

Denying Chinese Victory

Cost, Resource, and Military Advantages Available to the United States

An Open-Source Military Assessment, 2026–2035

PUBLISHED

19 SEPTEMBER 2026

STATUS

WORKING PAPER – SSRN

FACTS CURRENT TO

19 SEPTEMBER 2026

VERSION

3.3

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Paper record

ABSTRACT

This paper identifies the military, cost, and resource advantages the United States can use to make it difficult for the People's Republic of China to win a conflict in any of the forms Beijing could choose: invasion of Taiwan, blockade, coercion below the threshold of war, or protracted war. It assesses eight military measures and six economic and technological measures against four criteria: what each costs, when it can be fielded, what it forces the People's Liberation Army (PLA) or the Chinese state to spend or forgo, and how Beijing can counter it. The central finding is that the measures with the most favorable cost-exchange ratios are also the fastest to field: naval mines and undersea attack on PLA sealift, mobile ground-based anti-ship missiles in the first island chain, attacks on the PLA's long-range maritime targeting chain, passive defense of air bases, and Taiwanese stockpiles. On the quantity assumptions stated in Annex C, the U.S.-funded share costs roughly \$15 billion to \$25 billion over five years, of which the largest component, \$9 billion to \$10.5 billion for air base hardening, rests on a single reported Hudson Institute estimate; Taiwanese-funded stocks and systems add \$5 billion to \$10 billion. The measures that would do the most to decide a protracted war, attack-submarine production, shipbuilding, and munitions inventory, cannot mature before the 2030s, and the 2026 Iran war set munitions inventories back by one to four years. On the economic side, controls on semiconductor manufacturing equipment and coordinated allied trade remedies impose real cost, but Chinese control of rare earth processing limits how far Washington can press until Western capacity exists. The paper's analytical contribution is a transparent mine-requirement and lift-attribution model (Annex D) built on the standard uniform-random minefield formulation, with three cases: a barrier crossed at random, a barrier the PLA lanes through, and lanes reseeded between waves. It shows that a 3,000 to 6,000 mine barrier that the PLA clears lanes through to 90 percent effectiveness removes only 3 to 11 percent of planned lift, because ships in lanes can meet only the residual lane mines; that the barrier's value is to force the PLA into lanes and impose a clearance task; and that the attrition comes from reseeding those lanes, where 175 to 350 GPS-guided mines released between waves remove 19 to 128 hulls, 5 to 24 percent of planned lift, at 2 to 13 mines released per hull lost once placement losses and PLA re-clearance are allowed for. Mine efficiency scales inversely with the width the mines are spread over, which makes standoff precision placement and persistent surveillance of lane locations the binding requirements, not mine numbers. The model also shows that the Luzon and Miyako straits are too deep for bottom mines, which narrows the mining task to port approaches and the strait itself. The paper states the PLA counter to each measure, the scenarios in which each measure contributes little, and the conditions under which its conclusions would change.

KEYWORDS

China; People's Liberation Army; Taiwan; cost imposition; cost-exchange ratio; deterrence by denial; naval mining; anti-ship missiles; counter-targeting; munitions; base hardening; export controls; rare earths.

JEL CLASSIFICATION

F13, F51, F52, H56, L64.

GOVERNING JUDGMENT

The measures with the most favorable cost-exchange ratios against a Chinese invasion of Taiwan are also the fastest to field, and cost roughly \$15 billion to \$25 billion over five years. The measures that would decide a protracted war cannot mature before the 2030s. Economic pressure is bounded by Chinese control of rare earth processing until Western capacity exists.

DISCLOSURES

This paper uses only unclassified, publicly available material: government reports and budget exhibits, congressional research, published wargames, peer-reviewed scholarship, official histories, and reputable journalism. It contains no classified information. Cost figures are open-source estimates, not program costs. Fast-moving items carry a date in the sentence that uses them. Annex B states the data limitations that remain after verification. The author received no external funding for this work and has no financial interest in any program, contractor, or security discussed. Large language models (Anthropic Claude) were used for source verification, citation checking, and copyediting under the author's direction. The author reviewed and revised the work and takes full responsibility for its content, judgments, and assumptions. Citations were checked against their sources where the source was accessible; exceptions are listed in Annex B. The views are the author's alone.

REPLICATION

WP-2026_mine_requirement_model.py, distributed with the paper, reproduces Tables D1 through D5 and accepts any parameter values.

IF YOU READ NOTHING ELSE**The leverage point**

China's hardest military problem is moving and sustaining a force across 130 to 180 kilometers of water on civilian hulls that have no damage control, no self-defense, and no ability to operate in mined water. Every measure that attacks sealift, the receiving ports, or the targeting data protecting them has high leverage. Everything else is secondary in an invasion.

The mining result

A 3,000 to 6,000 mine barrier the PLA lanes through removes only 3 to 11 percent of planned lift. The attrition comes from reseeding the cleared lanes: 175 to 350 GPS-guided mines remove 5 to 24 percent. The binding requirement is persistent surveillance of lane locations and standoff placement, not mine numbers.

The constraint

Every measure that depends on allied territory depends on allied consent, and wartime authority to fire from Japanese or Philippine soil has not been publicly settled. Without it, forward missile batteries are a peacetime signal with uncertain wartime value.

Summary of findings

1. China's hardest military problem is moving and sustaining a force across 130 to 180 kilometers of water. Every measure that attacks sealift, the ports that receive it, or the targeting data that protects it has high leverage. Every measure that does not is secondary in an invasion scenario.
2. Five measures are inexpensive, fieldable before 2030, and favorable in cost exchange: mines and unmanned undersea vehicles (the model in Annex D shows that a 3,000 to 6,000 mine barrier laned through by the PLA removes 3 to 11 percent of planned lift, while 175 to 350 mines reseeded into the cleared lanes between waves remove 5 to 24 percent, so the requirement is precision placement and lane surveillance more than mine numbers); ground-based anti-ship missiles; counter-targeting; air

base hardening and dispersal; Taiwanese munitions, energy, and food stocks. Four can be costed from open sources. The U.S.-funded share (mines, undersea vehicles, missiles, hardening, and one-way attack drones) is roughly \$15 billion to \$25 billion over five years. Taiwanese-funded stocks and systems add \$5 billion to \$10 billion. The hardening component (\$9 billion to \$10.5 billion) is a single-source estimate (Annex B). Counter-targeting cannot be costed from open sources and is excluded from both figures (Table 2a, Annex C).

3. Three measures decide a long war and cannot be bought quickly: attack submarines (1.1 to 1.3 Virginia-class boats per year against a requirement above 2.0), surface shipbuilding, and precision-munitions inventory. CSIS estimates that in the 39-day air campaign against Iran in 2026 the United States expended more than half of its prewar inventory of four of seven critical munitions, and that returning to prewar levels, which were already judged inadequate for a war with China, will take one to four years.¹
4. Beijing selects the scenario. Mines and anti-ship missiles contribute heavily against invasion, moderately against blockade, and little against quarantine or coercion short of war. No single measure covers all four scenarios. Section 3 maps measures to scenarios.
5. Economic measures are constrained by a dependency that runs the other way. Chinese rare earth and magnet export controls in 2025 showed that Beijing can impose rapid cost on U.S. and allied manufacturing. Until separation and magnet capacity exists outside China, U.S. economic pressure is limited.
6. Every measure that depends on allied territory depends on allied consent, and wartime authority to fire from Japanese or Philippine soil has not been publicly settled.

Recommended actions

Fund now. Multiyear procurement for maritime mines (Quickstrike-ER, Hammerhead), Naval Strike Missile, and Maritime Strike Tomahawk; procurement of extra-large unmanned undersea vehicles beyond the prototypes; a dedicated military construction line for air base hardening in the Western Pacific at the scale Hudson analysts have estimated (\$9 billion to \$10.5 billion); low-cost one-way attack drones in the tens of thousands; persistent surveillance of the strait sufficient to locate cleared lanes within hours, which Annex D shows is the condition on which mine attrition depends; and, for auxiliaries, execution of the CONSOL tanker and roll-on/roll-off acquisition plan that the presidential memorandum of 13 August 2026 already directs under the delegated 10 U.S.C. § 8679 exception, together with a statutory exception for auxiliaries that does not carry the memorandum's condition that the foreign builder establish a U.S. yard and build all hulls after the first two in the United States.

Settle. A written understanding with Japan and with the Philippines on the use of their territory for strikes on PLA forces in defined contingencies. It can remain classified. Without it, forward missile batteries are a peacetime signal with uncertain wartime value (Sections 4.2 and 9).

Separate. Controls on semiconductor manufacturing equipment and servicing are one policy. Licensing of finished accelerators is another. They should be decided and defended separately. Unilateral tariffs on allies are not a substitute for coordinated trade remedies and are an obstacle to them (Section 6.2).

Sequence. Economic measures against China should stay below the level that invites rare earth retaliation the United States and its allies cannot yet absorb, until non-Chinese separation and magnet capacity exists (Section 6.4).

Do not wait. Two Virginia-class deliveries per year, a larger surface fleet, and restored munitions inventories arrive after 2030. None of them is a reason to defer the \$15 billion to \$25 billion set of measures that can be in place before then.

1 Question, Scope, and Method

Question. What can the United States do, at what cost and on what timeline, that makes it difficult for China to win a conflict in any form, and how can Beijing respond?

Scope. 2026 to 2035. Conflict forms considered: amphibious invasion of Taiwan, blockade, quarantine and coercion below the threshold of war, seizure of outlying islands, and protracted war following a failed or stalled invasion. Economic conflict without shooting is treated in Section 6.

Method. Three tools. First, the competitive-strategies approach developed by Andrew Marshall: identify enduring adversary weaknesses and choose investments that force the adversary to spend more to respond than the investment cost.^{2,3} Second, historical cases in which comparable measures were used, with their force levels and results. Third, open-source force, inventory, production, and budget data. Fourth, for the one measure the paper rates decisive against invasion, a simple analytical model of mine requirement and lift attrition (Annex D) whose every parameter is stated and whose code is distributed with the paper.

Metric. Cost-exchange ratio. Because no authoritative public unit costs exist for PLA Rocket Force missiles or for most PLA Navy hulls, and published estimates are speculative, the ratio is applied qualitatively throughout: the paper states the U.S. cost where public unit costs allow and describes, rather than computes, what the measure forces the PLA to spend. Where the text says a ratio is favorable by “orders of magnitude,” the claim rests on the disparity between a mine or missile and a loaded ship, not on a PLA unit-cost figure.

Limits. Open sources lag classified assessments. U.S. munitions inventories are classified; the figures used are CSIS reconstructions from budget exhibits and press reporting of official statements.¹ PLA doctrine is inferred from translated Chinese military publications as summarized in DoD and U.S. Naval War College reporting, not from operational plans.

2 The Operational Problem from Beijing's Side

2.1 Geography

The Taiwan Strait is about 130 kilometers wide at its narrowest and about 180 kilometers on average, with depths mostly under 100 meters. Shallow water favors mines and complicates submarine operations for both sides. South of Taiwan, the Luzon Strait separates the island from the Philippine province of Batanes; the northernmost Philippine islands lie roughly 140 to 150 kilometers from Taiwan's southern cape. To the northeast, Japan's Yonaguni Island is about 110 kilometers from Taiwan's east coast, and the Miyako Strait, the PLA Navy's principal exit to the Philippine Sea, is about 250 kilometers wide. These distances fall inside the range of ground-launched anti-ship missiles now fielded by the United States and Japan (Section 4.2).

2.2 Forces

DoD's 2024 report credits the PLA Navy with more than 370 ships and submarines, the largest navy in the world by hull count, and projects 435 by 2030.⁴ DoD's 2025 report, released 23 December 2025, counts about 550 intermediate-range ballistic missiles (DF-26 class) on about 300 launchers, an increase of about 50 in each category over the 2024 report.⁶ The 2024 report counted about 1,300 medium-range ballistic missiles, about 900 short-range ballistic missiles, and about 400 ground-launched cruise missiles.⁴ This is the inventory that threatens U.S. and allied air bases and surface ships west of Guam.

2.3 The binding constraint: lift

The PLA Navy's dedicated amphibious fleet (Type 075 and Type 076 assault ships, Type 071 dock landing ships, and older tank landing ships) can carry only a fraction of the force an invasion requires. Open-source estimates of first-wave organic lift cluster around 20,000 to 30,000 troops; estimates vary with assumptions and should be treated as a range.⁵ The PLA's answer is civilian shipping. It has exercised roll-on/roll-off ferries, floating causeways, and semi-submersible barges with naval amphibious units since at least 2020, and U.S. Naval War College studies document the legal and organizational machinery for mobilizing civilian hulls.⁵ In 2025, analysts working from commercial imagery reported purpose-built landing barges with extendable bridges under construction and on trials at Guangzhou; their apparent role is offloading vehicles across beaches without port facilities. This is imagery analysis, not an officially confirmed program.⁵

Civilian hulls have no damage control, no self-defense, and no ability to operate in mined water without escort. An invasion force that depends on them must keep sea lanes and receiving ports open for weeks. That requirement, more than the first landing, is where the PLA is most exposed.

2.4 Known PLA weaknesses

DoD reports have described PLA anti-submarine warfare as a continuing shortfall while noting sustained investment to close it: KQ-200 maritime patrol aircraft, towed-array sonars on Type 056A corvettes and

Type 054A/B frigates, and fixed seabed sensor networks in the near seas.⁴ The statement that Beijing has “no fix” would be wrong. The defensible statement is that PLA ASW remains weaker than its surface and missile forces, and that protecting hundreds of slow civilian hulls from submarines and mines is a harder task than protecting a naval task group.

The PLA has not fought a major war since 1979, although border fighting with Vietnam continued through the 1980s and the PLA Navy fought a brief action at Johnson South Reef in 1988. DoD's 2024 report judged that the 2023 removal of the Rocket Force commander and political commissar and of two former defense ministers, among other senior officers, “may have disrupted” progress toward the PLA's 2027 modernization goals.⁴ On 17 October 2025 the Ministry of National Defense announced the expulsion from the Party of nine senior officers, including Central Military Commission Vice Chairman He Weidong, the director of the CMC Political Work Department, and the second successive Rocket Force commander.⁷ DoD's 2025 report, released 23 December 2025, nonetheless judged that the PLA “continues to make steady progress toward its 2027 goals.”⁶ Open sources establish that the removals occurred. They do not establish the net effect on readiness, and this paper draws no conclusion from them.

3 Chinese Theories of Victory and Which Measures Apply

Beijing chooses the form of conflict. A measure that defeats invasion may be irrelevant to quarantine. Table 1 is the paper's answer to the objection that denial measures address only one scenario.

Table 1. Contribution of each measure by scenario. Author's assessment.

Measure	Invasion	Blockade	Quarantine / coercion	Outlying islands	Protracted war
Mines and undersea attack	Decisive	Moderate (against blockading ships)	Low	Low	High
Ground-based anti-ship missiles	High	High	Low (use would be escalatory)	Moderate	High
Counter-targeting	High	High	Low	Moderate	High
Base hardening and dispersal	High	High	None	Low	High
Taiwanese stocks (munitions, energy, food)	High	Decisive	High	Low	High
Munitions inventory	High	High	None	Low	Decisive
Submarine and ship production	Moderate (existing fleet fights)	Moderate	None	None	Decisive
Distant interdiction of Chinese imports	None in a short war	Moderate	None	None	High
SME controls, trade remedies, sanctions	None in a short war	Low	Moderate	Low	High

“Decisive” in this table means the measure that most directly attacks the binding constraint in that scenario. It does not mean sufficient to win. Section 9 states what each measure cannot do.

Two conclusions follow. First, against quarantine and coercion short of war, the relevant measures are Taiwanese stocks, which extend the time Taipei can hold without concession, and economic measures. Military denial measures deter escalation from quarantine to blockade or invasion but do not defeat the quarantine itself. Lonnie Henley's study of a protracted blockade and the 2025 CSIS blockade wargame both find that Taiwan's energy stocks, especially liquefied natural gas, which ran out in about ten days in every CSIS scenario, are the limiting factor.⁸ Second, protracted war is decided by production, which is where the United States is weakest (Section 5).

4 Measures Fieldable Before 2030

4.1 Mines and undersea attack on sealift

Historical record. In Operation Starvation (March to August 1945), B-29s of the XXI Bomber Command flew 1,529 sorties and laid 12,135 mines in Japanese home waters, mainly the Shimonoseki Strait and

Inland Sea ports. They lost 15 aircraft. The mines sank or damaged about 670 ships totaling roughly 1.25 million tons and closed most major ports. The effort consumed under 6 percent of the command's sorties. The U.S. Strategic Bombing Survey concluded that mining should have started earlier.⁹ On 9 May 1972, Navy A-6 and A-7 aircraft from USS *Coral Sea* laid 36 mines in the approaches to Haiphong. Follow-on sorties laid more than 11,000 mines and destructors across North Vietnamese ports and inland waterways over eight months. No large vessel entered or left Haiphong until U.S. forces swept the field in 1973 under the Paris accords.¹⁰ In the Pacific submarine campaign, U.S. submarines sank 1,113 merchant ships of about 4.8 million tons, some 55 percent of Japanese merchant losses by tonnage, with a force that was under 2 percent of Navy personnel, at a cost of 52 boats.¹¹

Current capability. Quickstrike-ER adds a wing kit and GPS guidance to a bomb-body mine; a release at 35,000 feet gives about 40 nautical miles of standoff.¹² Hammerhead is a moored, encapsulated-torpedo mine intended for delivery by unmanned undersea vehicles; the Navy ordered 188 additional units under a \$229.65 million contract modification announced 31 July 2026.¹³ The Orca extra-large unmanned undersea vehicle is in prototype delivery; the five prototypes and a test asset were estimated in 2022 at about \$621 million, roughly \$110 million per vehicle, and GAO put cumulative spending at about \$885 million in 2025 while questioning the program's transition to a program of record.¹⁴ One published estimate puts Orca's payload at roughly eight Hammerheads or 32 500-pound Quickstrikes per sortie.¹² The Navy's FY2026 request contained \$179.4 million for maritime mine procurement and \$61.5 million for mine development, nearly all of the latter in the reconciliation request.¹³

Cost. A JDAM guidance kit costs about \$66,000.¹ No official Quickstrike-ER unit cost is public; the wing kit and target detection device add to the JDAM figure, which places the weapon in the low hundreds of thousands of dollars. Several thousand such mines cost hundreds of millions of dollars. A PLA Type 071 dock landing ship or a large ferry loaded with a mechanized battalion is worth orders of magnitude more than the mine that stops it.

Requirement and exchange (Annex D). The uniform-random minefield model used in U.S. mine warfare planning gives the probability that a ship crossing a field of N mines spread over a width W encounters a mine as $1 - (1 - w/W)^N$, where w is the width across which a mine will actuate against the target. For a barrier 150 kilometers long across the invasion front, a first-crossing threat of 0.5 requires about 1,000 mines if w is 100 meters and about 2,100 if it is 50 meters. But the PLA would not cross at random; it would clear lanes. Ships in lanes can meet only the mines that were in the lanes, and with 10 kilometers of lanes through a 3,000-mine barrier that is 200 mines before clearance and 20 after clearance to 90 percent. Twenty mines cannot remove more than twenty hulls. Against a fleet of 300 hulls making eight crossings, the laned barrier removes 10 to 65 hulls, or 3 to 11 percent of planned lift, across the model's range of field sizes and damage probabilities. Its value is that it forces the PLA into lanes, imposes a 200 to 400 mine clearance task on a force of 24 to 36 mine countermeasures platforms, and fixes where the follow-on echelons will be. The attrition comes from reseeding those lanes. Because traffic in a lane is dense, nearly every mine that reaches it actuates. Allowing for placement losses and for PLA re-clearance of reseeded mines before each wave, 25 to 50 GPS-guided mines released before each wave, 175 to 350 in all, remove 19 to 128 hulls, 5 to 24 percent of planned lift, at 2 to 13 mines released per hull lost and

under \$60 million in mines; Operation Starvation took about 18 mines per ship sunk or damaged. A mine placed into 10 kilometers of known lanes is fifteen times as effective per transit as one scattered across the barrier. That is the case for Quickstrike-ER in particular, since standoff GPS placement is what makes reseeding possible, and it adds a requirement the paper must state: persistent surveillance of lane locations and enough surviving bomber or unmanned sorties to place a few dozen mines per wave. Port-approach fields are smaller and are not laned: 45 to 90 mines in a two-kilometer channel give a first-transit threat of 0.5 to 0.9 before clearance and remove 7 to 24 percent of sorties from a port after clearance to 90 percent. The quantities in Annex C follow from these figures.

Weaknesses a critic will raise. The U.S. mine inventory is not public and is widely regarded as small. Forty nautical miles of standoff does not clear PLA long-range air defenses in the strait, so air delivery there requires penetrating platforms or prior suppression. Mining before hostilities is an act of war; mining after hostilities begin must be done under fire. Undersea delivery is covert but slow and low in volume. Quickstrike bottom mines are limited to water shallower than about 90 meters, so they cannot be used in the Luzon and Miyako straits, where depths exceed 1,000 meters; those straits are a task for moored mines such as Hammerhead against submarines and for missiles against surface ships. The realistic uses are therefore the approaches to PLA embarkation ports, mined from submarines and unmanned vehicles before hostilities are certain, and a bottom-mine barrier across the strait itself, which is 60 meters deep on average, laid by bombers once hostilities begin. Annex D sizes both.

PLA counters. Expanded mine countermeasures forces; route survey before and during operations; using expendable civilian hulls as lead ships; legal and information campaigns portraying mining as indiscriminate; and preemptive attack on bomber bases. The PLA Navy's mine countermeasures force is sized for coastal defense, not for clearing lanes under fire for hundreds of civilian ships, and each day of delay works against an invasion timetable.

4.2 Ground-based anti-ship and strike missiles

Historical record. In 1982 Argentina held five air-launched AM39 Exocets. They sank HMS *Sheffield* and the container ship *Atlantic Conveyor*, whose loss removed most of the task force's heavy-lift helicopters and changed the land campaign. A ship-type Exocet fired from an improvised shore launcher hit HMS *Glamorgan*.¹⁵ In April 2022, two Ukrainian R-360 Neptune missiles sank the cruiser *Moskva*; subsequent missile and unmanned surface vessel attacks pushed the Black Sea Fleet out of the western Black Sea and reopened Ukraine's grain corridor without a Ukrainian fleet.¹⁶

Current capability. A Typhon (Mid-Range Capability) battery has four launchers with four cells each, 16 missiles per load, firing Tomahawk (range above 1,600 kilometers, Maritime Strike variant in delivery) and SM-6.¹⁷ The Marine Corps' NMESIS fires the Naval Strike Missile, range about 185 kilometers, from an unmanned launcher; Marine Littoral Regiments are the employing formation.¹⁸ PrSM has a range above 500 kilometers; Increment 2, by the Army's program description, adds a seeker for moving maritime targets.¹ Japan is fielding an upgraded Type 12 with a range near 1,000 kilometers and contracted in January 2024 for 400 Tomahawks; as of April 2026 Tokyo had reportedly been told deliveries might slip because of U.S. expenditure against Iran.¹ The Army deployed Typhon to northern Luzon in April 2024 and

kept it there over Chinese objection, conducting its first live fire in the Philippines in May 2026; it displayed Typhon at Iwakuni, Japan, for Resolute Dragon 25 in September 2025; and the Marine Corps placed NEMESIS on Batan Island in Batanes in April 2025 for Balikatan.¹⁹ From Batanes, the Naval Strike Missile covers the Bashi Channel. It does not reach the Taiwan Strait. Typhon with Maritime Strike Tomahawk does.

Cost. Approximate unit procurement costs from budget exhibits are about \$2.5 million for Tomahawk (FY2026), \$3.2 million for LRASM (FY2024), \$2.6 million for JASSM, and roughly \$2 million for the Naval Strike Missile.^{1,20} Line-item arithmetic on the FY2026 and FY2027 Tomahawk requests gives higher figures, \$3.8 million to \$4.7 million, because those lots include the Maritime Strike variant and nonrecurring cost; Annex C shows the sensitivity. These are not inexpensive weapons. The favorable exchange comes from the target: a \$2.5 million missile against a major combatant or a loaded transport. Against decoys or empty hulls the exchange reverses.

Weaknesses a critic will raise. Sixteen missiles per battery is a small salvo against a task group with layered defenses; the Army plans only a handful of batteries. Reloads compete with the Navy for the same production, and Navy Tomahawk procurement averaged 86 per year from FY2015 to FY2026.²¹ PrSM stocks were reported by one Army official to have been exhausted in the Iran war, a claim other officials dispute.¹ Launchers are mobile but the islands are small and road networks limited.

Allied consent. This is the binding constraint. Neither Manila nor Tokyo has publicly committed to permit strikes on PLA forces from its territory in a Taiwan contingency. The 2023 CSIS wargame called Japanese basing access the “linchpin” of the defense and one of four conditions necessary for its success.²²

What Washington would be asking. Under the 1960 exchange of notes accompanying the U.S.–Japan security treaty, the use of bases in Japan for combat operations other than the defense of Japan is subject to prior consultation with Tokyo. In the Philippines, the agreed locations under the Enhanced Defense Cooperation Agreement are Philippine bases, and their use for combat is subject to Philippine consent. The request is therefore specific: agreement in advance on the outcome of consultation for defined contingencies, covering anti-ship fires against PLA forces operating against Taiwan or in the straits adjoining allied territory. What the United States can offer in return is air and missile defense of the host locations, funding for hardening at host bases, co-production of the munitions involved, and priority in deliveries. A refusal does not make the batteries useless, since they still cover the defense of Japanese and Philippine territory, but it removes them from the Taiwan problem and returns the anti-ship mission to submarines and bombers, which depend on the munitions in shortest supply.

PLA counters. Surge ISR against launchers; preemptive strikes on known garrisons; decoys and salvo saturation; and sustained political pressure on host governments, which is the cheapest counter and the one Beijing already uses.

4.3 Counter-targeting

A DF-21D or DF-26 can hit a moving ship only if the PLA can find it, identify it, track it, and pass updated coordinates to the missile during a flight of several minutes. DoD's 2025 report credits China with more

than 500 ISR-capable satellites after 67 launches in 2024, the Yaogan series among them, plus skywave over-the-horizon radars, maritime patrol aircraft, and unmanned systems.⁶ Andrew Erickson's study of the anti-ship ballistic missile program identified this targeting architecture, not the missile, as the hard part.²³ Biddle and Oelrich argue that the physics of sensing mobile targets at range limits anti-access effectiveness as distance from the Chinese coast grows.²⁴

The PLA must succeed at every link for each shot, while the defender needs to break one.

Every link is subject to attack that is non-kinetic, deniable, or reversible: emissions control and deceptive emitters, decoys that present false radar and infrared signatures, jamming of satellite downlinks and data relays, and cyber operations against fusion centers.

Unclassified programs in this category include the Navy's Surface Electronic Warfare Improvement Program Block 3, which adds electronic attack to the AN/SLQ-32 suite; the Nulka active offboard decoy; the Space Force's Counter Communications System, a ground-based satellite communications jammer; and the counter-C5ISR priority the commander of U.S. Indo-Pacific Command stated at his confirmation hearing in February 2024.²⁵ Their budgets are public. Their effectiveness against the PLA targeting architecture is not, and the most relevant efforts are classified. This paper therefore treats counter-targeting as high in value by reasoning and unscored by evidence. It appears in Tables 2a and 2b without a cost band and is excluded from the cost totals.

PLA counters. Proliferation of low-earth-orbit constellations to make satellite attack uneconomic; redundant terrestrial and airborne sensors; and firing larger salvos on lower-quality data, which spends Rocket Force inventory faster.

Escalation note. Some PLA early-warning and command systems serve both conventional and nuclear forces. Caitlin Talmadge has shown how conventional attacks on such systems could be read in Beijing as the opening of a counterforce campaign.²⁶ Counter-targeting should be confined to systems with a maritime conventional role, and the paper does not recommend attacks on strategic early warning.

4.4 Base hardening and dispersal

Between 1968 and 1970 the U.S. Air Force built 373 hardened shelters in Vietnam under a program named Concrete Sky; by the end of the Cold War the United States and its allies had about 1,000, including more than 100 in Japan.²⁷ Since the early 2010s China has more than doubled its shelters to over 3,000, enough for most of its combat aircraft. Hudson's 2025 study counts China's hardened shelters within 1,000 nautical miles of the Taiwan Strait rising from about 370 to more than 800 between 2010 and 2020, against two added by the U.S. military in the same area, and calculates that as few as ten missiles with submunition warheads could neutralize exposed aircraft and fuel at a major U.S. base.²⁷ Published wargames agree that most U.S. aircraft losses would occur on the ground; in the 2023 CSIS wargame the share was 90 percent.²²

Cost. Hudson analysts have estimated \$9 billion to \$10.5 billion for shelters and passive defenses across Pacific airfields, a figure reported in April 2026 and not contained in the January 2025 Hudson report, which this paper treats as a single-source estimate (Annex B).²⁷ The Hudson report itself puts a bomber-sized shelter at about \$30 million, protecting an aircraft worth over \$600 million, and notes that forgoing one fighter purchase per year would fund about 20 fighter shelters.²⁷ Each shelter forces the PLA to allocate one or more unitary-warhead missiles to a target that a fraction of a submunition warhead could otherwise destroy.

PLA counters. More missiles per aimpoint, runway and fuel attack instead of aircraft attack, and attack on personnel and maintenance facilities, which shelters do not protect. The relevant question is whether Rocket Force inventory can pay that price across dozens of dispersed fields while also servicing Taiwan, Japan-based air defenses, and ships. Hardening does not make bases safe. Because a single submunition-armed missile can cover a ramp of exposed aircraft while a hardened shelter requires at least one unitary-warhead missile for each aircraft, hardening raises the number of missiles required per aircraft destroyed by roughly the number of aircraft a ramp holds, which is an order of magnitude at a large base.

4.5 Taiwan's own defense

Admiral Lee Hsi-min's Overall Defense Concept calls for large numbers of small, mobile, survivable weapons, such as coastal-defense cruise missiles, mines, short-range air defense, and unmanned systems, in place of a small number of costly platforms that would not survive the first strikes.²⁸ Taiwan produces its own Hsiung Feng anti-ship missiles and sea mines and operates Min Jiang-class fast minelayers, so part of this is a domestic production question, not only a U.S. delivery question.

Undelivered U.S. arms sales to Taiwan stood at about \$21.5 billion at the end of November 2025 and about \$32 billion after the December 2025 notifications; as of August 2026 the figure was about \$29.7 billion. These figures measure value under contract, not delay; some of it is on schedule. The share classed as asymmetric rose from 22 percent in late 2023 to 46 percent after the December 2025 sales and 49 percent in August 2026.²⁹ On 21 May 2026 the Acting Secretary of the Navy, Hung Cao, told the Senate Appropriations defense subcommittee that deliveries to Taiwan were paused to preserve munitions for operations against Iran.³⁰ That pause is the clearest current example of one theater's consumption reducing deterrence in another.

Against blockade and quarantine, the deciding variables are Taiwanese: natural gas storage measured in days to weeks, coal and oil stocks measured in weeks to months, food reserves, and the resilience of the power grid.⁸ These cost single-digit billions and are funded by Taipei. The political obstacle is inside Taiwan: reallocating money from aircraft and large ships to stocks and reserves has been contested in the Legislative Yuan in successive budget cycles.

PLA counters. Strikes on storage and power infrastructure; cyber attack on the grid; and a slow quarantine calibrated to stay below the threshold that triggers U.S. intervention while stocks run down.

5 Measures That Decide a Long War and Cannot Be Bought Quickly

5.1 Munitions inventory

The 2023 CSIS invasion wargame found that U.S. forces ran short of long-range anti-ship missiles early in the war in most iterations and recommended larger inventories.²² The 2026 air campaign against Iran, Operation Epic Fury, tested the inventory in practice. CSIS, working from budget exhibits and press reporting of official figures, estimates that in 39 days U.S. forces struck more than 13,000 targets and fired more than 1,000 Tomahawks and about 1,100 JASSM-ER, and that for four of seven critical munitions the United States may have expended more than half of its prewar inventory; secondary reconstructions of the CSIS ranges put SM-6 expenditure at roughly one sixth to one third of inventory, THAAD and PAC-3 MSE near or above half, and PrSM, on one Army official's account, at all of it.¹ A press figure of 425 JASSM-ER, sometimes read as the total remaining, referred to the number available outside the Middle East after repositioning and is not used here.³¹

Production cannot replace this quickly. The interval from appropriation to delivery of a full lot is about 52 months.¹ Navy Tomahawk procurement averaged 86 per year from FY2015 to FY2026; the 785 requested for FY2027 begin delivery in March 2030, 34 months after award.²¹ Industry has announced capacity targets of more than 1,000 Tomahawks, 2,000 PAC-3 MSE (from about 600), and 400 THAAD interceptors (from 96) per year, and the FY2027 request seeks 540 SM-6; on the announced schedules, none of these rates is reached before the end of the decade.^{1,21} CSIS concludes that the United States retains enough munitions for the Iran contingency and that the risk lies in a subsequent war against a peer.¹

The inexpensive complement exists. The LUCAS one-way attack drone costs about \$35,000, with a range near 800 kilometers and an 18-kilogram warhead.¹ It cannot sink a warship. It can force a defender to spend interceptors, which is the PLA's own method turned around, and it can damage sensors, launchers, and unarmored civilian hulls. Ten to twenty thousand cost \$350 million to \$700 million. It is included in Tables 2a and 2b on that basis.

5.2 Attack submarines

Submarines are the U.S. platform least affected by the PLA's anti-access systems and the one the 2023 wargame found most productive per unit, though too few in number.²² Virginia-class production has run at about 1.1 to 1.2 boats per year since 2022 by the Congressional Research Service's count, and about 1.3 by the Chief of Naval Operations' account in May 2026, against a requirement of 2.0 for the U.S. Navy plus additional capacity for boats promised to Australia. Unit cost is about \$5.0 billion.³² On 12 May 2026 the Chief of Naval Operations told House appropriators that a two-per-year delivery rate would not be reached until around 2032.³³ The constraint is not funding alone. It is welders, pipefitters, nuclear-qualified tradesmen, and single-source suppliers of castings, forgings, and valves, all of which take years to train or qualify. Maintenance backlogs also keep a meaningful share of the existing force unavailable at any time.³²

5.3 Shipbuilding

An Office of Naval Intelligence briefing slide from 2023 put Chinese shipbuilding capacity at about 232 times that of the United States. The figure compares gross commercial tonnage capacity, and the Navy described the slide as an informal compilation of public data. It does not measure warship output, combat-system integration, or nuclear-submarine construction, where the gap is far smaller. The defensible statement is that China can build and repair hulls at a rate the United States cannot approach before the mid-2030s, and that in a war of attrition this matters more than the opening order of battle.³⁴ Title 10, section 8679, bars construction of naval vessels and major hull components in foreign yards absent a presidential determination that an exception is in the national security interest. A presidential memorandum of 13 August 2026 delegated that determination, and the notice to Congress it requires, to the Secretary of War, but only for contracts that meet the conditions of its section 3(a), modeled on the October 2025 icebreaker understanding with Finland: no more than three ship classes; a foreign builder that simultaneously builds or acquires a majority position in a U.S. shipyard, builds every hull after the first two in the United States, hires and trains a U.S. workforce, licenses its techniques, and sources a U.S. supply chain. The same memorandum directed a plan within 90 days for acquiring CONSOL tankers and roll-on/roll-off vessels under that framework.³⁵ Korean yards have performed depot-level maintenance on U.S. Navy auxiliaries since 2024, beginning with USNS *Wally Schirra* at Hanwha Ocean.³⁵ The administration has therefore already chosen the auxiliary route this paper recommends, with strings attached. The condition that all hulls after the first two be built in the United States limits the near-term capacity gain to two ships per class; the fastest available increase would come from a statutory exception for auxiliaries, and for maintenance and repair, that does not carry that condition, leaving the Finland-model conditions for combatants.

5.4 Distant interdiction of Chinese imports

China imported about 11.1 million barrels of crude oil per day in 2024, roughly three quarters of what it consumed, and about 92 percent of that arrived by sea, much of it through the Strait of Malacca, where China accounted for nearly half of the oil transiting in the first half of 2025.³⁶ The academic literature is consistent on what this does and does not offer. Collins and Murray showed that a blockade is operationally harder than it appears: cargoes change ownership at sea, neutral shipping is implicated, and enforcement requires many ships for a long time. Mirski concluded that a blockade could impose severe cost only in a long war and only with the cooperation of China's neighbors. Hammes proposed distant interdiction as a deliberately slow, low-escalation strategy. Cunningham found that Chinese strategists regard blockade as a serious but manageable threat.³⁷ Beijing has hedged with a strategic reserve, pipelines from Russia and Central Asia, domestic coal, and rapid electrification of road transport.

Interdiction therefore does not defeat an invasion or end a short war. Its value is twofold. In a protracted war it compounds. In peacetime, a credible capability gives the PLA Navy a reason to spend on carriers, large escorts, and overseas logistics for sea-lane protection far from Taiwan. How large that diversion is cannot be shown from open sources, and this paper does not rest any conclusion on it.

5.5 Forces held on China's land borders

The Western Theater Command is China's largest by area and holds substantial ground, air, and rocket forces opposite India. The June 2020 clash in the Galwan Valley killed 20 Indian soldiers; China acknowledged four dead in February 2021, and higher figures are reported but unconfirmed.³⁸ An October 2024 patrolling arrangement at Depsang and Demchok reduced friction on the Line of Actual Control without withdrawing the forces behind it. Indian capability on that line is an advantage the United States obtains at no cost to itself. U.S. tariffs on India rose to 50 percent on 27 August 2025; a framework announced 2 February 2026 and formalized on 6 February lowered the reciprocal rate to 18 percent and removed the 25-point penalty tied to Russian oil purchases.³⁹ On 16 and 17 September 2026 Congress passed the Sanctioning Russia Act of 2026, which authorizes but does not require tariffs of up to 100 percent on the largest buyers of Russian energy; as of this paper's date it awaited signature, and New Delhi had stated its concerns about it publicly.³⁹ The measurable effect on Indian force posture is nil so far. The effect on Indian willingness to coordinate with Washington in a crisis is unmeasured.

6 Economic and Technological Measures

6.1 Semiconductor manufacturing equipment

Controls issued in October 2022, October 2023, and December 2024, with parallel Dutch and Japanese measures in 2023, restrict China's access to extreme-ultraviolet lithography entirely and to advanced deep-ultraviolet immersion tools, etch, deposition, and metrology equipment for leading-edge nodes. Chinese firms have reached 7-nanometer-class production using multiple patterning on older tools, at lower yields and higher cost per wafer. The most effective element of the controls is the least discussed: the restriction, introduced in the October 2022 rule and expanded since, on U.S. persons servicing and supplying parts for installed Western tools at advanced Chinese fabs, which degrades existing capacity over time.⁴⁰

The effect is delay, not denial, and it comes at the cost of state-funded Chinese efforts to build a domestic tool industry. Separately, a BIS rule effective 15 January 2026 moved exports of certain advanced AI accelerators, of the Nvidia H200 and AMD MI325X class, to China from presumption of denial to case-by-case review, subject to a cap on volumes relative to U.S. sales, third-party testing, and a 25 percent Section 232 tariff.⁴¹ Equipment controls and chip sales are different instruments. Selling finished chips eases China's near-term compute shortage while leaving its manufacturing deficit in place. Whether that trade is sound depends on whether the contest is decided by compute available in 2027 or by fabrication capability in 2032. A restored denial policy would cover accelerators above a defined performance threshold and high-bandwidth memory. It would not stop smuggling or training on rented offshore compute.

6.2 Coordinated trade remedies

China's goods trade surplus was \$1.189 trillion in 2025, on exports of \$3.77 trillion and imports of \$2.58 trillion.⁴² With property investment contracting and household demand weak, net exports carry a larger

share of growth than at any time in nearly two decades. After U.S. tariff increases in 2025, Chinese exports to the United States fell by about a fifth while exports to the European Union and Southeast Asia rose by 8 and 13 percent, and the total surplus grew.⁴² Unilateral tariffs redirect Chinese goods. They do not reduce them.

A coordinated package would have four parts: simultaneous anti-dumping, countervailing-duty, or safeguard actions by the United States, the European Union, Japan, and other large importers on a short list of sectors (steel, electric vehicles, batteries, solar); shared customs data and rules of origin to defeat transshipment and third-country assembly; discipline on export credit; and removal of U.S. tariffs on the participating allies as the price of their participation.

Two qualifications are necessary. European reluctance predates U.S. tariffs on Europe: German automakers opposed the European Union's 2024 duties on Chinese electric vehicles, and member states split on the October 2024 vote, with Germany among the five against.⁴³ The administration's position, that tariff pressure has raised allied defense spending and improved U.S. bargaining leverage, has evidence behind it on defense spending, where NATO members committed at The Hague in June 2025 to 5 percent of GDP by 2035. Neither point changes the arithmetic that China's surplus grew under unilateral tariffs. Coordination is the instrument with the larger effect, and of the obstacles to it, U.S. tariffs on prospective participants are the one Washington controls. European and Japanese domestic politics are obstacles it does not control.

Chinese counters. Transshipment, overseas assembly, currency management, retaliation against individual participants, particularly against firms dependent on the Chinese market, and rare earth licensing (6.4).

6.3 Financial sanctions

Executive Order 14114 of 22 December 2023 exposed foreign banks to secondary sanctions for handling transactions tied to Russia's military-industrial base. During 2024, Chinese banks, including large state banks, delayed or refused Russia-related payments, which shows that access to dollar clearing remains an effective instrument even against major Chinese institutions.⁴⁴ Applying full blocking sanctions to the largest Chinese banks would be a different act. Those banks are among the largest in the world, and the damage would reach U.S. and allied firms quickly. The threat has deterrent value only if packages are agreed with allies in advance, with target lists and legal authorities prepared, and if the sequence of steps stops short of measures that would trigger mineral retaliation the West cannot yet absorb.

6.4 The limit on U.S. economic pressure: rare earths and magnets

China accounted for about 91 percent of refined rare earth output and 94 percent of sintered permanent magnet production in 2024.⁴⁵ It restricted gallium and germanium exports from August 2023; in December 2024 it banned dual-use exports to U.S. military end users and banned gallium, germanium, and antimony exports to the United States; in April 2025 it imposed licensing on seven medium and heavy rare earths and related magnets; and on 9 October 2025 it announced controls with extraterritorial reach

over products containing Chinese-origin material. After the presidents met in Busan on 30 October 2025, the October measures were suspended until 10 November 2026 and the December 2024 ban on gallium, germanium, and antimony exports to the United States until 27 November 2026; the April licensing regime and the military end-user ban remain in force.⁴⁶ Automotive and defense suppliers in the United States, Europe, and Japan reported production interruptions within weeks of the April controls.

The U.S. response includes a July 2025 Department of Defense investment in MP Materials: \$400 million in convertible preferred equity, a ten-year price floor of \$110 per kilogram for neodymium-praseodymium oxide, and a commitment to buy the output of a new magnet plant for ten years.⁴⁷ DFARS restrictions on magnets mined, refined, separated, or produced in China take full effect on 1 January 2027.⁴⁸ New separation and magnet capacity takes years to build and qualify.

This position is sometimes described as “escalation dominance.” The term is inaccurate. Each use of the control spurs stockpiling, substitution, and non-Chinese investment, so the leverage declines with use.

The accurate statement is that through roughly 2028 China can impose faster and more concentrated economic cost on the United States than the reverse, and U.S. economic measures must be sequenced with that in mind. The expected Chinese counter to Western capacity is price: selling below the cost of new entrants, which is why the price floor exists.

6.5 Talent

Chinese nationals who earn U.S. doctorates in science and engineering have historically stayed at high rates: 88 percent of the 2015–2017 cohort and 83 percent of the 2017–2019 cohort were in the United States about five years after graduation, in National Science Foundation data.⁴⁹ Each one who stays is a trained researcher added to the U.S. base and subtracted from China's. Visa restrictions and investigations aimed at this population reduce the inflow and raise departures. The counterintelligence concern is real and is a reason for screening at the project level, not for reducing the population.

6.6 A measure that is not available

Separating Russia from China is proposed periodically. Since 2022 Russia has become more dependent on China for trade, payments, and dual-use components, not less. Nothing Washington can offer Moscow outweighs that dependence on a relevant timescale.

7 Costs, Authorities, Consent, and Indicators

Table 2a. Cost and authority. Open-source estimates, not program costs.

Measure	Cost band (5 yr)	U.S. authority or account
Mines, Hammerhead, Quickstrike-ER	\$1–2.5 bn	Navy weapons procurement, BLI 3231 (Maritime Mines); mine development RDT&E, PE 0604601N
Orca and large UUVs	\$1–2.5 bn	Navy other procurement, RDT&E
Ground-based anti-ship and strike missiles	\$4–9 bn including munitions (\$5–10 bn at line-item Tomahawk cost)	Army and Marine Corps missile procurement
Counter-targeting (unscored)	Not scoreable from open sources	Navy (SEWIP Block 3, Nulka), Space Force (Counter Communications System), Cyber Command
One-way attack drones (LUCAS class)	\$0.4–0.7 bn	Procurement; FY2026 reconciliation sections 20004–20005
Hardening and dispersal	\$9–10.5 bn (Hudson estimate as reported; single source)	Military construction; Pacific Deterrence Initiative
Taiwan stocks and asymmetric systems	\$5–10 bn (Taiwan-funded)	Foreign Military Sales; Taiwan special budgets
Munitions inventory	\$30–60 bn	Multiyear procurement authority; FY2027 request and reconciliation
Virginia-class and industrial base	\$40 bn+	Shipbuilding and conversion; submarine industrial base funds
Auxiliary construction in allied yards	Net saving	10 U.S.C. § 8679 exception as delegated 13 Aug 2026 (Finland-model conditions), or statutory exception for auxiliaries
SME controls	Administrative	Export Control Reform Act
Coordinated trade remedies	Administrative; tariff revenue forgone	Trade Act §§ 201, 301; AD/CVD law
Pre-agreed sanctions	Administrative	IEEPA; existing executive orders
Rare earth and magnet capacity	\$2–5 bn public	Defense Production Act Title III; DoD equity; DFARS

Table 2b. Consent, counters, and indicators.

Measure	Allied consent required	PLA/PRC counter	Indicator by 2028
Mines, Hammerhead, Quickstrike-ER	None for stock; basing for bombers	Mine countermeasures growth; lead-ship tactics; concealment of lanes	Inventory in thousands; routine bomber mining exercises; demonstrated lane detection and reseedling
Orca and large UUVs	None	Seabed sensors	10+ operational vehicles
Ground-based anti-ship and strike missiles	Japan, Philippines: peacetime basing and wartime firing	Preemption; pressure on hosts	Permanent batteries in both countries; stated firing arrangements
Counter-targeting (unscored)	Minimal	LEO proliferation; salvo size	Partial proxies only: SEWIP Block 3 installations; jammer units fielded
One-way attack drones (LUCAS class)	Basing in Japan, Philippines	Low-cost interceptors; guns	Inventory in the tens of thousands
Hardening and dispersal	Japan, Philippines, Australia, freely associated states	More missiles per aimpoint	Shelter starts at Kadena, Misawa, Guam, Tinian
Taiwan stocks and asymmetric systems	Taiwan legislature	Infrastructure strikes; slow quarantine	LNG storage days; reserve training throughput
Munitions inventory	Co-production: Japan, Australia	Own mass production	Deliveries reach announced rates
Virginia-class and industrial base	Australia (AUKUS)	Numerical growth	1.5+ deliveries per year
Auxiliary construction in allied yards	Korea, Japan	None needed	CONSOL/Ro-Ro plan issued; first contract award
SME controls	Netherlands, Japan	Indigenization; smuggling	Chinese leading-edge yield and volume
Coordinated trade remedies	EU, Japan, Korea, others	Transshipment; targeted retaliation	Joint actions in two or more sectors
Pre-agreed sanctions	G7	CIPS; mineral licensing	Agreed target list exists
Rare earth and magnet capacity	Australia, Japan, Malaysia	Below-cost pricing	Non-Chinese heavy rare earth separation at scale

The U.S.-funded near-term rows (mines, undersea vehicles, ground-based missiles, hardening, one-way attack drones) total roughly \$15 billion to \$25 billion over five years, or about 1.5 to 3 percent of one year's U.S. defense budget depending on whether the denominator is the roughly \$850 billion base or the roughly \$1 trillion FY2027 request including reconciliation. Taiwan's row adds \$5 billion to \$10 billion funded by Taipei. Counter-targeting is excluded. Annex C gives the quantities behind each band.

Sequence.

- FY2027 legislation: multiyear procurement for mines and anti-ship munitions; a dedicated hardening line; a statutory section 8679 exception for auxiliaries and for maintenance and repair without the Finland-model conditions; sustained funding for the submarine supplier and workforce base.
- 2026–2028 fielding: mine inventory; Orca deliveries; one-way attack drone inventory; additional batteries in Japan and the Philippines; shelter construction; Taiwan's shift of funds to stocks.
- 2027–2029 enabling: co-production of munitions with Japan and Australia; non-Chinese magnet supply; agreed sanctions and trade-remedy packages.
- After 2030: submarine delivery rate; surface and auxiliary construction; munitions inventories at announced production rates.

7.1 Authorities

- **National Defense Authorization Act:** multiyear procurement authority for maritime mines and anti-ship munitions; a dedicated program element for air base hardening; a statutory 10 U.S.C. § 8679 exception for auxiliaries and for maintenance and repair in allied yards, alongside the conditioned exception the 13 August 2026 memorandum delegates for up to three classes.
- **Appropriations:** Navy weapons procurement BLI 3231 (maritime mines) and mine development RDT&E; military construction under the Pacific Deterrence Initiative; submarine supplier and workforce funding.
- **Department of State:** wartime use of territory as a negotiating objective with Tokyo and Manila, with the offsets described in Section 4.2.
- **Department of Commerce:** equipment, subcomponent, and servicing controls maintained under the Export Control Reform Act in alignment with the Netherlands and Japan; accelerator licensing decided as a separate question with its own stated rationale.
- **Department of the Treasury:** a target list agreed in advance with the G7 under IEEPA and existing executive orders, with steps ordered so that the early ones do not provoke mineral retaliation.
- **Department of Defense, industrial policy:** Defense Production Act Title III and equity or offtake support for non-Chinese separation and magnet capacity; DFARS magnet sourcing rules enforced on schedule in 2027.

Host-nation risk. Japan: local opposition in Okinawa Prefecture and the Sakishima islands to new missile units; no public wartime firing arrangement. Philippines: basing policy has reversed with past changes of president, and the next presidential election is in May 2028. Taiwan: legislative disputes over special defense budgets. Australia: domestic debate over AUKUS cost and U.S. delivery capacity. Freely associated states: the Government Accountability Office found in May 2026 that compact funds were disbursed late and oversight delayed, which Beijing can exploit.⁵⁹

8 Escalation

China's operational nuclear warheads remained in the low 600s through 2024 by DoD's estimate and are projected to exceed 1,000 by 2030.^{4,6} The measures in this paper divide into three groups.

Defensive or confined to the battle area: mines in the approaches to Taiwan and in international straits, anti-ship missiles against ships at sea, deception, hardening, and stocks. These deny an objective without attacking the Chinese mainland.

Punitive if expanded: distant interdiction, full financial sanctions, and strikes on mainland ports, airfields, or sensors. These may be necessary in a long war. They carry higher risk and should be decisions taken at the time, not defaults built into the plan.

Not recommended: attacks on PLA strategic early warning, nuclear command and control, or ballistic-missile submarines; mining of Chinese commercial ports before hostilities; any economic measure whose predictable Chinese response the West cannot absorb.

9 Tests of the Argument

If the inexpensive measures are fielded and Beijing invades anyway, the war is decided by munitions, submarines, and repair capacity, where the United States is weakest until the 2030s. The inexpensive measures raise the cost and lengthen the timeline of an invasion. They do not by themselves defeat one.

If host nations cap missile numbers or refuse wartime firing, ground-based missiles become a peacetime signal with little wartime effect, and the burden returns to submarines and bombers, which need the munitions that are short.

If Beijing uses rare earth licensing selectively during a crisis, approving licenses for some allies and denying others, coordinated economic action divides as Beijing chooses.

If coordinated trade remedies prove politically impossible, the economic measures reduce to export controls, which delay but do not deny.

If Virginia-class deliveries remain near 1.2 per year through 2035, the attack-submarine force, which the Congressional Research Service projects to reach a trough of 47 boats in FY2030, would by the author's extrapolation fall into the mid-40s against a requirement of 66, and mines and unmanned vehicles must carry more of the undersea mission than they are funded to carry.³²

If the United States cannot locate cleared lanes within hours or cannot place a few dozen mines into them between waves, the mining case in Annex D reduces to the laned barrier, which removes 3 to 11 percent of planned lift, and to port-approach fields. Mine attrition depends on surveillance and standoff placement, not on mine numbers.

If Beijing chooses quarantine, most of the military measures do not apply, and the outcome turns on Taiwanese stocks and political endurance and on allied economic response.

What would change the conclusions: evidence that PLA mine countermeasures and ASW have closed the gap faster than DoD reports indicate; a public Japanese or Philippine commitment on wartime use of their territory, in either direction; submarine deliveries reaching 2.0 before 2030; non-Chinese heavy rare earth separation at scale before 2028.

10 Conclusion

China's central military problem in a war over Taiwan is lift and sustainment across a defended strait, and its central economic exposures are imported energy, imported chipmaking tools, and foreign markets for surplus production. The United States can act against each. The measures that offer the best return for their cost, mines, mobile anti-ship missiles, hardened bases, and Taiwanese stocks, are available this decade for a small share of the defense budget; for mines, Annex D shows the return in numbers, with a few hundred precision-placed mines reseeded into cleared lanes removing 5 to 24 percent of the PLA's planned lift, provided the lanes can be found and reached, with counter-targeting alongside them as a measure of high value by reasoning that open sources cannot cost, and they are underfunded compared with platforms that will arrive after the period of greatest risk. The measures that would decide a long war are constrained by production capacity that money cannot expand quickly, and the 2026 campaign against Iran drew down the inventories that a Pacific war would need first. On the economic side, the United States holds real instruments whose use is limited, for now, by dependence on Chinese mineral processing.

None of these measures guarantees that China loses. Together they make every form of Chinese victory slower, costlier, and less certain, which is the practical meaning of deterrence by denial.

ANNEX A

Historical data used

Case	Force employed	Result	Note
Operation Starvation, 1945	1,529 B-29 sorties; 12,135 mines; 15 aircraft lost	~670 ships sunk or damaged, 1.25 million tons; major ports closed	9

Case	Force employed	Result	Note
Haiphong, 1972–73	36 mines in first strike; 11,000+ mines and destructors total	Port closed to large vessels until swept in 1973	10
Pacific submarine campaign, 1941–45	<2% of Navy personnel; 52 boats lost	1,113 merchant ships, ~4.8 million tons, 55% of Japanese merchant losses by tonnage	11
Falklands, 1982	5 air-launched Exocets; 1 improvised shore launcher	2 ships sunk, 1 damaged; heavy-lift helicopters lost	15
Black Sea, 2022–24	Shore-based Neptune; unmanned surface vessels	<i>Moskva</i> sunk; fleet withdrew from western Black Sea	16
Concrete Sky, 1968–70	373 shelters built	Aircraft ground losses to rocket and mortar fire fell	27

ANNEX B

Data limitations

Every quantitative claim in this paper was checked against its cited source where the source was accessible before this version was issued; exceptions are listed here. The following limitations remain and should be carried by anyone citing the figures.

- Hudson hardening estimate (\$9–10.5 billion).** Reported by *Air Force Times* on 6 April 2026 as a Hudson Institute analysis. The figure is not in the January 2025 *Concrete Sky* report, and the underlying document was not located. It is the largest component of the \$15–25 billion total in Table 2a and Annex C; readers who exclude it obtain \$6–15 billion.
- PLA first-wave organic lift (20,000–30,000 troops).** A range from secondary literature; CSIS says only “tens of thousands.” No authoritative figure exists in open sources.
- Rocket Force counts other than IRBMs.** MRBM, SRBM, and GLCM figures are from the 2024 DoD report; the 2025 report was used for IRBMs and ISR satellites.
- Orca unit cost (~\$110 million).** Derived from GAO's 2022 estimate for five prototypes; GAO's 2025 assessment implies roughly \$175 million per vehicle on spending to date. Annex C uses the lower figure for production vehicles.
- Hammerhead and Typhon battery costs.** Not public. Annex C assumes \$1 million per Hammerhead and \$0.3–0.5 billion per Typhon battery. The July 2026 Hammerhead modification implies about \$1.2 million per unit if it covers 188 units alone, but its scope is not stated.
- Tomahawk unit cost.** The \$2.5 million figure is an approximate unit procurement cost; line-item arithmetic on the FY2026 and FY2027 requests gives \$3.8–4.7 million. Annex C shows both.

7. **Guangzhou landing barges.** Commercial imagery analysis; no official confirmation as of September 2026.
8. **PLA doctrine and readiness.** Inferred from DoD and Naval War College summaries of Chinese publications, not from operational plans. The anti-submarine warfare description in Section 2.4 is a paraphrase of DoD reporting across several editions and was not confirmed verbatim against the 2024 report. The net effect of the 2023–2025 leadership removals on readiness is unknown, and the paper draws no conclusion from it.
9. **Strait widths and island distances.** Approximate; confirm against a chart if used quantitatively.

ANNEX C

Quantity assumptions behind Table 2a

Five-year totals. Unit costs are from the sources cited in the text unless marked as assumptions.

Item	Quantity assumed	Unit cost	Subtotal
Quickstrike-ER	5,000–10,000 (Annex D: 3,000–6,000 barrier, 1,600–4,000 port approaches, 200–700 lane reseeded)	\$0.10–0.15 m (JDAM kit \$66,000 plus wing kit and target detection device; assumption)	\$0.5–1.5 bn
Hammerhead	500–1,000	Not public; \$1 m assumed	\$0.5–1.0 bn
Mines total			\$1–2.5 bn
Orca XLUVV	10–20	~\$110 m (2022 prototype-derived; 2025 spending implies higher)	\$1.1–2.2 bn; band \$1–2.5 bn with support
Additional Typhon batteries	4–6	Not public; \$0.3–0.5 bn assumed	\$1.2–3.0 bn
Maritime Strike Tomahawk reloads	500–1,000	~\$2.5 m (sensitivity: \$3.8 m)	\$1.25–2.5 bn (\$1.9–3.8 bn at \$3.8 m)
Naval Strike Missile	500–1,000	~\$2 m	\$1.0–2.0 bn
NMESIS launchers and support	—	—	\$0.5–1.0 bn (assumption)
Ground-based missiles total			\$4–9 bn (\$5–10 bn at the higher Tomahawk cost)

Item	Quantity assumed	Unit cost	Subtotal
Hardening and passive defense	Hudson estimate as reported	—	\$9–10.5 bn
One-way attack drones	10,000–20,000	~\$35,000	\$0.35–0.7 bn
U.S.-funded near-term total			~\$15–25 bn (~\$16–26 bn at the higher Tomahawk cost)
Taiwan stocks and asymmetric systems	Taipei-funded	—	\$5–10 bn (not a U.S. cost)
Counter-targeting	—	—	Excluded

The mine quantities are derived in Annex D. The remaining quantities are illustrative of a program large enough to matter, not derived from a campaign model. A reader who prefers different quantities can recompute the bands from the unit costs.

ANNEX D

Mine requirement and lift-attrition model

D.1 Purpose and formulation

Section 4.1 rates mines decisive against invasion. This annex states the arithmetic behind that rating so that a reader can reject or revise it parameter by parameter. The model is the uniform-random minefield formulation used in U.S. mine warfare analysis: mines are treated as independently and uniformly distributed over the field, which Washburn notes is a fair approximation of laid lines once navigation error, mixed lines, and duds are accounted for.⁵¹ No classified planning factor is used. Actuation widths and damage probabilities are classified and are carried here as parameter ranges. The model is run in three cases, and the difference between them is the annex's main result.

First-transit threat. For N mines spread across a width W , a ship whose track crosses at a random point encounters at least one mine with probability

$$P_1 = 1 - (1 - w/W)^N \approx 1 - \exp(-Nw/W),$$

where w is the actuation width, the distance across which the mine will actuate against the target class. The number of mines for a chosen threat is $N = \ln(1 - P_1) / \ln(1 - w/W)$.

Damage given actuation. An actuation is not a kill. Each actuation damages the hull with probability d , carried at 0.5 and 0.8. Actuators consume mines whether or not they damage.

Sequential waves with consumption. A fleet of H hulls crosses in waves. The threat to each wave is computed from the mines present in the width the ships actually use; actuators in a wave cannot exceed the mines present; damaged hulls are removed; actuated mines are subtracted. Outputs are hulls lost and crossings completed as a share of crossings planned.

Case A, barrier crossed at random. The fleet crosses the whole width W at random points. This is the textbook case and the upper bound on what a barrier can do. It is not how the PLA would cross.

Case B, barrier laned through. The PLA clears lanes of total width L to effectiveness c and its ships transit only inside them. The mines a ship can meet are the residual lane mines, $m = N(L/W)(1 - c)$. The per-transit threat inside a lane is $1 - \exp(-m w/L) = 1 - \exp(-N(1 - c)w/W)$, the same as area clearance with $q = c$, so the lane's width cancels from the threat. It does not cancel from the attrition: the fleet can actuate at most m mines, and m is small.

Case C, lanes reseeded. As Case B, with R mines released toward the lanes before each wave after the first. Only a fraction s of released mines lands in a lane and functions, and the PLA re-clears a fraction c_r of those before the wave, so the effective reseed per wave is $R s(1 - c_r)$. The case with $s = 1$ and $c_r = 0$ is an upper bound and is shown as such. Reseeding requires knowing where the lanes are and being able to place mines into them by standoff delivery while the crossing is under way.

D.2 Parameters

Parameter	Value or range	Basis
Barrier length W	150 km	West-coast invasion front, Taoyuan to Tainan; the band the sealift must cross. 100 km shown for sensitivity.
Water depth	About 60 m average; Taiwan Banks about 20 m	Connell (2026); within the Quickstrike limit of about 90 m (NRC 2001: "< 300 ft"). ⁵²
Actuation width w	50 m (conservative), 100 m (central); 200 m shown in Table D1 as sensitivity only	Classified; range assumed for a 2,000-pound bottom influence mine against a large steel hull in shallow water. Halve for 500-pound mines.
Damage given actuation d	0.5, 0.8	Classified; at 60 m a bottom mine's damage to a large surface hull is well below certain.
Lanes L	10 km total (for example five lanes of 2 km)	Assumption. Wider lanes hold more mines before clearance and take longer to clear; the residual threat per transit is unchanged.
Clearance effectiveness c	0.8, 0.9, 0.95	PLA Navy operates 24–36 dedicated MCM platforms (Connell); clearance under fire and on a timetable is unlikely to exceed 0.9–0.95. ⁵²
Reseeding R	25, 50 mines released per wave	Assumption; 25 mines is roughly one B-52 sortie at 2,000-pound loads or one Orca sortie at 500-pound loads.
Placement success s	0.5, 0.8 (1.0 as upper bound)	Stated assumption: share of released mines that reach a lane and function, allowing for lane-location error, delivery losses, and duds.
Re-clearance c_r	0.5, 0.8 (0 as upper bound)	Stated assumption: share of reseeded mines the PLA clears before the next wave. The PLA that cleared 90 percent of the barrier will not clear zero percent of mines dropped into the same lanes in view of its escorts.

Parameter	Value or range	Basis
Port-approach channel width	2 km	Typical dredged approach; 12–15 embarkation and RO-RO ports on the Fujian, Zhejiang, and Guangdong coasts (Dahm; Kennedy). ⁵ The channel is the whole field, so Case B does not apply.
PLA fleet and crossings	300 hulls × 8 crossings = 2,400	Stated assumption: amphibious ships plus mobilized civilian hulls; a first-wave lift of 20,000–30,000 troops with follow-on echelons over weeks (Section 2.3).
Bomber loads	B-52H: about 45–51 500-lb or about 18 2,000-lb class; B-1B: 84 Mk 62 or 24 Mk 65	Open-source figures; not official loadouts. ⁵³
Unit cost	\$0.10–0.15 m	Annex C assumption (JDAM kit \$66,000 plus wing kit and target detection device).

D.3 Results

Table D1. Mines required for a first-transit threat P_1 , by field width and actuation width.

Field	w (m)	$P_1 = 0.5$	$P_1 = 0.9$
Port approach, $W = 2$ km	50	27	91
	100	14	45
	200	7	22
Barrier, $W = 100$ km	50	1,390	4,600
	100	690	2,300
	200	350	1,150
Barrier, $W = 150$ km	50	2,080	6,910
	100	1,040	3,450
	200	520	1,730

Table D2. Case A, barrier of $W = 150$ km crossed at random, 300 hulls $\times$ 8 crossings. Upper bound; not the PLA's method.

Mines N	Cleared q	w (m)	d	First-wave threat	Hulls lost	Crossings delivered (share of plan)
3,000	0	50	0.5	0.63	281	27%
3,000	0	50	0.8	0.63	298	13%
3,000	0	100	0.5	0.86	296	17%
3,000	0.5	50	0.5	0.39	231	46%
3,000	0.5	50	0.8	0.39	278	28%
3,000	0.5	100	0.5	0.63	275	29%
6,000	0.5	50	0.5	0.63	281	27%
6,000	0.5	100	0.5	0.86	296	17%

Table D3. Case B, barrier laned through: lanes of $L = 10$ km cleared to c ; ships transit only in lanes; 300 hulls $\times$ 8 crossings.

Mines N	c	Lane mines before / after	w (m)	d	First-wave threat	Hulls lost	Crossings delivered
3,000	0.8	200 / 40	50– 100	0.5	0.18–0.33	20	93%
3,000	0.8	200 / 40	50– 100	0.8	0.18–0.33	32	89%
3,000	0.9	200 / 20	50– 100	0.5	0.10–0.18	10	97%
3,000	0.9	200 / 20	50– 100	0.8	0.10–0.18	16	95%
3,000	0.95	200 / 10	50– 100	0.5	0.05–0.10	5	98%
3,000	0.95	200 / 10	50– 100	0.8	0.05–0.10	8	97%
6,000	0.8	400 / 80	50– 100	0.5	0.33–0.55	40	87%
6,000	0.8	400 / 80	50– 100	0.8	0.33–0.55	64	79%
6,000	0.9	400 / 40	50– 100	0.5	0.18–0.33	20	93%
6,000	0.9	400 / 40	50– 100	0.8	0.18–0.33	32	89%
6,000	0.95	400 / 20	50– 100	0.5	0.10–0.18	10	97%
6,000	0.95	400 / 20	50– 100	0.8	0.10–0.18	16	95%

Table D4. Case C, lanes reseeded: as Table D3 with $N = 3,000$ and $c = 0.9$ (20 residual lane mines), plus R mines released toward the lanes before each of waves 2 through 8, with placement success s and PLA re-clearance c_r . Rows with $s = 1$, $c_r = 0$ are the upper bound.

R	s	c_r	w (m)	d	Hulls lost	Crossings delivered	Mines released	Released per hull lost
25	1.0	0	50–100	0.5	98	82%	175	1.8
25	1.0	0	50–100	0.8	151–156	71–72%	175	1.1–1.2
25	0.8	0.5	50–100	0.5	45	91%	175	3.9
25	0.8	0.5	50–100	0.8	72	85%	175	2.4
25	0.8	0.8	50–100	0.5	24	94%	175	7.3
25	0.8	0.8	50–100	0.8	38	91%	175	4.6
25	0.5	0.5	50–100	0.5	32	93%	175	5.5
25	0.5	0.5	50–100	0.8	51	89%	175	3.4
25	0.5	0.8	50–100	0.5	19	95%	175	9.3
25	0.5	0.8	50–100	0.8	30	92%	175	5.8
50	1.0	0	50–100	0.5	173–185	68–69%	350	1.9–2.0
50	1.0	0	50–100	0.8	245–265	50–53%	350	1.3–1.4
50	0.8	0.5	50–100	0.5	80	85%	350	4.4
50	0.8	0.5	50–100	0.8	126–128	76%	350	2.7–2.8
50	0.8	0.8	50–100	0.5	38	92%	350	9.2
50	0.8	0.8	50–100	0.8	61	87%	350	5.8
50	0.5	0.5	50–100	0.5	54	89%	350	6.5
50	0.5	0.5	50–100	0.8	86	83%	350	4.1
50	0.5	0.8	50–100	0.5	27	94%	350	12.7
50	0.5	0.8	50–100	0.8	44	90%	350	8.0

Shaded rows are upper-bound cases ($s = 1$, $c_r = 0$) and are not the headline result.

Table D5. Port-approach field, $W = 2$ km is the whole field, 30 hulls $\times$ 8 sorties from one port, clearance 0.9.

Mines N	w (m)	d	First-transit threat	Hulls lost	Sorties delivered (share of plan)
45	50	0.5	0.11	2.2	93%
45	100	0.8	0.20	3.6	88%
90	50	0.5	0.20	4.5	86%
90	100	0.8	0.36	7.2	76%

D.4 Reading the results

- 1. The barrier alone does little once it is laned.** A 3,000 to 6,000 mine barrier that the PLA lanes through at 80 to 95 percent clearance removes 5 to 64 hulls, or 2 to 21 percent of planned lift, and at the central case of 90 percent clearance 10 to 32 hulls, 3 to 11 percent. Ships in lanes can meet only the mines that were in the lanes, and after clearance those number 10 to 80. Case A, the textbook random-crossing case, overstates the barrier by an order of magnitude and should not be quoted.
- 2. The barrier's function is to force lanes and impose a clearance task.** It puts 200 to 400 mines into 10 kilometers of lanes that a force of 24 to 36 mine countermeasures platforms must clear under fire before the crossing, and it fixes where the crossing will occur. The delay and the fixing are the barrier's contribution; they are not modeled here and are the reason the barrier is worth its \$0.3 billion to \$0.9 billion.
- 3. The attrition comes from reseeding.** Traffic in a lane is dense enough that nearly every mine that reaches it actuates, so losses approach d times the mines that survive placement and re-clearance. With placement success and re-clearance each between 0.5 and 0.8, 25 to 50 mines released per wave, 175 to 350 in all, remove 19 to 128 hulls, 5 to 24 percent of planned lift, at 2 to 13 mines released per hull lost and \$20 million to \$50 million in mines. The upper-bound rows, with every mine landing in a lane and none re-cleared, give 100 to 265 hulls at 1 to 2 mines per hull; they are not the headline, because the PLA that cleared 90 percent of the barrier would not leave reseeded mines in the same lanes untouched. For comparison, Operation Starvation took about 18 mines per ship sunk or damaged (12,135 mines, about 670 ships); channelized traffic justifies doing better than that, and the modeled range sits credibly below it rather than far beneath it. The model counts only attrition. A wave that halts after early hits and re-sweeps the lane converts the modeled losses into delay, which the model does not count and which also works against the invasion timetable. A mine placed into 10 kilometers of known lanes is fifteen times as effective per transit as one scattered across the 150-kilometer barrier: mine efficiency scales inversely with the width the mines are spread over.
- 4. What reseeding requires.** Knowledge of lane locations within hours, which means persistent surveillance of the strait by satellite, aircraft, unmanned systems, or seabed sensors, all of which the PLA will attack; and the ability to place 25 to 50 mines per wave by standoff delivery, about one to two B-52 sorties at 2,000-pound loads or one to two Orca sorties at 500-pound loads. This is the case for

Quickstrike-ER specifically: GPS-guided standoff placement is what makes lane reseeding possible. It is also the reason mining, hardening of bomber bases, and counter-targeting appear together in Table 2a.

5. **Port approaches.** The channel is the whole field, so the PLA cannot lane around it and Case B does not apply; the defender's problem there is that the field must be in place before the first sortie, which means submarine or unmanned delivery before hostilities are certain (Section 8). Forty-five to ninety mines per two-kilometer channel remove 7 to 24 percent of sorties from a port after clearance to 90 percent. Twelve to fifteen such fields, replanted three times, need 1,600 to 4,000 mines.
6. **Deep straits.** Quickstrike is limited to about 90 meters. The Luzon and Miyako straits exceed 1,000 meters. The barrier, the lanes, and the port approaches are the whole of the bottom-mine task; the deep straits are a moored-mine task against submarines and a missile task against surface ships.
7. **What would overturn the result.** Failure to locate lanes or to reach them with sorties, which returns the case to Table D3; PLA re-clearance of reseeded lanes above 80 percent, or placement success below 0.5, which pushes the reseeding case toward the laned-barrier result; an actuation width well below 50 meters or a damage probability well below 0.5, which halves the figures again; or a PLA decision to accept the losses and press the crossing.

Replication. WP-2026_mine_requirement_model.py, distributed with this paper, reproduces Tables D1 through D5 when run and accepts any parameter values, including s and c_p .

NOTES

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SUGGESTED CITATION

George, Collin B. 2026. *Denying Chinese Victory: Cost, Resource, and Military Advantages Available to the United States*. Sanctir Open-Source Policy Research Series, WP-2026, version 3.3 (19 September). Replication code for Annex D: WP-2026_mine_requirement_model.py, distributed with the paper.

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