Contingency & Integration		15% of the above power and mass	2,838	1,514
			P_o	M_{PL}
NO. OF PLATFORMS: 12		TOTALS:	21,757	11,605

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 65oE

OTV: IOTV, Expendable

OPER. MODE: E – Serviced, 16 yr life. 3 yr consumables supply

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 127 Case: III ($M_{PY} \geq 2700$)	16,600	2,981
2. Structure – Basic		$M_S = 0.259\ (M_{PY}) + 300 = 1072$ kg	0	1,791
– Secondary		10% of $M_S = 107$ kg		
– T/W Penalty		T/W = 0.51; Penalty = 612 kg		
3. EPS		$M_E = 0.0620\ (P_o) + 210 = 1555$ kg		1,555
		$P_E = 0.067\ (P_o) + 100 = 1553$ W	1,553	
4. ACS		$M_A = 0.0258\ (M_{PL}) + 56 = 296$ kg		296
		$P_A = 0.011\ (M_{PL}) + 30 = 132$ W	132	
5. RCS	$M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (578) = 694$ kg		694
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 44$ W ($M_{PY} < 4400$)	44	
6. TCC		$M_T = 0.0317\ (M_{PY}) + 45 = 139$ kg		139
		$P_T = 0.0195\ (M_{PY}) + 40 = 98$ W	98	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 45 = 97$ kg		97
		$P_H = 0.0438\ (M_{PY}) + 100 = 231$ W ($M_{PY} \geq 2600$)	231	
8. Rendezvous & Docking		$M_{RD} = 0.0388\ (M_{PY}) + 400 = 516$ kg		516
		$P_{RD} = 200$ W	200	
		Sub Tot:	18,858	8,069
9. Contingency & Integration		15% of the above power and mass	2,829	1,210
			P_o	M_{PL}
NO. OF PLATFORMS: 12		TOTALS:	21,687	9,279

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 65oB

OTV: IOTV, Expendable

OPER. MODE: B – Non-serviced, 8 year life, replaced

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 128 Case: III ($M_{PY} \geq 2200$)	16,600	2,650
2. Structure – Basic		$M_S = 0.29 (M_{PY}) + 300 = 1069$ kg	0	1,787
– Secondary		10% of $M_S = 107$ kg		
– T/W Penalty		T/W = 0.51; Penalty = 612 kg		
3. EPS		$M_E = 0.055 (P_o) + 187 = 1364$ kg		1,364
		$P_E = 0.067 (P_o) + 100 = 1534$ W	1,534	
4. ACS		$M_A = 0.0228 (M_{PL}) + 50 = 263$ kg		263
		$P_A = 0.011 (M_{PL}) + 30 = 133$ W	133	
5. RCS	$M_P = 0.166 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1553) = 1864$ kg		1,864
	$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 41$ W ($M_{PY} < 4400$)	41	
6. TCC		$M_T = 0.0306 (M_{PY}) + 40 = 121$ kg		121
		$P_T = 0.0195 (M_{PY}) + 40 = 92$ W	92	
7. TCS		$M_H = 0.0175 (M_{PY}) + 40 = 86$ kg		56
		$P_H = 0.0438 (M_{PY}) + 100 = 216$ W	216	
8. Rendezvous & Docking		N/A	N/A	N/A
		Sub Tot:	18,616	8,137
9. Contingency & Integration		15% of the above power and mass	2,792	1,221
			P_o	M_{PL}
NO. OF PLATFORMS: 12		TOTALS:	21,409	9,358

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, L. T. Expendable

PLATFORM NO. 96hC'

OPER. MODE: C' – Non-Serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements		Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment		Item: 129 Case: III ($M_{PY} \geq 3000$)	16,600	3,612
2. Structure – Basic		$M_S = 0.226\ (M_{PY}) + 300 = 1113$ kg	0	1,224
– Secondary		10% of M_S = 111 kg		
– T/W Penalty		T/W = 0.05; Penalty = 0 kg		
3. EPS		$M_E = 0.0609\ (P_o) + 200 = 1525$ kg		1,525
		$P_E = 0.067\ (P_o) + 100 = 1558$ W	1,558	
4. ACS		$M_A = 0.0294\ (M_{PL}) + 64 = 384$ kg		384
		$P_A = 0.011\ (M_{PL}) + 30 = 150$ W	150	
5. RCS	$M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1807) = 2169$ kg		2,169
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 49$ W ($M_{PY} < 4400$)	49	
6. TCC		$M_T = 0.0319\ (M_{PY}) + 52 = 167$ kg		167
		$P_T = 0.0195\ (M_{PY}) + 40 = 110$ W	110	
7. TCS		$M_H = 0.0175\ (M_{PY}) + 52 = 115$ kg		115
		$P_H = 0.0438\ (M_{PY}) + 100 = 258$ W	258	
8. Rendezvous & Docking		$M_{RD} = 0.0193\ (M_{PY}) + 200 = 270$ kg		270
		$P_{RD} = 200$ W	200	
		Sub Tot:	18,926	9,466
9. Contingency & Integration		15% of the above power and mass	2,839	1,420
			P_o	M_{PL}
NO. OF PLATFORMS: 12		TOTALS:	21,765	10,886

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 96gE

OTV: IOTV, L.T. Reusable

OPER. MODE: E-serviced, 16 yr. life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 130 Case: III ($M_{PY} \geq 2700$)	16,600	3,150
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1116$ kg	0	1,374
- Secondary	10% of $M_s = 112$ kg		
- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1555$ kg		1,555
	$P_E = 0.067\ (P_o) + 100 = 1554$ W	1,554	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 288$ kg		288
	$P_A = 0.011\ (M_{PL}) + 30 = 129$ W	129	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (559) = 671$ kg		671
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 45$ W ($M_{PY} < 4400$)	45	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 145$ kg		145
	$P_T = 0.0195\ (M_{PY}) + 40 = 101$ W	101	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 100$ kg		100
	$P_H = 0.0438\ (M_{PY}) + 100 = 238$ W ($M_{PY} \geq 2600$)	238	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 522$ kg		522
	$P_{RD} = 200$ W	200	
	Sub Tot	18,867	7,806
9. Contingency and Integration	15% of the above power and mass	2,830	1,171
		P_o	M_{PL}
NO. OF PLATFORMS: 12	TOTALS:	21,698	8,977

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 96gB

OTV: IOTV, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 131 Case: III ($M_{PY} \geq 2200$)	16,600	2,800
2. Structure - Basic	$M_s = 0.29\ (M_{PY}) + 300 = 1112$ kg	0	1,223
- Secondary	10% of $M_s = 111$ kg		
- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 1365$ kg		1,365
	$P_E = 0.067\ (P_o) + 100 = 1535$ W	1,535	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 249$ kg		249
	$P_A = 0.011\ (M_{PL}) + 30 = 126$ W	126	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1449) = 1739$ kg		1,739
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 42$ W ($M_{PY} < 4400$)	42	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 126$ kg		126
	$P_T = 0.0195\ (M_{PY}) + 40 = 95$ W	95	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 89$ kg		89
	$P_H = 0.0438\ (M_{PY}) + 100 = 223$ W	223	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	18,261	7,591
9. Contingency and Integration	15% of the above power and mass	2,793	1,139
		P_o	M_{PL}
	TOTALS:	21,414	8,730

NO. OF PLATFORMS: 12

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 97jC

OTV: OTV, L.T. Reusable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 132 Case: III ($M_{PY} \geq 3000$)	18,100	3,780
2. Structure - Basic	$M_s = 0.225 (M_{PY}) + 300 = 1151$ kg	0	1,266
- Secondary	10% of $M_s = 115$ kg		
- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
3. EPS	$M_E = 0.0713 (P_o) + 240 = 1914$ kg		1,914
	$P_E = 0.067 (P_o) + 100 = 1673$ W	1,673	
4. ACS	$M_A = 0.0294 (M_{PL}) + 64 = 551$ kg		551
	$P_A = 0.011 (M_{PL}) + 30 = 212$ W	212	
5. RCS $M_P = 0.332 (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (5498) = 6597$ kg		6,597
$M_R = M_P + 0.2 M_P$	$P_R = 0.008 (M_{PY}) + 20 = 50$ W ($M_{PY} < 4400$)	50	
6. TCC	$M_T = 0.0319 (M_{PY}) + 52 = 173$ kg		173
	$P_T = 0.0195 (M_{PY}) + 40 = 114$ W	114	
7. TCS	$M_H = 0.0175 (M_{PY}) + 52 = 118$ kg		118
	$P_H = 0.0438 (M_{PY}) + 100 = 266$ W	266	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	20,415	14,398
9. Contingency and Integration	15% of the above power and mass	3,062	2,160
		P_o	M_{PL}
NO. OF PLATFORMS: 11	TOTALS:	23,477	16,558

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 98nB

OTV: OTV, Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 133 Case: III ($M_{PY} \geq 2200$)	21,000	3,500
2. Structure - Basic	$M_s = 0.29\ (M_{PY}) + 300 = 1315$ kg	0	2,163
- Secondary	10% of $M_s = 132$ kg		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 1672$ kg		1,672
	$P_E = 0.067\ (P_o) + 100 = 1909$ W	1,909	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 319$ kg		319
	$P_A = 0.011\ (M_{PL}) + 30 = 160$ W	160	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1957) = 2348$ kg		2,348
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 48$ W ($M_{PY} < 4400$)	48	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 147$ kg		147
	$P_T = 0.0195\ (M_{PY}) + 40 = 108$ W	108	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 101$ kg		101
	$P_H = 0.0438\ (M_{PY}) + 100 = 253$ W	253	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	23,479	10,250
9. Contingency and Integration	15% of the above power and mass	3,522	1,538
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	27,001	11,788

PLATFORM MASS & POWER ESTIMATES — PLATFORM NO. 98nE

OTV: OTV, Expendable — OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 134 Case: III ($M_{PY} \geq 2700$)	21,000	3,938
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1320$ kg	0	2,168
- Secondary	10% of $M_s = 132$ kg		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1902$ kg		1,902
	$P_E = 0.067\ (P_o) + 100 = 1928$ W	1,928	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 355$ kg		355
	$P_A = 0.011\ (M_{PL}) + 30 = 157$ W	157	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (721) = 865$ kg		865
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 52$ W ($M_{PY} < 4400$)	52	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 170$ kg		170
	$P_T = 0.0195\ (M_{PY}) + 40 = 117$ W	117	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 114$ kg		114
	$P_H = 0.0438\ (M_{PY}) + 100 = 272$ W ($M_{PY} \geq 2600$)	272	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 553$ kg		553
	$P_{RD} = 200$ W	200	
	Sub Tot	23,726	10,064
9. Contingency and Integration	15% of the above power and mass	3,559	1,510
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	27,285	11,573

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 98hB

OTV: OTV, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 135 Case: III ($M_{PY} \geq 2200$)	21,000	3,500
2. Structure - Basic	$M_s = 0.9\ (M_{PY}) + 300 = 1315$ kg	0	1,447
- Secondary	10% of $M_s = 132$ kg		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_E = 0.055\ (P_o) + 187 = 1671$ kg		1,671
	$P_E = 0.067\ (P_o) + 100 = 1908$ W	1,908	
4. ACS	$M_A = 0.0228\ (M_{PL}) + 60 = 294$ kg		294
	$P_A = 0.011\ (M_{PL}) + 30 = 147$ W	147	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1773) = 2128$ kg		2,128
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 48$ W ($M_{PY} < 4400$)	48	
6. TCC	$M_T = 0.0306\ (M_{PY}) + 40 = 147$ kg		147
	$P_T = 0.0195\ (M_{PY}) + 40 = 108$ W	108	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 101$ kg		101
	$P_H = 0.0438\ (M_{PY}) + 100 = 253$ W	253	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	23,466	9,288
9. Contingency and Integration	15% of the above power and mass	3,520	1,393
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	26,985	10,681

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 98hE

OTV: OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 136 Case: III ($M_{PY} \geq 2700$)	21,000	3,938
2. Structure - Basic	$M_S = 0.259\ (M_{PY}) + 300 = 1320$ kg	0	1,452
- Secondary	10% of $M_S = 132$ kg		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 1901$ kg		1,901
	$P_E = 0.067\ (P_o) + 100 = 1927$ W	1,927	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 331$ kg		331
	$P_A = 0.011\ (M_{PL}) + 30 = 147$ W	147	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (663) = 796$ kg		796
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 52$ W ($M_{PY} < 4400$)	52	
6. TCC	$M_T = 0.0317\ (M_{PY}) + 45 = 170$ kg		170
	$P_T = 0.0195\ (M_{PY}) + 40 = 117$ W	117	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 114$ kg		114
	$P_H = 0.0438\ (M_{PY}) + 100 = 272$ W ($M_{PY} \geq 2600$)	272	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 553$ kg		553
	$P_{RD} = 200$ W	200	
	Sub Tot	23,715	9,253
9. Contingency and Integration	15% of the above power and mass	3,557	1,388
		P_o	M_{PL}
NO. OF PLATFORMS: 9	TOTALS:	27,273	10,641

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 66jC'

OTV: 2 STG. OTV, L.T. Reusable

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 137 Case: III ($M_{PY} \geq 3000$)	25,000	5,031
2. Structure - Basic	$M_s = 0.225\ (M_{PY}) + 300 = 1432$ kg	0	1,575
- Secondary	10% of $M_s = 143$ kg		
- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 2174$ kg		2,174
	$P_E = 0.067\ (P_o) + 100 = 2272$ W	2,272	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 499$ kg		499
	$P_A = 0.011\ (M_{PL}) + 30 = 193$ W	193	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2458) = 2950$ kg		2,950
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 60$ W ($M_{PY} \geq 4400$)	60	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 209$ kg		209
	$P_T = 0.0195\ (M_{PY}) + 40 = 138$ W	138	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 140$ kg		140
	$P_H = 0.0438\ (M_{PY}) + 100 = 320$ W	320	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 297$ kg		297
	$P_{RD} = 200$ W	200	
	Sub Tot	28,183	12,876
9. Contingency and Integration	15% of the above power and mass	4,228	1,931
		P_o	M_{PL}
	TOTALS:	43,522	14,807

NO. OF PLATFORMS: 7

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 66kC

OTV: 2 STG. OTV, L.T. Expendable

OPER. MODE: C - Non-service, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 138 Case: III ($M_{PY} \geq 3000$)	25,000	5,031
2. Structure - Basic	M_s $0.225\ (M_{PY}) + 300 = 1432$ kg	0	1,575
- Secondary	10% of $M_s = 143$ kg		
- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3. EPS	$M_E = 0.0713\ (P_o) + 240 = 2540$ kg		2,540
	$P_E = 0.067\ (P_o) + 100 = 2261$ W	2,261	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 700$ kg		700
	$P_A = 0.011\ (M_{PL}) + 30 = 268$ W	268	
5. RCS $M_P = 0.332\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (7184) = 8621$ kg		8,621
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 60$ W ($M_{PY} \geq 4400$)	60	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 209$ kg		209
	$P_T = 0.0195\ (M_{PY}) + 40 = 138$ W	138	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 140$ kg		140
	$P_H = 0.0438\ (M_{PY}) + 100 = 320$ W	320	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	28,047	18,816
9. Contingency and Integration	15% of the above power and mass	4,207	2,822
		P_o	M_{PL}
NO. OF PLATFORMS: 7	TOTALS:	32,264	21, 638

PLATFORM MASS & POWER ESTIMATES PLATFORM NO. 68jB

OTV: 2 STG. OTV, L.T. Reusable OPER. MODE: B - Non-serivced. 8 year life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 139 Case: III ($M_{PY} \geq 2200$)	31,700	5,400
2.	Structure - Basic	$M_s = 0.29\ (M_{PY}) + 300 = 1866$ kg	0	2,053
	- Secondary	10% of $M_s = 187$ kg		
	- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
3.	EPS	$M_E = 0.055\ (P_o) + 187 = 2418$ kg		2,418
		$P_E = 0.067\ (P_o) + 106 = 2817$ W	2,817	
4.	ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 411$ kg		411
		$P_A = 0.011\ (M_{PL}) + 30 = 204$ W	204	
5.	RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (2629) = 3155$ kg		3,155
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 63$ W ($M_{PY} \geq 4400$)	63	
6.	TCC	$M_T = 0.026\ (M_{PY}) + 60 = 200$ kg		200
		$P_T = 0.0195\ (M_{PY}) + 40 = 145$ W	145	
7.	TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 135$ kg		135
		$P_H = 0.0438\ (M_{PY}) + 100 = 337$ W	337	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	35,267	13,772
9.	Contingency and Integration	15% of the above power and mass	5,290	2,066
			P_o	M_{PL}
	NO. OF PLATFORMS: 6	TOTALS:	40,556	15,838

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 68jE

OTV: 2 STG. OTV, L.T. Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 140 Case: III ($M_{PY} \geq 2700$)	31,700	6,075
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1873$ kg	0	2,061
- Secondary	10% of $M_s = 187$ kg		
- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 2743$ kg		2,743
	$P_E = 0.067\ (P_o) + 100 = 2838$ W	2,838	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 457$ kg		457
	$P_A = 0.011\ (M_{PL}) + 30 = 201$ W	201	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (968) = 1162$ kg		1,162
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 69$ W ($M_{PY} \geq 4400$)	69	
6. TCC	$M_T = 0.0262\ (M_{PY}) + 68 = 227$ kg		227
	$P_T = 0.0195\ (M_{PY}) + 40 = 158$ W	158	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 151$ kg		151
	$P_H = 0.0438\ (M_{PY}) + 100 = 366$ W ($M_{PY} \geq 2600$)	366	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 636$ kg		636
	$P_{RD} = 200$ W	200	
	Sub Tot	35,532	13,512
9. Contingency and Integration	15% of the above power and mass	5,330	2,027
		P_o	M_{PL}
NO. OF PLATFORMS: 6	TOTALS:	40,865	16,193

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG. OTV, Reusable

PLATFORM NO. 68IE

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 141 Case: III ($M_{PY} \geq 2700$)	31,700	6,019
2. Structure - Basic	$M_s = 0.259\ (M_{PY}) + 300 = 1259$ kg	0	2,825
- Secondary	10% of $M_s = 186$ kg		
- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 2744$ kg		2,744
	$P_E = 0.067\ (P_o) + 100 = 2838$ W	2,838	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 474$ kg		474
	$P_A = 0.011\ (M_{PL}) + 30 = 208$ W	208	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1009) = 1211$ kg		1,211
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 68$ W ($M_{PY} \geq 4400$)	68	
6. TCC	$M_T = 0.0262\ (M_{PY}) + 68 = 226$ kg		226
7. TCS	$P_T = 0.0195\ (M_{PY}) + 40 = 157$ W	157	
	$M_H = 0.0175\ (M_{PY}) + 45 = 150$ kg		150
8. Rendezvous and Docking	$P_H = 0.0438\ (M_{PY}) + 100 = 364$ W ($M_{PY} \geq 2600$)	364	
	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 434$ kg		434
	$P_{RD} = 200$ W	200	
	Sub Tot	35,535	14,081
9. Contingency and Integration	15% of the above power and mass	5,330	2,112
NO. OF PLATFORMS: 6	TOTALS:	P_o 40,865	M_{PL} 16,193

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG. OTV, L.T. Expendable

PLATFORM NO. 99kC'

OPER. MODE: C' - Non-serviced, 16 yr life, consumables ~~replenished at 8 yrs~~

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 142 Case: III ($M_{PY} \geq 3000$)	41,460	8,514
2. Structure - Basic	$M_S = 0.225\ (M_{PY}) + 300 = 2216$ kg	0	2,437
- Secondary	10% of $M_S = 222$ kg		
- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3. EPS	$M_E = 0.0609\ (P_o) + 200 = 3449$ kg		3,449
	$P_E = 0.067\ (P_o) + 100 = 3675$ W	3,675	
4. ACS	$M_A = 0.0294\ (M_{PL}) + 64 = 767$ kg		767
	$P_A = 0.011\ (M_{PL}) + 30 = 293$ W	293	
5. RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (3971) = 4765$ kg		4,765
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 88$ W ($M_{PY} \geq 4400$)	88	
6. TCC	$M_T = 0.0263\ (M_{PY}) + 77 = 301$ kg		301
	$P_T = 0.0195\ (M_{PY}) + 40 = 206$ W	206	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 52 = 201$ kg		201
	$P_H = 0.0438\ (M_{PY}) + 100 = 473$ W	473	
8. Rendezvous and Docking	$M_{RD} = 0.0193\ (M_{PY}) + 200 = 36?$ kg		354
	$P_{RD} = 200$ W	200	
	Sub Tot	46,395	20,798
9. Contingency and Integration	15% of the above power and mass	6,959	3,120
NO. OF PLATFORMS: 5	TOTALS:	P_o 53,354	M_{PL} 23,918

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 100kB

OTV: 2 STG. OTV, L.T. Expendable

OPER. MODE: B - Non-serivced, 8 yr life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 143 Case: III ($M_{PY} \geq 2200$)	50,840	8,200
2.	Structure - Basic	$M_s = 0.29\ (M_{PY}) + 300 = 2678$ kg	0	2,946
	- Secondary	10% of $M_s = 268$ kg		
	- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3.	EPS	$M_E = 0.055\ (P_o) + 187 = 3749$ kg		3,749
		$P_E = 0.067\ (P_o) + 100 = 4439$ W	4,439	
4.	ACS	$M_A = 0.0228\ (M_{PL}) + 50 = 592$ kg		592
		$P_A = 0.011\ (M_{PL}) + 30 = 292$ W	292	
5.	RCS $M_P = 0.166\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (3948) = 4738$ kg		4,738
	$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 86$ W ($M_{PY} \geq 4400$)	86	
6.	TCC	$M_T = 0.026\ (M_{PY}) + 60 = 273$ kg		273
		$P_T = 0.0195\ (M_{PY}) + 40 = 200$ W	200	
7.	TCS	$M_H = 0.0175\ (M_{PY}) + 40 = 184$ kg		184
		$P_H = 0.0438\ (M_{PY}) + 100 = 459$ W	459	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	56,316	20,682
9.	Contingency and Integration	15% of the above power and mass	8,447	3,102
NO. OF PLATFORMS:	4	TOTALS:	64,763	23,785

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 100kE

OTV: 2 STG. OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 144 Case: III ($M_{PY} \geq 2700$)	50,840	9,225
2. Structure - Basic	$M_S = 0.259\ (M_{PY}) + 300 = 2689$ kg	0	2,958
- Secondary	10% of $M_S = 269$ kg		
- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3. EPS	$M_E = 0.0620\ (P_o) + 210 = 4246$ kg		4,246
	$P_E = 0.067\ (P_o) + 100 = 4461$ W	4,461	
4. ACS	$M_A = 0.0258\ (M_{PL}) + 56 = 652$ kg		652
	$P_A = 0.011\ (M_{PL}) + 30 = 284$ W	284	
5. RCS $M_P = 0.0623\ (M_{PL})$	$M_R = 1.2\ (M_P) = 1.2 \times (1439) = 1727$ kg		1,727
$M_R = M_P + 0.2\ M_P$	$P_R = 0.008\ (M_{PY}) + 20 = 94$ W	94	
6. TCC	$M_T = 0.0262\ (M_{PY}) + 68 = 310$ kg		310
	$P_T = 0.0195\ (M_{PY}) + 40 = 220$ W	220	
7. TCS	$M_H = 0.0175\ (M_{PY}) + 45 = 206$ kg		206
	$P_H = 0.0438\ (M_{PY}) + 100 = 504$ W ($M_{PY} \geq 2600$)	504	
8. Rendezvous and Docking	$M_{RD} = 0.0388\ (M_{PY}) + 400 = 758$ kg		758
	$P_{RD} = 200$ W	200	
	Sub Tot	56,603	20,081
9. Contingency and Integration	15% of the above power and mass	8,490	3,012
		P_o	M_{PL}
NO. OF PLATFORMS: 4	TOTALS:	65,094	23,093