

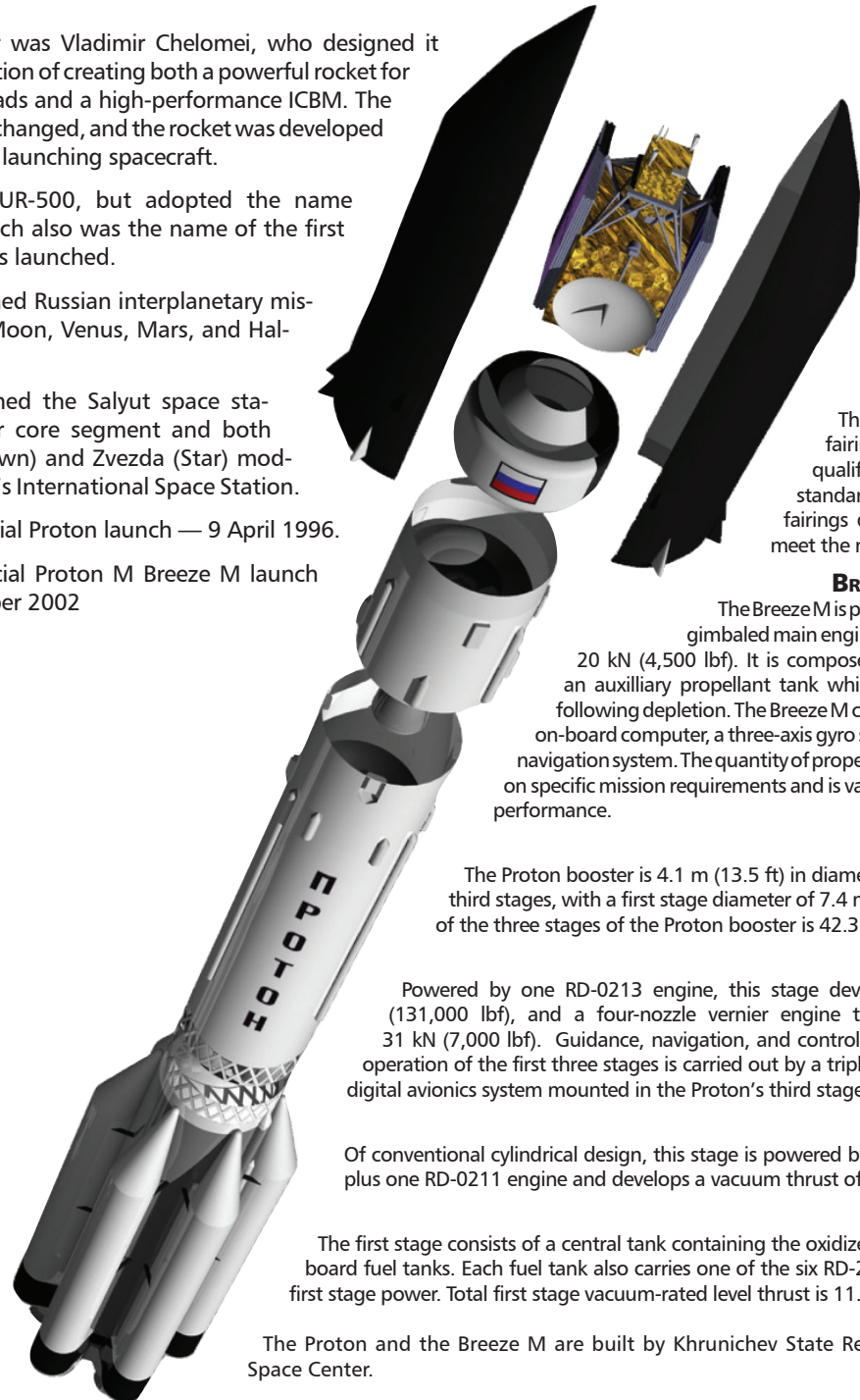
# THE VEHICLE

# THE SATELLITE

## PROTON HISTORY

- Lead designer was Vladimir Chelomei, who 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.
- First named UR-500, but adopted the name "Proton," which also was the name of the first three payloads launched.
- Proton launched Russian interplanetary missions to the Moon, Venus, Mars, and Halley's Comet.
- Proton launched the Salyut space stations, the Mir core segment and both the Zarya (Dawn) and Zvezda (Star) modules for today's International Space Station.
- First commercial Proton launch — 9 April 1996.
- First commercial Proton M Breeze M launch — 30 December 2002

## PROTON DESCRIPTION



**TOTAL HEIGHT**  
58.2 m (191 ft)

**GROSS LIFT-OFF WEIGHT**  
705,000 kg  
(1,554,000 lb)

**PROPELLANT**  
UDMH and NTO

**INITIAL LAUNCH**  
16 July 1965  
Proton-1 Spacecraft

**PAYLOAD FAIRINGS**  
There are multiple payload fairing designs presently qualified for flight, including standard commercial payload fairings developed specifically to meet the needs of our customers.

**BREEZE M UPPER STAGE**  
The Breeze M is powered by one pump-fed gimbaled main engine that develops thrust of 20 kN (4,500 lbf). It is composed of a central core and an auxiliary propellant tank which is jettisoned in flight following depletion. The Breeze M control system includes an on-board computer, a three-axis gyro stabilized platform, and a navigation system. The quantity of propellant carried is dependent on specific mission requirements and is varied to maximize mission performance.

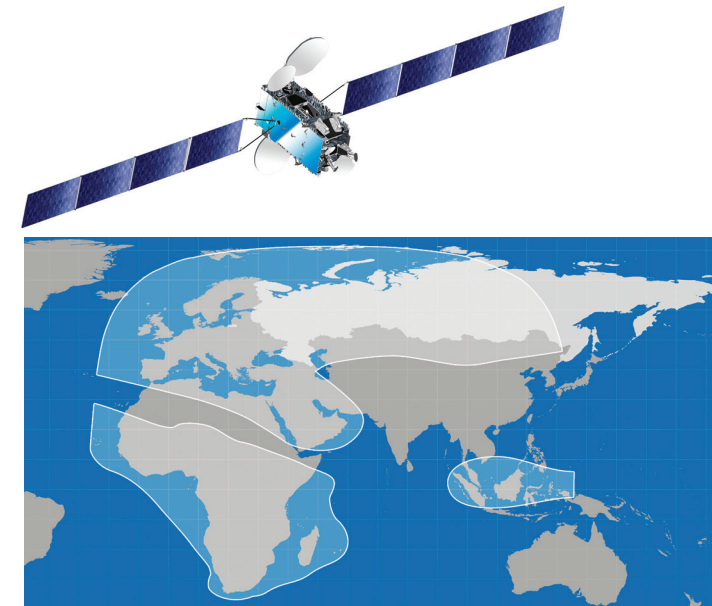
**PROTON BOOSTER**  
The Proton booster is 4.1 m (13.5 ft) in diameter along its second and third stages, with a first stage diameter of 7.4 m (24.3 ft). Overall height of the three stages of the Proton booster is 42.3 m (138.8 ft).

**THIRD STAGE**  
Powered by one RD-0213 engine, this stage develops thrust of 583 kN (131,000 lbf), and a four-nozzle vernier engine that produces thrust of 31 kN (7,000 lbf). Guidance, navigation, and control of the Proton M during operation of the first three stages is carried out by a triple redundant closed-loop digital avionics system mounted in the Proton's third stage.

**SECOND STAGE**  
Of conventional cylindrical design, this stage is powered by three RD-0210 engines plus one RD-0211 engine and develops a vacuum thrust of 2.4 MN (540,000 lbf).

**FIRST STAGE**  
The first stage consists of a central tank containing the oxidizer surrounded by six out-board fuel tanks. Each fuel tank also carries one of the six RD-276 engines that provide first stage power. Total first stage vacuum-rated level thrust is 11.0 MN (2,500,000 lbf).

The Proton and the Breeze M are built by Khronichev State Research and Production Space Center.



**SATELLITE OPERATOR**  
Gazprom Space Systems  
[www.gazprom-spacesystems.ru](http://www.gazprom-spacesystems.ru)

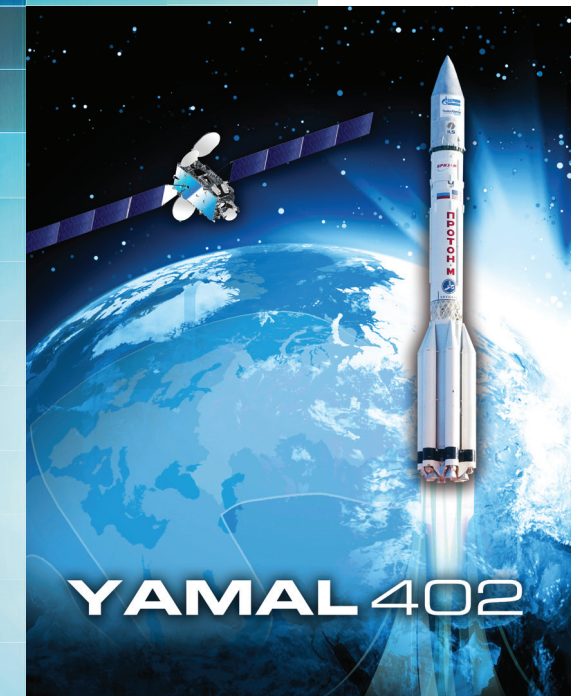
**SATELLITE MANUFACTURER**  
Thales Alenia Space  
[www.thalesaleniaspace.com](http://www.thalesaleniaspace.com)

**PLATFORM**  
Spacebus 4000C3

**SEPARATED MASS**  
4463 kg

**SATELLITE MISSION LIFETIME**  
15 Years

**SATELLITE MISSION**  
At an orbital location of 55° East longitude, the Yamal 402 communications satellite will provide services to Russia, CIS countries, Europe, the Middle East and Africa. The all Ku-band satellite will have 66 equivalent 36 MHz transponders, which will compose 4 fixed beams (Russian, Northern, European, Southern) and 1 steerable beam. JSC Gazprom Space Systems has ensured the development of the ground infrastructure based on ground stations and technical control means provided by Thales Alenia Space. With the addition of the Yamal 402 JSC Gazprom Space Services will strengthen their position in the global satellite industry.



## Mission Overview



Experience ILS: Achieve Your Mission  
QUALITY | PERFORMANCE | EXPERIENCE | DEDICATION

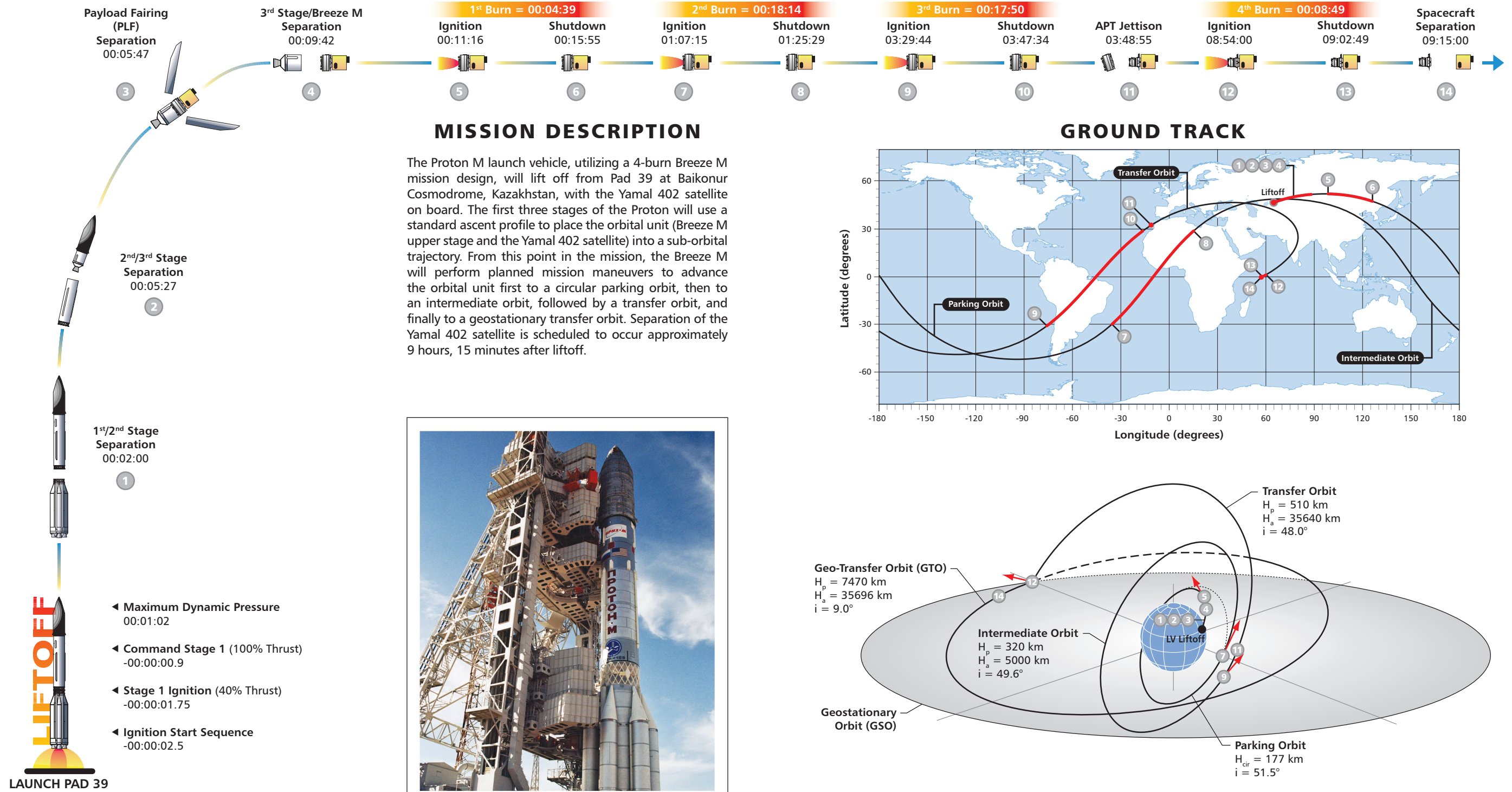


[www.ilslaunch.com](http://www.ilslaunch.com)

## Yamal 402

- 8th ILS Proton Launch in 2012
- 77th ILS Proton Launch Overall
- 1st Gazprom Space Systems Satellite Launched on ILS Proton
- 8th Thales Alenia Space Satellite Launched on ILS Proton

# THE MISSION



Payload Fairing (PLF) Separation 00:05:47

3<sup>rd</sup> Stage/Breeze M Separation 00:09:42

1<sup>st</sup> Burn = 00:04:39  
 Ignition 00:11:16    Shutdown 00:15:55

2<sup>nd</sup> Burn = 00:18:14  
 Ignition 01:07:15    Shutdown 01:25:29

3<sup>rd</sup> Burn = 00:17:50  
 Ignition 03:29:44    Shutdown 03:47:34

4<sup>th</sup> Burn = 00:08:49  
 Ignition 08:54:00    Shutdown 09:02:49

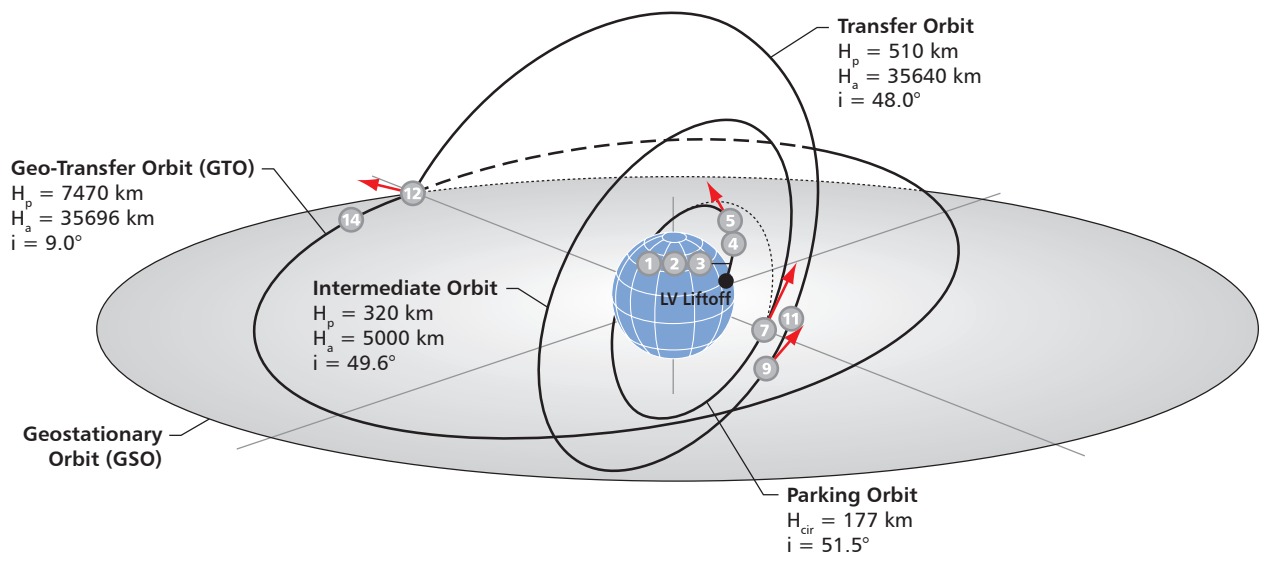
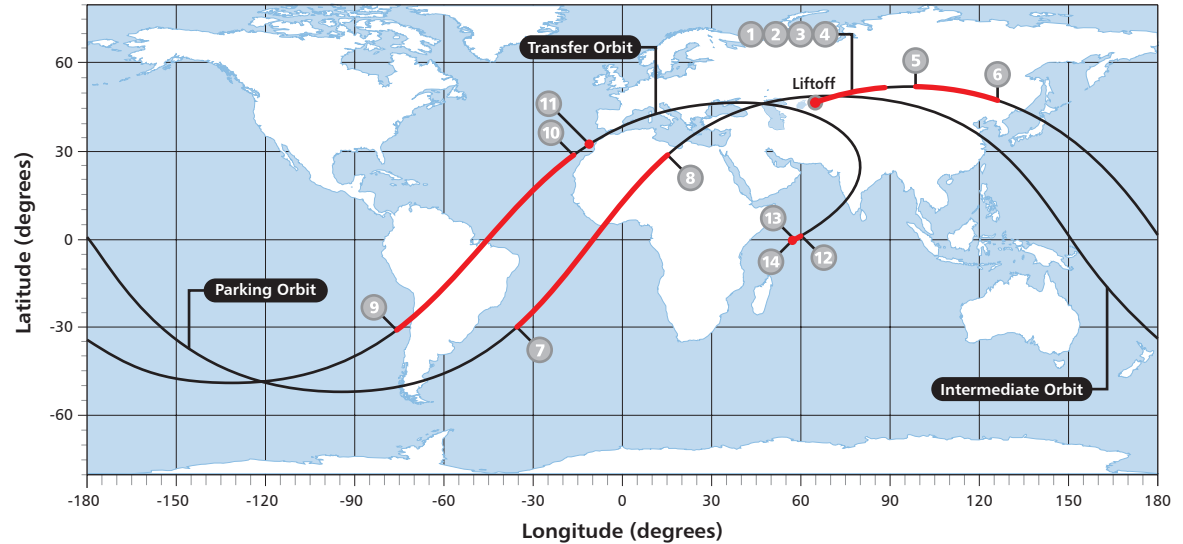
APT Jettison 03:48:55

Spacecraft Separation 09:15:00

## MISSION DESCRIPTION

The Proton M launch vehicle, utilizing a 4-burn Breeze M mission design, will lift off from Pad 39 at Baikonur Cosmodrome, Kazakhstan, with the Yamal 402 satellite on board. The first three stages of the Proton will use a standard ascent profile to place the orbital unit (Breeze M upper stage and the Yamal 402 satellite) into a sub-orbital trajectory. From this point in the mission, the Breeze M will perform planned mission maneuvers to advance the orbital unit first to a circular parking orbit, then to an intermediate orbit, followed by a transfer orbit, and finally to a geostationary transfer orbit. Separation of the Yamal 402 satellite is scheduled to occur approximately 9 hours, 15 minutes after liftoff.

## GROUND TRACK



**LAUNCH PAD 39**

1<sup>st</sup>/2<sup>nd</sup> Stage Separation 00:02:00

2<sup>nd</sup>/3<sup>rd</sup> Stage Separation 00:05:27

1<sup>st</sup> Burn = 00:04:39

2<sup>nd</sup> Burn = 00:18:14

3<sup>rd</sup> Burn = 00:17:50

4<sup>th</sup> Burn = 00:08:49

APT Jettison 03:48:55

Spacecraft Separation 09:15:00

Maximum Dynamic Pressure 00:01:02

Command Stage 1 (100% Thrust) -00:00:00.9

Stage 1 Ignition (40% Thrust) -00:00:01.75

Ignition Start Sequence -00:00:02.5

ASCENT PROFILE

PROTON ON PAD 39

FLIGHT DESIGN