October 2010

AEROSPACE AMERICA

X-51 scrams into the future

Conversations with Werner J.A. Dahm

Critical times for India's space program

A PUBLICATION OF THE AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

Space launches spike upward

THIRTY-FIVE SPACE LAUNCH MISSIONS WERE attempted during the first six months of this year. Only two of the missions failed, India's GSLV 1 rocket on April 15 and South Korea's Naro 1 on June 11. The number of missions is slightly more than the 34 posted in the first half of 2009. There were also two launch failures during those six months, Orbital Sciences' Taurus XL booster on February 24 and North Korea's Taepo Dong 2.

The Long March and the Proton, opposite, are two of the most active launch programs.

Based on launch activity through the end of June, recent-year launch totals, known launch manifests worldwide, and the predictable trend of more launches in the second half of the year than in the first, we project that the total number of missions attempted for this year may surpass 80 for the first time since 2000. For most of the past decade, the annual launch numbers have hovered between the mid-50s and mid-60s.

More active launch programs

There is now clearly a trend upward, and it is being driven by a combination of three factors: Most of the major launch vehicle programs are as active as they have been in the past decade; some of the traditionally less active programs have begun to pick up the pace of their launches slightly; and a few new launch vehicles have been introduced.

There are five launcher programs that we classify as highly active—programs that consistently launch five or more times a year. They are Russia's Soyuz and Proton, Boeing's Delta II, Arianespace's Ariane 5, and China's Long March family. In 2009, all but one of them—Long March, which was coming off a record 11 launches in 2008—launched as many as or more than they had at any time in recent memory. Those four vehicles alone accounted for nearly half of all the launch missions attempted last year.

Soyuz had an exceptional year, with a total of 12 successful missions. For a launch vehicle program to average one mission per month is unheard of these days. Meanwhile, the Ariane 5's seven missions were at around maximum capacity for that program.

Whenever the most active launchers happen to have a good year together, the probability of a robust launch market increases significantly. That is what occurred last year, and (with the exception of the Delta II) this year it appears to be happening again.

This probability of a robust market rises even more when we factor in activity by a second group of launch vehicle programs that account for an average of one to five missions annually. These less active but established programs include NASA's shuttle, Sea Launch's Zenit 3, ULA's Atlas V and Delta IV, Japan's H-2A, Russia's Cosmos 3M and Dnepr 1, India's PSLV, Eurockot Launch Services' Rockot 1, Space Exploration Technologies' Falcon 1, and the Air Force's Minotaur I. Most of these programs posted

average to good launch activity last year.

From a relative standpoint, the shuttle, Atlas V, and Rockot 1 had an excellent year in 2009. The space shuttle launched five successful missions, more than at any time since 2002—the year before the loss of Columbia. Atlas V's five missions were more than the vehicle had ever launched in its eight-year career. And the three missions for Rockot were a record for that 20-year program.

Had we only taken into account activity by the established launcher programs, 2009 would have been a fairly dynamic year. Not since 2000 has there been a year when more launches were attempted. The addition of three new launch vehicle programs made last year stand out just a little more as the most active period for the global launch services industry in recent years, with a total of 75 missions attempted.

Three new vehicles made their initial flights last year—South Korea's Naro 1, Iran's Safir 2, and North Korea's Taepo Dong 2. Although their impact on the launch market is slight, these programs do contribute to the upward trend in launch activity we are now seeing.

Both South Korea and Iran are currently developing satellites they would like to launch aboard their own vehicles for the sake of national pride, as well as the more pragmatic purpose of gaining independent access to space. Consequently, we believe that at least the Naro and Safir programs may eventually produce vehicles that could compete in the market.

South Korea seems especially determined to move forward with Naro. After the vehicle's failed maiden launch on August 25, 2009, the government moved quickly to launch a second Naro earlier this year. That mission failed as well, but it suggests that South Korea is determined to field an operational vehicle as soon as possible. It is easy to speculate that Naro could accelerate North Korea's efforts to develop its Taepo Dong 2.

The introduction of new launch vehicles continued this year with the successful maiden flight of SpaceX's Falcon 9 medium- to heavy-lift rocket on June 4. We anticipate the first launch of Orbital Sciences' new Taurus II during the first quarter of next year. Both of these vehicles have been contracted by NASA to provide commercial resupply services for the ISS as part of the Commercial Orbital Transportation Services program.

Civil and military payloads rule

So what is driving all this activity? Why do so many of the launch vehicle programs seem to be so busy at about the same time? It is understandable that some rockets would be more active than others in a given year. But lately it seems like a larger number of vehicles than usual are launching at relatively high rates in roughly the same period.

If you look at the types of payloads launched to Earth orbit during 2009 and the first six months of this year, the largest percentage is civil. Last year, 43% of all payloads launched were civil. During the first half of this year, 52% were civil payloads. By comparison, only 27% of the payloads launched last year were commercial, and 26% were military. During the first six months this year, 35% of the payloads were military and only 13% were commercial.

In short, there are clearly more civil and military payloads being launched, and far fewer commercial ones. In 2009, the number of civil payloads launched grew by 13%, military payloads by 33%. The number of commercial payloads launched last year was down 30%. This trend continued through the first half of this year. In fact, even fewer commercial satellites were launched during the first six months of 2010 than during the same period last year, while many more military payloads were placed in orbit. Civil payloads launched have remained on pace with last year's numbers.

The preponderance of civil payloads is due largely to a rise in the number of ISS missions launched by both the shuttle and Soyuz. Normally, there are three or four space shuttle missions launched annually to transport assembly hardware for the ISS, and six Soyuz missions to transport crews and supplies to the station. In 2009 there were four shuttle and eight Soyuz flights to the ISS. As of the

VEHICLES LAUNCHED (by program)

	2005	2006	2007	2008	2009	2010*
Soyuz	11	11	11	8	12	6
Proton	7	6	7	10	10	6
Delta II	3	6	8	5	8	0
Ariane 5	5	5	6	6	7	2
Atlas V	2	2	4	2	5	2
Space shuttle	1	3	3	4	5	3
Long March	5	6	10	11	4	4
Zenit 3	4	5	1	6	4	0
Delta IV	0	3	1	0	3	2
H-2A	1	4	2	1	3	0
Rockot 1	2	1	0	0	3	1
PSLV 1	1	0	2	3	2	0
Cosmos 3M	3	1	3	3	1	1
Dnepr 1	1	2	3	2	1	3
Falcon 1	0	1	1	2	1	0
Minotaur I	2	2	1	0	1	0
Naro 1	0	0	0	0	1	1
Safir 2	0	0	0	0	1	0
Taepo Dong 2	0	0	0	0	1	0
Taurus XL	0	0	0	0	1	0
Tsyklon	0	1	0	0	1	0
Atlas IIIB	1	0	0	0	0	0
Falcon 9	0	0	0	0	0	1
GSLV 1	0	1	1	0	0	1
M-5	1	2	0	0	0	1
Molniya M	1	1	1	1	0	0
Pegasus XL	1	1	1	2	0	0
Shavit 1	0	0	1	0	0	1
Shtil 1	0	1	0	0	0	0
Start 1	0	1	0	0	0	0
Titan 4B	2	0	0	0	0	0
Volna	1	0	0	0	0	0
Zenit 2	0	0	1	0	0	0
Total	**55**	**66**	**68**	**66**	**75**	**35**

*Through June.

PAYLOADS LAUNCHED (by type)

	2005	2006	2007	2008	2009	2010*
Commercial	19	24	35	40	28	7
Civil	29	44	48	39	45	27
Military	22	27	37	18	27	18
University	3	18	5	7	5	0
Total	**73**	**113**	**125**	**104**	**105**	**52**

*Through June.

NASA has contracted with both the Taurus II (left) and Falcon 9 for resupply missions to the ISS.

end of June this year, there had been three shuttle and five Soyuz flights to the station, surpassing last year's pace.

The shuttle will be launched for the last time in 2011, and will cease playing a role in carrying assembly hardware to the ISS. But this kind of payload was going to drop off anyway, given the scheduled completion of the station next year.

Launches of civil payloads to the ISS will continue for the foreseeable future, but these will consist of crewmembers and supplies. Soyuz rockets will continue to launch an average of six Progress resupply and Soyuz crew capsules annually, while new vehicles such as Falcon 9 and Taurus II will help with resupply missions using the Dragon and Cygnus capsules, respectively.

A secondary factor in the growth of civil payload numbers involves the recent push by the governments of Iran, North Korea, and South Korea and by SpaceX to field new rockets. When governments develop launch vehicles, it is usually for deploying civil and military payloads. The initial payloads assigned to these vehicles are often small scientific or technology development satellites that, at least officially, are designed for civil, not military, purposes. This has been the case with the Naro 1, Safir 2, Taepo Dong 2, and Falcon 9.

Both the failed Naro missions carried 100-kg STSAT scientific satellites for the Korean Aerospace Research Institute. The Safir reportedly launched Omid, the 37.2-kg experimental communications satellite for the Iranian Space Organization. The North Korean government stated that the Kwangmyongsong 2 civil communications microsatellite was aboard the failed Taepo Dong. And the Falcon carried a demonstration Dragon capsule in preparation for a series of Dragon missions to the ISS for NASA.

While civil payloads are clearly the most numerous in the launch market, it is military payloads that have shown the most dramatic growth during the past two years. There is no single factor that accounts for this. The U.S. and Russia are launching roughly the same number of military satellites they usually launch—8-10 each. The difference lately is that most of the countries that are capable of building and launching military satellites have been actively doing so.

From 2009 through June 2010, China, France, Germany, Israel, Italy, and Japan, as well as the U.S. and Russia, have built and launched military satellites. Germany and Japan have each launched more than one military satellite; France has launched three. This phenomenon is similar to what is happening with launch vehicle programs—nearly everyone happens to be active at about the same time.

Marco Cáceres
Teal Group
mcaceres@tealgroup.com