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Chandrayaan-4 — India's First Lunar Sample-Return Mission and the Mons Mouton-4 Landing Site

11 February 2026

SUBJECTS COVERED

SCIENCE & TECH

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WHY IN NEWS

ISRO identified **Mons Mouton-4 (MM-4)** — located at 84.289°S, 32.808°E near the Moon's south pole — as the primary candidate landing site for Chandrayaan-4, India's first lunar sample-return mission, using imagery from the Chandrayaan-2 Orbiter's High Resolution Camera (OHRC).

WHAT IS CHANDRAYAAN-4?

Chandrayaan-4 is India's fourth lunar mission, representing a qualitative leap from previous missions: it aims to **land on the Moon, collect soil/rock samples (regolith), and return them to Earth** — making India only the fourth country in the world to achieve a lunar sample-return (after the USA, Soviet Union, and China).

Mission profile (planned):

- Land near the lunar south pole — a region of high scientific interest due to confirmed water-ice deposits in permanently shadowed craters
- Collect ~3 kg of surface regolith samples
- Return samples to Earth via an ascent vehicle docking with an orbiting return module
- Total mission complexity: requires mastery of six critical technologies India has not yet demonstrated in combination: **precision landing, sample collection, ascent from the Moon, rendezvous and docking in lunar orbit, re-entry, and Earth recovery**

THE LANDING SITE — MONS MOUTON-4

Mons Mouton is a plateau formation (mons = mountain/highland in lunar nomenclature) located in the Moon's south polar region. The **MM-4 site** at **84.289°S, 32.808°E** was selected after analysis of:

- OHRC (Orbiter High Resolution Camera) imagery from **Chandrayaan-2** — which has been orbiting the Moon since 2019 and continues to produce data despite the Vikram lander's crash
- Terrain assessment by **Space Applications Centre (SAC)**, ISRO, Ahmedabad — India's primary remote sensing and space applications institution

Criteria: slope gradient (<15°), boulder density, sunlight availability for solar power, proximity to water-ice deposits

Why the south pole?

Permanently Shadowed Regions (PSRs) at the south pole contain **water-ice** — confirmed by Chandrayaan-1's Moon Mineralogy Mapper (M^3) instrument in 2008 and by ISRO's ShadowCam analysis from LRO data

Water ice = potential in-situ resource for future crewed missions (drinking water, oxygen, hydrogen fuel via electrolysis)

Temperature in PSRs: ~40 Kelvin (−233°C) — among the coldest places in the solar system

Chandrayaan-3's Vikram lander successfully landed at ~69°S on August 23, 2023 — Chandrayaan-4 targets a more challenging, higher-latitude site

THE CHANDRAYAAN PROGRAMME PROGRESSION

Mission	Year	Outcome
Chandrayaan-1	2008	Lunar orbiter; discovered water molecules on Moon via M^3 instrument
Chandrayaan-2	2019	Orbiter (operational); Vikram lander crash-landed; Pragyan rover lost
Chandrayaan-3	2023	Successful landing at ~69°S; Vikram lander + Pragyan rover; first soft landing near south pole globally
Chandrayaan-4	Planned ~2028	Sample-return; first Indian sample-return mission

THE GLOBAL SAMPLE-RETURN RACE

Chandrayaan-4 enters a competitive global landscape for lunar sample-return:

USA:

Apollo missions (1969–1972): Brought back 382 kg of lunar samples — still the benchmark for lunar science

Artemis programme: NASA targeting crewed return to Moon, including south polar landing

Soviet Union:

Luna 16 (1970), Luna 20 (1972), Luna 24 (1976): Three robotic sample-return missions; total ~300 grams returned

China:

- **Chang'e 5 (2020):** Returned 1.731 kg of lunar samples from Mons Rümker (near equatorial region) — the first new lunar samples in 44 years; confirmed ~2-billion-year-old volcanic activity
- **Chang'e 6 (2024):** First-ever sample return from the **lunar far side** (South Pole-Aitken Basin); returned ~1.9 kg

India's challenge: Chandrayaan-4 will need to demonstrate rendezvous and docking capability in lunar orbit — a technology India is also testing with the **SPADEX mission** (Space Docking Experiment).

KEY TECHNOLOGIES — SPADEX DOCKING DEMONSTRATION

The **SPADEX (Space Docking Experiment)** mission, launched December 2024, is India's precursor technology demonstrator:

- Two small spacecraft (SDX01 Chaser and SDX02 Target) launched together
- Demonstrated autonomous rendezvous and docking in Earth orbit
- Critical for Chandrayaan-4: the ascent vehicle leaving the Moon must dock with the orbiting return module to transfer samples

ISRO has confirmed that SPADEX's success is a prerequisite for Chandrayaan-4 proceeding to full development.

UPSC RELEVANCE

Chandrayaan-4 (India's first lunar sample-return mission), Mons Mouton-4 (84.289°S, 32.808°E), OHRC (Orbiter High Resolution Camera from Chandrayaan-2), Space Applications Centre (SAC), SPADEX (Space Docking Experiment), Chang'e 5 (China, 2020), Chang'e 6 (2024 — lunar far side), Apollo programme (382 kg), M³ instrument (Chandrayaan-1, water molecules 2008), Chandrayaan-3 landing date August 23, 2023.

Space technology — ISRO missions; lunar exploration; India's space programme milestones; dual-use space technologies.

📌 FACTS CORNER — KNOWLEDGEPEDIA

CHANDRAYAAN-4:

Mission type: India's first **lunar sample-return mission**

Target landing site: **Mons Mouton-4 (MM-4)** — 84.289°S, 32.808°E

Site identification tool: **OHRC** (Orbiter High Resolution Camera) from Chandrayaan-2

Site assessment: **Space Applications Centre (SAC)**, ISRO, Ahmedabad

Sample target: ~**3 kg** of lunar regolith

Planned year: ~2028

Prerequisite: SPADEX docking demonstration

CHANDRAYAAN PROGRAMME:

Chandrayaan-1 (2008): Discovered water molecules via **M³** instrument (Moon Mineralogy Mapper)

Chandrayaan-2 (2019): Orbiter (operational); Vikram crash-landed

Chandrayaan-3 (2023): Soft landing at ~**69°S**, August 23, 2023 — world's first near-south-pole landing

SPADEX MISSION:

Launched: **December 2024**

Purpose: Space docking demonstration in Earth orbit

Two spacecraft: **SDX01 Chaser** + **SDX02 Target**

Critical technology for Chandrayaan-4 lunar orbit rendezvous

GLOBAL SAMPLE-RETURN COMPARISON:

USA Apollo: **382 kg** returned (1969–1972)

China Chang'e 5 (2020): **1.731 kg** from Mons Rümker

China Chang'e 6 (2024): **~1.9 kg** — first from lunar **far side** (South Pole-Aitken Basin)

USSR: ~300 g (Luna 16, 20, 24 — 1970–1976)

LUNAR SOUTH POLE SCIENCE:

Permanently Shadowed Regions (PSRs): Temperature ~**40 Kelvin** (−233°C)

Water-ice confirmed: **Chandrayaan-1 M³** (2008); NASA LRO/ShadowCam

Water ice applications: drinking water, O_2 (breathable), H_2 fuel (electrolysis)

OTHER RELEVANT FACTS:

ISRO headquarters: **Bengaluru, Karnataka**; founded 1969; Chairman (current): **V. Narayanan**

Artemis programme (NASA): crewed Moon return; Artemis III (first crewed landing, planned 2026)

India's 4th country to achieve lunar orbit, 4th to soft-land on Moon (Chandrayaan-3), targeting 4th for sample-return

HLPST (High-Level Panel on Space Science and Technology): ISRO advisory body for mission prioritization

Sources: AffairsCloud, Drishti IAS

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