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Pacific Starbase

What it would take to launch SpaceX's AI satellites from the Philippines

CORRIDOR
Intelligence

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SPECULATIVE ENGINEERING ASSESSMENT
Independent analysis. Not affiliated with or endorsed by SpaceX.

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FOR THE PRINCIPAL

The case on one page

BOTTOM LINE

A Philippine launch site makes sense for SpaceX as a Pacific gateway for AI satellites into dawn-dusk polar orbit, alongside Louisiana rather than instead of it. Physics does not decide where. The corridor, the ship's return path, and the daily launch windows decide, and on all three the eastern Mindanao coast passes. Lallo, the government's chosen site, cannot reach dawn-dusk polar orbit cleanly. I

Four numbers

1
Shortlisted site usable in both directions: Pusan Point, Davao Oriental

~900
AI1 satellites a year left on the ground by a 5 t penalty on every daily launch

~3 GW/yr
Orbital compute added at one launch a day

0.83 Mt/yr
LNG at one launch a day, for about 150 MW around the clock

Three things to watch

1. A Technology Safeguards Agreement announced or under negotiation. The lead indicator.
2. PhilSA launch-licensing rules in draft.
3. A new or expanded economic-zone proclamation on the Pacific coast: Davao Oriental, Eastern Samar, or the Polillo group.

Where to go next. Executive summary, next page. The site comparison and the bottleneck register follow in the numbered sections listed in the contents.

Speculative engineering assessment. Independent analysis; not affiliated with or endorsed by SpaceX. Not legal advice.

EXECUTIVE SUMMARY

Bottom line

A Philippine site makes sense for SpaceX as a Pacific gateway for AI satellites into dawn-dusk polar orbit, alongside Louisiana rather than instead of it. Physics does not decide where. The corridor, the ship's return path, and the daily launch windows decide, and on all three the eastern Mindanao coast passes. Lal-lo, the government's chosen site, is well suited to sounding rockets and SpaceX's 30° shell, but cannot reach dawn-dusk polar orbit cleanly.

+470 m/s
Polar-orbit penalty, about the same from Louisiana or Mindanao

~70
AI1 satellites per launch at about 2 t each (8.5 MW of compute)

~3 GW/yr
Orbital compute added at one launch a day, about 3% of SpaceX's stated goal

~150 MW
Round-the-clock site power, mostly to make liquid oxygen; 0.83 Mt of LNG a year

Five findings

1. **Polar orbit costs the same everywhere.** Launching against Earth's rotation into a 97.6° dawn-dusk orbit costs about 470 m/s more than a 30° launch, roughly 58 t of a V4's 200 t payload. The cost is nearly identical from Louisiana or Mindanao, so latitude is not the discriminator.
2. **Corridors and dog-legs are.** A 5° dog-leg to avoid land costs another 27–54 t, depending on where in the ascent it is flown. Lal-lo cannot reach dawn-dusk orbit cleanly with any dog-leg up to 12°. In business terms, a 5 t penalty on every daily launch leaves about 900 satellites a year on the ground. Pusan Point in Davao Oriental is the only shortlisted site usable in both directions, needing at most a 1° dog-leg.
3. **Each launch carries about 70 AI1 satellites, or 8.5 MW of compute,** if the AI1 weighs about 2 t (bounded 1.2–2.5 t; SpaceX has not published its mass, and one published critique puts it nearer 6 t, which would cut these figures by about two-thirds). At one launch a day, the site adds about 3 GW of orbital compute a year, about 3% of SpaceX's stated goal of 100 GW a year.
4. **The ship comes home from the north.** Returning from orbit to the launch tower, every Philippine candidate has a clean final 1,500 km if the ship arrives from the north. The tracks pass well upstream over Japan or Korea at high altitude.
5. **Gas is the critical commodity.** At one launch a day the site needs about 150 MW around the clock, most of it to make liquid oxygen from air, and about 0.83 million metric tons of LNG a year. Solar would need about a fifth of an island the size of Jomalig at that cadence, and more than half at three launches a day.

The bottlenecks that bind first I

Full register, with lead times, levers, and signposts, in Section 9.

#	Bottleneck	Type	Why it binds
1	US–Philippines Technology Safeguards Agreement	Schedule	No US launch from Philippine soil without one
2	Gas supply: 0.15–2.4 Mt of LNG a year	Operational	Every launch and every megawatt depends on it
3	Oxygen plant and power: 5,700–17,000 t a day	Engineering	78% of propellant; sets site power
4	Dawn-dusk launch windows	Orbital and operational	One window a day per direction per orbital plane; caps cadence at one-direction sites
5	Land, hazard buffer, indigenous consent, and turbine air permits	Schedule	Gate construction; litigation risk

WATCH FOR

1. A Technology Safeguards Agreement announced or under negotiation. The lead indicator.
2. PhilSA launch-licensing rules in draft.
3. A new or expanded economic-zone proclamation on the Pacific coast: Davao Oriental, Eastern Samar, or the Polillo group.
4. Land activity: a 99-year lease under RA 12252, or a mining tenement on Homonhon changing hands or terms.

WHAT WOULD WEAKEN THE CASE

- Talks stay at Lal-lo, at 30° or sounding-rocket scale.
- The project is framed as Starlink ground or manufacturing presence, with no launch.
- The dawn-dusk share of the FCC filing shrinks, or AI satellites move to the 30° shells.

Not legal advice. The author is a US patent attorney, admitted in Colorado. He is not admitted to practice law in the Philippines. This is policy analysis of public material, not a legal opinion on Philippine law.

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D **Documented.** From a public source listed at the end.

A **Assumption.** A stated input, listed in the assumptions register.

I **Inference.** The author's reasoning or a computed result.

SECTION 01

How to read this

What this is. A Corridor Intelligence Special Edition: an engineering assessment of what it would take for SpaceX to launch its AI data-center satellites from the Philippines. It is informed speculation. The Philippine government has confirmed early talks with SpaceX about a launch complex, and nothing more; SpaceX has not commented. The aim is to set out what such a site involves.

How it is built. Every figure is one of three kinds, and labeled:

- D **Documented:** from a public source listed at the end.
- A **Assumption:** a stated input, listed in the assumptions register with what changes if it is wrong.
- I **Inference:** the author's reasoning or a computed result.

Computed figures come from four short scripts, available on request: corridor geometry, orbital trades, mass and energy balance, and fleet throughput. Nothing is estimated in prose.

Time frame. The analysis is set where SpaceX says it is going, not where it is today. It assumes Starship V4 flying operationally, both stages caught at the tower and rapidly reused, and the AI-satellite constellation in production. In SpaceX's stated timeline that is roughly 2030 onward. The study asks what a Philippine site would need in that world.

Structure. Design basis and assumptions come first, then the constraints in four families: orbital, engineering, operational, and regulatory and schedule. The bottleneck register then gathers every binding constraint in one table, with its lead time, the lever that loosens it, and the signpost that shows it moving. Site choices follow from the constraints.

Trademarks and affiliation. SpaceX, Starship, Super Heavy, Raptor, Starlink, Starmind, AI1, Megapack, and Megablock are trademarks of their owners. Corridor Intelligence is independent. It has no affiliation with, information from, or endorsement by SpaceX, Tesla, or any government, and nothing here describes an actual plan.

SECTION 02

What is on the record

As of November 21, 2026:

Date	Event	Why it matters here
Feb. 12, 2025	Ambassador Romualdez: Musk is interested in a SpaceX launch pad in Mindanao, citing its nearness to the equator; DICT calls the talks exploratory D	The earliest public mention found, and the right region for the wrong reason: latitude does not help polar launches (Finding 1); the corridors do
Jan 2026	SpaceX applies to the FCC for up to one million orbital data-center satellites; a later supplement places 500,000 in dawn-dusk sun-synchronous orbits at 565–1,002 km D	Half the constellation needs a polar launch
Jan–Mar 2026	Musk: “We’re doing 100 kilowatts per ton”; SpaceX’s filing: one million metric tons a year at 100 kW per metric ton would add 100 GW of AI compute a year D	Sets the mass logic for AI satellites
Jun 2026	AI1 unveiled: about 20 m high with a 70 m wingspan, 150 kW peak and about 120 kW average compute D; Gigasat factory in Bastrop, Texas, aiming at about 1 GW a year by end-2027, or more than 6,000 AI1 D	The payload this site would fly
Aug 2026	Starmind constellation named; launches of thousands of satellites from 2027 D	Demand starts before any Philippine site could exist
Aug. 25, 2026	Starbase Louisiana: $100 billion, ~125,000 acres, 10 pads, propellant and power on site, first launch 2029 D	The template, and the competitor
Oct 2026	Musk: 10,000 Starship launches a year “just from Starbase Louisiana” D	The scale SpaceX plans in the US alone
Nov. 14, 2026	Flight 15: the ship flies 14 orbits over 22.5 hours and is caught by the launch tower for the first time; the booster is lost in the Gulf D	Full return to the launch site is now demonstrated, once
Nov. 16, 2026	Musk outlines Starship V4: about 70 m ship, nine engines, more than 60% more propellant, payload above 200 t D	The vehicle this study is sized to
Nov. 20, 2026	President Marcos confirms early discussions with SpaceX on a possible launch complex, separate from PhilSA’s Lal-lo sounding-rocket project D	The opening

No site, commitment, or timetable has been disclosed. On November 19, Ambassador Romualdez told ANC: “From what I’m told, Elon Musk comes here quietly very often because he has one or two islands, I’m told, that he’s developing.” Neither Musk nor his companies have confirmed it. D The Philippines signed the Artemis Accords on October 27, 2025, a step toward US space alignment ahead of any safeguards agreement. D

SECTION 03

Design basis



Concept rendering: a reusable heavy launcher on a Pacific-coast catch tower at dawn. Illustrative only; not a SpaceX design or plan.

The vehicle: Starship V4

Parameter	V3 (flying)	V4 (announced; used here)
Ship	52 m; 3 Raptor + 3 Raptor Vacuum D	About 70 m; 9 engines, all higher-thrust V4 Raptors D
Ship propellant	1,600 t D	More than 60% more; 2,560 t used D
Booster propellant	3,650 t D	4,050 t, planned D
Payload to low orbit, reusable	More than 100 t D	More than 200 t D
Recovery	Booster and ship caught at the tower D	Same, routinely A
Propellant cost goal	—	Below $500,000 a flight D

The payload: AI1 satellites

SpaceX has published the AI1's size and power but not its mass. [D] Musk's working figure for the whole system is 100 kW of compute per metric ton. [D] This study bounds the mass [A]:

Case	AI1 mass	Basis	Per V4 launch to dawn-dusk orbit (142 t)	Per V4 launch to the 30° shell (200 t)
Low	1.2 t	Musk's 100 kW per metric ton at 120 kW average compute	118 satellites, 14.2 MW	166 satellites
Base	**2.0 t**	Reported bus mass above 2 t; a reported 70 kW per metric ton at 150 kW	**71 satellites, 8.5 MW**	**100 satellites**
High	2.5 t	Base plus propellant and structural growth	56 satellites, 6.7 MW	80 satellites

The study assumes loads are limited by mass, not volume. With a 70 m wingspan folded inside a 9 m fairing, volume may bind first; the longer V4 ship helps. [A]

Critic case. The 2 t base case is, in effect, SpaceX's own implied number: 150 kW at a claimed 70 kW per metric ton. A published critique argues that once radiators, oversized arrays, batteries, and structure are counted honestly, the AI1 is closer to 24 kW per metric ton, or about 6 t. [D] At 6 t a V4 carries about 23 AI1s to dawn-dusk orbit (2.8 MW of compute) and 33 to the 30° shell. Daily launches would then add about 1 GW a year rather than 3. The site logic does not change, but every compute-per-launch figure in this edition falls by about two-thirds, and each metric ton lost to a dog-leg costs fewer satellites. [I]

Why satellite mass shapes the site. Every metric ton lost to geometry is a satellite not flown. On the base case, each 2 t of payload lost to a dog-leg or a corridor detour is one AI1, or 120 kW of orbital compute, left on the ground. Over a year of daily launches, a 5 t penalty per flight costs about 900 satellites. A clean corridor is worth more than any other site attribute. [I]

Cadence and throughput (base case)

Phase	Indicative years	Pads	Launches a year	AI1 a year	Compute added a year	Share of SpaceX's 100 GW-a-year goal
1. Pathfinder	2030	1	52	3,700	0.44 GW	0.4%
2. Daily	2031–32	2	365	25,900	3.1 GW	3.1%
3. High cadence	2033 on	2	1,095	77,700	9.3 GW	9.3%

The years are indicative, set two to four years behind Louisiana's 2029 first launch. [A]

The fleet: rapid reuse

SpaceX's model is aircraft-like reuse: both stages caught at the tower, inspected, and restacked. D This study assumes a mature version of it A: boosters last 100 flights with a one-day turnaround; ships last 30 flights (the heat shield is the life limit) with a three-day turnaround plus a day in orbit; 1% of flights lose a vehicle.

	Phase 1	Phase 2	Phase 3
Boosters in rotation (with spare)	2	2	4
Ships in rotation (with spare)	2	5	13
New boosters needed a year	1	6	16
New ships needed a year	2	14	42
Raptor engines a year, for new stages	44	308	919

Ships, not boosters, drive replacement. At Phase 3 a new ship is needed almost every week, which is the strongest argument for eventually building stages near the site. I

SECTION 04

Assumptions register

Every input the analysis rests on but cannot source directly. The last column says what moves if the assumption is wrong.

ID	Assumption	Value used	Basis	If wrong
A1	V4 is the operational vehicle	6,610 t propellant; 200 t to low orbit	Musk, Nov. 16, 2026	On V3, payload halves and launches double for the same compute
A2	AI1 mass	2.0 t (bounds 1.2–2.5 t)	Bounded from published power and Musk's 100 kW per metric ton	Satellites per launch range 56–118
A3	Loads limited by mass, not volume	—	V4's longer ship	If volume binds, fewer satellites per launch and payload penalties matter less
A4	Satellites inserted at their final inclination and raise their own altitude	Insertion at about 300 km, 97.6°	Starlink practice	Direct insertion to 565–1,002 km costs more payload everywhere, equally
A5	Both stages caught at the launch tower	Booster and ship return to launch site	Demonstrated once, Nov. 14, 2026	Ocean recovery would remove return-corridor constraints and add ships and barges
A6	Reuse life	Booster 100 flights; ship 30; 1% losses	Aircraft-like reuse goal	Shorter ship life raises replacement shipping sharply
A7	Engines accepted in the US	Raptors tested at McGregor, Texas; static fires on the launch mount only; no engine test stand at the site	SpaceX's McGregor role	An on-site test stand adds land, noise, and permits
A8	Stages built in Texas at first	Shipped by sea until Phase 3	Current factory footprint	A local stage factory moves earlier if shipping proves slow
A9	Mixture ratio and losses	Oxidizer-to-fuel 3.6; 10% losses	Typical Raptor figure; engineering allowance	±10% on propellant and power
A10	Oxygen plant energy	0.5 MWh/t of liquid oxygen (range 0.3–0.9)	Published plant data	Phase 2 power 100–240 MW; the largest single sensitivity
A11	Power from gas turbines, simple cycle with heat recovery	38% electrical; exhaust heat drives air precooling and desalination	Typical; SpaceX's own turbine program	Full combined cycle would cut fuel gas by about 30% but needs a steam plant and 2+ years of heavy civil work — and it would use the heat the chillers need
A12	Propellant methane from imported LNG	Purified and subcooled on site	No gas grid on the Pacific coast	A pipeline would add liquefaction load

ID	Assumption	Value used	Basis	If wrong
A13	Deluge water	1,325 m^3 a launch, half recovered	FAA 2022 assessment	Not material; water is never binding
A14	Cadence phases	52 / 365 / 1,095 launches a year	SpaceX's stated ambitions, scaled to two pads	Scales the balance linearly
A15	Corridor metric	Share of land under the first 2,000 km of ascent ground track; last 1,500 km of return	Proxy for overflight risk	Real trajectories dog-leg and loft; treat as a screen, not a range-safety analysis

SECTION 05

Constraints 1: orbital

The polar penalty is the same everywhere

A dawn-dusk orbit at 565–800 km sits at about 97.6° inclination, slightly retrograde. A rocket heading there launches a few degrees west of due north or south, so Earth's eastward spin works against it instead of helping. I

Site	Latitude	Ground speed east	Rotation help, 30° orbit	Rotation help, dawn-dusk orbit	Polar penalty	V4 payload lost
Pecan Island, Louisiana	29.7°N	404 m/s	+403 m/s	−64 m/s	467 m/s	~58 t
Lal-lo, Cagayan	18.2°N	442 m/s	+401 m/s	−66 m/s	467 m/s	~58 t
Jomalig, Quezon	14.7°N	450 m/s	+400 m/s	−67 m/s	467 m/s	~58 t
Homonhon, Eastern Samar	10.7°N	457 m/s	+400 m/s	−67 m/s	467 m/s	~58 t
Pusan Point, Davao Oriental	7.3°N	461 m/s	+399 m/s	−68 m/s	467 m/s	~58 t

The penalty is computed at a 300 km insertion (A4) and converted to payload at about 0.124 t per m/s for the V4 ship. That rate assumes a 200 t ship dry mass; a range of 150–300 t gives 0.107–0.160 t per m/s. A I

The result is counter-intuitive and important. Lower latitude does not help polar launches; it slightly hurts. Louisiana, Luzon, and Mindanao all deliver about 142 t to dawn-dusk orbit. **Site choice for AI satellites is about the corridor, not the latitude.** I

Dog-legs: what avoiding land costs

A dog-leg is a sideways turn during ascent that keeps the rocket over water and then turns it back onto the target orbit. Its cost is the plane change, and that cost grows with the vehicle's speed at the moment of the turn. I

Dog-leg	Early, in booster phase (~2.5 km/s)	Mid-ascent, ship phase (~5 km/s)	At orbital speed (~7.7 km/s)
1°	44 m/s · 5 t · 12,000 lb	87 m/s · 11 t · 24,000 lb	135 m/s · 17 t · 37,000 lb
2°	87 m/s · 11 t · 24,000 lb	175 m/s · 22 t · 48,000 lb	270 m/s · 34 t · 74,000 lb
5°	218 m/s · 27 t · 60,000 lb	436 m/s · 54 t · 119,000 lb	674 m/s · 84 t · 184,000 lb
10°	436 m/s · 54 t · 119,000 lb	872 m/s · 108 t · 238,000 lb	1,347 m/s · 167 t · 368,000 lb

Read the table as a first-order upper bound on payload lost from the ~142 t to dawn-dusk orbit. Early dog-legs are cheaper but use booster propellant that is held for the flight back to the tower, so in practice they shrink the booster's return margin rather than the ship's payload. In AI1 terms, a 5° mid-ascent dog-leg costs about 27 satellites a launch, or 3.2 MW of compute. I

What each site needs

Share of land under the first 2,000 km of the ascent track at 97.6°, and the smallest inclination offset that brings it to 5% or less (tested to 12°). I

Site	Northbound	Southbound	Dog-leg needed	Verdict
Pusan Point	6% (1° brings it to 4%)	3%	None southbound; 1° northbound	Usable both ways
Homonhon	3%	35%	None northbound	Northbound only
Patnanungan	57%	4%	None southbound	Southbound only
Jomalig	59%	5.5% (0.5° brings it to 4%)	0.5° southbound	Southbound only; a needle: at 96.7° the track crosses Sulawesi
Lal-lo	67% (Taiwan, China)	29% (down Luzon)	None found within 12°	Cannot reach dawn-dusk orbit cleanly
Pecan Island (reference)	100%	15% (Mexico)	None found within 12°	SpaceX accepts the overflight I

Pecan Island is the calibration point. SpaceX chose a site whose southbound polar corridor crosses Mexico's Isthmus of Tehuantepec, so it evidently plans to accept about 15% overflight, or to fly a mitigation this simple screen cannot see. Every usable Philippine direction is cleaner. I

Launch windows: the hidden cadence cap

A dawn-dusk orbit is fixed relative to the Sun. A site passes under a given orbital plane twice a day, about 12 hours apart: once heading north and once heading south, near local dawn and dusk. A site usable in only one direction therefore gets **one window a day per orbital plane**, each a few minutes wide. I

- **Pusan Point** has two windows a day per plane.
- **Homonhon, Jomalig, and Patnanungan** have one window a day per plane.
- **The lever** is to spread the constellation across planes with different local times of ascending node (LTAN), say 05:00 to 07:00 rather than a single 06:00. That widens the daily launch block from minutes to about two hours. Altitude shells alone do not help: planes at the same LTAN pass over the site at the same local time. Using both pads in the same window also helps. That makes the launch range, not the pad, the constraint at Phase 3. I

Return: the ship comes home

The ship deploys its satellites and returns to the tower that launched it, as Flight 15 did after 14 orbits and 22.5 hours. D To land, the ship must pass back over the site, either about 12 hours after launch on the opposite pass or about a day later on the same pass. Its re-entry track runs upstream along the orbit for thousands of kilometers, and the final 1,500 km, low and slow, matters most (Figure D1). I

Site	Arriving from the north: last 3,000 km / last 1,500 km over land	Arriving from the south	Best return	Same pass as launch?
Pusan Point	0% / 0%	35% / 14% (Halmahera, northern Australia)	From the north	Southbound launch: yes. Northbound: no
Homonhon	11% / 0% (Kyushu, far upstream)	33% / 35%	From the north	No: launches north, returns south-bound
Jomalig	23% / 0% (Korea, far upstream)	16% / 28% (Visayas)	From the north	Yes
Patnanungan	25% / 2%	17% / 26%	From the north	Yes
Lal-lo	27% / 1%	22% / 40%	From the north	—
Pecan Island (reference)	97% / 100%	29% / 34% (Yucatán, Guatemala)	From the south	No

Three consequences I:

- **Every Philippine site has a clean final approach from the north.** The upstream track crosses Japan or Korea while the ship is still very high and fast. That needs a notification arrangement with Tokyo or Seoul, not consent to fly low over them.
- **At Jomalig and Patnanungan, launch and return use the same daily window.** A ship returning on the morning of a launch competes for the same minutes and the same range. A dedicated catch tower, or a third pad, is the lever.
- **Homonhon and Pusan Point separate launch from return,** launching on one pass and catching on the other. That is the cleaner operation.

Site operations at a glance

Launch direction, return direction, and daily windows per orbital plane, drawn from the three tables above. I

Site	Clean launch direction	Best return	Windows a day per plane	Launch and return
Pusan Point	Both (northbound with a 1° dog-leg)	From the north	2	Separate on a northbound launch; shared on a southbound one
Homonhon	Northbound	From the north	1	Separate passes

Site	Clean launch direction	Best return	Windows a day per plane	Launch and return
Jomalig	Southbound (0.5° dog-leg)	From the north	1	Same window; a third pad or catch tower is the lever
Patnanungan	Southbound	From the north	1	Same window
Lal-lo	None clean within 12°	From the north	0 clean	—
Pecan Island (reference)	Southbound, accepting 15% overflight	From the south	1	Separate passes

Cross-range. A returning ship is not locked to its ground track. Its body and flaps give it hypersonic cross-range of the order of hundreds of kilometers, so the upstream track can be bent away from Yonaguni, Kyushu, or Korea if needed. That is an operational lever; it does not change the basic advantage of a northern ocean approach. I

Hazard and bail-out zones

- **Booster.** It returns to the tower, so in nominal flight there is no downrange drop zone. V3 removed the jettisoned hot-staging interstage D, so no ring falls downrange either. A failed booster falls within the first few hundred kilometers, which is open ocean in every usable direction above. I
- **Ship ascent abort.** Until orbit, the ship's impact point sweeps along the corridor, so the land share above doubles as an abort-risk screen. The bail-out zones are the Philippine Sea northbound and the Celebes and Banda Seas southbound. I
- **Re-entry abort.** A ship that cannot reach the tower ditches along the return track. Arriving from the north, that is the open Philippine Sea. I
- **Closures.** Each launch and each return closes airspace and sea lanes along the corridor. At Phase 3 that means up to six closures a day, three launches and three returns, across shipping lanes and fishing grounds. I

The contrast with today's launches. The Philippines already lives under other countries' launch hazards. PhilSA routinely warns of debris from Chinese Long March launches falling in Philippine waters. The most recent warning, on November 9, 2026, concerned suspected debris near Palawan, and the Navy has recovered debris near Tubbataha Reef Natural Park. D PhilSA has called on international partners to develop protocols on rocket debris. D A fully reusable Starship drops no spent stages: booster and ship both return to the tower. For a Philippine public used to debris advisories, that is a material difference, and a political lever. I

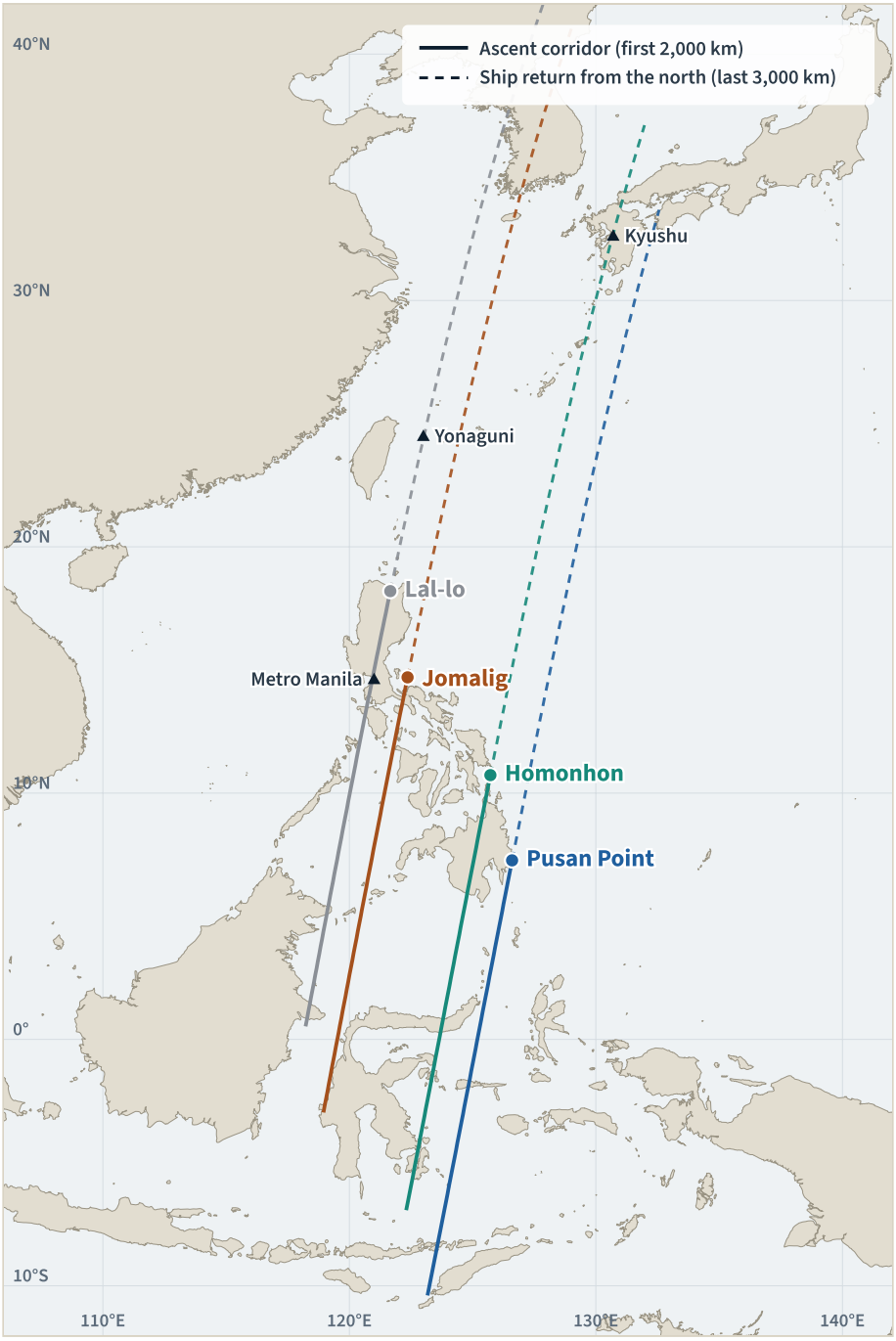


Figure D1. Dawn-dusk orbit at 97.6°: clean ascent corridors (solid) and ship returns from the north (dashed) for the four sites tested in this section. Lal-lo (gray) shown for contrast; both of its corridors cross land. Author's model, not flight trajectories.

SECTION 06

Constraints 2: engineering



Concept rendering: oxygen plant, turbine hall, and LNG berth at a coastal launch site. Illustrative only; not a SpaceX design or plan.

Mass and energy balance

One V4 launch loads about 7,300 t of propellant including losses: 5,690 t of liquid oxygen and 1,581 t of methane. Oxygen is made from air; methane is shipped in (Figure D3). **Oxygen is 78% of the load, so a launch site's capacity is set by its power plant.** I

Per year, V4	Phase 1	Phase 2	Phase 3
Launches	52	365	1,095
Liquid oxygen	0.30 Mt	2.08 Mt	6.23 Mt
Methane propellant	82 kt	577 kt	1.73 Mt
Average electric load	43 MW	147 MW	391 MW
of which oxygen plant	17 MW	119 MW	356 MW
LNG burned for power (simple cycle)	72 kt	249 kt	663 kt
Total LNG (propellant plus power)	**0.15 Mt**	**0.83 Mt**	**2.39 Mt**
Water	0.58 million m^3	0.79 million m^3	1.27 million m^3

What else draws power. The non-oxygen load is about 26 MW at Phase 1, 29 MW at Phase 2, and 35 MW at Phase 3. Most of it is a site base of 25 MW, assumed for payload processing, hangars and stacking, cryogenic pumping and transfer, and housing and port services. A Methane purification adds 0.5, 3.3 and 9.9 MW across the phases, and desalination under 1 MW. Once launches are daily, the oxygen plant is more than 80% of the site's electricity. I

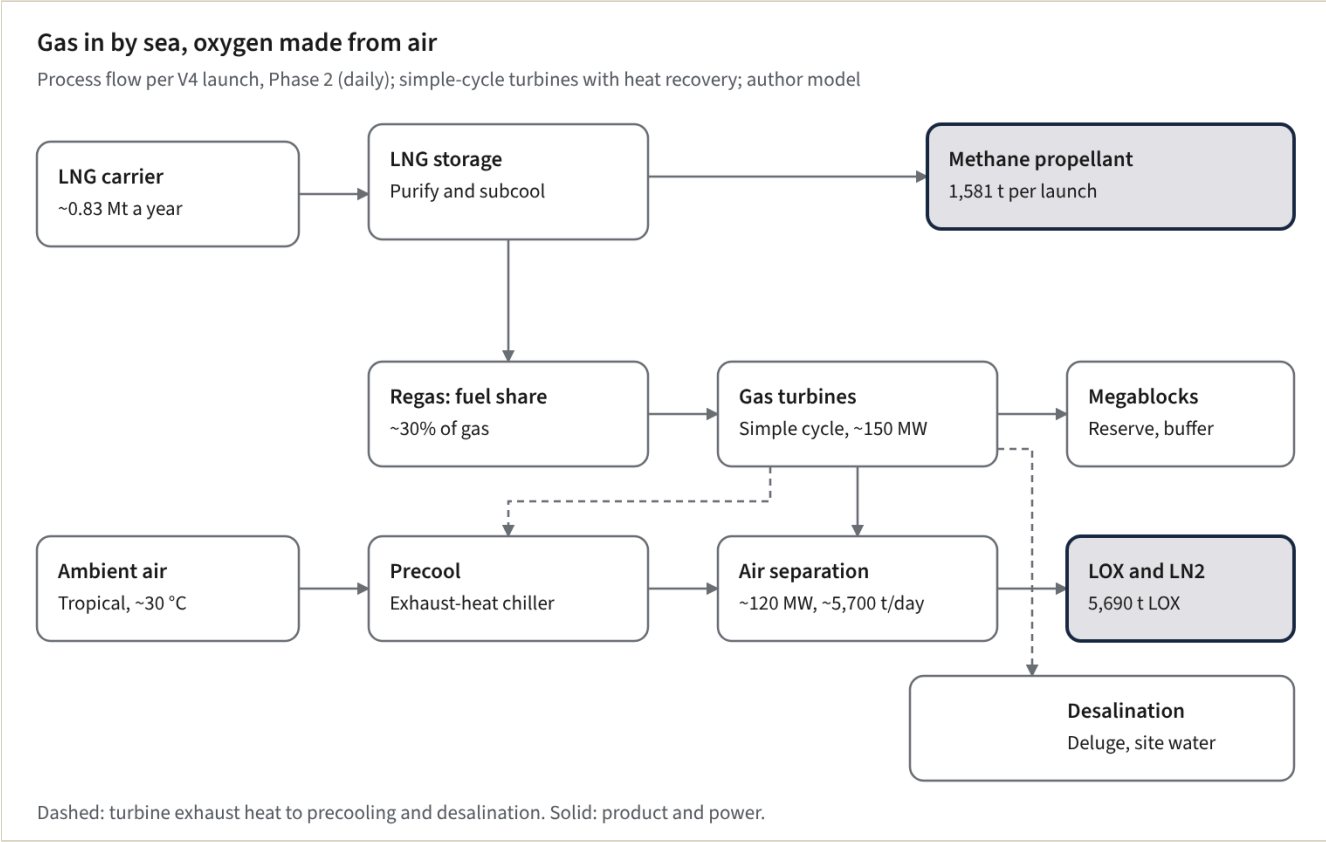


Figure D3. Gas in by sea, oxygen made from air: process flow per V4 launch at Phase 2 (daily). About 30% of the gas fuels roughly 150 MW of simple-cycle turbines; exhaust heat drives precooling and desalination. Author's model.

Oxygen plant

At Phase 2 the plant makes about 5,700 t of liquid oxygen a day, the scale of one large industrial train. Phase 3 needs about 17,000 t a day, the class of the largest multi-train complexes, which exceed 15,000 t a day. D Plant energy is the study's largest uncertainty: at 0.3–0.9 MWh/t, Phase 2 needs 100–240 MW. Two tropical design points I:

- **Precooling.** Intake air at 30°C costs compressor power; absorption chillers on turbine exhaust heat recover part of it.
- **LNG cold.** Using regasifying LNG as a heat sink can cut oxygen-plant energy by about a third. D Here only the fuel share of the gas, about 30%, is regasified; the rest is burned as liquid propellant. The gain is a few megawatts.

Power: turbines, Megablocks, and why not solar

SpaceX's own playbook already answers this. It has applied in Texas for 35 gas turbines totaling 748 MW, committed $2.8 billion to turbines, and is casting turbine blades in-house. D Musk: natural gas "will still be needed to supplement and bootstrap solar for several years." D

Simple cycle is the base case. Turbines in the ~21 MW class are deployed in simple cycle for speed and modularity: about 38% electrical efficiency, with exhaust heat recovered for air precooling and desalination rather than for a steam cycle. Full combined cycle would cut fuel gas by about 30%, but it needs steam turbines, condensers, and two or more years of heavy civil work, and it would use up the heat the chillers depend on. It is a later-phase upgrade, not the starting point. I

	Phase 1	Phase 2	Phase 3
Design capacity (1.25 × average)	53 MW	184 MW	489 MW
Turbines at ~21 MW (Texas average unit), simple cycle	3 + 1 spare	9 + 2	23 + 3
LNG burned for power	72 kt	249 kt	663 kt
Megablock reserve (two turbines out, four hours)	9 (180 MWh), under an acre	9	9
Solar alternative: capacity for 24-hour supply	251 MWac	866 MWac	2,300 MWac
Solar land (LBNL 2022, modern fixed-tilt: 0.28 MWac per acre) D	363 ha	1,252 ha	3,324 ha
Sensitivity: solar land on the older NREL 2013 benchmark (7.9 acres per MW) D	801 ha	2,767 ha	7,354 ha
Storage for 14 hours (Megablocks)	30	103	274
Solar land as a share of Jomalig (5,665 ha), LBNL 2022 (NREL 2013 sensitivity)	6% (14%)	22% (49%)	59% (130%)

Land figures use the LBNL 2022 empirical density for modern fixed-tilt plants. The older NREL 2013 benchmark needs about 2.2 times the land and is shown as a sensitivity. Even on the modern figure, solar is land-bound and typhoon-exposed. Gas plus a Megablock reserve fits in a few hectares. I

Methane and water

- **Methane.** Starbase Texas is moving to pipeline gas (Starpipe, due January 2027) feeding an on-site liquefaction plant. D The Philippines has no gas grid on its Pacific coast, and the Malampaya field is expected to be depleted by 2027. D Imported LNG, purified to propellant grade and subcooled with liquid nitrogen from the oxygen plant, is the only practical route. Liquefying regasified gas instead would add about 20 MW at Phase 2 for no gain. I
- **Water.** The deluge uses up to 350,000 gallons a launch. D At Phase 2 the whole site needs about 2,200 m^3 a day: a small desalination plant, or multi-effect distillation on turbine exhaust heat, plus a retention basin. Water is never the binding constraint. I

Natural hazards: typhoons, earthquakes, and tsunamis

Typhoons. Typhoon frequency falls toward the equator, and Mindanao rarely sees strong typhoons. D Pusan Point, at 7.3°N, sees fewer storms than Homonhon at 10.7°N or the Polillo group at 14.7°N. Fewer is not none. Bopha (Pablo), the only Category 5 typhoon on record to make landfall on Mindanao, came ashore at Baganga, Davao Oriental, in December 2012, the municipality next to Caraga, and killed people in Caraga itself. D Every site needs catch towers, cryogenic tanks, LNG berths, and turbine halls built to Philippine structural wind zones. The study assumes no launches during typhoon passage and holds 30 days of LNG in reserve. A

Earthquakes and tsunamis. The Philippine Trench runs offshore along the whole eastern seaboard of the Visayas and Mindanao. On October 10, 2025 a magnitude 7.4 earthquake offshore Davao Oriental, at 7.07°N 127.06°E, about 55 km from Pusan Point, prompted a destructive-tsunami warning for Davao Oriental, Eastern Samar, and five other provinces. D PHIVOLCS warns that eastern coastal communities would have only 2 to 15 minutes to evacuate after a magnitude 8.7 trench earthquake. D Every short-listed site faces the trench. Towers, cryogenic tanks, and the LNG jetty need seismic design loads and set-back or elevation above tsunami run-up. Crews need a vertical-evacuation plan, and the LNG jetty is the most exposed asset. I

SECTION 07

Constraints 3: operational

Gas: the critical commodity

	Phase 1	Phase 2	Phase 3
LNG a year (propellant plus simple-cycle power)	0.15 Mt	0.83 Mt	2.39 Mt
Small-carrier loads (30,000 m^3)	11	61 (more than one a week)	177 (about three a week)
Conventional-carrier loads (170,000 m^3)	2	11	31
30-day typhoon reserve on site	~13 kt (~29,000 m^3)	~69 kt (~153,000 m^3)	~200 kt (~443,000 m^3)

For scale, the Philippines imported 1.58 Mt of LNG in the first ten months of 2025 through two terminals, both in Batangas. D Its terminals are significantly underused, according to the energy secretary. D Phase 2 alone would add more than 40% to the national import pace; Phase 3 would more than double it. I

Levers. A long-term supply contract; a dedicated small-carrier shuttle, from Batangas if a terminal can reload, or direct from exporters; on-site storage sized for the typhoon season; and propellant-grade purification sized for the cargo actually bought. I

Fleet and hardware flow

Under the rapid-reuse assumptions (A5, A6), the site holds a small flying fleet and receives a steady stream of new stages and engines. I

Flow	Phase 2	Phase 3	Route
New ships a year	14	42	By sea from Texas; a local line at Phase 3
New boosters a year	6	16	By sea from Texas
Raptor engines a year (new stages only)	~310	~920	Air or sea from McGregor and Hawthorne, accepted in the US D
AI1 satellites a year	~26,000	~78,000	From Bastrop's Gigasat factory D
Satellite containers a week, at ~70 per launch	~7 launch-loads	~21 launch-loads	Sea freight, US-controlled processing

The Raptor counts cover new stages only. Mid-life engine swaps and overhauls come on top, so read them as a floor. Engines arrive already accepted at McGregor (A7), and the site does static fires on the launch mount only. That keeps an engine test stand, with its noise, land, and permits, out of the Philippines, and it keeps Raptors inside the custody regime of the safeguards agreement. I

Satellite flow is the overlooked operational load. At Phase 2 the site receives a launch-load of satellites every day, about 140 t, from a factory 13,000 km away. Payload processing must be fast, secure, and under US custody. I

What gets built where

One rule follows from the balance: **make oxygen where you fly, and ship methane.** I

Item	Where	Why
Stacking, catch, turnaround	Pad site	Vehicles return to the tower they launch from
Liquid oxygen and nitrogen	Pad site	78% of the load; made from air; cannot practically be shipped
Methane conditioning and storage	Pad site	LNG arrives by sea
Turbines and Megablocks	Pad site, or an energy island	The oxygen plant is the load
Desalination	Pad site	Small; runs on exhaust heat
Payload processing	Pad site or nearby port, under US custody	One launch-load a day
Ship and booster structures	Texas first; a port factory at Phase 3	42 new ships a year justifies a local line
Raptor engines	US only	Acceptance testing at McGregor; safeguards custody
AI1 satellites	US (Bastrop)	Factory scale already exists
Turbines and Megablocks	Imported from SpaceX's and Tesla's own supply	Vertical integration

Range operations

At Phase 3 the range handles three launches and three returns a day, inside dawn and dusk windows, with booster returns minutes after each launch. The range control center, tracking, and airspace and maritime coordination with CAAP and the Coast Guard become a 24-hour operation. That is a capability the Philippines does not yet have, and it has to be built. I

SECTION 08

Constraints 4: regulatory and schedule

Land under RA 12252, indigenous consent under IPRA, environmental compliance, and the treaty-or-executive-agreement question are shared with every large foreign project in the corridor. The CI Pax Silica series covers them: the signed instruments and land in Paper 2026-01, the treaty-or-executive-agreement question in Paper 2026-02, and indigenous consent in a forthcoming piece. This section covers what launch adds, and how long each gate takes (Figure D4). I

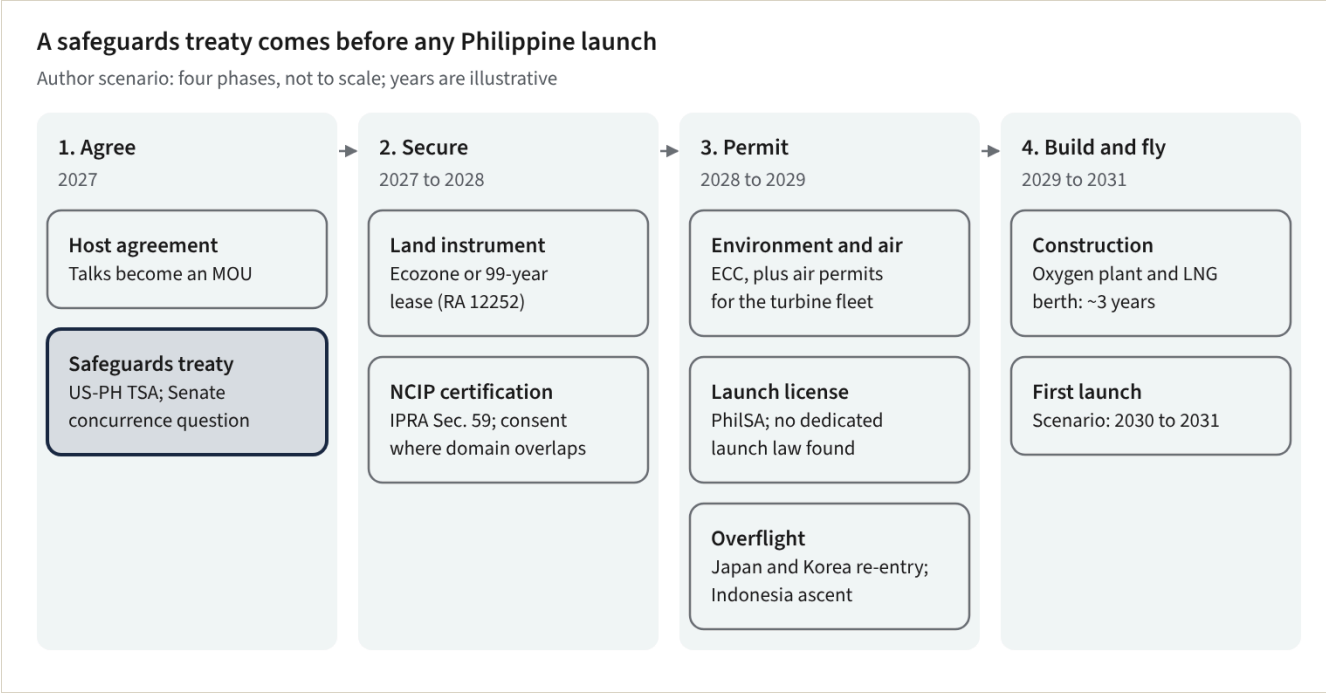


Figure D4. Permitting path in four phases: agree, secure, permit, and build and fly. The safeguards treaty gates everything after it. Author scenario; years are illustrative.

Process unique to a launch site

Item	Why it is unique to launch	Lead body	Lead time A
Technology Safeguards Agreement	No US launch without one; fixes custody of US hardware and data	US State Department and DFA	1–3 years. Australia's took about nine months from signature to entry into force, after parliamentary review D
Launch and re-entry authorization	No dedicated Philippine launch-licensing regime found; PhilSA's stated goal is predictable licensing timelines D	PhilSA	1–2 years to write rules
Range: hazard areas and closures	Up to six closures a day at Phase 3	CAAP; Philippine Coast Guard	Built alongside the site

Item	Why it is unique to launch	Lead body	Lead time A
Overflight and re-entry	Ascent toward Indonesian waters or past Yonaguni; return over Japan or Korea at altitude	DFA with Tokyo, Seoul, Jakarta	1–2 years, in parallel
Air permits for a turbine fleet	SpaceX's AI subsidiary has been sued for allegedly running 27 turbines without an air permit in Mississippi D	DENR Environmental Management Bureau (Clean Air Act, RA 8749)	6–18 months; litigation risk
LNG berth and storage	First LNG facility outside Batangas	Department of Energy; Philippine Ports Authority	2–3 years including construction
Captive power and water	50–490 MW of self-generation; seawater intake	Energy Regulatory Commission; National Water Resources Board	Months, in parallel
International liability	Launch-state liability under the UN space treaties	DFA; PhilSA	Settled in the safeguards and host agreements
US export controls	Raptors, avionics, and payload data	US State and Commerce Departments	Standing licenses

Coastal ecology and fisheries. Beyond air permits, the triggers most likely to be litigated in the Philippines are reefs and marine protected areas near berths and outfalls; thermal and brine discharge from desalination; and artisanal fisherfolk who lose fishing grounds to up to six maritime closures a day. Municipal waters, out to 15 km from shore, fall under local government jurisdiction under the Fisheries Code, so the municipality is a permitting party, not just a host. Closure scheduling, fisheries compensation, and early consultation are the levers. I

The critical path

Treaty, then land and consent, then environmental and air permits, then a three-year build of the oxygen plant and LNG berth. Technip's reported 36-month schedule for Louisiana's methane plant is a fair proxy. D Run in sequence, that lands a first launch in 2030–31 at the earliest. The lever is to run land, consent, and permitting in parallel with treaty negotiation, on government land inside an economic zone, which removes the most litigation-prone gates. I

SECTION 09

Bottleneck register

Every binding constraint in one table. "Binds at" is the phase where it first limits the site. The lever is what loosens it; the signpost is what a reader would see if someone were pulling that lever.

#	Bottleneck	Type	Binds at	Lead time	Lever	Residual risk	Signpost
B1	US–Philippines Technology Safeguards Agreement	Schedule	Before anything	1–3 years	Negotiate in parallel with site work; executive-agreement route	Senate concurrence fight	Announcement or negotiation notice
B2	Launch licensing regime	Schedule	Before first launch	1–2 years	PhilSA implementing rules modeled on FAA Part 450	Untested regulator	Draft rules published
B3	Land at the pad site	Schedule	Before construction	1–3 years	Government land in an economic zone; mining tenement (Homonhon); 99-year lease	Smallholder title disputes	New ecozone proclamation on the Pacific coast
B4	Hazard and acoustic buffer	Engineering and schedule	Before construction	With land	Headland sites where the buffer falls over sea	Relocating residents on small islands	Resettlement plans
B5	Indigenous consent	Schedule	Before construction	1–2 years	Avoid ancestral domains; early consent process	Pusan Point's Mandaya uplands	NCIP field investigation opened
B6	Environmental, air and coastal permits	Schedule	Before operation	6–24 months	Programmatic EIS for an ecozone; phased air permits; Megablocks to cut turbine run-hours; and fisheries compensation	Litigation, as in Mississippi; reef and fisheries challenges	DENR-EMB filings
B7	Gas supply	Operational	Phase 1	2–3 years (berth and contract)	Long-term contract; dedicated carrier shuttle; Batangas reload	Price spikes; typhoon interruptions	LNG berth or contract with no obvious buyer
B8	Oxygen plant scale	Engineering	Phase 2	~3 years	Modular trains; exhaust-heat precooling	Energy at 0.9 MWh/t would add ~95 MW	Industrial-gas contractor engaged
B9	Power plant	Engineering	Phase 2	1–2 years	SpaceX's own turbines, simple cycle with heat recovery; Megablock reserve	Turbine competition with data centers	Turbine import or air-permit filing

#	Bottleneck	Type	Binds at	Lead time	Lever	Residual risk	Signpost
B10	Seismic and tsunami exposure	Engineering	Day one	Design choice	Seismic loads; set-back and elevation; vertical evacuation	Philippine Trench event with minutes of warning	PHIVOLCS hazard studies commissioned
B11	Dawn-dusk launch windows	Orbital and operational	Phase 2–3	Design choice	Two-way site (Pusan Point); planes spread across LTANs; both pads per window	Cadence cap at one-direction sites	—
B12	Launch and return on the same pass	Operational	Phase 2 at Jomalig and Patnanungan	Design choice	Dedicated catch tower or third pad	Range congestion	Third tower in plans
B13	Corridor precision	Orbital	Day one	Fixed by site	Choose a clean site; small dog-legs	Lal-lo cannot fly dawn-dusk cleanly	Site named
B14	Re-entry overflight	Orbital and diplomatic	First return	1–2 years	Arrive from the north; cross-range; notification arrangements with Japan and Korea	Political objection	Diplomatic traffic with Tokyo or Seoul
B15	Regional geopolitics	Diplomatic	Throughout	Ongoing	Frame as civil and commercial; transparency on closures	Chinese diplomatic and gray-zone pressure	Coast Guard incidents in closure areas
B16	Ship replacement	Operational	Phase 3	2–3 years for a factory	Local stage factory at a nearby port	Shipping 42 ships a year from Texas	Factory land at a port
B17	Payload flow	Operational	Phase 2	1–2 years	Secure processing under US custody; dedicated freight	Satellite factory output	Payload-processing building
B18	Range operations	Operational	Phase 2	2–3 years	A 24-hour range center with CAAP and the Coast Guard	Shipping and fishing disruption	Range-safety office created
B19	Typhoon season	Engineering and operational	Every year	—	Design loads; 30-day gas reserve; schedule margin; southern site	Lost cadence	—

Reading the register. Rows B1 to B6 are mostly schedule. They decide **when**, and they are mostly government actions. Rows B7 to B10 decide **how big**, and they turn on gas. Rows B11 to B15 decide **where**, and they are fixed the day a site is chosen. That is why the site choice matters more than anything that follows it.

SECTION 10

Site implications



Concept rendering: a headland launch site with its hazard buffer and port. Illustrative only; not a SpaceX design or plan.

The screen

Twelve Pacific-facing sites were screened for corridors, then checked against protected-area law, population, and land use. These are outputs of a screen; nobody is known to be considering any of them (Figure D2). I

- **Eliminated by law despite good geometry:** Siargao and Bucas Grande (protected landscape and seascape); Suluan, Calicoan, and the Guiuan group (protected landscape and seascape; Suluan was the first place Haiyan struck); Pujada Island (protected seascape). D
- **Shortlist:** Pusan Point (mainland, Caraga, Davao Oriental; 39,704 people in the municipality; a Mandaya ancestral-domain title covers about 14,000 ha of the uplands). Homonhon (4,722 people; 6,489 of 7,400 ha under mining contracts; inside the Guiuan protected area; Magellan's landing site). Jomalig (7,884 people; 5,665 ha, mostly agricultural). Patnanungan (15,052 people; 139 km^2; a pending tourism-zone bill). D

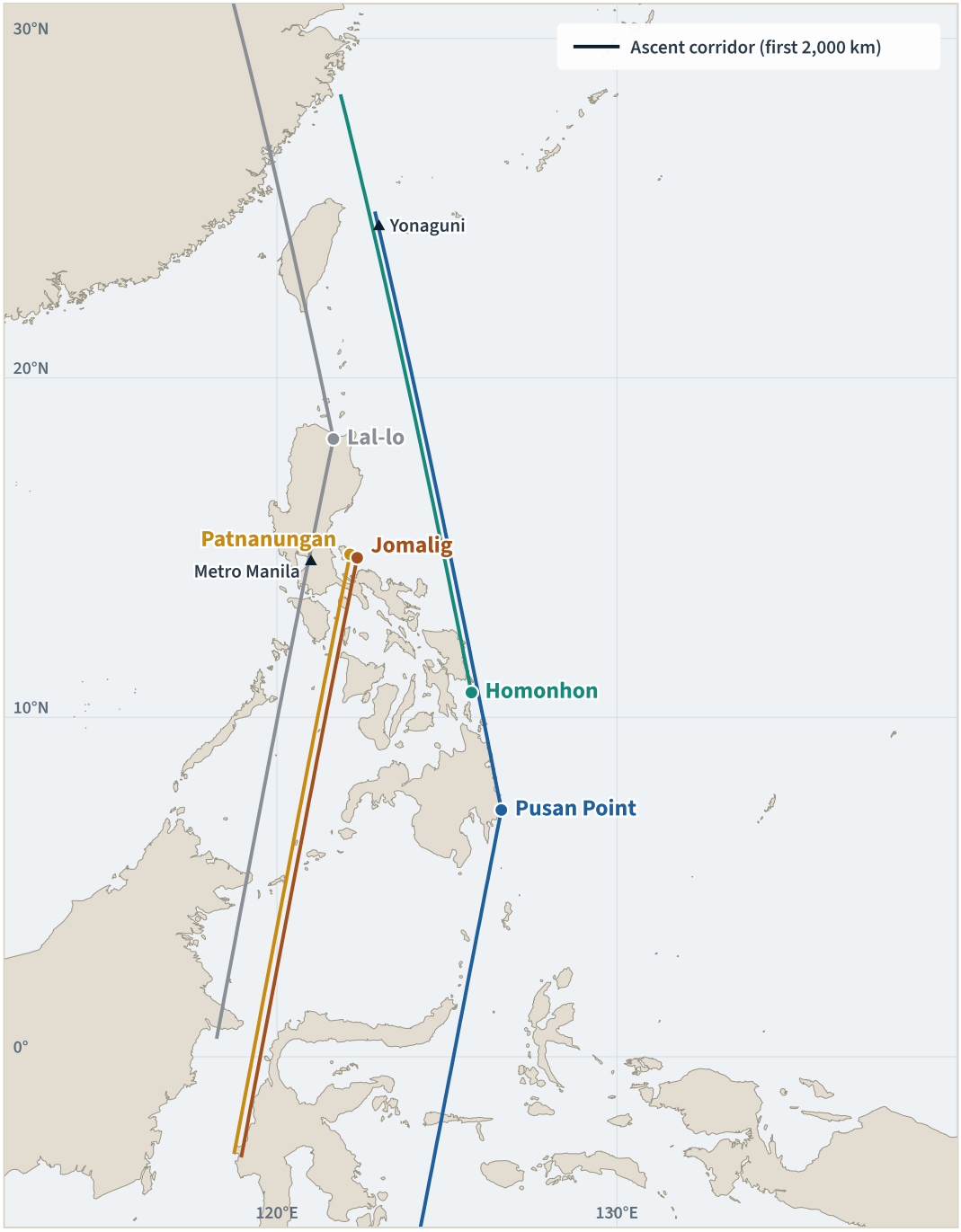


Figure D2. The four shortlisted sites and their clean ascent corridors at 97.6°, with Yonaguni and Metro Manila marked. Lal-lo (gray) shown for contrast. Screening output only.

Gate first, then score

For AI satellites, a site that cannot reach dawn-dusk orbit cleanly does not qualify for that mission, however good it is otherwise. **Gate:** at least one direction with 6% land or less, using a dog-leg of 1° or less. I

Site	Passes the gate?	Note
Pusan Point	Yes, both directions	

Site	Passes the gate?	Note
Homonhon	Yes, northbound	
Jomalig	Yes, southbound with 0.5°	A needle
Patnanungan	Yes, southbound	
Lal-lo	**No**	Qualifies only for the 30° shell, half of the FCC filing
Pecan Island (reference)	No, at 15%	SpaceX chose it anyway; the calibration point

Scores for the sites that pass (1 = poor, 5 = strong; weights in brackets; author's judgment) I

Criterion	Pecan Island	Pusan Point	Homonhon	Patnanungan	Jomalig
Orbit: corridors, windows, and return (20)	3	5	4	3	3
Land control at scale, including hazard buffer (15)	5	2	4	3	2
Permitting path (20)	4	3	2	3	3
Port and logistics (10)	5	2	3	2	2
Propellant and power (10)	5	1	1	1	1
Typhoon, seismic, and tsunami hazard (10)	2	2	1	2	2
Community and political risk (10)	4	2	2	2	3
Overflight and geopolitics (5)	3	3	3	4	4
Score (of 100)	**78**	**55**	**53**	**51**	**50**
Score if orbit is weighted 35	76	61	57	52	51

Pusan Point leads because it is the only two-way site: two windows a day and a clean return, so northbound launches and catches never compete for the same window. Its hazard score drops to 2 because Bopha's 2012 landfall and the October 2025 trench earthquake were both next door. Pecan Island drops to 3 on overflight, because its polar ascent crosses Mexico and its return crosses Guatemala. Homonhon is the brownfield alternative. The Polillo pair, Jomalig and Patnanungan, works best together, though the hazard buffer, below, weighs hardest on them. The gap to Louisiana is land, gas, and power, not geometry. I

Multi-island trade

Concept	At the pad site	Elsewhere	For	Against	Fits
A. Integrated (the Pecan model)	Everything	Nothing	Simplest operations	Thousands of hectares under one control, with housing next to the hazard area	Homonhon (tenements); Pusan Point
B. Pad site plus port (base case)	Pads, oxygen plant, turbines, LNG berth, tanks, desalination	Port: payload processing, housing, later stage production	Smallest pad footprint; existing ecozone labor	Barge link exposed to typhoons	Pusan Point, Jomalig, Patnanungan
C. Pad site plus energy island	Pads, tanks, oxygen plant	LNG terminal and turbines on a neighboring island, linked by subsea cable	Gas plant and its air permits off the pad site	150–490 MW of cable as a single point of failure	Polillo: power on Patnanungan, pads on Jomalig
D. Shipped propellant	Pads only	Oxygen and methane barged in	Minimal pad site	5,690 t of liquid oxygen a launch, every day	Rejected

Fence versus buffer. A two-pad site with its tank farm, oxygen plant, and power systems needs a fenced industrial area of roughly 400–800 ha. A That is not the hazard area. Daily launches and catches of the largest rocket ever built need an acoustic, overpressure, and sonic-boom buffer, assumed here at 3–5 km from each pad. A A 4 km radius is about 5,000 ha, nearly the whole of Jomalig (5,665 ha, about 7,900 people). On a populated small island the buffer, not the fence, is the binding land constraint. On a headland like Pusan Point, much of the buffer arc falls over the Pacific. That is a further point for Concept B (Figure D5) at Pusan Point, and a reason Concept C would put the pads on the less populated island of a pair. I

Why not offshore platforms? SpaceX bought two oil rigs in 2020 to convert into Starship launch platforms, then sold them. Gwynne Shotwell: “We bought them. We sold them. They were not the right platform.” D SpaceX still expects offshore platforms to play a role eventually at very high cadence. D For this mission the oxygen plant settles it: 120–360 MW of power, 5,700–17,000 t a day of liquid oxygen and 30 days of LNG storage do not float easily in a typhoon belt. A platform might take the pad and its buffer offshore, with propellant shuttled from land. That is a Concept B variant worth watching, not the base case. I

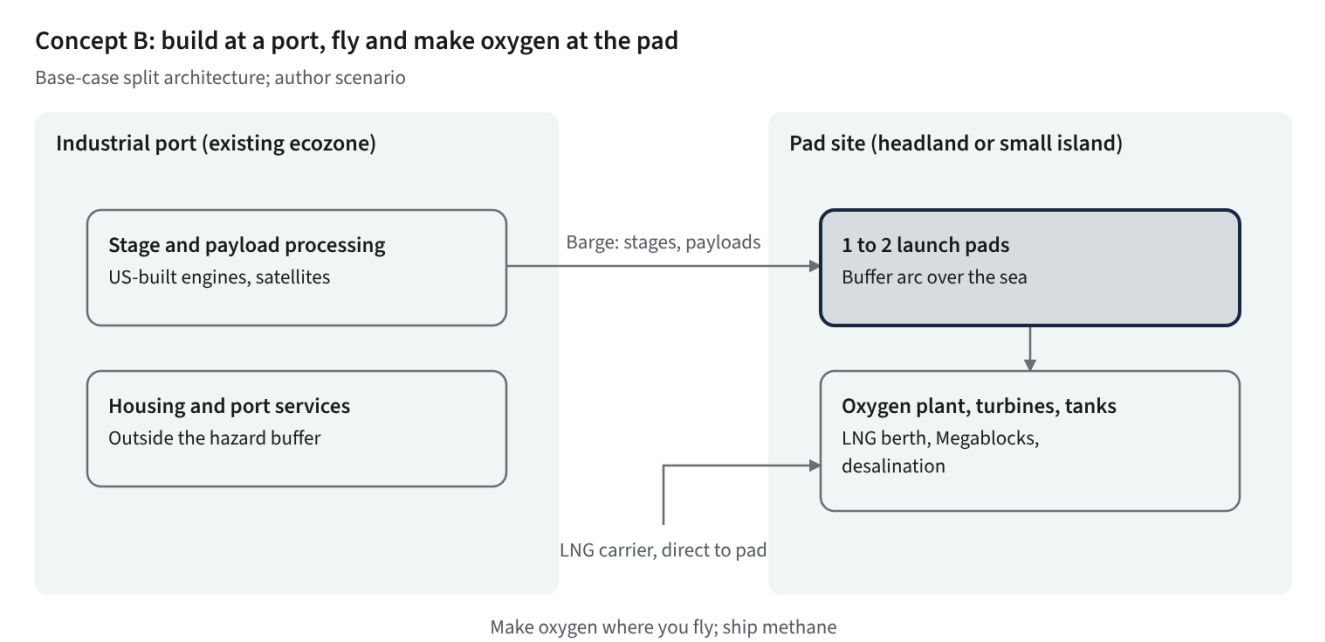


Figure D5. Concept B, the base case: stages and payloads are processed at an existing industrial port and barged to a headland or small-island pad site, which makes its own oxygen from LNG delivered direct. Author scenario.

SECTION 11

Side by side: Louisiana and a Pacific annex

	Starbase Louisiana (announced)	Pacific annex (this study's base case)
Status	Announced Aug. 25, 2026 D	Early talks confirmed Nov. 20, 2026; no site named D
Land	~125,000 acres, largely one former Exxon Mobil holding D	400–800 ha fenced pad site plus port facilities A
Pads	10, in 5 complexes D	2 A
Launches a year	Musk: 10,000 D	52 → 365 → 1,095 A
Payload to dawn-dusk orbit per V4	~142 t, with a corridor crossing Mexico I	~142 t on a cleaner corridor I
Ship return	From the south, over Yucatán and Guatemala I	From the north; clean final 1,500 km I
Gas	On the US Gulf Coast gas system D	Imported LNG, 0.15–2.4 Mt a year I
Power	On-site generation planned D	50–490 MW of gas turbines plus Megablocks I
Regulator	FAA, an established regime D	PhilSA, with no dedicated launch law found D I
Treaty needed	None	US–Philippines Technology Safeguards Agreement I
First launch	2029 planned D	2030–31 at the earliest I

What the comparison suggests. The annex does not compete with Louisiana; it complements it. It adds a second weather window, a second regulator, a cleaner polar corridor, a clean return path, and launch capacity next to Asian customers. It is also a diplomatic object: for Washington an alliance anchor in space, for Manila the spaceport PhilSA has been seeking. I

It also changes the debris story. Today the Philippines receives spent stages from Chinese launches in its waters. A Starship annex would launch from Philippine soil and leave nothing behind downrange. I

SECTION 12

Risks and signposts

Risks to the scenario

Risk	Effect	Likelihood (author)
Orbital compute disappoints commercially; SpaceX's own filing warns it may not achieve viability D	Demand for a second polar gateway disappears	Medium
Louisiana and Florida absorb all polar demand, accepting Mexico overflight	No need for a Pacific site	Medium
Rapid reuse matures more slowly than SpaceX says	Cadence and fleet numbers slide right	Medium–high
Safeguards agreement stalls in the Senate concurrence debate	Schedule slides by years	Medium
Regional friction: a US-custody heavy-lift site in a treaty ally, flying past Yonaguni about 110 km from Taiwan, will not be read in Beijing as purely commercial	Diplomatic pressure; gray-zone interference with maritime closure areas; insurance and enforcement costs	Medium–high
Philippine Trench earthquake or tsunami	Damage to towers, tanks, and LNG jetty; loss of life	Low annual, high consequence
LNG price spike or supply disruption	Operating cost; cadence	Medium
Local opposition or litigation over land, air, reefs, or fisheries	Site lost or delayed	Medium
Atmospheric impact of high cadence and re-entry becomes a policy issue; a new study estimates the million-satellite plan could raise upper-atmosphere pollution more than a hundredfold D	Regulatory drag in all jurisdictions	Rising

Signposts, in likely order

1. A Technology Safeguards Agreement announced or under negotiation. The lead indicator.
2. PhilSA launch-licensing rules in draft.
3. A new or expanded economic-zone proclamation on the Pacific coast: Davao Oriental, Eastern Samar, or the Polillo group.
4. Land activity: a 99-year lease under RA 12252, or a mining tenement on Homonhon changing hands or terms.
5. An NCIP field investigation or consent process in a coastal municipality.
6. An LNG berth, supply contract, or small-carrier charter with no obvious buyer.
7. An industrial-gas contractor or turbine shipment bound for the east coast.
8. Diplomatic traffic with Tokyo, Seoul, or Jakarta about overflight and re-entry.
9. Hiring: permitting, range-safety, or government-relations roles in the Philippines.

What would weaken the case

- Talks stay at Lal-lo, at 30° or sounding-rocket scale.
- The project is framed as Starlink ground or manufacturing presence, with no launch.
- The dawn-dusk share of the FCC filing shrinks, or AI satellites move to the 30° shells.

SECTION 13

Key uncertainties

The analysis rests on inputs SpaceX has not published and on screens that are not yet full engineering studies. The ones that move the answer most:

- **AI1 mass.** Not published. The base case assumes about 2 t (bounded 1.2–2.5 t); a published critique implies about 6 t, which cuts every compute-per-launch figure by about two-thirds.
- **Starship V4 performance.** Payload and the ship dry mass behind the payload-per-m/s rate (200 t assumed; 150–300 t tested) are the author's assumptions.
- **Corridors are a screen, not a trajectory analysis.** Ground tracks and land fractions rank the sites; a full trajectory tool with lofting and staging points would refine them.
- **Oxygen-plant energy.** The largest engineering sensitivity: 0.5 MWh per metric ton of liquid oxygen assumed, in a 0.3–0.9 range.
- **Hazard buffer and fence size.** The 3–5 km buffer and 400–800 ha fence are assumptions, not sourced figures.
- **Site checks not yet done.** Protected-area boundaries, ancestral-domain overlaps, mining tenements, tsunami and ground-shaking hazard maps, and typhoon days lost per season have not been confirmed site by site.
- **Treaty status.** The Philippines' position under the Liability and Registration Conventions, and the air-permit path for site turbines, are unconfirmed.

Each input is listed in the assumptions register with what changes if it is wrong. Corrections are welcome and will be logged.

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- Air-separation energy (Thunder Said Energy; peer-reviewed ASU literature); LNG cold-energy ASU studies (Energy, 2015 and 2025); Wärtsilä small-scale liquefaction data.
- FAA 2022 Starbase environmental assessment (deluge volume); Starbase Pad 2 deluge tests (2026).
- Atmospheric-impact study of the million-satellite plan (Scientific American, Nov 2026).

Added after external review

- Bolinger and Bolinger, "Land Requirements for Utility-Scale PV: An Empirical Update on Power and Energy Density," IEEE Journal of Photovoltaics (LBNL, 2022).
- PHIVOLCS primer and tsunami information on the October 10, 2025 magnitude 7.4 offshore Davao Oriental earthquake; PHIVOLCS on 2–15 minute evacuation windows (via GMA News, 2025).
- Typhoon Bopha (Pablo) landfall at Baganga, Davao Oriental (PAGASA via Inquirer and MindaNews, December 2012; Weather Underground).

- SpaceX's purchase and sale of the Phobos and Deimos rigs; Shotwell's remarks (SpaceNews, February 2023).

Method

- Author's scripts: corridor geometry (ground tracks on a rotating Earth, land mask); orbital trades (rotation penalty, plane-change cost, payload sensitivity); mass and energy balance; fleet and throughput. Available on request.

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Independent analysis of the US–Philippines technology corridor: what the signed papers say, and what the physics requires.

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INDEPENDENCE

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CORRECTIONS

Corrections are welcome and will be logged. Write to gene@corridorintelligence.net.

NOT LEGAL ADVICE

The author is a US patent attorney, admitted in Colorado. He is not admitted to practice law in the Philippines. This is policy analysis of public material, not a legal opinion on Philippine law.

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