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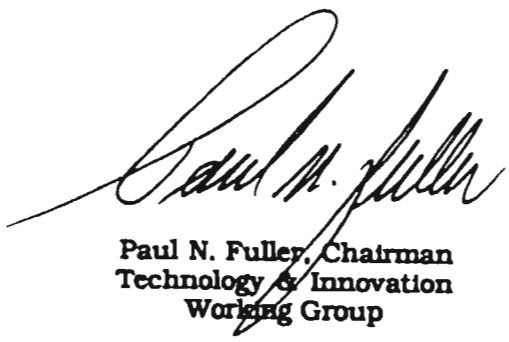
Report of the
COMSTAC Technology & Innovation Working Group

COMMERCIAL SPACECRAFT MISSION MODEL UPDATE

18 MAY 1995



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Technology & Innovation
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Commercial Space Transportation Advisory Committee (COMSTAC)
Office of Commercial Space Transportation
U.S. Department of Transportation

COMMERCIAL SPACECRAFT MISSION MODEL UPDATE
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INTRODUCTION

The U.S. Department of Transportation's Office of Commercial Space Transportation (DoT/OCST) is responsible for promoting, encouraging, and facilitating commercial space launches by the private sector in the United States. An important element of this effort is to establish the commercial space industry's view of future space launch requirements. Since 1993, the DoT/OCST has requested that its industry advisory group, the Commercial Space Transportation Advisory Committee (COMSTAC), prepare and maintain a commercial spacecraft launch demand mission model.

This report presents the 1995 update of the worldwide commercial GTO satellite mission model for the period 1995 through 2010. It is based on market forecasts obtained in early 1995 from major spacecraft manufacturers, launch service organizations, and satellite operators. The mission model has been limited to "addressable" spacecraft for which the launches are open to competitive procurement from U. S. launch service providers. Captive payloads to national flag carriers, which are not open to competitive launch procurements have been excluded from this model. Because of potential multiple manifesting of some payloads in this mission model, the addressable launch services market for the U.S. commercial space transportation industry is a subset of the commercial spacecraft mission mission model presented herein.

DISCUSSION

Background: COMSTAC prepared and issued a commercial mission model in April 1993 as part of a report on commercial space launch system requirements (reference 1). The forecast period for the mission model was from 1992 through 2010. It was prepared by the major launch service providers in the U.S. and was based on contracted and firm payloads for the near future (i.e.. 1-3 years). The out-year projections were based on the assumed replacement of the near-term satellite systems at the end of their design life. Only modest growth in current telecommunications markets and limited new applications were considered.

In February 1994, at the request of the Secretary of Transportation (reference 2), COMSTAC issued an update of the 1993 commercial mission model (reference 3). The forecast period was from 1994 through 2010 and was based on the average of quantitative responses obtained from Hughes Space & Communication Group, Martin Marietta Astro Space, and Space Systems Loral. The projected mission models received were averaged to obtain the best estimate forecast. The 1994 mission model data provided by the spacecraft manufacturers were "smoother" and contained less variation in the year-to-year demand than the earlier 1993 projections. Although it projected a higher overall spacecraft launch demand, averaging 17 payloads per year over the forecast period, some members of the spacecraft manufacturing community believed the mission model to be conservative, underpredicting future satellite demand.

1995 Mission Model Update Approach: Because of the continuing need for up-to-date information on the evolving world market for commercial launch services, the COMSTAC mission model projections have been well received by industry, government agencies, and international organizations. In October 1994, COMSTAC established a subgroup within the Technology and Innovation Working Group to maintain and update the

misson model on a continuing basis (reference 4). Although the COMSTAC represents the interest of the domestic commercial space transportation industry, the special committee undertook efforts to assure participation of the spacecraft manufacturers, and that inputs from satellite services operators also be solicitied.

The Technology & Innovation Working Group met in December 1994 to plan and organize the commercial spacecraft mission model update for 1995. Worldwide commercial launch demand forecast data were requested from the following organizations:

1. Hughes Space and Communications (GM Hughes)
2. Space Systems/Loral
3. Martin Marietta Commercial Launches Services (Lockheed Martin)
4. McDonnell Douglas Aerospace
5. Lockheed Missiles and Space Company (Lockheed Martin)
6. Arianespace
7. AT&T
8. GE Americom
9. Intelsat
10. Martin Marietta Astro Space (Lockheed Martin)
11. TRW
12. Aerospatiale (No response)
13. Matra Marconi Space (No response)

A letter requesting input data was sent over the signature of the Director of the Office of Commercial Space Transportation (reference 5). The letter requested market projection data representing the best forecast of the number of addressable commercial GTO payloads per year for the years 1995 through 2010. "Addressable" payloads were defined as those that were considered open to competitive launch service procurements from U.S., European and other foreign launch providers. Excluded were payloads predetermined to be manifested on national flag launch service providers. Those excluded include government owned payloads such as DoD and NASA spacecraft and similar European, Chinese or other international captive payloads. A table was provided requesting that the payloads be segregated into categories of "small", "medium", "intermediate", and "heavy" based on separated mass/weight inserted into geosynchronous transfer orbit (GTO). Mission identification by specific name would be welcomed, but not required. It was requested that substantive changes from the 1994 mission model projections be identified and explained. Low earth orbit (LEO) and medium earth orbit (MEO) payload mission models could be submitted separately, if desired.

Responses were received from organizations that produce over 90% of the addressable commercial spacecraft and firms that launch over 90% of the commercial payloads manufactured in the United States. In addition to these specific inputs, data from sources such as Euroconsult, the Teal Group, and the DoD Industrial Assessment were considered in arriving at the final projected mission model.

Market Forecast Assumptions: Initial data from the respondents contained sizeable variations in projected launch demand over the entire period of interest. To reconcile the variations, the following procedure was used:

- Historic launch rates for commercial GTO payloads beginning in 1988 were reviewed by name to establish, by example, which particular satellite type, class, or ownership would be included or excluded in the addressable mission model.

- The 1995-1997 (near-term) mission model was identified on a name-by-name basis to establish agreement on the currently manifested mission model, to eliminate double counted payloads, and to confirm the definition of addressable payloads.

- The 1998-2010 (out-year) mission model was established using agreed-to modeling assumptions and guidelines on likely outcomes. This resulted in a high and low range for the out-year projections.

Historical Launch Rates 1988 to 1994: The commercial GTO mission model addresses future launch needs for spacecraft in the 2,000 to 10,000 pound range. This range is divided into four classifications that correspond to the payload launch capability of specific U.S. launch vehicles. These are:

Launch Capability Pounds	Classification	U.S. Launch Vehicle
< 2000	Small	Med Light
2000 - 4000	Medium	Delta Family
4000 - 8000	Intermediate	Atlas Family
8000 - 10000	Heavy	Exceeds Atlas IIAS Capability

The performance ranges shown above are the approximate dividing points for the current U.S. fleet of launch vehicles. In earlier historical periods, the performance capability ranges were lower. For example, the Atlas Family only reached 8,000 pounds of payload (separated weight to GTO) in December 1993. Because this boundary is approximately the upper limit of current U.S. launch vehicle capability, the "Heavy" category represents a class of satellite in which there exists no U.S. commercial launch capability. The owner or manufacturer of Heavy class commercial payloads will be required to go to a foreign launch vehicle.

Some satellites may be able to reduce propellant mass (with a shortening of lifetime) as a means of dropping down into the Atlas IIAS Intermediate class performance range to reduce launch cost. Further, as electric propulsion systems become used for North-South station keeping, launch mass will become less for a given satellite bus, payload mass, and mission lifetime. This may also have the effect of moving certain satellites from the Heavy class into the Intermediate class.

Appendix 1 contains a summary of all launches that occurred between 1988 and 1994 on U.S. commercial launch vehicles, and on launch vehicles competing with the U.S. launch industry. Included are launches on the Titan 3 which provided commercial launch services during a few years of this period. The table is divided into addressable commercial GTO launches, non-addressable launches that utilized the same launch systems, and launches on non-commercial Titan and Shuttle launch systems. These data are provided to demonstrate the categorization of commercial addressable payloads based on recent past experience. Note the exclusion of launches such as France's

Telecom and TDF series of satellites, China's Dong Fong Hang satellites, and the U.S. Navy UHF series. These are examples of captive non-addressable payloads.

Forecast Launch Rates 1995 to 1997: A summary of the near-term mission model is presented in Appendix 2. All launches forecast in the period 1995 through 1997 on U.S. commercial launch vehicles and the launch vehicles competing with the U.S. launch industry are identified. As in Appendix 1 the table is divided into addressable commercial GTO launches and other than commercial launches that utilize the same launch systems. These data are provided to demonstrate the categorization of the near-term market where most procurement decisions have been made and the launch vehicle manifests have been established. Only 18 of 83 expected spacecraft requiring launch during this period have not been placed. Note that even in this near-term period, complete unanimity was not obtained due to differences in opinion on outcomes of "expected" demand for launch services. These included delays, cancellation of orders, double booking, etc. Therefore, Appendix 2 also identifies the ground rules that were adopted to arrive at the forecast presented.

Forecast Launch Rates 1995 to 2010: The forecast payload launch demand (mission model) for the period 1995 to 2010 is shown in Table 1. The forecast is divided into launch demand for small, medium, intermediate and heavy payloads. Two mission models are provided: 1) a "Modest Growth" estimate, and 2) a "Higher Growth" estimate. A plot of the total year-by-year projected launch demand (for all payload mass categories) is shown in Figure 1. The forecast from the 1994 mission model is also shown for comparative purposes.

The "Modest Growth" forecast includes firm contracted missions, current satellite operator's planned missions, current operator's replacement missions, current operator's growth, and growth replacement. The "Higher Growth" forecast includes the above plus "unidentified operator growth". Both estimates include an allowance for attrition (replacement for launch or on-orbit satellite failure). Attrition is based on a 10% failure rate, and assumed to add to the launch demand two years later. With the "Higher Growth" forecast, the population of active satellites in orbit will grow at a rate of approximately 3% per year from 2000 to 2010.

In the 1994 mission model, the out-year projections provided by the spacecraft manufacturers were "smoother" with less variation predicted in the year-to-year demand. The 1995 update of the mission model utilized a more specific, name-by-name, "bottoms-up" approach to identify future launch demand. The results indicate a cyclical demand during the projected period 1995 to 2010 in both the "Modest Growth" and "Higher Growth" forecasts. The relative variation is particularly notable in the "Modest Growth" scenario where demand cycles from a high of 30 payloads per year to a low of 13 payloads per year. The "Higher Growth" forecast predicts swing in launch demand from 44 payloads per year to 22 payloads per year.

The breakdown of the projected mission models by payload size (mass) is shown in Figure 2. In both the "Modest Growth" and "Higher Growth" scenarios, about 70% of the payloads are in the 4,000 lb to 8,000 lb intermediate size payload category. The combined medium and intermediate payload class (2,000 to 8,000 lb) represent nearly 85% of the payload launch demand through the year 2010. These results are similar to results obtained in the 1993 and 1994 mission model projections, and confirm again the high market demand for intermediate payload class launch services.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on the results of this 1995 update of the worldwide commercial GTO mission model:

- The average annual demand for launch of commercial payloads for equatorial, low inclination orbits will likely be between 20 per year ("Modest Growth") and 32 per year ("Higher Growth") in the period 1995 to 2010.

- Demand for GTO launch services will experience a dip from 1998 through 2003 before the cycle in replacement satellite launches occurs.

- Intermediate class (4,000 lb to 8,000 lb to GTO) spacecraft represent about 70% of the commercial mission model through 2010. Medium class (2,000 lb to 4,000 lb to GTO) spacecraft are 14% of the forecast market.

- The heavy class (>8,000 lb to GTO) is not currently addressed by U.S. built launch vehicles. Heavy class payloads represent about 16% of the forecast market.

The update of the mission model indicates a cyclical demand during the projected period 1995 to 2010 in both the "Modest Growth" and "Higher Growth" forecast scenarios. The launch industry may be challenged to maintain its economic health during the low points in the launch demand cycle for its services. A mitigating circumstance could be that the low point of the "Modest Growth" model may coincide with the period of deployment of LEO systems thereby increasing the demand on the U.S. launch fleet.

To maintain a vigorous domestic space transportation infrastructure, the U.S. launch industry must increase its share of the entire commercial launch market. If the low points of the "Modest Growth" model hold true, the need for U.S. market share is even more critical to the vitality of the U.S. commercial launch industry.

The following recommendations are based on the results of this 1995 update of the worldwide commercial GTO mission model:

- The 1995 COMSTAC Mission Model forecast should be provided to appropriate U.S. Government agencies for their use.

- The COMSTAC GTO mission model forecast should continue to be updated on an annual basis.

- The Office of Commercial Space Transportation should update the 1994 LEO Commercial Payload Projection mission model (reference 6).

Finally, it is recommended that the U.S. Department of Transportation and the Administration encourage the continued development and growth of a strong and healthy domestic commercial space launch industry. This can be accomplished by implementation of space transportation policies and programs that support improvements to the competitiveness of the U.S launch industry, and prevent unfair foreign trade practices in the sale of commercial launch services.

REFERENCES:

1. COMSTAC Report, "Commercial Space Launch Systems Requirements - 28 April 1993," Office of Commercial Space Transportation, U.S. Department of Transportation, Washington, D.C.

2. Department of Transportation letter, dated 12/23/93, F. Pena to A. Bondurant

3. COMSTAC Report, "Commercial Space Launch Systems Requirements - February 1994," Office of Commercial Space Transportation, U.S. Department of Transportation, Washington, D.C.

4. Verner, Liifert, Bernhard, McPherson and Hand letter, dated 10/18/94, A. Bondurant to P.N. Fuller

5. Department of Transportation letter, dated 2/16/95, F. Weaver

6. Department of Transportation letter, "LEO Commercial Payload Projections," dated 3/31/94, F. Weaver

Table 1

COMSTAC 1995 Commercial GTO Mission Model Summary

	L/V Class		95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	1995-2010	Average
Modest Growth Model	SLV	<2000 lbs																		
	MLV	2000-4000 lbs	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	49	3.1
	ILV	4000-8000 lbs	14	20	20	15	14	11	8	7	7	15	13	18	16	24	12	12	226	14.1
	HLV	>8000 lbs	5	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	53	3.3
	Total		22	30	26	21	20	17	14	13	13	21	19	24	22	30	18	18	328	20.5

	L/V Class		95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	1995-2010	Average
Higher Growth Model	SLV	<2000 lbs																		
	MLV	2000-4000 lbs	3	4	4	4	4	5	4	5	4	5	4	5	4	5	4	5	69	4.3
	ILV	4000-8000 lbs	14	20	26	28	19	20	16	16	16	24	22	28	25	34	23	23	354	22.1
	HLV	>8000 lbs	5	6	3	5	6	5	6	5	6	5	6	5	6	5	6	5	85	5.3
	Total		22	30	33	37	29	30	26	26	26	34	32	38	35	44	33	33	508	31.8

Notes:

1. SLV Class represents Atlas E, Titan I and small co-passenger (multi-manifest) Ariane LVs
2. MLV Class represents Atlas I, Delta II, small co-passenger Ariane 4 or 5 and H-2, & Long March 3A LVs
3. ILV Class represents Delta III, Atlas IIA-IIAS, Ariane 42P-44P-44LP, co-passenger Ariane 5, H-2, and Long March 3C LVs
4. HLV Class represents Ariane 4 & 5, Proton, and Long March 3B LV's
5. Model includes only addressable launch services market
6. Multiple manifesting will lower the number of launches. Slightly less than 50% of all Arianespace launches are dual
7. Attrition is based on a 10% failure rate (launch and on-orbit spacecraft failure) with a replacement launch in 2 years

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Figure 1

1995 COMSTAC Mission Model

(2,000-10,000 lbs to GTO)

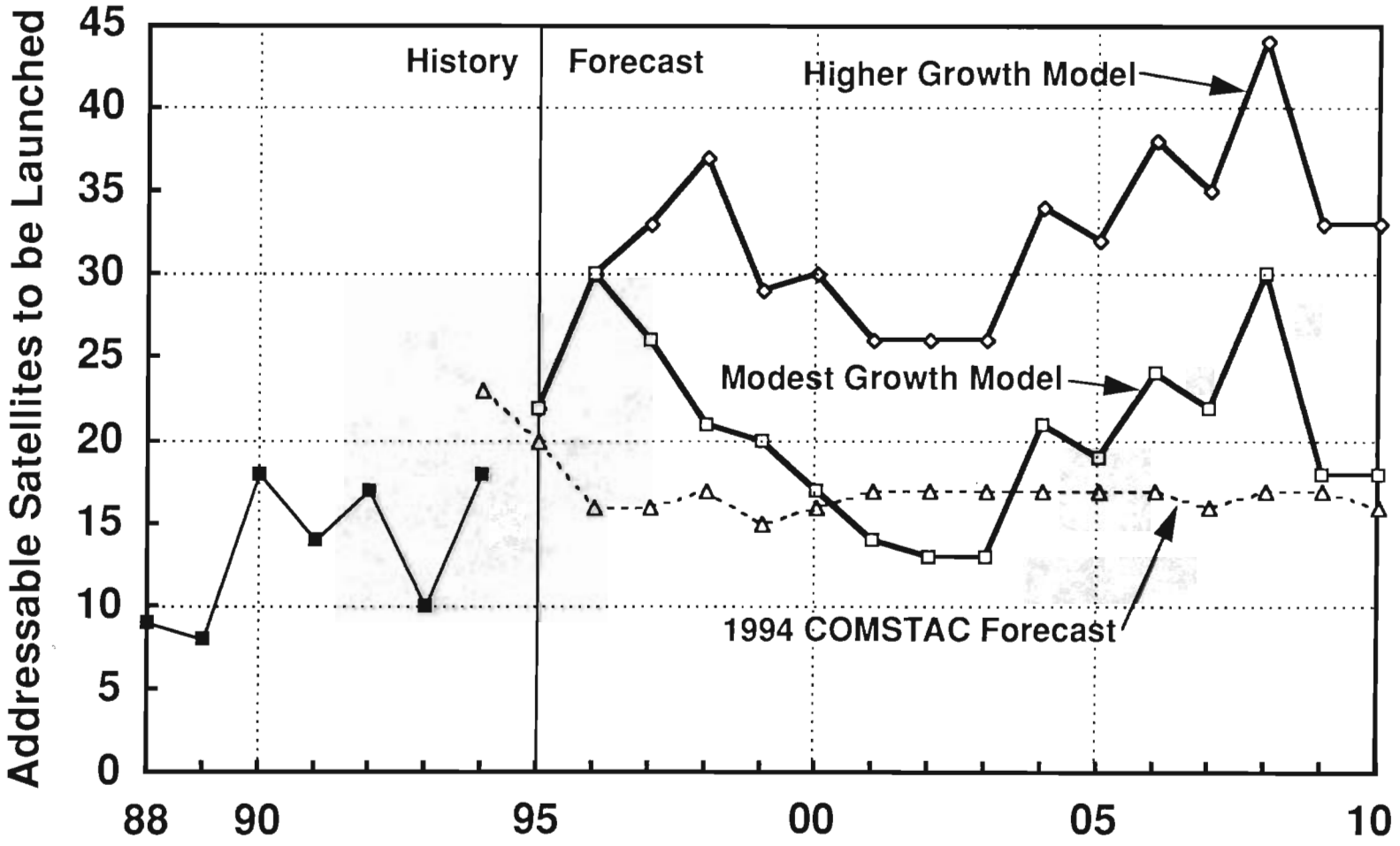

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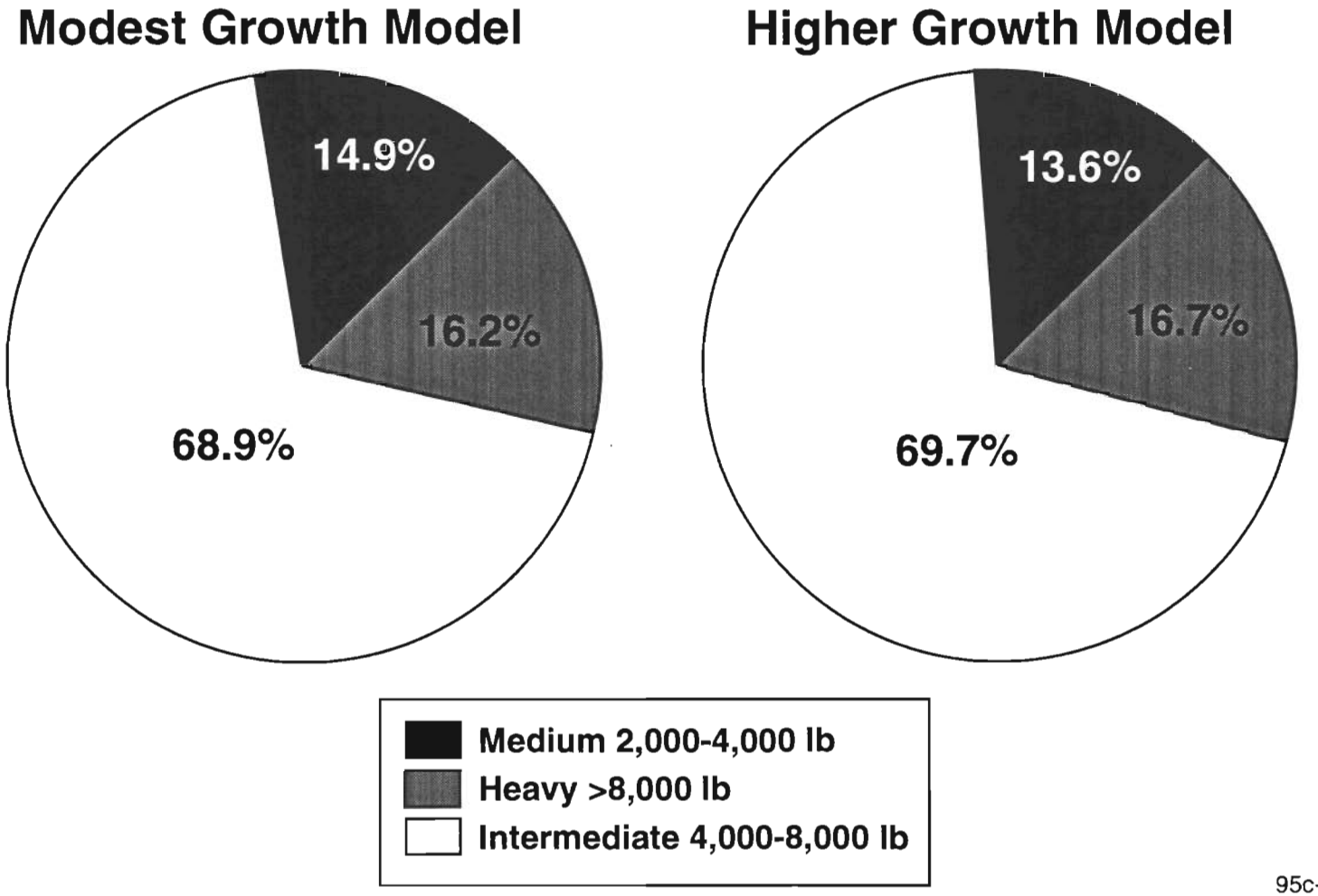
Figure 2

Payload Mass Distribution for Satellites to be Launched From 1995-2010



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REPORT OF THE
COMSTAC TECHNOLOGY & INNOVATION WORKING GROUP

COMMERCIAL-SPACECRAFT MISSION MODEL UPDATE

MAY 1995

Appendix 1
1995 Mission Model - History

Commercial Space Transportation Advisory Committee (COMSTAC)
Office of Commercial Space Transportation
U.S. Department of Transportation

Appendix 1:COMSTAC 1995 Mission Model - History

Commercial GTO Mission Model

	1988	1989	1990	1991	1992	1993	1994	TOTAL	Average Rate
TOTAL =	9	8	18	14	17	10	18	94	13.4
Arianespace	9	7	9	8	9	8	12	62	8.9
HLV		Intelsat 602	Comsat-SBS 6	Intelsat 601	Hughes-Galaxy 7	Hughes-DBS 1	Intelsat 702		
		JSSI-JCSat1	SCC-Superbird B	Intelsat 605	SCC-Superbird B1	Hughes-Galaxy 4			
		SCC-Superbird A		SES-Astra 1B	SCC-Superbird A1	Intelsat 701			
				Telesat-Anik E1		SES-Astra 1C			
				Telesat-Anik E2		Solidaridad 1			
ILV	Intelsat 513A	DBP-TVSat 2	Eutelsat-II F1	Eutelsat-II F2	Eutelsat-II F4	India-Insat 2B	AT&T-Telstar 402		
	SES Astra 1	Intelsat 515A		Italy-Italsat 1	India-Insat 2A	Spain-Hispasat 1B	Brazilsat B1		
		SSC-Tele-X			Spain-Hispasat 1A		Eutelsat-II F5		
							Panamsat 2		
							Panamsat 3		
							SES-Astra 1D		
							Solidaridad 2		
							Turksat 1A		
							Turksat 1B		
MLV	Comsat-SBS 5	DBP-DFS 1	DBP-DFS 2	Inmarsat 2 F3	GE-Satcom C3	Thaicom 1	Thaicom 2		
	Eutelsat-I F5		GE-Satcom C1		Arabsat 1C		Japan-NHK-BS 3N		
	GTE-GStar 3		GTE-GStar 4		Inmarsat 2 F4				
	GTE-Spacenet 3R		Hughes-Galaxy 6						
	India-Insat 1C		Nasda-BS 2X						
	Panamsat 1		UK-Skynet 4C						
	UK-Skynet 4B								
Atlas	0	0	0	2	3	1	3	9	1.3
HLV							Intelsat 703		
ILV				Eutelsat-II F3	Intelsat K1	AT&T-Telstar 401	Hughes-DBS 2		
							Orion 1		
MLV				Japan-NHK-BS 3H	Hughes-Galaxy 1R				
					Hughes-Galaxy 5				
Delta	0	1	4	4	3	1	1	14	2.0
MLV		BSB-Marcopolo 1	BSB-Marcopolo 2	GE -Satcom(Aurora) C5	DBP-DFS 3	NATO 4B	Hughes-Galaxy1R-2		
			India-Insat 1D	GTE-Spacenet (ACS 2)	GE-Satcom C4				
			Indonesia-Palapa B03	Inmarsat 2 F2	Indonesia-Palapa B4				
			Inmarsat 2 F1	NATO 4A					
Titan 3	0	0	4	0	0	0	0	4	0.6
HLV			Intelsat 603						
			Intelsat 604						
ILV			Japan-JCSat 2						
MLV			UK-Skynet 4A						
Long March	0	0	1	0	2	0	2	5	0.7
ILV					Optus B1		Optus B3		
					Optus B2				
MLV			Asiasat 1				APStar 1		

Appendix 1:COMSTAC 1995 Mission Model - History

Not Included in Commercial GTO Mission Model - Utilized Commercial Launch Service Vehicles

	1988	1989	1990	1991	1992	1993	1994	TOTAL	Average Rate
TOTAL =	11	13	15	8	14	14	10	85	12.1
Ariane	ESA-Meteosat 3 France-TDF 1 France-Telecom 1C	ESA-Olympus 1 ESA-Hipparcos ESA-Meteosat 4	France-Spot 2 France-TDF 2	ESA-ERS 1 ESA-Meteosat 5 France-Telecom 2A	France-Telecom 2B NASA-TOPEX	Eumetsat-Meteosat 6 France-Spot 3			
Atlas	NOAA 11 USAF-DMSP F09	USN-Fltsatcom 8	NASA/AF-CRESS USAF-DMSP F10 USAF-Stacksat	USAF-DMSP F11 NOAA 12	USAF-DSCS 3 B01 USAF-DSCS 3 B02	NOAA 13 USAF-DSCS 3-03 USAF-DSCS 3-04 USN-UHF F01 USN-UHF F02	NOAA 14 NOAA-Goes 8 USAF-DMSP F12 USN-UHF F03		
Delta	USAF-DM43-ThrustVecE	GPS-Navstar II-01 GPS-Navstar II-02 GPS-Navstar II-03 GPS-Navstar II-04 GPS-Navstar II-05 USAF-CosBkgndExp USAF-Delta Star	Germany-Rosat-X Ray GPS-Navstar II-06 GPS-Navstar II-07 GPS-Navstar II-08 GPS-Navstar II-09 GPS-Navstar II-10 USAF-RelayMirrorExp	GPS-Navstar II-11	GPS-Navstar II-12 GPS-Navstar II-13 GPS-Navstar II-14 GPS-Navstar II-15 GPS-Navstar II-16 GPS-Navstar II-17 Japan-Geotail NASA-EUVE	GPS 2-Block 2-01 GPS 2-Block 2-02 GPS 2-Block 2-03 GPS 2-Block 2-04 GPS 2-Block 2-05 GPS-Navstar II-18	GPS 2-Block 2-06 NASA-Wind		
Titan II	USAF-Titan 2	USAF-Titan 2			USAF-Titan 2	NASA-Landsat 6	NASA-Clementine		
Japan	Japan-CS-3A Japan-CS-3B	Japan-GMS 4	Japan-BS-3A Japan-MOS 1B	Japan-BS-3B	Japan-JERS		Japan-ETS-6		
Proton - (Western Use Only)							Rimsat-Express		
Long March	Dong Fang Hong 201 Dong Fang Hong 202		Dong Fang Hong 203	Dong Fang Hong 204			Dong Fang Hong 301		

Appendix 1:COMSTAC 1995 Mission Model - History

Not Included in Commercial GTO Mission Model - Did Not Utilized Commercial Launch Service Vehicles

	1988	1989	1990	1991	1992	1993	1994	TOTAL	Average Rate
TOTAL =	4	9	8	7	7	3	4	42	6.0
Shuttle	DoD NASA-TDRS C	DoD DoD NASA-Galileo NASA-Magellan NASA-TDRS D	DoD DoD NASA-Astro 1 NASA-Hubble NASA-Ulysses USN-Syncom IV-5	DoD NASA-GRO NASA-TDRS E NASA-UARS SDIO-	ESA-Eureka NASA-Lageos-II NASA-TSS DoD Intelsat 603 Reboost	NASA-ACTS NASA-TDRS F			
Titan III & IV	USAF-Titan 34D USAF-Titan 34D	USAF-Titan 34D USAF-DSCS II-16 USAF-DSCS III-4 USAF-DSP-14	USAF-Titan 4 USAF-DSP-15	USAF-Titan 4 USAF-Titan 4	NASA-Mars Observer USAF-Titan 4	USAF-Titan 4	USAF-Milstar DFS-1 USAF-DSP 16 USAF-Titan 4 USAF-Titan 4		

Legend: Spacecraft failed to reach operating status as planned

Spacecraft partially failed after achieving operating status

TOTAL SPACECRAFT LAUNCHED=	24	30	41	29	38	27	32	221	31.6
FAILURES	2	2	3	2	3	3	5	20	2.9
	8.3%	6.7%	7.3%	6.9%	7.9%	11.1%	15.6%	9.0%	9.0%

REPORT OF THE
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COMMERCIAL- SPACECRAFT MISSION MODEL UPDATE

MAY 1995

Appendix 2
1995 Mission Model - Near Term

Commercial Space Transportation Advisory Committee (COMSTAC)
Office of Commercial Space Transportation
U.S. Department of Transportation

1995 Mission Model - Near Term

This Appendix contains a summary of the near-term mission model. All launches forecast in the period 1995 through 1997 on U.S. commercial launch vehicles and the launch vehicles competing with the U.S. launch industry are identified. The table is divided into addressable commercial GTO launches and other non-commercial launches that utilize the same launch systems. These data are provided to demonstrate the categorization of the near-term market where most procurement decisions have been made and the launch vehicle manifests have been established. Only 18 of 83 expected spacecraft requiring launch during this period have not been placed. Note that even in this near term period, complete unanimity was not obtained due to differences in opinion on outcomes of "expected" demand for launch services. These included delays, cancellation of orders, double booking, etc. The following ground rules (listed in order of priority) were adopted to establish the near-term mission model presented.

- Published manifests of the launch service providers were used unless a failure event or other recognizable event has caused a delay.

- Where manifests do not exist or where an event which caused a delay has occurred, the subgroup relied on the data source from the subgroup that had the most likely superior knowledge. For example, the McDonnell Douglas representative could modify the published manifest data for the Delta II, or a spacecraft manufacturer with knowledge of launch dates for the now delayed Arianespace manifest could modify the published Arianespace manifest and the subgroup would accept the result.

- Where the spacecraft has been ordered, but the launch company has not been selected, the date the operator contracted for satellite launch readiness was used.

- Plans of existing satellite service operators were used as available.

- Plans of new or potential operators (i.e. growth in demand) were subject to the judgement of the individual subgroup members. It is this factor that led to the small differences in the 1997 forecast, and is the basis for most of the post 1997 (out-year) differences in forecast payload launch demand. The divergence of opinion on the magnitude of the growth in demand was so great that an upper and lower estimate for projected launch demand was required to obtain consensus.

The above approach does not reflect the subgroup member's view on the realistic basis of the launch providers planning, but merely an acceptance that the plan is as close to the operators demand that they can achieve.

Appendix 2 : COMSTAC 1995 Mission Model - Near Term

Commercial GTO Mission Model

		1995	1996	1997	TOTAL	Average Rate
TOTAL =		22	30	31	83	27.7
Arianespace		11	14	9	34	11.3
	HLV	Intelsat 706A Japan-NStar CS-4A	Intelsat 707A Intelsat 709 Intelsat 802 Intelsat 803 Japan-NStar CS 4B	Intelsat 804 Intelsat 806		
	ILV	AT&T-Telstar 402R Brazilsat B2 Eutelsat-II F6-Hotbird 1 Hughes-DBS 3 Insat 2C Panamsat 3R Panamsat 4 SES-Astra 1E	Arabsat 2A GE-Satcom GE2 Indonesia-Palapa C2 Inmarsat 3 F1 Italsat 2 Panamsat DTH 6 TMI-MSat M1 Turksat 1C	Arabsat 2B Eutelsat-Hotbird 3 Inmarsat 3 F5 Insat 2D Loral-Sat CD Radio 1		
	MLV	Malaysia-MeaSat 1	Israel-Amos 1	Brazilsat B3 Japan-BSat 1		
Atlas		5	6	1	12	4.0
	HLV	Intelsat 704 Intelsat 705				
	ILV	AMSC-MSat M2 Hughes-Galaxy 3R Japan-JSat 3	Eutelsat-Hotbird 2 GE-PrimeStar Tempo Sat 2 GE-Satcom GE1 Indonesia-Palapa C1 Inmarsat 3 F2 Inmarsat 3 F3	Japan-JSat 4		
	MLV					
Delta		2	1	1	4	1.3
	MLV	KoreaSat 1 KoreaSat 2	Hughes-Galaxy 9	UK-Skynet 4D		
Long March		4	4	2	10	3.3
	HLV	Intelsat 708A	Intelsat 801	Intelsat 805		
	ILV	China-APStar 2 China-Asiasat F2 Echo Star 1	Echo Star 2 Argentina-Nahuel 3	US-Echo Star3		
	MLV		China-APStar 1A			
Proton		0	3	2	5	1.7
	HLV					
	ILV		GE-PrimeStar Tempo Sat 1 Inmarsat 3 F4 SES-Astra 1F	Panamsat 5 SES-Astra 1G		
	MLV					
TBD		0	2	16	18	6.0
	HLV					
	ILV		Thaicom 3	ASCom AT&T-Telstar 5 China-APStar 3 China-Asiasat 3 GE-Satcom GE3 Hughes-DBS 4 Hughes-Galaxy 10 Hughes-Galaxy 8I Japan-SCC-Superbird C Nilesat Philippine-Mabuhaysat 1 Sweden-Sirius Germany-Europe Star 1 Insat 2E Norway-Thor 3	
	MLV		Malaysia-MeaSat 2	Indonesia-Indostar 1		

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Appendix 2 : COMSTAC 1995 Mission Model - Near Term

Not Included in Commercial GTO Mission Model

	1995	1996	1997	TOTAL	Average Rate
TOTAL =	19	17	29	65	21.7

Ariane

1995	1996	1997
ESA-ERS 2	ESA-Artemis 1	France-Spot 4
ESA-European Cluster	Eumetsat-Meteosat(MOP 4) 7	France-Telecom 2D
ESA-ISO		
France-Helios 1		
France-Telecom 2C		

Atlas

1995	1996	1997
ESA-SOHO	ESA-SAX-Astronomy	US-AF-DSCS 3-06
US-AF-DSCS 3-05	US-AF-Call UP MLV-7	US-N-UHF/EHF F08
US-N-UHF/EHF F04	US-N-UHF/EHF F07	US-N-UHF/EHF F09
US-N-UHF/EHF F05		US-N-UHF/EHF F10
US-N-UHF/EHF F06		
US-NASA/NOAA-Goes J		

Delta

1995	1996	1997
Canada-Radarsat	Iridium - 5	GlobalStar - 04
US-AF-MidcourseSpace Exp	Iridium - 5	Iridium - 5
US-GPS 2-Block 2-07	US-AF-Argos P91	Iridium - 5
US-GPS 2-Block 2-08	US-GPS 2-Block 2-09	Iridium - 5
US-NASA-Polar	US-GPS 2-Block 2-10	Iridium - 5
US-NASA-XTE	US-GPS 3-01	Iridium - 5
	US-GPS 3-02	Iridium - 5
	US-NASA-MESUR Pathfinder	US-AF-GPS 3-03
	US-NASA-MGS	US-AF-GPS 3-04
	US-NASA-Near	US-AF-GPS 3-05
		US-AF-GPS 3-06
		US-NASA-ACE

Japan

1995	1996	1997
Japan-GMS	Japan-ADEOS	Japan-Comets
Japan-SFU		Japan-TRMM
		Japan-ETS-7

Long March

1995	1996	1997
	Chinasat-Dongfanghong 302	Brazil-CBERS 1
		China-Fengyun 2A
		Chinasat-Dongfanghong 303

Proton

1995	1996	1997
		Iridium - 7
		Iridium - 7
		Iridium - 7

TBD

1995	1996	1997
		GlobalStar - 04
		GlobalStar - 08

Note: 1. LEO/MEO Missions count multiple spacecraft as single requirement missions.

2. Indicate LEO or MEO Mission

Legend: Spacecraft not included in lower growth industry model

	1995	1996	1997	TOTAL	Average Rate
TOTAL SPACECRAFT LAUNCHED=	41	47	60	148	49.3

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