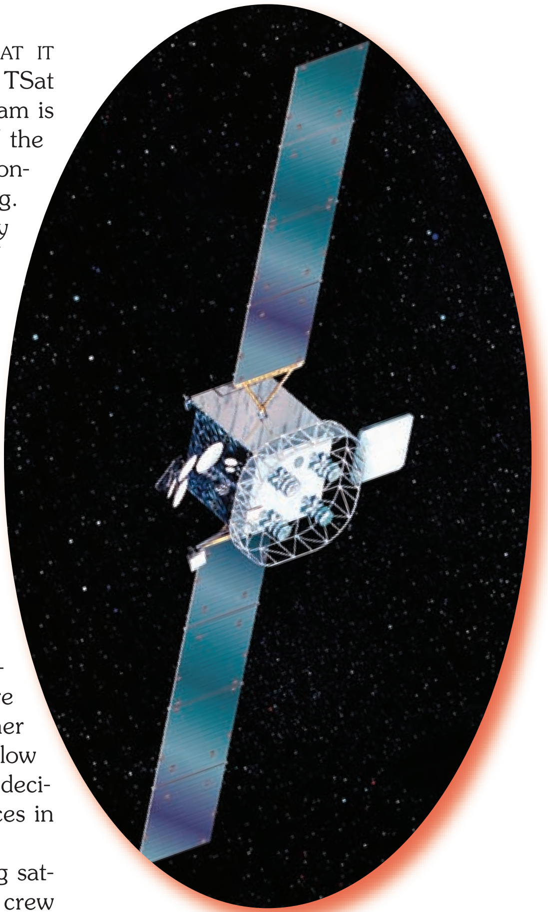
Navigation satellites fuel payload growth

DOD'S APRIL ANNOUNCEMENT THAT IT plans to cancel the Air Force's TSat (Transformational Satellite) program is the latest high-profile example of the fact that no proposed satellite or constellation of satellites is a sure thing. It also serves to highlight how tricky it is to come up with forecasts of the satellite and launch market when even "must-have" systems are sacrificed.

For several years, TSat has been one of the Air Force's highest priority programs. Pentagon officials have consistently viewed it as a "transformational" system in that it has the potential for radically improving the way the U.S. military will operate in the future. Because of its ability to provide huge amounts of bandwidth, TSat would give U.S. commanders faster access to more timely, more accurate, and higher quality data, which would in turn allow them to make quicker and better decisions and relay them to their forces in real time.

New space payloads—including satellites, deep space probes, and crew transport and resupply capsules—are being proposed worldwide every week, most not nearly as visible or seemingly vital as TSat. Thus they either proceed quietly through their development phases and are built and launched, or they get canceled or die from lack of attention and funding.

To honestly evaluate the potential size and value of the satellite and launch services markets, however, it is important to track not just the dozens of major payloads being proposed by the major players in the space industry, but also as much as possible of the relatively "small stuff" being considered by everyone else. The larger and more expansive the field of payloads, the more confidence you can build into a forecast, because you know you are working with solid data rather than merely plotting numbers on a bar graph—numbers that you think best reflect a vague vision of how many payloads will go into Earth orbit but that do not always correlate with specific programs.



Until its recent cancellation, TSat had been one of the USAF's highest priority programs.

So, for example, when we project that 1,355 payloads will be built and launched during the next 10 years, there is a rational process that allows us to get to these figures. Part of it involves looking at historical trends, so that we at least have a realistic starting point and can get ideas on how to factor in some conceivable future cycles. Another part of the process entails gauging the demand for the services that will be provided by proposed payloads, and also analyzing the support and available funding for these programs.

But the most fundamental part of the process is simply being aware of what payloads are being envisioned by hundreds and perhaps thousands of potential owners, operators, and manufacturers. The judgments about which of the payloads will actually materialize, and when, come later.

Counting payloads

There is no magic to arriving at a fair awareness of what payloads are out there. You just have to gather as much data as you can for as long as you can, and keep fine-tuning the information until you feel comfortable with it. This is precisely what we have done during the past two decades through our annual Worldwide Mission Model, which surveys the payloads planned by space agencies, companies, universities, institutes, and organizations, as well as payloads that may still be only in the conceptual stage.

In 1992, we counted as many proposed payloads as we could find around the world. We came up with a total of 656 for 1993-2002. The numbers for our annual 10-year surveys grew steadily throughout the 1990s, when there was so much excitement within the industry about a wide range of new satellite technologies, services, and applications, and so much private capital flowing into new programs.

Following the demise of many of these programs and the drying up of investment capital by the early years of this decade, our numbers peaked. In 2001, we counted more than 2,000

PROPOSED PAYLOADS

Type

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Civil	155	133	146	82	58	55	39	28	15	15	**726**
Commercial	71	102	118	66	47	64	48	41	18	15	**590**
Military	56	63	24	23	10	16	23	17	15	12	**259**
University	31	40	7	4	0	0	1	0	0	0	**83**
Total	**313**	**338**	**295**	**175**	**115**	**135**	**111**	**86**	**48**	**42**	**1,658**

Region

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
North America	111	111	144	64	39	61	59	49	15	18	**671**
Europe	66	96	71	37	42	19	15	16	6	7	**375**
Asia/Pacific Rim	60	71	29	26	23	25	17	10	15	8	**284**
Russia/CIS	56	39	25	40	8	27	17	8	9	8	**237**
Africa/Middle East	15	12	9	5	2	0	3	3	1	1	**51**
Latin America/Caribbean	5	9	17	3	1	3	0	0	2	0	**40**
Total	**313**	**338**	**295**	**175**	**115**	**135**	**111**	**86**	**48**	**42**	**1,658**

Orbit

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Low Earth orbit	205	208	202	95	63	70	56	61	18	22	**1,000**
Geostationary	71	84	50	41	32	43	27	14	16	16	**393**
Medium Earth orbit	9	20	24	26	14	12	16	7	10	2	**140**
Deep space	17	23	12	13	5	4	6	3	4	3	**90**
Elliptical	11	3	7	0	1	6	6	1	0	0	**35**
Total	**313**	**338**	**295**	**175**	**115**	**135**	**111**	**86**	**48**	**42**	**1,658**

payloads proposed for 2001-2010. By 2005, our 10-year count was down to less than 1,300.

We observed in 2006 that things appeared to be picking up. Not only were established satellite operators starting to place more orders for new satellites, but companies we had never heard of before and a growing number of governments and universities were more frequently making announcements about spacecraft they would like to develop and for which they were seeking available and affordable rides to orbit.

Our models in 2006 and 2007 counted a total of 1,450 and 1,597 payloads respectively. The model we released in 2008 for the period 2009-2018 shows 1,658 proposed payloads, an increase of 3.7%. This growth occurs because there are 10% more civil payloads than in our previous model.

Commercial, military, and university payloads have remained constant. While we have eliminated payloads that have been canceled, and those proposed by companies that are no longer viable, we have added new ones that have balanced out the numbers. Civil payloads, on the other hand, have risen by more than 10% because we have added a lot more payloads from the Asia and Pacific Rim region than we have eliminated.

From one year to the next there have been relatively small fluctuations in the number of civil payloads proposed by countries in North America, Europe, Russia, Africa and the Middle East, and Latin America and the Caribbean. However, this is not the case for Asia and the Pacific Rim, as the Chinese and Indian national space programs continue to announce new programs or feel comfortable revealing information about programs they have been working on for many years.

China and India

Among the largest Chinese satellite development programs is the proposed Compass global navigation system, which could eventually consist of up to 35 satellites, designated Beidou. We have been tracking this program since the late 1990s, when we first learned that China was planning to launch a few demonstration Beidous. By February 2007, the country had launched four Beidou 1s. The first two Beidou 2s have been launched during the past two years, and will make up part of a first-generation Compass constellation of 12 satellites to provide regional service.

Information about Compass has been trickling out throughout the past decade, and along the way we have incorporated more Beidou payloads into our models. Thus we now have a total of 35 Beidous—30 of them destined for medium Earth orbit and five for geostationary Earth orbits. The same is true for sizable Indian programs such as IRNSS

By February 2007, China had launched four Beidou 1 satellites.

Forecast Payloads

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Civil	37	40	45	50	54	55	60	58	61	53	**513**
Commercial	38	48	56	42	38	42	39	41	27	28	**399**
Military	24	21	22	26	24	28	34	30	35	37	**281**
University	14	10	20	10	14	24	12	19	21	18	**162**
Total	**113**	**119**	**143**	**128**	**130**	**149**	**145**	**148**	**144**	**136**	**1,355**

(Indian Regional Navigation Satellite System), which was first approved in 2006 and, we eventually learned, will consist of at least seven GEO satellites.

The flow of information about both China's and India's space exploration ambitions has been picking up speed in recent years. In the case of the China National Space Administration, we think the launch of the agency's Chaang'e-1 lunar orbiter in October 2007, and particularly the success of its Shenzhou manned orbital missions since 2003—efforts that have gained the agency an international reputation—have helped to bring about more openness by the Chinese government.

In the years leading up to and since the successful launch of the Chandrayaan-1 lunar orbiter in October 2008, we also began to come across a lot more readily available and specific information about satellites proposed by the Indian Space Research Organization (ISRO).

When spacecraft function as intended and missions go according to plan, the tendency appears to be for agencies, companies, and other institutions involved in space to be more receptive to exposure. This facilitates the data collection efforts for our models.

The increase in Beidou satellites, along with the higher number of Glonass military navigation satellites proposed by the Russians, helps to explain the 30% growth in the number of MEO payloads in our model.

Smaller fluctuations

The numbers of payloads in the model destined for LEO, GEO, deep space, and elliptical orbits have remained roughly the same over the past year. The last significant fluctuations in payloads in these types of orbits occurred around 2005, when we started to include large numbers of Globalstar II and Iridium NEXT LEO mobile communications satellites in anticipation of some formal contract announcements about these programs.

By the end of 2006, Globalstar had signed a contract with Alcatel Alenia Space (now Thales Alenia Space) to begin manufacturing 48 Globalstar II satellites. The following year, Iridium Satellite LLC officially announced it had reached an agreement with Lockheed Martin, Space Systems/Loral, and Thales Alenia Space to develop design concepts, review critical engineering trades, and evaluate performance and capabilities required for the Iridium NEXT system that will replace the existing 66-satellite Iridium constellation.

Russia's renewal

The more frequent Russian announcements regarding their Glonass constellation during the past three years result from a newfound commitment to finally modernizing the system after years of neglect. The commitment certainly had something to do with the system's being on the verge of becoming completely useless. A fully operational Glonass providing global coverage requires 20-24 satellites. By 2003, though, the system had decayed to no more than eight functioning spacecraft. Russia had been launching an average of three Glonass satellites annually for several years when it should have been launching twice that many to maintain the system properly.

The 2004 agreement between Russia's space agency, Rosaviakosmos, and India's ISRO to restore Glonass to its full capability was the first visible sign of Russia's long-term commitment to the system. But ultimately, the main reason for renewed Russian interest in Glonass probably had more to do with the growing health of the country's economy and increased revenues for the government from rising prices for its primary export commodity—oil. Its sudden wealth allowed Russia to begin accelerating the development and launch of Glonass replenishments. Six Glonass satellites were launched in 2007, followed by six more in 2008.

A fully operational Glonass system will require 20-24 satellites.

Last year, the space agency announced that it would launch enough spacecraft to expand the Glonass constellation to 30 satellites by 2011, implicitly making it known that dozens more satellites would be built and launched over the next decade to keep the system in good working order. We have incorporated these new payloads into our model.

The other three billion

The only other program that has contributed noticeably of late to the growth in MEO payloads is the O3b Networks' proposed O3b ("Other 3 billion"). This commercial system (in partnership with Google) would consist of at least 16 broadband communications satellites designed to provide fast Internet access to billions of people who do not have it, in regions such as Africa, Asia, Latin America, and the Middle East.

Launches of the O3b satellites are scheduled to begin in the next few years.

Marco Cáceres
Teal Group
mcaceres@tealgroup.com