



UPSC & STATE PCS CURRENT AFFAIRS · UJIYARI.COM

DAILY CURRENT AFFAIRS

ISRO's CE20 Cryogenic Engine — 22-Tonne Hot Test and LVM3 Upgrades

16 March 2026

SUBJECTS COVERED

SCIENCE & TECH

CURATED & WRITTEN BY

Bharat Choudhary

UPSC Educator & Content Creator •

[linkedin.com/in/epicbharat](https://www.linkedin.com/in/epicbharat)

Free UPSC & State PCS Resources

ujiyari.com

ISRO's CE20 Cryogenic Engine — 22-Tonne Hot Test and LVM3 Upgrades

16 March 2026 · 7 min read

▼ On this Page

01 ISRO's CE20 Cryogenic Engine

- What is a Cryogenic Engine?
- India's Cryogenic Journey
- CE20 vs CE7.5 — Technical Comparison
- LVM3 and Its Missions
- IPRC Mahendragiri
- Gaganyaan Connection

✎ WHY IN NEWS

ISRO successfully completed a **165-second sea-level hot test** of the CE20 cryogenic engine at **22-tonne thrust** at ISRO Propulsion Complex (IPRC), Mahendragiri, Tamil Nadu on March 10, 2026 — the engine's 20th hot test and a milestone for the uprated **C32 Cryogenic Stage** that will power future **LVM3** missions including Gaganyaan.

ISRO'S CE20 CRYOGENIC ENGINE

What is a Cryogenic Engine?

A **cryogenic rocket engine** uses propellants stored at extremely low (cryogenic) temperatures — temperatures below -150°C . The CE20 uses:

Fuel: Liquid Hydrogen (LH₂) — stored at -253°C (just above absolute zero)

Oxidiser: Liquid Oxygen (LOX) — stored at -183°C

This combination delivers the **highest specific impulse (Isp)** of any chemical propellant pair — approximately 440 seconds vacuum specific impulse. Isp measures how efficiently a propellant produces thrust per unit of fuel consumed. The higher the Isp, the more payload a rocket can carry to orbit.

Cryogenic engines are significantly more efficient than solid propellant or earth-storable liquid propellant engines, but far more complex to design, build, and test. Only a handful of countries have mastered cryogenic technology: USA, Russia, France (ESA), Japan, China, and India.

India's Cryogenic Journey

India's cryogenic programme has a politically significant history. In **January 1991**, ISRO signed an agreement with Russia's **Glavkosmos** for the transfer of cryogenic engine technology. In **May 1992**, the **United States imposed sanctions** on both ISRO and Glavkosmos, citing **MTCR (Missile Technology Control Regime)** concerns — the technology could theoretically be used in ballistic missiles. Under sustained US pressure, Russia cancelled the technology transfer agreement. A revised deal in **January 1994** allowed Russia to supply seven fully assembled KVD-1 engines — but without the underlying technology.

This forced India to develop cryogenic technology entirely indigenously — a process that took nearly two decades. ISRO's first indigenous cryogenic engine (CE7.5) powered the **GSLV Mk I/II** upper stage. The **CE20** is the next-generation engine developed for the more powerful **LVM3** (formerly GSLV Mk III).

Key milestones:

- 1991:** ISRO-Glavkosmos cryogenic technology transfer agreement signed
- 1992:** US sanctions on ISRO and Glavkosmos; technology transfer blocked
- 1994:** Revised deal — Russia to supply 7 assembled engines (no technology transfer)
- 2001:** GSLV D1 — first GSLV flight (with Russian KVD-1 cryogenic stage)
- 2010:** GSLV D3 — first flight with indigenous CE7.5 cryogenic engine (failed at 295 seconds)
- 2014:** GSLV D5 (January 5) — first successful GSLV with indigenous cryogenic stage (CE7.5)
- 2017:** First CE20 engine flight on LVM3 (GSLV Mk III D1, carrying GSAT-19)
- 2019:** Chandrayaan-2 launched on LVM3 with CE20
- 2023:** Chandrayaan-3 launched on LVM3
- 2026:** CE20 uprated to 22-tonne for C32 stage (March 10 test)

CE20 vs CE7.5 — Technical Comparison

Feature	CE7.5	CE20
Vehicle	GSLV Mk I/II	LVM3
Thrust (vacuum)	7.5 tonne	20 tonne (standard); 22 tonne (uprated)
Propellant	LH2 / LOX	LH2 / LOX
Stage	CUS (Cryogenic Upper Stage)	C25 → C32 (upgraded)

LVM3 and Its Missions

LVM3 (Launch Vehicle Mark-3) — formerly called GSLV Mk III — is ISRO's most powerful operational rocket:

Configuration: Solid strap-ons (S200) + Liquid core stage (L110) + Cryogenic upper stage (C25/C32)

LEO capacity: ~10 tonnes | **GTO capacity:** ~4 tonnes

Notable missions: GSAT-19 (D1, June 2017 — first CE20 flight), Chandrayaan-2 (2019), Chandrayaan-3 (2023), OneWeb satellite batches (2023), Gaganyaan crew module test

The **C32 upgrade** (32-tonne propellant, vs. C25's 25-tonne) combined with the 22-tonne CE20 will increase LVM3's payload capacity — enabling heavier Gaganyaan crew modules and future Moon/beyond missions.

IPRC Mahendragiri

ISRO Propulsion Complex (IPRC) at Mahendragiri, Tirunelveli district, Tamil Nadu is India's premier rocket propulsion testing facility. All ISRO engine types — cryogenic, semi-cryogenic, liquid, solid — are tested here before flight qualification. Its remote location (hills of Tirunelveli) provides natural acoustic and safety isolation for high-energy tests. The first successful hot test of the semi-cryogenic engine power head (SE-2000) was also conducted here in March 2025.

Gaganyaan Connection

Gaganyaan is India's first crewed spaceflight programme, targeting sending **3 astronauts (Vyomnauts)** to low Earth orbit (400 km) for up to 3 days. LVM3 is the launch vehicle. Upgrading CE20 to handle heavier crew module + service module combinations is directly relevant to Gaganyaan's eventual crewed mission.

India's four astronaut-designates are Group Captain **Prashanth Balakrishnan Nair**, Group Captain **Ajit Krishnan**, Group Captain **Angad Pratap**, and Group Captain **Shubhanshu Shukla** — all IAF test pilots. Shukla became the first Indian astronaut corps member to fly in space when he piloted **Axiom Mission 4** to the ISS (launched June 25, 2025; splashdown July 15, 2025), making him the second Indian in space after Rakesh Sharma (1984).

UPSC Angle — Prelims & GS-3: MTCR: 35-member informal arrangement controlling transfer of missiles with range >500 km and payload >500 kg; India joined in June 2016 (35th member). Specific Impulse (Isp) = thrust efficiency measure; cryogenic > liquid storable > solid propellants. IPRC = ISRO Propulsion Complex, Mahendragiri, Tamil Nadu. Gaganyaan = first Indian crewed spaceflight; crew selection: 4 IAF test pilots; Shubhanshu Shukla flew to ISS on SpaceX Axiom Mission 4 (launched June 25, 2025) — first Indian astronaut corps member in space. Semi-cryogenic engine (SE-2000, formerly SCE-200) under development — uses liquid oxygen + refined kerosene (not LH2); power head hot test successful March 2025.

UPSC RELEVANCE

CE20 (22T thrust, 165 sec, ISRO Propulsion Complex Mahendragiri), C25 vs C32, LVM3, Gaganyaan, MTCR (India joined June 2016, 35 members), Specific Impulse definition, cryogenic propellants (LH₂ + LOX), Axiom Mission 4 (Shubhanshu Shukla, June 2025).

MAINS GS-3:

India's space technology milestones; significance of indigenous cryogenic capability; dual-use technology and MTCR; Gaganyaan programme and India's human spaceflight ambitions.

★ FACTS CORNER — KNOWLEDGE PEDIA

CE20 CRYOGENIC ENGINE:

Type: Cryogenic (Liquid Hydrogen + Liquid Oxygen)

Standard thrust: **20 tonnes**; Upgraded: **22 tonnes** (March 2026 test)

Test duration: **165 seconds** (sea level) | Test number: **20th hot test** (programme record)

Facility: **ISRO Propulsion Complex (IPRC), Mahendragiri, Tirunelveli district, Tamil Nadu**

Application: **C32** (upgraded Cryogenic Upper Stage) for LVM3

Special feature tested: **Nozzle Protection System**

CRYOGENIC PROPELLANTS:

Fuel: **LH2 (Liquid Hydrogen)** — stored at -253°C

Oxidiser: **LOX (Liquid Oxygen)** — stored at -183°C

Advantage: Highest Specific Impulse (~ 440 s vacuum Isp) of any chemical propellant pair

Countries with cryogenic capability: USA, Russia, France (ESA), Japan, China, **India**

LVM3 (LAUNCH VEHICLE MARK-3):

Earlier name: GSLV Mk III

Stages: S200 (solid) + L110 (liquid) + C25/C32 (cryogenic)

LEO capacity: ~ 10 tonnes | GTO capacity: ~ 4 tonnes

Key missions: Chandrayaan-2 (2019), Chandrayaan-3 (2023), OneWeb batches, Gaganyaan (upcoming)

INDIA'S CRYOGENIC HISTORY:

1991: ISRO-Glavkosmos technology transfer agreement signed

1992: US sanctions; technology transfer blocked

1994: Revised deal — 7 assembled Russian KVD-1 engines (no technology)

2001: GSLV D1 — first flight (Russian cryogenic stage)

2010: GSLV D3 — first flight with indigenous CE7.5 (failed)

2014: GSLV D5 (Jan 5) — first success with **indigenous** cryogenic stage (CE7.5)

2017: First CE20 flight (LVM3 D1, carrying GSAT-19)

2019: Chandrayaan-2 on LVM3 with CE20

GAGANYAAN:

India's first crewed spaceflight mission

Launch vehicle: **LVM3** | Orbit: LEO (~ 400 km) | Crew: 3 Vyomnauts | Duration: Up to 3 days

4 selected astronaut-trainees: Prashanth Balakrishnan Nair, Ajit Krishnan, Angad Pratap, **Shubhanshu Shukla**

Shubhanshu Shukla: flew on **Axiom Mission 4** to ISS (SpaceX, launched June 25, 2025; splashdown July 15, 2025) — first Indian astronaut corps member in space (second Indian after Rakesh Sharma, 1984)

MTCR:

Full form: **Missile Technology Control Regime**

Members: **35 countries** (informal political arrangement, not a treaty)

Controls: Missiles/rockets with range > 500 km AND payload > 500 kg; UAVs; related technology

India joined: **June 27, 2016** (35th member)

India IS member of: MTCR, Wassenaar Arrangement, Australia Group

India NOT member of: **NSG** (Nuclear Suppliers Group)

OTHER RELEVANT FACTS:

Specific Impulse (Isp): Thrust per unit of propellant weight flow; higher = more efficient

Semi-Cryogenic Engine (SE-2000, formerly SCE-200): Under development by ISRO; LOX + refined kerosene; for future heavy launchers; power head hot test successful March 2025 at IPRC Mahendragiri; SC120 stage expected operational by 2027

ISRO headquarters: **Bengaluru (Antariksh Bhavan)**

Vikram Sarabhai Space Centre (VSSC): Thiruvananthapuram — LVM3 development

Satish Dhawan Space Centre (SDSC-SHAR): Sriharikota — launch pad

Sources: [ISRO](#), [GKToday](#), [PIB](#)

RELATED EDITORIALS

THE HINDU

AI-Powered Taxation — Project Insight's Gains and Governance Risks

20 Mar

INDIAN EXPRESS

The Happiness Deficit — What the 2026 World Happiness Report Tells Policymakers

20 Mar

HINDUSTAN TIMES

Screen Time, Mental Health, and the Case for Children's Online Safety Law

20 Mar

THE HINDU

Green Hydrogen in India — From Mission to Market

18 Mar

CURATED & WRITTEN BY

Bharat Choudhary

UPSC Educator & Content Creator

 linkedin.com/in/epicbharat

 [Read Full Article on Ujyari](#) →

<https://ujyari.com/daily/2026/03/16/isro-ce20-cryogenic-engine/>

Free UPSC & State PCS Current Affairs · ujyari.com