2009 GSO Section

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COMSTAC 2009 COMMERCIAL GEOSYNCHRONOUS ORBIT (GSO) LAUNCH DEMAND FORECAST

EXECUTIVE SUMMARY

This report was compiled by the Commercial Space Transportation Advisory Committee (COMSTAC) for the Office of Commercial Space Transportation of the Federal Aviation Administration (FAA/AST). The *2009 Commercial Geosynchronous Orbit (GSO) Launch Demand Forecast* is the 17th annual forecast of the global demand for commercial GSO satellites and launches addressable to the U.S. commercial space launch industry. The forecast extends 10 years and provides more specific detail for the near-term three years. It is intended to assist FAA/AST in its planning for licensing and efforts to foster a healthy commercial space launch capability in the United States.

The commercial forecast is updated annually, and is prepared using the inputs from commercial companies across the operator, satellite, and launch industries. Both a satellite and a launch demand forecast are included in this report; the satellite demand is a forecast of the number of GSO satellites that satellite operators intend to have launched, and launch demand is determined by adjusting satellite demand by the number of satellites projected to be launched together, referred to in the report as a "dual-manifest" launch. This forecast includes only commercial satellite launches addressable to the U.S. space launch industry. Addressable is defined as launch service procurements open to international competition.

The 2009 Commercial GSO Launch Demand Forecast for 2009 through 2018 is shown in Figure 5. Table 2 provides the corresponding values of forecasted satellites to be launched, the estimated number of dual-manifested launches, and the resulting number of projected launches for each year. This year's data shows a slightly decreased demand from the two previous forecasts.

The 2009 forecast predicts an average demand for 20.8 satellites to be launched annually in the ten-year time frame from 2009 through 2018. The associated launch demand for the same period is 15.7 launches per year. This year's average satellite demand represents a slight decrease from the previous two COMSTAC GSO forecasts. An average of 21.8 satellites launched per year was forecast in 2008 and 21.0 satellites launched per year in 2007. The launch demand of 15.7 in 2009 is a decrease from 16.2 in 2008. The near-term forecast, which is based on specific existing and anticipated satellite programs for 2009 through 2011, shows demand for 21 launches in 2009, 16 in 2010, and 17 in 2011. Last year's forecast predicted 23 launches in 2009, 18 in 2010, and 16 in 2011.

It is important to distinguish between forecasted demand and the actual number of satellites that are actually launched. Space related projects, like most high-technology projects, are susceptible to delays, which tend to make the forecasted demand an upper limit of the number of satellites that might actually be launched. To attempt to account for these differences, a "launch realization factor" has been devised. This factor is based on historical data of actual satellites launched versus predicted satellite demand from previous commercial GSO forecasts. This factor has been applied to the near-term forecast in order to provide an idea of the actual number of satellites that may reasonably be expected to be launched. For example, while the demand forecast for satellites to be launched in 2009 is 27, the realization factor discounts this to a range of between 18 and 23.

Over the 17 years this report has been published, predicted demand in the first year of the forecast period has consistently exceeded the actual number of satellites launched in that year. Since the launch realization factor was added to the COMSTAC GSO Demand Forecast in 2002, the actual number of satellites launched has generally fallen within the discounted realization range.

In 2008, 23 commercial GSO satellites were launched, an increase of 5 from the 18 commercial satellites launched in 2007. The 2008 forecast had projected the 2008 satellite demand for 27 launches, with a launch realization range of 18 to 22.

Many factors impact the demand for commercial GSO satellites, including terrestrial infrastructure, global economic conditions, operator strategies, new market applications, and availability of financing for satellite projects. A more detailed description of these factors is discussed later in the report. The factors were generated by the Forecast team's industry experience as well as derived from inputs from the survey respondents.

An alternative view of satellite launch statistics is included in an assessment of the number of transponders launched and the mass of satellites launched over time. The expectation is that the average mass per satellite will trend towards constancy. The last four years have averaged around 5,000 kilograms and the expectation is that the next several years will be similar. The projected total satellite mass to be launched in 2009 will be an all-time high; nearly 116,500 kilograms.

Figure 5. **Commercial GSO Satellite and Launch Demand**

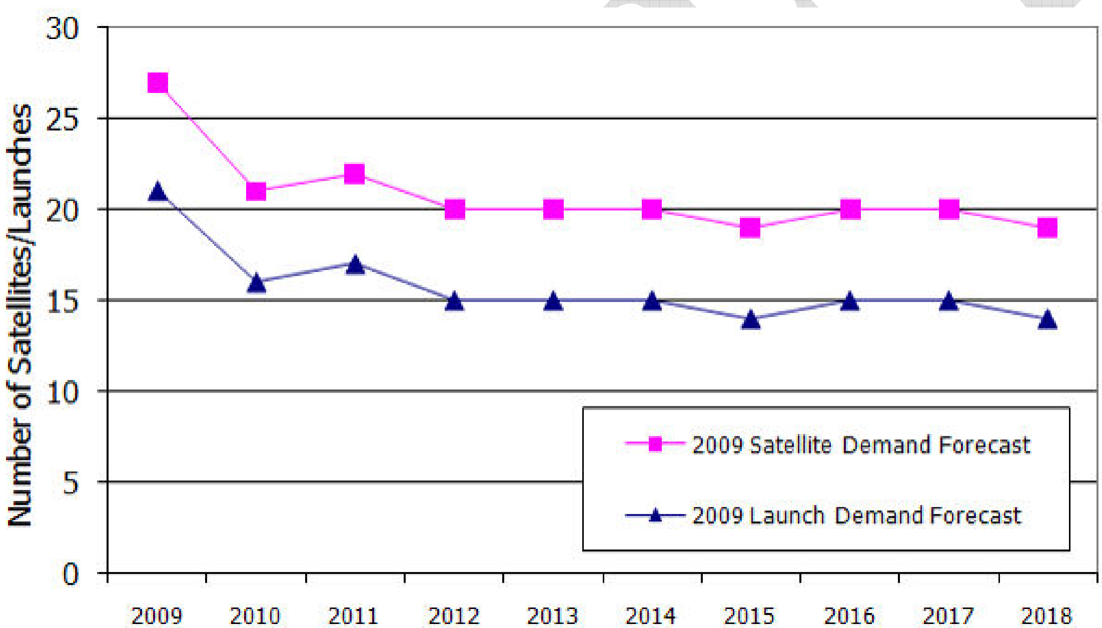


Table 2. **Commercial GSO Satellite and Launch Demand Forecast Data**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Average 2009 to 2018
Satellite Demand	27	21	22	20	20	20	19	20	20	19	208	20.8
Dual Launch Forecast	6	5	5	5	5	5	5	5	5	5	51	5.1
Launch Demand	21	16	17	15	15	15	14	15	15	14	157	15.7

BACKGROUND

The Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST) of the U.S. Department of Transportation (DOT) is interested in fostering a healthy commercial space launch capability in the United States. In 1993, the DOT requested that its industry advisory group, the Commercial Space Transportation Advisory Committee (COMSTAC), annually prepare a commercial geosynchronous orbit (GSO) satellite launch demand forecast to obtain the commercial space launch industry's view of future space launch requirements.

COMSTAC prepared the first commercial demand forecast in April 1993 as part of a report on commercial space launch systems requirements. It was developed by the major U.S. launch service providers and covered the period 1992–2010. The following year, the major U.S. satellite manufacturers and the satellite service providers began to contribute to the demand forecast. In 1995, the Technology and Innovation Working Group (the Working Group) was formally chartered by the FAA/AST to prepare the annual Commercial Payload Mission Model Update. Since 2001, the Commercial Launch Demand Forecast has covered a ten-year period, with this year's report covering 2009 through 2018. This year the committee received inputs from 21 satellite service providers, satellite manufacturers, and launch service providers. COMSTAC would like to thank all of the participants in the 2009 Commercial GSO Launch Demand Forecast.

FORECAST METHODOLOGY

Except for minor adjustments, the Working Group's launch demand forecast methodology has remained consistent throughout the history of the forecast. The Working Group, via the FAA Associate Administrator for Commercial Space Transportation, requests commercial GSO satellite forecasts from global satellite operators, satellite manufacturers, and launch service providers. Two types of requests are made: Individual input is requested from satellite operators for a projection of their individual company requirements for the period 2009–2018; and comprehensive input is requested for the same period from satellite manufacturers and launch service providers for a broad perspective.

Addressable payloads in the context of this report are defined as commercial satellite launches open to internationally competitive launch service procurement. Excluded from this forecast are satellites captive to national flag launch service providers (i.e., U.S. or foreign government satellites that are captive to their own national launch providers or commercial satellites that are not internationally competed). In 2008, two commercial satellite launches (Venesat-1 (Venezuela) and Chinasat 9 (China)) were excluded from the actual number of addressable commercial launches listed in this report because they were not internationally competed.

As more nations without national launch providers enter the commercial satellite marketplace, it is likely to be more common to see government-to-government agreements on building and launching spacecraft. Such situations will affect the forecast.

The commercial GSO satellite demand forecast is divided into four different mass classes based on the mass of the satellite at separation into geosynchronous transfer orbit (GTO). The mass categories are logical divisions based on standard satellite models offered by satellite manufacturers. The four classifications are: below 2,500 kilograms (<5,510 pounds); 2,500 to 4,200 kilograms (5,510 to 9,260 pounds); 4,200 to 5,400 kilograms (9,260 to 11,905 pounds); and above 5,400 kilograms (>11,905 pounds). A list of current satellite models associated with each mass category is shown in Table 3.

Table 3. **Satellite Mass Class Categorization**

GTO Launch Mass Requirement	Satellite Bus Models
Below 2,500 kg (<5,510 lbm)	LM A2100A, Orbital Star 2
2,500 - 4,200 kg (5,510 - 9,260 lbm)	LM A2100, Boeing 601/601HP, Loral 1300, Astrium ES2000+, Alcatel SB 3000A/B/B2, Orbital Star 2
4,200 - 5,400 kg (9,260 - 11,905 lbm)	LM A2100AX, Boeing 601HP/702, Loral 1300, Alcatel SB 3000B3
Above 5,400 kg (>11,905 lbm)	Boeing 702/GEM, Loral 1300, Astrium ES 3000, Alcatel SB 4000

This year, the following 21 organizations (noted with the country in which their headquarters are located) responded with data used in developing the 2009 report:

- Arianespace (France)
- AirLaunch (U. S.)
- The Boeing Company* (U.S.)
- China Great Wall Corp (China)
- Hisdesat (Spain)
- Intelsat (U.S.)
- Lockheed Martin Commercial Launch Services * (U.S)
- MEASAT ITU Coordination (Malaysia)
- Mitsubishi Electric Company (Japan)
- Mobile Broadcasting Corporation (Japan)
- Orbital Sciences Corp.* (U.S.)
- Sea Launch* (U.S.)
- SES New Skies (The Netherlands)
- Shin Satellite (Thailand)
- SkyPerfect (JSAT, SCC) (Japan)
- SkyTerra (Mobile Satellite Ventures) (U.S.)
- Space Exploration Technologies Corp (U.S.)
- Space Systems/Loral* (U.S.)
- Telesat (Canada/U.S.)
- Thales Alenia (Europe)
- Thuraya (United Arab Emirates)

*The Working Group uses the comprehensive inputs from the U.S. respondents to derive the average satellite demand expected per year by mass class. The sum of the demand in the four mass categories then provides total demand per year.

Forecasting commercial satellite launch demand presents significant difficulty and thus there is uncertainty in the predictions. The satellite production cycle for an existing satellite design is approximately two years; it is typically longer for heavier, more complex satellites. Orders within a two-year time period are thus generally more certain. Satellite orders in the third year and beyond become more difficult to identify by name as many of these satellites are in premature stages of the procurement cycle. Beyond a five-year horizon, new markets or new uses of satellite technology may emerge that were not known during the forecast year.

Some of the factors that were considered by respondents in creating this forecast included:

- Firm contracted missions

- Current satellite operator planned and replenishment missions
- Projection of growth in demand from new and existing satellite services and applications
- Availability of financing for commercial space projects
- Industry health and consolidation

The combined comprehensive input from U.S. respondents was used to generate the long-term demand forecast 2012–2018. The remaining inputs were used for a cross check. The Working Group, using individual satellite operators' inputs, developed the near-term forecast, covering the first three years (2009–2011) of the ten-year forecast. It is a compilation of launch vehicle providers' and satellite manufacturers' manifests, as well as an assessment of potential satellite systems to be launched.

In order to determine the demand for commercial GSO launches, the satellite demand forecast was adjusted by the projected number of dual-manifested launches per year (i.e., launch of two satellites at once). Based on the future plans and capability of Arianespace's Ariane 5, it is estimated that five launches per year will be dual-manifested in the long-term forecast; the near-term forecast of dual-manifest launches is based on an assessment of the current Arianespace manifest.

COMSTAC COMMERCIAL GSO LAUNCH DEMAND FORECAST RESULTS

NEAR-TERM DEMAND MODEL

The three-year near-term demand forecast is based on input from each U.S. satellite manufacturer and launch services provider, along with the inputs received from individual satellite operators. Developing the near-term forecast in this way results in the maximum identifiable demand for satellites to be launched each year. Identified demand for any particular year is defined as the number of satellites that customers wish to have launched, with no adjustment for potential launch schedule delays. Table 4 shows the near-term mission model for 2009 through 2011.

Table 4. Commercial GSO Near-Term Manifest

	2009		2010		2011	
Total	27		21		21	
Below 2,500kg	0		2		1	
(<5,510 lbm)			Bsat 3B	Ariane/Soyuz	Telkom 3	Proton
			SES OS1	Proton		
2,500 - 4,200 kg	14		8		8	
(5,510 - 9,260 lbm)	*Measat 3a	Land Launch	Intelsat 16	Proton	AnikG	
	*Sicral 1B	Sea Launch	Intelsat 18	LandLaunch	Bsat 3C	Ariane
	*Telstar 11N	Land Launch	Koreasat 6	Ariane	Hispasat AG1	TBD
	Asiasat 5	Proton	Nilesat 201	Ariane/Soyuz	New Dawn	TBD
	COMS 1	Ariane	RASCOM 1R	Ariane	SES OS-3	Ariane (TBD)
	Hylas	Falcon 9	SatCom BW1	Ariane	Star C3	
	Insat 4G	Ariane	SatCom BW2	Ariane	Telstar 14R	
	Intelsat 15	Land Launch	SES OS-2	Ariane (TBD)	Thor 7	TBD
	JCSat 12	Ariane				
	NSS-9	Ariane				
	Optus D3	Ariane				
	Palapa D	Long March				
	Protostar II	Proton				
	Thor 6	Ariane				
4,200 - 5,400 kg	4		2		4	
(9,260 - 11,905 lbm)	Arabsat 5A	Ariane	BADR 5B	Proton	Arabsat 5C	Ariane (TBD)
	Astra 3B	Proton	Hispasat 1E	Ariane	ST-2	TBD
	Hot Bird 10	Ariane			Turksat 4A	Ariane
	Nimiq 5	Proton			Yamal 401	Ariane
Over 5,400kg	9		9		8	
(>11,905 lbm)	Amazonas 2	Ariane	Echostar 14	TBD	Astra 1N	TBD
	DirecTV 12	Proton	Echostar 15	TBD	EuropaSat	Proton
	Eutelsat W2A	Proton	Eutelsat W3B	LongMarch	Eutelsat W3C	TBD
	Eutelsat W7	Sea Launch	KA-Sat	Sea Launch	Intelsat 17	Sea Launch
	Intelsat 14	Atlas 5	NSS-14	Proton	Quetzsat	TBD
	NSS-12	Ariane	SkyTerra 1	Proton	SES Sirius 5	Proton
	Sirius FM 5	Proton	SkyTerra 2	Sea Launch	Viasat 1	Proton
	Terrestar 1	Ariane	Terrestar 2	TBD	Yahsat 1B	Proton
	XM 5	Sea Launch	Yahsat 1A	Ariane		

* Indicates slip from COMSTAC 2008 GSO Forecast

SATELLITE LAUNCH FORECAST MASS CLASS TREND

Figure 6 and Table 5 show the trends in annual GSO satellite mass distribution. Actual data are presented for 1993 through 2008, followed by the distribution projected in this year's demand forecast.

2009 will be a unique year for the smallest of the mass classes since no satellites are forecasted to be launched. There were 3 small satellites launched in 2008, and while the trend for these very small GEO's appears to be declining, there is still an average of two per year from 2010 forward.

The smallest mass class group was changed in 2008 to include satellites up to 2,500 kilograms from a maximum of up to 2,200 kilograms analyzed in prior years. This adjustment was made to capture the recent growth in the mass of the smallest satellites being manufactured. Orbital's Star bus can be configured to bring its mass close to the 2,500-kilogram range, within the small mass class category.

There was a shift in the percentage of satellites in the medium and large mass class categories (satellites with mass greater 2,500 to 4,200 kilograms and 4,200 to 5,400 kilograms). The biggest growth was in the medium mass class with 14 launches projected in 2009. This is partially due to some small satellites increasing in mass just above the lowest class. The average number of satellites in the large mass class is dipping just below 4 for the next three years. From a high of 11 satellites launched in the mass range of 4,200 to 5,400 kilograms in 2008, this mass class is forecasted to settle back to its 5-year average of 6 to7 satellites. There is a rise in the forecast for the largest satellite class, over 5,400 kilograms, to 8.6 satellites per year for the next 3 years. This trend is anticipated to settle to around 5 per year beyond 2011.

Figure 6. Trends in GSO Satellite Mass Distribution

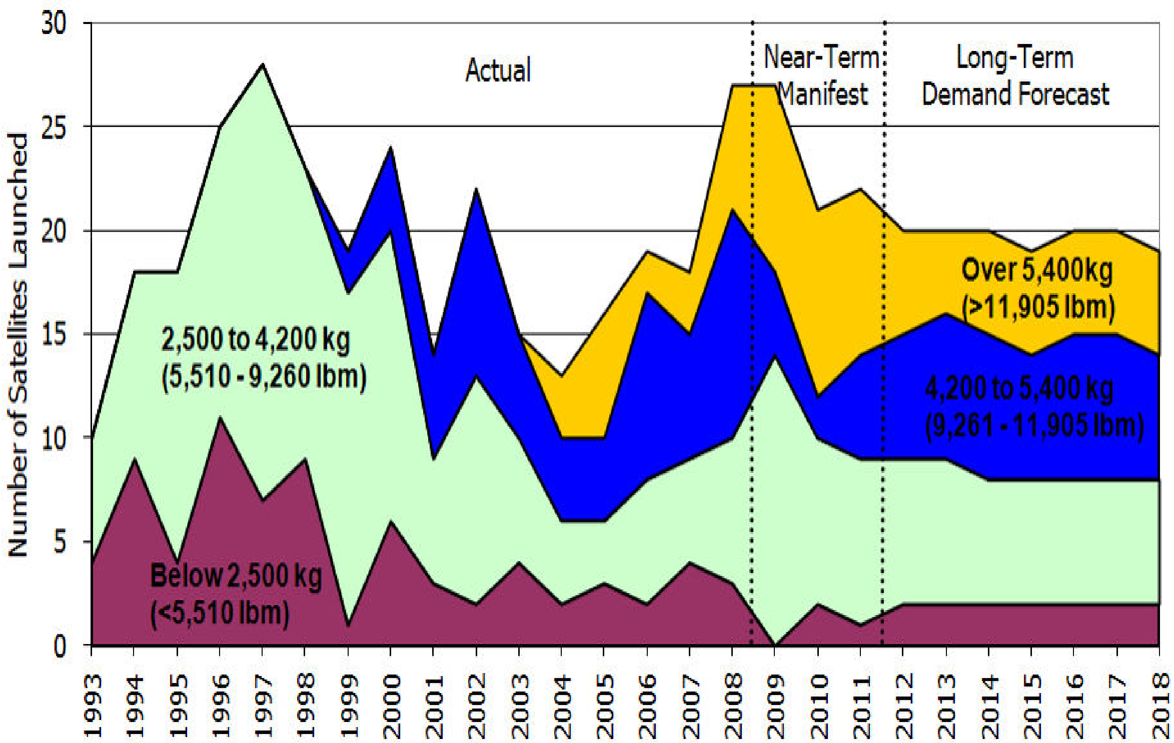


Table 5. **Trends in GSO Satellite Mass Distribution**

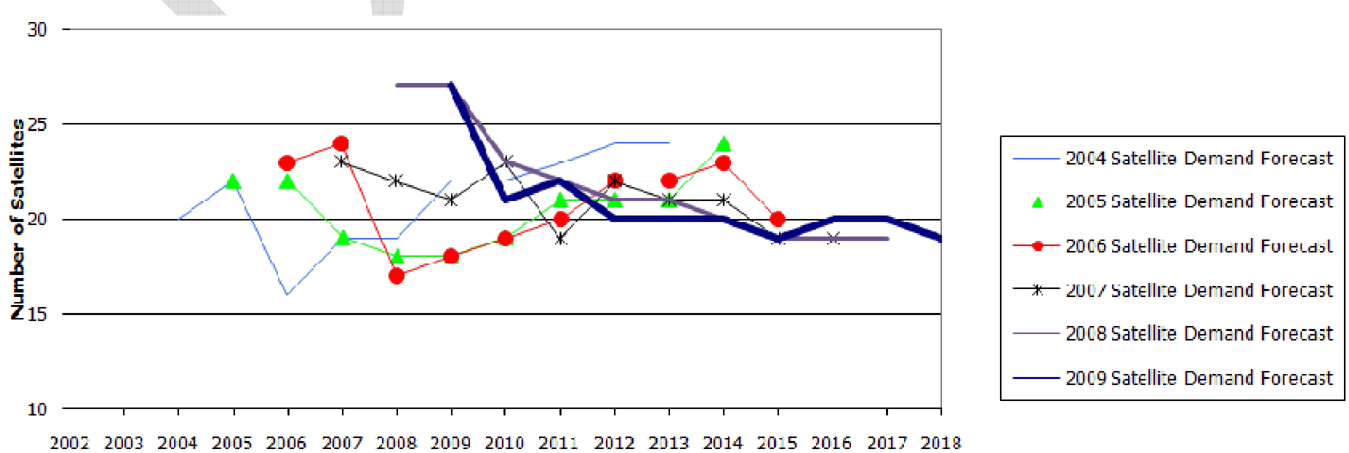
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total 2009 to 2018	Avg 2009 to 2018	% of Total
Below 2,500 kg (<5,510 lbm)	4	9	4	11	7	9	1	6	3	2	4	2	3	2	4	3	0	2	1	2	2	2	2	2	2	2	17	1.7	8%
2,500 to 4,200 kg (5,510 - 9,260 lbm)	6	9	14	14	21	14	16	14	6	11	6	4	3	6	5	7	14	8	8	7	7	6	6	6	6	6	74	7.4	36%
(9,260 - 11,905 lbm)	0	0	0	0	0	0	2	4	5	9	5	4	4	9	6	11	4	2	5	6	7	7	6	7	7	6	57	5.7	27%
Over 5,400 kg (>11,905 lbm)	0	0	0	0	0	0	0	0	0	0	0	3	6	2	3	6	9	9	8	5	4	5	5	5	5	5	60	6.0	29%
Total	**10**	**18**	**18**	**25**	**28**	**23**	**19**	**24**	**14**	**22**	**15**	**13**	**16**	**19**	**18**	**27**	**27**	**21**	**22**	**20**	**20**	**20**	**19**	**20**	**20**	**19**	**208**	**21**	**100%**

Comparison with Previous COMSTAC Demand Forecasts

The 2009 forecast for commercial GSO satellites launched is compared to the 2004 through 2008 forecasts in Figure 7. The ten-year demand forecast dropped by 10–15 percent annually from 2001 to 2004. Since 2004, the ten-year forecast has remained fairly consistent, thus establishing the floor of the demand forecast. Based upon inputs received this year, there has been no increase in the 2009 and 2011 projections. There is a slight drop in the 2010 launch forecast. For outer years, the forecast levels to 19-20 spacecraft per year. The composition of the 27 spacecraft forecast for 2009 has changed however due to the slip of 3 payloads from 2008 into 2009 with a complementary slip of four payloads from last year's forecast for 2009 into 2010. One satellite moved forward from last year's forecast for 2010 into 2009.

The 2010 forecast changed from last year's prediction of 23 spacecraft to this year's prediction of 21 spacecraft. Four payloads slipped from 2009 into 2010, but five slipped from last year's prediction for 2010 into 2011. One payload is no longer considered since it will fly on a Long March under a directed procurement that was not open to competition. The business cases for three other satellites appeared in question and hence these spacecraft were withdrawn from the current forecast for 2010. As noted previously, one satellite moved from 2010 forward into 2009. Launch vehicle contracts for four other satellites procured in late 2008 and early 2009 have been let for launch in 2010 so these have been added to the current forecast. The net result of these changes is a reduction of two satellites in the current forecast for 2010. Typically, the third year of the near-term forecast has been hardest to predict. In some cases satellites have been planned or manufacturing contracts have been let but have not been named publicly. But with crowded launch manifests the prediction for 2011 is more confident. Five satellites predicted last year to launch in 2010 have now slipped into 2011 with that year's count remaining at 22.

Figure 7. **2004 Through 2008 vs. 2009 Commercial GSO Satellite Demand Forecast**



COMPARISON TO INTERNATIONAL COMPREHENSIVE INPUTS

This year, the Working Group received comprehensive inputs from two international launch service providers (Arianespace, China Great Wall) and two international satellite manufacturers (Thales Alenia, MELCO). The combined average of these international inputs is slightly lower than the combined 2009 demand forecast based on U.S. satellite and launch vehicle manufacturer inputs. The international input average annual demand for 2009 through 2018 is 20.8 satellites per year; the U.S.-based average annual demand forecast is 21.2 satellites per year. The differential between mass classes is highest in the small mass class where the percentage of total satellites is 19.3% for aggregate international inputs vs. only 10.7% for aggregate U.S. inputs. The differential is less pronounced in the medium class where the percentage of total satellites is 29.2% for international inputs vs. 33% for U.S. inputs. The disparity is more pronounced in the intermediate mass class where the percentage of total satellites is 23.8% for international inputs vs. 30.6% for U.S. inputs. Finally, the differential in the percentage of total satellites is the smallest in the large mass class where international inputs are 27.7% vs. 25.7% for U.S. inputs.

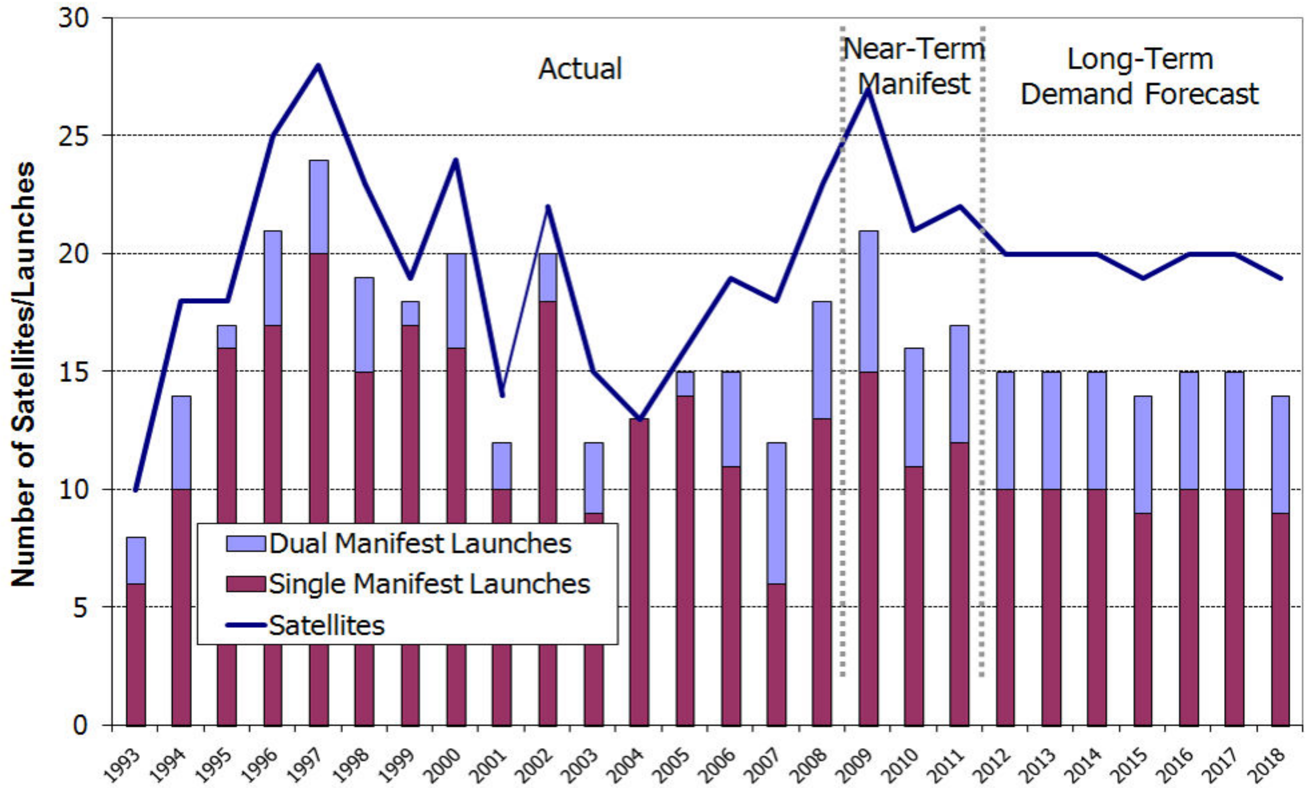
LAUNCH VEHICLE DEMAND

The commercial GSO launch forecast is based on the forecasted number of satellites expected to launch and an assumption on the extent to which launch vehicles will dual-manifest payloads (launch two satellites at once). Currently only the Ariane 5 has the capability to dual-manifest commercial GSO satellites.

Given the history of dual-manifest realization and the unlikely expectation that new dual-manifest capabilities will emerge during the forecast period, the Working Group has based its projection of dual-manifest launches on Arianespace's projected manifest. Arianespace has indicated a launch expectation of approximately seven Ariane 5 launches in 2009 and 2010, with most, if not all, commercial missions expected to be dual-manifested. Based on Arianespace's launch history, we project that one per year will likely be of a non-commercial (e.g., European government) payload, and one commercial mission will have to fly on a single-manifested mission due to schedule, manifesting, or customer choice, meaning that five dual-manifested missions can be expected each year for the 2012–2018 forecast period. The 2009–2011 near-term forecast includes dual-manifest launches consistent with the best current understanding of the mission set.

Figure 8 presents the 2009 satellite and launch demand forecast as well as actual values for 1993 through 2008.

Figure 8. **COMSTAC GSO Satellite and Launch Demand Forecast**



COMSTAC DEMAND PROJECTION VS. ACTUAL LAUNCHES REALIZED

FACTORS THAT AFFECT SATELLITE LAUNCH REALIZATION

The demand projection is a representation of the number of new or replacement satellites that customers hope to launch in a given year. This demand is typically larger than the number of satellites actually launched.

Some of the factors that affect the realization of actual launches for a given year are:

Satellite issues. Satellite manufacturers may have factory, supplier, or component issues that can delay the delivery of a spacecraft. Increased satellite complexity has increased the likelihood of a delay due to technical challenges or immature planning. Delays in delivery of spacecraft to the launch site in turn impact the planning and order of launches.

Launch vehicle issues. Launch vehicle manufacturers may have factory, supplier, or component issues that can delay the availability of the launch vehicle or cause a delay at the launch pad. A launch failure or component problem can cause a stand-down to all subsequent launches until the anomaly is identified to determine if there are fleet issues that need to be resolved.

Scheduling issues. Both satellite and launch issues lead to scheduling issues. One individual launch delay has a cascading impact on subsequent launches scheduled in a given year. Missing one launch window may cause a significant delay, especially in a well-packed launch manifest.

Dual-manifesting. The desire to dual-manifest creates additional schedule complexity, in that one launch is dependent on two satellites being delivered on time. Payload compatibility issues may also cause manifesting challenges.

Weather. Inclement weather, including ground winds, flight winds, cloud cover, lightning, and ocean currents can cause multiple launch delays, though these typically are short-term delays (i.e. on the order of days).

Planning. Failure to perform to plan will result in delays. Corporate reprioritization or changing strategies may delay or even cancel currently planned launches.

Funding. Satellite service providers may be unable to obtain the funding needed to carry out their planned satellite launch, or it may be delayed until alternate funding is found.

Regulatory issues. Export compliance problems, Federal Communications Commission (FCC) licensing issues, or trouble in dealing with international licensing requirements can slow down or stop progress on a program. The U.S. Government policy regarding satellite and launch vehicle export control is hampering U.S. satellite suppliers and launch vehicle providers in their efforts to work with their international customers. This has caused both delays and program cancellations.

Projecting Actual Satellites Launched Using a Realization Factor

The Working Group acknowledges that over the history of this report, the forecasted demand in terms of both satellites and launches has almost always exceeded the actual number of satellites and launchers for the near-term (first three years) forecast. In order to provide an estimate of the number of near-term satellites one might reasonably expect to be launched, the near-term demand for satellites has been adjusted by a "realization factor." Each time the report is published, an historical variation is calculated, based on a five-year rolling window of forecasted demand. The working group believes this provides a more accurate factor for the near-term forecast.

The range of expected actual satellites launched is calculated by multiplying the near-term demand forecast for the first and second years by the highest and lowest variations over the past five years.

Since the GSO forecast was originally produced in 1993, the number of satellites projected to be launched in the first year of the forecast has consistently been greater than the number of satellites actually launched in that year. The actual number of satellites has been 58% to 85% of the forecast number, with an average of 75%. For the past five years, the range has been 65% to 85%, with an average of 77%.

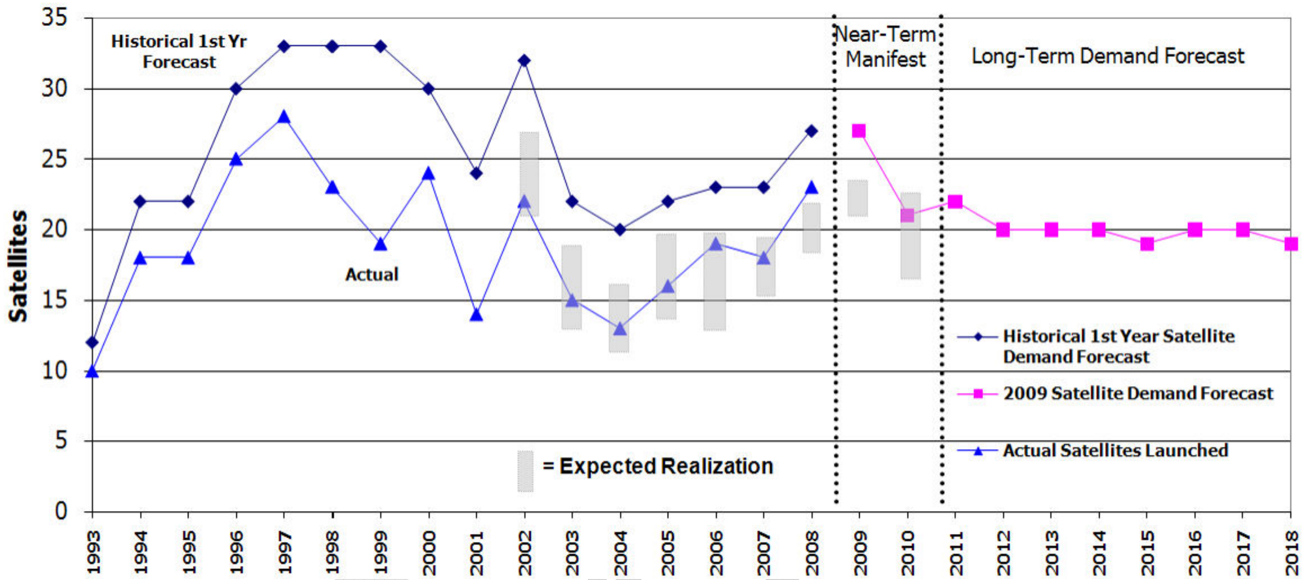
The consistent overestimation illustrates the "bow-wave" effect of the forecast, by which respondents to the forecast survey look to "make up" for satellites that were planned for the previous year, but have slipped into the subsequent year, while not concurrently slipping forward any of the satellites planned for launch that subsequent year.

The methodology used by the Working Group to determine the expected realization is to multiply the projected number of satellites (27 for 2009) by the highest and lowest variations over the past five years (65% and 85%). Therefore, the expected realization for 2009 is 18 to 23 satellites.

For the second out-year, the calculation becomes less clear. The forecast had always overestimated the actual launches two years hence, until the 2007 report, which underestimated the number of satellites (22 forecast for 2008 vs. 23 actual) for the first time. Since 1993, the actual realization has ranged from 45% to 105%, with an average of 74%. For the past five years, the range has been 72% to 105%, with an average of 82%. Using the same methodology as above, the expected realization for 2010 is 15 to 22 satellites.

Since the launch realization factor was added to the COMSTAC GSO Launch Demand Forecast in 2002, the actual number of satellites launched has generally fallen within the launch realization range.

Figure 9. Commercial GSO Demand: Historical, Near-Term, and Long-Term Forecasts



Forecasted Satellite Demand versus Actual Satellite Launches in 2008

The 2008 COMSTAC Commercial GSO Demand Forecast listed 27 satellites for the 2008 near-term manifest. Twenty-three satellites were actually launched in 2008. The difference between actual and manifested satellite launches is due to two reasons:

- Three satellites were delayed due to logistics issues associated with Sea Launch and Land Launch
- One satellite scheduled to fly on Proton was cancelled (Echostar's CMBStar)

Of the three delayed satellites noted above, two have subsequently been launched as of publication of this report (Telstar 11N on Land Launch and Sicral 1B on Sea Launch). The other satellite (Measat 3) is awaiting launch in June on Land Launch.

FACTORS THAT MAY AFFECT FUTURE DEMAND

The global satellite services industry is impacted by a variety of financial, regulatory, and environmental factors that can affect current and future demand forecasts for commercial GSO satellite launches. The Working Group has identified the following issues as potential factors that may impact satellite demand in the future.

Uncertainty in the financial markets extended quickly outside of the structured credit and sub-prime mortgages markets over the past twelve months. Limited access to corporate credit, the cost of credit, and the broad losses in major equity indices have impacted all businesses around the world, as they continue to work through the economic recession. Access to funds from private equity firms has dried up after a surge of interest in the sector over the past two years. While these conditions affect the growth prospects of satellite operators, the underlying strength of the FSS industry remains intact. For the time being, global and regional FSS operators have remained somewhat resistant to the effects of the ongoing downturn due to continued growth tied to the media and broadcast industries coupled with a resilient direct-to-home television consumer choosing these services as cost-effective alternatives to other entertainment forms. Anchored by high satellite use rates, long-term contracts, and large backlogs, satellite operators are continuing to build healthy balance sheets. The growth prospects for the MSS operators are equally robust, but the requirement to fund the build-out of new hybrid networks may delay some operators going forward who are largely dependent upon the timing of the recovery of the world's credit markets and their continued access to working capital. Small-fleet regional operators also may face some risk in obtaining reasonably priced credit going forward. This has increased demand for alternative project financing including spacecraft and launch vehicle provided vendor-financing and government-backed financing from export credit agencies such as EXIM and Coface - providing access to credit that might not otherwise be available. Given the extended planning, budgeting, manufacturing, and launch lead-times associated with deploying GSO spacecraft assets on orbit, the continued effect that the ongoing uncertainty in the financial markets has on new satellite orders should be minimal barring a protracted economic recession.

New commercial launch competitors will impact the launch market over the next few years with increased competition. Land Launch is now operational from the Baikonur Cosmodrome. Using a Zenit-3SLB vehicle, modified slightly from the Sea Launch Zenit-3SL, its lift capability of 3,600 kilograms moves Sea Launch Company, L.L.C. into the medium launch market segment (2,500 – 4,000 kilograms), complementing the Sea Launch heavy-lift capability. Launch rate capacity is planned to be four launches per year. The debut of Arianespace's Soyuz launch from French Guiana (Kourou) has been delayed until 2009. This modified Soyuz will provide medium-lift capability: the Soyuz 2-1-a can lift 2,700 kilograms to GTO, and the Soyuz 2-1-b will be capable of lifting 3,000 kilograms to GTO. The near-equatorial launch location significantly increases the capacity of the upgraded Soyuz over the launch capacity from Baikonur. This will add another new competitor in the medium launch market segment. A new entrant to the space launch industry is SpaceX, a commercially-funded company designing the Falcon 1 and Falcon 9 launch vehicles. The Falcon 1 successfully reached orbit in Q3 of 2008. While the Falcon 1 is too small to launch payloads to GTO, the larger Falcon 9 will be able to launch just under 5,000 kilograms to GTO in the single core version and over 12,000 kilograms to GTO in the common booster core configuration. Its first launch is scheduled for 2009. Orbital may also enter the GTO market with a Taurus II equipped with an orbit raising upper-stage. The IOC for Taurus II for LEO launches is 2010. Finally, India plans to demonstrate in 2009 a further upgraded version of the GSLV launch vehicle, the GSLV Mark III, which is to be test launched in 2009. The Mark III is planned to have a payload capacity of four tons and use an indigenously-developed cryogenic engine.

Indigenous launch vehicles will continue to decrease the demand for internationally-competed commercial launches as more countries successfully build and launch their own government and commercial payloads. These new competitors have not only removed their government payloads from the internationally competed commercial launch market, but have now established a presence in the global commercial launch market. These competitors include the Indian GSLV, the Chinese Long March, and the Japanese H-IIA. The GSLV has a lift capability of 2,500 kilograms to GTO. While still early in its operational phase, GSLV is now successfully being used to launch the Insat satellites that had previously been part of the internationally-competed commercial launch market. The H-IIA launch system has a lift capacity of 4,100–7,500 kilograms to GTO. The H-IIA has performed well and Japan has successfully performed 14 out of 15 H-IIA launches. The Japanese Space Agency, JAXA, is well underway in developing the H-IIB configuration. The H-IIB provides increased lift capability to support International Space Station cargo resupply missions and is likely to be offered for commercial missions as required. Like China, the introduction of domestically manufactured satellites to the marketplace and an increased presence in the international commercial launch market will result in higher usage of the H-IIA. Like the H-IIA, various configurations of the Long March 3B provide a range of lift capabilities from 1.500 to 7,000 kilograms to GTO. Long March has been precluded from performing launch services for satellites containing U.S. ITAR restricted components. The newly introduced "ITAR-Free" satellites have provided Long March the opportunity to increase its presence in the internationally competed commercial launch market while maintaining its primary role launching payloads for the Chinese government. Long March is currently scheduled to launch one commercial GEO satellite in 2009, Palapa D. As more countries grow their internal launch capability, the degree of open (commercial) competition for launches will likely continue to decrease.

Demand for new video content and the need for interconnectivity from anywhere continue to push demand for satellite services and new satellite systems. High-definition television (HDTV) bandwidth, mobile services backhaul, and satellite broadband access services continue to drive growth in FSS services. DBS/DTH operators continue to order satellites with more video channel capability to enhance their current fleets. Wildblue and HNS broadband systems are serving the pent up consumer demand in North America for broadband. This market could be accelerated further by USG stimulus efforts to promote internet connectivity throughout the U.S.. ViaSat and Eutelsat will soon be providing consumer broadband services in the U.S. and in Europe, respectively. A third satellite launched, Inmarsat recently achieved close to global coverage with Broadband Global Area Network (BGAN), which provides mobile internet and telephone service. In the MSS segment, ICO has launched a satellite beginning its mobile video service. In addition, both MSV and TerreStar, will launch over the next year. All three systems plan to also use the Ancillary Terrestrial Component authorized by the FCC that enables an integrated terrestrial/satellite network solution for MSS providers. With the successful U.S. merger of XM and Sirius Satellite Radio, there continues to be interest in providing DARS and mobile video broadcast services in Europe and Asia.

U.S. Government regulatory environment continues to be an issue for domestic manufacturers as international competitors develop satellite and launch offerings that are not subject to U.S. export regulations for the commercial market. The U.S. Department of State approval to export satellites to international launch sites applies to domestic satellites and non-U.S. manufacturers that integrate ITAR-restricted U.S. components. Satellites with ITAR-restricted components have been denied licensing for export to selected countries with indigenous launch systems. Thales Alenia Space has recently introduced a configuration of its Spacebus platform without ITAR-restricted components. The introduction of ITAR free satellites will impact the global launch community, as well as U.S. satellite manufacturers, by enabling internationally competed commercial launch opportunities to be awarded to launch services providers which would normally not be allowed to launch satellites with ITAR-restricted components.

Hosted payloads are payloads that are too small to justify a dedicated mission due to payload size, government budget, or potential revenues. Typically a hosted payload is paired with a commercial satellite service mission, where the satellite operator is willing to accommodate the payload to offset its launch and operating costs. There are a variety of potential hosted payloads including: experimental, demonstration, scientific, remote sensing, weather and climate monitoring, FAA, GPS, and military communications missions. Payload hosting offers many benefits to both parties. The cost of the satellite and launch services is shared, thereby reducing the primary payload's launch costs while providing affordable space access for the hosted payload. In addition, the hosted payload gains the efficiency of using a commercial launch system that provides access to more orbital locations. In addition, the commercial launch schedule from start of program to launch is relatively short and fairly predictable compared to a shared launch with other government missions.

There are limitations to widespread acceptance and use of hosted payloads. The contractual relationships are more complex because there are three (or more) parties, rather than two, involved in the spacecraft purchase. In certain cases, the hosted payload is "added" after a contract is signed between the satellite manufacturer and the satellite owner. In some cases, the commercial satellite service provider does not want to impact its program and requires firm deadlines for delivery of the hosted payload as well as clearly defined interfaces at the start of satellite construction. If the hosted payload fails to arrive on time, the client could be liable for covering any residual impacts to the satellite cost and schedule. Further, the satellite manufacturer will likely seek "off-ramps" to offset the possibility of late delivery penalties if the hosted payload causes a delay in delivery of the satellite. To be sure, commercial satellite owners regularly formulate their satellite procurement contracts to address their business needs and take advantage of opportunities, like hosted payloads, to improve their return on investment.

Certainly, there is a broad interest in developing, launching, and operating hosted payloads. Industry or other collaborative leadership is necessary to coalesce the clients, their funding agencies/customers, the spacecraft owner/operators, and the launch vehicle providers into agreement on standardized hosted payload processes to make this a routine part of the commercial satellite business.

SUPPLEMENTARY QUESTIONNAIRE RESULTS

As part of the COMSTAC request for inputs from industry participants, a supplemental questionnaire was provided to satellite service providers. The questions focus on factors that impact service providers' plans to purchase and launch satellites. A summary of the responses to this questionnaire is provided in Table 6. The last column is a comparison to the survey responses received for the 2008 COMSTAC report.

The following 13 satellite service providers responded to the supplementary questionnaires. The Working Group would like to offer special thanks to these companies for providing this additional input:

DigitalGlobe
Hisdesat Servicios Estrategicos, S. A. *
JSAT Corporation *
Measat Satellite Systems Sdn. Bhd.
Mitsubishi Electric Corporation
Mobile Broadcasting Corporation *
Mobile Satellite Ventures (MSV) *
PanAmSat Corporation
SES New Skies
Shin Satellite (Thaicom Public Company Limited)
Telesat Canada *
Thales Alenia Space
Thuraya Satellite Telecommunications Company *

* Indicates 2008 survey respondent

The Supplementary Questionnaire inquiries can be broken down into three main categories: financial, technical, and regulatory. The 2009 survey reflects a generally negative perception of the industry and satellite market demand drivers. Global economic conditions were cited as having a negative impact by the vast majority of respondents. An increasing percentage of respondents were satisfied with the satellite component of their business, but there was an increase in concern about the reliability and availability of launch vehicles. The only area to see an unquestionably positive trend was the regulatory category.

As might be expected in the current economic situation, the trend in the financial category was overwhelmingly negative. The percentage of respondents who said they experienced some or significant negative impact due to global or regional economic conditions more than doubled to 77 per cent in 2009 from 33 per cent in 2008. The availability of financing was also a key issue for respondents, with 69 per cent reporting some or significant negative impact in 2009 versus only 28 per cent in 2008. The weaker economy may be contributing to the decline in demand for services seen by 31 per cent of 2009 respondents, compared to only 17 per cent of the respondents who saw a decline in demand for services in 2008. Negative trends were also apparent in the responses to questions on the ability to compete with terrestrial services, the availability of affordable insurance, and the impact of service provider consolidation. However, the increases in per cent of negative responses to these questions were much smaller.

Operators appear to be satisfied with the variety and reliability of satellite systems available to them. Thirty-eight per cent of the respondents in 2009 said that the reliability and longer lifetime of satellite systems was having a negative impact on their plans to purchase and launch satellites as compared to 17 per cent of the 2008 respondents. Paradoxically, this increase in negative responses could indicate a positive situation for the industry, since this means that the increased reliability and lifetimes of existing satellites has a negative impact on plans to purchase additional satellites. Respondents were not as optimistic when it came to launch vehicles, however. Twenty-three per cent of the respondents in 2009 said that the availability of launch vehicles had some or significant negative impact on their plans compared to only 11 per cent of 2008 respondents. This is a reflection of operators' concerns about vehicle reliability and the full near-term manifests of almost all commercial launch providers. Launch vehicle reliability was cited as a negative factor by almost one-third (31 per cent) of the 2009 respondents versus 22 per cent in 2008, despite the fact that there was only one commercial launch vehicle failure in 2008 (ProtonM/AMC-14) as opposed to two failures in 2007 (Sea Launch/NSS 8 and Proton M/JCSAT-11).

The only survey area to show some improvement from 2008 to 2009 was the regulatory category. Fifteen per cent of the 2009 respondents experienced some or significant negative impact as a result of their ability to obtain the required export licenses compared to 23 percent of the 2008 respondents. A similar improvement was seen in the ability to obtain the required operating licenses, with 23 percent of 2009 respondents experiencing some or significant negative impact versus 28 percent in 2008.

Table 6. COMSTAC Survey Questionnaire Summary

	Significant Negative Impact	Some Negative Impact	No Effect	Some Positive Impact	Significant Positive Impact	Compared to 2008
Regional or global economic conditions	0%	77%	23%	0%	0%	↓
Demand for satellite services	8%	23%	23%	38%	8%	↓
Ability to compete with terrestrial services	15%	15%	69%	0%	0%	→
Availability of financing	23%	46%	8%	23%	0%	↓
Availability of affordable insurance	0%	23%	46%	31%	0%	→
Consolidation of service providers	0%	15%	77%	8%	0%	↓
Increasing satellite life times	0%	38%	54%	8%	0%	↓
Availability of satellite systems that meet your requirements	0%	8%	54%	31%	8%	→
Reliability of satellite systems	0%	38%	38%	15%	8%	↓
Availability of launch vehicles that meet your requirements	8%	15%	46%	23%	8%	↓
Reliability of launch systems	0%	31%	46%	23%	0%	↓
Ability to obtain required export licenses	0%	15%	69%	8%	8%	↑
Ability to obtain required operating licenses	8%	15%	69%	8%	0%	↑

↑	More positive compared to 2008
↓	More negative compared to 2008
→	No significant change from 2008

COMMERCIAL GSO SATELLITE TRENDS

TRENDS IN NUMBER OF TRANSPONDERS PER SATELLITE

Figure 10 and Table 7 show the number of C-band, Ku-band, and Ka-band transponders launched per year and the average number of transponders per satellite launched from 1993 to 2008, with a projection for 2009 based on the near-term manifest shown in Table 4. Peaks in total number of transponders launched correspond to peaks in number of satellites launched for a given year. The average number of transponders launched in recent years tends to trend up and down with respect to the numbers of each class of satellite launched with variances year over year. The five-year moving average reveals that despite the growth period in the number of transponders per satellite seen in the early part of this decade, the past several years have remained relatively stable. This corresponds with the stabilization of the move to larger FSS/BSS transponder satellites. The average in 2009 is expected increase and future growth is expected to be relatively incremental. For the purpose of this analysis, a small number of satellites were excluded because their application is substantially different from the standard commercial GSO satellite. The satellites excluded are those used primarily for mobile applications because their communication payloads are not easily analyzed in terms of typical C-band, Ku-band, and Ka-band transponders. Examples include the Inmarsat, Paradigm (Skynet 5), Thuraya, XTAR/Spainsat, ICO, XM, and Sirius satellites, which have X-band, L-band, and/or S-band transponders.

Figure 10. **Total C/Ku/Ka Transponders Launched per Year and Average Transponders per Satellite**

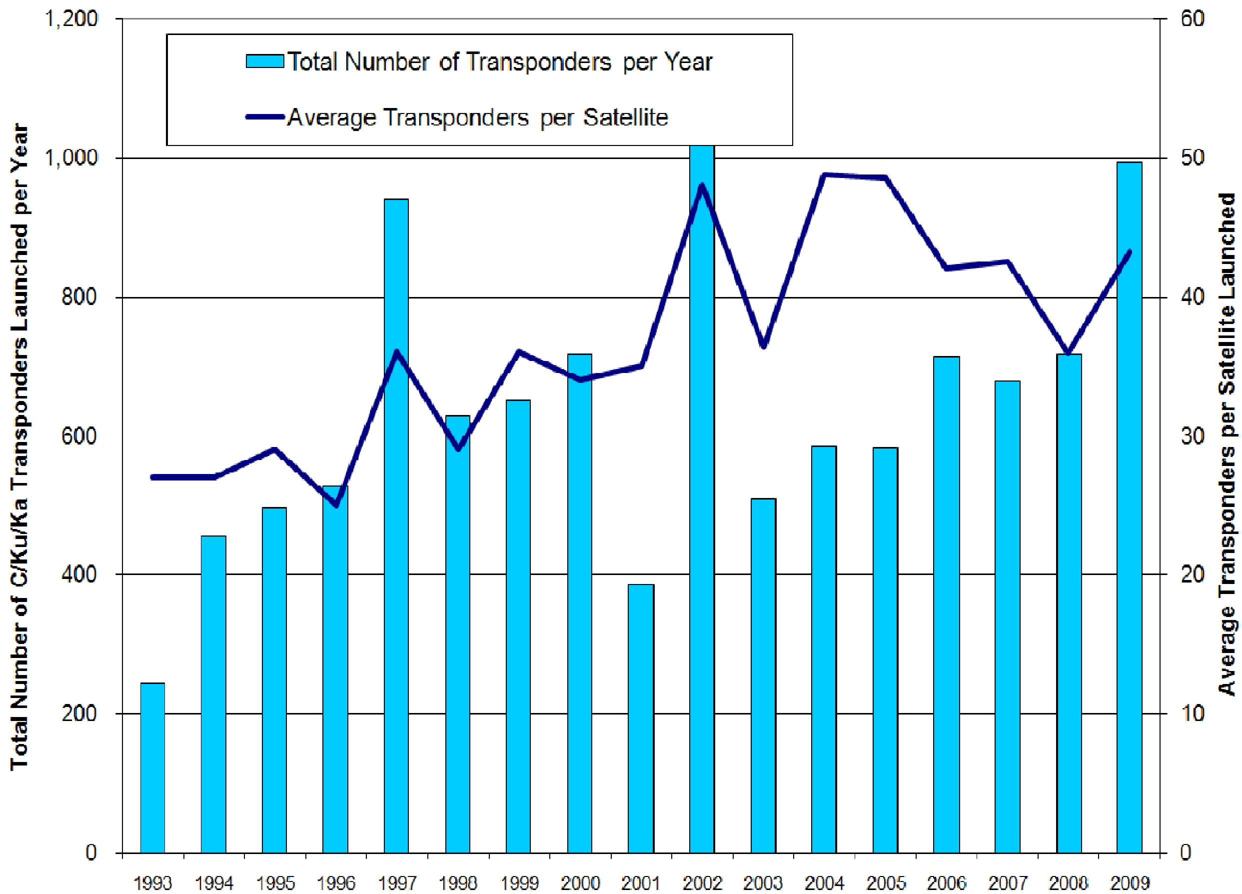


Table 7. **Total C/Ku/Ka Transponders Launched per Year and Average Transponders per Satellite**

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Number of Transponders per Year	245	455	497	527	939	630	651	717	386	1,064	509	585	582	714	680	718	993
Average Transponders per Satellite	27	27	29	25	36	29	36	34	35	48	36	49	49	42	43	36	43

Trends in Average Satellite Mass

Figure 11 and Table 8 show the total mass launched per year and the average mass per satellite launched. The total mass launched per year correlates with the number of satellites launched per year, as does the total number of transponders. The average satellite mass peaked in 2005 with 2006 showing a slight downturn. The average mass in 2009 is expected to increase slightly and growth trends in the future are also expected to be incremental. The last four years have averaged a little over 4,000 kilograms and the expectation is that the next several years will be similar. This again correlates to stabilizing the shift to heavier, higher-power satellites. The projected total mass to be launched in 2009 will be an all-time high, over 116,000 kilograms.

Figure 11. **Total Satellite Mass Launched per Year and Average Mass per Satellite**

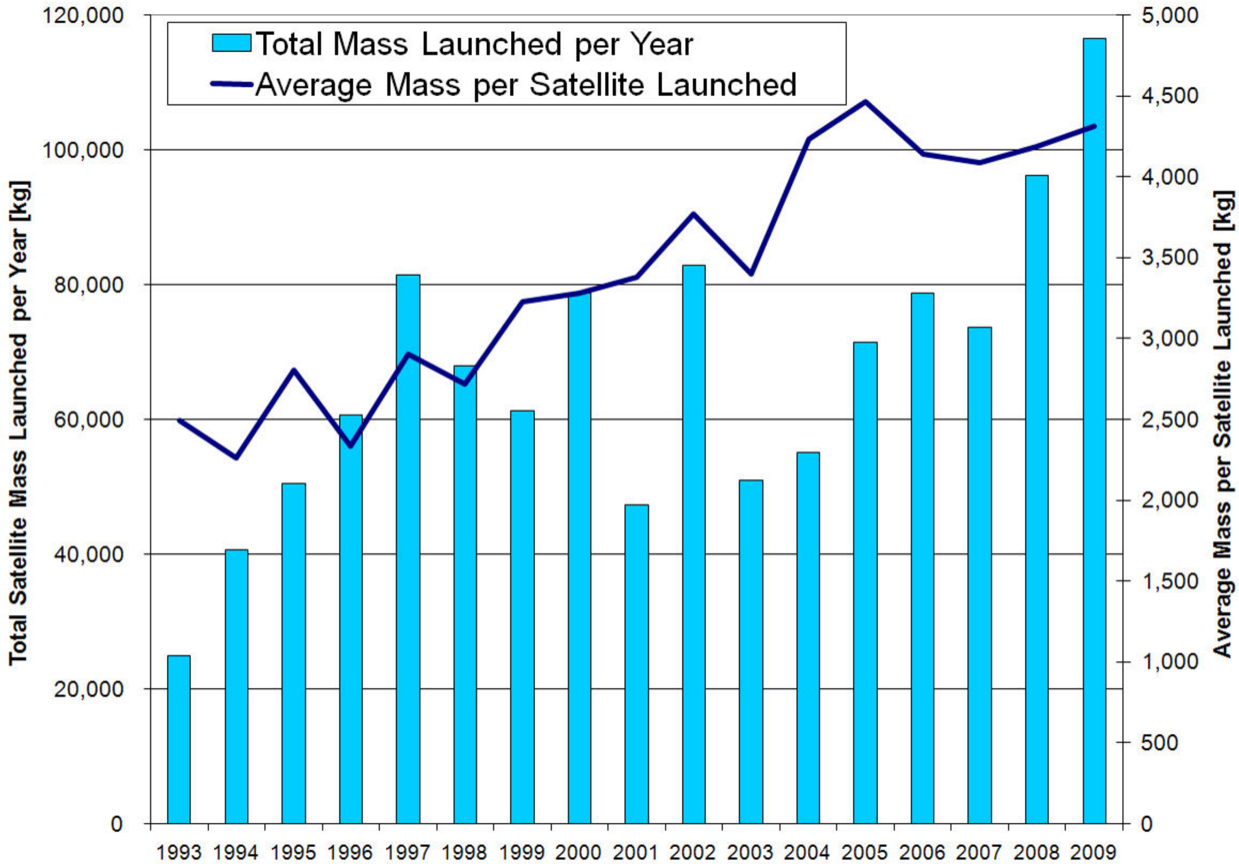


Table 8. **Total Satellite Mass Launched per Year and Average Mass per Satellite**

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Mass Launched per Year [kg]	24,910	40,689	50,502	60,695	81,373	68,015	61,295	78,784	47,329	82,880	50,990	55,070	71,456	78,680	73,611	96,251	116,496
Average Mass per Satellite [kg]	2,491	2,261	2,806	2,334	2,906	2,721	3,226	3,283	3,381	3,767	3,399	4,236	4,466	4,141	4,090	4,185	4315

SUMMARY

The 2009 COMSTAC Commercial GSO Launch Demand Forecast projects an average annual demand of 20.8 satellites to be launched from 2009 through 2018, a decrease of one satellite when compared to the 2008 forecast of 21.8 and the 2007 forecast of 21.0 satellites per year. Actual launches per year were above 20 for the first time since 2002 and the highest total since 2000, with 23 satellites launched in 2008.

The Working Group forecasts 21 total launches (including 6 dual-manifest) in 2009, decreasing to 16 total (including 5 dual-manifest) launches in 2010, with a slight increase to 17 (including 5 dual-manifest) launches expected in 2011. The long term forecast of average annual single-manifest launches over the ten-year period spanning 2009 through 2018 is 10.6 launches per year. The average annual dual-manifest launches during 2009 through 2018 are forecasted to be 5.1. Based on these data and the satellite demand projection, the 2009 Commercial GSO Launch Demand Forecast averages 15.7 launches per year from 2009 through 2018—a small decrease from last year's forecast.

There has been steady growth in satellite mass since 1993 and the trend continues toward the 2005 peak level of 4,500 kilograms. The total satellite mass launched is expected to remain near or slightly above 100,000 kilograms forecast for the coming years with an all-time high of nearly 116,500 kg in 2009. At the same time, the trend in increasing average number of transponders per satellite continues and, with the 2009 forecast at 993 transponders, is approaching the peak number of over 1,000 transponders launched in 2002.

With the uncertain future of the Delta II launch system, the launch vehicle industry is adding capacity with three new launch vehicle entrants capable of launching medium-class payloads in the immediate and mid-term periods. Land Launch successfully launched its initial commercial satellite in April 2008; Falcon 9 plans to launch in 2009; and Soyuz, launched from Kourou, plans to conduct its initial launch late in 2009. The Taurus II, currently in development, will also add launch capacity to support medium class payloads. While satellite demand may outnumber available commercial launch competitors in the near future, these new launch vehicles along with new applications of existing systems, with new systems from other emerging space nations, will maintain sufficient launch capacity in the future.

Table 9. Historical Addressable Commercial GSO Satellites Launched (1993–2008)

	1993	1994	1995	1996	1997
Total Launches	8	14	17	21	24
Total Satellites	10	18	18	25	28
Over 5,400 kg (>11,905 lbm)	0	0	0	0	0
4,200 - 5,400 kg (9,260 - 11,905 lbm)	0	0	0	0	0
2,500 - 4,200 kg (5,510 - 9,260 lbm)	6	9	14	14	21
Below 2,500 kg (<5,510 lbm)	4	9	4	11	7

Year	Mass class	DM	Satellite	Launch vehicle
1993	2,500 - 4,200 kg (5,510 - 9,260 lbm)		Astra 1C	Ariane 42L
1993		DM2	DBS 1	Ariane 44L
1993			Galaxy 4	Ariane 42P
1993			Intelsat 701	Ariane 44LP
1993		DMN	Solidaridad 1	Ariane 44LP
1993			Telstar 401	Atlas IIAS
1993	Below 2,500 kg (<5,510 lbm)	DM1	Insat 2B	Ariane 44L
1993		DM1	Hispasat 1B	Ariane 44L
1993		DM2	Thaicom 1	Ariane 44L
1993			NATO 4B	Delta II
1994	2,500 - 4,200 kg (5,510 - 9,260 lbm)		Astra 1D	Ariane 42P
1994			Intelsat 702	Ariane 44LP
1994		DM2	PAS 2	Ariane 44L
1994			☐ PAS 3	Ariane 42P
1994		DM4	Solidaridad 2	Ariane 44L
1994			Telstar 402	Ariane 42L
1994			DBS 2	Atlas IIA
1994			Intelsat 703	Atlas IIAS
1994			Optus B3	Long March 2E
1994	Below 2,500 kg (<5,510 lbm)	DM3	Brazilsat B1	Ariane 44LP
1994		DM2	BS-3N	Ariane 44L
1994		DM1	☐ Eutelsat II F5	Ariane 44LP
1994		DM4	Thaicom 2	Ariane 44L
1994		DM1	☐ TurkSat 1A	Ariane 44LP
1994		DM3	TurkSat 1B	Ariane 44LP
1994			Orion 1	Atlas IIA
1994			Galaxy 1RS	Delta II
1994			APStar 1	Long March 3
1995	2,500 - 4,200 kg (5,510 - 9,260 lbm)		Astra 1E	Ariane 42L
1995			DBS 3	Ariane 42P
1995			Intelsat 706A	Ariane 44LP
1995			N-Star a	Ariane 44P
1995			PAS 4	Ariane 42L
1995			Telstar 402R	Ariane 42L
1995			AMSC 1	Atlas IIA
1995			Galaxy 3R	Atlas IIA
1995			Intelsat 704	Atlas IIAS
1995			Intelsat 705	Atlas IIAS
1995			JCSat 3	Atlas IIAS
1995			☐ APStar 2	Long March 2E
1995			ASIASAT 2	Long March 2E
1995			EchoStar 1	Long March 2E
1995	Below 2,500 kg (<5,510 lbm)	DM1	Brazilsat B2	Ariane 44LP
1995		DM1	Hot Bird 1	Ariane 44LP
1995		DMN	Insat 2C	Ariane 44L
1995			Koreasat 1	Delta II
1996	2,500 - 4,200 kg (5,510 - 9,260 lbm)	DM3	Arabsat 2A	Ariane 44L
1996		DM4	Arabsat 2B	Ariane 44L
1996			EchoStar 2	Ariane 42P
1996			Intelsat 707A	Ariane 44LP
1996			Intelsat 709	Ariane 44P
1996			MSAT 1	Ariane 42P
1996			N-Star b	Ariane 44P
1996		DM2	Palapa C2	Ariane 44L
1996		DM1	PAS 3R	Ariane 44L
1996			AMC 1	Atlas IIA
1996			Hot Bird 2	Atlas IIA
1996			Palapa C1	Atlas IIAS
1996			☐ Intelsat 708A	Long March 3B
1996			Astra 1F	Proton K/DM
1996	Below 2,500 kg (<5,510 lbm)	DM2	Amos 1	Ariane 44L
1996		DMN	Italsat 2	Ariane 44L
1996		DM1	Measat 1	Ariane 44L
1996		DM4	Measat 2	Ariane 44L
1996		DM3	TurkSat 1C	Ariane 44L
1996			Inmarsat 3F1	Atlas IIA
1996			Inmarsat 3F3	Atlas IIA
1996			Galaxy 9	Delta II
1996			Koreasat 2	Delta II
1996			APStar 1A	Long March 3
1996			Inmarsat 3F2	Proton K/DM
1997	2,500 - 4,200 kg (5,510 - 9,260 lbm)	DMN	Hot Bird 3	Ariane 44LP
1997			Intelsat 801	Ariane 44P
1997			Intelsat 802	Ariane 44P
1997			Intelsat 803	Ariane 42L
1997			Intelsat 804	Ariane 42L
1997			JCSat 5	Ariane 44P
1997			PAS 6	Ariane 44P
1997		DM4	Sirius 2	Ariane 44L
1997		DM2	Thaicom 3	Ariane 44LP
1997			AMC 3	Atlas IIAS
1997			DirecTV 6	Atlas IIA
1997			EchoStar 3	Atlas IIAS
1997			Galaxy 8i	Atlas IIAS
1997			JCSat 4	Atlas IIAS
1997			Superbird C	Atlas IIAS
1997			Agila II	Long March 3B
1997			APStar 2R	Long March 3B
1997			Aatra 1G	Proton K/DM
1997			☐ Asiasat 3	Proton K/DM
1997			PAS 5	Proton K/DM
1997			Telstar 5	Proton K/DM
1997	Below 2,500 kg (<5,510 lbm)	DM1	AMC 2	Ariane 44L
1997		DM2	BSat 1A	Ariane 44LP
1997		DM4	Cakrawarta 1	Ariane 44L
1997		DM3	Inmarsat 3F4	Ariane 44LP
1997		DM3	Insat 2D	Ariane 44LP
1997		DM1	Nahuel 1A	Ariane 44L
1997			Thor II	Delta II

☐ = Launch Failure

DM# = Dual Manifested Launch with Another COMSTAC Satellite
Example: DM1 was paired with DM1, DM2 with DM2, etc.

DMN = Dual Manifested Launch with Non-Addressable Satellite
DMN missions are counted as a single launch in the launch count

Note: The 1996 launch of Chinasat 7 was removed in 2004 as it was retroactively determined not to have been competitively bid.

Table 9. **Historical Addressable Commercial GSO Satellites Launched (1993–2008) [Continued]**

	1998			1999			2000			2001			2002		
Total Launches		19			18			20			12			20	
Total Satellites		23			19			24			14			22	
Over 5,400 kg (>11,905 lbm)		0			0			0			0			0	
4,200 - 5,400 kg (9,260 - 11,905 lbm)		0			2			4			5			9	
					Galaxy 11	Ariane 44L		Anik F1	Ariane 44L		DirecTV 4S	Ariane 44LP		Intelsat 904	Ariane 44L
					Orion 3	Delta III		PAS 1R	Ariane 5G		Intelsat 901	Ariane 44L		Intelsat 905	Ariane 44L
								Garuda 1	Proton K/DM		Intelsat 902	Ariane 44L		Intelsat 906	Ariane 44L
								Thuraya 1	Sea Launch		XM Rock	Sea Launch		NSS-6	Ariane 44L
											XM Roll	Sea Launch		NSS-7	Ariane 44L
														Astra 1K	Proton K/DM
														Echostar 8	Proton K/DM
														Intelsat 903	Proton K/DM
														Galaxy IIIC	Sea Launch
2,500 - 4,200 kg (5,510 - 9,260 lbm)		14			16			14			6			11	
	DM4	Afristar	Ariane 44L		AMC 4	Ariane 44L	DM1	Asiastar 1	Ariane 5G	DM2	Artemis	Ariane 5G	DMN	Atlantic Bird 1	Ariane 5G
	DM3	Eutelsat W2	Ariane 44L	DM1	Arabsat 3A	Ariane 44L	DM3	Astra 2B	Ariane 5G		Atlantic Bird 2	Ariane 44P	DMN	Hotbird 7	Ariane 5ECA
		Hot Bird 4	Ariane 42P		Insat 2E	Ariane 42P		Europe*Star 1	Ariane 44LP	DM1	Eurobird	Ariane 5G		Insat 3C	Ariane 42L
		PAS 6B	Ariane 42L		Koreasat 3	Ariane 42P		Eutelsat W1R	Ariane 44P		Turksat 2A	Ariane 44P	DM1	JCSat 8	Ariane 44L
		PAS 7	Ariane 44LP		Orion 2	Ariane 44LP		Galaxy 10R	Ariane 42L		Astra 2C	Proton K/DM	DM2	Stellat 5	Ariane 5G
		Satmex 5	Ariane 42L		Telkom	Ariane 42P		Galaxy IVR	Ariane 42L		PAS 10	Proton K/DM		Echostar 7	Atlas IIIB
		ST-1	Ariane 44P		Telstar 7	Ariane 44LP		N-Sat-110	Ariane 42L					Hispasat 1D	Atlas IIAS
		Hot Bird 5	Atlas IIA		Echostar V	Atlas IIAS		Superbird 4	Ariane 44LP					Hotbird 6	Atlas V 401
		Intelsat 805A	Atlas IIAS		Eutelsat W3	Atlas IIAS		Echostar VI	Atlas IIAS					Eutelsat W5	Delta IV M+ (4,2)
		Intelsat 806A	Atlas IIAS		JCSat 6	Atlas IIAS		Eutelsat W4	Atlas IIIA					DirecTV 5	Proton K/DM
		Galaxy 10	Delta III		Asiasat 3S	Proton K/DM		Hispasat 1C	Atlas IIAS					Nimiq 2	Proton M/M
		Astra 2A	Proton K/DM		Astra 1H	Proton K/DM		AAP 1	Proton K/DM						
		EchoStar 4	Proton K/DM		LMI 1	Proton K/DM		AMC 6	Proton K/DM						
		PAS 8	Proton K/DM		Nimiq	Proton K/DM		PAS 9	Sea Launch						
					Telstar 6	Proton K/DM									
					DirecTV 1R	Sea Launch									
Below 2,500 kg (<5,510 lbm)		9			1			6			3			2	
	DM4	AMC 5	Ariane 44L	DM1	Skynet 4E	Ariane 44L	DM3	AMC 7	Ariane 5G	DM1	BSat 2A	Ariane 5G	DM1	Astra 3A	Ariane 44L
	DM1	Brazilsat B3	Ariane 44LP				DM4	AMC 8	Ariane 5G	DM2	BSat 2B	Ariane 5G	DM2	N-Star c	Ariane 5G
	DM2	BSat 1B	Ariane 44P				DM4	Astra 2D	Ariane 5G	DMN	Skynet 4F	Ariane 44L			
	DM1	Inmarsat 3F5	Ariane 44LP				DM2	Brazilsat B4	Ariane 44LP						
	DM2	NileSat 101	Ariane 44P				DM1	Insat 3B	Ariane 5G						
	DM3	Sirius 3	Ariane 44L				DM2	Nilesat 102	Ariane 44LP						
		Bonum-1	Delta II												
		Skynet 4D	Delta II												
		Thor III	Delta II												

[ ] = Launch Failure

DM# = Dual Manifested Launch with Another COMSTAC Satellite
Example: DM1 was paired with DM1, DM2 with DM2, etc.

DMN = Dual Manifested Launch with Non-Addressable Satellite
DMN missions are counted as a single launch in the launch count

Note: The 1998 launches of Chinastar 1 and Sinosat 1 were removed in 2004 as they were retroactively determined not to have been competitively bid.

Table 9. Historical Addressable Commercial GSO Satellites Launched (1993–2008) [Continued]

	2003			2004			2005			2006			2007		
Total Launches		12			13			15			15			12	
Total Satellites		15			13			16			19			18	
Over 5,400 kg (>11,905 lbm)		0			3			6			2			3	
					Anik F2	Ariane 5G+	DM1	Spaceway 2	Ariane 5ECA	DM2	Satmex 6	Ariane 5ECA	DM3	Spaceway 3	Ariane 5ECS
					Intelsat X	Proton M/M		Thaicom 4	Ariane 5G+	DM3	DirecTV 9S	Ariane 5ECA		DirecTV 10	Proton M/M
					DirecTV 7S	Sea Launch		Inmarsat 4F1	Atlas V 431					**NSS-8**	Sea Launch
								IA-8	Sea Launch						
								Inmarsat 4F2	Sea Launch						
								Spaceway 1	Sea Launch						
4,200 - 5,400 kg (9,260 - 11,905 lbm)		5			4			4			9			6	
		Intelsat 907	Ariane 44L		Eutelsat W3A	Proton M/M		AMC-12	Proton M/M	DM4	Wildblue 1	Ariane 5ECA	DM1	Skynet 5A	Ariane 5ECA
	DM2	Optus C1	Ariane 5G		Amazonas	Proton M/M		Anik F1R	Proton M/M		Astra 1KR	Atlas V 411	DM2	Astra 1L	Ariane 5ECA
		Rainbow 1	Atlas V 521		Estrela do Sul	Sea Launch		AMC-23	Proton M/M		Hotbird 8	Proton M/M	DM5	Skynet 5B	Ariane 5ECA
		EchoStar 9	Sea Launch		APStar V	Sea Launch		XM-3	Sea Launch		Measat 3	Proton M/M		Nigcomsat	Long March 3B
		Thuraya 2	Sea Launch								Echostar X	Sea Launch		Anik F3	Proton M/M
											JCSat 9	Sea Launch		SES Sirius 4	Proton M/M
											Galaxy 16	Sea Launch			
											Koreasat 5	Sea Launch			
											XM-4	Sea Launch			
2,500 - 4,200 kg (5,510 - 9,260 lbm)		6			4			3			6			5	
	DM1	Insat 3A	Ariane 5G		Superbird 6	Atlas IIAS	DMN	XTAR-EUR	Ariane 5ECA	DM1	**Hotbird 7A**	Ariane 5ECA	DM1	Insat 4B	Ariane 5ECA
	DM3	Insat 3E	Ariane 5G		MBSat	Atlas IIIA		Insat 4A	Ariane 5G+	DM1	Spainsat	Ariane 5ECA	DM2	Galxy 17	Ariane 5ECA
		Asiasat 4	Atlas IIIB		AMC-16	Atlas V 521		DirecTV 8	Proton M/M	DM2	Thaicom 5	Ariane 5ECA	DM5	Star One C1	Ariane 5ECA
		Hellas-sat	Atlas V 401		AMC-15	Proton M/M				DMN	JCSat 10	Ariane 5ECA	DM6	RASCOM 1	Ariane 5G+
		AMC-9	Proton K/M								Arabsat 4A	Proton M/M		**JCSat 11**	Proton M/M
		Galaxy XIII	Sea Launch								Arabsat 4B	Proton M/M			
Below 2,500 kg (<5,510 lbm)		4			2			3			2			4	
	DM2	Bsat 2C	Ariane 5G		AMC-10	Atlas IIAS	DM1	Telkom 2	Ariane 5ECA	DM4	AMC-18	Ariane 5ECA	DM3	Bsat 3A	Ariane 5ECA
	DM3	e-Bird 1	Ariane 5G		AMC-11	Atlas IIAS	DMN	Galaxy 15	Ariane 5G+	DM3	Optus D1	Ariane 5ECA	DM4	Intelsat 11	Ariane 5G+
	DM1	Galaxy XII	Ariane 5G					Galaxy 14	Soyuz				DM4	Optus D2	Ariane 5G+
		Amos 2	Soyuz										DM6	Horizons	Ariane 5G+

[box] = Launch Failure (boxed entries shown in bold)

DM# = Dual Manifested Launch with Another COMSTAC Satellite
Example: DM1 was paired with DM1, DM2 with DM2, etc.

DMN = Dual Manifested Launch with Non-Addressable Satellite
DMN missions are counted as a single launch in the launch count

Table 9. Historical Addressable Commercial GSO Satellites Launched (1993–2008) [Continued]

		2008	
Total Launches		**18**	
Total Satellites		**23**	
Over 5,400 kg (>11,905 lbm)		**5**	
		Inmarsat 4F3	Proton M
		DirecTV 11	Sea Launch
		ICO G-1	Atlas V
		Echostar 11	Sea Launch
		Ciel 2	Proton M
4,200 - 5,400 kg (9,260 - 11,905 lbm)		**8**	
	DM1	Skynet 5C	Ariane 5G
		Astra 1M	Proton M
		Nimiq 4	Proton M
	DM3	HotBird 9	Ariane 5G
		Thuraya 3	Sea Launch
		Galaxy 18	Sea Launch
		Galaxy 19	Sea Launch
	DM5	Superbird 7	Ariane 5G
2,500 - 4,200 kg (5,510 - 9,260 lbm)		**8**	
	DM2	BADR 6	Ariane 5G
	DM3	Eutelsat W2M	Ariane 5G
		AMC 14	Proton M
	DM4	Vinasat	Ariane 5G
	DM2	Protostar 1	Ariane 5G
	DM5	AMC 21	Ariane 5G
	DM1	Turksat 3A	Ariane 5G
	DM4	StarOne C2	Ariane 5G
Below 2,500 kg (<5,510 lbm)		**2**	
		AMOS 3	Land Launch
		Thor 5	Proton M

[box] = Launch Failure

DM# = Dual Manifested Launch With Another COMSTAC Satellite
example: DM1 was paired with DM1, DM2 with DM2, etc.

DMN = Dual Manifested Launch With Non-Addressable Satellite
DMN missions are counted as a single launch in the launch count

Table 10. Historical Non-Addressable Commercial GSO Satellites Launched (1993–2008)

	1993	1994	1995	1996	1997
Total Launches	3	4	1	4	1
Total Spacecraft	3	4	2	5	1

1993 (3)		1994 (4)		1995 (2)		1996 (5)		1997 (1)	
Gorizont	Proton K/DM	DFH 3-1	Long March 3A	DMC Telecom - 2C	Ariane 44L	DMC Telecom 2D	Ariane 44L	Chinasat 6	Long March 3A
Gorizont 40	Proton K/DM	Express	Proton K/DM	Gals 2	Proton K/DM	Chinasat 7	Long March 3A		
Gorizont 41	Proton K/DM	Gals-1	Proton K/DM			Express 2	Proton K/DM		
		Gorizont 42	Proton K/DM			Gorizont 43	Proton K/DM		
						Gorizont 44	Proton K/DM		

	1998	1999	2000	2001	2002
Total Launches	9	8	15	7	6
Total Spacecraft	2	3	4	1	1

1998 (2)		1999 (3)		2000 (4)		2001 (1)		2002 (1)	
ChinaStar-1	Long March 3B	Express A1	Proton K/DM	Express A2	Proton K/DM	Ekran M	Proton M/M	Express A4	Proton K/DM
Sinosat-1	Long March 3C	DM1 Yamal 101	Proton K/DM	Express A3	Proton K/DM				
		DM1 Yamal 102	Proton K/DM	Gorizont 45	Proton K/M				
				SESAT	Proton K/DM				

	2003	2004	2005	2006	2007
Total Launches	3	2	3	2	0
Total Spacecraft	4	2	3	2	2

2003 (4)		2004 (2)		2005 (3)		2006 (2)		2007 (2)	
Express AM-22	Proton K/DM	Express AM-11	Proton K/DM	Express AM 2	Proton K/DM	Kazsat	Proton K/DM	Sinosat 3	Long March 3B
DM1 Yamal 200 SC1*	Proton K/DM	Express AM 1	Proton K/DM	Express AM 3	Proton K/DM	Sinosat 2	Long March 4B	Chinasat 6B	Long March 3B
DM1 Yamal 200 SC2*	Proton K/DM			Apstar 6	Long March 3B				
Zhongxing 20	Long March 3A								

☐ = Launch Failure

DM# = Dual Manifested Launch With Another Non-Addressable GSO Sate example: DM1 was paired with DM1, DM2 with DM2, etc.

DMC = Dual Manifested Launch With Commercial Addressable Satellite DMC missions are not counted as launches in this launch count

	2008
Total Launches	2
Total Spacecraft	2

2008 (2)	
Venesat 1	Long March 3B
Chinasat 9	Long March 3B

☐ = Launch Failure

DM# = Dual Manifested Launch With Another Non-Addressable GSO Sate example: DM1 was paired with DM1, DM2 with DM2, etc.

DMC = Dual Manifested Launch With Commercial Addressable Satellite DMC missions are not counted as launches in this launch count