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A conversation with Sir Martin Sweeting

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U.S. launch numbers take a dive

In 2010, the number of launches worldwide totaled 75—exactly the same number as in 2009. This is good news for the launch services industry, because it suggests that this sudden spike in the number in 2009 was not an anomaly, but rather the start of a trend toward a more robust market than that of 2001-2008, when the number of attempted launches averaged 62 per year.

The bad news, at least for the U.S., is that U.S. launch service providers accounted for the lowest number of attempted launches, relative to providers from other countries, in at least the past decade.

Shrinking U.S. share

Of the 75 rockets launched last year, only 15 were of U.S. nationality. That represents a mere 20% of all the rockets launched worldwide. During the past 10 years, U.S. rockets have consistently accounted for more than a quarter, and often more than a third, of annual launch missions. In 2001 and 2003, U.S. rockets accounted for 42% and 39% of the launches respectively. Even as recently as 2009, U.S. rockets represented 37% of the vehicles launched.

The sudden downturn in U.S. launch vehicle activity may appear to validate the concerns of those who have been warning about the impending loss of U.S. space launch supremacy. That loss follows the Obama administration's 2010 decision to terminate the shuttle program, dramatically scale back the Ares/Orion effort, and cancel plans to return to the Moon by 2020. The decision entrusted responsibility for meeting NASA's space transportation needs to vehicles developed and operated entirely by private launch companies such as SpaceX (Space Exploration Technologies) and Orbital Sciences. In reality, though, the administration's decision and the launch downturn have absolutely nothing to do with each other.

If anything, last year marked a major milestone for the shift away from the traditional, U.S. government-led space transportation paradigm toward one that allows private industry to innovate and lead the way.

On June 4, 2010, SpaceX successfully launched its first Falcon 9 rocket, a medium-to-heavy-lift vehicle designed to carry the Dragon capsule. The Falcon 9/Dragon system is one of two tasked by NASA, under the Commercial Orbital Transportation Services program, to eventually take over resupply of the ISS for the U.S. The maiden launch of the Falcon 9 validated the rocket.

On December 8, 2010, SpaceX followed up with a perfect launch of the Falcon 9/Dragon system. The Dragon capsule completed two orbits and then reentered the Earth's atmosphere to splash down in the Pacific Ocean, clearing the way for Falcon 9/Dragon to begin taking over ISS resupply missions after the shuttle performs its last mission, either in April with Endeavour's last flight or sometime this summer with the final flight of Atlantis. Falcon 9/Dragon is scheduled to undertake at least 12 cargo resupply missions to ISS. Eventually it may also carry astronauts to the station, as Falcon 9 is designed for both unmanned and manned spaceflight.

Falcon 9

A better explanation

Perhaps the best explanation for the marked slide in U.S. launch vehicle activity in 2010 is simply that U.S. rockets had an exceptionally active year in 2009, and thus were due for a less active one last year. All but one of the U.S. government and commercial launch systems that were operational as of 2009 were launched that year, including the shuttles Atlantis, Endeavour, and Enterprise, as well as Atlas V, Delta II, Delta IV, Falcon 1, Minotaur I, Taurus XL, and both the sea-based and land-based models of the Sea Launch Zenit program.

The near disappearance of Boeing's Delta II rocket from the scene made last year's U.S. launch numbers look much weaker than they would normally be after a strong year. Because of its long-anticipated phase-out in favor of the larger and more powerful Delta IV family, and consequently its higher per-mission costs, the II launched only once in 2010.

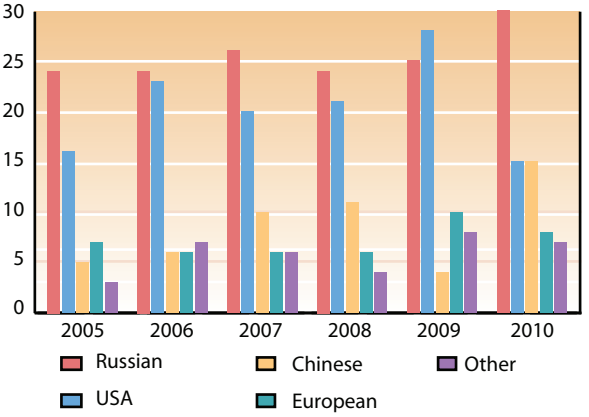
A total of eight Delta IIs flew in 2009, and that may well have been the last significant year for the program—unless a large enough market can be found, one that would allow Boeing to offer the venerable rocket at its more traditional and more competitive price of $50 million-$60 million per mission. With the cost of a Delta II


Delta II

now exceeding $90 million, and likely to reach more than $100 million, the vehicle has become too expensive for NASA and commercial satellite operators to use regularly.

As for the huge drop in the number of U.S. rocket launches relative to rockets from abroad, this can best be explained by the combination of fewer Delta IIs and many more Chinese and Russian rockets launched in 2010.

NUMBER OF ROCKETS LAUNCHED, 2005 - 2010
BY COUNTRY



Russia, led by its Soyuz and Proton programs, normally carries out about 25 launches a year. A total of 30 Russian rockets were launched last year, including 12 Soyuz medium-lift vehicles and 12 heavy-lift Protons. The combined number of Soyuz and Proton rockets launched in a given year usually equals 18-20, but in 2010 the total grew by about 25%, on the increased commercial strength of Proton and continued reliance by NASA and the Russian space agency, Rosaviakosmos, on Soyuz for space station cargo resupply and crew transport services.


Proton

Last year, the Proton rockets launched eight large commercial communications satellites destined for geostationary orbits, including the 2,450-kg Intelsat 16 for Intelsat, the 6,379-kg EchoStar 14 and 5,521-kg EchoStar 15 for EchoStar Communications, the 3,152-kg SES-1 for Société Européenne des Satellites, the 5,420-kg Arabsat 5B for the Arab Satellite Communications Organization, the 5,984-kg XM-5 for XM Satellite Radio Holdings, the 5,390-kg SkyTerra-1 for SkyTerra Communications, and, finally, the 6,150-kg Ka-Sat for Eutelsat.

The other four Protons were used to launch military satellites for the Russian Ministry of Defense. Three of those vehicles carried Glonass-M satellites as part of a renewed effort by the Russian Space Forces to modernize their aging 24-satellite Glonass global navigation system.

Meanwhile, nine of the 12 Soyuz rockets were used to launch Soyuz crew capsules and Progress cargo capsules to the ISS. The high pace of Soyuz launch activity will undoubtedly continue for the foreseeable future, given the lack of support from the space shuttle fleet after this year and the likelihood that it will take time for new systems such as Falcon 9/Dragon and Orbital Sciences' Taurus II/Cygnus to develop their launch rhythm.

Two of the other three Soyuz vehicles launched military satellites for the Russian Ministry of Defense, and the third carried a batch of six Globalstar II mobile communications satellites to begin modernizing the 52-satellite Globalstar costellation. Three additional Soyuz launchers will be used to boost three more batches of six Globalstar IIs within the next two years.

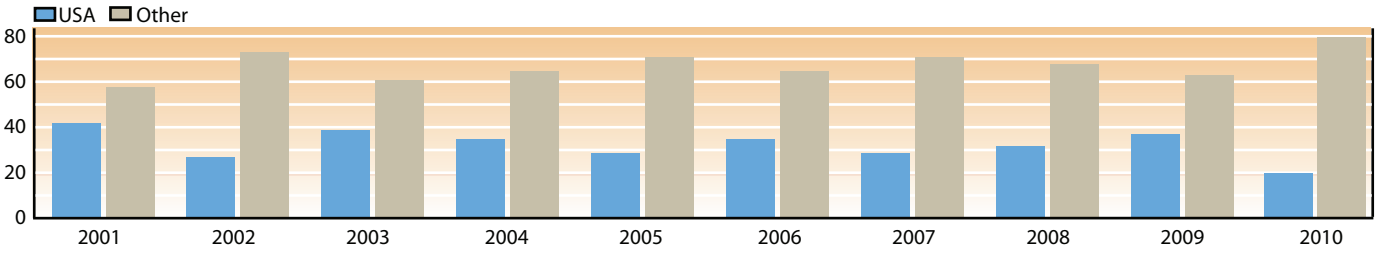
China's long march to dominance

The real news last year, however, was the dominance of China's Long March family of launch vehicles. A total of 15 Long March rockets were launched by China Great Wall Industry, and that is more than any other launch program in the past decade anywhere in the world. The launch activity was spread out among six different Long March models, including the Long March CZ-3A, which launched four missions; the Long March CZ-2D, CZ-3C, and CZ-4C, with three missions each; and the Long March CZ-3B and CZ-4B, with one apiece.

What tended to distinguish last year's Long March missions was the


Long March

PERCENTAGE OF U.S. VS. OTHER ROCKETS LAUNCHED, 2001 - 2010



unusual number of navigation satellites launched. Five of the 15 rockets carried 2,200-kg Beidou satellites for the Chinese government's Compass civil/military navigation system. The country is planning a limited constellation of 12-15 satellites that will offer services to the Asia-Pacific region by the end of next year, which means that at least 10 more Long Marches will launch Beidou satellites during 2011-2012. A global Compass constellation of up to 35 spacecraft is envisioned by 2020, which suggests that navigation satellites will remain a sta-

LAUNCH MISSIONS ATTEMPTED

	2009	2010
Long March	4	15
Proton	10	12
Soyuz	12	12
Ariane 5	7	6
Atlas V	5	4
Delta IV	3	3
Dnepr 1	1	3
Space shuttle	5	3
Falcon 9	0	2
GSLV 1	0	2
Minotaur IV	0	2
Rockot 1	3	2
Cosmos 3M	1	1
Delta II	8	1
H-2A	3	1
Naro 1	1	1
M-5	0	1
Molniya M	0	1
PSLV 1	2	1
Shavit 1	0	1
Zenit 3F	0	1
Sea Launch Zenit	4	0
Falcon 1	1	0
Minotaur I	1	0
Safir 2	1	0
Taepo Dong 2	1	0
Taurus XL	1	0
Tsyklon 3	1	0
Total	**75**	**75**


Soyuz

ple of Long March's launch manifest for many years.

Apart from the Beidou missions, Long Marches launched a wide assortment of satellites, including the 5,100-kg Chinasat 6A commercial communications satellite for China Satellite Communications and the 2,300-kg Chinasat 20A military communications satellite for the Chinese Ministry of National Defense (MND), two 2,700-kg Yaogan surveillance satellites, and the 1,500-kg Tianhui 1 imaging satellite for the MND, the 2,495-kg Chaang'e 2 lunar probe and three 1,200-kg Shijian scientific satellites for the China National Space Administration, and the 2,200-kg Feng Yun 3B weather satellite for the China Meteorological Administration's activities.

In other words, China alone has a large enough satellite market to keep Long Marches flying at a robust rate. You can imagine what the rates will look like the day these vehicles start to be contracted on a consistent basis by Western satellite companies.

Not only did Long March outperform all other launch vehicle programs, it demonstrated the ability to launch quickly. By the end of June 2010, there had been only four Long March launches, leading us then to project a total of 10 Long March missions for the entire year. We assumed that China Great Wall Industry would average no more than one Long March launch per month, as that is about the best pace that can be expected of even the busiest programs, such as Soyuz. But in the second half of the year, Long March managed to post 11 launches—nearly two missions per month. You would probably have to go back two decades to find the last time a launcher program logged as many flights over a six-month period.

Lastly, it is worth noting that for the first time in history, China matched the U.S. in the number of rockets launched. In this sense, it is true that the U.S. no longer shares space launch supremacy with Russia only, as has been the case for half a century. However, it is not because the U.S. has ceded ground in this industry, but rather because China has committed itself as a nation to being a major player in space and has invested heavily in developing the necessary technologies since the 1990s. The Chinese have now arrived.

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