

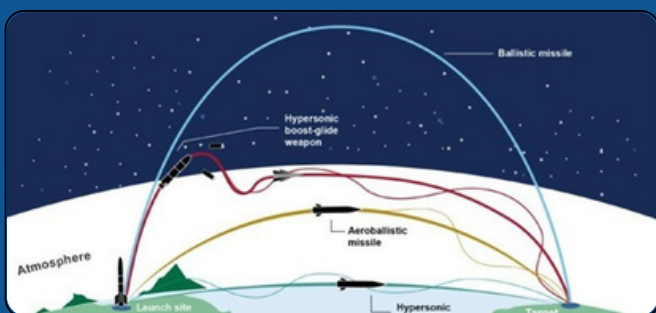


Indian Inventions

BrahMos

Supersonic Cruise Missile

Imagine a missile so fast that it travels **three times the speed of sound**, accurately hitting its target within minutes. That is the power of the **BrahMos Supersonic Cruise Missile**, one of the fastest operational cruise missiles in the world.



Developed through a collaboration between India and Russia, BrahMos represents a perfect blend of physics, engineering, and innovation. For students, it is not just about defence, it is about understanding how science is applied to solve real - world challenges.

What is BrahMos?

BrahMos is a **supersonic cruise missile** capable of:

- Flying at speeds of **Mach 2.8–3.0**
- Carrying conventional warheads
- Launching from land, sea, air, and submarines.



It is named after two rivers:

- Brahmaputra (India)
- Moskva (Russia)

Why is it important?

Modern defence requires:

Speed - Accuracy - Reliability

BrahMos provides:

- Quick response capability
- High precision strikes
- Strong deterrence

Key Features

- Supersonic speed
- Precision targeting
- Multi-platform launch capability
- Fire - and - forget system

Where is it used?

BrahMos is deployed in:

- Indian Army (land systems)
- Indian Navy (warships)
- Indian Air Force (air - launched version)

When was it developed?

- Joint venture established in **1998**
- Successfully tested multiple times since the early 2000s

Who developed it?

Developed by:

- **Defence Research and Development Organisation (DRDO)**
- Russia's NPO Mashinostroyenia

Why India Needs BrahMos?

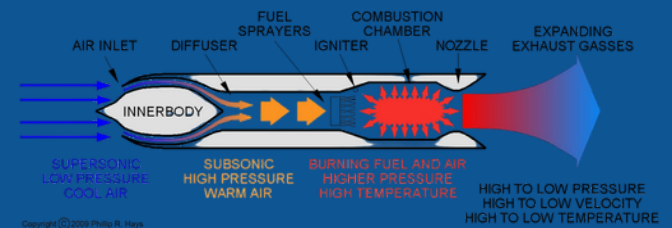


Challenges in defence systems and India's physiology

- Slow response time
- Inaccurate targeting
- Difficulty in interception
- Long coastlines
- Strategic borders
- Growing security needs

Fast and accurate systems are essential.

Definitions



1. Supersonic Speed

Speed greater than the speed of sound (~1235 km/h)

BrahMos travels nearly **3 times faster**.

2. Cruise Missile

A missile that:

- Flies at low altitude
- Uses jet engines
- Is guided throughout its path



3. Ramjet Engine

A type of engine that:

- Uses incoming air for combustion
- Works efficiently at high speeds

4. Mach Number

- Mach 1 = speed of sound
- Mach 3 = three times the speed of sound

Variants

- Land-based
- Ship-based
- Air – launched (from Su-30MKI)
- Submarine – launched



How It Works: Methods & Procedures

Step – by – Step Process

1. Launch from platform
1. Booster accelerates missile
1. Ramjet engine takes over
1. Cruise phase at supersonic speed
1. Terminal guidance to target

Guidance System

- GPS – based navigation
- Inertial navigation system (INS)
- Active radar homing

- Thrust generated by combustion
- Aerodynamic design reduces drag
- High kinetic energy ensures impact

Real – Life Connection

While BrahMos is a defence system, the science behind it is used in:

- Aviation technology
- Rocket science
- GPS navigation
- Materials engineering

Advantages of BrahMos

- Extremely fast
- High accuracy
- Difficult to intercept
- Versatile deployment
- Indigenous defence technology
- Engineering innovation
- Career opportunities in aerospace

Limitations of BrahMos

- Expensive
- Requires advanced technology
- Limited payload compared to slower missiles

Impact Created

- Strengthens national security
- Promotes indigenous technology
- Inspires students in STEM



DIY Activities for Students

Project Ideas

1. Build a **model rocket**
2. Study **aerodynamics using paper planes**
3. Design a **guidance system concept**

Classroom Activity for Teachers

Teachers can ask students engaging questions such as

- How can we reduce air resistance?
- What materials can withstand high temperatures?
- Can we develop reusable missile systems?

Conclusion

BrahMos is not just a missile, it is a symbol of **scientific excellence and innovation**.

It shows that:

- Science has real – world applications.
- Engineering solves complex problems.
- India can lead in advanced technology.

As one of the fastest supersonic cruise missiles in the world, it reflects the nation's progress in indigenous defense innovation and advanced engineering.

Word Search 2606 - Science of Space



TELESCOPE
WHITE DWARF
DARK ENERGY
WAVELENGTH
SUPERNOVA
GALAXY
PARALLAX
SPECTROGRAPH
BLACK HOLE
DARK MATTER
NEUTRON STAR
SPECTRUM
NEBULA
MAIN SEQUENCE
CONVEX LENS
PULSAR
PROTOSTAR
QUASAR

(Answers on Back Cover Inside)