


Report of the
COMSTAC Technology & Innovation Working Group

COMMERCIAL SPACECRAFT MISSION MODEL UPDATE

FEBRUARY 1994



Paul N. Fuller, Chairman
Technology & Innovation
Working Group

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

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INTRODUCTION

The Administration is undertaking a comprehensive review of space transportation to establish space launch policy and recommend an investment strategy to meet future space transportation needs. An important element of this effort is the commercial space industry's view of future space launch requirements.

Transportation Secretary Federico Pena (reference 1) has asked the Commercial Space Transportation Advisory Committee (COMSTAC) to update its April 1993 report "*Commercial Space Launch System Requirements*" (reference 2). In particular, an update of the commercial space transportation mission model was requested to support the work of the Office of Science and Technology Policy (OSTP) in its policy and budget deliberations.

This report presents an updated worldwide commercial satellite mission model for the period 1994 through 2010. It is based on the worldwide market forecasts obtained from the major U.S. commercial spacecraft and satellite manufacturers in early 1994. Since certain payloads in the model will be launched on specified foreign launch vehicles, and because of multiple manifesting of some payloads, the addressable launch services market for the U.S. commercial space transportation industry is a subset of this model.

DISCUSSION

COMSTAC prepared and issued a commercial mission model in April 1993 as part of a report on commercial space launch system requirements. The forecast period for the mission model was from 1992 through 2010. It 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 existing and firm near-term satellite systems at the end of their design life. Little or no growth in current telecommunications markets or new applications was considered.

These assumptions were conservative, and may have underestimated future launch service demand. Therefore, an update of the mission model was undertaken to establish a current, more comprehensive forecast of future worldwide commercial payloads and launch needs.

Mission Model Update Approach: In order to update the commercial mission model, the major domestic producers of commercial spacecraft and satellites were contacted and requested to share their best estimates of the commercial payload market for the period 1994 through the year 2010. The proprietary nature of much of the data, and the competitive sensitivity of identifying specific missions was recognized. Therefore, only annual totals were requested, without specific names to protect proprietary marketing information.

The commercial mission model data were requested from the following U.S. manufacturers of spacecraft and satellites:

- Hughes Space & Communications Company
- Martin Marietta Astro Space
- Space Systems Loral
- TRW Space and Electronics Group
- Lockheed Missiles & Space Corporation

Mission model forecast data were requested in early December 1993 and obtained from spacecraft manufacturers in mid-January 1994. The following organizations provided quantitative responses: Hughes Space & Communications Group, Martin Marietta Astro

Space, and Space Systems Loral. These firms manufacture over 90% of the U.S. satellites and spacecraft with commercial applications.

Market Forecast Assumptions: Commercial spacecraft today are almost exclusively geosynchronous earth orbit (GEO) telecommunications satellites for voice, video, and digital data. Other business sectors may develop in the future such as commercial navigation, earth resources, remote sensing, materials processing, and perhaps weather. Promising forecasts have been made regarding commercialization of these areas for many years, but have yet to be demonstrated and are not included in this forecast.

Similarly, a significant small commercial satellite market is emerging in the mobile cellular communications area that may impact the demand for launch services. Five or six competing systems (collectively known as LEO comsats) have been proposed for launch in the mid to late 1990's. Each of these systems propose to launch significant numbers of satellites, ranging from ten to more than 100. Clearly, not all of the competitors will survive and enter the marketplace. Projections of real demand are nebulous, and the level of uncertainty makes any credible projection impossible. Therefore, LEO comsats have not been included in this forecast.

The updated mission model represents a forecast of worldwide commercial spacecraft demand as of early 1994. Only commercial payloads open to international competition are included. Excluded from this mission model are government (military, civil, and science) satellites of the United States, Europe, Russia, and Asian nations. Each payload in the mission model represents a potential business opportunity for the commercial spacecraft provider.

The following assumptions were used by the respondents in their mission model forecasts:

- The commercial mission model will continue to be dominated by telecommunication satellites, generally in geosynchronous earth orbit (GEO).
- Data are provided for individual payloads. Certain of these payloads may be combined for dual or multiple manifesting, but the mission model does not attempt to define which will be so treated.
- The estimates for years 1994 through 1996 are generally data derived from launch service provider's manifests, which have a 3-year (or less) planning horizon for launch date commitments.
- Firm payload market forecasts and strategic planning horizons do not normally extend beyond 5 years. Estimates for the out-years, late-1990's through 2010, are "best estimates" of what each organization feels will be the demand for satellites.
- The market forecasts include consideration of the following: a) replacement of existing capability, b) lengthening of the on-orbit life of recent generations of spacecraft, c) the expansion of existing telecommunications technologies into new geographic markets, and d) the growth of telecommunications technologies into new areas.

Results of Mission Model Update: The mission model projections received were averaged to obtain the best estimate forecast shown in Table 1*. The corresponding April 1993 mission model of reference 2 is shown in Figure 1. A comparison of the April 1993 and the updated February 1994 mission model is shown Figure 2. Note that the current mission model is

- Table 1 represents the number of GTO satellites that are expected to be launched. The number of launches required will be somewhat lower because some launches will carry multiple payloads. Slightly more than 50% of all Ariane launches to date have carried two payloads. For example, if one assumes Ariane captures 55% of the market and half of the launches carry dual satellites, a year in which 17 satellites are anticipated will require 14 launches.

"smoother" and contains less variation in the year-to-year demand. It also projects a higher overall number of missions over the forecast period, averaging 17 payloads per year.

Figures 3 and 4 provide breakdowns of the projected mission model by payload size (mass). The relative proportions of the payload size distribution are nearly constant over the forecast period. Nearly 65% of the payloads are in the intermediate 4,000 lb to 8,000 lb (GTO) mass category. The medium 2,000 lb to 4,000 lb (GTO) lb mass category represents about 30% of the projected payloads.

The payload forecast represent potential satellite (and launch service) opportunities for commercial customers worldwide. Certain of these "commercial" payloads will be launched on specified foreign launch systems because of pre-existing agreements or competitive restrictions (e.g. European satellites launched on the Ariane ELVs, Japanese satellites launched on the H-II, and Russian and Chinese satellites launched on Protons or Long March vehicles). Therefore, the launch service *addressable* market is a subset of this mission model. Studies conducted by the COMSTAC International Competition Working Group indicates that the market leader, Arianespace, will capture 50% - 60% of the addressable world market over the forecast period. That leaves less than half of the launch services market as addressable for all other competitors.

The commercial launch segment is a growing portion of the market for space transportation. It is important for the health of the U.S. space transportation industry to capture a larger portion of this growing market in future years. To accomplish this the domestic space launch industry must improve its competitive position by product improvements to the current ELV fleet, while pursuing development of a new launch system designed from the outset for low cost.

CONCLUSIONS

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

- The average number of commercial payloads for equatorial, low-inclination orbits is 17 per year through the forecast period. Because of multiple manifesting, the annual number of launches forecast will be lower.
- Intermediate weight (4,000 lb to 8,000 lb GTO) spacecraft will represent nearly 65% of the commercial mission model through 2010. Medium weight (2,000 lb to 4,000 lb GTO) satellites are almost 30% of the forecast market demand.
- If Arianespace continues its historic capture rate, launches of less than 50% of the projected commercial payloads are available for U.S. industry to divide with the rest of the world.

The update of the mission model indicates a stable commercial payload demand, and illustrates the importance of the commercial satellite market for launch services. To maintain a vigorous space transportation system, the U.S. launch industry must increase its share of this market. U.S. space transportation policy should encourage the continued development and growth of the domestic commercial space launch industry by:

- Promoting an aggressive product improvement program for the existing ELV fleet, while seeking
- U.S. Government backing and support for the development of a new, low-cost launch system that includes a commercially adaptable launch vehicle in the 20,000 lb LEO (8,000 lb GTO) payload class.

Further, Administration space transportation policies should support improvements to the competitiveness of the U.S. launch industry, and prevent unfair foreign trade practices in the sale of commercial launch services.

Finally, the demand for commercial spacecraft and launch services will change as new applications and markets develop, and in response to changes in the business and government regulatory environments. The Department of Transportation and COMSTAC will continue to monitor commercial space launch demand and update its mission models as the market evolves. Special attention will be given to the small commercial satellite market.

References:

1. Dept. of Transportation letter dated 12/23/93, F. Pena to A. Bondurant
2. COMSTAC Report, "Commercial Space Launch System Requirements - 28 April 1993", Office of Commercial Space Transportation, U.S. Department of Transportation.

DOT COMMERCIAL SPACECRAFT MISSION MODEL SUMMARY February 1994

Destination	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
L/V CLASS	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SLV																	
MLV	7	2	3	4	5	4	5	5	5	6	6	5	5	5	5	5	5
ILV	16	12	12	11	11	10	10	11	11	10	10	11	11	10	11	11	10
HLV	0	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL	23	20	16	16	17	15	16	17	17	17	17	17	17	16	17	17	16

Notes:

1. SLV Class represents Titan-2, Atlas-E, and small Ariane LVs (up to 2000 lb GTO)
2. MLV Class represents Delta-2, Atlas-1, and small Ariane-4 LVs (from 2000 to 4000 lb GTO)
3. ILV Class represents Atlas-2A, Ariane-4, and H-2 LVs (from 4000 to 8000 lb GTO)
4. HLV Class represents Titan-3/4 and Ariane 5-LVs (>8000 lb GTO)
5. The addressable launch services market is a subset of this model
6. Multiple manifesting will lower the number of launches. Slightly more than 50% of all Ariane launches to date have carried two payloads. For example, if one assumes Ariane captures 55% of the market and half of the launches carry dual satellites, a year in which 17 satellites are anticipated will require 14 launches.

Table 1

DOT COMMERCIAL SPACECRAFT MISSION MODEL

APRIL 1993

Equatorial - Low Inclination Orbits

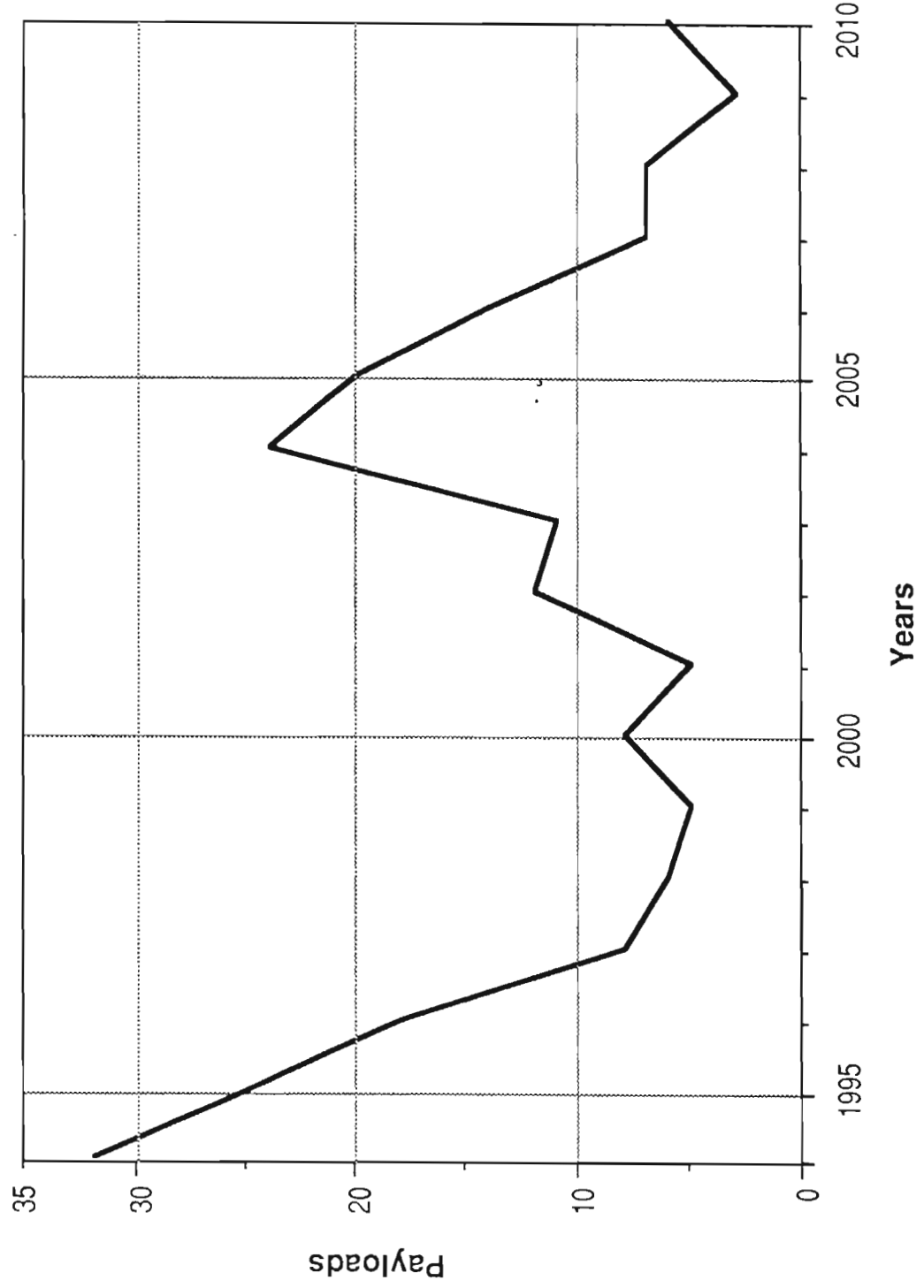


Figure 1

DOT COMMERCIAL SPACECRAFT MISSION MODEL COMPARISON

Equatorial - Low Inclination Orbits

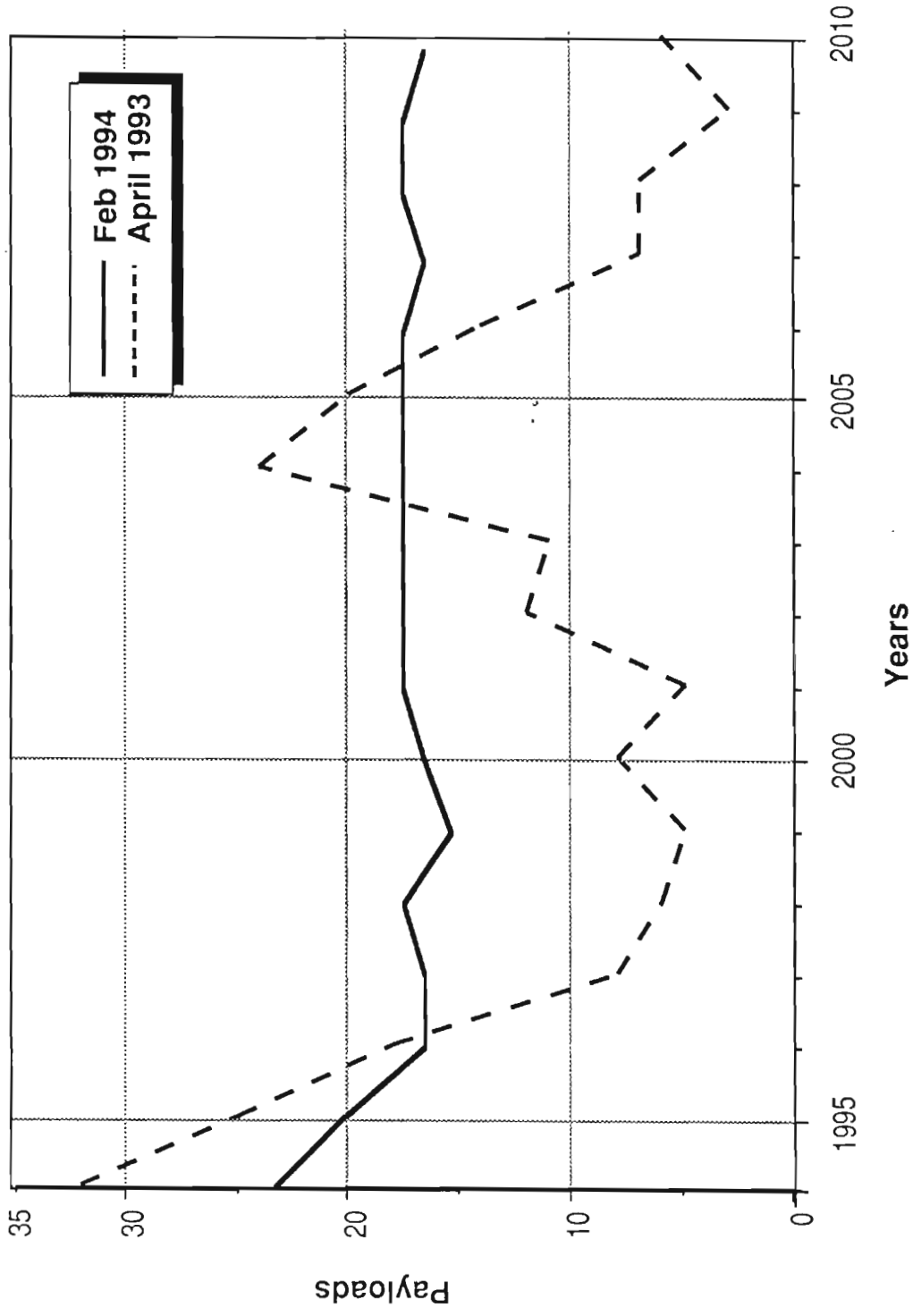


Figure 2

DOT COMMERCIAL SPACECRAFT MISSION MODEL PAYLOAD SIZE DISTRIBUTION

Equatorial - Low Inclination Orbits
February 1994

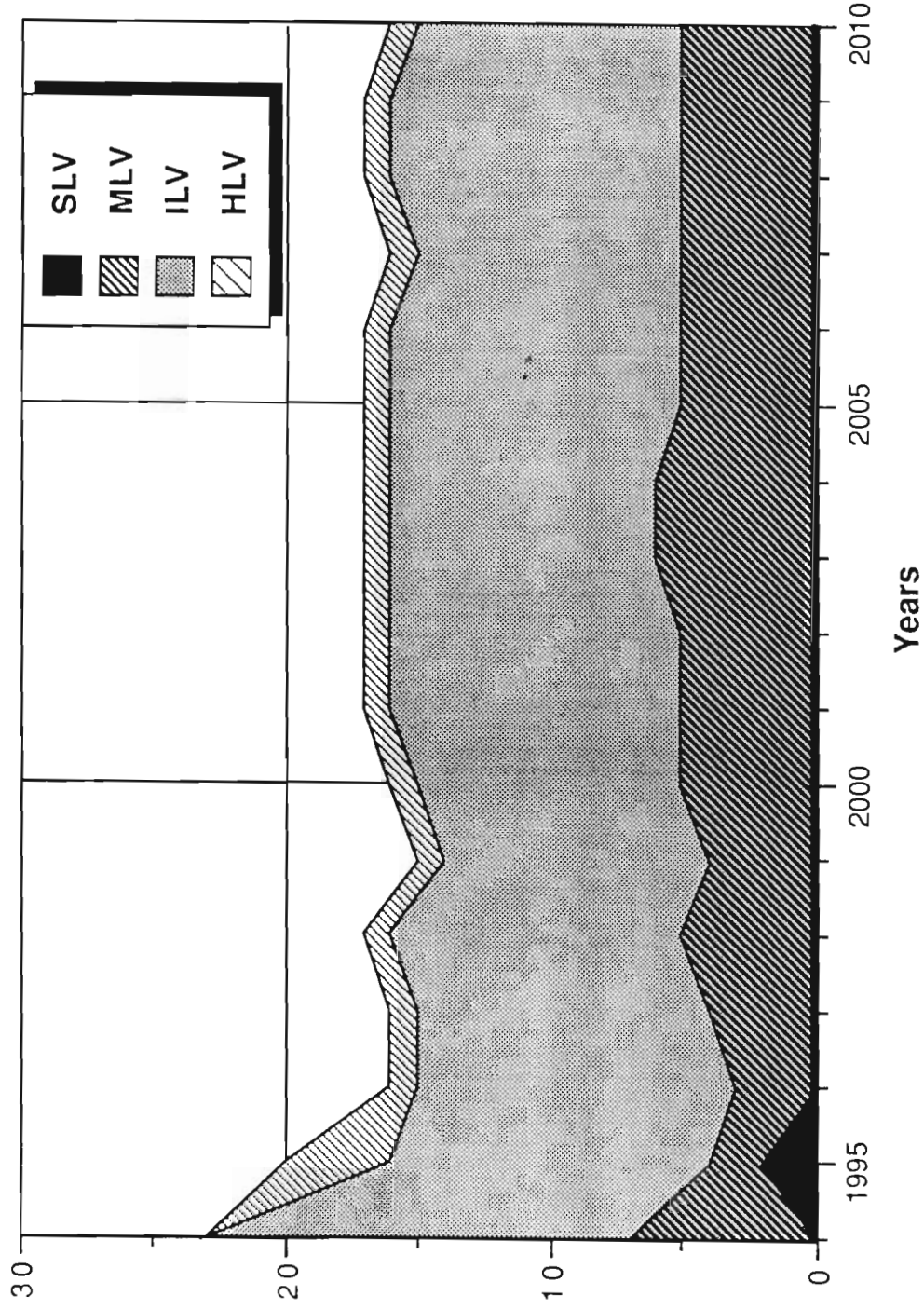
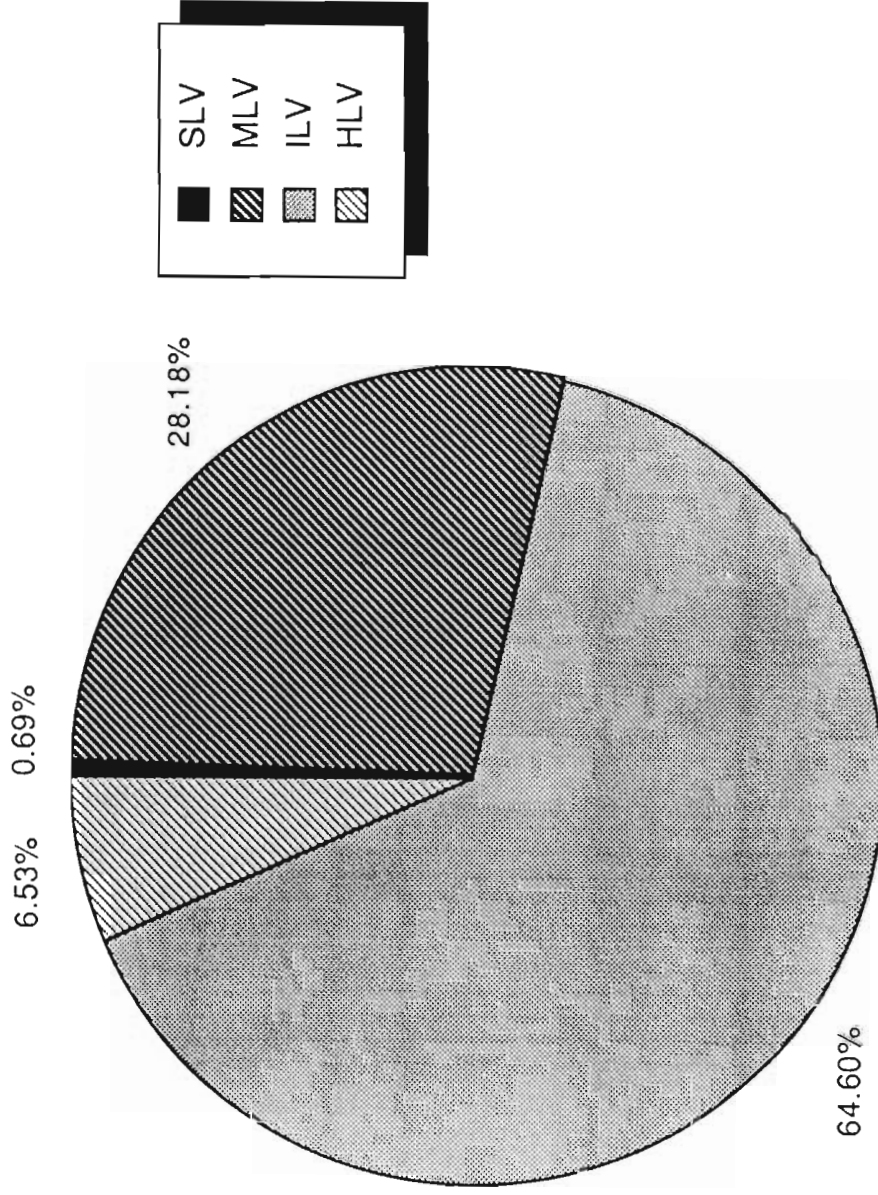


Figure 3

DOT COMMERCIAL SPACECRAFT MISSION MODEL PAYLOAD SIZE DISTRIBUTION

Equatorial - Low Inclination Orbits
February 1994



1994 - 2010

Figure 4