

Analytical Review

NAVAL MINE WARFARE IN THE STRAIT OF HORMUZ: TIMELINES, CAPABILITIES, AND STRATEGIC CHALLENGES FOR DEPLOYMENT AND CLEARANCE OPERATIONS

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Running title

Iranian Naval Mining and Mine Countermeasures in the Strait of Hormuz

Abstract

The Strait of Hormuz is one of the world's most critical maritime chokepoints, through which approximately 20–21% of global seaborne oil normally transits. In a high-intensity conflict, Iranian naval mining operations—primarily executed by the Islamic Revolutionary Guard Corps Navy (IRGCN)—could rapidly disrupt commercial shipping in the narrow Traffic Separation Scheme (TSS). Coalition mine countermeasures (MCM) in a contested environment would face substantial technical, operational, and threat-related challenges. This analytical review assesses deployment and clearance timelines using open-source data on Iranian mine inventories (estimated 2,000–6,000 units), platform capabilities, historical precedents from the 1991 Gulf War, and current U.S. Navy MCM systems centered on the Littoral Combat Ship (LCS) Mine Countermeasures Mission Package. Effective interdiction could occur within days to weeks, while comprehensive clearance may require several months to over two years, depending on threat intensity and minefield density.

Keywords

Strait of Hormuz, maritime chokepoint, naval mining, IRGC Navy, mine countermeasures, commercial shipping disruption, Gulf security, maritime security, traffic separation scheme, U.S. Navy MCM



Data Source: Archives, Biographies, Databanks, Encyclopedias, Libraries, Metadata Registries, Reports, Repositories, arXiv, Crossref, OpenAI, Wikipedia, World Health Organization, Zenodo.

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Peer Review Statement: This manuscript has not undergone external peer review, as it represents a structured synthesis and analysis of existing evidence. The methodological approach adheres to established standards to ensure rigor, transparency, and scientific validity.

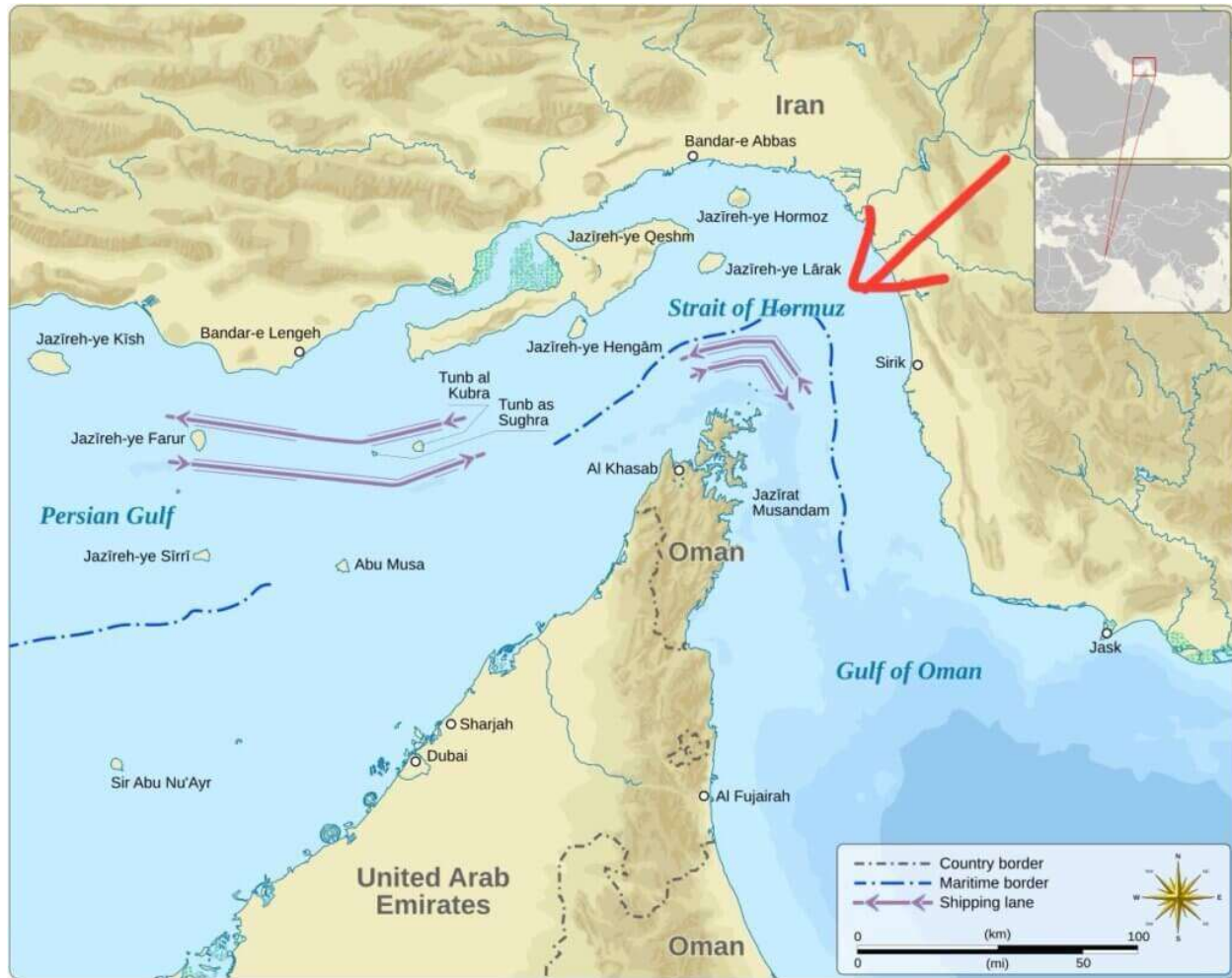
Data Synthesis and Analysis

Data were synthesized using meta-analysis (fixed/random effects) with heterogeneity assessed by I^2 and Cochran's Q. Where pooling was not feasible, narrative and thematic syntheses were applied. Network meta-analysis and meta-regression were conducted where appropriate, in accordance with PRISMA and Cochrane guidelines.



Introduction:

The Strait of Hormuz spans roughly 21 nautical miles at its narrowest point and features an IMO-mandated TSS consisting of two 2-mile-wide shipping lanes separated by a 2-mile buffer zone. This confined geometry makes it particularly susceptible to naval mines as an anti-access/area-denial (A2/AD) weapon. Iran possesses one of the largest naval mine stockpiles globally, estimated at 2,000–6,000 units of varying types, including contact, influence (acoustic, magnetic, pressure-activated), moored, bottom-laid, drifting, and limpet mines.

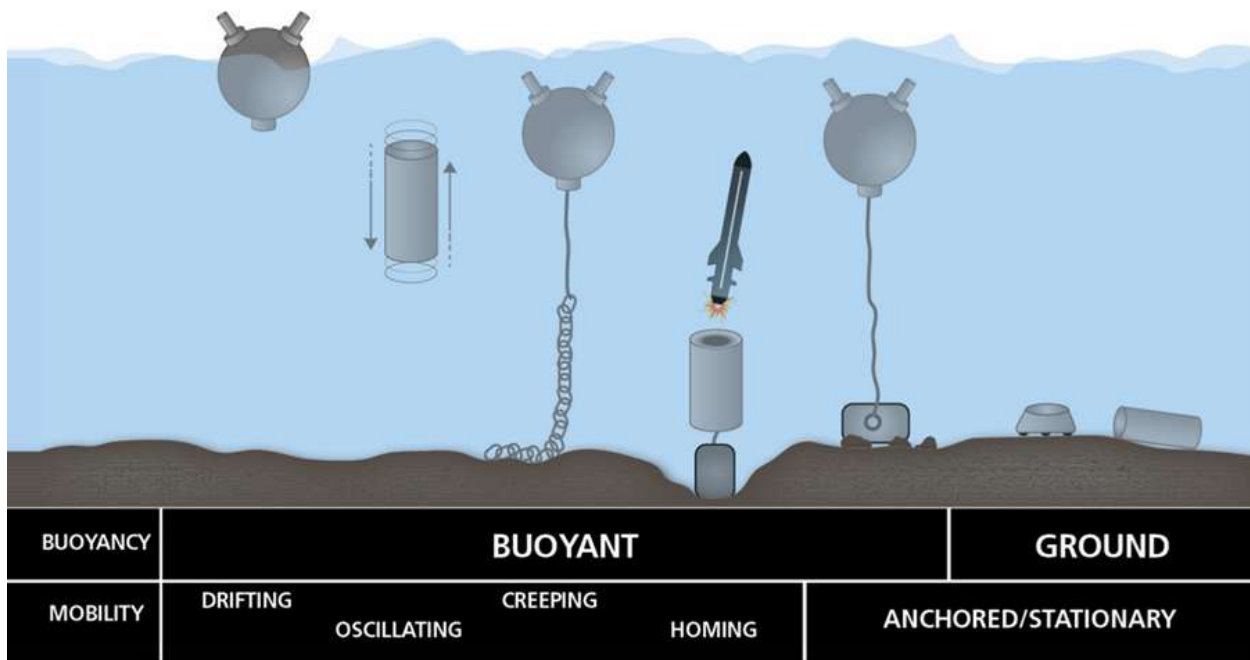


mappingaround.in Strait of Hormuz - Mapping Around

Figure 1. Strait of Hormuz Traffic Separation Scheme (TSS) and primary shipping lanes. The narrowest sections (approximately 3.2 km per lane) demonstrate high vulnerability to concentrated mine emplacement.

Iranian Mine Deployment: Timelines and Mechanisms Iranian forces can achieve significant disruption by concentrating even a few hundred mines in the TSS chokepoints. The 1972 U.S. mining of Haiphong Harbor with only 36 mines demonstrated that limited emplacement can effectively halt commercial traffic, amplified by immediate psychological and insurance-related effects. IRGCN fast attack craft (FAC) and fast inshore attack craft (FIAC) serve as primary minelaying platforms. Each vessel can deploy 2–3 mines per sortie. Given their high numbers, speed, and dispersed coastal operations, effective lane closure could be achieved within days to a few weeks, even under partial coalition interdiction.

Naval mine types – buoyancy and mobility



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Figure 2. Naval mine types relevant to Strait of Hormuz scenarios, illustrating differences in buoyancy and mobility (buoyant drifting/oscillating, creeping, homing, and anchored/ground mines). Diverse fuzing and placement options significantly complicate detection and neutralization.

Coalition Mine Clearance Operations: Challenges and Timelines Mine clearance is far more complex and time-consuming than deployment. During the 1991 Gulf War, Iraqi forces laid approximately 1,300 mines off Kuwait. Coalition forces required over 50 days to clear 907 mines in one sector—even with the benefit of Iraqi-provided maps—and full regional demining extended for months. U.S. vessels such as USS Tripoli and USS Princeton were damaged by mines during these operations.

The U.S. Navy has shifted from dedicated Avenger-class minesweepers to Independence-class LCS platforms equipped with the MCM Mission Package. This system integrates MH-60S Seahawk helicopters with Airborne Laser Mine Detection System (ALMDS) and Airborne Mine Neutralization System (AMNS), unmanned surface vehicles, advanced sonar, and influence sweep gear.



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Figure 3. U.S. Navy MH-60S Seahawk helicopter engaged in airborne mine countermeasures operations. Helicopter-based systems enable standoff detection and neutralization, though their effectiveness is constrained in high-threat littoral environments.



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Figure 4. Naval mine countermeasures operations often require coordinated helicopter and surface assets in contested waters. Current LCS-based MCM packages represent a shift toward unmanned and standoff capabilities, but remain operationally unproven at scale under sustained combat conditions.

Key Operational Constraints

- **Contested environment:** Persistent threats from Iranian anti-ship missiles, drones, and FAC swarms make slow, methodical MCM operations highly vulnerable.
- **Mine diversity:** Drifting and advanced influence mines increase search complexity amid variable bathymetry and seabed clutter.
- **Capacity limitations:** Limited numbers of specialized MCM assets and incomplete operational testing of the LCS package constrain rapid response.

Consequently, establishing initial safe corridors may take weeks to months under favorable conditions, while full reopening of the strait in a prolonged conflict could require 6–24+ months.

Table 1. Comparative Timelines and Key Determinants

Phase	Estimated Duration	Primary Determinants	Key Historical Analogues
Iranian Minelaying	Days to several weeks	Mine stockpile (2,000–6,000), FAC/FIAC swarm tactics, TSS geometry	1972 Haiphong Harbor
Coalition Clearance	Months to 2+ years	MCM asset availability, threat suppression, mine diversity	1991 Gulf War (1,300 mines)
Economic/Psychological Disruption	Immediate upon confirmation	Insurance withdrawal, rerouting, oil price volatility	1980s Tanker War

Broader Strategic Implications

Naval mining exemplifies effective asymmetric warfare: low-cost, rapid deployment creates outsized economic disruption through halted energy flows and insurance denials. Prolonged clearance operations would divert significant naval resources from other theaters, highlighting the need for accelerated MCM modernization, expanded autonomous systems, and multinational coordination.

Conclusion

Iranian mining of the Strait of Hormuz offers a potent A2/AD capability capable of swift disruption while imposing prolonged and hazardous clearance burdens on coalition forces. Mitigation success will depend on rapid threat suppression, intelligence superiority, and investment in scalable standoff MCM technologies. Policymakers should prioritize pre-conflict deterrence measures, MCM force enhancements, and diversified energy transit options to protect maritime security and global economic stability.

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2. U.S. Navy Fact File – Littoral Combat Ship Mine Countermeasures Mission Package (2025 update).
3. Naval History and Heritage Command – Operation Desert Storm Mine Warfare summaries.
4. Additional open-source analyses from USNI Proceedings and Naval News (2025–2026).



Ethical Statement

This is a research-based manuscript prepared and structured in a scientific narrative review format. Modern AI-assisted tools were used to access current and authentic information from digital archives, bibliographic databanks, online libraries, research articles, academic repositories, and encyclopedias.

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Literature Search and Information Management

Literature retrieval was conducted using a structured and reproducible search strategy in accordance with PRISMA-S reporting standards. Search strategies were independently evaluated using the PRESS framework to ensure methodological quality, accuracy, and completeness. Grey literature was systematically identified using the CADTH *Grey Matters* framework to enhance coverage of unpublished, non-indexed, and policy-relevant sources, thereby minimizing publication bias and improving comprehensiveness.

Risk of Bias and Evidence Quality

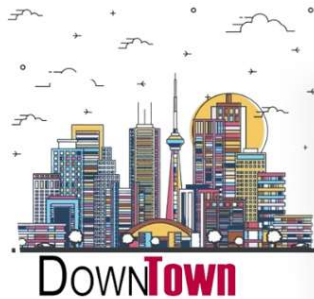
Risk of bias was assessed using validated, design-specific tools (RoB 2, ROBINS-I, QUADAS-2/3, AMSTAR 2, Newcastle–Ottawa Scale, and CASP). The certainty of evidence and strength of recommendations were evaluated using the GRADE framework, ensuring a standardized and reproducible assessment across study designs.

Review Typology and Reporting

Review designs were classified into standard categories (scoping, umbrella, rapid, qualitative, and mixed-methods), with reporting aligned to established guidelines (PRISMA-ScR, PRIOR, PRISMA-RR, ENTREQ, and PRISMA/MMAT) to ensure methodological rigor and transparency.

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