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Stealth sneaks into UCAVs

A conversation with Michael Gazarik
Expanding customer base for space payloads

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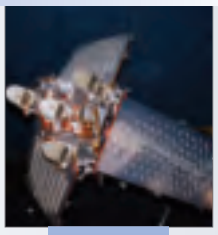

Expanding customer base for space payloads

If you look back at the number of space payloads launched (successfully or not) to Earth orbit during the past decade, the low point was in 2004, when the total was only 76. Note that by 'payloads,' we refer to any satellites or capsules. We also mean any distinct piece of hardware or equipment carried to the ISS during its assembly period.

There were only 55 launches attempted in 2004, and four of those missions were failures—the launch of the Telstar 8 commercial communications satellite by a Zenit 3SL rocket, the Offeq 6 military spy satellite by a Shavit 1, the Demosat instrumented dummy satellite and two military technology satellites (Ralphie and Sparky) by a Delta IV-Heavy, and the Sich-1M and Mikron civil Earth observation satellites by a Tsyklon 3.

That leaves 69 payloads that actually made it to orbit in 2004: 25 civil payloads, 22 military, 19 commercial, two university, and one nonprofit. Of those, 63 were satellites and six were capsules carrying supplies or crews to the ISS. (Technically, anything that goes into an orbit is a satellite, but we prefer to differentiate between these two types of payloads.)

Nearly 60% of the payloads were small (100-1,500 kg) or medium-sized (1,500-4,000 kg); 26% were large (4,000-5,500 kg), extra-large (5,500-6,500 kg), or heavy (over 6,500 kg). The remaining 14% were nano/pico-sized (20 kg or less) or micro-sized (20-100 kg). Sixty-one percent of the payloads were launched to LEO, 23% to geostationary (GEO), 9% to medium Earth orbit (MEO), 4% to elliptical, and 3% to deep space.

The payloads were launched using 23 different types of rockets: Europe's Ariane 5G; the U.S. Atlas IIAS, Atlas IIIA, Atlas V, Delta II, Taurus XL, and Titan 4B; Russia's Cosmos 3M, Dnepr 1, Molniya M, Proton K, Proton M, Soyuz 2.1a, Soyuz FG, Soyuz U, Tsyklon 2, Zenit 2, and Zenit 3SL; India's GSLV 1; and China's Long March 2A, 2B, 2C, and 4B.

The payloads belonged to government agencies, companies, universities, or organizations from 15 different countries or regions: Argentina, 2; Canada, 2; China, 10; Europe, 2; France, 7; India, 1; Italy, 1; Japan, 2; Russia, 20; Saudi Arabia, 3; Spain, 2; Taiwan, 1; Netherlands, 4; U.K., 1; and U.S., 11.

Market snapshot

The space market, which is driven primarily by the payloads market, appeared completely stagnant in 2004. Not many new satellites or capsules were being ordered. Nor were many new launch contracts awarded. In fact, in 2005, the number of launches attempted (55) was the same. Three ended in failure, leaving a total of, again, 69 payloads (62 satellites and seven capsules) sent to orbit. Clearly there was a sense of being stuck.

Not only was there little in the way of new contract work; there also were relatively few new payloads being proposed for manufacture and launch over the short (2-3 years), medium (4-6 years), or long term (7-10 years).

At the Berlin Air Show in early 2004, we released our Worldwide Mission Model: 2004-2013, listing planned payloads for that 10-year span. We were able to identify only 1,209 payloads—a drop of 14% from our model in 2003, which had counted 1,410 payloads. Our 2003 model, in turn, had diminished in number from the previous year, which had listed 1,547 payloads.

As this column noted in 2004, "We peaked in 2001 when we identified 2,160 payloads proposed for launch during 2001-2010….There are just not enough new commercial satellites being proposed to make up for all those commercial satellite programs that have died of attrition during the past few years."

From 2001 through 2004, hundreds of payloads that governments and companies had been envisioning simply dropped off the radar. There was no development work or financing activity of any consequence within these programs, so we opted not to factor them into either our model or our forecasts.

Uninterrupted growth

However, in 2005, we did notice that things were starting to change a little in the market—more contracts, and particularly more talk about new programs. In our model that year for the period 2005-2014, we counted 1,297 payloads—a 7 % increase from the pre-

NUMBER OF PAYLOADS BY MARKET

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Civil	74	205	156	62	38	56	39	40	36	39	**745**
Commercial	54	142	141	130	35	32	31	43	38	43	**689**
Military	36	68	94	80	54	48	24	21	16	16	**457**
University and nonprofit	53	60	63	27	23	10	8	5	9	6	**264**
Total	**217**	**475**	**454**	**299**	**150**	**146**	**102**	**109**	**99**	**104**	**2,155**

NUMBER OF PAYLOADS BY ORBIT

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
LEO	170	317	341	233	109	98	63	62	65	78	1,536
GEO	23	80	66	31	26	31	22	22	21	15	337
MEO	16	27	16	21	9	7	14	19	7	5	141
Deep space	4	34	21	8	6	9	3	6	3	4	98
Elliptical	4	17	10	6	0	1	0	0	3	2	43
Total	**217**	**475**	**454**	**299**	**150**	**146**	**102**	**109**	**99**	**104**	**2,155**

vious year. This was followed by a 10.5% increase in our model for 2006-2015, which included 1,450 payloads.

The number of payloads proposed around the world has continued to grow without interruption ever since. Our latest model has 2,155 payloads for 2013-2022. Moreover, the number of payloads launched annually since 2006 has remained above 100. It has surpassed 110 each year, except in 2008 (105). The number of launches has been above 60 every year since 2006, and over 70 annually since 2009.

So the space market has recovered since its low point in 2004, and it also has stabilized. It is not what we would characterize as a 'booming' market. But looking at what has occurred during the past three years, we feel there is much reason for enthusiasm and hope. For example, there are far more payload customers from many more countries than ever before.

In 2010, payloads were launched for agencies, companies, universities, and organizations from 21 countries. Unsurprisingly, the numbers for the U.S. (52), Russia (29), China (18), and European nations (19) were strong. But countries such as Egypt and the Ivory Coast also launched payloads, as did about 43 different customers from these and other nations.

In 2011, the number of countries launching payloads rose to 25. Among the most active were the U.S. (48), Russia (25), China (19), Europe (13), and India. Others included Chile, Iran, Kazakhstan, Mexico, Nigeria, Pakistan, Singapore, South Africa, Turkey, the United Arab Emirates, and Ukraine. About 57 different customers from these and other countries launched payloads.

In 2012, the number of countries launching payloads rose again, to 28. Europe (29), U.S. (22), Russia (22), China (21), and Japan (7) led the way, but others were also active, including Belarus, Brazil, Indonesia, Iran, Mexico, North Korea, South Korea, Turkey, UAE, Venezuela, and Vietnam. Some 62 customers launched payloads.

The number of government agencies, companies, universities, and organizations that are becoming players in the buying and operating of space payloads is consistently growing, as is the number of countries. In 2004, 15 countries launched payloads. Last year it was 28. In 2004, there were 32 customers that launched. Last year, there were 62.

Future implications

These are extremely positive trends that bode well for the industry's future. While the number of payloads being launched each year (and their total dollar value) may not be nearly as high as what many in the 1990s had expected it to be by now, there are a lot more players in the market, and they will be buying more and more payloads every year.

During the past 10 years, for example, about 225 agencies, companies, universities, and organizations in 55 countries have launched payloads to orbit. By comparison, we estimate there will be more than 350 payload customers from nearly 100 countries over the next 10 years. Our Worldwide

NUMBER OF PAYLOADS BY MASS

Mass, kg	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
<20	88	62	86	63	44	13	15	9	14	13	407
20>100	10	53	51	45	13	14	3	3	0	4	196
100>1,500	65	231	211	129	45	54	45	52	41	52	925
1,500>4,000	20	62	46	26	19	29	10	9	11	9	241
4,000>5,500	8	23	16	10	8	15	10	13	6	10	119
5,500>6,500	10	16	24	11	8	6	7	8	14	3	107
6,500>	16	28	20	15	13	15	12	15	13	13	160
Total	**217**	**475**	**454**	**299**	**150**	**146**	**102**	**109**	**99**	**104**	**2,155**

NUMBER OF PAYLOADS BY CUSTOMER REGION

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
North America	102	183	183	141	64	56	25	30	31	38	853
Russia & CIS	35	48	76	42	29	30	31	21	26	24	362
Europe	42	121	94	71	28	31	15	23	14	9	448
Asia and Pacific Rim	29	77	72	30	22	21	23	27	20	25	346
Latin America and Caribbean	7	24	18	14	5	5	6	5	4	7	95
Africa and Middle East	2	22	11	1	2	3	2	3	4	1	51
Total	**217**	**475**	**454**	**299**	**150**	**146**	**102**	**109**	**99**	**104**	**2,155**

Mission Model for the period 2013-2022 specifically identifies 320 of these customers and 70 of these countries, and it names the 2,155 payloads that they are proposing either to build or to buy and launch.

Thirty-five percent of the payloads are civil—meaning government nonmilitary. Thirty-two percent are commercial, 21% military, 12% university or nonprofit. Of the roughly 1,109 payloads launched during 2003-2012, 40% were civil, 26% commercial, 26% military, and 8% university or nonprofit. We do believe that the growth trends favor commercial and university/nonprofit payloads.

In the next two or three years alone, there will be dozens of Globalstar, Iridium, and Orbcomm mobile communications replacement satellites launched to LEO, along with some 30 Galileo navigation, 20 O3b broadband communications satellites headed for MEO, and perhaps others less certain, such as the 24 Cicero meteorological satellites for LEO. There are potentially hundreds of pico-, nano-, and microsatellites from hundreds of universities—many of which are just waiting for affordable launchers. We have identified more than 200 university satellites proposed for launch in the next five years alone. We anticipate a lot more of them 5-10 years out.

Civil vs. military payloads

Civil payloads will not dominate quite so much as in past years because of public funding constraints in the U.S. and Europe. However, because of expanding national programs in China and India, payloads from countries recently entering the space market, and the increasing use of picosats, nanosats, and microsats by governments, civil payloads should make up at least one-third of the total.

We foresee military payloads comprising less than 20% of the market. The U.S. and Russia will continue to build and launch the vast majority of military payloads, and the U.S. in particular will increasingly employ picosats, nanosats, and microsats for imaging, communications, and technology development missions. A noteworthy program in this category is Colony 1, which calls for a constellation of 50 3-kg technology CubeSats built by Boeing Phantom Works for surveillance and reconnaissance. Another is the Kestrel Eye system, which would consist of six 15-kg nanosats built by Andrews Space for the Army Space and Missile Defense Command (SMDC). These are also technology development imaging satellites.

Another nanosat program for the U.S. military is ONE (Operational Nanosatellite Effect), which calls for at least 10 3-kg technology satellites for communications. These will be built by Miltec Missiles and Space for SMDC as well. DARPA is working on a system called SeeMe (Space Enabled Effects for Military Engagements), which envisions six prototype and 24 operational 40-kg technology microsats for surveillance. Millennium Space Systems has been contracted on this program.

Thus, while the Pentagon will perhaps be building and launching many more payloads than ever before, many of these will be very small technology satellites built to increase understanding of how they can support U.S. warfighting and logistical requirements. These picosats, nanosats, and microsats may eventually find useful applications, but probably not until 10-20 years from now.

We do not see other countries building and launching many dedicated military payloads. This is partly because of cost considerations and partly because of the trend toward sharing platforms with commercial and civil payloads. Another major reason is that so many military imaging and communications requirements can now be fulfilled by commercial payloads. Leasing or purchasing simply makes more sense than owning.

This is certainly the case within the civil payloads market, notably with regard to cargo resupply and crew transport services to the ISS. If you consider solely the payloads that could go up in the next four years as a result of NASA's Commercial Orbital Transportation Services program, there are about 16, split evenly between SpaceX with its Dragon capsules and Orbital Sciences with its Cygnus capsules.

Meanwhile, NASA will continue to lease seats for its astronauts aboard Russian Soyuz crew capsules, until a human-rated U.S. capsule—as part of NASA's Commercial Crew Integrated Capability—is ready to take over. That could be as early as 2015, but more likely will be closer to 2018-2020.

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