Current situation in Russian space industry and Russian launch market

COMMERCIAL SPACE TECHNOLOGIES
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Current Russian LVs to be impacted by political relationship
The ‘Dnepr’

- The ‘Dnepr’ small launch vehicles, are converted from the RS–20 (SS–18) heavy ICBMs, which is being provided, by the ‘Kosmotras’ International Space Company established in 1997 as a Russian–Ukrainian joint venture.
- ‘Yuzhnoye’ NPO (Design Bureau and ‘Yuzhmash’ Plant) and ‘Khartron’ Research and Production Enterprise (NPP) are participants from the Ukrainian party.
- As much as **22 launches** were realized till the current time (the last launch, KOMPSAT–3 (Korea Multi–Purpose Satellite–3) The portfolio of the ‘Kosmotras’ contains several orders for further launches two of which should be realized this year.
- The launches are being carried out by launch crews of the Russian Strategic Rocket Troops (RVSN) from standard silos of the Yasnyi (Dombarovskyi) Russian base
- The role of the Ukrainian party:
  1–‘Yuzhnoye’ DB is providing supervision in the RS–20 missiles’ operation and is participating in prolongations of their guaranteed lifetimes. The last prolongation of lifetime allows to provide the missile operation until 2022 /8/
  2– ‘Yuzhnoye’ DB is also doing the fairing manufacturing for the Dnepr LV.
The ‘Sea Lauch’

As much as 36 launches in total were carried out during this period and launchers for this activity were being manufactured by the ‘Yuzhmash’

However, hard times began for the ‘Sea Launch’ still before a beginning of the current Ukrainian–Russian contradiction. On June 22, 2009, the SLC announced its bankruptcy that had been initiated by a range of reasons including a decrease of demand, competition and several failures of the ‘Zenit–3SL’. A reorganization of the company, which was realized by a court judgement in 2010, led to a change of the company’s shares distribution: 95% received the Russian ‘Energia’ RSC.

After this reorganization, the company realized still more six launches one of which, on February 1, 2013, was an unsuccessful one. The next launch on May 26, 2014 was successful, but the company’s portfolio contained only single preliminary order for a launch in 2016 /11/. In these conditions, which were still complicated with a deterioration of political relationships between Ukraine and Russia, the ‘Energia’ RSC–led ‘Sea Launch AG’ made a decision on August 22, 2014 to keep idle its activity till the end 2015 /12/.
Operation of the ‘Zenit’ IV from Baikonur has begun in the late 1985. Land Launch missions differ from Sea Launch missions in that they use modernised Zenit – 3SLB LV.

From the 2008, six commercial launches of foreign geostationary communication satellites done, all the launches were successful ones (last was Sep 1, 2013).

‘Zenit’s’ launch site in Baikonur was being used also for launches of spacecraft for Russian national space missions. Thus, the ‘Electro–L’ geostationary meteorological satellite and ‘Spectr–R’ scientific satellite were launched using ‘Zenit–3SLBF’ in 2011.

The Ukrainian party has also a right to use this launch site for its national missions. It intended to use this right for launching its first national geostationary communication satellite ‘Lybid’,. But currently Ukrainian party had not money for an advance payment for a supply of the RD–171M engine.

Meanwhile, Roscosmos itself had ordered the ‘Zenit–3SLBF’ for a launch of the ‘Electro–L’ #2 satellite in 2015 and this order, which had been paid in time, is currently almost implemented. Two ‘Zenits’ for both the Russian and Ukrainian national space missions are ready and laying at Yuzhmash.
The ‘Soyuz–U(FG)’ & The ‘Rockot’

‘Soyuz–U (FG)’ launch is using control/guidance systems that are being manufactured by the Ukrainian ‘KhartronLTD’ Research and Production Enterprise (NPP). The Ukrainian ban could be spread onto supplies of Ukraine–built control/guidance systems’ units for the currently operated ‘Soyuz–U/FG’ launchers but this action is not a direct threat for operation termination since the ‘Progress’ Plant has a stock that would be sufficient for a continuation of the launcher production during a 2 year time as a minimum. Nevertheless, the Russian side already undertook measures for accelerating ‘Soyuz–U/FG’ substitution with the ‘Soyuz–2.1A/B’ launchers.

‘Rockot’ and the ‘Breeze’ upper stages is one more example of Russia’s dependence from the Ukraine on main components delivery.

The LV and ‘Breeze’ upper stages for Rockot were continuing to be equipped with the control/guidance systems that were being supplied from Ukraine.

At the same time, a threat that these supplies would be found under the Ukrainian ban, is in existence since the ‘Rockot’ is being used for launching military–purpose satellites of the Russian MoD.

Forecast: a use of the ‘Rockot’ for servicing Russian national space missions would be terminated in 2016, a commercial operation of the launcher would be continued by the ‘Eurockot’
New Russian LVs
New Russian LVs – Angara family

- Two successful test launches in 2014 from Plesetsk
- 3d Launch is scheduled for Q3–Q4 2016 with a real payload from Plesetsk. LV Angara A5
- Heavy Angara A5V is planned for 2021 from Vostochny launch site.
- Angara rockets, designed to provide lifting capabilities between 2,000 and 35,500 kg into low earth orbit, are expected to become the core of Russia's carrier rocket fleet, replacing several existing systems.
- Potential replacement for Rockot and Proton LVs
Soyuz-2.1v “light”

• First successful test launch – 28 Dec 2013
• Future launch is scheduled for the 15–25 Dec 2015 from Vostochniy cosmodrome, main payload Mikhailo Lomonosov (MVL) SC and Aist 2 small SC (Upper stage Volga)
• This small launcher is being produced by the Russian Samara Space Centre as a replacement for the Cosmos and other light launchers to be phased out. It has environmentally cleaner propellants (LOX/Kerosene)
• Block A engine use one powerful NK 33–1 engine.
• The new launcher is able to deliver up to 2.8 tones in low Earth orbit.
• The vehicle has 2 stages, is about 44m long and weighs around 136 tons at lift off.
Vostochny Cosmodrome, (Russian:Космодром Восточный) is a Russian spaceport currently under construction in the Russian Far east, Amur district.

Should be completed in 2018

First launch is scheduled for Dec 2015 – LV type, Soyuz-2.1v “light” with Russian science SC Lomonosov.

Main goal for the construction – reduce Russian dependency on the Baikonur Cosmodrome located in Kazakhstan.

Current status:
Overrun of the estimated construction cost by $180 million.
Construction of the launch facility, housing accommodations and social infrastructure for the support staff is behind schedule
Launch scheduled for the end of 2015 will be carried on.

After the construction finalization Vostochny Cosmodrome, will be one of the leading world spaceports.
<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Date</th>
<th>Launch Vehicle</th>
<th>Satellite Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>August</td>
<td>31</td>
<td>Tyklon (1 piggy-back)</td>
<td>Fasat Alpha</td>
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<tr>
<td>1998</td>
<td>July</td>
<td>10</td>
<td>Zenit (2 piggy-back)</td>
<td>Fasat Bravo+TM sat</td>
</tr>
<tr>
<td>1999</td>
<td>April</td>
<td>21</td>
<td>Dnepr (1 dedicated)</td>
<td>Uo Sat 12 (first commercial use of SS-18)</td>
</tr>
<tr>
<td>2000</td>
<td>June</td>
<td>28</td>
<td>Cosmos (2 piggy-back)</td>
<td>Tsinghua 1 +Snap (first SSO flight of Cosmos)</td>
</tr>
<tr>
<td>2000</td>
<td>September</td>
<td>26</td>
<td>Dnepr (1 piggy-back)</td>
<td>Tiung Sat</td>
</tr>
<tr>
<td>2002</td>
<td>November</td>
<td>28</td>
<td>Cosmos (main in cluster)</td>
<td>Alsat-first Disaster Monitoring Constellation (DMC)</td>
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<tr>
<td>2003</td>
<td>September</td>
<td>27</td>
<td>Cosmos (3 in cluster)</td>
<td>NigeriaSat-1, BiLSat-1 and UK-DMC (all DMC)</td>
</tr>
<tr>
<td>2004</td>
<td>June</td>
<td>29</td>
<td>Dnepr (main in cluster)</td>
<td>Demeter (CNES, first SSO flight of Dnepr)</td>
</tr>
<tr>
<td>2005</td>
<td>October</td>
<td>27</td>
<td>Cosmos (3 in cluster)</td>
<td>TopSat, ChinaSat (DMC), SSETI Express+ 3 cubesats</td>
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<tr>
<td>2008</td>
<td>August</td>
<td>29</td>
<td>Dnepr (5 in cluster)</td>
<td>RapidEye constellation</td>
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<tr>
<td>2009</td>
<td>July</td>
<td>29</td>
<td>Dnepr (2 in cluster)</td>
<td>UK-DMC2 + DEIMOS-1 (both DMC)</td>
</tr>
<tr>
<td>2009</td>
<td>September</td>
<td>17</td>
<td>Soyuz/Fregat (1 piggy-back)</td>
<td>SumbandilaSat (South Africa, first piggy-back)</td>
</tr>
<tr>
<td>2010</td>
<td>June</td>
<td>15</td>
<td>Dnepr (1 of a pair)</td>
<td>Picard (CNES, paired with Prisma)</td>
</tr>
<tr>
<td>2011</td>
<td>August</td>
<td>17</td>
<td>Dnepr (2 in a pair)</td>
<td>NigeriaSat-2 and NigeriaSat-X</td>
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<tr>
<td>2012</td>
<td>July</td>
<td>22</td>
<td>Soyuz/Fregat (1 piggy back)</td>
<td>ADS-1B + (Canopus-V and BKA SC’s)</td>
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<tr>
<td>2014</td>
<td>Jun</td>
<td>19</td>
<td>Dnepr (1 in cluster)</td>
<td>KazEOSat-2</td>
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<td>2014</td>
<td>July</td>
<td>08</td>
<td>Soyuz/Fregat (2 piggy-back)</td>
<td>TechDemoSat-1 (TDS-1), UKube-1.</td>
</tr>
</tbody>
</table>

**Totally 33 SC launched**
The CST team is directly involved in the international project for building SC constellation on Kanopus type platform.

- First 2 SC’s were launched in 2012
- CST represents interests of SSTL which is delivering onboard equipment and software to VNIIEM.
- Based on the successful project SSTL and VNIIEM continue work on SC design, next to go is Lomonosov scientific spacecraft built on a Kanopus platform, and Kanopus V–IR satellite.
- CST team is also involved in the SC acceptance, AIT and commissioning activities
Mikhail Vasilyevich Lomonosov SC, (MVL)

MVL is a satellite for simultaneous studies of gamma–bursts using optic cameras and gamma-detectors built by the M. V. Lomonosov Moscow State University. The satellite is named to honor the 300th birthday of Mikhail Vasilyevich Lomonosov.

The satellite is built on the same platform with Kanopus V and BKA SC’s

The objective of the mission is the observation of ultra-high energy cosmic rays and studies of transient phenomena in the Earth's upper atmosphere.

The main instrument is the TUS detector. (Tracking Ultraviolet Set Up) detector, used for measurements of the light, radiated by Ultra High Energy Cosmic Rays (UHECR) in the earth atmosphere as well as for transients’ studies.

Launch date: 15–25 Dec 2015
Launch site: Vostochniy spaceport
LV: Soyuz–2.1v “light” with Volga upper stage
CONCLUSIONS

- The current political conflict between Ukraine and Russia has touched seriously a former close collaboration between space industries of these countries that is leading to a disturbance and even interruption of this collaboration in various fields, mostly, in the field of production and operation of launch vehicles.

- A range of current Russian programmes on launch vehicle operation and certain projects of future launch systems are being influenced with consequences of these disturbance and interruption of the collaboration and a majority of them should be changed in order to achieve a provision of their further realization with national powers only.

- An assessment and analysis of these supposed changes lead to the general conclusion that the influence of the Ukrainian–Russian political conflict’s consequences onto the Russian space industry and space activity would have a positive nature in the regard of further development and expansion of the Russian space industry’s capabilities whilst negative features of this influence would be expressed mostly in the necessity to make additional expenditures.
Thank you for your attention

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