METIS INSIGHTS

NORTHERN SEA ROUTE (NSR) RISK OUTLOOK

ARCTIC SHIPPING, SANCTIONS, SAFETY AND INSURANCE IMPLICATIONS

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Bottom Line Up Front

- The Russia-administered Northern Sea Route is currently the most developed Arctic shipping route amidst sea ice retreat in the region
- Growth of the route has been gradual due to the harsh climate, lack of infrastructure, and conditional economic viability
- As sanctions and environmental concerns drive Western shipping companies away, international uptake has come almost exclusively from China
- ·The strengthening Russia-China commercial and military partnership in the Arctic region threatens established norms, with the possible imposition of tolls or access restrictions if either gain effective control over emerging Arctic routes
- A risky pattern of regulatory backsliding from Russian authorities has seen 'shadow fleet' vessels operating on the route without adequate ice-class or icebreaker escort
- Multilateral oversight of Arctic shipping in the region has been hampered by the inability of Russia and the NATO-dominated Arctic Council to cooperate

Executive Summary

AS SEA ICE RETREATS DUE TO CLIMATE CHANGE, THE POSSIBILITY OF MAJOR SHIPPING ROUTES THROUGH THE ARCTIC IS OPENING UP.

The feasibility of such routes has been a topic of great interest to the maritime industry over the past two decades. The most developed of the routes is the Northeast Passage, which follows the Northern Eurasian coastline. This route can cut down transit times between Europe and Asia by up to half compared to the conventional Suez Canal Route.

So far, Russia has been the primary driver of the development of Arctic shipping. It maintains control over and has been investing heavily in its own Northern Sea Route (NSR), which makes up a major section of the Northeast Passage. While the expansion of Arctic shipping routes seems inevitable in the long-term, current uptake on the NSR has been gradual for three key reasons:

1. Arctic shipping is plagued by risks posed by the harsh climate and lack of infrastructure.
2. In the short-term, the NSR is only comparably profitable to conventional routes under particular economic and environmental conditions.
3. Sanctions and environmental concerns have driven Western shipping companies away.

Today, traffic on the NSR is mostly exports from Russian Arctic energy projects bound for China. Through diplomatic efforts, Russia has succeeded in encouraging China's participation in the NSR under the Polar Silk Road policy. Chinese companies are now leading the charge in the use of the Northeast Passage for cargo shipments between Europe and Asia. The growing Russia-China commercial and military partnership in the Arctic threatens Western dominance and established norms in the region. Any state that maintains control over Arctic shipping routes could impose tolls or selectively exclude access to vessels. This is part of the reason why Greenland, situated on maritime chokepoints at the convergence of multiple routes, has recently gained attention as a key strategic asset for Arctic power projection.

Recently, a dangerous pattern of regulatory backsliding and safety violations on the NSR has been observed as heavily sanctioned Russia operates the route unchecked. ‘Shadow fleet’ vessels carrying Russian oil are known to operate along the route, often without sufficient ice-classing or ice-breaker escorts. The typically poor condition of these vessels, in combination with the hazardous Arctic environment and lack of search and rescue infrastructure, greatly increases the risk of serious accidents. The regional governance mechanisms that could address such issues have been hampered while Russian relations with the West remain poor.

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Introduction

Three shipping routes connect the Atlantic and Pacific oceans via the Arctic (Figure 1): the Transpolar Sea Route (TSR), the Northwest Passage (NWP), and the Northeast Passage (NEP). The NEP is currently the most frequented of the three and follows the Northern Eurasian coastline from the Barents Sea to the Bering Strait. The Northern Sea Route (NSR) is a Russia-administered section of the NEP beginning at the Kara Strait and ending at the Bering Strait; however, many sources refer to the entire NEP as the Northern Sea Route.

Figure 1. Map of Major Arctic Shipping Routes (Source: Arctic Portal)

The NSR has been used for commercial shipping since 1935, owing to the fact that it lies entirely within the USSR's internal waters. Cargo volume declined after the dissolution of the USSR, but the Russian government has been dedicated to reviving the route since 2018. The NSR is currently controlled by the Russian State Atomic Energy Corporation (Rosatom). Its subsidiary, the Main Directorate of the Northern Sea Route (Glavsemorput), issues permits to sail the NSR, monitors vessel traffic and sets the rules of navigation. Rosatom also manages 'Atomflot', a fleet of nuclear icebreakers that provide escort to vessels on the NSR for a fee and can 'rescue' vessels that become trapped in sea ice.
A record 37.9 million tonnes of cargo was moved on the NSR in 2024, with Russian authorities projecting a further 20% increase for 2025. However, even this level of uptake has lagged behind Russian goals.

Unique Risks of Arctic Shipping

Vessels face unique risks in the Arctic due to the harsh climate and isolated nature of the region.

The main risk factor associated with operating in the Arctic is sea ice. Statistical analysis of vessel data from Arctic Canada shows a marked increase in accidents as sea ice concentration increases (Nicoll et al., 2024). Ice conditions are difficult to predict and vessels operating in conditions above their ice-class can become damaged or stuck.

The Arctic Council's risk management guidelines also list additional concerns such as rapidly changing weather, extremely low temperatures, extended periods of darkness, communication failures due to high latitudes, poor emergency preparedness and limited access to salvage services (EPPR, 2020). Occupational health and safety risks to seafarers from prolonged exposure to high UV or darkness, as well as hypothermia or frostbite from cold temperatures, are also issues to consider in planning an Arctic voyage. Navigation is a challenge as well, with large areas of the Arctic remaining uncharted, GPS unavailable at high latitudes, and seafarers requiring special training.

While Russia is engaged in a comprehensive plan to invest in the development of the Siberian region to support the NSR, progress has been slowed by sanctions and the economic strain of the Ukraine war. The dearth of infrastructure along the NSR means bunkering, salvage and repair services are still lacking. Search and rescue capability is notably limited in both range and capacity, especially in the off-season, with long response times and an inability to respond adequately to large incidents.
There has also been significant opposition to Arctic shipping on environmental grounds. Oil spillage, toxic emissions, and biofouling are recognised as significant risks for habitat destruction in the area. If an environmental disaster were to occur, response capacity would likely be severely limited by the remoteness of the region.

Current Traffic

Cargo volume on the NSR increased significantly after Russia's Arctic Strategy was announced in 2018. However, progress appeared to slow during COVID-19 and again after the invasion of Ukraine (Figure 2).

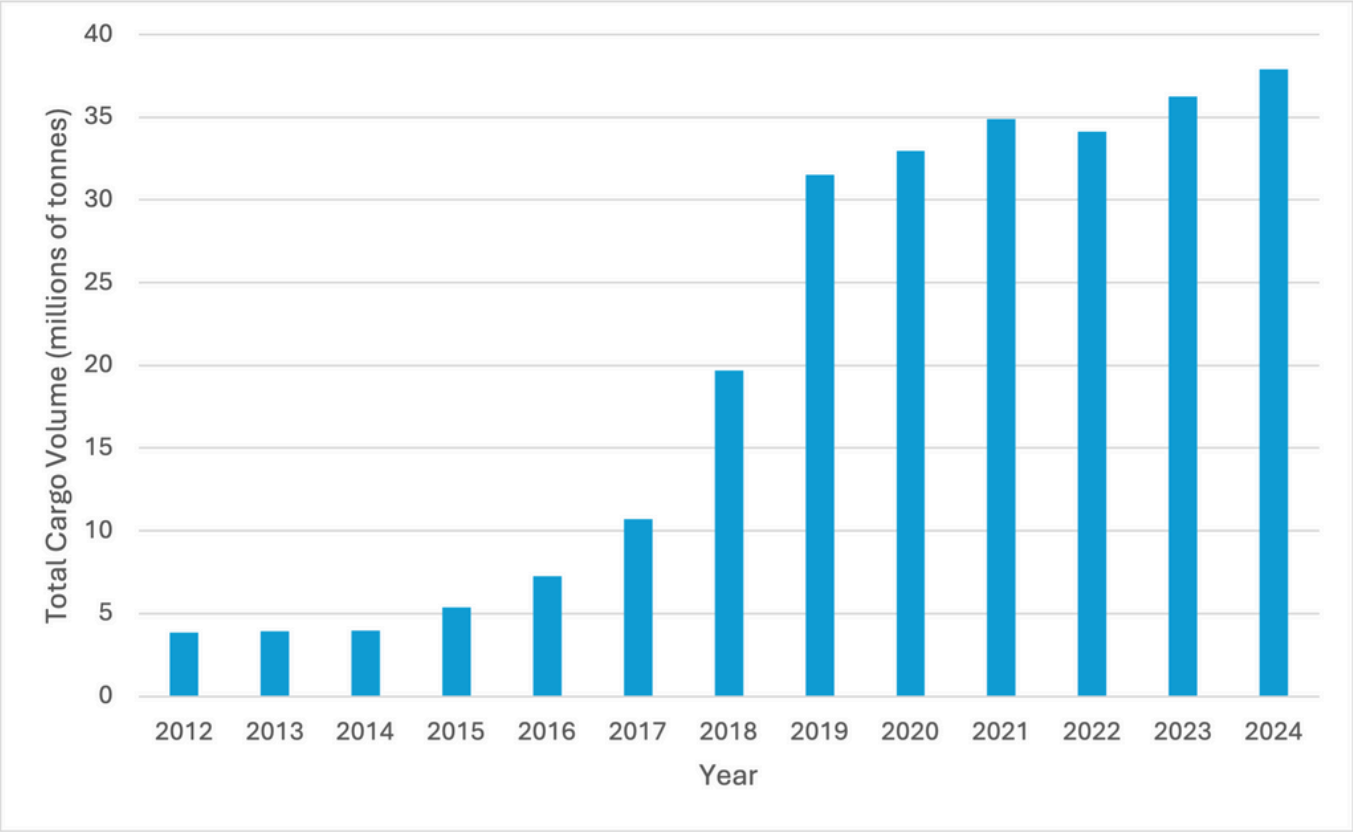

Figure 2. Total Cargo Volume on the Northern Sea Route from 2012 to 2024 (Source: Rosatom)

NSR cargo volume is increasing much slower than Russia has envisioned. In 2024 the reported cargo volume was 37.9 million tonnes, falling short of Russia's 80 million tonne goal by just over half. Though figures have not been released for 2025 as of writing, Rosatom predicted a 20% increase in cargo volume for 2025.

Importantly, complete end-to-end transits of the NSR (indicative of the growth of the Northeast Passage) have been increasing. From 2024 to 2025, the number of transit voyages increased marginally from 97 to 103, with a total of 3.2 million tonnes of cargo (CHNL, 2025). All but one of the international voyages were between Russian and Chinese ports. Exports from Russian Arctic energy projects to China constitute the majority of eastbound activity, with tankers remaining the most common vessel type on the NSR. Almost all westbound voyages from China have been in ballast, except for container voyages.

Westbound container voyages are expected to grow in the future as Chinese companies explore the feasibility of shipping not just to Russia, but to Europe via the NSR. In 2025, the first container ship transit from China to Europe via the NSR was completed as a test for planned regular services in 2026. The Istanbul Bridge departed Ningbo, China on 23 September and arrived in Felixstowe, UK on 13 October. The ship transited the NSR in a record six days, and the entire voyage in just 22 days, approximately halving the time required for such a transit via the Suez Canal route.

Economic Viability

While the NSR can reduce sailing distances and shorten voyage times compared to conventional routes, this does not guarantee cost efficiency. The cost of Arctic routes is also affected by higher insurance premiums, ice-classing costs, ice-breaking fees and delays due to poor weather (Emmerson, 2012). Marine insurers are in many ways the 'gatekeepers' of Arctic shipping. Due to the relative recency and low traffic of Arctic shipping, there is not enough historical data on maritime incidents to accurately model risk. Insurers are improvising by adding a percentage (reportedly approximately 40%) to the basic premium. The viability of the NSR for major companies long-term is dependent on the willingness of insurers to cover the area. Ice-breaking fees can reach up to $700,000 on the NSR, with about 40% of journeys made in the winter season (December to May) requiring an escort. To avoid ice-breaking fees, vessels must have an ice-class that Rosatom deems acceptable for the conditions. Theocharis et al. (2024) conducted a required freight rate analysis that compared the break-even cost per tonne for shipowners between various modelled conditions on the NSR. They found that the NSR can be more competitive than the Suez Canal and Cape routes when fuel and commodity prices are high (when the journey is time sensitive) and when vessels navigate independently (without icebreaker escort).

However, the cost of repairing ice-damage would render the NSR less cost-effective than all routes. The high cost of ice-classing a ship means that the route is more viable in summer, when ice-class requirements are lower (Sibul et al., 2023).

The IMO Net-Zero Framework (combining a mandatory GHG fuel intensity standard with a global emissions pricing/levy mechanism), originally targeted for adoption in October 2025 and entry into force around March 2027, was postponed at the extraordinary MEPC session in October 2025 due to strong opposition (notably from the U.S. and oil-producing states). Discussions were adjourned for one year, with potential reconsideration no earlier than October 2026—pushing any entry into force to March 2028 or later if adopted.

If ultimately implemented, the framework could marginally improve the economic attractiveness of the Northern Sea Route (NSR) by imposing costs on higher-emission (longer) voyages, thereby favoring shorter, lower-emission Arctic routes like the NSR over alternatives such as the Suez Canal, provided the pricing level is sufficient to influence routing decisions. With the current delay, however, this benefit remains hypothetical and has no immediate impact on voyage economics.

While there are conditions under which the NSR can be profitable, modelling conducted by Wu et al. (2025) predicts that the NSR will not become viable as a year-round shipping route before 2065. Accordingly, the majority of NSR traffic currently is seasonal or experimental, with the exception of year-round exports from Siberian energy projects.

Geopolitical Circumstances

THE EXPANSION OF THE NSR COMES AT A TIME WHEN CONVENTIONAL ROUTES HAVE BEEN FRAUGHT WITH SECURITY ISSUES.

The Suez Canal route has seen reduced traffic since 2023 due to the Red Sea Crisis, where Houthi militants have been attacking vessels. To avoid the crisis, some operators chose to take the much longer Cape of Good Hope route, but few have opted to try the shorter Northeast Passage. Even during the height of the crisis in 2024, the Suez Canal saw 13,000 transits compared to only 97 for the Northeast Passage. This avoidance can be blamed on a lack of readiness to take on the risks of Arctic shipping as well as the impact of Western sanctions imposed on Russia since its invasion of Ukraine in 2022.

NSR-related companies, including those involved in Siberian energy projects, have been a consistent target of sanctions. For example, Atomflot, the operator of Russia's nuclear icebreaker fleet, is currently subjected to sanctions by the EU, UK, Australia, Canada, Japan, and the US, among others. These sanctions have interrupted the development of infrastructure along the NSR, deterred Western shipping companies from continued involvement, and driven Russia's turn towards cooperation with China on the NSR.
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From the West

Western shipping companies initially showed great interest in the NSR as an alternative to conventional routes. The first complete NSR transit by containership was made by Danish shipping giant Maersk in August 2018. However, since the full-scale invasion of Ukraine, unwillingness to engage in Russia-related projects and concerns about secondary sanctions have led Western companies to almost completely withdraw.
Environmental concerns have been cited in the withdrawal as well. Major shipping lines, including MSC, Maersk, CMA CGM, Hapag-Lloyd and Evergreen, as well as logistics companies including DHL and Kuehne & Nagel, have signed a pledge with NGO Ocean Conservancy to avoid Arctic shipping.

To the East

Participation in the NSR has been part of China's "Polar Silk Road" policy since 2018. The NSR is just one route in a diverse array of trade networks that China is cultivating to build logistical resilience. However, NSR participation from Chinese shipping companies also slowed considerably in 2022 following the invasion of Ukraine. COSCO Shipping, a Chinese company that had previously led the charge in non-Russian commercial use of the NSR, made not a single voyage in 2022 despite making a record 14 passages in 2021.

A concerted diplomatic effort from Russia has proven successful at instilling confidence again. The first and second meetings of the Russian-Chinese Subcommission on Cooperation on the Northern Sea Route, respectively, took place in November 2024 and October 2025. COSCO has returned to the NSR and in June 2024, Rosatom signed an agreement of intent with Hainanese NewNew Shipping Co. for the first regular year-round container service transiting via the NSR to begin in 2026. These steps toward arctic shipping are being made tentatively, but with Western companies out of the question, Chinese companies will have a first-mover advantage.

Russia is also courting India for NSR cooperation. In October 2024, the first meeting of the Russian-Indian working group on cooperation along the Northern Sea Route was held in New Delhi. Key points discussed were the prospects of Arctic navigation training for Indian sailors and joint ice-class shipbuilding projects in India.

Safety Issues

RUSSIA HAS RECENTLY APPEARED TO BE CUTTING CORNERS TO LEVERAGE THE ECONOMIC ADVANTAGE OF THE NSR.

Exacerbated by sanction pressure, these moves stem from a 2018 incident where LNG tanker Boris Vilkitsky was detained in the port of Sabetta after the Northern Sea Route Administration (NSRA) claimed that it had entered the NSR with too low an ice-class for independent navigation. The Kremlin intervened to release the ship. Or years later, control of the NSR had been completely transferred from the long-established and safety-oriented NSRA to Rosatom, an agency that profits directly from icebreaker fees.

Since then, Rosatom has amended the Rules of Navigation to allow lower ice-classed vessels to navigate independently for longer in the season. For example, Arc7 LNG carriers can now operate without icebreaker escort from June to January, rather than the previous July to November.
Russia has also begun to use aging vessels in poor condition and without ice-class along the NSR (Staalensen, 2025).

These vessels are part of the 'shadow fleet' that exports Russian oil and attempts to avoid sanctions by using multiple names, turning off AIS transponders, and conducting risky ship-to-ship transfers at sea. Such vessels are usually aging and poorly maintained. Their use in an area as hostile as the Arctic, especially without adequate salvage or search and rescue infrastructure, comes with high risks.

On 6 September 2025, the non-ice-class Oman-flagged oil tanker operating under the name Lynx became stuck in ice along the Eastern section of the NSR. It was forced to wait several days before it could proceed along the route. Although independent operation of non-ice class vessels is prohibited at all times under the Rules of Navigation, the vessel was not accompanied by an icebreaker escort or even listed in the online registry of vessels approved to sail the NSR. Several similar incidents had also occurred previously.

Pushing the boundaries like this increases the risk of major accidents, prompting calls for independent oversight and multilateral governance. The correct forum for this would be the Arctic Council, however relations between the Arctic states have rapidly deteriorated. Almost all Arctic Council members are also members of NATO and have refused to participate in any meetings or activities involving Russia since 2022.

Arctic Adversary Expansion and Greenland's Strategic Role

SINCE THE MID-2010S, RUSSIA HAS PURSUED A SUSTAINED PROGRAM OF MILITARY MODERNIZATION IN THE ARCTIC.

This includes reopening and upgrading dozens of former Soviet-era bases, airfields, ports, radar stations, and coastal defense sites along its extensive northern coastline. The effort encompasses the permanent deployment of advanced submarines, hypersonic and cruise missiles, and layered air defense systems. In 2021, Russia restructured its Northern Fleet into a full military district to secure the Northern Sea Route, protect its nuclear deterrent forces on the Kola Peninsula, and project power into the North Atlantic.

China, which designates itself a “near-Arctic state,” advances its interests through the Polar Silk Road framework. It has invested heavily in Russian Arctic energy infrastructure, including Yamal LNG and Arctic LNG 2. Beijing has expanded its fleet of icebreakers to more than four operational vessels, with additional heavy ice-capable units planned. China has also established research stations and dual-use facilities while conducting frequent scientific and commercial expeditions. The deepening Russia-China partnership, demonstrated through joint naval exercises, shared use of the Northern Sea Route, and complementary economic-military objectives, presents a converging strategic challenge to Western dominance and established access norms in the region.

Russia’s Arctic activities are driven by core imperatives of homeland defense, economic exploitation of oil, gas, minerals, and fisheries, and control over emerging commercial transit lanes as sea ice retreats. China, in turn, seeks shorter shipping routes to European markets that promise substantial reductions in transit times and costs compared with traditional chokepoints such as the Suez and Panama Canals.

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It also pursues reliable access to critical resources, including rare earth elements, hydrocarbons, and fisheries. Through dual-use research bases that support intelligence collection, icebreakers that enable year-round operational access, and economic investments that generate long-term leverage, China is establishing strategic influence without immediate overt militarization. Russia provides military security and physical infrastructure, while China contributes capital, technology, and market demand, creating mutual gains in a newly accessible frontier.

Greenland occupies a pivotal position in this strategic contest. It commands the GIUK Gap, the historic chokepoint through which Russian submarines must pass to threaten NATO sea lines of communication, U.S. East Coast targets, or reinforcement flows to Europe. The island lies adjacent to emerging Arctic passages, including the Northwest Passage and potential future transpolar routes. It also hosts essential U.S. early-warning and missile-detection infrastructure at Pituffik/Thule Air Base and contains vast untapped deposits of rare-earth elements, strategic minerals, and hydrocarbons critical to defense, technology, and energy supply chains.

China maintains a significant economic footprint in Greenland's prospective mining sector. Notably, Shenghe Resources holds a major stake in the Kvanefjeld rare earth project, with an agreement to handle processing and marketing. More broadly, China's global dominance in rare earth separation and refining—controlling over 90 percent of downstream processing—provides substantial leverage over any future Greenland extraction. Although no active rare earth mining currently takes place in Greenland due to environmental, infrastructural, and regulatory challenges, Beijing's control of processing capacity enables it to convert economic stakes into strategic pressure. Under the PRC's system of state oversight of commercial enterprises, this influence can be used to restrict supply or condition access, potentially affecting regional security dynamics and Western supply chains.

Should Russia or China achieve effective control, whether through direct military basing, dominant economic influence, or proxy arrangements, they could deny or selectively restrict Western commercial shipping on emerging polar routes, impose tolls or exclusionary measures favoring their own fleets and partners, compromise NATO's ability to monitor and defend the GIUK Gap, degrade transatlantic reinforcement capabilities, undermine missile-defense and early-warning systems reliant on Greenland-based sensors, and deepen Western vulnerabilities in critical mineral supply chains where China already holds significant processing dominance. Such an outcome would signal a broader Western retreat in the warming Arctic, encouraging further adversary militarization and economic consolidation of polar domains.

No immediate occupation, encirclement, or naval presence by Russian or Chinese forces has been observed in waters proximate to Greenland. Nevertheless, the persistent buildup by both powers positions the island as a critical geographic and resource node in the evolving Arctic competition. Denmark, as the current sovereign authority, maintains only a limited independent military capacity in the high Arctic. The US remains the only NATO ally with the full range of power projection, undersea warfare, long-range strike, air superiority, and sustained logistical capabilities required to credibly deter, if not prevent, adversary dominance over Greenland and its strategic approaches.

The Future of Arctic Shipping

In the far future it seems that the expansion of arctic shipping routes is inevitable as sea ice retreats.

If tensions between Russia and the West ease, Western shipping companies are likely to explore the use of the NSR again. However, the involvement of major companies will be dependent on cooperative multilateral governance, adequate infrastructure, safety standards, and insurance costs and coverage. It remains to be seen whether companies that signed environmental agreements will backtrack when these problems are addressed and the NSR becomes economically advantageous rather than only viable compared to the Suez Canal.

While tensions with Russia persist, Western companies will likely continue to avoid the NSR. Russia and China will further consolidate their commercial and military presence in this area as multilateral governance breaks down. If either achieves effective control of these emerging Arctic routes, the imposition of tolls or access restrictions is possible.

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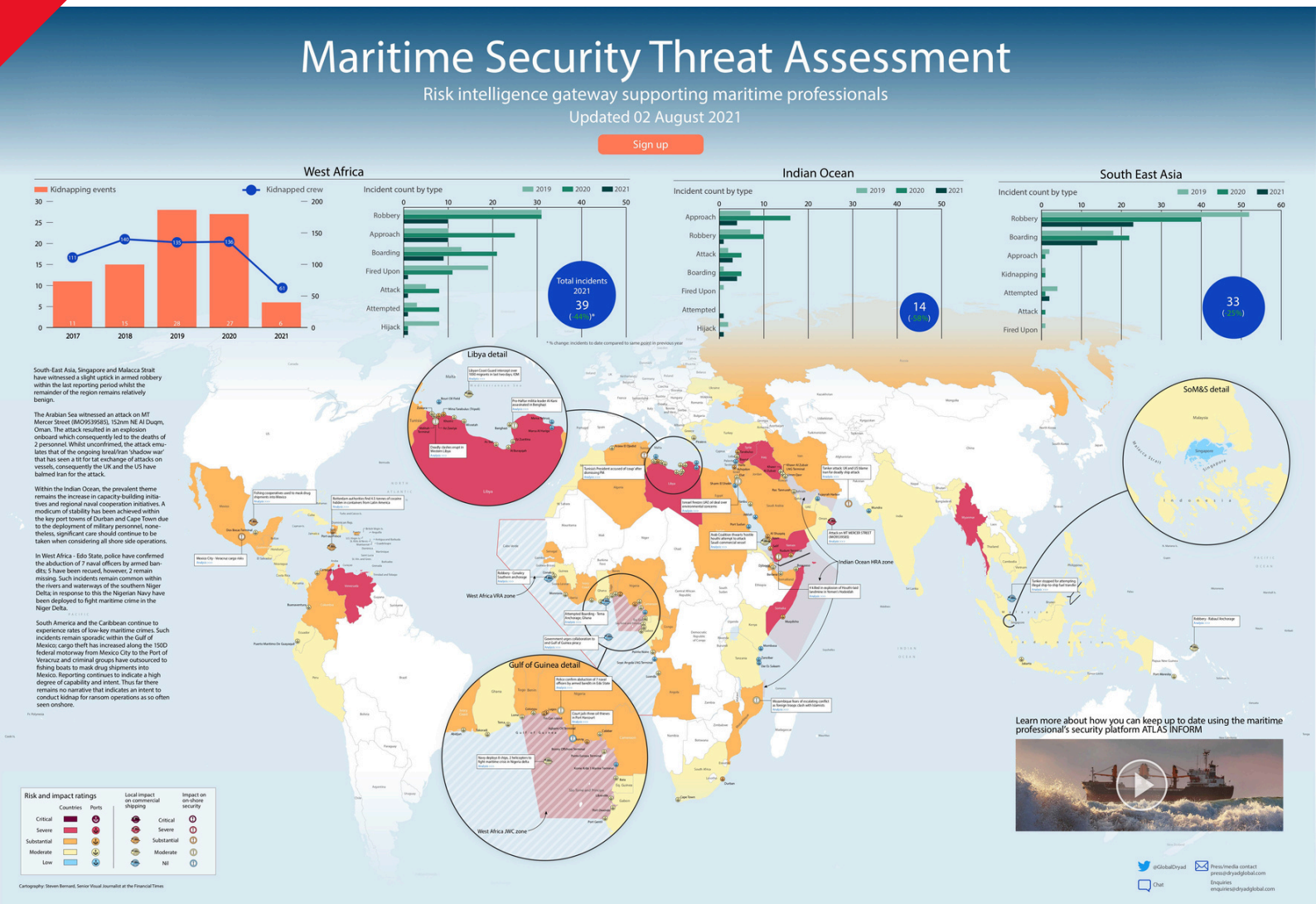

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