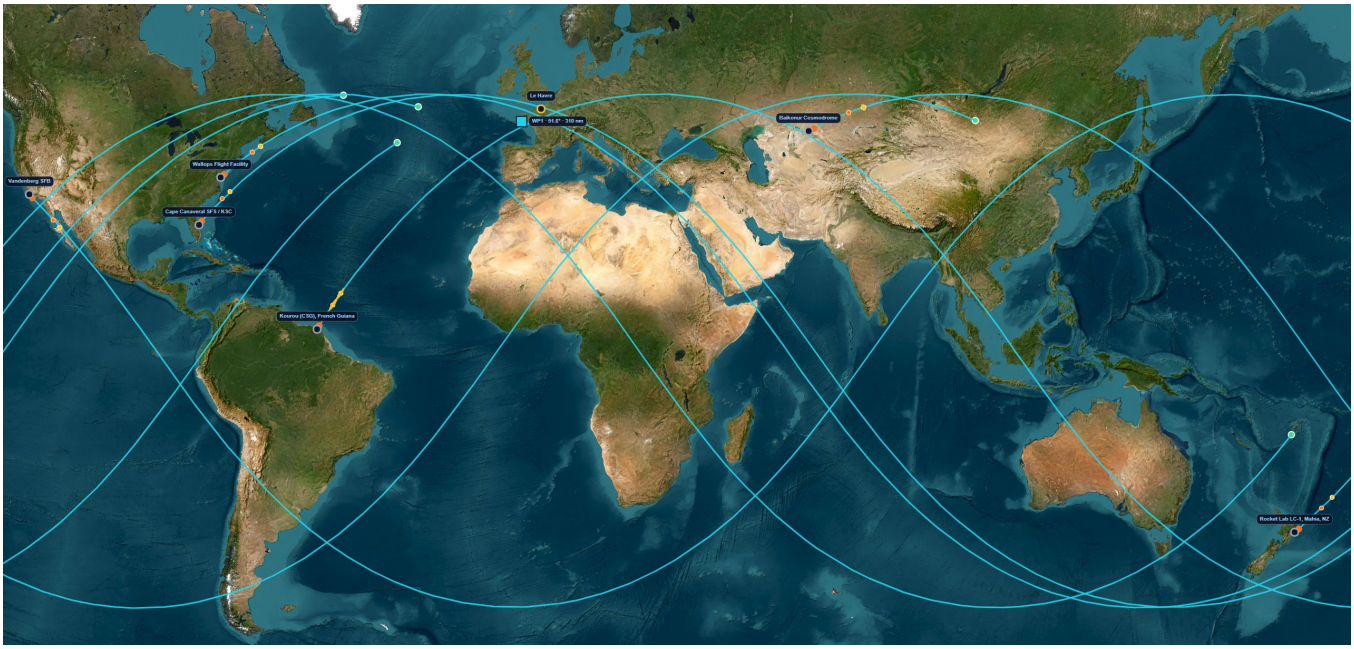
Launch Site Study

Demo Study

Generated: 2026-10-31 15:15 (UTC+4)

6 candidate sites · 1 logistics base(s)



Sites	Type	Latitude	Longitude
Kourou (CSG), French Guiana	Reference site	5.1700°	-52.7700°
Cape Canaveral SFS / KSC	Reference site	28.5000°	-80.6000°
Vandenberg SFB	Reference site	34.6000°	-120.6000°
Baikonur Cosmodrome	Reference site	45.9600°	63.3000°
Wallops Flight Facility	Reference site	37.8400°	-75.4900°
Rocket Lab LC-1, Mahia, NZ	Reference site	-39.2600°	177.8600°
Le Havre	Logistics base	49.4811°	0.1099°

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Kourou (CSG), French Guiana — 5.1700°, -52.7700°	24
Cape Canaveral SFS / KSC — 28.5000°, -80.6000°	26
Vandenberg SFB — 34.6000°, -120.6000°	28
Baikonur Cosmodrome — 45.9600°, 63.3000°	30
Wallops Flight Facility — 37.8400°, -75.4900°	32
Rocket Lab LC-1, Mahia, NZ — -39.2600°, 177.8600°	34
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Executive summary

Provisional recommendation

PROVISIONAL — to confirm once the points below are settled. Recommended for the next phase: Kourou (CSG), French Guiana — non-dominated: yes; first on 6 of 17 discriminating criteria (Drops: distance to land, Population within 100 km, Distance to the nearest city of 100 000+, Seismic hazard, Tropical cyclones per decade, Highest tsunami runup within 100 km); mean normalised rank 0.33 (0 = best everywhere, equal weights). The choice depends on the weights: see the sensitivity line. Runner-up: Baikonur Cosmodrome. First in 49 % of the draws over every weighting and the data uncertainty (92 % with equal weights).

Population and environmental impact

- Kourou (CSG), French Guiana: Ec 8.6e-6 per flight, 189 459 people within 100 km, nearest protected area 21 km.
- Cape Canaveral SFS / KSC: Ec 5.6e-5 per flight, 3 702 385 people within 100 km, nearest protected area 11 km.
- Vandenberg SFB: Ec 2.3e-4 per flight — above 1e-4, 676 916 people within 100 km, nearest protected area 5 km.
- Baikonur Cosmodrome: Ec 1.6e-3 per flight — above 1e-4, 181 287 people within 100 km, nearest protected area 30 km.
- Wallops Flight Facility: Ec 6.4e-4 per flight — above 1e-4, 520 606 people within 100 km, nearest protected area 16 km.
- Rocket Lab LC-1, Mahia, NZ: Ec 2.5e-7 per flight, 181 113 people within 100 km, nearest protected area 22 km.

Before relying on this conclusion

- Illustrative example inputs, not the project's: Rule set "Example — fixed corridor, no large city overflown", Mission "Example — 51.6° station orbit, 420 km", Vehicle "Example — two-stage medium launcher (illustrative)".
- The programme cost uses example unit costs (round numbers, not market data): enter your own in the Cost tab before quoting it.
- Expected casualties use illustrative casualty areas and a 3 % failure probability: set the vehicle's own values (Environment tab) before quoting them.

Key findings

- Programme cost: best Baikonur Cosmodrome (132 M€); range 132 – 316 M€.
- Expected casualties per flight (Ec): best Rocket Lab LC-1, Mahia, NZ (2.5e-7); range 2.5e-7 – 1.6e-3.
- Distance to protected areas: best Baikonur Cosmodrome (30 km); range 5 – 30 km.
- Admissible azimuths: best Rocket Lab LC-1, Mahia, NZ (309°); range 114° – 309°.
- Mission planes: best Wallops Flight Facility, Rocket Lab LC-1, Mahia, NZ (2 headings); range 1 – 2 headings.
- Weather availability (year): best Vandenberg SFB, Baikonur Cosmodrome (95 %); range 68 – 98 %.
- Drops: distance to land: best Kourou (CSG), French Guiana, Rocket Lab LC-1, Mahia, NZ (>= 300 km); range on land – >= 300 km.
- Sea route from the base: best Wallops Flight Facility (3 274 nm); range 3 274 – 11 005 nm.
- Aerodrome for heavy cargo: best Cape Canaveral SFS / KSC, Vandenberg SFB, Baikonur Cosmodrome, Wallops Flight Facility (5 km); range 5 – 236 km.
- Port for heavy cargo: best Cape Canaveral SFS / KSC (22 km); range 22 – 97 km.
- Population within 100 km: best Kourou (CSG), French Guiana, Baikonur Cosmodrome, Rocket Lab LC-1, Mahia, NZ (189 459); range 181 113 – 3 702 385.
- Distance to the nearest city of 100 000+: best Kourou (CSG), French Guiana (276 km); range 42 – 276 km.
- Seismic hazard: best Kourou (CSG), French Guiana, Cape Canaveral SFS / KSC, Baikonur Cosmodrome, Wallops Flight Facility (0.6 % g); range 0.1 – 44.8 % g.
- Drops: distance to a shipping lane: best Baikonur Cosmodrome (>= 1 500 km); range 18 – >= 1 500 km.
- Vessel traffic near the site: best Baikonur Cosmodrome (0 h); range 0 – 135 187 h.

- Tropical cyclones per decade: best Kourou (CSG), French Guiana, Vandenberg SFB, Baikonur Cosmodrome (0.0 / decade); range 0.0 – 6.6 / decade.
- Highest tsunami runup within 100 km: best Kourou (CSG), French Guiana, Cape Canaveral SFS / KSC, Baikonur Cosmodrome, Wallops Flight Facility (0.0 m); range 0.0 – 15.0 m.
- Equivalent for every site (within tolerance): Payload, same target.
- Non-dominated sites (no other site is as good or better on every criterion): Kourou (CSG), French Guiana, Cape Canaveral SFS / KSC, Vandenberg SFB, Baikonur Cosmodrome, Wallops Flight Facility, Rocket Lab LC-1, Mahia, NZ.
- Sensitivity: the first place changes when the weight of Weather availability (year) (-> Baikonur Cosmodrome) is doubled.
- Without Expected casualties per flight (Ec) (-> Baikonur Cosmodrome), Admissible azimuths (-> Baikonur Cosmodrome), Drops: distance to land (-> Baikonur Cosmodrome), Sea route from the base (-> Baikonur Cosmodrome), the first place goes to another site.
- Uncertainty carried to the ranking (5 000 draws over every possible weighting and the uncertainty of each figure): first place — Kourou (CSG), French Guiana 49 %, Baikonur Cosmodrome 31 %, Rocket Lab LC-1, Mahia, NZ 12 %, Wallops Flight Facility 7 %, Cape Canaveral SFS / KSC 2 %.
- With equal weights, the data uncertainty alone gives the first place to Kourou (CSG), French Guiana 92 %, Baikonur Cosmodrome 8 %.
- Kourou (CSG), French Guiana comes first when the weights favour Drops: distance to land.
- Baikonur Cosmodrome comes first when the weights favour Weather availability (year), Drops: distance to a shipping lane, Vessel traffic near the site.
- Rocket Lab LC-1, Mahia, NZ comes first when the weights favour Mission planes, Admissible azimuths, Expected casualties per flight (Ec).

Watch points

- Jettisoned bodies falling less than 100 km from land: Vandenberg SFB — Stage 1 6 km, Vandenberg SFB — Fairing 53 km, Wallops Flight Facility — Fairing 29 km.
- Cape Canaveral SFS / KSC: 6.6 tropical storms per decade within 150 km — campaigns and structures must allow for cyclone season.
- Cape Canaveral SFS / KSC: a jettisoned body falls 18 km from a shipping lane — notices to mariners and a clearance plan are needed.
- Vandenberg SFB: city of 100 000+ at 42 km.
- Vandenberg SFB: expected casualties 2.3e-4 per flight, above the 1e-4 public collective-risk reference — trajectory, drop zones or exclusion areas must change.
- Vandenberg SFB: tsunami runup of 3.4 m observed within 100 km — check pad and port elevations.
- Baikonur Cosmodrome: expected casualties 1.6e-3 per flight, above the 1e-4 public collective-risk reference — trajectory, drop zones or exclusion areas must change.
- Wallops Flight Facility: expected casualties 6.4e-4 per flight, above the 1e-4 public collective-risk reference — trajectory, drop zones or exclusion areas must change.
- Wallops Flight Facility: 6.4 tropical storms per decade within 150 km — campaigns and structures must allow for cyclone season.
- Rocket Lab LC-1, Mahia, NZ: tsunami runup of 15.0 m observed within 100 km — check pad and port elevations.
- Rocket Lab LC-1, Mahia, NZ: high seismic hazard (PGA 45 % g).

Site synthesis

Item	Kourou (CSG), French Guiana	Cape Canaveral SFS / KSC	Vandenberg SFB	Baikonur Cosmodrome	Wallops Flight Facility	Rocket Lab LC-1, Mahia, NZ
Admissible azimuths	264° of 360°	141° of 360°	206° of 360°	114° of 360°	141° of 360°	309° of 360°
Mission planes	1 / 1 planes · 1 / 2 headings	1 / 1 planes · 1 / 2 headings	1 / 1 planes · 1 / 2 headings	1 / 1 planes · 1 / 2 headings	1 / 1 planes · 2 / 2 headings	1 / 1 planes · 2 / 2 headings
Payload, same target	22 407 kg -> 51.6° / 420 km · parking 200 km · deorbit	22 408 kg -> 51.6° / 420 km · parking 200 km · deorbit	22 334 kg -> 51.6° / 420 km · parking 200 km · deorbit	22 474 kg -> 51.6° / 420 km · parking 200 km · deorbit	22 220 kg -> 51.6° / 420 km · parking 200 km · deorbit	22 169 kg -> 51.6° / 420 km · parking 200 km · deorbit
Programme cost (your unit costs)	217 M€ over 10 years (investment 0 €, 3.3 M€ per flight, payload shortfall 2.0 M€/yr)	216 M€ over 10 years (investment 0 €, 3.3 M€ per flight, payload shortfall 2.0 M€/yr)	302 M€ over 10 years (investment 0 €, 4.3 M€ per flight, payload shortfall 4.2 M€/yr)	132 M€ over 10 years (investment 0 €, 2.2 M€ per flight) — without sea route	263 M€ over 10 years (investment 0 €, 3.1 M€ per flight, payload shortfall 7.6 M€/yr)	407 M€ over 10 years (investment 0 €, 5.3 M€ per flight, payload shortfall 9.1 M€/yr)
Population impact: expected casualties (Ec)	8.6e-6 per flight (drops 0 · failure 8.6e-6)	5.6e-5 per flight (drops 0 · failure 5.6e-5)	2.3e-4 per flight (drops 7.3e-6 · failure 2.3e-4) — above 1e-4	1.6e-3 per flight (drops 3.1e-4 · failure 1.3e-3) — above 1e-4	6.4e-4 per flight (drops 3.0e-5 · failure 6.1e-4) — above 1e-4	2.5e-7 per flight (drops 0 · failure 2.5e-7)
Protected areas (OpenStreetMap)	site: Estuaire du fleuve Sinnamary, 21 km · drops: none within 30 km · 1 within 50 km	site: Pine Island Conservation Area, 11 km · drops: none within 30 km · 18 within 50 km	site: U.S. Space Force, 5 km · drops: Costa Savalje Wildlands, 5 km (Stage 1) · 9 within 50 km	site: none within 60 km · drops: none within 30 km · 0 within 50 km	site: Guard Shore, 16 km · drops: none within 30 km · 49 within 50 km	site: Opoutama Sections Conservation Area, 22 km · drops: none within 30 km · 1 within 50 km
Drops: closest to land	>= 300 km (Stage 1)	160 km (Stage 1)	6 km (Stage 1)	on land (Stage 1)	29 km (Fairing)	>= 300 km (Stage 1)
Water depth at the site (GEBCO)	land pad	land pad	land pad	land pad	land pad	land pad
Sea route from the base	3 794 nm, 13.2 d from Le Havre @ 12 kn	3 837 nm, 13.3 d from Le Havre @ 12 kn	7 714 nm, 26.8 d from Le Havre @ 12 kn	…	3 274 nm, 11.4 d from Le Havre @ 12 kn	11 005 nm, 38.2 d from Le Havre @ 12 kn
Aerodrome for heavy cargo (runway >= 2 400 m)	Cayenne – Félix Eboué Airport — 60 km, runway 3 196 m (nearest: Kourou Airport, 8 km, 1 106 m)	Cape Canaveral SFS Skid Strip — 5 km, runway 3 048 m	Vandenberg Space Force Base — 15 km, runway 4 572 m (nearest: Lompoc Airport, 14 km, 1 402 m)	Yubileyniy Airfield — 11 km, runway 4 500 m	Wallops Flight Facility Airport — 11 km, runway 2 666 m	RNZAF Base Ohakea — 236 km, runway 2 447 m (nearest: Wairoa Airport, 48 km, 914 m)
Port for heavy cargo (channel >= 9.4 m or ships > 152 m)	DEGRAD DES CANNES — 66 km, channel 3.4–4.6 m, vessels > 152 m	CANAVERAL HARBOR — 22 km, channel 12.5–13.7 m, vessels > 152 m	GAVIOTA — 40 km, channel 11.0–12.2 m	none for heavy cargo in range	PINEY POINT — 97 km, channel 4.9–6.1 m, vessels > 152 m (nearest: SALISBURY, 59 km, channel 1.8–3.1 m, vessels <= 152 m)	GISBORNE — 68 km, channel 9.4–10.7 m, vessels <= 152 m
Weather availability (year)	68 % (3-h window) — worst May 46 % · 1 h 81 % · 6 h 55 %	90 % (3-h window) — worst Sep 80 % · 1 h 95 % · 6 h 84 %	95 % (3-h window) — worst Mar 88 % · 1 h 97 % · 6 h 94 %	98 % (3-h window) — worst Mar 97 % · 1 h 99 % · 6 h 97 %	91 % (3-h window) — worst Feb 88 % · 1 h 95 % · 6 h 87 %	85 % (3-h window) — worst Jul 82 % · 1 h 90 % · 6 h 81 %
Launch windows (lift-off times, opportunities, weather)	no timing constraint (planes free), good weather 99 % of days	no timing constraint (planes free), good weather 100 % of days	no timing constraint (planes free), good weather 100 % of days	no timing constraint (planes free), good weather 100 % of days	no timing constraint (planes free), good weather 100 % of days	no timing constraint (planes free), good weather 98 % of days
Population within 10 / 50 / 100 km	1 633 / 47 307 / 189 459 (GHSL 2025)	2 884 / 503 944 / 3 702 385 (GHSL	126 / 265 748 / 676 916 (GHSL 2025)	10 275 / 70 402 / 181 287 (GHSL 2025)	4 871 / 73 940 / 520 606 (GHSL 2025)	22 / 6 180 / 181 113 (GHSL 2025)

Item	Kourou (CSG), French Guiana	Cape Canaveral SFS / KSC	Vandenberg SFB	Baikonur Cosmodrome	Wallops Flight Facility	Rocket Lab LC-1, Mahia, NZ
		2025)				
Nearest city of 100 000+	Paramaribo (223 757) — 276 km	Palm Bay (119 760) — 52 km	Santa Maria (105 093) — 42 km	Kyzylorda (354 800) — 212 km	East Hampton (147 993) — 116 km	Tauranga (161 000) — 229 km
Shipping lanes (Major / Middle)	drops 401 km (Fairing) · site >= 1 500 km from a major lane (97 km from any lane)	drops 18 km (Fairing) · site 74 km from a major lane	drops 141 km (Stage 1) · site 40 km from a major lane	drops >= 1 500 km (Stage 1) · site >= 1 500 km from a major lane	drops 126 km (Fairing) · site 57 km from a major lane	drops 819 km (Stage 1) · site >= 1 500 km from a major lane (381 km from any lane)
Vessel traffic near the site (GFW)	7 025 h of vessel presence (90 days, 50 km)	135 187 h of vessel presence (90 days, 50 km)	14 740 h of vessel presence (90 days, 50 km)	0 h of vessel presence (90 days, 50 km)	14 878 h of vessel presence (90 days, 50 km)	3 587 h of vessel presence (90 days, 50 km)
Airspace crossed (OpenAIP) · FIR	unavailable	unavailable	unavailable	unavailable	unavailable	unavailable
Seismic hazard (GSHAP PGA, 475 yr)	0.6 % g (Low)	1.1 % g (Low)	23.8 % g (Moderate)	0.1 % g (Low)	1.7 % g (Low)	44.8 % g (Very high)
Tropical cyclones (IBTrACS)	0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026	6.6 per decade >= 34 kt (1.7 >= 64 kt), within 150 km, 1980–2026	0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026	0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026	6.4 per decade >= 34 kt (1.3 >= 64 kt), within 150 km, 1980–2026	1.1 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026
Tsunami runups (NOAA NCEI)	no runup recorded within 100 km	3 runups within 100 km, highest 0.2 m (2004)	92 runups within 100 km, highest 3.4 m (1812)	no runup recorded within 100 km	1 runups within 100 km, highest 0.3 m (1929)	42 runups within 100 km, highest 15.0 m (1931)
Sensitive features (your layers)	no layer loaded (e.g. Allen Coral Atlas)	no layer loaded (e.g. Allen Coral Atlas)	no layer loaded (e.g. Allen Coral Atlas)	no layer loaded (e.g. Allen Coral Atlas)	no layer loaded (e.g. Allen Coral Atlas)	no layer loaded (e.g. Allen Coral Atlas)
Reefs, Natural Earth 1:10m	3096 km — coarse, not ranked	260 km — coarse, not ranked	3542 km — coarse, not ranked	2362 km — coarse, not ranked	1203 km — coarse, not ranked	1914 km — coarse, not ranked

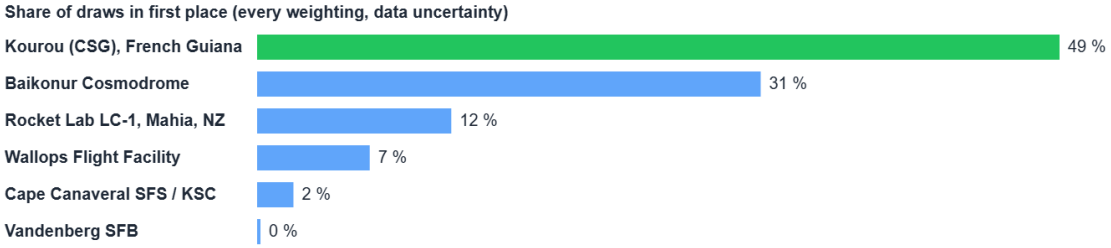
Green: best of the sites on that line; red: least good; amber: in between; white: equivalent within tolerance or not computed. A reading aid, not a score. Raw figures side by side, no score. "…" = computing, "—" = not computed (see "Compute everything"). Azimuths: width of the admissible sectors out of 360°. Mission planes: planes reachable directly / total, "+n with delta-i" = reachable only with an inclination change delta-i (costing delta-v); headings: admissible launch headings over all planes (two per plane, northbound and southbound). Payload: same target and vehicle for every site, left out of the ranking when the results are not comparable. Drops: distance from land of the closest jettisoned body (stages, boosters, fairing). Depth: GEBCO grid (~450 m). Population: GeoNames places of 1 000+ inhabitants at their centre point, a lower bound. Seismic hazard: GSHAP 1999, land only. Natural Earth reefs are too coarse to rank on: load a fine layer (e.g. Allen Coral Atlas, CC BY 4.0) in the Environment tab. Population: JRC GHSL 2025 (CC BY 4.0) in 0.05° cells when loaded, else GeoNames places (a lower bound). Ec: expected casualties per flight from the planned drops and a launch failure (settings in the Environment tab), compared with 1e-4. Protected areas: OpenStreetMap (ODbL), nearest to the site and to the drops. Launch windows: lift-off times of the planes whose node is fixed (local time or right ascension), opportunities per year and share of days with an opportunity in good weather; ranked only when a plane has such a constraint. Shipping lanes: closest jettisoned body to a Major or Middle lane, and the site's distance to a major lane. Vessel traffic: Global Fishing Watch presence over 90 days within 50 km. Airspace: OpenAIP control zones, terminal areas and airways met below 20 km of altitude, and the FIR. Cyclones: IBTrACS storms of 34 kt or more within 150 km per decade. Tsunamis: highest NCEI runup within 100 km (0 = none recorded, not no risk).

Overall standing (equal weights)



Sites	Non-dominated	First on	Mean normalised rank
Kourou (CSG), French Guiana	OK	Drops: distance to land, Population within 100 km, Distance to the nearest city of 100 000+, Seismic hazard, Tropical cyclones per decade, Highest tsunami runup within 100 km	0.33
Baikonur Cosmodrome	OK	Programme cost, Distance to protected areas, Weather availability (year), Aerodrome for heavy cargo, Population within 100 km, Seismic hazard, Drops: distance to a shipping lane, Vessel traffic near the site, Tropical cyclones per decade, Highest tsunami runup within 100 km	0.37
Wallops Flight Facility	OK	Mission planes, Sea route from the base, Aerodrome for heavy cargo, Seismic hazard, Highest tsunami runup within 100 km	0.46
Rocket Lab LC-1, Mahia, NZ	OK	Expected casualties per flight (Ec), Admissible azimuths, Mission planes, Drops: distance to land, Population within 100 km	0.47
Cape Canaveral SFS / KSC	OK	Aerodrome for heavy cargo, Port for heavy cargo, Seismic hazard, Highest tsunami runup within 100 km	0.53
Vandenberg SFB	OK	Weather availability (year), Aerodrome for heavy cargo, Tropical cyclones per decade	0.57

Robustness of the ranking under uncertainty



Sites	Rank 1	Rank 2	Rank 3	Rank 4	First, equal weights
Kourou (CSG), French Guiana	49 %	33 %	12 %	4 %	92 %
Baikonur Cosmodrome	31 %	28 %	22 %	12 %	8 %
Rocket Lab LC-1, Mahia, NZ	12 %	20 %	25 %	17 %	0 %
Wallops Flight Facility	7 %	13 %	26 %	32 %	0 %
Cape Canaveral SFS / KSC	2 %	5 %	10 %	21 %	0 %
Vandenberg SFB	0 %	1 %	5 %	14 %	0 %

SMAA-2 (Lahdelma & Salminen, 2001): 5 000 draws; in each, weights drawn uniformly over every possible weighting and every figure within its one-sigma uncertainty (table in Method and inputs), then the same ranking rule. Rank acceptability = share of draws where a site takes that place. A site first in most draws is robust whatever the weights; shares split between sites mean the choice rests on the weights the decision-maker gives.

1. Method and inputs

Each candidate site is assessed on the same inputs: the user's range-safety rule set screens every launch azimuth for land and populated places; the mission planes are checked against the admissible azimuths; the ascent model gives the payload and the drop zones; sea routes, access infrastructure, weather availability, population, seismic hazard and sensitive features complete the comparison. The conclusions come from per-criterion ranks with equivalence tolerances, Pareto dominance and an equal-weight mean rank with its sensitivity — no weight is chosen by SatView.

Rule set — Example — fixed corridor, no large city overflown

- Azimuth step 1°; not screened within 10 km of the pad.
- Phase 1: 0–1 000 km, corridor half-width 25 -> 25 km — a place of 100 000+ inhabitants in the corridor -> excluded; any land or island on the ray -> restricted.
- Phase 2: 1 000–4 000 km, corridor half-width 50 -> 50 km — a place of 1 000 000+ inhabitants in the corridor -> excluded.

Mission — Example — 51.6° station orbit, 420 km

Plane	Inclination °	Altitude km	Planes × satellites
51.6°	51.6	420	1 × 1

Vehicle — Example — two-stage medium launcher (illustrative)

#	Vacuum thrust kN	Isp vac s	Propellant kg	Dry kg
1	8 227	311	411 000	22 200
2	981	348	107 500	4 000

Weather thresholds

wind <= 15 m/s · gusts <= 20 m/s · rain <= 0.5 mm/h · waves <= 2.5 m — window 3 h, 5 years of ERA5

Terms used

- Admissible azimuths "163° of 360°": total width of the launch headings the rule set allows.
- Mission planes "5 / 6 (+1 with delta-i)": planes reachable by a direct ascent / total; "+1 with delta-i" = one more plane reachable only with an inclination change delta-i, which costs a velocity increment delta-v = 2·V·sin(delta-i/2). Headings: admissible launch headings over all planes, two per plane (northbound and southbound).
- delta-v of a plane change: in the Missions table, the minimum (delta-i = site latitude - plane inclination, V of the target orbit); in the Ascent table, from the inclination the computed ascent actually reaches (a few hundredths of a degree more), hence a slightly higher value.
- Stage 1 impact: in the Ascent table, the distance flown from the pad; in the Trajectories section, the distance from the impact point to the nearest land.

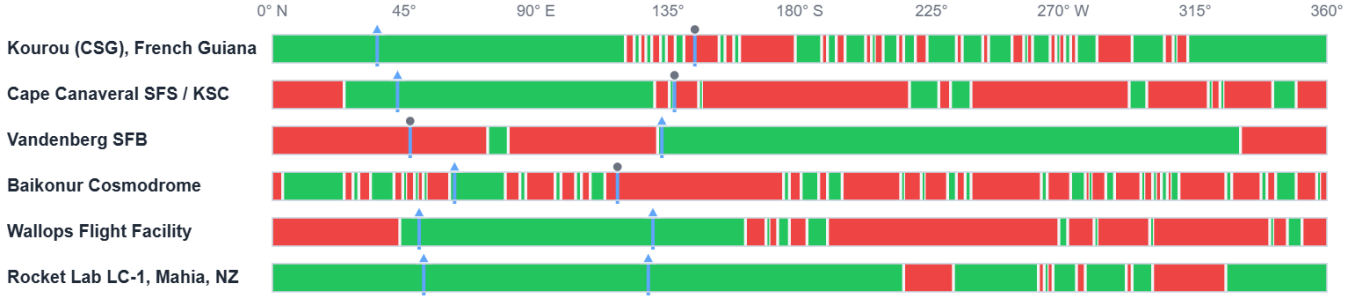
How the conclusions are derived

Criterion	Better when	Tied within	Uncertainty (1 sigma)
Payload, same target	higher	2 %	+/- 2 %
Programme cost	lower	5 %	+/- 30 %
Expected casualties per flight (Ec)	lower	1.0e-7 / 25 %	× / ÷ 3
Distance to protected areas	higher	5 km	+/- 2 km
Admissible azimuths	higher	5°	+/- 5 °
Mission planes	higher	0.25 headings	0
Weather availability (year)	higher	3 pts	+/- 3 pts
Days with a good-weather lift-off opportunity	higher	3 pts	+/- 3 pts
Drops: distance to land	higher	10 km	+/- 2 km + +/- 10 %
Water depth at the site	lower	3 m	+/- 5 m
Sea route from the base	lower	2 %	+/- 3 %
Aerodrome for heavy cargo	lower	15 km	0
Port for heavy cargo	lower	15 km	0
Population within 100 km	lower	1 000 / 10 %	+/- 15 %
Distance to the nearest city of 100 000+	higher	25 km	0
Seismic hazard	lower	2.0 % g	+/- 30 %
Distance to sensitive features	higher	10 km	+/- 1 km
Drops: distance to a shipping lane	higher	10 km	+/- 5 km
Vessel traffic near the site	lower	50 h / 10 %	+/- 30 %
Airspaces crossed at low altitude	lower	0	0
Tropical cyclones per decade	lower	0.5 / decade	Poisson, 45 yr
Highest tsunami runup within 100 km	lower	0.5 m	+/- 20 %

Ranks: sites within the tolerance of a group's best share its rank. Dominance: a site as good or better on every criterion and better on one dominates the other. Mean normalised rank: 0 when first everywhere, 1 when last everywhere, equal weights; the sensitivity test doubles each weight in turn.

2. Launch azimuths and mission planes

For each site, the bar shows every launch heading from 0° to 360°: green clear, amber admissible under conditions, red excluded by the rule set. Each mission plane gives one or two ground headings (triangles when admissible, grey dots when not).



Comparison

Sites	Latitude	Earth rotation, m/s	delta vs reference, m/s	Admissible	Mission planes
Kourou (CSG), French Guiana	5.17°	463.2	0.0	264°	1 / 1
Cape Canaveral SFS / KSC	28.50°	408.7	-54.5	141°	1 / 1
Vandenberg SFB	34.60°	382.8	-80.4	206°	1 / 1
Baikonur Cosmodrome	45.96°	323.3	-139.9	114°	1 / 1
Wallops Flight Facility	37.84°	367.3	-95.9	141°	1 / 1
Rocket Lab LC-1, Mahia, NZ	-39.26°	360.1	-103.1	309°	1 / 1

Mission — Example — 51.6° station orbit, 420 km

Plane	Kourou (CSG), French Guiana	Cape Canaveral SFS / KSC	Vandenberg SFB	Baikonur Cosmodrome	Wallops Flight Facility	Rocket Lab LC-1, Mahia, NZ
51.6°	N 36° OK · S 144° X	N 43° OK · S 137° X	N 47° X · S 133° OK	N 62° OK · S 118° X	N 50° OK · S 130° OK	N 52° OK · S 128° OK

Green: every heading of the plane admissible; amber: one heading only, or an inclination change needed (delta-i / delta-v); red: no admissible heading.

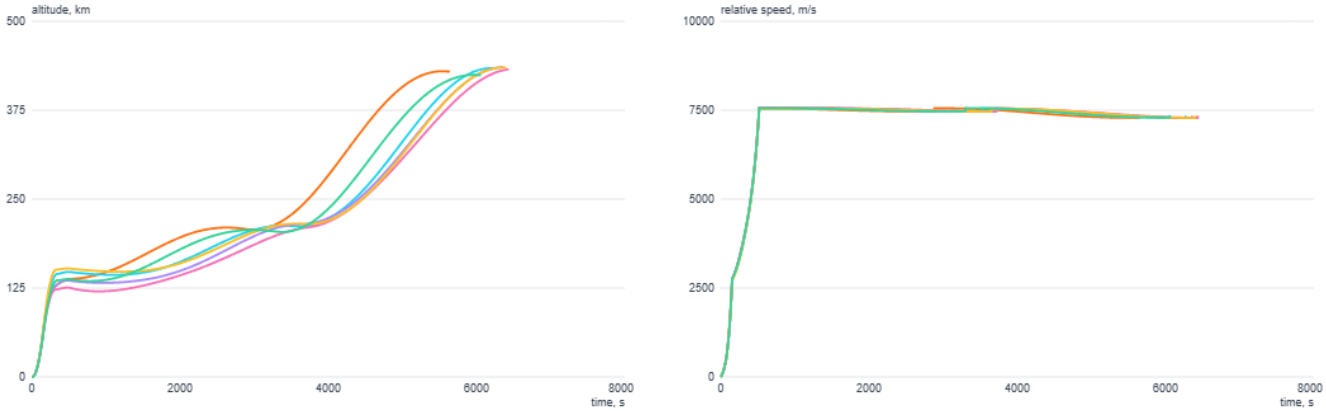
3. Launch performance

Vehicle: Example — two-stage medium launcher (illustrative)

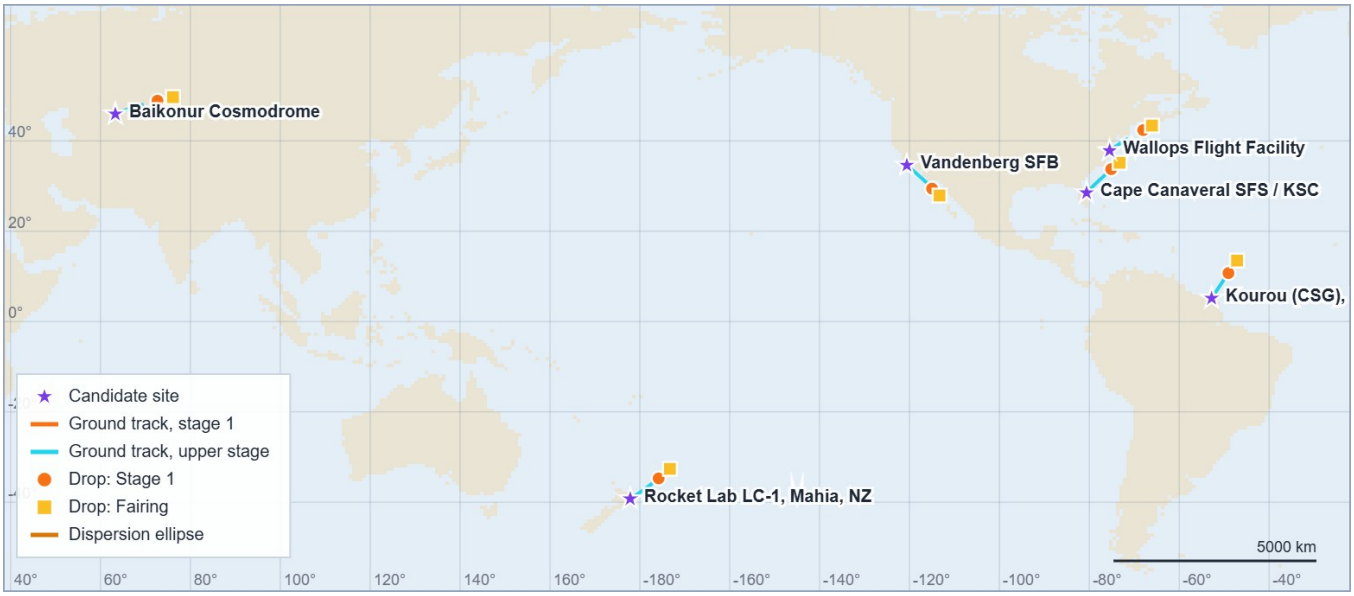


Sites	Plane	Heading	Payload	Orbit reached	Max Q · max g	Stage 1 impact: distance from the pad	Constraints · dispersions
Vandenberg SFB	51.6° / 420 km · parking 200 km · deorbit	S 128.3°	22 334 kg — optimal control of the ascent to the parking orbit, SQP on 12 parameters (+1.2 % vs gravity turn); later burns flown, 27 kg more than impulsive	420 × 425 km, i 51.59°	34.1 kPa / 5.00 g	781 km	—
Baikonur Cosmodrome	51.6° / 420 km · parking 200 km · deorbit	N 56.4°	22 474 kg — optimised guidance (+1.9 % vs gravity turn) — optimal control also run: 22 315 kg, less, so this result is kept	419 × 428 km, i 51.70°	34.1 kPa / 5.00 g	777 km	—
Cape Canaveral SFS / KSC	51.6° / 420 km · parking 200 km · deorbit	N 38.3°	22 408 kg — optimal control of the ascent to the parking orbit, SQP on 12 parameters (+1.7 % vs gravity turn); later burns flown, 4 kg more than impulsive	419 × 423 km, i 51.59°	34.1 kPa / 5.00 g	782 km	—
Kourou (CSG), French Guiana	51.6° / 420 km · parking 200 km · deorbit	N 35.0°	22 407 kg — optimised guidance (+1.7 % vs gravity turn) — optimal control also run: 22 389 kg, less, so this result is kept	419 × 426 km, i 51.69°	34.2 kPa / 5.00 g	742 km	200 dispersed flights at 21 287 kg: orbit reached 31 %; stage 1 391 × 17 km, 0.0 % on land; fairing 244 × 24 km, 0.0 % on land
Wallops Flight Facility	51.6° / 420 km · parking 200 km · deorbit	N 45.1°	22 220 kg — optimised guidance (+0.8 % vs gravity turn) — optimal control also run: 22 044 kg, less, so this result is kept	420 × 428 km, i 51.67°	34.1 kPa / 5.00 g	813 km	—
Rocket Lab LC-1, Mahia, NZ	51.6° / 420 km · parking 200 km · deorbit	N 57.7°	22 169 kg — optimised guidance (+0.4 % vs gravity turn) — optimal control also run: 22 157 kg, less, so this result is kept	419 × 428 km, i 51.66°	34.2 kPa / 5.00 g	754 km	—

Altitude and speed profiles



4. Trajectories and drop zones

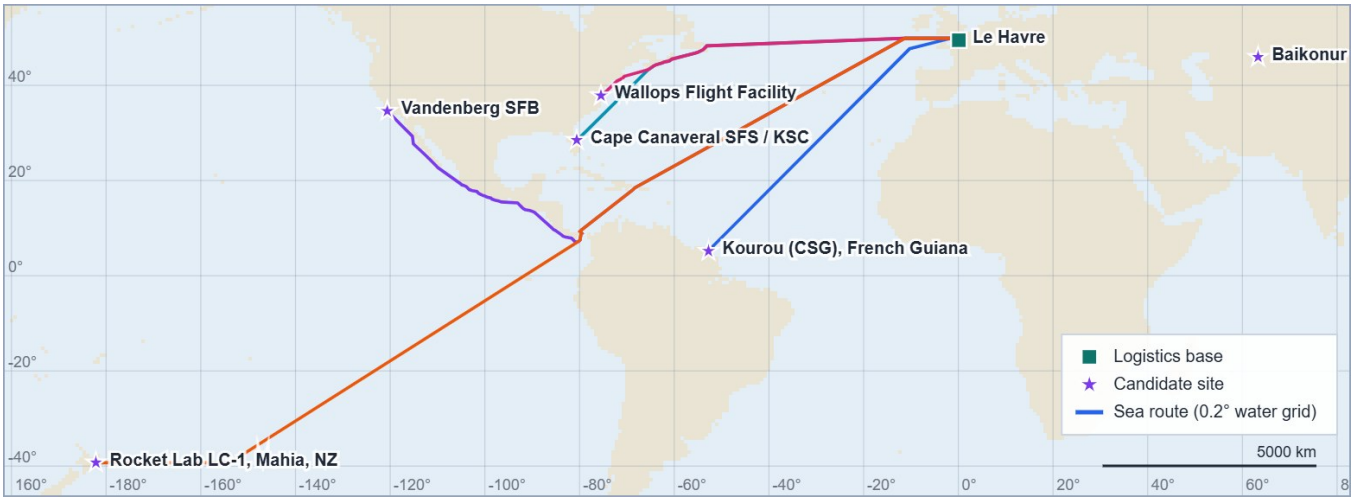


Ascent zone: ground tracks up to the last jettison, computed impact points of each jettisoned body (fall with drag) and, when computed, the Monte-Carlo dispersion ellipses.

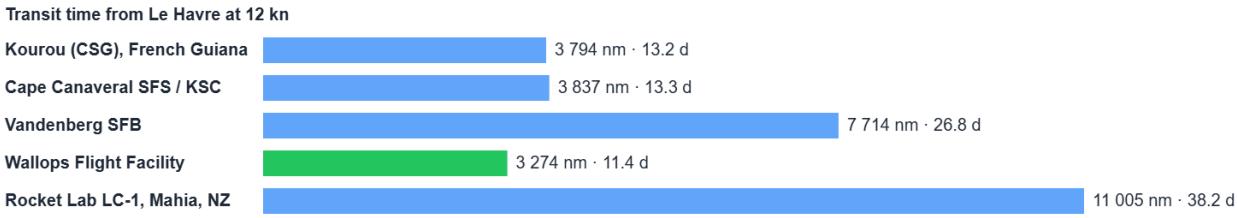
Screening of each trajectory

Trajectory	Heading	Land below 100 km	Drops: distance to land
Vandenberg SFB · 51.6° / 420 km · parking 200 km · deorbit	135° OK	6 km	Stage 1 X 6 km · Fairing 53 km
Baikonur Cosmodrome · 51.6° / 420 km · parking 200 km · deorbit	61° OK	250 km	Stage 1 > 100 km · Fairing > 100 km
Cape Canaveral SFS / KSC · 51.6° / 420 km · parking 200 km · deorbit	40° OK	0 km	Stage 1 160 km · Fairing 204 km
Kourou (CSG), French Guiana · 51.6° / 420 km · parking 200 km · deorbit	33° OK	4 km	Stage 1 > 100 km · Fairing > 100 km
Wallops Flight Facility · 51.6° / 420 km · parking 200 km · deorbit	48° OK	10 km	Stage 1 170 km · Fairing X 29 km
Rocket Lab LC-1, Mahia, NZ · 51.6° / 420 km · parking 200 km · deorbit	51° OK	5 km	Stage 1 > 100 km · Fairing > 100 km

5. Logistics and access



Sea routes from the logistics base(s), on SatView's water grid with the main straits opened — a planning estimate.



Sites	From Le Havre
Kourou (CSG), French Guiana	3794 nm (13.2 d) — great circle 3763 nm
Cape Canaveral SFS / KSC	3837 nm (13.3 d) — great circle 3779 nm
Vandenberg SFB	7714 nm (26.8 d) — great circle 4856 nm
Baikonur Cosmodrome	no sea route
Wallops Flight Facility	3274 nm (11.4 d) — great circle 3216 nm
Rocket Lab LC-1, Mahia, NZ	11005 nm (38.2 d) — great circle 10186 nm

Access infrastructure

Sites	Nearest aerodrome	Runway	Nearest port	Port data
Le Havre	Le Havre-Octeville Airport (LEH) — 6 km	2 300 m	PORT OF LE HAVRE — 1 km	large harbour (river tide gate), channel 14.0–15.2 m, cargo pier 15.5–16.8 m, vessels > 152 m, cranes fixed/mobile/floating, drydock, repairs: major
Kourou (CSG), French Guiana	Kourou Airport — 8 km	1 106 m	DEGRAD DES CANNES — 66 km	very small harbour (river natural), channel 3.4–4.6 m, cargo pier 4.9–6.1 m, vessels > 152 m, cranes mobile, repairs: limited
Cape Canaveral SFS / KSC	Cape Canaveral SFS Skid Strip — 5 km	3 048 m	CANAVERAL HARBOR — 22 km	very small harbour (coastal natural), channel 12.5–13.7 m, cargo pier 12.5–13.7 m, vessels > 152 m
Vandenberg SFB	Lompoc Airport (LPC) — 14 km	1 402 m	GAVIOTA — 40 km	very small harbour (open roadstead), channel 11.0–12.2 m, cargo pier 6.4–7.6 m
Baikonur Cosmodrome	Yubileyniy Airfield — 11 km	4 500 m	none in range	—
Wallops Flight Facility	Wallops Flight Facility Airport (WAL) — 11 km	2 666 m	SALISBURY — 59 km	very small harbour (river natural), channel 1.8–3.1 m, cargo pier 1.8–3.1 m, vessels <= 152 m, repairs: major
Rocket Lab LC-1,	Wairoa Airport (WIR) — 48 km	914 m	GISBORNE — 68 km	small harbour (river basin), channel 9.4–10.7 m,

Sites	Nearest aerodrome	Runway	Nearest port	Port data
Mahia, NZ				cargo pier 9.4–10.7 m, vessels <= 152 m, cranes mobile/floating, repairs: limited

Mobile platform

Position	Plane	Heading	From base by sea
WP1 — 47.50°N 4.50°W	51.6° / 420 km	S 114°	310 nm (1.1 d)

Base: Le Havre.

6. Weather availability

Share of the time, month by month, when every threshold is met (ERA5 hourly reanalysis). A sun marks months at 70 % or more; otherwise the pictogram shows the criterion that blocks most often.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Σ
Kourou (CSG), French Guiana	62%	61%	69%	58%	46%	54%	68%	79%	90%	86%	76%	63%	**68%**
Cape Canaveral SFS / KSC	95%	93%	95%	93%	92%	85%	86%	83%	80%	91%	94%	95%	**90%**
Vandenberg SFB	91%	89%	88%	96%	98%	99%	100%	100%	99%	99%	95%	91%	**95%**
Baikonur Cosmodrome	98%	97%	97%	97%	98%	99%	99%	99%	99%	99%	97%	98%	**98%**
Wallops Flight Facility	91%	88%	91%	92%	91%	93%	88%	92%	92%	93%	95%	92%	**91%**
Rocket Lab LC-1, Mahia, NZ	86%	87%	86%	89%	83%	85%	82%	84%	83%	87%	87%	86%	**85%**

≥ 70 % · wind · gusts · rain · cloud cover · waves



Launch window length

Sites	1 h window	3 h window	6 h window
Kourou (CSG), French Guiana	81 %	68 %	55 %
Cape Canaveral SFS / KSC	95 %	90 %	84 %
Vandenberg SFB	97 %	95 %	94 %
Baikonur Cosmodrome	99 %	98 %	97 %
Wallops Flight Facility	95 %	91 %	87 %
Rocket Lab LC-1, Mahia, NZ	90 %	85 %	81 %

ERA5 reanalysis via Open-Meteo: atmosphere on a 0.25° grid (~28 km), waves on a 0.5° grid (~55 km). Sites closer than a cell share the same series; differences of a few points between nearby sites are not significant.

- Kourou (CSG), French Guiana: best Sep (90 %), worst May (46 %), most frequent blocker rain.
- Cape Canaveral SFS / KSC: best Mar (95 %), worst Sep (80 %), most frequent blocker rain.
- Vandenberg SFB: best Jul (100 %), worst Mar (88 %), most frequent blocker rain.
- Baikonur Cosmodrome: best Jun (99 %), worst Mar (97 %), most frequent blocker rain.
- Wallops Flight Facility: best Nov (95 %), worst Feb (88 %), most frequent blocker rain.
- Rocket Lab LC-1, Mahia, NZ: best Apr (89 %), worst Jul (82 %), most frequent blocker rain.

7. Launch windows

Lift-off times for a direct ascent into each plane of the mission, by admissible heading, from what fixes the plane in space: nothing (free), a local time of the ascending node (same time every day) or a node right ascension at a date (times drift with the J2 precession).

Plane	Plane fixed by	Value	Tolerance +/- °	Lead (min)
51.6°	nothing (free)	—	—	0

Lift-off times

Plane	Kourou (CSG), French Guiana	Cape Canaveral SFS / KSC	Vandenberg SFB	Baikonur Cosmodrome	Wallops Flight Facility	Rocket Lab LC-1, Mahia, NZ
51.6°	any time (N)	any time (N)	any time (S)	any time (N)	any time (N / S)	any time (N / S)

Days with a lift-off opportunity in good weather

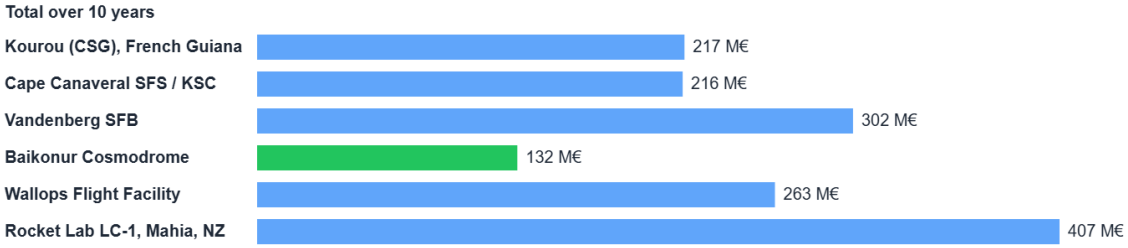
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Σ
Kourou (CSG), French Guiana · 51.6°	98%	98%	98%	99%	95%	100%	100%	100%	100%	100%	100%	99%	**99%**
Cape Canaveral SFS / KSC · 51.6°	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%	100%	**100%**
Vandenberg SFB · 51.6°	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	99%	**100%**
Baikonur Cosmodrome · 51.6°	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	**100%**
Wallops Flight Facility · 51.6°	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	**100%**
Rocket Lab LC-1, Mahia, NZ · 51.6°	99%	99%	98%	99%	97%	98%	99%	97%	99%	100%	99%	98%	**98%**

≥ 70 % · wind · gusts · rain · cloud cover · waves

Direct ascent, first order: the site is in the plane at lift-off minus the lead (checked on Sentinel-2A, Kourou, and Landsat 9, Vandenberg, within 6 and 13 minutes of the times flown). Local time = mean solar time; J2 precession only; in-plane phasing for a rendezvous is not modelled. Window = time for the Earth to sweep +/- the plane tolerance. Weather: a day counts when the hours of the launch window before an opportunity, and the hour after, meet every threshold (ERA5).

8. Programme cost

A parametric programme cost per site from the study's own figures (sea route, water depth, weather, payload) and your unit costs. Undiscounted, for comparing sites — not a budget. Example unit costs (round numbers, not market data): enter your own.



Sites	Investment	Transport / flight	Campaign / flight	Weather standby / flight	Payload shortfall / year	Total over 10 years
Kourou (CSG), French Guiana	0 €	1.1 M€ (13.2 d)	2.2 M€	29 k€ (0.5 d)	2.0 M€	217 M€
Cape Canaveral SFS / KSC	0 €	1.1 M€ (13.3 d)	2.2 M€	7 k€ (0.1 d)	2.0 M€	216 M€
Vandenberg SFB	0 €	2.1 M€ (26.8 d)	2.2 M€	3 k€ (0.0 d)	4.2 M€	302 M€
Baikonur Cosmodrome	0 €	—	2.2 M€	1 k€ (0.0 d)	0 €	132 M€
Wallops Flight Facility	0 €	909 k€ (11.4 d)	2.2 M€	6 k€ (0.1 d)	7.6 M€	263 M€
Rocket Lab LC-1, Mahia, NZ	0 €	3.1 M€ (38.2 d)	2.2 M€	10 k€ (0.2 d)	9.1 M€	407 M€

Unit costs

Years 10 · Flights per year 6 · Fixed site 150 M€ · Mobile platform 80.0 M€ · Reference site (existing pad) 0 € · Island area at sea (m²) 200 000 · Height above sea (m) 5 · Fill per m³ 20 € · Vessel day rate 40 k€ (round trip) · Campaign days 20 · Campaign cost per day (also weather standby) 60 k€ · Range fee 1.0 M€ · Payload value per kg 5 k€

Investment = base per site kind + reclamation for a fixed site at sea (area × (GEBCO depth + height) × fill cost). Per flight = transport from the nearest base (transit days at the Logistics speed × vessel day rate, round trip) + campaign (days × daily cost) + expected weather standby ((1 - p) / p days at the daily cost, p = share of days with a good-weather lift-off opportunity) + range fee. Payload shortfall = (best site - this site) × value per kg × flights per year, when payloads are comparable. Total undiscounted over the programme. The ranking uses the total without the payload shortfall (payload is its own criterion), with a +/-30 % one-sigma uncertainty in the robustness draws.

9. Environment, population and hazards

Sites	Population within 10 / 50 / 100 km	Nearest city of 100 000+	Seismic hazard (GSHAP PGA, 475 yr)	Nearest reef
Kourou (CSG), French Guiana	1 633 / 47 307 / 189 459 (GHSL 2025)	Paramaribo (223 757) — 276 km	0.6 % g (Low)	3096 km — coarse, not ranked
Cape Canaveral SFS / KSC	2 884 / 503 944 / 3 702 385 (GHSL 2025)	Palm Bay (119 760) — 52 km	1.1 % g (Low)	260 km — coarse, not ranked
Vandenberg SFB	126 / 265 748 / 676 916 (GHSL 2025)	Santa Maria (105 093) — 42 km	23.8 % g (Moderate)	3542 km — coarse, not ranked
Baikonur Cosmodrome	10 275 / 70 402 / 181 287 (GHSL 2025)	Kyzylorda (354 800) — 212 km	0.1 % g (Low)	2362 km — coarse, not ranked
Wallops Flight Facility	4 871 / 73 940 / 520 606 (GHSL 2025)	East Hampton (147 993) — 116 km	1.7 % g (Low)	1203 km — coarse, not ranked
Rocket Lab LC-1, Mahia, NZ	22 / 6 180 / 181 113 (GHSL 2025)	Tauranga (161 000) — 229 km	44.8 % g (Very high)	1914 km — coarse, not ranked

Population impact and protected areas

Sites	Population within 10 / 50 / 100 km	Population impact: expected casualties (Ec)	Protected areas (OpenStreetMap)
Kourou (CSG), French Guiana	1 633 / 47 307 / 189 459 (GHSL 2025)	8.6e-6 per flight (drops 0 · failure 8.6e-6)	site: Estuaire du fleuve Sinnamary, 21 km · drops: none within 30 km · 1 within 50 km
Cape Canaveral SFS / KSC	2 884 / 503 944 / 3 702 385 (GHSL 2025)	5.6e-5 per flight (drops 0 · failure 5.6e-5)	site: Pine Island Conservation Area, 11 km · drops: none within 30 km · 18 within 50 km
Vandenberg SFB	126 / 265 748 / 676 916 (GHSL 2025)	2.3e-4 per flight (drops 7.3e-6 · failure 2.3e-4) — above 1e-4	site: U.S. Space Force, 5 km · drops: Costa Savalje Wildlands, 5 km (Stage 1) · 9 within 50 km
Baikonur Cosmodrome	10 275 / 70 402 / 181 287 (GHSL 2025)	1.6e-3 per flight (drops 3.1e-4 · failure 1.3e-3) — above 1e-4	site: none within 60 km · drops: none within 30 km · 0 within 50 km
Wallops Flight Facility	4 871 / 73 940 / 520 606 (GHSL 2025)	6.4e-4 per flight (drops 3.0e-5 · failure 6.1e-4) — above 1e-4	site: Guard Shore, 16 km · drops: none within 30 km · 49 within 50 km
Rocket Lab LC-1, Mahia, NZ	22 / 6 180 / 181 113 (GHSL 2025)	2.5e-7 per flight (drops 0 · failure 2.5e-7)	site: Opoutama Sections Conservation Area, 22 km · drops: none within 30 km · 1 within 50 km

Ec = sum of probability of impact × population density × casualty area, per flight: planned drops (Monte-Carlo impact points when computed, else a Gaussian of 3 % of the range) plus a launch failure of probability 0.03 spread over the powered flight, its debris (casualty area 5000 m²) falling around the instantaneous impact point. Casualty areas: stage 1 300 m², upper stage 200 m², each booster 150 m², fairing 100 m². Reference: 1e-4 per flight for the public (FAA 14 CFR 450.101). Population: JRC GHSL 2025, CC BY 4.0, 0.05° cells. Protected areas: OpenStreetMap contributors (ODbL), searched within 60 km of the site and 30 km of each drop. A planning estimate, not a flight-safety analysis.

Shipping, airspace, cyclones and tsunamis

Sites	Shipping lanes (Major / Middle)	Vessel traffic near the site (GFW)	Airspace crossed (OpenAIP) · FIR	Tropical cyclones (IBTrACS)	Tsunami runups (NOAA NCEI)
Kourou (CSG), French Guiana	drops 401 km (Fairing) · site >= 1 500 km from a major lane (97 km from any lane)	7 025 h of vessel presence (90 days, 50 km)	unavailable	0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026	no runup recorded within 100 km
Cape Canaveral SFS / KSC	drops 18 km (Fairing) · site 74 km from a major lane	135 187 h of vessel presence (90 days, 50 km)	unavailable	6.6 per decade >= 34 kt (1.7 >= 64 kt), within 150 km, 1980–2026	3 runups within 100 km, highest 0.2 m (2004)
Vandenberg SFB	drops 141 km (Stage 1) · site 40 km from a major lane	14 740 h of vessel presence (90 days, 50 km)	unavailable	0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026	92 runups within 100 km, highest 3.4 m (1812)
Baikonur Cosmodrome	drops >= 1 500 km (Stage 1) · site >= 1 500 km from a major lane	0 h of vessel presence (90 days,	unavailable	0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150	no runup recorded within 100 km

Sites	Shipping lanes (Major / Middle)	Vessel traffic near the site (GFW)	Airspace crossed (OpenAIP) · FIR	Tropical cyclones (IBTrACS)	Tsunami runups (NOAA NCEI)
		50 km)		km, 1980–2026	
Wallops Flight Facility	drops 126 km (Fairing) · site 57 km from a major lane	14 878 h of vessel presence (90 days, 50 km)	unavailable	6.4 per decade >= 34 kt (1.3 >= 64 kt), within 150 km, 1980–2026	1 runups within 100 km, highest 0.3 m (1929)
Rocket Lab LC-1, Mahia, NZ	drops 819 km (Stage 1) · site >= 1 500 km from a major lane (381 km from any lane)	3 587 h of vessel presence (90 days, 50 km)	unavailable	1.1 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026	42 runups within 100 km, highest 15.0 m (1931)

Shipping lanes: global lane centre-lines (CIA map of the world's oceans, 2012, digitised by the open Shipping-Lanes project) — a structural signal, not live traffic. Vessel traffic: Global Fishing Watch vessel presence over the last 90 days within 50 km (all vessel types). Airspace: OpenAIP CTR, TMA, ATZ and airways containing a trajectory point below 20 km, and the FIR / UIR of the site. Cyclones: NOAA IBTrACS v04r01 storms of 34 kt or more whose track passed within 150 km (1° grid), since 1980. Tsunamis: NOAA NCEI runups within 100 km, probable or definite events — no record does not mean no risk.

Drop points and sensitive features

Drop point	Reefs (Natural Earth)
Vandenberg SFB · 51.6° / 420 km · parking 200 km · deorbit — Stage 1	2934 km
Vandenberg SFB · 51.6° / 420 km · parking 200 km · deorbit — Fairing	2747 km
Baikonur Cosmodrome · 51.6° / 420 km · parking 200 km · deorbit — Stage 1	2955 km
Baikonur Cosmodrome · 51.6° / 420 km · parking 200 km · deorbit — Fairing	3153 km
Cape Canaveral SFS / KSC · 51.6° / 420 km · parking 200 km · deorbit — Stage 1	779 km
Cape Canaveral SFS / KSC · 51.6° / 420 km · parking 200 km · deorbit — Fairing	986 km
Kourou (CSG), French Guiana · 51.6° / 420 km · parking 200 km · deorbit — Stage 1	3243 km
Kourou (CSG), French Guiana · 51.6° / 420 km · parking 200 km · deorbit — Fairing	3315 km
Wallops Flight Facility · 51.6° / 420 km · parking 200 km · deorbit — Stage 1	1877 km
Wallops Flight Facility · 51.6° / 420 km · parking 200 km · deorbit — Fairing	2040 km
Rocket Lab LC-1, Mahia, NZ · 51.6° / 420 km · parking 200 km · deorbit — Stage 1	1507 km
Rocket Lab LC-1, Mahia, NZ · 51.6° / 420 km · parking 200 km · deorbit — Fairing	1284 km

Population: GeoNames places of 1 000+ inhabitants at their centre point (a lower bound). Seismic hazard: GSHAP 1999 PGA with a 10 % chance of exceedance in 50 years, no value at sea. Tsunami, volcanoes and storm climate: SatView's Natural Hazards and Weather & Climate windows.

10. Open points

Not assessed by this study, yet decisive for a site's feasibility: to settle before any choice.

- Launching-state responsibility and liability (Outer Space Treaty, 1972 Liability Convention, 1975 Registration Convention): which state launches, licences and registers.
- Notices to mariners (NAVAREA warnings) and to airmen (NOTAM) for every campaign; the flight information region (FIR) crossed and its air-traffic constraints.
- Export control of launcher data and hardware (MTCR, national regimes such as ITAR / EAR or EU dual-use rules).

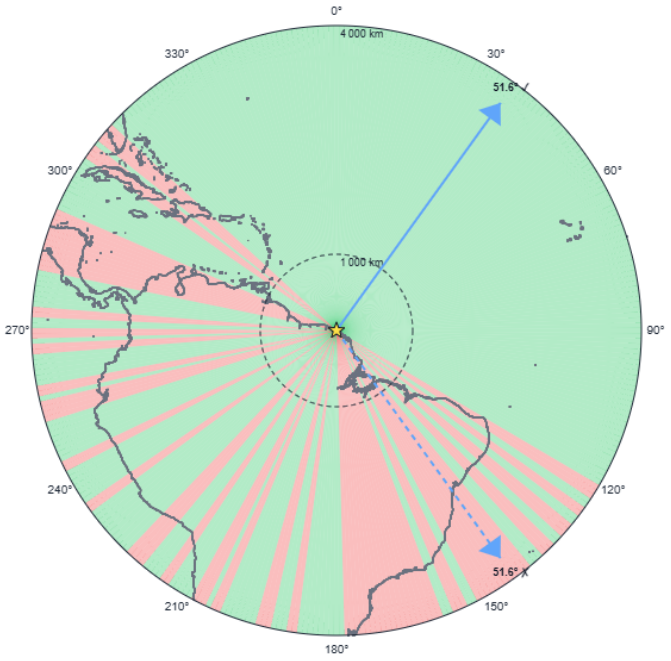
11. Criteria — Example — six macro-criteria

Criterion	Kourou (CSG), French Guiana	Cape Canaveral SFS / KSC	Vandenberg SFB	Baikonur Cosmodrome	Wallops Flight Facility	Rocket Lab LC-1, Mahia, NZ
Sovereignty and access rights						
Launch without another state's discretionary approval						
Flag, launching-state and liability obligations						
CAPEX						
Platform or pad foundations						
Vessels, port and base infrastructure	3794 nm (13.2 d) from le havre · Kourou Airport 8 km, 1106 m · DEGRAD DES CANNES 66 km	3837 nm (13.3 d) from le havre · Cape Canaveral SFS Skid Strip 5 km, 3048 m · CANAVERAL HARBOR 22 km	7714 nm (26.8 d) from le havre · Lompoc Airport 14 km, 1402 m · GAVIOTA 40 km	Yubileyniy Airfield 11 km, 4500 m	3274 nm (11.4 d) from le havre · Wallops Flight Facility Airport 11 km, 2666 m · SALISBURY 59 km	11005 nm (38.2 d) from le havre · Wairoa Airport 48 km, 914 m · GISBORNE 68 km
Propellants, cryogenics, range and protection systems						
Operational flexibility						
Orbit and inclination access	Admissible 264° · Mission planes: 1 / 1	Admissible 141° · Mission planes: 1 / 1	Admissible 206° · Mission planes: 1 / 1	Admissible 114° · Mission planes: 1 / 1	Admissible 141° · Mission planes: 1 / 1	Admissible 309° · Mission planes: 1 / 1
Launch performance	22407 kg -> 51.6° / 420 km · parking 200 km · deorbit	22408 kg -> 51.6° / 420 km · parking 200 km · deorbit	22334 kg -> 51.6° / 420 km · parking 200 km · deorbit	22474 kg -> 51.6° / 420 km · parking 200 km · deorbit	22220 kg -> 51.6° / 420 km · parking 200 km · deorbit	22169 kg -> 51.6° / 420 km · parking 200 km · deorbit
Annual availability (weather, sea state)	68 % of the time within thresholds; worst May (46 %)	90 % of the time within thresholds; worst Sep (80 %)	95 % of the time within thresholds; worst Mar (88 %)	98 % of the time within thresholds; worst Mar (97 %)	91 % of the time within thresholds; worst Feb (88 %)	85 % of the time within thresholds; worst Jul (82 %)
Campaign duration and transit	3794 nm (13.2 d) from le havre · Kourou Airport 8 km, 1106 m · DEGRAD DES CANNES 66 km	3837 nm (13.3 d) from le havre · Cape Canaveral SFS Skid Strip 5 km, 3048 m · CANAVERAL HARBOR 22 km	7714 nm (26.8 d) from le havre · Lompoc Airport 14 km, 1402 m · GAVIOTA 40 km	Yubileyniy Airfield 11 km, 4500 m	3274 nm (11.4 d) from le havre · Wallops Flight Facility Airport 11 km, 2666 m · SALISBURY 59 km	11005 nm (38.2 d) from le havre · Wairoa Airport 48 km, 914 m · GISBORNE 68 km
Cadence, relocation, contingencies						
OPEX						
Marine campaign days, crews, upkeep						
Propellant losses, security, licences, cost per mission						

Criterion	Kourou (CSG), French Guiana	Cape Canaveral SFS / KSC	Vandenberg SFB	Baikonur Cosmodrome	Wallops Flight Facility	Rocket Lab LC-1, Mahia, NZ
Site security						
Threat exposure, surveillance, exclusion enforcement						
Supply-line resilience, response and evacuation						
Environment						
Reefs, protected habitats and drop zones	Reefs (Natural Earth): 3096 km	Reefs (Natural Earth): 260 km	Reefs (Natural Earth): 3542 km	Reefs (Natural Earth): 2362 km	Reefs (Natural Earth): 1203 km	Reefs (Natural Earth): 1914 km
Dredging, piling, noise, lighting, spills						
Fisheries and local communities						

Assessments entered by the user; no weights and no overall score.

Kourou (CSG), French Guiana — 5.1700°, -52.7700°



Key figures

Payload, same target
22 407 kg -> 51.6° / 420 km · parking 200 km · deorbit

Programme cost
217 M€ over 10 years (investment 0 €, 3.3 M€ per flight, payload shortfall 2.0 M€/yr)

Expected casualties per flight (Ec)
8.6e-6 per flight (drops 0 · failure 8.6e-6)

Distance to protected areas
site: Estuaire du fleuve Sinnamary, 21 km · drops: none within 30 km · 1 within 50 km

Admissible azimuths
264° of 360°

Mission planes
1 / 1 planes · 1 / 2 headings

Drops: distance to land
>= 300 km (Stage 1)

Water depth at the site
land pad

Weather availability (year)
68 % (3-h window) — worst May 46 % · 1 h 81 % · 6 h 55 %

Days with a good-weather lift-off opportunity
no timing constraint (planes free), good weather 99 % of days

Sea route from the base
3 794 nm, 13.2 d from Le Havre @ 12 kn

Aerodrome for heavy cargo
Cayenne – Félix Eboué Airport — 60 km, runway 3 196 m (nearest: Kourou Airport, 8 km, 1 106 m)

Port for heavy cargo
DEGRAD DES CANNES — 66 km, channel 3.4–4.6 m, vessels > 152 m

Population within 100 km
1 633 / 47 307 / 189 459 (GHSL 2025)

Drops: distance to a shipping lane
drops 401 km (Fairing) · site >= 1 500 km from a major lane (97 km from any lane)

Airspaces crossed at low altitude
unavailable

Tropical cyclones per decade
0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026

Highest tsunami runup within 100 km
no runup recorded within 100 km

Distance to sensitive features
no layer loaded (e.g. Allen Coral Atlas)

Standing: 1 of 6 · non-dominated · first on: Drops: distance to land, Population within 100 km, Distance to the nearest city of 100 000+, Seismic hazard, Tropical cyclones per decade, Highest tsunami runup within 100 km

Weather availability by month

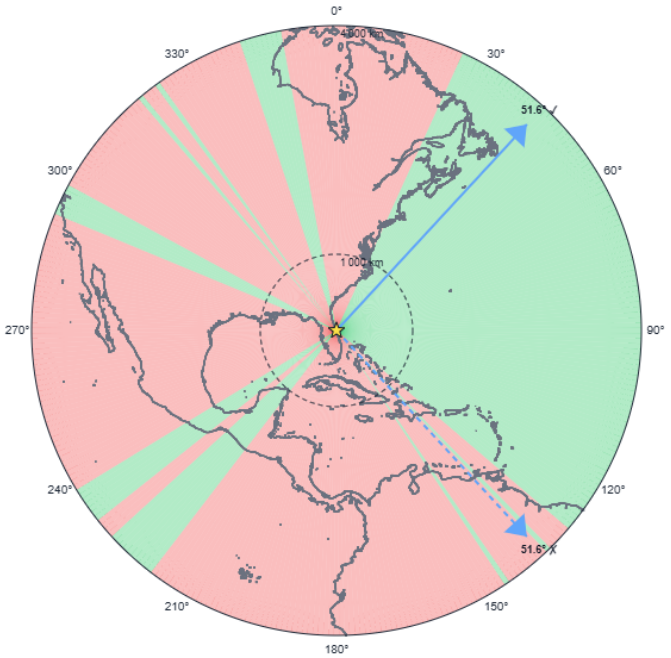
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
62%	61%	69%	58%	46%	54%	68%	79%	90%	86%	76%	63%

Admissible (264°)

124–125° (i 34–35°) · 128–129° (i 38–39°) · 133–134° (i 43–44°) · 138–140° (i 48–50°) · 153–154° (i 63–64°) · 158–159° (i 68–69°) · 179–187° (i 89–97°) · 190–192° (i 100–102°) · 196–202° (i 106–112°) · 205–205° (i 115–115°) · 209–213° (i 119–123°) · 216–219° (i 126–129°) · 224–233° (i 134–143°) · 236–242° (i 146–152°) · 245–252° (i 155–161°) · 257–257° (i 166–166°) · 260–265° (i 169–173°) · 268–268° (i 174–174°) · 271–272° (i 174–175°) · 275–281° (i 168–173°) · 294–304° (i 146–155°) · 308–308° (i 142–142°) · 313–120° (i 5–137°)

- Paramaribo (223 757 inh.) — phase 1, from 276 km: 10° excluded
- Macapa (512 902 inh.) — phase 1, from 601 km: 4° excluded
- Manaus (2 219 580 inh.) — phase 2, from 1223 km: 4° excluded
- Fortaleza (2 400 000 inh.) — phase 2, from 1864 km: 3° excluded
- Maceio (1 031 597 inh.) — phase 2, from 2507 km: 3° excluded
- Braganca (132 489 inh.) — phase 1, from 961 km: 3° excluded

Cape Canaveral SFS / KSC — 28.5000°, -80.6000°



Key figures

Payload, same target
22 408 kg -> 51.6° / 420 km · parking 200 km · deorbit

Programme cost
216 M€ over 10 years (investment 0 €, 3.3 M€ per flight, payload shortfall 2.0 M€/yr)

Expected casualties per flight (Ec)
5.6e-5 per flight (drops 0 · failure 5.6e-5)

Distance to protected areas
site: Pine Island Conservation Area, 11 km · drops: none within 30 km · 18 within 50 km

Admissible azimuths
141° of 360°

Mission planes
1 / 1 planes · 1 / 2 headings

Drops: distance to land
160 km (Stage 1)

Water depth at the site
land pad

Weather availability (year)
90 % (3-h window) — worst Sep 80 % · 1 h 95 % · 6 h 84 %

Days with a good-weather lift-off opportunity
no timing constraint (planes free), good weather 100 % of days

Sea route from the base
3 837 nm, 13.3 d from Le Havre @ 12 kn

Aerodrome for heavy cargo
Cape Canaveral SFS Skid Strip — 5 km, runway 3 048 m

Port for heavy cargo
CANAVERAL HARBOR — 22 km, channel 12.5–13.7 m, vessels > 152 m

Population within 100 km
2 884 / 503 944 / 3 702 385 (GHSL 2025)

Drops: distance to a shipping lane
drops 18 km (Fairing) · site 74 km from a major lane

Airspaces crossed at low altitude
unavailable

Tropical cyclones per decade
6.6 per decade >= 34 kt (1.7 >= 64 kt), within 150 km, 1980–2026

Highest tsunami runup within 100 km
3 runups within 100 km, highest 0.2 m (2004)

Distance to sensitive features
no layer loaded (e.g. Allen Coral Atlas)

Standing: 5 of 6 · non-dominated · first on: Aerodrome for heavy cargo, Port for heavy cargo, Seismic hazard, Highest tsunami runup within 100 km

Weather availability by month

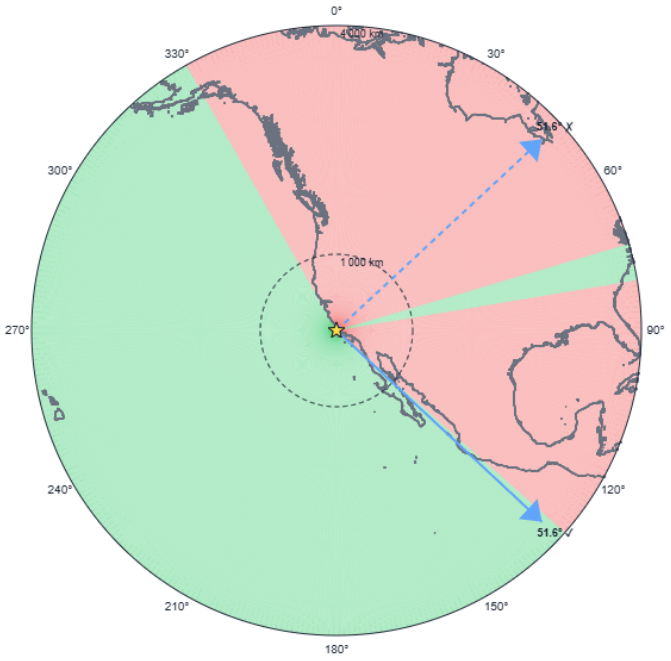
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
95%	93%	95%	93%	92%	85%	86%	83%	80%	91%	94%	95%

Admissible (141°)

25–130° (i 29–68°) · 136–136° (i 52–52°) · 146–146° (i 61–61°) · 218–227° (i 123–130°) · 232–238° (i 134–138°) · 293–298° (i 141–144°) · 320–320° (i 124–124°) · 324–324° (i 121–121°) · 342–349° (i 100–106°)

- Palm Bay (119 760 inh.) — phase 1, from 52 km: 58° excluded
- Orlando (334 854 inh.) — phase 1, from 76 km: 38° excluded
- Lakeland (104 401 inh.) — phase 1, from 142 km: 16° excluded
- Gainesville (145 214 inh.) — phase 1, from 211 km: 14° excluded
- Jacksonville (1 009 833 inh.) — phase 1, from 228 km: 12° excluded
- Cape Coral (175 229 inh.) — phase 1, from 253 km: 10° excluded

Vandenberg SFB — 34.6000°, -120.6000°



Key figures

Payload, same target
22 334 kg -> 51.6° / 420 km · parking 200 km · deorbit

Programme cost
302 M€ over 10 years (investment 0 €, 4.3 M€ per flight, payload shortfall 4.2 M€/yr)

Expected casualties per flight (Ec)
2.3e-4 per flight (drops 7.3e-6 · failure 2.3e-4) — above 1e-4

Distance to protected areas
site: U.S. Space Force, 5 km · drops: Costa Savalje Wildlands, 5 km (Stage 1) · 9 within 50 km

Admissible azimuths
206° of 360°

Mission planes
1 / 1 planes · 1 / 2 headings

Drops: distance to land
6 km (Stage 1)

Water depth at the site
land pad

Weather availability (year)
95 % (3-h window) — worst Mar 88 % · 1 h 97 % · 6 h 94 %

Days with a good-weather lift-off opportunity
no timing constraint (planes free), good weather 100 % of days

Sea route from the base
7 714 nm, 26.8 d from Le Havre @ 12 kn

Aerodrome for heavy cargo
Vandenberg Space Force Base — 15 km, runway 4 572 m (nearest: Lompoc Airport, 14 km, 1 402 m)

Port for heavy cargo
GAVIOTA — 40 km, channel 11.0–12.2 m

Population within 100 km
126 / 265 748 / 676 916 (GHSL 2025)

Drops: distance to a shipping lane
drops 141 km (Stage 1) · site 40 km from a major lane

Airspaces crossed at low altitude
unavailable

Tropical cyclones per decade
0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026

Highest tsunami runup within 100 km
92 runups within 100 km, highest 3.4 m (1812)

Distance to sensitive features
no layer loaded (e.g. Allen Coral Atlas)

Standing: 6 of 6 · non-dominated · first on: Weather availability (year), Aerodrome for heavy cargo, Tropical cyclones per decade

Weather availability by month

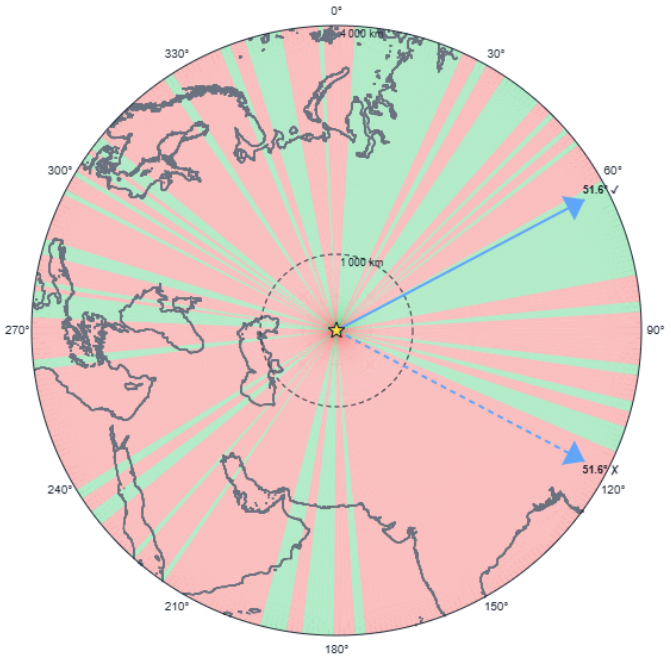
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
91%	89%	88%	96%	98%	99%	100%	100%	99%	99%	95%	91%

Admissible (206°)

74–80° (i 36–38°) · 132–330° (i 52–145°)

- Santa Maria (105 093 inh.) — phase 1, from 42 km: 73° excluded
- Oxnard (207 254 inh.) — phase 1, from 138 km: 20° excluded
- Salinas (157 380 inh.) — phase 1, from 250 km: 11° excluded
- Bakersfield (373 640 inh.) — phase 1, from 168 km: 10° excluded
- Lancaster (161 103 inh.) — phase 1, from 226 km: 7° excluded
- Enterprise (108 481 inh.) — phase 1, from 511 km: 6° excluded

Baikonur Cosmodrome — 45.9600°, 63.3000°



Key figures

Payload, same target
22 474 kg -> 51.6° / 420 km · parking 200 km · deorbit

Programme cost
132 M€ over 10 years (investment 0 €, 2.2 M€ per flight) — without sea route

Expected casualties per flight (Ec)
1.6e-3 per flight (drops 3.1e-4 · failure 1.3e-3) — above 1e-4

Distance to protected areas
site: none within 60 km · drops: none within 30 km · 0 within 50 km

Admissible azimuths
114° of 360°

Mission planes
1 / 1 planes · 1 / 2 headings

Drops: distance to land
on land (Stage 1)

Water depth at the site
land pad

Weather availability (year)
98 % (3-h window) — worst Mar 97 % · 1 h 99 % · 6 h 97 %

Days with a good-weather lift-off opportunity
no timing constraint (planes free), good weather 100 % of days

Sea route from the base
…

Aerodrome for heavy cargo
Yubileyniy Airfield — 11 km, runway 4 500 m

Port for heavy cargo
none for heavy cargo in range

Population within 100 km
10 275 / 70 402 / 181 287 (GHSL 2025)

Drops: distance to a shipping lane
drops >= 1 500 km (Stage 1) · site >= 1 500 km from a major lane

Airspaces crossed at low altitude
unavailable

Tropical cyclones per decade
0.0 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026

Highest tsunami runup within 100 km
no runup recorded within 100 km

Distance to sensitive features
no layer loaded (e.g. Allen Coral Atlas)

Standing: 2 of 6 · non-dominated · first on: Programme cost, Distance to protected areas, Weather availability (year), Aerodrome for heavy cargo, Population within 100 km, Seismic hazard, Drops: distance to a shipping lane, Vessel traffic near the site, Tropical cyclones per decade, Highest tsunami runup within 100 km

Weather availability by month

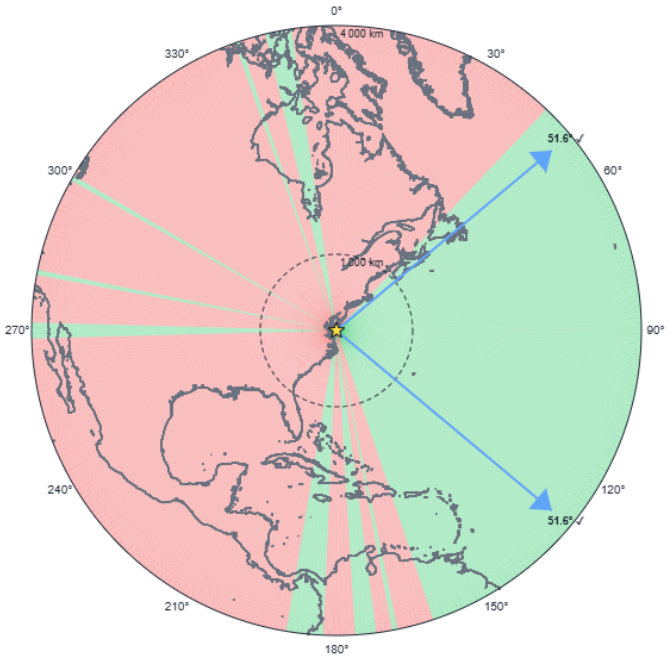
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
98%	97%	97%	97%	98%	99%	99%	99%	99%	99%	97%	98%

Admissible (114°)

4–24° (i 74–87°) · 28–29° (i 70–71°) · 34–41° (i 63–67°) · 45–45° (i 61–61°) · 49–49° (i 58–58°) · 52–52° (i 57–57°) · 61–79° (i 47–53°) · 85–86° (i 46–46°) · 97–98° (i 46–46°) · 104–105° (i 48–48°) · 109–113° (i 49–50°) · 175–176° (i 87–87°) · 181–186° (i 91–94°) · 190–194° (i 97–100°) · 215–215° (i 113–113°) · 222–222° (i 118–118°) · 231–233° (i 123–124°) · 237–238° (i 126–126°) · 263–264° (i 134–134°) · 273–277° (i 134–134°) · 279–279° (i 133–133°) · 285–287° (i 132–132°) · 297–297° (i 128–128°) · 301–301° (i 127–127°) · 304–305° (i 125–125°) · 307–309° (i 123–124°) · 326–327° (i 112–113°) · 338–339° (i 104–105°) · 343–349° (i 98–102°) · 357–357° (i 92–92°)

- Kyzylorda (354 800 inh.) — phase 1, from 212 km: 14° excluded
- Zhezqazghan (104 357 inh.) — phase 1, from 392 km: 7° excluded
- Urganch (145 000 inh.) — phase 1, from 535 km: 6° excluded
- Dasoguz (201 142 inh.) — phase 1, from 531 km: 6° excluded
- Nukus (332 500 inh.) — phase 1, from 488 km: 6° excluded
- Chelyabinsk (1 202 371 inh.) — phase 2, from 1032 km: 6° excluded

Wallops Flight Facility — 37.8400°, -75.4900°



Key figures

Payload, same target
22 220 kg -> 51.6° / 420 km · parking 200 km · deorbit

Programme cost
263 M€ over 10 years (investment 0 €, 3.1 M€ per flight, payload shortfall 7.6 M€/yr)

Expected casualties per flight (Ec)
6.4e-4 per flight (drops 3.0e-5 · failure 6.1e-4) — above 1e-4

Distance to protected areas
site: Guard Shore, 16 km · drops: none within 30 km · 49 within 50 km

Admissible azimuths
141° of 360°

Mission planes
1 / 1 planes · 2 / 2 headings

Drops: distance to land
29 km (Fairing)

Water depth at the site
land pad

Weather availability (year)
91 % (3-h window) — worst Feb 88 % · 1 h 95 % · 6 h 87 %

Days with a good-weather lift-off opportunity
no timing constraint (planes free), good weather 100 % of days

Sea route from the base
3 274 nm, 11.4 d from Le Havre @ 12 kn

Aerodrome for heavy cargo
Wallops Flight Facility Airport — 11 km, runway 2 666 m

Port for heavy cargo
PINEY POINT — 97 km, channel 4.9–6.1 m, vessels > 152 m (nearest: SALISBURY, 59 km, channel 1.8–3.1 m, vessels <= 152 m)

Population within 100 km
4 871 / 73 940 / 520 606 (GHSL 2025)

Drops: distance to a shipping lane
drops 126 km (Fairing) · site 57 km from a major lane

Airspaces crossed at low altitude
unavailable

Tropical cyclones per decade
6.4 per decade >= 34 kt (1.3 >= 64 kt), within 150 km, 1980–2026

Highest tsunami runup within 100 km
1 runups within 100 km, highest 0.3 m (1929)

Distance to sensitive features
no layer loaded (e.g. Allen Coral Atlas)

Standing: 3 of 6 · non-dominated · first on: Mission planes, Sea route from the base, Aerodrome for heavy cargo, Seismic hazard, Highest tsunami runup within 100 km

Weather availability by month

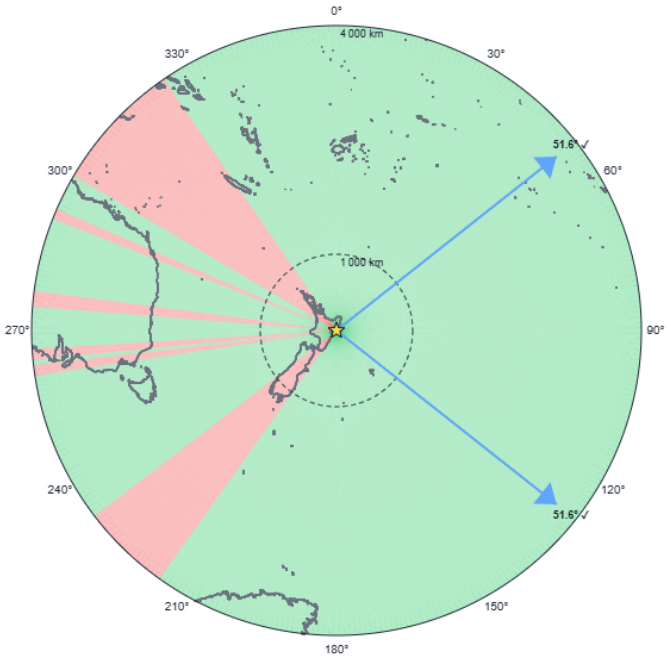
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
91%	88%	91%	92%	91%	93%	88%	92%	92%	93%	95%	92%

Admissible (141°)

44–161° (i 38–75°) · 169–169° (i 81–81°) · 173–176° (i 84–87°) · 183–189° (i 92–97°) · 269–271° (i 142–142°) · 281–281° (i 141–141°) · 300–300° (i 133–133°) · 341–341° (i 105–105°) · 347–351° (i 97–100°)

- East Hampton (147 993 inh.) — phase 1, from 116 km: 25° excluded
- Virginia Beach (454 808 inh.) — phase 1, from 118 km: 18° excluded
- Alexandria (159 467 inh.) — phase 1, from 173 km: 17° excluded
- Richmond (226 610 inh.) — phase 1, from 176 km: 16° excluded
- Baltimore (585 708 inh.) — phase 1, from 188 km: 15° excluded
- Philadelphia (1 573 916 inh.) — phase 1, from 237 km: 12° excluded

Rocket Lab LC-1, Mahia, NZ — -39.2600°, 177.8600°



Key figures

Payload, same target
22 169 kg -> 51.6° / 420 km · parking 200 km · deorbit

Programme cost
407 M€ over 10 years (investment 0 €, 5.3 M€ per flight, payload shortfall 9.1 M€/yr)

Expected casualties per flight (Ec)
2.5e-7 per flight (drops 0 · failure 2.5e-7)

Distance to protected areas
site: Opoutama Sections Conservation Area, 22 km · drops: none within 30 km · 1 within 50 km

Admissible azimuths
309° of 360°

Mission planes
1 / 1 planes · 2 / 2 headings

Drops: distance to land
>= 300 km (Stage 1)

Water depth at the site
land pad

Weather availability (year)
85 % (3-h window) — worst Jul 82 % · 1 h 90 % · 6 h 81 %

Days with a good-weather lift-off opportunity
no timing constraint (planes free), good weather 98 % of days

Sea route from the base
11 005 nm, 38.2 d from Le Havre @ 12 kn

Aerodrome for heavy cargo
RNZAF Base Ohakea — 236 km, runway 2 447 m (nearest: Wairoa Airport, 48 km, 914 m)

Port for heavy cargo
GISBORNE — 68 km, channel 9.4–10.7 m, vessels <= 152 m

Population within 100 km
22 / 6 180 / 181 113 (GHSL 2025)

Drops: distance to a shipping lane
drops 819 km (Stage 1) · site >= 1 500 km from a major lane (381 km from any lane)

Airspaces crossed at low altitude
unavailable

Tropical cyclones per decade
1.1 per decade >= 34 kt (0.0 >= 64 kt), within 150 km, 1980–2026

Highest tsunami runup within 100 km
42 runups within 100 km, highest 15.0 m (1931)

Distance to sensitive features
no layer loaded (e.g. Allen Coral Atlas)

Standing: 4 of 6 · non-dominated · first on: Expected casualties per flight (Ec), Admissible azimuths, Mission planes, Drops: distance to land, Population within 100 km

Weather availability by month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86%	87%	86%	89%	83%	85%	82%	84%	83%	87%	87%	86%

Admissible (309°)

233–261° (i 128–140°) · 264–264° (i 140–140°) · 267–274° (i 141–141°) · 278–291° (i 136–140°) · 294–300° (i 132–135°) · 326–215° (i 39–116°)

- Tauranga (161 000 inh.) — phase 1, from 229 km: 12° excluded
- Hamilton (192 100 inh.) — phase 1, from 278 km: 10° excluded
- Lower Hutt (114 200 inh.) — phase 1, from 331 km: 9° excluded
- Christchurch (419 200 inh.) — phase 1, from 645 km: 5° excluded
- Dunedin (132 800 inh.) — phase 1, from 950 km: 3° excluded
- Sydney (5 638 830 inh.) — phase 2, from 2445 km: 3° excluded

Diagrams: azimuthal equidistant around the site (angle = bearing, radius = distance). Green clear, orange admissible under conditions, red excluded; dashed circles = phase limits; arrows = mission planes (dashed = not admissible).

Sources · Scope & limitations

- Coasts and islands: Natural Earth 1:10m Land and Minor Islands (public domain).
- Populated places: GeoNames cities1000, CC BY 4.0 (places of 1 000+ inhabitants).
- Direct-ascent inclination cos i = cos(lat)·sin(Az); Earth rotation v = 2piR/T·cos(lat); plane-change delta-v = 2V·sin(delta-i/2); sun-synchronous inclination from first-order J2.
- Sea routes: SatView 0.2° water grid from Natural Earth 1:10m, main straits opened, canals switchable — planning estimate. Aerodromes: OurAirports (public domain). Ports: NGA World Port Index, Pub. 150 (public domain).
- Ascent: SatView 3-D point-mass model (rotating Earth, J2, US Standard Atmosphere 1976, Mach-dependent Cd, boosters, fairing, g and max-Q throttling, gravity turn then an optimised pitch and yaw programme, coast and circularisation), checked on public reference cases (Europa III, Ariane 5 ECB) — a representative envelope. Drop zones from a fall with drag; land from SatView's 0.2° grid (Natural Earth 1:10m). Dispersions: Monte-Carlo with the nominal guidance, Gaussian ellipses — a planning estimate, not a range-safety analysis. Imported trajectories are shown as given.
- Availability: ERA5 hourly reanalysis via Open-Meteo (archive and marine APIs). Reefs: Natural Earth 1:10m (public domain); other environmental layers are the user's own.
- Shipping lanes: global lane centre-lines digitised from the CIA map of the world's oceans (2012) by the open Shipping-Lanes project. Vessel traffic: Global Fishing Watch 4Wings vessel presence (your own token). Airspace: OpenAIP (your own key). Tropical cyclones: NOAA IBTrACS v04r01 (public domain). Tsunami runups: NOAA NCEI Global Historical Tsunami Database (doi:10.7289/V5PN93H7).
- Launch windows: sidereal time IAU 1982, first-order J2 nodal precession, direct ascent (site in the plane at lift-off).
- Population: JRC GHSL GHS-POP R2023A, epoch 2025 (Schiavina et al., European Commission JRC, CC BY 4.0), summed into 0.05° cells. Protected areas: © OpenStreetMap contributors (ODbL), via the Overpass API.
- SatView provides the means to use these sources; it does not resell them.

Scope & limitations

First-order screening with the user's own rules and a representative ascent model, not a certified range-safety analysis. Small islets below the 1:10m scale can be missing; place populations come from mixed census years and are a lower bound. Shipping lanes, airspace, cyclones and tsunamis are structural indicators from public datasets, not live traffic or a hazard study. The legal status of the waters and range-safety approval are not assessed here.