## India's Dhvani Hypersonic Missile

India is on the verge of a historic defence breakthrough with the upcoming test of **Dhvani**, a next-generation **hypersonic missile**. This will place India among a select group of nations with hypersonic strike capability, significantly boosting its deterrence and strategic posture.

## 1. Background & Context

- Hypersonic weapons = Missiles that can travel at speeds greater than Mach
  5 (five times the speed of sound).
- Countries with developed hypersonic tech: USA, Russia, China (India preparing to join).
- India has already tested HSTDV (Hypersonic Technology Demonstrator Vehicle), laying the foundation for Dhvani.
- Dhvani is expected to undergo testing by end of 2025 and possible deployment by 2029-30.

## 2. Technical Features of Dhyani

- **Type**: Hypersonic Glide Vehicle (HGV).
- Design:
  - ∘ Length: ~9 metres | Width: ~2.5 metres.
  - Blended wing-body design for aerodynamic efficiency.
- Heat Protection:
  - Uses ultra-high-temperature ceramic composites.
  - Survives 2,000°C-3,000°C during atmospheric re-entry.
- **Stealth**: Angled surfaces reduce radar visibility → **harder to detect/intercept**.

## 3. Strategic Advantages

- Speed: Travels faster than Mach 5.
- Manoeuvrability:
  - $\circ\,$  Can perform sharp, unpredictable turns.

- Avoids interception by missile defence systems.
- Range: Estimated 6,000 10,000 km (double the Agni-5's reach).
- Versatility: Can carry conventional as well as nuclear warheads.

## 4. Impact on Regional Security

#### • Pakistan:

- Relies mainly on conventional ballistic missiles.
- Dhvani creates a major technological gap in India's favour.

#### • China:

- Already fields hypersonic systems like **DF-ZF**.
- India's entry reduces the asymmetry with Beijing.

## South Asia Security:

- Strengthens deterrence.
- Enhances regional stability by discouraging aggression.

## 5. Global Context

- Russia: Avangard Hypersonic Glide Vehicle.
- **China**: DF-ZF (operational).
- USA: Developing Dark Eagle & HACM.
- India: Achieving hypersonic tech indigenously, boosting Atmanirbhar Bharat (self-reliance) in defence.

## 6. Strategic Significance for India

- **Defence Posture**: Counters advanced missile defence systems.
- Power Projection: Extends India's strike capability far beyond South Asia.
- Geopolitics: Enhances India's credibility in global security forums.
- **Technology Leadership**: Indigenous R&D makes India a leader among

## 7. Future Prospects

- Operationalisation: By 2029-30.
- **Expansion**: Development of hypersonic variants for:
  - Anti-ship warfare.
  - Precision strikes.
  - Nuclear deterrence.
- **Strategic Messaging**: Sends a signal of India's technological progress and defence readiness to global powers.

## 8. UPSC Relevance

- **GS Paper II (International Relations)** → India's regional security dynamics.
- GS Paper III (Security & Defence Technology) → Defence R&D, Atmanirbhar Bharat.
- **Essay** → "Hypersonic technology and future of warfare".

## ☐ In Summary:

Dhvani represents a **transformational leap** in India's defence capabilities, combining **speed, stealth, manoeuvrability, and precision**. It bridges the technological gap with global powers and strengthens India's security posture in an evolving geopolitical environment.

## FAQs on Dhvani - India's Hypersonic Missile

#### Q1. What is Dhvani missile?

Dhvani is India's upcoming **hypersonic glide vehicle (HGV)** missile capable of traveling faster than **Mach 5** with high manoeuvrability and stealth.

## Q2. When is Dhvani expected to be tested and deployed?

First test: By end of 2025

Likely operational deployment: 2029-30

## Q3. What makes hypersonic missiles like Dhvani significant?

They combine **extreme speed, unpredictable manoeuvres, and stealth**, making them nearly impossible for existing missile defence systems to intercept.

## Q4. What is the estimated range of Dhvani?

Between 6,000 km and 10,000 km, nearly double that of Agni-5.

## Q5. How does Dhvani strengthen India's security?

- Creates a **technological edge** over Pakistan.
- Reduces the gap with China's hypersonic programme.
- Enhances strategic deterrence and regional stability.

## Q6. What is the global context of hypersonic weapons?

- Russia: Avangard HGV (operational).
- China: DF-ZF HGV (operational).
- **USA**: Dark Eagle, HACM (under development).
- India: Dhvani (indigenous, upcoming).

# Q7. What materials are used to withstand extreme heat in Dhvani? It uses ultra-high-temperature ceramic composites that can survive 2,000°C-3,000°C during re-entry.

#### Q8. What are the strategic roles of Dhvani?

- Nuclear deterrence.
- Anti-ship capability.
- Long-range precision strike.

#### Q9. Why is Dhvani important for UPSC preparation?

It is relevant for:

- **GS Paper II** International Relations (India-China-Pakistan security dynamics).
- **GS Paper III** Science & Technology, Defence, Atmanirbhar Bharat.
- Essay "Future of Warfare" / "Indigenous Defence Technology".

#### Q10. How does Dhvani showcase India's self-reliance?

The missile is **largely indigenous**, developed after HSTDV trials, marking a milestone in India's journey towards **Atmanirbhar Bharat in defence technology**.

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