



Liftoff of the Ariane 5 with the ASTRA 1L and Galaxy 17 satellites (May 4, 2007). Photo courtesy of Arianespace.

Maintaining our presence in Space

Launch systems are the foundations that ensure that the plethora of services we on earth enjoy from Space continue to be made available. The teams of professionals whose job it is to get the satellites into Space work hard to give their customers the best service possible. With customers scrambling for launch slots Satellite Evolution takes a look at what's new in the world of launch systems.

You only needed to walk through the satellite hall at CommunicAsia this year to see that the satellite industry is looking very healthy. This, in turn, is creating steady demand for the launch of new spacecraft into orbit and the three big players in the launch industry, Arianespace, ILS and Sea Launch are all working hard to meet those demands. With talk of a new generation of launchers currently being developed and a lack of launch slots what is going on in the industry at the moment?

ILS

Headquartered in McLean, Virginia, ILS (International Launch Services) is a long-standing, successful US- Russian joint venture with exclusive rights to the worldwide sale of commercial Proton launch

services. Since 1995, ILS has signed contracts for more than 100 launches at a value of over \$80 billion. The joint venture partners are Space Transport Incorporated, the Khrunichev State Research and Production Centre and RSC Energia. The Proton vehicle launches commercial ILS missions and also Russian government payloads from the Baikonur Cosmodrome operated by RosCosmos and under lease from the Republic of Kazakhstan.

ILS' first commercial launch was made in 1996 and has since worked with all the principal satellite operators and has maintained a steady launch pace. The Proton launch vehicle is the main workhorse of the Russian Space programme and, since 1965 has an impressive reliability record of 96 percent in 320 launches. Once a customer secures a slot with ILS, the Proton is configured to suit the



payload it will be launching. ILS and SES Satellite Leasing announced a contract at the recent Paris Air Show that calls for the launch of five SES satellites on Proton Breeze M vehicles through 2013. Financial details were not disclosed.

With five firm orders, this is the largest single Proton launch services contract. ILS has been marketing the Russian Proton Breeze M vehicle to commercial satellite operators since 1993, and has carried out 40 launches.

The Proton flights will be available to SES' operating companies: SES AMERICOM, SES ASTRA, SES NEW SKIES and SES SIRIUS. The first mission is expected to be in 2009.

"The real value in this unique multibuy contract is the flexibility it offers SES, in terms of matching payloads and launch periods," said Frank McKenna, ILS President.

"We're proud to continue our long-standing partnership with SES," McKenna said. "Our relationship goes back to the very beginning of ILS. SES was the customer for the first commercial launch on Proton back in 1996, and ILS has launched at least one satellite a year for SES operating companies ever since. In 2007, we have scheduled launches for SES AMERICOM and SES SIRIUS."

Romain Bausch, SES president and CEO, said: "We are confident that with this innovative agreement in place, the continuous development and replacement of our global satellite fleet is ensured at attractive terms and conditions for the foreseeable future, providing SES with an additional competitive edge. International Launch Services and SES have a long history together and we look forward to continuing our successful collaboration on Proton launches."

Recent product enhancements enable Proton Breeze M to lift more than six metric tonnes to geosynchronous transfer orbit from the Baikonur Cosmodrome.

Successful DIRECTV launch

International Launch Services (ILS) successfully launched the DIRECTV 10 satellite in July using an enhanced version of Russia's premier vehicle, the Proton.

The mission lasted 9 hours and 8 minutes, before the Breeze M upper stage placed the DIRECTV 10 satellite into a geosynchronous transfer orbit. After about two months of in-orbit testing, the satellite will move to its operating position of 102.8 degrees West longitude to enhance DIRECTV's high-definition services across the United States, including Alaska and Hawaii.

"We're proud of the excellent performance of our Enhanced Proton Breeze M and its demonstrated ability to lift such a massive payload as the DIRECTV 10 satellite," said ILS President Frank McKenna. "At around six metric tons, this Boeing 702 model was the heaviest spacecraft launch for Proton."

McKenna continued: "Not only are we proud of the vehicle's performance, we're also proud of our schedule performance. We met our commitment to launch the satellite in order to support DIRECTV's goal of delivering up to 100 national HDTV channels by the end of the year."

This was the 41st mission for ILS.

Khrunichev is also preparing another Proton M vehicle for the next commercial mission. That is the scheduled launch in September of the JCSAT-11 satellite for JSAT Corp. of Japan. This mission will be the third of the year for International Launch Services.

The de-assembled Proton M launch vehicle assigned to the mission was delivered June 16 by rail in separate containers to Kazakhstan's Tyura Tam station from Moscow. The Khrunichev team is conducting off-loading operations.

The offloaded containers will be transported by rail to the Launch Vehicle Assembly and Test Building 92-A50 and installed in Hall 111, where Khrunichev engineers will perform routine assembly and test operations with the first through third stages of the rocket.

The Proton Breeze M launch with JCSAT-11 will be the first Proton commercial mission for a Japanese customer. The satellite, an A2100 model, is being developed by Lockheed Martin Commercial

Space Systems. The future is looking very busy for ILS. They will have exclusive rights to the next-generation Angara launch vehicle that is currently in development with Khrunichev engineers. Funded by the Russian Government, the new family of launchers will use environmentally sound propellants and RosCosmos say that it is expected to be ready for its first test launch in 2010-11.

Sea Launch

Sea Launch was formed in 1995 and partners include Boeing Commercial Space Company, Aker ASA, RSC Energia and SDO Yuzhnoye. Sea Launch uses a modified oil platform to launch commercial satellites at sea giving excellent environmental conditions. The equatorial launch pad site ensures the most direct route to orbit and maximum lift capacity. The direct routing also means that precious fuel is saved and extends the life of the spacecraft. Sea Launch provides the complete launch package and provides modern, accessible, user-friendly payload processing, all-inclination launch capability along with the facilities of a US launch site.

Following the unsuccessful launch of NSS-8 from the Sea Launch Odyssey platform the Sea Launch Failure Review Oversight Board (FROB) concluded its review of the findings of an interagency CIS Joint Commission, which has been investigating the cause of the unsuccessful launch of January 30, 2007. All systems have been cleared for operations, pending completion and tests of all repairs on the Launch Platform.

The commission concluded on March 12 that the failure initiated in the liquid oxygen (LOx) turbopump section of the RD-171M main engine. Following the initial FROB meeting in April with the commission, the Sea Launch partners performed internal inspections of already manufactured and tested RD-171M engines, with the objective of confirming the LOx feed system and pumps were free of debris.

The FROB met again with the commission from May 24-June 1,



BADR-4 Launch. Photo courtesy of ILS.



Launch of KoreaSat 5 - August 21, 2006. Photo courtesy of Sea Launch.

to review results of the engine inspections and further findings. FROB Chairman Kirk Pysher, Vice President and Chief Systems Engineer for Sea Launch, reported that members of the FROB concurred with the commission findings, conclusions and recommendations. It was agreed that the anomaly had occurred as a result of a metallic object becoming lodged between the pump's moving and stationary components. This object ignited and burned as a result of friction-induced heat. The combustion of the object set off a string of events that led to the destruction of the Lox pump, RD-171M engine and ultimately the Zenit 3SL.

The commission performed a thorough review of operations on the RD-171M engine, following the standard full duration acceptance test that each manufactured engine undergoes at the Energomash test stand. This review included the RD-171M return-to-flight engine currently installed on a Zenit-2 vehicle awaiting launch from the Baikonur Space Centre this summer. The commission found two operations with the potential for introduction of foreign object debris (FOD) into the LOx feed system. The FROB confirmed that the commission identified the necessary corrective actions to preclude these operations as potential sources for FOD introduction in the future.

"The commission has conducted an extensive and thorough review of the processes, hardware and systems related to the engine and its supporting systems," said Rob Peckham, President and General Manager of Sea Launch. "The Sea Launch FROB completed its work with no constraints on continuing hardware production. We are now continuing to move forward to our launch operations in October. I am confident that we have not only identified the cause of the launch failure in January, but that we are also doing everything possible to ensure that this incident will never happen again. I am extremely proud of the professionalism and diligence demonstrated by everyone involved throughout this process and look forward to regaining our launch tempo."

In parallel with the investigation and corrective actions, the Sea Launch team is proceeding on schedule with repairs and re-certification of the Odyssey Launch Platform and associated launch support equipment. The Launch Platform is currently en route to a ship-

yard in British Columbia, where a team of specialists will be performing heavy industrial repair work and painting over the next several weeks. Sea Launch expects to complete these activities and conduct marine tests by the end of the summer.

Road to recovery

Mobile Satellite Ventures LP and joint venture partner Mobile Satellite Ventures (Canada) recently announced that MSV has contracted with Sea Launch Company, LLC, for the launch in 2010 of one of two high-powered, next-generation satellites, designed to provide seamless, transparent and ubiquitous broadband wireless coverage of North and Central America to consumer electronic devices. The contract demonstrates the satellite's industry's confidence in Sea Launch who plan to launch the MSV spacecraft on a Zenit-3SL vehicle from a site on the Equator near the island of Kiribati in the Pacific Ocean.

The hard work and determination of the Sea Launch team will see launch activities returning to normal by October. Now that the FROB have come to their conclusions, it is time to move on.

Arianespace

Currently, the Arianespace portfolio consists of the Ariane 5 heavy launcher, the Soyuz medium launcher and the Vega light launcher that will see its first launch from the European Spaceport in French Guiana in 2008.

The first of two Ariane 5 launch vehicles for Arianespace missions planned in August and September 2007 has completed its initial build-up at the Spaceport in French Guiana.

This launcher, an Ariane 5 GS version, has been equipped with its vehicle equipment bay and storable propellant EPS upper stage, which followed the mating of its two solid boosters with the core cryogenic stage. It will be utilised for a mid-September flight to orbit the Intelsat-11 and Horizons-2 satellites. With its basic build-up complete, the vehicle will be transferred to the Spaceport's Final Assembly Building, freeing up the Launcher Integration Building for preparation of an Ariane 5 ECA. The heavy-lift Ariane 5 ECA will be used for a mission scheduled in mid-August, which will orbit the SPACEWAY



3 and BSAT-3A satellites.

Once the Ariane 5 ECA's basic assembly is finished, a swap-out will occur—with the Ariane 5 ECA moving over to the Final Assembly Building for installation of its dual-satellite payload, while the Ariane 5 GS returns to the Launcher Integration Building, ready for final processing.

Arianespace has the capability to adapt its launch pace to meet customers' mission needs, and can adjust when necessary for delivery schedule changes with their satellites. Operational resources available for Arianespace at the Spaceport include an extensive ground infrastructure and two Ariane 5 mobile launch tables, which are backed up by the production capacity of Ariane's industrial team in Europe.

Arianespace has further consolidated its commercial launch services leadership by announcing five more contracts and ordering new Ariane 5 and Soyuz launchers during the Paris Air Show. With these major developments, Arianespace hopes to be able to continue meeting its customers' evolving requirements with a growing launch vehicle family and high-quality service.

During the Paris Air Show, Arianespace also announced the largest contract ever for the European space industry - a multi-launch framework agreement with SES covering missions over a five-year period, along with orders for Arabsat 5 (the Arab League), Thor 6 (Norway), Rascom 1 (Africa) and Insat 4G (India). With this new business, Arianespace's backlog is now equal to a workload exceeding three years - with 44 satellites to be launched.

In addition, Arianespace signed a preliminary order concerning the production of 35 Ariane 5 launchers and it inked a contract with the Russian space industry for acquisition of the first four Soyuz rockets to be launched from Guiana Space Centre.

Arianespace's involvement with the EGAS (European Guaranteed Access to Space) programme began in 2004 in response to calls from several European governments that stated that Space should be available to Europe whenever it was needed. With its own launch base in French Guiana, the time was right to build on the previous successes.

The principal objective of EGAS was to ensure that Ariane 5

launchers would always be available. The decline in the market for commercial satellite launches spurred the EGAS programme to make two pledges: to provide Europe with guaranteed access to Space by being capable of offering at least six launches per year over a five year period and to create an institutional market within Europe to ensure the continued production of Ariane 5 launchers. It certainly seems that Arianespace's commitment to lead the industry in Europe is very evident.

Future launchers – ESA's contribution

The ESA Future Launchers Preparatory Programme began in February 2004 with aim of building a next generation launch vehicle by 2020. The first two phases of development are to be completed by 2009.

The programme was started with the intention of improving the present launchers and taking them to a more competitive level through analysing new technologies. Using university research facilities and industry it is hoped that the new launchers will be at the forefront of research and development. Studies carried out by various institutions and companies will look at the type of launcher systems that will determine the architecture of the launcher, they will provide in-flight experimentation and an insight into rocket propulsion, materials and structures, aerothermodynamics, launcher health management and avionics.

By bringing together the concepts and the technology and by examining what it is that Europe needs to create a new generation launcher, the resulting development will be a true reflection of Europe's requirements – secure access to space that is cost effective and reliable.

A buoyant market

The launch market is now buoyant with a shortage of launch slots available due to high demand. It is difficult to believe that the industry saw such a slump not so long ago. This positive outlook is felt throughout the satellite industry.

There will be bumps in the road but overall there are many reasons to be cheerful. ■



Rolling out the Proton-M. Photo courtesy of ILS.