Evolution of the Proton Launch Vehicle:

Proton Beginnings

The maiden flight of the Proton rocket took place on 16 July 1965. The launcher's lead designer, Vladimir Chelomei, initially designed it with the intention of creating both a powerful rocket for military payloads and a high-performance ICBM. The program was changed, and the rocket was developed exclusively for launching spacecraft.The original name of the launch vehicle was UR-500, but it adopted the name “Proton,” which also was the name of the first three payloads that the rocket launched.

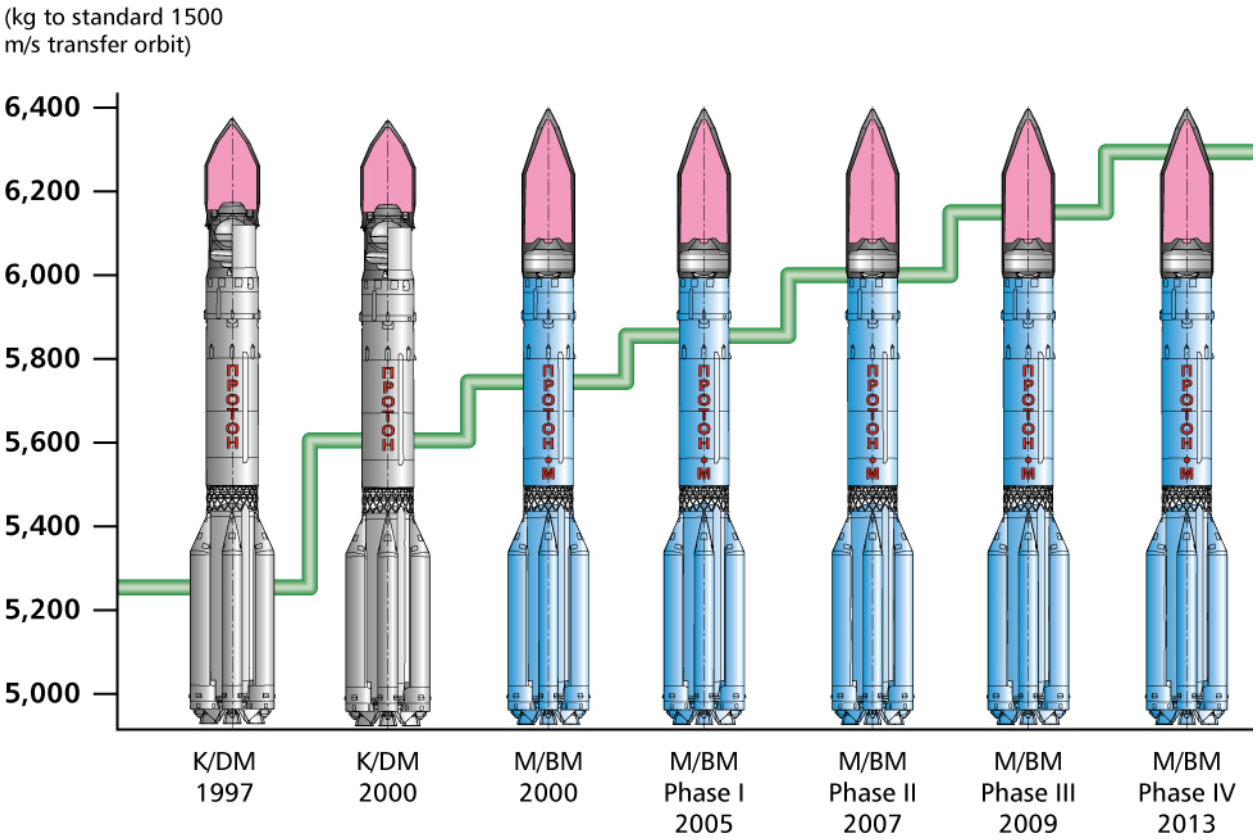
Current Version

Khrunichev debuted its new generation launch vehicle: the Proton M/ Breeze M with the launch of the Ekran M satellite in April 2001. A major evolution from the Proton K launcher is the featured digital avionics on the Proton M rocket. The Proton M rocket paired with the Breeze M Upper Stage, both designed and built by Khrunichev, offers improved performance, new mission design flexibility and increased payload volume under the fairing.

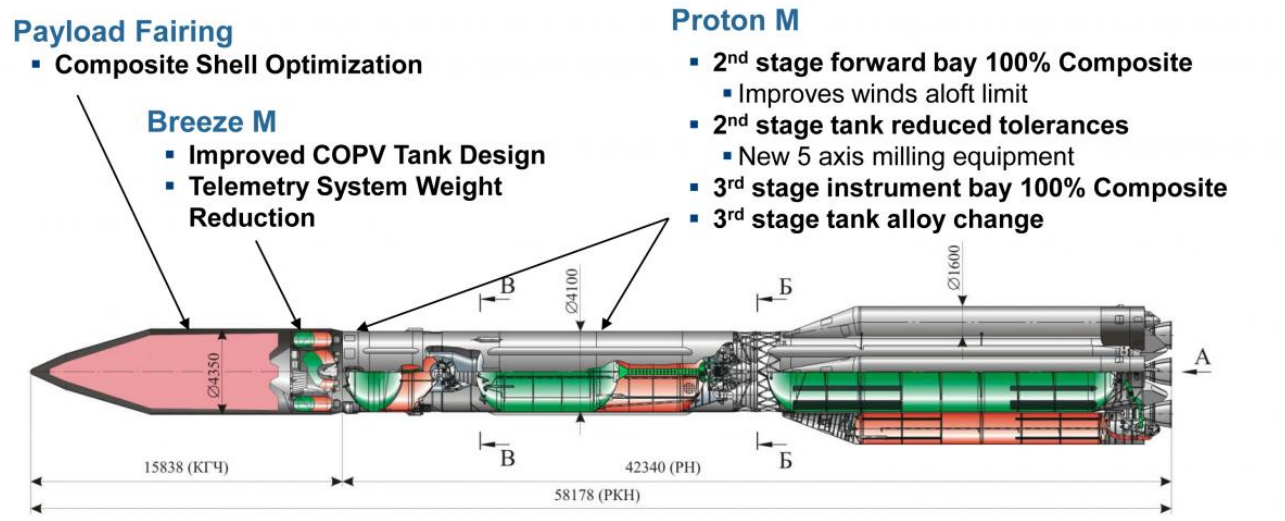
As part of a continuous improvement program, the Phase I configuration of Proton Breeze M launcher enhancements carried out nearly all of the commercial missions in the 2004 to 2009 period. The last commercial Phase I Proton Breeze M flew the Astra 1M mission for SES in November 2008.
The Phase II Proton Breeze M rocket flew for the first time in July 2007 with the successful launch of the DirecTV 10 satellite. The last commercial Phase II Proton Breeze M flew the Skyterra 1 mission for Light Squared in December 2010.

The Phase III Proton Breeze M launch vehicle was flight proven on the Russian Federal dual mission of Express AM-44 and Express MD-1 in February 2009 and performed its first commercial launch in March 2010 with the Echostar XIV satellite. The Proton Breeze M phase III configuration is the current standard configuration for ILS Proton. This configuration provides 6,150 kg of GTO performance, which is an increase of 1,150 kg over the original Proton Breeze M, while maintaining the fundamental design configuration.

Khrunichev has initiated development of a set of phase IV enhancements in order to keep pace with market demands and the mass growth trends of commercial satellites. The implementation of Phase IV Proton Breeze M enhancements will be completed in 2013. The Payloads Systems Mass performance for phase IV has been increased to 6,300 kg to a reference GTO orbit with 1500 m/s of residual delta V to GSO



Proton launch vehicle enhancements



Phase IV Proton Breeze M planned enhancements

Proton Accomplishments:

Proton rockets have played a role in many historic events:

- Launching interplanetary exploration payloads such as Zond, Mars, Vega, Phobos and the Luna missions that produced the first samples of the lunar surface to be returned by an unmanned spacecraft
- First soft landing on the surface of Venus with the Venera series missions
- Orbiting the Salyut series space stations and MIR space station modules
- Delivering two of the first elements of the International Space Station, the Zarya and Zvezda modules

ILS Proton Breeze M Launch Vehicle

Payload Fairing

The Payload Fairing encloses and protects the spacecraft during ground operations and launch vehicle ascent.

Two PLF lengths are available at 13305 mm and the standard 15255 mm. Although of similar design, there are specific useable volumes for the two fairing types tailored to individual adapter systems.

Specific adapters take into account required adapter clearances for installation and required flight clearances with the adapter structure.

ILS Proton Breeze M Launch Vehicle

Payload Adaptor

Multiple standard payload adaptors are available to meet a multitude of spacecraft mission requirements to accommodate both mass and volume.

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ILS Proton Breeze M Launch Vehicle

Breeze M

Length: 2.61 m
Diameter: 4.0 m
Engine(s): One 14D30 Sustainer, Four 11D458M Control Thrusters
Thrust: 19.62 kN
Inert Mass: 2,370 kg
Propellant: 19,800 kg
Mass: Comprised of a central core and an additional Jettison-able propellant tank and powered by one pump-fed gimbaled main engine features increased lift capability of 6,150 kg (13,558 lbs) PSM to geosynchronous transfer orbit with a 1,500 m/sec residual velocity to GSO. Strengthened structure allows launching heavier spacecraft with higher center of gravity locations, and even allows for launching multiple spacecraft.

ILS Proton Breeze M Launch Vehicle

Proton 3rd stage

Length: 4.11m
Diameter: 4.1m
Engine(s): One RD-0213 and one Four-Nozzle Vernier
Thrust: 583 kN (131,000 lbf)
Inert Mass: 3,500 kg
Propellant: 46,562 kg
Guidance, navigation, and control of the Proton M during operations of the first three stages is carried out by a triple redundant closed-loop digital avionics system mounted in the 3rd Stage

ILS Proton Breeze M Launch Vehicle

Proton 1st and 2nd stage

2nd Stage

Length: 17.05 m
Diameter: 4.1 m
Engine(s): Three RD-0210 and One RD-0211
Thrust: 2.4 MN
Inert Mass: 11,000 kg
Propellant: 157,300 kg
Mass: Utilizes conventional cylindrical design.

1st Stage

Length: 21.18 m
Diameter: 7.4 m
Engine(s): Six RD-276
Thrust: 10.0 MN at Sea Level
Inert Mass: 30,600 kg
Propellant: 428,300 kg
Mass: Consists of a central tank containing oxidizer surrounded by six outboard fuel tanks, each of which also carries one of the six engines.