US Stock Express

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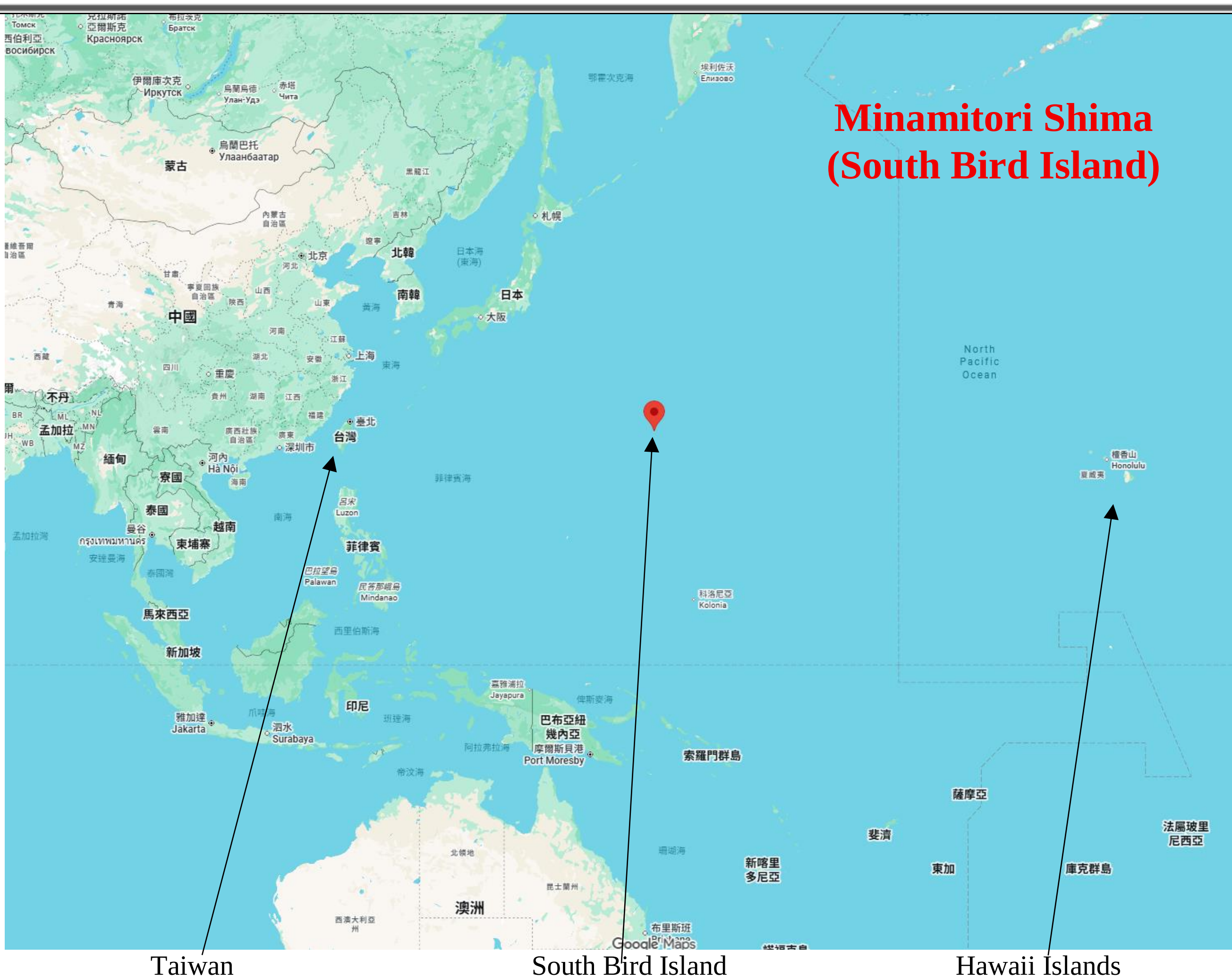
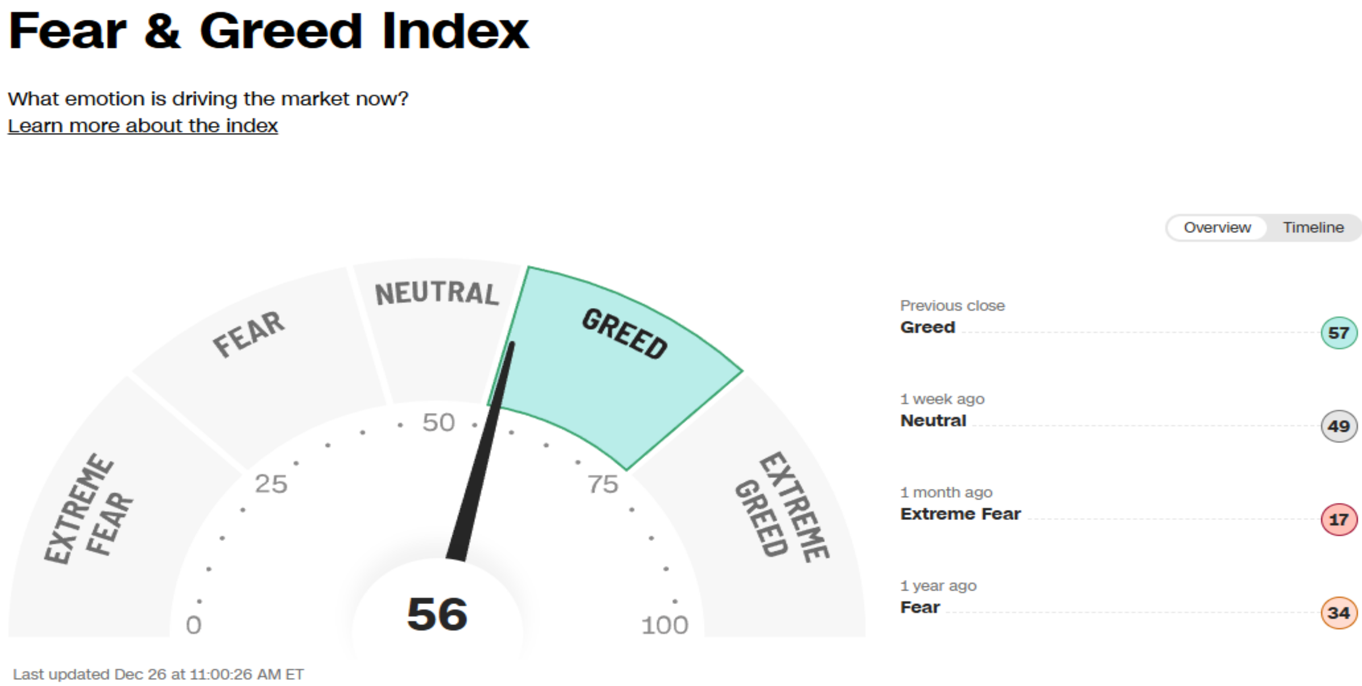


South Bird Island is the eastmost territory of Japan, 1,200 miles southeast of Tokyo. University of Tokyo and Nippon Foundation discovered 230 million tons of manganese nodules cotaining rare earth elements. It is buried deep in sea bed of 5.700 meters. Rare earth extraction worths **£26 billion.** Japan and US is having joint venture on extraction and Chinese aircraft carrier Liaoning is by the side watching. Before 2010, Japan relied 90% on importing rare earth from China, now just 60% even the demand for e-vehicle batteries will increase 300%-400% per year. When will Japan fully independent of the rare earth supply from China? See page 8 to 13 please.

Japan's Minami-Tori-shima Set for Extraction of £26 billion Worth of Rare Earth Metals

Risk disclosure: Price can go up and down at any moment, use free money to trade and bear the risk according to your own capital; Never trade with money that has a deadline for withdrawal.
All suggestions are for reference only, even AI cannot be 100% reliable, final decision still lies upon investors.
Copy trading cannot replicate another trader's background or psychological state.



North East West South is *NEWS*

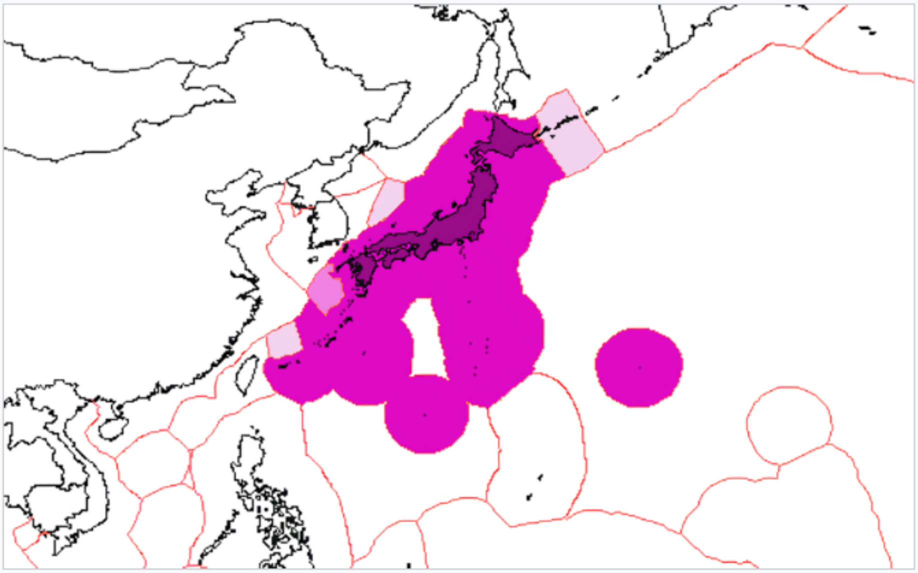
Owing to shortage in supply, silver prices broke $75 per ounce for the first time, with both precious and industrial metals hitting record highs at the end of the year due to increased economic and geopolitical uncertainty. Silver rose to a high of $75.1515 per ounce today. Gold prices also hit a record high, reaching $4531.04 per ounce.

The Japanese government approved a record budget for the next fiscal year to address various expenditures, from increased defense spending to soaring social security costs, while inflation remains a concern. The 122.3 trillion yen budget, which runs from April 2026, will include nearly 9 trillion yen in defense spending. Against the backdrop of deteriorating relations with China, Prime Minister Sanae Takaichi aims to accelerate Tokyo's comprehensive escalation of its military capabilities.

A woman in London recently recovered her stolen phone, revealing a new thief's method of burying stolen goods in park flowerbeds. Agiimaa Oyungerel, a 35-year-old journalist and content creator, had her phone stolen by a bicycle thief outside Surrey Quays train station on December 20. Using Google Find My Device tracking, she dug her phone out two hours later under a tree in Pepys Park in Lewisham, along with four other iPhones that had also been buried there. London police data shows that 80,000 mobile phones were stolen citywide last year, and the tactic of burying stolen goods in flowerbeds to evade immediate tracking is now spreading from the West End to other areas.

Elon Musk said within 3 weeks, Robotaxi will be launched out without driver and even without remote control monitoring in Austin for commercial usage.

Nvidia is making its largest purchase ever, acquiring assets from nine-year-old chip startup Groq for about $20 billion. The company was founded by creators of Google's tensor processing unit, or TPU, which competes with Nvidia for artificial intelligence workloads. Groq, which was valued at $6.9 billion in a financing round in September, framed the deal as a "non-exclusive licensing agreement," with its CEO and other senior leaders joining Nvidia.



Japan's exclusive economic zones: Minamitorishima is at the center of the isolated easternmost circle.

- Japan's EEZ
- Joint regime with Republic of Korea
- EEZ claimed by Japan, disputed by others

Wikipedia
The Free Encyclopedia

[Minamitorishima - Wikipedia]

South Bird Island is eastmost of Japan not southmost.

Minamitorishima

Native name: 南鳥島

No local residents live on Minamitorishima. Civilians are not allowed to reside there, and the personnel of the Japan Meteorological Agency, JSDF, and the Japan Coast Guard, only serve on the island for a limited time, and in limited numbers.

Market Observation

Dilemma of retail investors

USD/JPY

156.504

There is no need to worry about inflation now, for the effect of tariff war is not so much as anticipated. Bank of Japan raised interest rate and Federal Reserve cuts interest rate, it pushed up gold and silver, as well as stock market, but crypto falls. Even Warren Buffet also invests in Tokyo stock market and Nikkei go up to 50705 points, the highest level in the world.

In Macro Economics, the Space Superiority Order (The Express @ 20251222) and Pax Silica (The Express @ 20251216) proved the current AI trend is not a bubble, at most some over-estimation and still will grow steadily. The IPO of SpaceX in mid-2026 kicks off a new stage of Space Race and Mars Landing hotness, together with success in Full Self Driving and humanoid robot, AI is stepping out from computer and mobile to physical world in 2026.

The future is splendid and brilliant! However individual investors are in great headache, for too much potential stocks need to buy, but too little capital left in hand. It is a common problem for you and me, for he and she. We are not Warren Buffett or Cathy Wood, so must fix a new way in such a situation. The only way is to have deeper and broader research instead of copy trade. We must understand the big picture of economy first and then enter into individual industry like space industry and AI development and supply chains, the last is individual stocks.

For Space Economy, before touching the SpaceX should understand the Project Artemis, Project Apollo, Project Gemini and Project Mercury. For AI trend we have to under differences among CPU, GPU, TPU and ASIC (The Express @ 20251124). There will be strong competition among these giant stocks. NVDA still will lead the market, they purchased Groq to face the keen competition from the TPU and quantum computer of GOOG. The DGX cloud is developed to face AWS of AMZN. The OHISAMA Project of Japan got initial experiment of generating electricity from space and transmit back to earth, but too faint, only under 1kilowatt. It must be over 1kw in order to boil a kettle of water for coffee of a small family and thus will be considered successful. That's why Elon Musk said he can do it very soon. But that this very soon may take 5 or more years for mass production of commercial usage. Developing data centre in space is a common target of those giants and will carry on. GOOG is having co-operation with META and AMZN. AAPL will use the GOOG Gemini. X.AI will have competition with Open AI.

Therefore, such keen competitions prove AI is not a bubble and will have sustain and continuous development. Don't forget ORCL, it will rise with the purchase of TikTok. AVGO will have the function of NVDA of designing and also the function of TSM which is manufacturing chips. PLTR not only have a lot of co-operation but won a lot of government projects.

Now concerning computing power like quantum computer, everything need ultra-high speed, but what PLTR provides is not speed but accuracy, especially among enormous data must accurately to the point. PLTR is famous for finding out Bid Laden among numerous mobile monitoring. Laden himself did not use mobile; his messenger would not talk anything less people suspicious them on mobile. PLTR could not find out anything from conservation, but find out one number does not speak and turn off mobile always. Thus, incredibly fixed the location of Laden. TEM will be the trend of AI going to physical world, in the future, medical doctor will step aside and AI will take their place to prescribe medicine and operation also. For any disease, AI will compare with the whole nation and whole world and the family background to prescribe the most accurate medicine. Therefore, PLTR and TEM will not have anything concerning speed, but accuracy is above all.

Too many stocks need to buy, too limited capital indeed! Santa Claus Rally on the average can only give a rise of 1.3%, no use at all, but just make people happy during the festival period. No matter you want to invest in Space Industry or AI competition, it should be an investment for 5 to 10 years. Short term fluctuation is nothing but *Dusk In the Wind*. Market would not go in a straight line and we have to prepare for the golden pit and stand fast against all ups and downs. For all the above stocks, the harvest time should be in 2030 or even later.

World Observation

Day 1405
Russia/Ukraine Conflict

Mars Landing 2030

(10) True of False Landing

On 13th October 2016, President Obama gave a speech in the University of Pittsburgh that US should send people to Mars in 2030 and back safely. Since then, some people kept on saying that the Landing on the Moon in 1969 was a fake landing, it was just a film from Hollywood studio. Of course, some people would believe in them, but if we view things high above and can see it is so ridiculous. Let's view it rationally.

The landing on the Moon is not as they said just one single shooting, it is a series of project crossing from 1961 to 1972. Each flight is monitored by radio wave worldwide, including rival countries, academic institutions and radio wave amateur lovers. That is when US Apollo Project had detrimental accidents in 1967 and Soviet had accident in 1971, both parties send their consolation to the others. The landing of Apollo 11 on the Moon was confirmed by Soviet Union in another format, not congratulations, but they said they send an unmanned spacecraft to have hard landing (crashed) on surface of the Moon before the Apollo astronauts landing. Therefore, Soviet Union was just a few hours earlier.

Please refer to page 13-15 how the whole process is. The Project Mercury is a one-crew project and had 6 flights to test the gravity to human being. This project was fixed by President Eisenhower. The Project Gemini of 2 crews had 12 flights of how to make 2 crafts meet in the vast space and also spacewalk. The Apollo Project has 17 flights each has 3 members. Apollo 1 had an explosion before shooting and 3 members became victims. Apollo 13 had accidents when orbiting round the Moon and cancelled landing but go back to earth safely.

Three Projects took 10 years to finish and involved 400,000 workers. If it is a trap or false landing, hard to conceal it. NASA said it will be even easier to go to the

Moon than have a false landing through a fake project of 10 years. Meanwhile, after landing, they brought back a lot of rocks from the Moon and send to friendly institutions and universities, including my university and rival countries like China and Soviet Union. Professors from Geology confirmed those rocks are not from earth. Perhaps those people are from lower class university and have no chance to see a real rock from the Moon, so they knew nothing. It is called a rock but actually slightly larger than a sand, may be 1cm only. Those time aroused great discussion on the rocks and have a lot of speeches from various professionalists.

Why they say so? It is really very naïve. Such as when Neil Armstong step on the Moon and had his famous saying “That’s one small step for [a] man, one giant leap for mankind”. They challenged that if he is the first-person landing on the Moon, who took the film for him. They thought that selfie only exists in Iphone of this century, and does not know in the 1960s how they took selfie without Iphone. Already said there is a camera mount on the legs of the lunar module, and selfie was taken by a wire as remote control of that age. Those that had not been cameraman of the 1960s really cannot understand if they do not have their research. They also asked why the sky is dark in day time? Only earth is blue because we have atmosphere and the universe should be dark. Its common sense. They also ask what the US flag can unfurl on the Moon since the Moon had no wind. No one said the Moon has wind, it is they say so. The flag was specially design in form of unfurl and wind blowing. As in the Olympic Games of swimming contest, there is no wind inside the pool, but all flags are unfurled in different forms.

In 2008, the Indian Chandrayaan-1 unmanned spacecraft landed on the site near to Apollo projects and took photos of their footprint for on the Moon there is no wind and the foot print can last forever. There are a lot of evidence but they just close their eyes and do not like to see, just like a frog under the well and say the sky is so small. What a pity!

Investors should have critical thinking to tell the true from false, and make priority of importance, which is unimportant and which should treat first. Because we only have limited capital but potential stocks are too much. It they do not want to wake up let it be, but investor should take this chance to train yourself on critical thinking.

GPT-5 is here - OpenAI

Direct Answer:
Manganese nodules found on the deep ocean floor are not only rich in manganese, nickel, copper, and cobalt, but they also contain **rare earth elements (REEs)**. These nodules act as natural concentrators of REEs, making them a potential alternative source for critical minerals needed in high-tech industries. [1] [2]

Manganese Nodules and Rare Earth Elements (REEs)

1. What Manganese Nodules Are

- Potato-sized mineral concretions found on the seabed, especially in the Pacific and Indian Oceans.
- Composed mainly of **manganese and iron oxides**, with trace amounts of nickel, copper, and cobalt.
- Formed over millions of years by slow precipitation of metals from seawater.

2. Rare Earth Element Content

- Nodules contain **rare earth elements (REEs)** such as neodymium, europium, samarium, and yttrium.
- Studies show **enrichment patterns**: for example, nodules often show higher concentrations of Sm and Eu compared to lighter and heavier REEs. [1]
- REEs are critical for electronics, renewable energy, defense, and medical technologies.

3. Why This Matters

- **Strategic importance:** REEs are essential for magnets in wind turbines, batteries, and semiconductors.
- **Supply chain diversification:** Most REEs today come from land-based mines (China dominates production). Deep-sea nodules could reduce geopolitical dependence.
- **Environmental trade-offs:** Extracting nodules could disturb fragile deep-sea ecosystems, raising ethical and ecological concerns.

Rare earth is is somewhat like potatoes, see the pictures:

[Japan finds massive rare metals deposit worth $26,290,800,000]

GPT-5 is here - OpenAI

Comparative Snapshot

Feature	Manganese Nodules	Conventional REE Mines
Location	Deep ocean floor (Pacific, Indian, Atlantic)	Land-based (China, US, Australia, Africa)
Main Metals	Mn, Fe, Ni, Cu, Co + REEs	REEs (varied depending on deposit)
Formation	Slow precipitation over millions of years	Igneous, sedimentary, or clay deposits
Extraction Challenges	Deep-sea mining tech, ecological impact	Land degradation, radioactive waste
Strategic Potential	Diversifies REE supply chain	Current dominant source

Sources: [1] [2]

Risks and Considerations

- **Ecological impact:** Mining nodules could destroy habitats and alter carbon cycles.
- **Economic feasibility:** Technology for large-scale extraction is still experimental.
- **Regulatory uncertainty:** International Seabed Authority (ISA) is still debating rules for deep-sea mining.
- **Market dynamics:** Even if nodules are mined, refining REEs economically remains a challenge.

In short: **Manganese nodules are a promising but controversial potential source of rare earth elements.** They could help diversify global supply chains, but ecological and technological hurdles remain significant.

Would you like me to build a **scenario matrix** showing the economic, environmental, and geopolitical outcomes if deep-sea REE mining from nodules becomes viable versus if it remains restricted?

GPT-5 is here - OpenAI

Direct Answer:
Japan will begin **test mining rare earths off Minamitori Shima in 2026**, with pilot extraction in 2027. Even if successful, experts suggest it will take **at least 10–15 years** before Japan could realistically reduce or eliminate dependence on Chinese imports, due to the scale-up challenges, refining infrastructure, and environmental/regulatory hurdles. [1] [2] [3]

JP Japan's Rare Earth Independence Timeline

1. Current Situation

- Japan imports **~60% of its rare earths from China**, making it vulnerable to supply shocks and geopolitical leverage. [2]
- Rare earths are critical for **EV batteries, wind turbines, semiconductors, and defense systems**.

2. Minamitori Shima Project

- **2026:** Trial mining begins. [1]
- **2027:** Pilot extraction planned. [1]
- The seabed mud near Minamitori Shima is estimated to contain **billions of tons of rare earth minerals valued at ~$26 billion** [3].
- This is one of the largest known deposits globally, potentially enough to supply Japan for centuries.

3. Barriers to Independence

- **Technological scale-up:** Deep-sea mining is still experimental; commercial extraction at scale may take a decade.
- **Refining capacity:** Mining is only half the equation; Japan must build domestic refining facilities to process REEs.
- **Environmental concerns:** Deep-sea ecosystems are fragile, and global scrutiny may slow approvals.
- **Global competition:** Other nations (US, EU, India) are also racing to secure seabed resources, which could complicate supply chains.

📊 Scenario Matrix: Japan's Path to Rare Earth Independence

GPT-5 is here - OpenAI

Scenario	Timeline	Dependence on China	Key Risks
Optimistic – rapid scale-up	2035	<10%	Environmental opposition, high costs
Moderate – gradual build-out	2040	20–30%	Tech hurdles, refining delays
Pessimistic – stalled progress	Beyond 2045	>40%	Regulatory blocks, global competition

Sources: 1 2 3

⚠️ Risks and Considerations

- **Environmental pushback** could delay or restrict mining.
- **Capital intensity:** Billions in investment needed for extraction + refining.
- **Geopolitical uncertainty:** China may respond with price manipulation or export restrictions.
- **Supply chain inertia:** Even with new sources, industries may take years to retool procurement.

👉 **Bottom line:** If Minamitori Shima exploration succeeds, Japan could start reducing reliance on China by the **mid-2030s**, but full independence is unlikely before **2040**. The decisive factor will be whether Japan can build **domestic refining and processing capacity** alongside mining.

Would you like me to build a **timeline chart** showing Japan's projected rare earth supply mix (China vs domestic vs other imports) from 2025 to 2045?

Relation Between Manganese Nodules and Rare Earth Elements

Manganese nodules, also known as polymetallic nodules, are potato-shaped mineral deposits found on the deep ocean floor. They form over millions of years through the precipitation of metals from seawater and primarily consist of manganese and iron oxides, along with other metals like nickel, copper, cobalt, and trace amounts of rare earth elements (REEs). REEs, which include elements like neodymium, dysprosium, and yttrium, are adsorbed onto the manganese and iron phases within these nodules, often in concentrations higher than in typical land-based ores. This makes nodules a potential alternative source for REEs, especially as demand grows for technologies like electric vehicles, wind turbines, and electronics. However, extraction is challenging due to the extreme depths (typically 4,000–6,000 meters) and environmental concerns. impossiblemetals.com +6 more

In the context of deep-sea mining, REEs are sometimes found in associated sediments or muds rather than nodules themselves, but the mineralogical link remains: REE patterns in nodules mirror those in surrounding ocean sediments and seawater, with enrichment driven by similar geochemical processes. onlinelibrary.wiley.com apps.dtic.mil

Japan's Experimental Exploration Near Minamitorishima

Japan's upcoming project focuses on extracting REE-rich mud from the deep seabed near Minamitorishima (also known as Minami-Tori-Shima), a remote island about 1,900 km southeast of Tokyo. This mud contains high concentrations of REEs, often associated with ferromanganese phases similar to those in manganese nodules. The deposits were discovered in 2012 and are estimated at around 6.8 million tons of REEs, potentially covering Japan's domestic demand for over 200 years or even global needs for centuries. reuters.com +4 more

The experimental phase is a proof-of-concept test for continuous extraction at depths of about 6,000 meters, using a long pipe to lift mud to a surface vessel. It will run from January 11 to February 14, 2026, aiming to verify a daily lift capacity of 350 metric tons while monitoring environmental impacts. This is government-funded (about 40 billion yen, or $256 million, since 2018) and led by organizations like JAMSTEC (Japan Agency for Marine-Earth Science and Technology). If successful, a full-scale pilot trial is planned for February 2027 to assess profitability and scale. Japan also plans to build a processing facility on Minamitorishima by 2027 to refine the extracted mud. japantimes.co.jp +6 more

Challenges include technical difficulties at extreme depths, high costs, environmental risks (e.g., sediment disturbance affecting marine ecosystems), and economic viability. This project is part of broader efforts to diversify supply chains, including partnerships with the US and Australia. spf.org +3 more

Please refer to The Express of : 20251021, 20251016, 20251013, 20250806 for rare earth.

Grok - xAI The World's Most Powerful AI

Current Rare Earth Dependency on China

As of 2025, Japan imports approximately 60-70% of its REEs from China, down from over 90% in 2010 due to diversification strategies like stockpiling, recycling, and sourcing from countries such as Australia (via Lynas) and Vietnam. Japan aims to reduce this below 50% by the end of 2025 through further alternative sourcing. China dominates global REE production (about 60-70% of mining and 80-90% of refining), but Japan's imports from China have declined in volume, with a notable drop in 2025.

nytimes.com +6 more

Timeline for Potential Independence from China

"Total independence" (0% imports from China) is ambitious and depends on successful scaling, but the Minamitorishima project could significantly accelerate it if viable. Based on current plans:

- **Short-term (2026-2027)**: Experimental tests and pilot trials; no commercial output yet. news.metal.com mining.com
- **Medium-term (2027-2030)**: If pilots succeed, initial commercial production could begin around 2028-2030, starting small and ramping up as processing infrastructure matures. Estimates suggest the reserves could meet Japan's full domestic needs, but building a complete supply chain (extraction, refining, distribution) might take 5-10 years post-pilot. asia.nikkei.com spf.org
- **Long-term (2030s onward)**: Full self-sufficiency could be achievable by the early 2030s if production scales to cover annual demand (Japan consumes about 20,000-30,000 tons of REEs yearly). However, global market dynamics, environmental regulations, and technological hurdles could delay this. Independence isn't guaranteed solely from this project—ongoing diversification will play a role, and some residual imports may persist for specific REE types. smallwarsjournal.com +2 more

No official projections set a firm date for total independence, as it hinges on test results and investment. If unsuccessful, Japan would continue relying on imports and alternatives, potentially delaying self-reliance indefinitely. reuters.com mining.com

10s 53 sources

↳ Environmental impacts of deep-sea mining

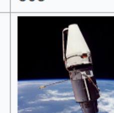
Wikipedia The Free Encyclopedia

Project Mercury (1 crew member)

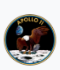
Mission	Spacecraft No.	Call-sign	Pilot	Launch		Duration	Orbits	Apogee mi (km)	Perigee mi (km)	Max. velocity mph (km/h)	Miss mi (km)
				time	site						
MR-3	7	*Freedom 7*	Shepard	14:34 on May 5, 1961	LC-5	15 m 22 s	0	117 (188)	—	5,134 (8,262)	3.5 (5.6)
MR-4	11	*Liberty Bell 7*	Grissom	12:20 on Jul. 21, 1961	LC-5	15 m 37 s	0	118 (190)	—	5,168 (8,317)	5.8 (9.3)
MA-6	13	*Friendship 7*	Glenn	14:47 on Feb. 20, 1962	LC-14	4 h 55 m 23 s	3	162 (261)	100 (161)	17,544 (28,234)	46 (74)
MA-7	18	*Aurora 7*	Carpenter	12:45 on May 24, 1962	LC-14	4 h 56 m 5 s	3	167 (269)	100 (161)	17,549 (28,242)	248 (400)
MA-8	16	*Sigma 7*	Schirra	12:15 on Oct. 3, 1962	LC-14	9 h 13 m 15 s	6	176 (283)	100 (161)	17,558 (28,257)	4.6 (7.4)
MA-9	20	*Faith 7*	Cooper	13:04 on May 15, 1963	LC-14	1 d 10 h 19 m 49 s	22	166 (267)	100 (161)	17,547 (28,239)	5.0 (8.1)

WIKIPEDIA The Free Encyclopedia

Project Gemini (2 crew members)

Mission	LV serial N°	Spacecraft N°	Command Pilot	Pilot	Mission dates	Launch time	Duration
Gemini 1	GLV-1 12556	SC1	Uncrewed	Uncrewed	8–12 April 1964	16:00 UTC	03d 23h[1]
	First test flight of Gemini; spacecraft was intentionally destroyed during re-entry 1: The mission duration was 4h 50m, sufficient to achieve all of the mission aims in three orbits; the spacecraft remained in orbit for 3d 23h.						
Gemini 2	GLV-2 12557	SC2	Uncrewed	Uncrewed	19 January 1965	14:04 UTC	00d 00h 18m 16s
	Suborbital flight to test heat shield						
Gemini 3	GLV-3 12558	SC3	Grissom	Young	23 March 1965	14:24 UTC	00d 04h 52m 31s
	First crewed Gemini flight, three orbits.						
Gemini IV	GLV-4 12559	SC4	McDivitt	White	3–7 June 1965	15:16 UTC	04d 01h 56m 12s
	Included first extravehicular activity (EVA) by an American; White's "space walk" was a 22-minute EVA exercise.						
Gemini V	GLV-5 12560	SC5	Cooper	Conrad	21–29 August 1965	14:00 UTC	07d 22h 55m 14s
	First week-long flight; first use of fuel cells for electrical power; evaluated guidance and navigation system for future rendezvous missions. Completed 120 orbits.						
Gemini VII	GLV-7 12562	SC7	Borman	Lovell	4–18 December 1965	19:30 UTC	13d 18h 35m 01s
	When the original Gemini VI mission was scrubbed because the launch of the Agena docking target failed, Gemini VII was used as the rendezvous target instead. Primary objective was to determine whether humans could live in space for 14 days. Completed 206 orbits.						
Gemini VI-A	GLV-6 12561	SC6	Schirra	Stafford	15–16 December 1965	13:37 UTC	01d 01h 51m 24s
	Rescheduled from October to rendezvous with Gemini VII after the original Agena Target Vehicle launch failed. First space rendezvous accomplished, station-keeping for over five hours at distances from 1 to 300 feet (0.30 to 91 m). First musical instruments played in space; crew played "Jingle Bells" on a harmonica and a ring of small bells as part of a jocular Santa Claus sighting.[26][27]						
Gemini VIII	GLV-8 12563	SC8	Armstrong	Scott	16–17 March 1966	16:41 UTC	00d 10h 41m 26s
	Accomplished first docking with another space vehicle, an uncrewed Agena Target Vehicle. While docked, a Gemini spacecraft thruster malfunction caused near-fatal tumbling of the craft, which, after undocking, Armstrong was able to overcome; the crew effected the first emergency landing of a crewed U.S. space mission.						
Gemini IX-A	GLV-9 12564	SC9	Stafford	Cernan	3–6 June 1966	13:39 UTC	03d 00h 20m 50s
	Rescheduled from May to rendezvous and dock with the Augmented Target Docking Adapter (ATDA) after the original Agena Target Vehicle launch failed. The ATDA shroud did not completely separate, making docking impossible (right). Three different types of rendezvous, two hours of EVA, and 44 orbits were completed.						
Gemini X	GLV-10 12565	SC10	Young	Collins	18–21 July 1966	22:20 UTC	02d 22h 46m 39s
	First use of the Agena Target Vehicle's propulsion systems. The spacecraft also rendezvoused with the Agena Target Vehicle from Gemini VIII. Collins had 49 minutes of EVA standing in the hatch and 39 minutes of EVA to retrieve experiments from the Agena. 43 orbits completed.						
Gemini XI	GLV-11 12566	SC11	Conrad	Gordon	12–15 September 1966	14:42 UTC	02d 23h 17m 09s
	Gemini record altitude with apogee of 739.2 nautical miles (1,369.0 km)[28] reached using the Agena Target Vehicle propulsion system after first orbit rendezvous and docking. Gordon made a 33-minute EVA and two-hour standup EVA. 44 orbits.						
Gemini XII	GLV-12 12567	SC12	Lovell	Aldrin	11–15 November 1966	20:46 UTC	03d 22h 34m 31s
	Final Gemini flight. Rendezvoused and docked manually with the target Agena and kept station with it during EVA. Aldrin set an EVA record of 5 hours and 30 minutes for one space walk and two stand-up exercises, and demonstrated solutions to previous EVA problems. 59 orbits completed						

Project Apollo (3 crew members)

Mission	Patch	Launch date	Crew	Launch vehicle[b]	CM name	LM name	Duration	Remarks	Refs
Apollo 1		February 21, 1967 Launch Complex 34 (planned)	Gus Grissom Ed White Roger B. Chaffee	Saturn IB (SA-204)	—	—	—	Never launched. On January 27, 1967, a fire in the command module during a launch pad test killed the crew and destroyed the module. This flight was originally designated AS-204, and was renamed to Apollo 1 at the request of the crew's families.	[1][8][18][19][20]
Apollo 7		October 11, 1968, 15:02 GMT Launch Complex 34	Wally Schirra Donn F. Eisele Walter Cunningham	Saturn IB (AS-205)	—	—	10 d 20 h 09 m 03 s	Test flight of Block II CSM in Earth orbit; included first live TV broadcast from American spacecraft.	[1][8][21][22][23]
Apollo 8		December 21, 1968, 12:51 GMT Launch Complex 39A	Frank Borman James Lovell William Anders	Saturn V (SA-503)	—	—	06 d 03 h 00 m 42 s	First humans to leave Earth orbit and first to arrive at the Moon, first circumlunar flight of CSM, had ten lunar orbits in 20 hours. First crewed flight of Saturn V.	[1][8][24][25][23]
Apollo 9		March 3, 1969, 16:00 GMT Launch Complex 39A	James McDivitt David Scott Rusty Schweickart	Saturn V (SA-504)	*Gumdrop*	*Spider*	10 d 01 h 00 m 54 s	First crewed flight test of Lunar Module; tested propulsion, rendezvous and docking in Earth orbit. EVA tested the Portable Life Support System (PLSS).	[1][8][26][27][28]
Apollo 10		May 18, 1969, 16:49 GMT Launch Complex 39B	Thomas P. Stafford John Young Eugene Cernan	Saturn V (SA-505)	*Charlie Brown*	*Snoopy*	08 d 00 h 03 m 23 s	"Dress rehearsal" for lunar landing. The LM descended to 8.4 nautical miles (15.6 km) from lunar surface.	[1][8][29][30][31]
Apollo 11		July 16, 1969, 13:32 GMT Launch Complex 39A	Neil Armstrong Michael Collins Edwin "Buzz" Aldrin	Saturn V (SA-506)	*Columbia*	*Eagle*	08 d 03 h 18 m 35 s	First crewed landing in Sea of Tranquility (Tranquility Base) including a single surface EVA.	[1][8][3][32]
Apollo 12		November 14, 1969, 16:22 GMT Launch Complex 39A	Charles (Pete) Conrad Richard F. Gordon Jr. Alan Bean	Saturn V (SA-507)	*Yankee Clipper*	*Intrepid*	10 d 04 h 36 m 24 s	First precise Moon landing in Ocean of Storms near Surveyor 3 probe. Two surface EVAs and returned parts of Surveyor to Earth.	[1][8][33][34]
Apollo 13		April 11, 1970, 19:13 GMT Launch Complex 39A	James Lovell Jack Swigert Fred Haise	Saturn V (SA-508)	*Odyssey*	*Aquarius*	05 d 22 h 54 m 41 s	Intended Fra Mauro landing cancelled after SM oxygen tank exploded. LM used as "lifeboat" for safe crew return. First S-IVB stage impact on Moon for active seismic test.	[1][8][35][7]
Apollo 14		January 31, 1971, 21:03 GMT Launch Complex 39A	Alan Shepard Stuart Roosa Edgar Mitchell	Saturn V (SA-509)	*Kitty Hawk*	*Antares*	09 d 00 h 01 m 58 s	Successful Fra Mauro landing. Broadcast first color TV images from lunar surface (other than a few moments at the start of the Apollo 12 moonwalk.) Conducted first materials science experiments in space. Conducted two surface EVAs.	[1][8][36][37]
Apollo 15		July 26, 1971, 13:34 GMT Launch Complex 39A	David Scott Alfred Worden James Irwin	Saturn V (SA-510)	*Endeavour*	*Falcon*	12 d 07 h 11 m 53 s	Landing at Hadley–Apennine. First extended LM, three-day lunar stay. First use of Lunar Roving Vehicle. Conducted three lunar surface EVAs and one deep space EVA on return to retrieve orbital camera film from SM.	[1][8][38][39]
Apollo 16		April 16, 1972, 17:54 GMT Launch Complex 39A	John Young Ken Mattingly Charles Duke	Saturn V (SA-511)	*Casper*	*Orion*	11 d 01 h 51 m 05 s	Landing in Descartes Highlands. Conducted three lunar EVAs and one deep space EVA.	[1][8][40][41]
Apollo 17		December 7, 1972, 05:33 GMT Launch Complex 39A	Eugene Cernan Ronald Evans Harrison Schmitt	Saturn V (SA-512)	*America*	*Challenger*	12d 13 h 51 m 59 s	Landing at Taurus–Littrow. First professional geologist on the Moon. First night launch. Conducted three lunar EVAs and one deep space EVA.	[1][8][9][42]