EXPERIENCE ILS

ACHIEVE YOUR MISSION

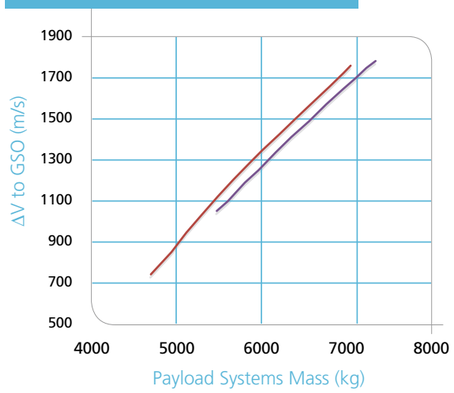
Proton Breeze M

International Launch Services

FLEXIBILITY | PERFORMANCE | EXPERIENCE | DEDICATION

Payload Systems Mass vs Delta V to Geosynchronous Orbit (GSO)

Performance



Geosynchronous Transfer Orbit (GTO)

Supersynchronous Transfer Orbit @ 65,000km Apogee

Features

HISTORY:
More than 390 flights since 1965

PRODUCTION:
Capability to support up to 12 missions per year

SUPPLIERS:
Main components Russian-supplied

TYPICAL MISSION:
~9 hours utilizing 5-burn Breeze M GTO mission design

STAGES:
Three-stage Proton with restartable Breeze M upper stage

PROPELLANTS:
Nitrogen Tetroxide (N_2O_4)
Unsymmetrical DiMethyl Hydrazine (UDMH)

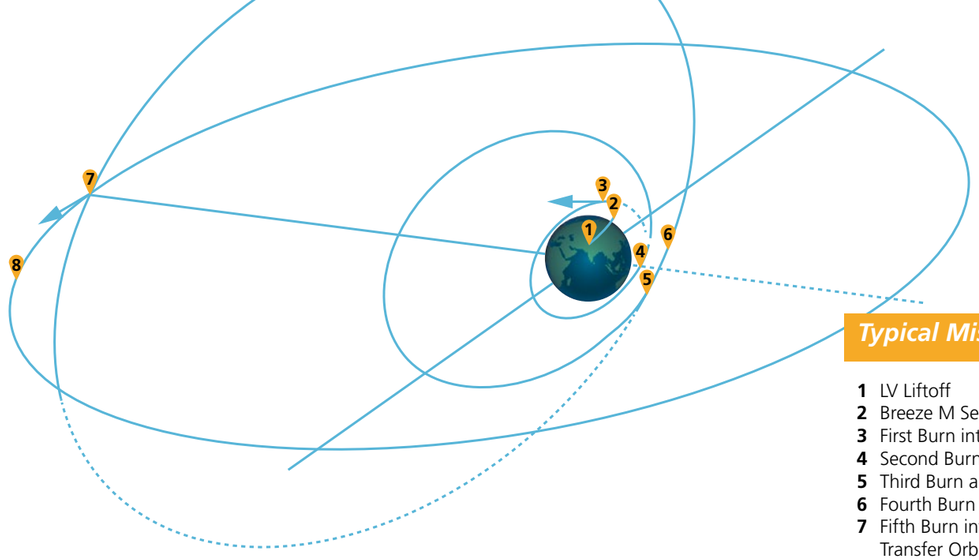
AVIONICS:
Closed-loop 3-string majority vote

MATERIALS:
Aluminum and composites

STRUCTURE TYPE:
Monocoque

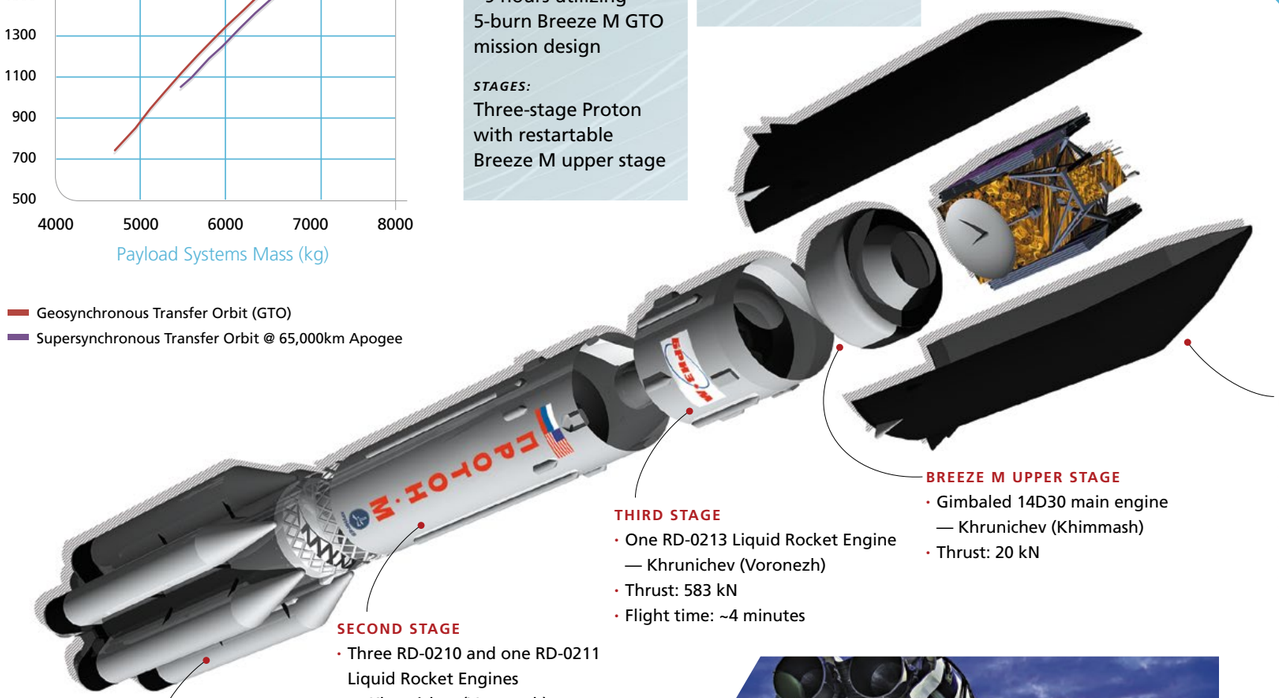
DIMENSIONS:
Length:
56.2 m or 58.2 m
Core diameter:
~4.1 m

GROSS MASS:
~705 metric tons at liftoff



Typical Mission

1 LV Liftoff
2 Breeze M Separation from Proton LV
3 First Burn into Parking Orbit
4 Second Burn into Intermediate Orbit
5 Third Burn and APT Jettison
6 Fourth Burn into Transfer Orbit
7 Fifth Burn into Geosynchronous Transfer Orbit (GTO)
8 Spacecraft Separation



PAYLOAD FAIRING & ADAPTER STAGE
- Two symmetrical payload fairing halves
- Static envelope diameter up to 3.87 m
- Post encapsulation spacecraft access available
- Composite sandwich monocoque structure
- Multiple adapter and separation system configurations available
- 13 m and 15 m PLF lengths available

BREEZE M UPPER STAGE
- Gimbaled 14D30 main engine
  — Khrunichev (Khimmash)
- Thrust: 20 kN

THIRD STAGE
- One RD-0213 Liquid Rocket Engine
  — Khrunichev (Voronezh)
- Thrust: 583 kN
- Flight time: ~4 minutes

SECOND STAGE
- Three RD-0210 and one RD-0211 Liquid Rocket Engines
  — Khrunichev (Voronezh)
- Thrust: 2.4 MN
- Flight time: ~3.5 minutes

FIRST STAGE
- Six RD-276 Liquid Rocket Engines
  — Khrunichev (Perm)
- Sea level thrust: 10.0 MN
- Vacuum rated thrust: 11.0 MN
- Flight time: ~2 minutes

Compatibility

Satellite Bus

	702	A2100	E2000/3000	SSL 1300	SB3000/4000	STAR	EXPRESS	DS2000
Compatible	•	•	•	•	•	•	•	•
Launched	•	•	•	•	•	•	•	•

- With over 45 years of experience and over 390 flights, Proton is a proven, heritage system developed and built by Khrunichev State Research and Space Production Center (Khrunichev), Russia's premier space manufacturer. International Launch Services (ILS), a U.S.-based company, has the exclusive rights to market the Proton vehicle commercially under the majority ownership of Khrunichev.

The **ILS Proton Breeze M** has the lift capability of 6.35 metric tons to reference GTO and 6.55 metric tons to reference SSTO at 1500 m/s delta v. In addition, ILS Proton's re-startable Breeze M upper stage allows for optimizing each mission and maximizing projected in-orbit lifetime. ILS Proton can deliver single or multiple satellites into LEO, MEO, HEO, GTO, and SSTO.

- Unified Quality Management System throughout Khrunichev and its integrated key suppliers
- Periodic reviews and recertification
- Quarterly Customer Quality Reports
- Insurance community annual briefings

Proton Production

Proton Launch Vehicles and Breeze M Upper Stages are designed and built by Khrunichev in Moscow, the majority owner of ILS. Khrunichev is home to all engineering, assembly and test functions of the Proton production. Khrunichev has direct oversight and control of up to 70% of all Proton manufacturing from suppliers to manufacturers.

KHRUNICHEV SPACE CENTER

- Proton and Breeze M manufacturing
- Design, manufacturing, integration, testing
- Engineering and mission design
- More than 390 Protons launched
- Over 70 Proton M Breeze M missions overall

BAIKONUR COSMODROME

- Proton Breeze M launch operations
- Launch vehicle processing and integration
- All satellite launch preparations
- ISO Class 8 clean room facilities
- Three operational Proton launch pads

Proton Launch Operations

The spacecraft is transported to the Baikonur Cosmodrome by air and is off-loaded at the on-site Yubileiny Airfield. It is then transported by rail to the state-of-the-art processing facility for testing, fueling, mating to the Breeze M upper stage and encapsulation within the payload fairing. Launch vehicle and spacecraft time on pad is 3 to 5 days.

Proton is designed to launch from Baikonur with very few weather restraints. Coupled with the two launch pads available for commercial missions, Baikonur offers unparalleled schedule assurance to customers.

ILS and Khrunichev provide manifest flexibility for customers by allowing overlapping launch campaigns, minimizing the required spacing between commercial missions and supporting timely launches.

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