The Launch Vehicle Landscape: New and Existing Entrants Serving the SmallSat Market

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The Angara 1.2 Launch Vehicle

- Built by Khrunichev State Research and Space Production Center of Moscow
  - Maker of the Proton launch vehicle; over 410 launches to date
  - Majority Owner of ILS

- Addresses the small to medium Class market with up to 3 MT to LEO
- Supports all spacecraft to all orbits, altitudes and inclinations
- Launch site: Plesetsk in Northern Russia
The Angara 1.2 Launch Vehicle: Flights

- A variant of the Angara Universal Rocket Module (URM) system was flight demonstrated successfully as the first stage of KSLV (Korean Space Launch Vehicle) during its first three missions in 2009, 2010 and 2013
- Angara 1 and 5 flights successfully conducted in 2014
- State of the art Angara factory in Omsk, Russia with all components domestically supplied
The Angara 1.2 Launch Vehicle: Service Module

- Designed to generate velocity impulses to inject the spacecraft into its target orbit
- Designed to support the required attitude during the coast phase of the mission while on transfer orbit and for spacecraft separation.
- Can generate velocity impulses for a de-orbiting maneuver from the spacecraft target orbit and uses 600 kg MON+MMH propellants
The Angara 1.2 Launch Vehicle: Payload Fairing

- The PLF is 2.9 m in diameter
- Clamshell design connected by mechanical pyro locks
- Installed on the upper ring of Stage 2
- 3-layered with a honeycomb filling compound
The Angara 1.2 Launch Vehicle: Performance

Sun-Synchronous Performance from Plesetsk Cosmodrome
The Angara 1.2 Launch Vehicle

Angara 1.2 LEO Performance

<table>
<thead>
<tr>
<th>Orbit Parameters</th>
<th>Payload System Mass (kg)</th>
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<tbody>
<tr>
<td>$H_{circ}$</td>
<td>Inclination</td>
</tr>
<tr>
<td>200 km</td>
<td>63.2°</td>
</tr>
<tr>
<td>835 km</td>
<td>98.7°</td>
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<tr>
<td>1500 km</td>
<td>83°</td>
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The Angara 1.2 Launch Vehicle

- The Angara 1.2 vehicle will be available to support a commercial launch from the Plesetsk Cosmodrome in 2019
- Plans for up to two ILS commercial Angara 1.2 missions per year starting in 2020