



 COLUMBIA | SIPA
Center on Global Energy Policy

Center for a
New American
Security

IN DIRE STRAITS? IMPLICATIONS OF US-IRAN TENSIONS FOR THE GLOBAL OIL MARKET

BY ILAN GOLDENBERG, JESSICA SCHWED, AND KALEIGH THOMAS
NOVEMBER 2019

ABOUT THE CENTER ON GLOBAL ENERGY POLICY

The Center on Global Energy Policy provides independent, balanced, data-driven analysis to help policymakers navigate the complex world of energy. We approach energy as an economic, security, and environmental concern. And we draw on the resources of a world-class institution, faculty with real-world experience, and a location in the world's finance and media capital.

Visit us at www.energypolicy.columbia.edu

   @ColumbiaUenergy



ABOUT THE SCHOOL OF INTERNATIONAL AND PUBLIC AFFAIRS

SIPA's mission is to empower people to serve the global public interest. Our goal is to foster economic growth, sustainable development, social progress, and democratic governance by educating public policy professionals, producing policy-related research, and conveying the results to the world. Based in New York City, with a student body that is 50 percent international and educational partners in cities around the world, SIPA is the most global of public policy schools.

For more information, please visit www.sipa.columbia.edu

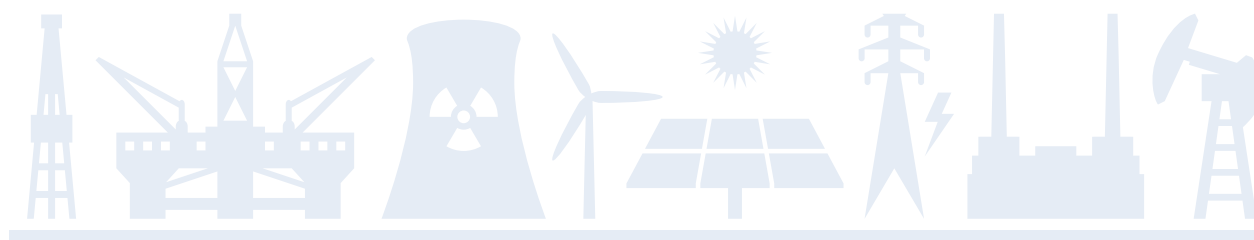
ABOUT THE CENTER FOR A NEW AMERICAN SECURITY

The mission of the Center for a New American Security (CNAS) is to develop strong, pragmatic and principled national security and defense policies. Building on the expertise and experience of its staff and advisors, CNAS engages policymakers, experts and the public with innovative, fact-based research, ideas and analysis to shape and elevate the national security debate. A key part of our mission is to inform and prepare the national security leaders of today and tomorrow. CNAS is located in Washington, and was established in February 2007 by co-founders Kurt M. Campbell and Michèle A. Flournoy. CNAS is a 501(c)3 tax-exempt nonprofit organization. Its research is independent and non-partisan. CNAS does not take institutional positions on policy issues. Accordingly, all views, positions, and conclusions expressed in this publication should be understood to be solely those of the authors. © 2019 Center for a New American Security.

For more information, please visit cnas.org

IN DIRE STRAITS? IMPLICATIONS OF US-IRAN TENSIONS FOR THE GLOBAL OIL MARKET

BY ILAN GOLDENBERG, JESSICA SCHWED, AND KALEIGH THOMAS
NOVEMBER 2019



1255 Amsterdam Ave.
New York, NY 10027

www.energypolicy.columbia.edu

   @ColumbiaUenergy

1152 15th Street NW, Suite 950
Washington, D.C. 20005

www.cnas.org

 @CNASdc

ACKNOWLEDGMENTS

The authors would like to thank all of their colleagues at Columbia University's Center on Global Energy Policy, especially Richard Nephew for coming to them with this project idea, partnering on the work, providing feedback throughout—particularly regarding the oil price impacts presented within the report—and for managing the publication process. The authors also greatly appreciate all those who provided feedback on this report, including those who attended the roundtable hosted by CGEP and offered their comments.

Finally, the authors would like to thank their CNAS colleagues Elizabeth Rosenberg, Neil Bhatiya, Loren DeJonge Schulman, Maura McCarthy, and Melody Cook for their input, comments, and assistance in the production of this report.



ABOUT THE AUTHORS

Ilan Goldenberg is a senior fellow and director of the Middle East Security Program at the Center for a New American Security (CNAS). He previously served at the State Department as a chief of staff for the small team supporting then-Secretary of State John Kerry's initiative to conduct permanent-status negotiations between Israelis and Palestinians. Goldenberg was formerly a senior professional staff member on the Senate Foreign Relations Committee, where he focused on the Middle East. Prior to that, he served as a special advisor on the Middle East and then as the Iran team chief in the Office of the Under Secretary of Defense for Policy.

Jessica Schwed is a research contractor in the Middle East Security Program at CNAS. Prior to joining CNAS, Jessica was heavily involved with issues related to refugees, immigration, and mass migration, and worked on developing constructive and creative solutions in her nonprofit Conversations Unbound. Schwed has also spent time in Greece, working with refugees, and Germany, performing research on asylum and integration procedures. She graduated from Vassar College with a BA in International Studies.

Kaleigh Thomas is a research associate in the Middle East Security Program at CNAS. Previously, she was a program coordinator for both the Middle East Security program and Energy, Economics, and Security program at CNAS. She earned her MA in international peace and conflict resolution from American University, and her BS in business administration with majors in international business and marketing from the University of South Carolina.



TABLE OF CONTENTS

Executive Summary	06
Introduction	08
Methodology	11
Background	13
Scenario 1: Significant Escalation Short of All-Out War	27
Scenario 2: Major Infrastructure Damage	31
Scenario 3: Strait Closure and Major Infrastructure Damage	37
Conclusion	42
Notes	44



EXECUTIVE SUMMARY

In recent months, Iran has responded to rising tensions with the United States—particularly the US launch of the “maximum pressure” campaign against Iran—by attacking oil tankers and infrastructure in the Persian Gulf region around the Strait of Hormuz (the Strait). These actions have been designed to signal to the United States, the Gulf states, and the international community that the American strategy of strangling Iran economically will not be cost-free, and to Saudi Arabia in particular that it is highly vulnerable to Iranian retaliation.

As the Strait of Hormuz is one of the world’s most critical energy chokepoints, the implications of Iran’s efforts merit close scrutiny and analysis. This study was designed to examine three scenarios for military conflict between Iran and the United States and assess the potential impacts on global oil prices—as one specific representation of the immediate economic impact of conflict—as well as broader strategic implications. The three scenarios are:

1. Increasing US-Iran tensions that ultimately lead to a new “Tanker War” scenario similar to the conflict of the 1980s, in which Iran attacks potentially hundreds of ships in the Persian Gulf and Gulf of Oman over a prolonged period while also launching missiles at Gulf oil infrastructure.
2. An escalation of tensions between Iran and the United States in which Iran significantly increases the scope and severity of missile attacks directed at major oil and energy infrastructure in Saudi Arabia and the UAE.
3. A major conflict between Iran and the United States that includes damage to Gulf oil infrastructure and a temporary closure of the Strait of Hormuz.

Its main conclusions are:

- The risk of a major military confrontation between the United States and Iran has increased in recent months but still remains relatively low, as neither the United States nor Iran wants war.
- That said, the September 14, 2019, attack on the Abqaiq and Khurais facilities was a strategic game changer and shows that the biggest risk is a prolonged, low-intensity military conflict. The fact that Iran was willing to conduct such an attack was a surprise to most analysts and to the US government and its Gulf partners. The level of accuracy it showed in the strike demonstrated a technical proficiency the US government and outside analysts did not believe Iran had.
- In the more moderate and likely conflict scenarios, increasing tensions between the United States and Iran are unlikely to dramatically affect global oil prices.
- The most profound costs in the more likely scenarios are not energy-related but security-related. Even in the less escalatory scenarios, the United States would be forced into long-term deployments of a large number of air and naval assets that



would need to remain in the Middle East for years at a cost of billions of dollars. Such deployments would take away resources that would otherwise be dedicated to managing great power competition with China and Russia. In the more extreme conflict scenarios, major loss of life and an even bigger and longer-term American military deployment would be expected.

- In the lower likelihood scenario of a major military confrontation between the United States and Iran, global oil prices would be dramatically affected, though price impacts would not be prolonged.
- All assumptions about the potential impacts on oil prices are based on the supposition that the United States protects global shipping lanes, but that theory deserves further scrutiny. For more than a generation, the United States has viewed securing global shipping lanes that are critical for commerce and energy as a core vital interest. But given the isolationist tendencies in the United States and President Donald Trump's attitude that America should stop underwriting the defense of its allies, it is conceivable he may choose not to respond in the types of scenarios described in this paper or demand that countries most dependent on oil trade from the Gulf—most notably China—step up instead.
- Another wild card for oil prices in a major crisis scenario would be President Trump's unpredictable policies regarding the Strategic Petroleum Reserve. Typically, an administration would be expected to coordinate an international response with the International Energy Agency (IEA) to release the SPR of a number of countries, but this cannot be assumed in the current administration.

Though these conclusions are to some extent comforting, the authors acknowledge that a key issue with any analysis of this situation is the unpredictability of the United States. In the present moment, neither US adversaries nor partners know quite what to expect—and, for that matter, neither does the US government or its observers.



INTRODUCTION

In recent months, Iran has responded to rising tensions with the United States by attacking oil tankers and infrastructure in the Persian Gulf region around the Strait of Hormuz (the Strait). The Trump administration has ramped up its “maximum pressure” campaign against Iran and driven down Iranian oil exports in an effort to wring concessions from Iran. Iran has responded with attacks at Fujairah Port in the United Arab Emirates (UAE) in May 2019, in the Gulf of Oman in June, and on Saudi oil infrastructure facilities in September. These actions have been designed to signal to the United States, the Gulf states, and the international community that the American strategy of strangling Iran economically will not be cost free and to Saudi Arabia in particular that it is highly vulnerable to Iranian retaliation.

The United States Energy Information Administration (EIA) refers to the Strait of Hormuz as “the world’s most important chokepoint.”¹ Almost one-third of all global oil and petroleum product exports pass through the Strait of Hormuz daily. Additionally, more than one-fourth of all global liquid natural gas exports and various consumer goods pass daily through the Strait.²

It is precisely this importance that has allowed Iran to use threats to the Strait of Hormuz as a bargaining chip in international politics. From a defensive posture, the threat to “close the Strait” and throw global oil prices into disarray is the closest option Iran has to a nuclear option. Iran’s actions in the Strait of Hormuz are also offensive. Brinksmanship in the Strait of Hormuz creates an opportunity for Iran to gain leverage on the world stage. But actually closing the Strait is equivalent to a nuclear option that Iran’s leadership is likely to employ only if it felt that the regime was under threat.

Still, it is important to ask what happens if tensions do get out of control. Even though neither the United States nor Iran wants a major military confrontation, the two countries may blunder their way into one. Both sides have a poor track record of understanding each other’s redlines and escalation ladders. The lack of direct channels of communication further increases the likelihood of a conflict neither wants. Indeed, in June 2019, the United States nearly bombed targets inside Iran after Iran shot down an American drone.

This study examines three scenarios for military conflict between Iran and the United States (see table 1) and assesses the potential impacts on global oil prices—as one specific representation of the immediate economic impact of conflict—as well as broader strategic implications. The three scenarios are:

1. Increasing US-Iran tensions that ultimately lead to a new “Tanker War” scenario similar to the conflict of the 1980s, in which Iran attacks potentially hundreds of ships in the Persian Gulf and Gulf of Oman over a prolonged period while also launching missiles at Gulf oil infrastructure.
2. An escalation of tensions between Iran and the United States in which Iran significantly increases the scope and severity of missile attacks directed at major oil and energy infrastructure in Saudi Arabia and the UAE.



3. A major conflict between Iran and the United States that includes damage to Gulf oil infrastructure and a temporary closure of the Strait of Hormuz.

The good news is that it would take a serious conflict to dramatically affect oil prices over a substantial period of time. Even a conflict similar in scope to the 1980s Tanker War—in which 190 international oil tankers were attacked over the span of four years—would have only a marginal impact on global oil prices. If Iran were to also use its missile arsenal to scale up attacks on oil facilities in Saudi Arabia, the UAE, or other Gulf Cooperation Council states, the effects on oil prices would be more disruptive. In many cases the price shift would not be dramatic, and the market could recover relatively quickly. The key determinants would be the size, scale, and effectiveness of the attack as well as the oil price and market dynamics at the time in question.

If, however, in the most extreme scenario, Iran and the United States were to engage in a major military conflict, effectively closing the Strait of Hormuz and causing significant damage to oil infrastructure in the Gulf, the impacts on oil prices would be more significant. Upward of 20 million barrels per day would go off the market and would have to be compensated for with the release of International Energy Agency (IEA) Strategic Petroleum Reserves (SPR). Assuming a price of \$65/barrel precrisis, oil prices could still rise to \$175–\$200 per barrel in the immediate aftermath before dropping to \$110–\$170 after one month, \$95–\$125 after six months, and \$80–\$100 after a year.

Despite these dire scenarios, a key conclusion from the authors' analysis is that the impacts on oil prices from a US-Iran crisis in the Gulf are significant but potentially overestimated by experts and policy makers who view Iran's ability to close the Strait as a major source of leverage. It is only in more extreme scenarios that a dramatic shift in oil prices is seen, and in those scenarios, significant security concerns and a severe public reaction would also be seen. The good news is these scenarios are also the least likely as none of the parties are interested in pursuing massive escalation and have shown little will to do so even as the crisis in the region has worsened.

That said, there are a number of profound negative implications that come from a major war between the United States and Iran. First, the reason the implications for the oil market would be so limited is because the authors assume the United States would be willing to invest tremendous military resources to protect the international oil market. But this is obviously a huge cost in itself. In the aftermath of a conflict, the United States would likely be forced to maintain a significant air and naval presence in the Persian Gulf in perpetuity, undermining efforts to refocus American military power on great power competition with China and Russia and costing the US taxpayers billions.

Moreover, it is unclear what this administration's unpredictable, often isolationist strategy might mean for both a unilateral release of the United States' SPR and collective release of IEA member states' strategic reserves. Since the biggest consumers of Middle Eastern oil are in Asia, the Trump administration might choose to not release the SPR and instead pressure China to make economic concessions elsewhere. It might also demand that South Korea and Japan cover the bill of the American military intervention. Or the administration could go a step further and, in an extreme scenario, refuse to intervene militarily, believing the US should no longer be footing the bill for securing shipping lanes out of the Middle East because the United States is not one of the major importers of Middle Eastern oil. Any of these steps could



have unpredictable impacts on global prices and the broader international regime that has been in place to try to insulate the global economy from oil supply shocks.

Finally, and most importantly, war is an ugly and unpredictable affair that often results in unforeseen consequences and significant death and destruction. Thus, while the authors' conclusion is that the impact on the global oil market from any such conflict might be less significant than currently expected, the authors do not in any way believe that a war between the United States and Iran is therefore advisable.

Table 1: Overview of conflict scenarios and implications for oil supply, price

Scenario	Description	Results	Supply impact	Price impact	Likelihood
1. Significant escalation short of all-out war	Months- or years-long conflict that escalates, similar to the Tanker War, coupled with limited missile attacks on Gulf oil infrastructure on the scale of the September 14, 2019, attack	Long-term increased US deployment of naval, missile defense, and intelligence, reconnaissance, and surveillance assets to the Gulf	Small, short-term fluctuations	Immediate, limited spikes due to sentimental reactions to small, short-term supply fluctuations	Already started at a low scale, and certainly conceivable if both sides continue to escalate
2. Major damage to Saudi or UAE infrastructure	Iran uses missiles to launch an extensive strike that successfully damages major Saudi and UAE energy infrastructure	Previous scenario plus significant damage at Fujairah Port and Abqaiq stabilization facility, requiring one to two years to return to full capacity	12-24 months of 5.5 million barrels per day (bpd) oil loss, phasing down over time to zero	Prices spike immediately to \$90-\$120/barrel, but one-year post-crisis fall to \$65-\$75/barrel	Less likely than the first scenario but certainly plausible given the current trajectory
3. Closure of the Strait of Hormuz plus major damage to Saudi or UAE infrastructure	Previous scenario plus a limited two- to four-week conflict in which the United States destroys Iran's naval capability but Iran mines the Strait and uses other weapons to limit access to the Strait	Previous scenario plus 4-10 weeks of no passage of tankers through the Strait	4- to 10-week loss of 24.8 million bpd followed by additional 9 months to 2 years of 5 million bpd loss, phasing down over time	Prices spike immediately to \$175-\$200/barrel, and one-year post-crisis fall to \$80-\$100/barrel	Relatively unlikely, unless we experience a major escalatory event or miscalculation

Note: Prices assume a predisruption \$65/barrel Brent price.



METHODOLOGY

This paper specifically focuses on actions Iran would take during a crisis that would potentially have effects on the global oil supply and price. The authors began by designing possible conflict scenarios based on their expertise and experience, a review of relevant literature, and interviews with defense experts. After developing the military scenarios, the authors interviewed oil analysts to ascertain the potential economic, oil supply, and oil price implications of the different military scenarios.

The oil price calculations are the result of judgments from experts at the Columbia University Center on Global Energy Policy, rather than a detailed supply-and-demand balance and oil price model. In all scenarios, no US production response is assumed by the end of one year, given insufficient pipeline and export capacity. In most of the scenarios, prices after the disruption remain higher due to having a lower or nonexistent strategic stock cushion.

The scenarios in this paper are not designed to cover every aspect or possibility that could occur in a conflict with Iran, but rather the actions that are deemed most worrisome and most likely based on historical and current contexts and with a special emphasis on implications for energy infrastructure. The authors recognize there are gradations among the scenarios that are also possible, but the scenarios were laid out for analytical utility purposes. As such, the authors recognize that conflict in the Strait of Hormuz would have profound implications not just for the oil market but also the natural gas market and non-energy-related trade that would have broader macroeconomic effects. But for analytical purposes, the authors have decided to focus specifically on the oil market.

While the paper focuses on Iranian actions that affect the oil market, the authors recognize that these Iranian activities would not occur in a vacuum. In addition to the activities described within each of the conflict scenarios within this report, Iran would likely also pursue actions such as proxy attacks on US and allied forces in places such as Iraq, Syria, and Afghanistan; missile launches on US and partner bases in the Persian Gulf region; increased attacks by Lebanese Hezbollah against Israel; terrorist attacks in Europe and potentially beyond; and cyberattacks on US financial institutions.

Moreover, the paper also assumes that outside of the US military response described within each scenario, the United States and its allies would also be engaged in diplomatic initiatives and other activities designed to counter the Iranian actions and deescalate the crisis. The paper assumes that all the key outside players, most notably Russia and China, continue to emphasize the importance of regional stability and deescalation as their policies have in the past and do not intervene on Iran's side. And that while Saudi Arabia, the UAE, Israel, and a number of European partners side with the United States, escalation dynamics are ultimately driven by the United States and Iran. The authors also assume that the United States continues to exercise its broad strategy of defending international access to and utility from energy supplies from the Middle East. To the extent that this assumption is flawed, then it is possible that a conflict could be more readily joined by the Iranians (confident that the United



States has abandoned its position since the Carter administration as a defender of energy security) and/or that the market effects could be far more severe.

Finally, the scenarios detailed in this report hypothetically take place over the next 12 to 18 months. As such, when discussing the effect of each scenario on the global oil supply and global oil price, this report assumes a steady state on current economic trends, such as the continuing prospect of recession, the continuing but managed US-China trade war, and a relatively soft oil market. As long as the trends and pressures that it took to get oil prices to \$65 per barrel remain, the price increase predictions presented in this report under each scenario would still apply. However, if market dynamics shift away from those built into the scenarios—such as strengthening demand—then the price predictions included in this report would no longer be accurate.



BACKGROUND

Since President Trump came into office in January 2017, tensions between the United States and Iran have continued to escalate. After a year of threatening to walk away from the Iran nuclear agreement—known as the Joint Comprehensive Plan of Action (JCPOA), President Trump withdrew the United States from the deal on May 8, 2018. For the next year, Iran's response was restrained as it focused on driving a wedge between the United States and the other parties to the agreement (China, Russia, the United Kingdom, France, and Germany). Iran did achieve some diplomatic victories in isolating the United States, but it could never convert those political gains into economic benefits as the Trump administration reimposed secondary sanctions that had been lifted as part of the JCPOA. Faced with the prospect of losing access to the US financial system, international companies ceased investments in Iran.

The situation began to dramatically escalate in late April and early May 2019, when the United States announced that it would no longer grant any waivers for importers of Iranian oil and try to drive Iran's oil exports to zero. At that point, Iran's exports had already fallen from its 2018 peak of 2.8 million barrels per day (bpd) during the days of the JCPOA to approximately 500,000 bpd.³ The threat to drive oil exports down further with an effort to get to zero (experts estimated Iran would still be able to export 200,000–300,000 bpd) convinced Iran's leadership that it was under too great an economic threat and it was time to shift strategies. Its new approach is to exact costs on the United States, its regional competitors across the Gulf (most importantly Saudi Arabia and the United Arab Emirates), and the rest of the international community in order to get economic relief.

On May 8, 2019, a year after President Trump's decision to withdraw from the JCPOA, Iranian President Rouhani announced that Iran would begin walking away from some of its commitments to the nuclear agreement—an approach it has pursued in the months since. Within days, four oil tankers in the UAE's Fujairah port were sabotaged in attacks that were almost certainly conducted by Iran. Then on June 13, a Japanese-owned ship and a Norwegian-owned ship, flagged by Panama and the Marshall Islands, respectively, were struck in the Gulf of Oman. This act was particularly brazen as Japanese Prime Minister Shinzo Abe was in Tehran in an effort to deescalate the crisis. In both cases, Iran deployed deniable mine attacks using limpet mines that can be attached to the sides of ships. Iran placed the mines above the waterline of the ships, thus intending to not cause fatalities, sink the ship, or cause a major environmental disaster.⁴ Seven days later, Iran shot down a US Global Hawk drone with its air defense systems, nearly leading to an American retaliatory strike that was called off at the last minute.⁵ And on July 19, Iran seized the British flagged tanker *Stena Impero* in response to the British seizure of an Iranian tanker headed for Syria in British territorial waters next to Gibraltar.

Iranian proxies in Yemen have also used missiles and unmanned aerial vehicles (UAVs) to attack Saudi pipelines and other oil facilities thus far without causing significant damage. In a May 14 attack, armed drones struck two Aramco pumping stations, causing a temporary shutdown of the East-West Pipeline. The attacks caused a small fire and minor damage at one



pumping station but did not disrupt oil output or exports of crude and petroleum products.⁶ The tools used in these operations have been relatively inaccurate and are unlikely to lead to major damage, but they have certainly raised international concern.

Tensions seemed to cool throughout August with speculation that the United States and Iran were engaging in direct negotiations. But then on September 14, Saudi Aramco facilities at Abqaiq and Khurais were attacked using UAVs and cruise missiles. The attacks damaged numerous storage tanks and a processing train in Abqaiq.⁷ While the attack was initially claimed by the Houthis, Secretary of State Michael Pompeo was quick to blame Iran⁸ and called the attacks against Saudi Arabia an “act of war.”⁹ France, the UK, and Germany have also since come out and blamed Iran for the attack. It is highly unlikely that the Houthis would have the capability to pull off this type of strike, which was almost certainly conducted by Iran and launched from Iranian territory.

The attacks represented a major escalation and stunning strategic surprise. The first surprise was that Iran would actually conduct such a brazen attack. The second was the capability that it showed. Iran was able to fire cruise missiles and UAVs that went north and crossed over land via Iraq or Kuwait, essentially circumventing the American and Saudi air defenses, which were pointed south and based in the Persian Gulf, from where an Iranian attack was assessed to be much more likely to come.¹⁰ Moreover, the level of accuracy associated with the strikes was unlike anything seen before from Iran, hitting pinpoint targets in Abqaiq. This strike is now forcing an entire reevaluation of both Iran’s missile capabilities and intent.¹¹

Iran’s escalation in the Gulf region is meant to send a message to the Gulf states that if they continue to encourage the United States to cut off Iran’s oil sector, Iran will take actions to harm their ability to export oil. The message to the United States is that the “maximum pressure” campaign is not without costs, and if the United States seeks to pursue this approach, Iran will take steps that have a negative impact on the global economy. As for the rest of the international community that supports the JCPOA, the message is also clear. Political support is not enough. If they will not buy oil from Iran or provide it any economic relief, Iran will threaten their oil supplies and raise global prices.

The American response began on May 5, 2019, with the announcement by National Security Adviser John Bolton of a deployment of the USS *Abraham Lincoln* Carrier Strike Group to the Gulf. The United States has also deployed additional Patriot missile defense batteries to the region and strike aircraft to Al-Dhafra Air Base in the UAE and Al-Udeid Air Base in Qatar. In June, in the aftermath of the Iranian attack on the American drone, President Trump ordered a retaliatory strike against the military facilities in Iran from which the missile that downed the Global Hawk was launched, before pulling back at the last minute.¹² Then, in July, the US military announced that it would develop Operation Sentinel—a multinational maritime effort to protect shipping through the Strait of Hormuz (the Strait) and other sensitive locations in the Gulf of Oman and Persian Gulf.¹³ Meanwhile, the UK has attempted to corral a European operation to protect international shipping in response to the seizure of its tanker. While the British initially avoided joining the American operation for fear of being dragged into a conflict and being seen as supporting the US withdrawal from the JCPOA, after failing to garner support from other European nations, the British have now joined the United States—



along with Bahrain and Australia, and after the most recent Aramco attacks, Saudi Arabia and the UAE—in patrolling the Strait of Hormuz.¹⁴ Meanwhile, in response to the attacks at Abqaiq, the United States has also announced that it will be bringing more troops and defensive capabilities into Saudi Arabia and the broader region.¹⁵

The bottom line is that tensions in the Strait of Hormuz and Persian Gulf have hit their highest levels in years. In this environment, it is critical to reassess the potential implications for the global oil market and the global economy if a major conflict were to break out. Assumptions about those impacts and what they may be in the event of a US-Iran conflict could play a central role in driving decisions about war and peace. This paper first explains the importance of the Strait of Hormuz and oil infrastructure in the Gulf region. It then summarizes the role that Iran's ability to threaten access to the Strait, and more broadly the oil infrastructure of its neighbors, plays in its strategic calculus. After that, the paper dives into three possible scenarios for a US-Iran conflict in the Middle East, the impacts of these conflicts for energy exports from the region, and the implications for the global oil price and economy. Based on this analysis, the paper then draws a series of conclusions and recommendations for policy makers.

The Role of the Strait of Hormuz in Global Oil Markets

The US Energy Information Administration refers to the Strait of Hormuz as “the world’s most important chokepoint”¹⁶ due to its geographic location, proximity to regional tensions, and exports of oil. The Strait of Hormuz, located between Iran and an enclave of Oman, is a narrow channel that connects the Persian Gulf to the Gulf of Oman. The Strait is 22 nautical miles wide, but due to the large volume of traffic and shallow waters, there is only a 2-mile-wide lane for through traffic to use in each direction, with a 2-mile buffer channel between these two lanes.¹⁷ The Strait is a key route for crude oil and other petroleum products to flow from the Middle East to the rest of the world. It is the most efficient and cost-effective manner for Iran, Iraq, Kuwait, Saudi Arabia, the UAE, and Qatar to ship their oil and natural gas worldwide.¹⁸

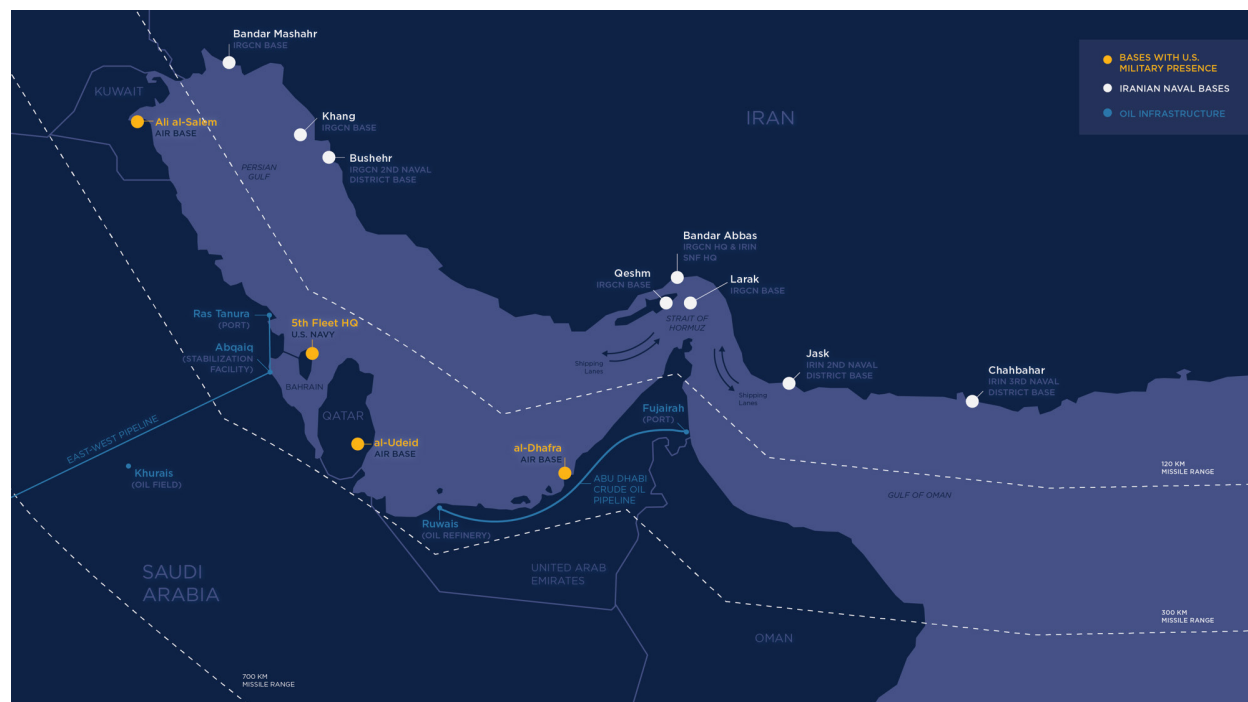
Almost one-third of all global oil and petroleum product exports pass through the Strait of Hormuz daily. On average, 18 million bpd of crude oil, 4 million bpd of petroleum products, and over 300 million cubic meters (10.6 billion cubic feet) of liquefied natural gas (LNG) transited the Strait per day in the first half of 2018.¹⁹ Most of this crude and LNG is headed for the Asian market, including China, Japan, India, and South Korea.²⁰ While the United States’ imports of Gulf crude oil have declined in the past decade, its imports of oil that pass through the Strait of Hormuz still accounted for approximately 16 percent of US crude oil and condensate imports in 2018 as well as 7 percent of total US petroleum liquids consumption.²¹ Regardless of the specific volume of these imports, the significance of the flow of crude—or of a disruption to this flow—through the Strait is fundamentally important to the price of all petroleum, refined product, and virtually all LNG bought and sold all over the world even if no Gulf crude is involved.

There is no effective way to bypass the Strait of Hormuz and maintain the same exporting capacity. A combination of spare pipeline capacity and Strategic Petroleum Reserves (SPR) would offset some disruptions to supply. However, a serious disruption slowing traffic through the Strait or halting it for any meaningful period of time would be able to significantly affect the global oil market.



Only two active pipelines bypass the Strait of Hormuz and transport oil from Saudi Arabia and the UAE. The East-West Pipeline transports oil from Saudi Arabia's Abqaiq facility to its Yanbu port on the Red Sea. The Abu Dhabi Crude Oil Pipeline transports oil from Abu Dhabi to Fujairah Port on the Gulf of Oman. Altogether, the two pipelines' capacity totals 6.3 million bpd with 3.9 million bpd of that capacity already in use.²² The additional combined 2.4 million bpd unused space falls far short of the 18 million bpd exported through the Strait.²³

Figure 1: Iran and the United States in the Strait of Hormuz



In addition to the spare capacity of the two pipelines, oil reserve stockpiles of consumer countries could be called on in the event of a massive disruption to the global oil market. Members of the International Energy Agency (IEA) are obliged to hold oil stocks equal to at least 90 days worth of their net imports.²⁴ Only three IEA members are net exporters—Canada, Mexico, and Norway—and do not have stock obligations under the IEA. Many member countries maintain stock levels above the IEA obligations, so that their use to address domestic supply disruptions or other unilateral use does not mean they drop below the 90-day threshold.

In the event of major global oil supply disruptions, the IEA helps coordinate a collective response among member states to include the release of member countries' SPR, demand-restraint measures, petroleum product substitutions, the activation of spare crude oil production, and the temporary relaxation of fuel quality and environmental standards.²⁵



The United States, an IEA member, has an SPR with 644.8 million barrels of crude oil, as of June 21, 2019.²⁶ If the US president orders the sale of US SPR oil—either as a unilateral response to a supply disruption or as part of a collective IEA response—the US Department of Energy can be ready to begin delivering oil into the marketplace within 13 days and can then pump oil at the maximum rate of 4.4 million bpd for up to 90 days. Alternatively, the oil can be pumped at a rate of 1 million bpd for up to a year and a half.²⁷

The IEA also highlights to nonmember countries—for example, China, India, Indonesia, and Thailand under its association program—the importance of maintaining oil emergency stocks to be prepared in the event of a major supply disruption. During a major disruption, the IEA would communicate with these countries as well and determine their willingness and capacity to release additional reserve oil into the market during an IEA stock release.²⁸ It remains to be seen how this would play out in practice and how willing China and India would be in coordinating the release of their SPR, but in theory this could offset much of the production loss from the region.

Even with the coordinated release of strategic reserves, mismatches between the grades of oil held in emergency stock by respective countries versus the grade they import from the Gulf mean price disruptions could still occur. While the reserve is intended to be used in times of emergency to mitigate the negative economic effects of a sudden supply loss, it is not intended to offset a long-term disruption to the global oil market, such as a longer-term conflict in the Persian Gulf and Gulf of Oman severely constricting the oil supplied via the Strait of Hormuz.²⁹

Overall, it would actually be quite difficult for Iran to interrupt the supply of millions of bpd from the region short of all-out conflict. During the Tanker War of the 1980s,³⁰ only 2 percent of oil tankers transiting the Strait were affected by Iranian attacks.³¹ As oil tankers are hard to sink, less than a quarter of those were actually disabled. This relatively low risk of transiting the Strait—especially in light of the more recent escalating tensions between the United States and Iran—has already been taken into consideration in the global oil price.³² Without a dramatic cut in supply from the region, it's unlikely to see global oil prices rise, especially in an oil market with downward pressure on prices due to an excess of supply and slowing growth in demand.

Iran's Approach to the Strait of Hormuz

Iranian officials regularly threaten to “close the Strait of Hormuz” but have never acted on this threat. In April 2019, Alireza Tangsiri, head of the Iranian Revolutionary Guard Corps (IRGC) navy force, made a threat in the state-run Fars News Agency: “If we are prevented from using it [Strait of Hormuz], we will close it.”³³ In December 2018, President Rouhani threatened to close the Strait on Iranian state TV by saying, “If someday, the United States decides to block Iran's oil, no oil will be exported from the Persian Gulf.”³⁴ It is important to note that Iran cannot technically “close” the Strait, but through a combination of actions such as mining, launching coastal defense cruise missiles (CDCMs), and small boat ship harassment, it could raise the risks high enough to eventually create an environment where passage is uninsurable or the costs and risks are so high that for all intents and purposes, the Strait is “closed.”

Iran uses its geographic position vis-à-vis the Strait as a bargaining chip in international



politics. From a defensive posture, the threat to close the Strait is the closest option Iran has to a nuclear option. The threat that Iran could throw global oil prices into disarray is useful to deter potential adversaries, especially since it does not possess a nuclear weapon, and as opposed to North Korea, another illicit nuclear proliferator, its conventional missile arsenal is not capable of meaningfully threatening major population centers with a massive conventional attack. But like the use of a nuclear weapon, actually taking this action would result in a massive military response from the United States and its partners with broad international support, which is why the threat itself is much more useful than acting on it. The only exception would be if Iran truly believes its regime existence is threatened.

That said, similar to the nuclear arena, brinksmanship in the Strait of Hormuz creates an opportunity for Iran to gain leverage on the world stage. Activities short of closing the Strait act both as a demonstration of power and reinforcement of the deterrent, but they also provide Iran with leverage to extract concessions from the international community. The most famous example of this approach came during the Tanker War of the 1980s. Iran responded to Arab and international support for Iraq in the Iran-Iraq War by dropping mines and attacking internationally flagged tankers. At the end of the war, ships from more than 38 countries had been attacked, with a special focus on Saudi Arabia and Kuwait, who were two of Iraq's strongest supporters.³⁵ More recently, Iran's actions in the past few months again demonstrate its effort to send messages to the world, to try to obtain relief from the Trump administration's maximum pressure strategy, and to build leverage for any future potential negotiations.

Another major factor that restrains Iran's activity in the Strait is the export of its own oil. Iran has some of the world's largest proven crude oil reserves and proven natural gas reserves. Most of Iran's oil exports are shipped on tankers through Iran's busiest port, Bandar Abbas, located right in the heart of the Strait of Hormuz. In 2018, Iran's petroleum exports accounted for \$60.2 billion in revenue, or more than 14 percent of its gross domestic product.³⁶ This export provides the single most significant source of hard currency to the isolated regime, a very powerful and vulnerable asset for Iran. Additionally, Iran relies on the Strait of Hormuz for its own import of nonoil consumer and industrial goods, including food and medicine. However, as the Trump administration has pursued its maximum pressure strategy and taken average crude oil and condensate exports from 2.5 million bpd in 2017 to only 500,000 bpd in May 2019, Iran's incentive to restrain itself in the Strait has decreased as evidenced by its escalation in the Gulf region. But strong incentives still remain for Iran not to go too far.³⁷

Iranian Military Capabilities in the Strait of Hormuz

Iranian military capabilities are unable to match US capabilities. However, Iran's military has improved significantly over the past 30 years, creating many new challenges for the United States that were not factors during the days of the Tanker Wars—the last time the US and Iran engaged in serious, direct, conventional confrontation.

Iran has two navies: its traditional navy, the Islamic Republic of Iran Navy (IRIN), and the Islamic Revolutionary Guard Corps Navy (IRGCN). In 2007, Iran's two navies were assigned geographic regions of operation: the Persian Gulf to the IRGCN and the Gulf of Oman and Caspian Sea to the IRIN. Meanwhile, the two navies share a responsibility for the Strait of



Hormuz, with the IRGCN taking on the bulk of the action.³⁸

According to an unclassified report by the Office of Naval Intelligence on Iran's two navies, the IRGCN mission includes the tracking of foreign warships in the Strait of Hormuz and Persian Gulf. IRGCN strategy sees the confined spaces and shallow waters within its areas of operation as an advantage where it can ably deploy its swarms of small boats and mobile weapons systems and potentially outmaneuver the enemy. In accordance with Iran's overall defense strategy, the IRGCN seeks to leverage its position in the Strait of Hormuz to deter an attack by projecting strength in the waterway—including through highly visible exercises like the Noble Prophet series—and reminding the world of the potential global economic repercussions if conflict were to escalate.

Compared to the IRGCN, the IRIN has a minimal role in leveraging the Strait of Hormuz as part of the country's deterrence strategy but would play a key role in a major conflict in the waterway if one broke out. In the event of a major conflict, the IRIN would be able to supplement the IRGCN's asymmetric assets with surface ships, submarines, air assets, and CDCM units. With these assets, the IRIN would play a role in attacking and detaining commercial ships and restricting access at the entrance of the Strait from the Gulf of Oman. However, the IRIN should not be overestimated in its conventional capabilities as it is still insufficiently equipped and proficient to fight an enemy navy far from Iran's own coast.

The tools Iran uses to threaten the Strait of Hormuz are primarily asymmetric in nature. Iran has used mining attacks both recently and in the past. During the Tanker War, it mined ports on the Arab side of the Gulf and dropped mines in the way of transiting ships. Again, in recent months it has attached mines to ships. The recent attacks thus far have been above the waterline of the ship, thus reducing the likely damage and signaling that Iran is trying to send a message without going too far. Iran has also refrained from wholesale mining of the Strait of Hormuz in the past, which would be significantly more escalatory. Iran stores its mines in depots near key ports. As long as the mines remain stored, they are easy targets, which is why Iran's military doctrine calls for loading mines on ships and scattering them in the event a conflict escalates. Once scattered on small ships, they are much harder to destroy.

In addition to mines, Iran also possesses CDCMs that can cause significant damage to ships transiting the Strait of Hormuz. Iran has three main CDCMs—the Noor, Ghader (Qader), and Ghadir—that have ranges of 120 km, 200 km, and 300 km, respectively, though it is unclear if they have over-the-horizon targeting capabilities for effective use outside of the Strait.³⁹ However, Iran's vast coastline and the narrowness of the waterway make tankers and other vessels easy targets for Iran's CDCMs when they pass through the Strait. While the missiles can be launched from sea as well as land, Iran prefers launching from land using mobile batteries, which can be scattered in the case of conflict to prevent having them destroyed. While the United States would likely be successful in destroying a significant number of batteries in its retaliatory strikes, it's highly unlikely it would be able to eradicate Iran's entire inventory. As of 2010, Iran was estimated to have at least 12 mobile inland truck-mounted batteries and more than 100 missiles.⁴⁰ Iran is also estimated to have 10 vessels capable of carrying two Ghader batteries that could potentially launch the missiles at sea.⁴¹ Iran has invested heavily in its missile capabilities since then, especially in its antiship missiles, and is



likely to have a greater inventory now.

As Iran has never before deployed its CDCM capability in actual conflict, the damage these missiles would incur can only be discussed theoretically. Iran claims it would be able to sink a US aircraft carrier, but there are many reasons to be skeptical about this claim.⁴² On the other hand, the missiles could likely decimate bulk carriers and freighters and disable oil tankers transiting the Strait, but it all depends on the payloads the missiles carry. Most notably, few of Iran's antiship cruise missiles (ASCMs) have a warhead powerful enough to cause serious damage to an American aircraft carrier. For comparison, during the Cold War, the Soviet Navy used ASCMs with warheads between 725 kg and 1,000 kg,⁴³ whereas the Noor and Ghader carry respective warheads of 155 kg and 200 kg, making it less plausible that they would be able to cause significant damage.⁴⁴

In addition to its cruise missiles, Iran has many ballistic missiles, most notably the Fateh-110, a short-range ballistic missile (SRBM) with a payload of 500 kg, capable of causing significant damage. Although with only a range of 210 km, the Fateh-110 is thought to be one of Iran's most accurate SRBMs and is road mobile, making it a weapon crucial to its arsenal.⁴⁵ Iran has also recently developed an antiship variant of the Fateh-110 called the Khalij Fars, which can cover a 1,100 km radius and carry a 635 kg warhead. In tests, Iran has claimed these missiles have shown 100 percent accuracy but has yet to use them in an actual conflict, so this is unverified and unlikely.⁴⁶ In fact, during its Noble Prophet Exercise 9 in February 2015, Iran used the Khalij Fars, along with other rockets and mines, to attack a mock US aircraft carrier. Photos and videos from the drill show the missile missing its target by less than 50 m, but notably, the explosive blast was still able to cause significant damage to the hull of the mock ship.⁴⁷ Clearly, the Khalij Fars has enough of a warhead to critically damage and disable a US aircraft carrier, but the probability of that actually happening remains low due to the superiority of US defenses. US aircraft carriers are typically escorted by a guided missile cruiser and one to two guided missile destroyers. These ships were designed with the specific intention of protecting aircraft carriers from mass air and missile attacks.⁴⁸ These factors make the probability of Iranian missiles being able to destroy a US aircraft carrier unlikely but not out of the question.

In the Strait of Hormuz, Iran would also use its fast attack craft, like the Tondar—smaller vessels capable of carrying torpedoes and Ghader ASCMs—as well as its fast-inshore attack craft, such as the Ashura and Tareq—lightly armed small boats. The latter's swarming tactics and large numbers can be quite challenging for a larger, more powerful, but also slower US ship. Difficult to detect and able to move with agility in the Strait's narrow waters, these crafts are deployed in large groups to combine their offensive power and overwhelm the target so at least some of the craft can break through the target's defenses to launch their hit-and-run style attacks.⁴⁹ While the exact number is unknown, Iran is estimated to have an inventory of fast inshore attack craft in the hundreds, outfitted with machine guns and/or rockets.⁵⁰ Iran has used both these types of vessels to harass international shipping and US Navy ships in the past. In 2016 and 2017, these small boats routinely harassed US vessels, even taunting a US destroyer.⁵¹ US personnel are empowered to take action to protect their ships if they must, but they usually start with warning announcements and warning shots that to date have worked to stop this Iranian behavior short of starting a major incident.



Table 2: Military capabilities Iran is most likely to use in the Strait of Hormuz or to target oil infrastructure

In the Strait of Hormuz	
ASCMs	Iran's three types of ASCMs—the Noor, Ghader, and Ghadir—can reach targets within 120 km, 200 km, and 300 km, respectively.
Small boats	The IRGC uses Tondar vessels—fast attack craft—to carry torpedoes and missiles to target enemy ships and oil tankers. The Ashura and Tareq vessels—fast inshore attack craft—lay mines and swarm larger ships in groups, blanketing them with rocket and machine gun fire.
Submarines	Iran's Kilo class submarines launch torpedoes and ASCMs at the enemy. Its smaller classes of submarines—Ghadir and Nahang—conduct targeted mining operations.
Mines	Iran is estimated to have between 500 and 1,000 mines, both foreign bought and self-manufactured, that it can deploy against ships transiting the Strait.
Ballistic missiles	In Iran's 2015 NOBLE PROPHET military exercise, the IRIN used its Khaliq Fars ballistic missile (1100 km range) to sink a mock U.S. aircraft carrier. But Iran's long-range ballistic missiles remain untested in actual conflict.

Targeting oil infrastructure	
Land attack cruise missiles	Iran would likely deploy its longer-range cruise missiles to target Gulf oil infrastructure—namely its Soumar, Ya-Ali, and Quds-1 missiles, which all have a range of 700 km. The Hoveyze missile has a range of 1350 km. It is suspected that Iran used the Ya-Ali missiles in its September 14, 2019, attack on Abqaiq and Khurais in Saudi Arabia.
UAVs	Iran has several UAVs that can be used for intelligence, surveillance, and reconnaissance and combat purposes. The Mobin has terrain contour matching and digital scene matching area correlation guidance for extreme accuracy. The Shahed 171 Simorgh and Saegheh 2 are stealth drones with intelligence, surveillance, and reconnaissance and combat capabilities and are thought to have been used by Iran in the September 14 attack on Abqaiq and Khurais in Saudi Arabia.
Cyber	Much of Iran's cyber capabilities are still unknown, but it used the Shamoon virus in 2012 to shut down tens of thousands of Saudi Aramco computers for months. If it has developed more sophisticated malware—often modified from what it can purchase on the criminal market—it could perpetrate a more severe attack.
Ballistic missiles	Iran's accurate and short-range (210 km) ballistic missile, the Fateh-110, could reach several major oil infrastructure targets on the east coast of Saudi Arabia and in the UAE.

The Threat to Gulf Oil Infrastructure

In addition to contemplating escalation in the Strait of Hormuz, during a conflict Iran may also attempt to influence the flow of oil through varying levels of attacks on Saudi and Emirati oil infrastructure. Iran's ability to influence the export or production of Saudi and Emirati oil is important to consider as these two countries combined produce 16.1 million bpd—the



equivalent to almost 16 percent of the world's daily oil production.⁵² Iran's ability to shut down oil production in either country could have very real consequences for the global oil market. Indeed, the recent attacks on Saudi facilities indicate that this possibility is much more likely than previously believed. These attacks could take a number of forms, including cyberattacks; sabotage attacks using proxies; and/or launching missiles at various production, processing, and exporting centers.

Saudi Arabia is the most likely target, with the second largest proven oil reserves in the world with 266.5 million barrels and nearly 13 percent of global daily oil production.⁵³ Saudi oil infrastructure consists of oil fields, pumping stations, gas and oil separation plants, stabilization plants, a large network of pipelines, and shipping ports. Saudi Arabia has nine domestic oil refineries with a combined capacity of 2.9 million bpd.⁵⁴ The majority of Saudi oil is considered "sour" oil due to the significant levels of hydrogen sulfide, which must be removed before the oil can be shipped.⁵⁵ This is done in one of five processing and stabilization facilities, the largest being Abqaiq facility in Eastern Saudi Arabia, which can process up to 7 million bpd. Once the oil has been stabilized, it can be exported. The majority of Saudi oil is exported through the Ras Tanura port, which handles 6.5 million bpd, and Ras al-Juaymah port, both located on the Persian Gulf.

The UAE has the seventh largest proven oil reserves in the world at 97.8 billion barrels and produces 3.7 million bpd of petroleum and other liquids. Most of this oil is from the Upper and Lower Zakum offshore oil fields off the coast of Abu Dhabi. The UAE has four major refining facilities that process 1.1 million bpd, with Ruwais being the largest, currently processing 817,000 bpd. Once refined, most of this oil is sent to Fujairah Port in the Gulf of Oman, which loads and unloads up to 2 million bpd but can store up to 70 million barrels.⁵⁶

Iran's attacks on Saudi facilities on September 14, 2019, were a genuine strategic surprise both in terms of Iranian capability to accurately target these facilities and the willingness to launch attacks from Iranian territory. According to news reports, Iran used a combination of cruise missiles and UAVs to strike at these facilities.

It is important to note that estimates of Iranian missile capabilities, ranges, and payloads are nominal given the extremely limited open source intelligence on these data points. Still, without a doubt, Iran has extensive and varied missile programs, which have been a focus of investment for the regime over the past decade. Iran's missile capabilities should not be underestimated, as evidenced by the surprisingly sophisticated attack on Saudi Arabia on September 14 that penetrated US and Saudi defenses.⁵⁷ Any sort of conflict would certainly be damaging to all parties involved. A conflict between the United States and Iran would not be the walk in the park that the Tanker War of the 1980s was, but a more serious conflict with significant damage to Iran and to United States' interests and forces in the region and potentially beyond, given Iran's ability to direct international acts of terrorism.

Iran has several types of land attack cruise missiles with a range of 700 km, such as the Soumar, Ya-Ali, and Quds-1,⁵⁸ that would be used to strike most oil infrastructure in Saudi Arabia's east, which in addition to Abqaiq and Khurais includes its largest port, Ras Tanura, as well as numerous other oil processing facilities. The Soumar is one of Iran's oldest cruise missiles that has an inertial navigation system, a global navigation satellite system, and radar



based terminal guidance and is thought to be accurate within 50 m.⁵⁹ The Soumar is land launched, which limits its use, but some of Iran's other cruise missiles, such as the Ya-Ali and Quds-1, can be launched from land, air, or ship, giving Iran flexibility in choosing and attacking targets within Saudi Arabia and the UAE.⁶⁰ In addition to this flexibility, these land-attack cruise missiles, as seen in the September Aramco attack, are capable of carrying payloads large enough to cause damage significant enough to affect oil production capacity.

In the attack on Abqaiq and Khurais oil facilities in mid-September 2019, 18 UAVs and 7 cruise missiles were used. Of the 18 UAVs, 17 made it to the Abqaiq oil facility to cause damage. Of the 7 cruise missiles launched, four struck the Khurais facility, and the other three fell short of their target of Abqaiq. In a press conference, Saudi Arabia stated that the cruise missiles were the Iranian Ya-Ali missiles.⁶¹ Given the level of accuracy of the September attacks, it appears that if Iran used these missiles, it was able to outfit them with more advanced targeting technology that allowed for incredibly accurate strikes.⁶²

Additionally, this type of missile is quite effective at evading defense systems as the missiles travel at a low altitude, making them difficult to detect, and when launched from close range, give minimal time for detection and destruction. For example, the Hoveyzeh land-attack cruise missile, a variation of the Soumar with a range of 1,350 km, launched from Iran toward Saudi Arabia traveling at an altitude of 100 m would give the missile defense operators under four minutes to detect and destroy the missile.⁶³ In the case of the recent attacks, it appears that Iran was able to fire cruise missiles that traveled over land over either Iraq or Kuwait and hit Saudi targets from the north. This made the strike much more difficult to detect.⁶⁴ It also caught the United States and Saudi Arabia by surprise, as all defense had been pointed south at either Yemen or other parts of Iran, where a strike was expected to come from.⁶⁵

In addition to its land-attack cruise missiles, Iran also recently unveiled a "cruise" UAV called the Mobin that uses terrain contour matching and digital scene matching area correlation guidance for extreme accuracy, which gives Iran more options for attacking specific oil infrastructure such as processing trains and storage tanks.⁶⁶ Taken together, these missile capabilities represent a much more serious threat to Gulf infrastructure than was believed before September 14, 2019.

In addition to the Mobin, Iran has also developed various UAV capabilities that give it increased stealth and accuracy when looking to attack targets close to its coast. Iran has various intelligence, surveillance, and reconnaissance (ISR) and combat attack drones, its most advanced of which is based off a US RQ-170 that the Iranians shot down and reverse engineered in 2011.⁶⁷ In addition to the Mobin, Iran's most sophisticated UAVs are believed to be the Shahed-171 Simorgh and the Saegheh-2, which are stealth drones with reconnaissance and combat capabilities, both of which are based on the RQ-170.⁶⁸ In his press conference after the September 14 attacks, Col. Turki al-Maliki said the drones used in the attack were Iranian delta wing UAVs, which most experts assume to be either the Shahed-170 or the Saegheh-2.⁶⁹

Another capability Iran could use to attack Gulf oil infrastructure is cyber, which could certainly cause challenges for supply chains and operations. These types of attacks could range from a cyberattack similar to the one in 2012 on Saudi Aramco, in which 35,000 computers were partially wiped or completely destroyed, and the entire computer system was



forced off line for five months.⁷⁰ Amazingly, even with the takedown of its entire computer system, Aramco was able to maintain steady production at 9.5 million bpd.⁷¹ However, there are a couple of scenarios in which attacks failed that could have had a drastic impact on production. In 2017, there was an attack on Saudi Aramco that specifically targeted the safety system. The malware attempted to shut down an unspecified system but was detected by Aramco before it could do any damage.⁷² The second potentially damaging attack took place in March 2018 against a private petrochemical plant in Saudi Arabia. The goal of the malware was to trigger an explosion, but an error in the code prevented this from happening.⁷³ While neither of these attacks was directly attributed to Iran, many assumed Iran was the perpetrator. The potential to ignite an explosion through malware is a cyberattack method that could cause damage to Saudi oil production, but only if it is successful.

Iran is considered a third-tier cyber power without capabilities as sophisticated as China, Russia, and the United States.⁷⁴ While Iran has spent the last decade bettering its cyber capabilities, the tools it uses in this space are usually modified malware from the criminal market.⁷⁵ These tools do not have the destructive effect of more advanced cyber weapons, and no major successful destructive cyberattack has yet been attributed to Iran.⁷⁶

As Iran continues to invest in indigenous cyber capabilities, it is possible it has a cyber weapon in reserve with greater sophistication than those it has used in the past. But until Iran deploys such a weapon, it remains hypothetical. And the reality is that the full extent of Iran's cyber capabilities may not be known until it actually attempts to use them.

It's important to note that as Iran has invested in its cyber capabilities, Saudi Arabia has devoted considerable resources to securing key infrastructure against such attacks.⁷⁷ Even if Iran were able to successfully target a more poorly secured pipeline control system, Saudi Arabia has developed measures to rapidly restore pipeline function.⁷⁸ Beyond oil and gas infrastructure, Iran could also seek to impede the operation of power grids and desalination plants in Saudi Arabia or other Gulf countries. While possible, given what is currently known on Iran's cyber capabilities, it would be difficult for Iran to successfully do so without improved sophistication and detailed intel to shut down the power grid for a significant period of time.⁷⁹

The Impact of Tensions with Iran on Global Oil Prices

Rising tensions in the region surrounding the Strait of Hormuz have in the past affected oil prices, but those impacts have not been that dramatic. During the height of the Tanker War in the 1980s—a nine-month period in which there were 44 attacks by Iran on international oil shipments—oil prices dropped 14 percent by the end.⁸⁰ Despite the uncertainty Iran generated in the Gulf, the overall market was characterized by high supply levels and slowly growing demand, putting downward pressure on prices.⁸¹ A month after Iran started installing missiles in the Strait of Hormuz and took possession of two disputed islands in March 1995, oil prices jumped by about 5 percent.⁸² When the United States has imposed new sanctions on Iran in the past, Iran has responded with various levels of threats and escalatory tactics in the Strait, from harassing and attacking tankers to mining the Strait to threatening to close the Strait completely.⁸³ Perhaps the last time tensions were as severe as they are today was in late 2011 and early 2012, when in response to US sanctions targeting the Iranian oil sector, Iranian



officials threatened to close the Strait, and IRGCN ships conducted provocative maneuvers, including boarding and temporarily detaining a number of ships. Even then, oil prices did not rise that dramatically, peaking on January 4, 2012, at a 4 percent rise.⁸⁴

In today's low oil price environment, the situation could be even less severe. Oil prices plummeted between mid-2014 and 2016 by approximately 70 percent due to a combination of declining global demand for oil and a rapid increase in US and Canadian production of oil.⁸⁵ While prices have fluctuated since 2016, they have risen overall to approximately half the cost of the mid-2014 high, as of July 2019. Despite increases in the United States' domestic production of oil, it still imports oil from the Middle East, meaning the country is not isolated from global oil price changes. While the looming threat of climate change and the need to achieve greater efficiency to cut costs and increase economic output put pressure on countries to curb their consumption of fossil fuels, Asia remains a booming market for oil purchases, especially from the Middle East. In fact, approximately 60 percent of the oil exported through the Strait of Hormuz heads to China, South Korea, India, and Japan.⁸⁶

Indeed, during the most recent period of escalatory action in the Strait of Hormuz, oil prices have not seen a dramatic rise. Overall, as of July, the Brent Crude and West Texas Intermediate are each down approximately 26 percent from October 2018 prices.⁸⁷ However, after individual incidents in the Gulf waters, prices do momentarily spike. For example, Brent crude rose 2.1 percent after Iran seized the *Stena Impero* (UK flagged tanker).⁸⁸ Even in the most recent attack against Saudi Aramco facilities at Abqaiq and Khurais, there was a 5.7 million bpd disruption in oil capacity that resulted in a minimal long-term impact on oil prices. The Monday after the Saturday attack saw Brent crude prices jump by 14.6 percent to \$69.02 per barrel. But Tuesday saw prices drop 7.4 percent after the Saudi energy minister, Prince Abdulaziz bin Salman, announced that petrol supply had returned to its preattack levels and that production capacity would return to its normal levels by the end of September, meaning that much of the initial price jump was due to fear rather than a result of oil shortage.⁸⁹ After a week, prices had dropped another 2.6 percent to \$62.99 per barrel.⁹⁰

The incidents through the summer have had little to no material impact on shipping in the Persian Gulf without significant interruptions in traffic or supply. Of the more than 2,000 companies operating in the Strait, only two have ceased their operations there altogether, even with increasing freighter rates and insurance premiums.⁹¹ The high supply—combined with slowing demand growth that has characterized the oil market in recent years, after the introduction of US and Canadian shale—has kept a downward pressure on prices. Additionally, oil traders still seem to be estimating the risk of conflict in the Strait of Hormuz as relatively low. For one, the example they have to study, the Tanker War of the 1980s, proved that it takes a lot of activity from Iran to disable any significant number of tankers (not even a quarter of the 2 percent of tankers affected by Iranian attacks were actually disabled) and actually disrupt supply.⁹² Second, the market appears to believe the United States will intervene to secure supply if any dramatic escalation were to occur.

Finally, the soft nature of the current global oil market also acts as a price ceiling. Global demand for oil is growing at a slower rate than the global supply of oil. The possibility of a global recession and ongoing US-China trade war are also putting downward pressure



on global oil prices. In this environment, it is reasonable to assume that any major crisis associated with Iran is likely to occur within an environment where other factors will be pushing downward on the overall oil price.

Even though the possibility of a sustained rise in oil prices is unlikely outside of an all-out war between Iran and the United States in the Strait of Hormuz, it is important to look at the impact that high oil prices would have on the US economy. Since the shale revolution, higher oil prices have had varied implications for the United States. On the one hand, domestic shale producers would benefit from higher oil prices, in turn producing more, investing more, and putting more money back into the US economy.⁹³ A \$20–\$30 increase in the price per barrel on oil, however, would likely cause a decline in consumer spending, which would negatively affect gross domestic product.⁹⁴ Higher energy prices also contribute to inflation and are often taken into account when the Federal Reserve makes its interest rate decisions.⁹⁵ When high oil prices endure in the long term, they create uncertainty and doubt about the future. Of the last seven US recessions, five have been preceded by a considerable rise in the price of oil.⁹⁶ A serious military conflict in the Strait of Hormuz would likely deal an economic blow, potentially increasing the likelihood of recession. Similar issues would exist for global economies, particularly those either heavily dependent on Middle East supplies of energy or on the vagaries of international oil prices.

Figure 2: Weekly Brent crude oil price, 2015-2019 (USD)⁹⁷



Source: Bloomberg



SCENARIO 1: SIGNIFICANT ESCALATION SHORT OF ALL-OUT WAR

Scenario 1 involves a tit-for-tat escalation beyond what played out over the summer of 2019 but that stops short of all-out conflict—in many ways akin to a modern-day version of the Tanker War of the 1980s. In this case, the situation would start with a continuation of where things have been for the past few months. Iran would continue pursuing deniable mine attacks for several months using limpet mines that can be attached to the sides of ships, as it did in Fujairah on May 12⁹⁸ and in the Gulf of Oman on June 13. However, similar to the May and June attacks, the mines would be placed by Iran above the waterline, thus specifically intending to not cause fatalities or a major environmental disaster.⁹⁹ The scope of these attacks would expand over time to include attacks not only in the Gulf of Oman but also in the Strait itself and inside the Persian Gulf.

Additionally, there would be more attacks on Saudi oil infrastructure. Some of these attacks would be similar to the one on the Saudi Aramco facilities of Abqaiq and Khurais that temporarily disrupted 5.7 million bpd of production capacity. Other less damaging attacks would be launched primarily by the Houthis using missiles and UAVs similar to the attack on May 14. In that attack, armed drones struck two Aramco pumping stations, causing a temporary shutdown of the East-West Pipeline. The attacks caused a small fire and minor damage at one pumping station but did not disrupt oil output or exports or crude and petroleum products.¹⁰⁰ The bottom line of these attacks is that the tools used would be of a scope and scale unlikely to lead to the type of damage that would dramatically erode Gulf production and export capacity for more than a matter of days or weeks, but they would raise concern in the Gulf and internationally.

Then amid these heightened tensions, a miscalculation would occur. Most likely an IRGCN vessel would look to intimidate a US Navy vessel by coming too close. This is a common occurrence, and US ships are able to get Iranian small boats to pull back by firing warning shots across their bows and displaying professional discipline. However, in this case, the Iranian ship would not respond to American warnings and push too close, and the American ship captain would feel that the ship was under immediate threat and would have to respond forcefully, striking the offending Iranian vessel, destroying the ship, and killing some members of its crew.

Iran then would respond with a series of more aggressive steps that would cause an escalation. Iran would perhaps launch a few of its CDCMs at US ships in the Persian Gulf or Gulf of Oman. Iran would also significantly accelerate the pace of mine attacks on shipping. During the Tanker War, Iran struck 190 ships flagged by 31 different nations over a span of four years.¹⁰¹ In this scenario, Iran would assume a similar pace with attacks occurring every two weeks and targeting multiple ships. The primary targets would be ships coming from and going to Saudi Arabia and the UAE—as those are the two regional states that Iran sees as the major protagonists in the Persian Gulf. In addition, some, though not all, of the attacks perpetrated by the IRGCN would become more lethal with mines laid below the waterline of some ships, resulting in occasional oil spills that would disrupt shipping traffic, cause



environmental damage, and cause some fatalities (during the Tanker War, 63 sailors were killed by Iranian attacks).¹⁰²

Iran would likely couple its naval operation with attacks on Saudi and Emirati oil infrastructure. This would start with attacks similar in nature to the September attacks on the facilities in Abqaiq and Khurais, though damage would likely be more limited as US and Saudi patriot batteries and other air defenses would be better prepared for the possibility of these strikes. It would also include potentially massive cyberattacks—like the attack on Saudi Aramco in 2012 that took down 35,000 computers, disrupted operations for months, but did not affect production—or more dangerous attempts to use cyber tools to cause explosions at petrochemical or refinery facilities.

The United States would respond with a course of action similar to what it pursued during the 1980s. It would agree to protect Saudi and Emirati shipping and reflag those tankers as American and may also agree to reflag the ships of a number of other international partners who would feel vulnerable. This would include a significant increase in the number of warships deployed to the Gulf along with patrol boats and ISR assets to monitor Iranian actions. Indeed, one of the main challenges associated with countering mine warfare is that in many ways it is the equivalent of countering insurgent tactics, but only at sea. It therefore requires a persistent presence of a large number of forces in the targeted area to deter attacks. The United States would seek international support for this mission from its European allies, the Gulf states, and Asian partners who are still the main recipients of Middle Eastern oil, especially since the US Navy is drastically smaller than it was during the Tanker War.

Specifically, increased maritime security in the Gulf would at a minimum require the United States to station two sentry ships—US naval destroyers equipped with helicopters—outside each entrance to the Strait of Hormuz to check tankers in and out and to direct the ships through Omani waters if necessary. The United States would use a P-8 aircraft to provide ISR from the air and have quick-response aircraft nearby on land, ready to go if the situation arose. This sentry mechanism would make it more difficult to attach limpet mines undetected and to visit, board, search, and seize ships, thus limiting Iran to more aggressive actions it would be hesitant to take.¹⁰³

Alternatively, the United States could escort tankers through the Strait of Hormuz, as it did under Operation Earnest Will in 1987-1988. It would create a meet-up point in the Persian Gulf and Gulf of Oman, and US destroyers would escort convoys of 15-20 ships all the way into port inside the Persian Gulf and then support convoys passing back out of the Persian Gulf through the Strait. This type of effort would also require significant ISR support. Supporting escort operations in the Strait of Hormuz would stress the US Navy more now than it did in the 1980s, when it was at the peak of its 600-ship-fleet era. Anti-mining and escort/ISR missions are resource-heavy, and the US Navy is still in the middle of recapitalizing support for these types of operations.¹⁰⁴

There would still almost certainly be occasional skirmishes at sea as US or partner ships would detect Iranian mining activity and fire on those Iranian targets or respond by targeting Iranian ports or mine storage facilities from which the attacks were launched in an effort to deter Iranian actions. There would also be an increased likelihood of further miscalculation,

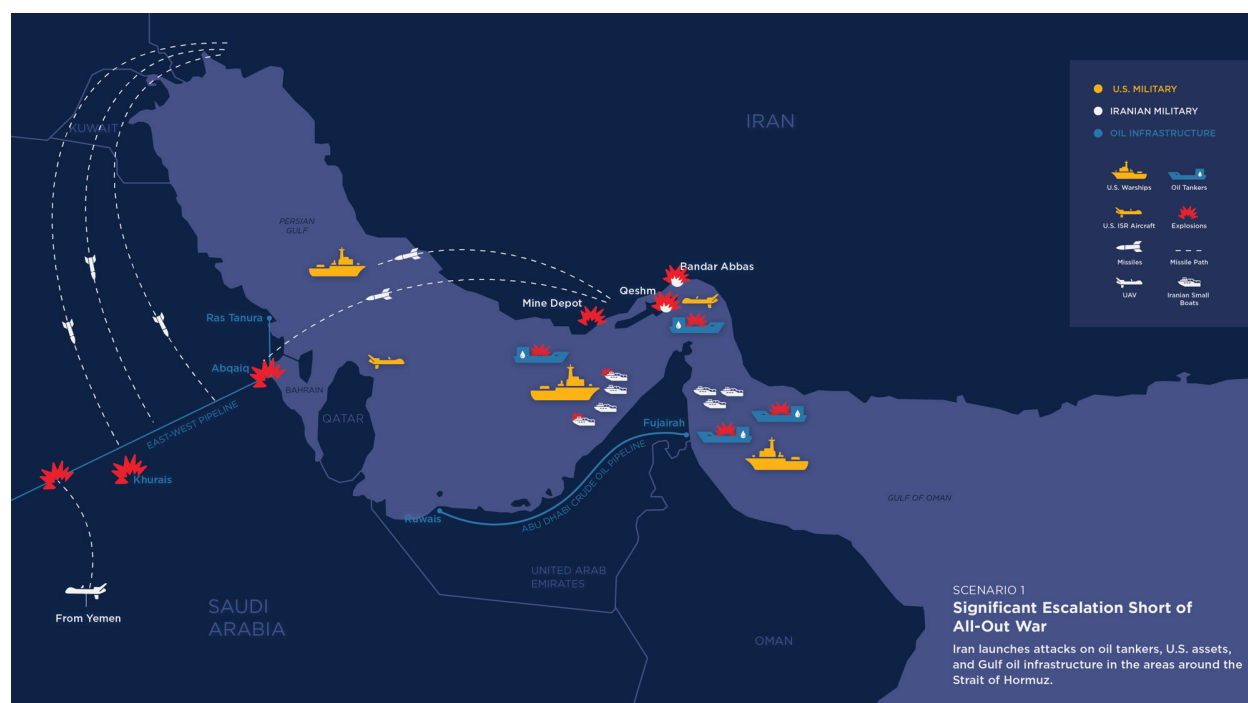


leading to small skirmishes that would result in casualties on all sides, but almost certainly more from Iran. The United States and its partners would also launch cyberattacks on Iran's oil infrastructure and military targets from which attacks were launched by Iran.

The United States would also step up defense of Saudi and Emirati energy infrastructure by increasing missile defense coverage of these facilities. But if Iran continued attacking Gulf oil infrastructure with cruise missiles, the United States or its Saudi or Emirati partners might strike at missile sites inside Iran or conduct cyberattacks on those sites to destroy them.

The situation might escalate to further limited confrontation in which the United States would try to deter Iran through punishment rather than increased monitoring, like it did in Operation Praying Mantis in the 1980s when the United States sunk a number of Iranian platforms and ships in retaliation to an attack on a reflagged tanker that injured 10 American crew members.¹⁰⁵ In a case of significant attacks on Saudi oil infrastructure, the United States may also consider attacking Iranian oil infrastructure in response. However, ultimately, all of these confrontations would stop short of an all-out war as the Tanker War did because Iran would not want to escalate to a full conventional war that it would almost certainly lose, and the United States would want to show restraint and not get bogged down in a new major conflict in the Middle East.

Figure 3: Scenario 1: Significant escalation short of all-out war



Oil price impacts in these scenarios would likely be marginal and occur in the short term. Supply of oil coming out of the Middle East would not be materially affected, and any



disruption could be offset with alternative global supplies or stocks. Insurance prices associated with shipping would rise, but given the economies of scale associated with the oil market, the per barrel cost would be minimal. For example, if insurance premiums were to increase from the current level of \$50,000 per Strait of Hormuz passage to around \$500,000, that would still result in only a 25-cent increase per barrel.¹⁰⁶ Tanker journey times could also be extended somewhat as ships might have to wait for convoys to journey through the Strait. However, the difference in journey time would unlikely be enough to cause a major effect on production or supply, especially in a market characterized by surplus. Therefore, the global oil price would be only minimally affected.

Significant attacks on oil infrastructure would be the most likely cause of a more severe spike on oil prices, but in this scenario, those would not be very different than the September 14 attacks, and a short-term oil price bump would be expected and would recede relatively quickly. The market would likely react to such an incident with an initial fluctuation in price, but this increase would be more out of sentiment and fear of larger conflict than a reflection of an impact on supply.

In the long term, if this scenario were to drag out for years or become semipermanent, it could incentivize the market to look for alternative transportation routes. The most likely response would be greater investment in building new pipelines or investing in existing pipelines to expand capacity and bypass the Strait of Hormuz.

The most important long-term impact of this scenario would not be economic but security related. It would force the United States to maintain a larger naval and air footprint in the Middle East than it is currently planning for, which would take resources away from the current shifting of resources to the Pacific to put greater emphasis on the challenges posed by China.

Indeed, these developments are already playing out. In the period of uncertainty immediately after the September 2019 attacks, there was a spike in oil prices that quickly receded as more facts became available and the public realized that Saudi Arabia would be able to maintain similar levels of oil exports. More than a month later, oil prices were actually lower than preattack levels, showing the resilience of the oil market as well as the difficulty for Iran to actually affect global oil prices.¹⁰⁷

The main impact in the aftermath of these attacks has been security related. The United States has had to spend resources reassuring the Saudis as well as other international partners that Iran will not be successful in future attempts to attack. The United States has deployed an additional 1,800 troops to Saudi Arabia as well as two Patriot missile batteries and an advanced air defense system.¹⁰⁸ Overall, the United States has deployed 14,000 additional troops to the Middle East since Iranian attacks began in the spring in efforts to deter Iranian aggression and reassure partners. This will end up being a long-term drain of money and military resources regardless of the impacts on oil prices.¹⁰⁹



SCENARIO 2: MAJOR INFRASTRUCTURE DAMAGE

In this scenario the situation would escalate beyond scenario 1 into more extreme attacks on Saudi and Emirati oil infrastructure. This would occur as the tit for tat in scenario 1 escalated and Iran took more and more aggressive action. It is also possible that this scenario could occur if the Trump administration continues on its current trajectory of pursuing maximum pressure via sanctions while failing to respond effectively to Iranian attacks on oil infrastructure. In that case, as the pressure would continue to build on Iran, and Iran would become increasingly convinced that President Trump would not respond militarily to Iranian actions against Saudi infrastructure, it would up the ante.

The most likely scenario would be for Iran to reprise its attacks of September 14, using a combination of cruise missiles and drones. However, in this case Iran likely would deploy more missiles and drones than the 8 missiles and 17 drones deployed in the previous attack. At the same time, a more effective defensive response from Saudi Arabia and the United States would be expected as they have surely disbursed missile defense systems around the entire Abqaiq facility instead of pointing everything exclusively south.

Iran also would have other options, such as sabotage attacks on pipelines or cyberattacks, but neither of those would be particularly disruptive. Pipelines, particularly in the Saudi case, could be repaired quite quickly. Aramco closely monitors its pipelines and can quickly make repairs, reportedly within 36 hours.¹¹⁰

Iran could also try to launch a sabotage attack using the IRGC Qods Force or its proxies on major oil production facilities, but that would be exceedingly difficult. These are hard targets that would be a high priority for protection by Saudi Arabia, the UAE, and the United States. Iran has been cultivating networks in Eastern Saudi Arabia, which is mostly Shia and where most of Saudi oil production comes from. There could be attempts at major attacks or persistent sabotage attacks possibly for years. But with these countries on high alert and dedicating significant resources to the protection of these facilities, this course of action would be less likely to yield a major result than attacks via missiles and UAVs from the air.

As for cyberattacks on Saudi or Emirati oil infrastructure, based on what Iran has been able to accomplish in past cyberattacks, as described earlier in this paper, it could certainly cause some disruptions, but a dramatic reduction in oil production from such attacks would not be expected. Iran has malicious cyber capabilities, which it has used to attack Aramco, electrical grids, and market and financial infrastructure, but these attacks were unable to cause the types of physical effects and explosions that would be necessary to cause a major disruption to oil production. While Iran would be expected to unleash its full malicious cyber capabilities, there is not a lot of publicly available information about Iran's capabilities and how much they may have developed in recent years. There is much more information about Iranian missile and naval capabilities, and therefore, for this maximum damage scenario, the authors focused on Iran's abilities to cause damage through those methods. However, if Iran's cyber capabilities have evolved further, the effects of such attacks in a worst-case scenario likely would not be



all that different than the effects described below when examining missile attacks on Iranian infrastructure.

The more significant question is what kind of damage Iran would be able to inflict through the use of its missile arsenal to cause sustained long-term damage to Saudi or Emirati oil production facilities. Until recently, it was assumed that Iran could not cause major damage to these facilities using missiles. Joshua R. Itzkowitz Shiffrin and Miranda Priebe eight years ago wrote an article concluding that it would be impractical for Iran to use its missile arsenal to strike at Saudi oil facilities.¹¹¹ However, the recent attacks make clear that Iran's technology has continued to improve, and missile and UAV strikes on Gulf infrastructure are now clearly a realistic scenario.

Oil fields in Saudi Arabia and the UAE would be unlikely targets as they are often very spread out, and Iran would need to destroy the wells, which are very small targets, to stop production. Gas and oil separation plants would also be unlikely targets due to similar reasons.

Instead, the most appealing and likely target for Iran would be trying to attack and destroy Saudi Arabia's stabilization facilities and prevent the Saudis from being able to transform their sour oil into oil that is able to be exported, therefore directly affecting their production. All five stabilization facilities are within 300 km of Iran and therefore within the range of cruise missile strikes. The stabilization process takes place within concentrated towers, many of which were specifically designed for Saudi Arabia, meaning that repair and replacement would be difficult and time consuming.¹¹² Abqaiq is Saudi Arabia's largest stabilization facility and where most of the oil in the country is processed before it can be exported.¹¹³

Iran's destruction of the Abqaiq stabilization plant would remove more than 7 million bpd of production capacity for Saudi Arabia.¹¹⁴ Riyadh could offset some of this loss in production by running its other stabilization facilities at maximum capacity, producing 3 million bpd, and increasing its production of naturally "sweet" oil to its maximum of 2.6 million bpd.¹¹⁵ On average, Saudi Arabia produced 10.1 million barrels of crude oil daily in June 2019.¹¹⁶ Without Abqaiq, Saudi could at most produce 5.6 million bpd, operating at a loss of 4.5 million bpd.

It is unclear how long this supply disruption would last. Take for example, a lesser attack such as the September attack on the Abqaiq and Khurais facilities. On one hand, Saudi Arabia has been able to relatively quickly reassure oil markets and bring its production capacity back to near preattack levels within weeks by drawing on other spare capacity and moving forward with some rapid repairs.¹¹⁷ On the other hand, there are also indicators that some Saudi officials are expecting repairs to take up to eight months before reaching a return to normal operations, as Aramco has to order many of the parts needed to repair the facilities from Europe and the United States. In addition, some of the parts must be specially manufactured and could take contractors up to a year to deliver and install.¹¹⁸ Given the opaque nature of the information shared by Saudi Arabia, this uncertainty is likely to remain. It is possible that once the public realizes the reality of how long it will take the Saudis to fully repair their facilities, there will be another spike in oil prices. In the long run, this will make the market more volatile, especially in the case of another attack on Saudi facilities, as the general public would see them as less credible in their estimates for repair time.



Therefore, in a more extreme attack, repairs would be expected to take at least 8 months or even as long as 16 months, but also, the impact on Saudi production would be much more sustained than it was in the September 14 attacks. Repairs of Abqaiq have been estimated to take at least several months or even years if Saudi Arabia does not have a stockpile of replacement parts on hand.¹¹⁹ Shifrinson and Priebe estimate a 6- to 15-month window as the midrange of past repair experiences.¹²⁰ Production, however, would likely return gradually rather than suddenly restart; it is reasonable to assume after several months that Saudi Arabia would be able to slowly increase its production capabilities even if a return to previous levels took closer to a year or more. Full repairs to Kuwaiti oil infrastructure damaged in the 1990–1991 Persian Gulf War took two years, though exports resumed within nine months and reached 83 percent of Kuwait’s exports before the war by 1992.¹²¹

In contrast to Saudi Arabia’s oil, most Emirati oil is “sweet,” meaning it has a low hydrogen sulfide content and therefore does not need to be stabilized before export. Therefore, when calculating the best way to affect UAE oil production with missile strikes, it is more likely that Iran would strike a UAE refinery such as Ruwais, which is also within 300 km of Iran.¹²² The Ruwais oil refinery has a capacity of 817,000 bpd, and its destruction would exact a big toll on Emirati refining procedures.¹²³ Based on an infrastructure repair project of Ruwais that took 18 months after a damaging fire in January 2017, the destruction from missile strikes would probably take anywhere from 6 to 18 months.¹²⁴

In addition to attacking refineries and stabilization plants, Iran could also attack Saudi and Emirati ports. Attacking these ports through missile or UAV strikes might be easier and could meaningfully damage Saudi Arabia’s or the UAE’s ability to maintain its export rate.¹²⁵ It is unlikely that an entire port would be destroyed. Moreover, there are options for immediately restarting some shipping out of ports that have been attacked. However, in the aftermath of a successful and significant attack, it would likely take a few months to get export capacity back to previous levels. And in the meantime, Saudi Arabia or the UAE would try to divert what it could through other ports or export facilities.

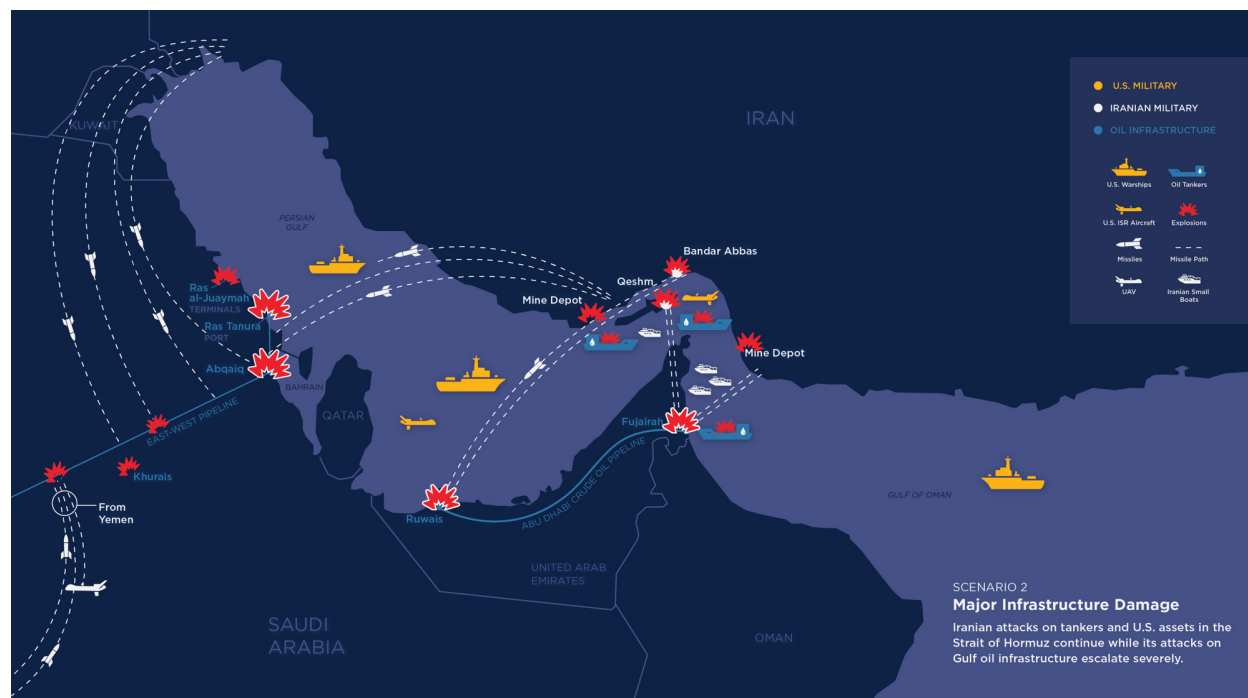
As previously mentioned, the major Saudi ports of Ras Tanura and Ras al-Juaymah are both located on the Persian Gulf and within range of Iranian missiles. The Ras Tanura terminals have an average handling capacity of 3.4 million bpd, and the Ras al-Juaymah terminals have an average handling capacity of 3.12 million bpd.¹²⁶ Ras Tanura also has a 33 million barrel storage capacity.¹²⁷ In this scenario, Saudi Arabia would partially offset these losses by increasing export through its Red Sea port at Yanbu, which has a loading capacity of 6.6 million bpd and only a 12.5 million barrel storage capacity. As of now, only light grade oil is loaded there, whereas the other terminals accommodate all grades.¹²⁸ If Saudi Arabia had to divert the majority of its exports to Yanbu on the Red Sea, shipping costs and times would dramatically increase.

It is a similar situation for the UAE. The Port of Fujairah in the Gulf of Oman is 120 km from Iran and is vulnerable to a missile strike. Almost all of the Emirati’s crude and petroleum product exports pass through Fujairah, meaning its destruction would be detrimental to the ability of the UAE to maintain its 3.7 million bpd of exports.¹²⁹ Fujairah is also based outside the Strait of Hormuz, meaning that exports could continue from there even if the Strait were closed. Fujairah can load and unload 2 million bpd of crude oil and petroleum products¹³⁰ and has a storage



capacity for crude oil of around 70 million barrels.¹³¹ Some of the oil coming from Fujairah could be redirected to the ports of Jebel Ali and Mina Zayed of Dubai and Abu Dhabi, but if the Strait of Hormuz was impassible, major damage to Fujairah would mean additional oil exports would go offline. Moreover, shipping costs and time would also increase in this scenario.¹³²

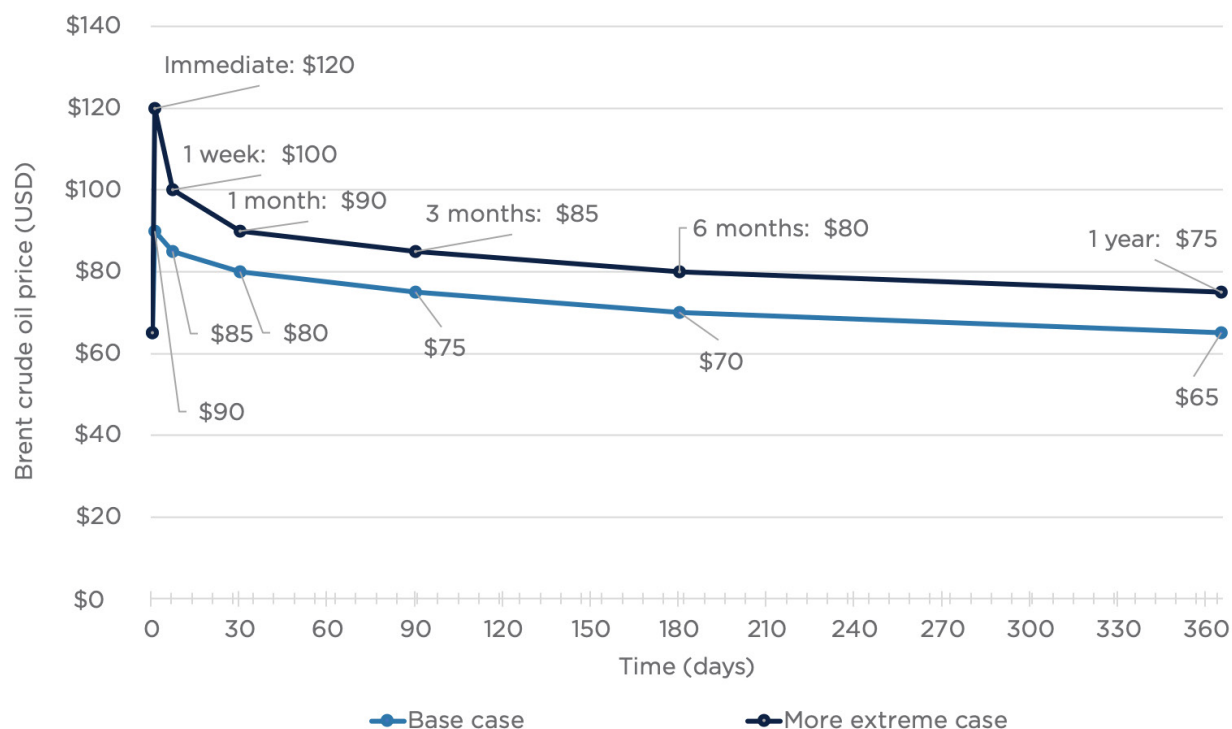
Figure 4: Scenario 2: Major infrastructure damage



Given the broad range of permutations involved in Iranian attacks on Gulf oil infrastructure, for the purpose of this scenario, the authors examine a base case and a worst-case scenario. In the base case, Iran would attack the Abqaiq stabilization plant in Saudi Arabia, which would take 6-12 months to repair. This would result in 4.5 million bpd of Saudi oil coming offline, with 1 million coming back online after 3 months, 2.25 million after 6 months, 3.25 million after 9 months, and full restoration after 1 year.

In a more extreme scenario, Iran's missile attacks would lead to more mass destruction at Abqaiq, which would take 4.5 million bpd offline that would start coming back on line at 6 months but would take 2 years to repair. In addition, in this scenario, Iran would also attack Fujairah Port in the UAE, taking roughly 1 million bpd in exports offline for 1-3 months, after which exports would slowly come back online, and Fujairah would return to normal export capacity within a year of the attack. In this worst-case scenario, the immediate net loss would total 5.5 million bpd. The price calculations over time would assume a 1.5 million bpd restored after six months, 2.75 million after 1 year, 3.75 after 18 months, and full restoration after 2 years.



Figure 5: Scenario 2: Oil prices under major infrastructure damage

Note: Prices assume a predisruption \$65/barrel Brent price.

Prices would depend significantly upon the international response. With assistance from experts at the Columbia University Center on Global Energy Policy, the authors examined price scenarios that assume both a theoretical drawdown of the SPR by the IEA, the drawdown of Chinese stock and Saudi and UAE stocks stashed in Asia, and the rationing of oil supplies in various countries around the world.¹³³

In a scenario in which repair and restoration work of the associated facilities would be manageable and short term, initial price jumps due to global panic would be expected, with a severe and immediate psychological impact on the market and an initial rise in oil price of \$25. After that, oil prices would stabilize some as the market would begin to assess the implications on supply.

In more extreme variations of this scenario, as noted, the price increase could be far more severe, with prices at least \$55 above the \$65 baseline in the immediate aftermath of an attack and then declining over time. Even then, the authors continue to assume a relatively “soft” market for oil demand that would allow for (likely offshore) spare capacity and inventories from the Saudis to be used and additional production from the United States and other sources to come online. In a scenario in which there were repeated attacks or a tighter



oil market, then the price effects could be far more severe and sustained.

Even as global prices would return to preattack levels after a year, it is important to note that serious attacks on Gulf oil infrastructure, such as the one described above, would have lasting and disproportionate effects on the economies of Saudi Arabia and the UAE. Beyond the immediate loss of production and supply capacity, and therefore revenue, global efforts to replace demand by buying alternative energy or from alternative markets would have even longer-term negative implications. For example, Asian buyers could shift to buying more Russian or US oil and gas, divesting from Saudi Arabia and the UAE. The decline in oil revenue for these Gulf partners and lengthy postwar recovery could also drive out investors, who might take their money elsewhere once they realized the vulnerability of the region. The economic downturn could also lead to political instability as the governments rely heavily on oil sale revenue to maintain their power and domestic control.



SCENARIO 3: STRAIT CLOSURE AND MAJOR INFRASTRUCTURE DAMAGE

In a worst-case scenario, Iran would not only attack and successfully cause significant oil infrastructure damage in Saudi Arabia and the UAE (extreme case scenario 2), but it would also attack and “close” the Strait of Hormuz. The good news is that this is the least likely scenario, as it would occur only in the event of an all-out war between the United States and Iran.

In this scenario, the United States and Iran would continue in an escalating tit for tat. Not having successfully exacted concessions or economic relief from the United States or international community, Iran would continue to ramp up its activities in the Strait of Hormuz and Persian Gulf. Eventually, the US military would go to the president and advise him that gradual escalation was not in America’s best interests and plays to Iran’s military strengths and that the wiser move would be to establish escalation dominance and degrade as much of Iran’s military capability as possible. This operation would stop short of trying to pursue regime change by force in a country with a population three times the size of Iraq but is most similar in concept to the first Gulf War—a limited military confrontation to degrade much of Iran’s military capability. However, as opposed to the Gulf War, this would be a purely naval and air operation with few ground forces. Once the United States decided to pursue a full kinetic response, Iran would feel backed into a corner and react by unleashing its full capabilities.

The United States would strike at Iran’s naval capabilities, including war ships, mine storage depots, small boats, and land based antiship missiles. It would also attack the nuclear program, training camps, and logistical supply networks inside Iran that support its proxies across the Middle East as well as missile sites. Such an operation would last a number of weeks and result in the destruction of most of Iran’s naval and much of its military capabilities. However, unlike in the Tanker War of the 1980s, Iran would exact a dramatic cost. This would include an intense naval war; missile launches across the Middle East; the activation of its proxies in Yemen, Iraq, and Syria to target the United States; and potentially an activation of Hezbollah to launch rocket attacks on Israel that could trigger an Israeli invasion of Lebanon.

In the naval arena, Iran would unleash as much of its mine laying capabilities as possible. It would wage all-out irregular maritime warfare in and around the Strait of Hormuz. This would include stepped up efforts by Iran to mine the Strait, part of the Gulf of Oman, and the Persian Gulf. Iran would drop mines from its small boats, but it would also deploy its submarines—three Russian-built 877 EKM Kilo-class—to strategically lay mines and coordinate attacks by radio-controlled small craft filled with explosives to sink vessels in the Strait, the Gulf of Oman, and in ports across the water. Iran would also use the submarines to carry out torpedo and ASCM attacks on tankers and US warships. In addition to its Kilo-class submarines, Iran also has a fleet of minisubmarines of the Ghadir and Nahang classes, which could be used for special targeted mining operations.¹³⁴ To further disrupt shipping and gain leverage, Iran would interdict vessels and launch swarming small-boat attacks on ships transiting the waterway as well as on US forces in the Persian Gulf. The Ashura and Tareq class small boats would be armed with mounted machine guns and unguided rockets but could also conduct covert mine-laying operations. The Tondar class small boats carry ASCMs and could target US



warships.¹³⁵ Iran would likely concentrate its firepower at the narrowest points of the Strait, where it is most difficult for ships to maneuver, making targeting easier. Iran has Russian S-300 batteries, ASCMs, torpedoes, and surface-to-air missiles it could use to battle in the gulfs and air. It has many land-mobile CDCMs that would pose a major threat to all ships within the Strait. Iran has also recently developed variants of the Fateh-110, called Hormuz-1 and Hormuz-2, which were designed as antiship missiles and are said to have antiradiation capabilities needed for attacking radar systems, meaning that Iran would be able to inflict damage against US ships in the Strait of Hormuz.¹³⁶

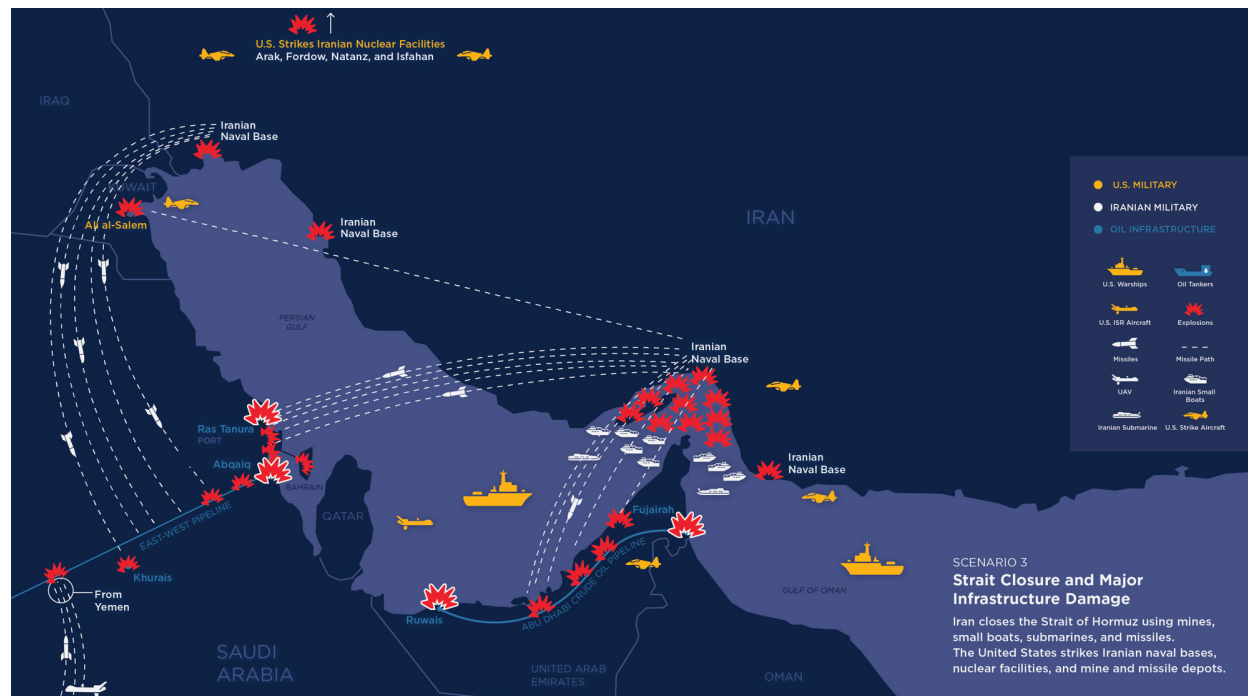
The US response would look to immediately degrade Iranian forces through the targeting of small boats, mine depots, and other critical targets. It would likely take the US military two to four weeks to significantly degrade Iranian forces enough to establish the conditions for mine removal in the Strait and the areas around it. During these two to four weeks, there would be no tankers transiting the Strait, which would have a definitive impact on the global oil market. Once the conditions were established for mine removal, the US military would begin clearing Q routes, single distinct passageways through which ships could safely pass. It would take the US military two to six weeks to clear enough mines to establish Q routes in both directions going in and out of the Strait. Thus, in a conflict, passage through the Strait would be expected to be entirely closed for one to two months.¹³⁷

Even with the establishment of Q routes, it would still take much more time to clear all the mines and get back to greater freedom of navigation in the area. Moreover, the US military, with the help of its allies in the form of a coalition, would still need to provide security against further Iranian attacks. This would be done through either of the two options described in scenario 1: (1) posting a destroyer with a helicopter as a sentry ship, one in the Gulf of Oman and one in the Persian Gulf, or (2) through tanker convoy escorts through the Strait. Both scenarios would call for the deployment of more naval and air forces to the region that would need to remain in perpetuity. And even with all of these incidents with ships hitting mines, harassment from small boats would continue.

In this scenario, no oil shipping would be expected to move through the Strait for four to ten weeks. That would mean that 17.3 million bpd of crude and condensate, 4 million barrels of refined oil products, and 300 million cubic meters (10.6 billion cubic feet) of LNG would not move through the Strait of Hormuz. Moreover, Iran's oil exports would also be at zero in this scenario. In addition to what would no longer be able to move through the Strait, the initial supply loss would also include an estimated 4 million bpd in panic stock building around the world and the 1 million bpd exported through Fujairah, outside the Strait. Offset by the maximum 1.5 million bpd the Saudis could export through the East-West Pipeline given their diminished production capacity, the total initial loss then would come to 24.8 million bpd.

Even after the Strait reopened and panic stock building slowed, the market would suffer a prolonged supply loss of 5.5 million bpd due to the damage incurred at Abqaiq and Fujairah that would take two years to fully repair, though some capacity slowly would start to come back online after the first six months. These losses to the oil market would be partially offset by a number of steps, including release of the SPR and ramp-up of production by American shale producers (the timing of which would be up to the discretion of the companies and could be delayed by practical issues in the fields).



Figure 6: Scenario 3: Strait closure and major infrastructure damage

Prices would be significantly dependent on the international response. With assistance from experts at the Columbia University Center on Global Energy Policy, the authors examined price scenarios that assume both a theoretical drawdown of the SPR by the IEA, the drawdown of Chinese stock and Saudi and UAE stocks stashed in Asia, and the rationing of oil supplies in various countries around the world.¹³⁸ In a scenario in which the IEA implemented a low stock drawdown of only 13-14 million bpd—insufficient to cover the total supply loss occurring in the first three months—the initial impacts to the price would be more severe. Yet, after three months, the oil prices would reach levels lower than they would in a full drawdown by the IEA given that strategic reserves would remain.

Initial price jumps would be expected due to global panic. As in scenario 2, a dramatic escalation of conflict would have a severe and immediate psychological impact on the market, with an initial rise in oil price of \$110–\$135 (resulting in an oil price of \$175–\$200, assuming a \$65 base price). Within a week, after the initial panic and with an initial assessment of implications on supply, the total rise would be \$60–\$115 (oil price of \$125–\$180, assuming a \$65 base). Within one month, oil price rises would be at \$45–\$105 (oil price of \$110–\$170, assuming a \$65 base). Within three months, the Strait would be coming back online, but global supplies and the SPR would be under heavy strain, and with Gulf infrastructure still damaged, prices could actually be higher at a \$60–\$85 rise (oil price of \$125–\$150, assuming a \$65 base). By six months, with the Strait open for a sustained period of time and Saudi infrastructure starting to come back online, oil prices would start to drop and be at levels



\$30–\$60 above precrisis prices (oil price of \$95–\$125, assuming a \$65 base). Within a year, even if Gulf infrastructure returned to full capacity, there would likely still be a new risk premium of \$15–\$35 above precrisis levels (oil price of \$80–\$100, assuming a \$65 base).

The closure of the Strait would also prohibit the shipping of LNG and other consumer goods. As more than one-fourth of daily LNG exports pass through the Strait, its closure would have an impact on LNG prices and would also impact the energy market. For the purpose of this paper and scope of the analysis the authors focus on the oil market and oil prices but acknowledge that the disruption to LNG supply would also impact the global energy market (at a minimum) and other trade more generally.

Figure 7: Scenario 3: Oil prices under strait closure and major infrastructure damage



Note: Prices assume a predisruption \$65/barrel Brent price. This scenario reflects the high infrastructure damage detailed in Scenario 2 in addition to closure of the Strait. The low stock draw case refers to a 13–14 million bpd draw, which would not fully cover the supply loss, while a full stock release case would be intended to fully cover supply loss.



An America First Approach to the Strategic Petroleum Reserve

One of the biggest wild cards for global oil prices in almost any crisis scenario would be the reaction of President Trump. It would be possible for most of the disruption in supply in these crisis scenarios to be offset by increases in supply from other sources and the coordinated release of strategic reserves. In the past, the United States would lead such an effort, and the reality is that given the importance of the US SPR, an effective coordinated response would not be possible without American leadership at the IEA. It would be possible and perhaps most likely that the president would want to act aggressively to keep oil prices down. The closer the 2020 US general election gets, the more likely the president would be to aggressively release the SPR and coordinate with others. His response to the Iranian attacks in September 2019 was to quickly reassure markets that he would be willing to use release of the SPR if necessary. But, worryingly, after the September 14 attacks on Saudi Arabia, there was a dissonance between the response of President Trump and the response of the IEA: The IEA announced it would monitor the situation and the president announced he had already authorized the release of the US SPR.¹³⁹

However, at the policy level, the Trump administration—in keeping with its America First theme—might not be keen to deploy its SPR. One can imagine that President Trump would be reluctant to jump to the aid of the market by releasing SPR crude or driving the IEA to do that. Trump would probably tell Saudi Arabia or others to do what they could to relieve pressure. He might calculate that China would be hurting from the higher prices and state that he would consider releasing strategic stocks only if China made trade concessions to the United States. He could also offer that since the United States would be leading the military campaign against Iran in any scenario, he would open the SPR only if allies such as Japan and South Korea, who are more dependent on Middle Eastern oil, footed some of the bill for the American military intervention. Again, these scenarios are probably not the most likely but must be considered in the current unpredictable environment.



CONCLUSION

Based on the analysis above, analysts and policy makers can draw a number of conclusions about the likelihood of a conflict between the United States and Iran and the potential implications for global oil prices.

1. **The risk of a major military confrontation between the United States and Iran has increased in recent months but still remains relatively low.** Neither the United States nor Iran wants war. President Trump campaigned on getting out of wars in the Middle East, while Iran's leadership prefers tit-for-tat tactics that avoid a major conflict with the United States, which Iran would certainly lose. Yet miscalculation by both sides and misunderstanding of redlines could still lead to a conflict neither wants. Iran's downing of an American drone in June 2019 and the near confrontation that followed demonstrated the possibility for miscalculation but also the strong inclinations on all sides to not get entangled in a major conflict. And President Trump's lack of response to the recent missile attacks is another sign of restraint but also points to the possibility that Iran may continue to test US redlines and eventually go too far, triggering a conflict.
2. **The September 14, 2019, attack on the Abqaiq and Khurais facilities was a strategic game changer and shows that the biggest risk is a prolonged, low-intensity military conflict.** The fact that Iran was willing to conduct such an attack was a surprise to most analysts and to the US government and its Gulf partners. The level of accuracy that it showed in the strike demonstrated a technical proficiency that the US government and outside analysts did not believe Iran had. Still, oil markets have proven resilient in the aftermath of the attacks, and the US military is already working with its Saudi partners on lessons learned, moving more missile defense assets into the region, and adjusting its tactics to be prepared for such a strike in the future. So, it is unclear if Iran could repeat the effectiveness of the attack on Abqaiq.
3. **In these more moderate yet likely conflict scenarios, increasing tensions between the United States and Iran are unlikely to dramatically affect global oil prices.** In the "new Tanker War" scenario, which is the most likely crisis scenario, there is little impact on price. Insurance premiums would rise, and tankers and other commercial shipping might slow down temporarily in the Strait, but with a market currently characterized by surplus, oil prices would be minimally affected. This conclusion is also supported by historical precedent as the Tanker War of the 1980s, which was much more dramatic than today's tensions, did not meaningfully move oil prices. Even the recent attacks on Saudi oil infrastructure did not have a sustained, dramatic impact on global oil prices.
4. **However, in these more likely scenarios, the most profound costs are not energy costs but security costs.** Even in the less escalatory scenarios, which are much more likely, the United States would be forced into long-term deployments of a large number of air and naval assets that would need to remain in the Middle East for



years at a cost of billions of dollars. Indeed, the recent spate of attacks has resulted in the deployment of an extra 14,000 American troops to the Middle East, which, if prolonged, could amount to billions in costs. Additionally, long-term, resource-heavy missions such as escort operations and ISR conducted by the US Navy would be profoundly more difficult than in the 1980s, when the Navy was sized and oriented better for such missions. Such deployments would take away resources that would otherwise be dedicated to managing great power competition with China and Russia. In the more extreme conflict scenarios, major loss of life and an even bigger and longer-term American military deployment would be expected. Thus, while the implications of a conflict between Iran and the United States for the global oil market might not be as dramatic as they are made out to be, the security consequences are still quite profound, and this is a scenario that should be avoided if at all possible.

5. **In the lower likelihood scenario of a major military confrontation between the United States and Iran, global oil prices would be dramatically affected, though price impacts would not be prolonged.** Iran would be unable to prevent shipping through the Strait of Hormuz for more than one to two months at most. Its ability to do dramatic long-term damage to Gulf infrastructure using missiles, drones, sabotage, or cyber tools is also meaningful. And combined, these actions could cause prices to skyrocket by more than \$100 per barrel. But these spikes would be short lived, as within a year oil prices likely would be only \$10–\$30 more per barrel than where they were before the conflict. Scenarios in which Iran is able to cause damage to the global oil market that lasts years and fundamentally reshapes the environment are highly unlikely.
6. **All of the assumptions about the potential impacts on oil prices are based on the assumption that the United States protects global shipping lanes, but that assumption deserves further scrutiny.** For more than a generation, the United States has viewed securing global shipping lanes that are critical for commerce and energy as a core vital interest. No other country has either the will or military capability to play that role if the United States were to walk away from this traditional role. But given isolationist tendencies in the United States and President Trump's attitude that America should stop underwriting the defense of its allies, it is conceivable he may choose not to respond in the types of scenario described above or he may demand that countries most dependent on oil trade from the Gulf—most notably China—step up instead. Such a shift would signal a sea change and would mean that in a crisis scenario the global oil price might spike much more dramatically.
7. **Another wild card for oil prices in a major crisis scenario would be President Trump's unpredictable policies regarding the SPR.** A normal administration would be expected to coordinate an international response with the IEA to release the SPR of a number of countries. President Trump might indeed choose to pursue this track, especially in the context of a US presidential election in 2020. However, since Asian countries—China, Japan, and South Korea—would be most immediately affected by the oil supply crisis, Trump might demand trade concessions from China or ask Japan and South Korea to cover costs associated with the military conflict with Iran before releasing the SPR.



NOTES

1. International Crisis Group, “Strait of Hormuz,” August 7, 2019, <https://www.crisisgroup.org/trigger-list/iran-us-trigger-list/flashpoints/hormuz>.
2. Justine Barden, “The Strait of Hormuz is the world’s most important transit chokepoint,” *US Energy Information Administration*, June 20, 2019, <https://www.eia.gov/todayinenergy/detail.php?id=39932>.
3. Bozorgmehr Sharafedin, Robin Emmott, and Josh Irish, “Iran Insists on Ramping Up Oil Sales to Stay in Nuclear Pact: Sources,” *Reuters*, May 13, 2019, <https://www.reuters.com/article/us-usa-iran-oil/iran-insists-on-ramping-up-oil-sales-to-stay-in-nuclear-pact-sources-idUSKCN1SJ1HX>.
4. Jon Gambrell, “Tankers Reported Damaged Off UAE on Major Oil Trade Route,” *Associated Press*, May 13, 2019, <https://www.apnews.com/3884ea5ef0084d7a9e8a7d48c03fb69e>.
5. Joshua Berlinger et al., “Iran Shoots Down US Drone Aircraft, Raising Tensions Further in Strait of Hormuz,” *CNN*, June 20, 2019, <https://www.cnn.com/2019/06/20/middleeast/iran-drone-claim-hnk-intl/index.html>.
6. Stephen Kalin and Rania El Gamal, “Saudi Oil Facilities Attacked, U.S. Sees Threat in Iraq from Iran-Backed Forces,” *Reuters*, May 14, 2019, <https://www.reuters.com/article/us-saudi-oil-usa-iran/saudi-oil-facilities-attacked-us-sees-threat-in-iraq-from-iran-backed-forces-idUSKCN1SKOYM>.
7. David D. Kirkpatrick et al., “Who Was behind the Saudi Oil Attack? What the Evidence Shows,” *New York Times*, September 16, 2019, <https://www.nytimes.com/interactive/2019/09/16/world/middleeast/trump-saudi-arabia-oil-attack.html?action=click&module=Top%20Stories&pgtype=Homepage>.
8. Secretary of State Michael Pompeo (@SecPompeo), “Tehran is behind nearly 100 attacks on Saudi Arabia while Rouhani and Zarif pretend to engage in diplomacy. Amid all the calls for de-escalation, Iran has now launched an unprecedented attack on the world’s energy supply. There is no evidence the attacks came from Yemen.” *Twitter*, September 14, 2019, 12:59 p.m., <https://twitter.com/SecPompeo/status/1172963090746548225>.
9. Ben Hubbard et al., “Pompeo Calls Attacks on Saudi Arabia ‘Act of War’ and Seeks Coalition to Counter Iran,” September 18, 2019, <https://www.nytimes.com/2019/09/18/world/middleeast/us-iran-saudi-arabia.html>.
10. Tim Lister and Nic Robertson, “Source: ‘High Probability’ Saudi Attack Launched from Iranian Base Near Iraq,” *CNN*, September 17, 2019, <https://www.cnn.com/2019/09/17/middleeast/saudi-attack-iran-base-intl/index.html>.
11. Natasha Turak, “How Saudi Arabia Failed to Protect Itself from Drone and Missile Attacks



- despite Billions Spent on Defense Systems,” *CNBC*, September 19, 2019, <https://www.cnbc.com/2019/09/19/how-saudi-arabia-failed-to-protect-itself-from-drones-missile-attacks.html>.
12. President Donald J. Trump (@realDonaldTrump), “On Monday they shot down an unmanned drone flying in International Waters. We were cocked & loaded to retaliate last night on 3 different sights when I asked, how many will die. 150 people, sir, was the answer from a General. 10 minutes before the strike I stopped it, not...” Twitter, June 21, 2019, 6:03 a.m., <https://twitter.com/realDonaldTrump/status/1142055375186907136>.
 13. Nahal Toosi, “Trump’s Coalition of One,” *POLITICO*, August 2, 2019, <https://www.politico.com/story/2019/08/02/trump-iran-coalition-of-one-1444834>.
 14. Jamie Tarabay, “Australia Is Third Country to Join U.S. in Patrolling Strait of Hormuz,” *New York Times*, August 21, 2019, <https://www.nytimes.com/2019/08/21/world/australia/ships-hormuz.html>; Scott Neuman, “UAE Agrees to Join U.S.-Led Maritime Coalition to Protect Gulf Shipping,” *NPR*, September 19, 2019, <https://www.npr.org/2019/09/19/762225417/uae-agrees-to-join-u-s-led-maritime-coalition-to-protect-gulf-shipping>.
 15. Phil Stewart and Idrees Ali, “United States Sending Troops to Bolster Saudi Defense after Attack,” *Reuters*, September 20, 2019, <https://www.reuters.com/article/us-saudi-aramco-usa-pentagon/united-states-sending-troops-to-bolster-saudi-defenses-after-attack-idUSKBN1W52K3>.
 16. International Crisis Group, “Strait of Hormuz.”
 17. Michael Ratner, *Iran’s Threats, the Strait of Hormuz, and Oil Markets: In Brief* (Congressional Research Service, August 6, 2018) 1, <https://fas.org/sgp/crs/mideast/R45281.pdf>.
 18. Ratner, *Iran’s Threats*, 5.
 19. Ratner, 1, 5.
 20. Ratner, 5.
 21. US Energy Information Administration, “Frequently Asked Questions: How Much Petroleum Does the United States Import and Export?” May 14, 2019, <https://www.eia.gov/tools/faqs/faq.php?id=727&t=6>.
 22. US Energy Information Administration, “United Arab Emirates,” March 21, 2017, <https://www.eia.gov/beta/international/analysis.php?iso=ARE>; US Energy Information Administration, “Saudi Arabia,” October 20, 2017, <https://www.eia.gov/beta/international/analysis.php?iso=SAU>.
 23. US Energy Information Administration, “World Oil Transit Chokepoints,” July 25, 2017, <https://www.eia.gov/beta/international/regions-topics.php?RegionTopicID=WOTC>.
 24. Ratner, *Iran’s Threats*, 6.



25. International Energy Agency, “Oil Security: Frequently Asked Questions,” [iea.org/topics/energysecurity/respondingtomajorsupplydisruptions/](https://www.iea.org/topics/energysecurity/respondingtomajorsupplydisruptions/).
26. US Department of Energy, “Strategic Petroleum Reserve Inventory,” June 21, 2019, <https://www.spr.doe.gov/dir/dir.html>.
27. US Department of Energy, “SPR Quick Facts and FAQs,” Office of Fossil Energy, <https://www.energy.gov/fe/services/petroleum-reserves/strategic-petroleum-reserve/spr-quick-facts-and-faqs>.
28. International Energy Agency, “Oil Security.”
29. International Energy Agency.
30. Ronald O’Rourke, “The Tanker War,” *Proceedings* 114, no. 5, May 1988, 1,023, <https://www.usni.org/magazines/proceedings/1988/may/tanker-war>. The Tanker War refers specifically to the maritime aspect of the Iraq-Iran War of the 1980s, in which both countries attacked ships, specifically oil tankers, traveling in and around the Persian Gulf, Strait of Hormuz, and Gulf of Oman regions. These attacks escalated later in the war, with the most attacks happening in 1986 and 1987. Almost 75 percent of the attacks were carried out on oil or petroleum products tankers, although nonpetroleum cargo ships also came under attack during this period, with the hopes of disrupting the global energy market. The United States entered into this conflict through Operation Earnest Will, during which it escorted reflagged Kuwaiti oil tankers through the Persian Gulf and Strait of Hormuz from July 1987 until September 1988. US Operation Praying Mantis (see endnote 105) shifted the dynamics of the Tanker War, which ended when the Iran-Iraq War ended in August 1988 with Iran’s acceptance of the UN brokered cease-fire agreement.
31. Stanley Reed, “How Tanker Attacks in the Strait of Hormuz Could Affect Oil Prices,” *New York Times*, June 13, 2019, <https://www.nytimes.com/2019/06/13/business/oil-tanker-attacks-strait-hormuz.html>.
32. Peter Coy and Alex Longley, “Strange Economics of Mideast Oil Shield Trump from Iran’s Bite,” *Bloomberg Business*, July 24, 2019, <https://www.bloomberg.com/news/articles/2019-07-24/strange-economics-of-mideast-oil-shield-trump-from-iran-s-bite>.
33. Arsalan Shahla and Ladane Nasser, “Iran Raises Stakes in U.S. Showdown with Threat to Close Hormuz,” *Bloomberg*, April 22, 2019, <https://www.bloomberg.com/news/articles/2019-04-22/iran-will-close-strait-of-hormuz-if-it-can-t-use-it-fars>.
34. Leila Gharagozlou and Tom DiChristopher, “Iranian President Hassan Rouhani Threatens to Close Strait of Hormuz if US Blocks Oil Exports,” *CNBC*, December 4, 2018, <https://www.cnbc.com/2018/12/04/iranian-president-hassan-rouhani-threatens-to-close-strait-of-hormuz.html>.
35. O’Rourke, “The Tanker War,” 1,023.
36. Organization of the Petroleum Exporting Countries, “Iran Facts and Figures,” OPEC.org,



- 2019, https://www.opec.org/opec_web/en/about_us/163.htm.
37. US Energy Information Administration, "Iran," January 7, 2019, <https://www.eia.gov/beta/international/analysis.php?iso=IRN>.
 38. Office of Naval Intelligence, *Iranian Naval Forces: A Tale of Two Navies*, February 2017, 11, <https://www.oni.navy.mil/Portals/12/Intel%20agencies/iran/Iran%20022217SP.pdf>.
 39. Office of Naval Intelligence, 31–32; Caitlin Talmadge, "Closing Time: Assessing the Iranian Threat to the Strait of Hormuz," *International Security* 33, no. 1 (summer 2008), 100–103, https://www.belfercenter.org/sites/default/files/legacy/files/IS3301_pp082-117_Talmadge.pdf.
 40. US Department of Defense, *Unclassified Report on Military Power of Iran*, April 2010, 5, https://fas.org/man/eprint/dod_iran_2010.pdf.
 41. Office of Naval Intelligence, *Iranian Naval Forces*, 28.
 42. Frederik Pleitgen and Shirzad Bozorgmehr, "Iranian Military Official Claims Country's Missiles Can Take Out Aircraft Carrier," *CNN*, June 20, 2019, <https://www.cnn.com/2019/06/19/middleeast/iran-united-states-hnk-intl/index.html>.
 43. Kyle Mizokami, "Welcome to a War: How Iran Could Sink a U.S. Navy Aircraft Carrier," *National Interest*, March 22, 2019, <https://nationalinterest.org/blog/buzz/welcome-war-how-iran-could-sink-us-navy-aircraft-carrier-48717>.
 44. Anthony Cordesman, "Iran's Rocket and Missile Forces and Strategic Options," 146; Fariborz Haghsheenas, *Iran's Asymmetric Naval Warfare*, Policy Focus #87, (Washington Institute for Near East Policy, September 2008), 15, <https://www.washingtoninstitute.org/uploads/Documents/pubs/PolicyFocus87.pdf>.
 45. Missile Defense Project, "Fateh-110," *Missile Threat* (Center for Strategic and International Studies, November 16, 2018), <https://missilethreat.csis.org/missile/fateh-110/>.
 46. Missile Defense Project.
 47. Farzin Nadimi, "Iran's Provocative Naval Exercise: Motives and Implications," Policy Watch 2381, (Washington Institute for Near East Policy, March 3, 2015), <https://www.washingtoninstitute.org/policy-analysis/view/irans-provocative-naval-exercise-motives-and-implications#When:14:42:53Z>.
 48. Mizokami, "Welcome to a War."
 49. Richard Scott, "Surviving the Swarm: Navies Eye New Counters to the FIAC Threat," *Jane's Naval Intelligence*, 2014, 2–3, https://www.janes.com/images/assets/571/36571/Surviving_the_swarm_new.pdf.
 50. Office of Naval Intelligence, *Iranian Naval Forces*, 28.
 51. Sune Engel Rasmussen, "Iran's Fast Boats and Mines Bring Guerrilla Tactics to Persian Gulf," *Wall Street Journal*, May 30, 2019, <https://www.wsj.com/articles/irans-fast-boats->



- [and-mines-bring-guerrilla-tactics-to-persian-gulf-11559208602](#); Henry Johnson, “Watch: Iranian Attack-Boats Swarm U.S. Destroyer,” *Foreign Policy*, August 25, 2016, <https://foreignpolicy.com/2016/08/25/watch-iranian-attack-boats-swarm-u-s-destroyer/>.
52. US Energy Information Administration, “Short-Term Energy Outlook,” August 6, 2019, https://www.eia.gov/outlooks/steo/report/global_oil.php.
 53. Organization of the Petroleum Exporting Countries, “Saudi Arabia Facts and Figures,” OPEC.org, 2019, https://www.opec.org/opec_web/en/about_us/169.htm; US Energy Information Administration, “Saudi Arabia,” October 20, 2017, <https://www.eia.gov/beta/international/analysis.php?iso=SAU>.
 54. US Energy Information Administration, “Saudi Arabia.”
 55. Joshua R. Itzkowitz Shiffrin and Miranda Priebe, “A Crude Threat: The Limits of an Iranian Missile Campaign against Saudi Arabian Oil,” *International Security* 36, no. 1 (summer 2011), 173, https://www.mitpressjournals.org/doi/pdf/10.1162/ISEC_a_00048.
 56. US Energy Information Administration, “United Arab Emirates.”
 57. Nancy A. Youssef et al., “U.S., Saudi Military Forces Failed to Detect Attack on Oil Facilities,” *Wall Street Journal*, September 17, 2019, <https://www.wsj.com/articles/saudi-arabia-increasingly-confident-iran-launched-oil-attack-11568733861>.
 58. Shahryar Pasandideh, “Under the Radar, Iran’s Cruise Missile Capabilities Advance,” *War on the Rocks*, September 25, 2019, <https://warontherocks.com/2019/09/under-the-radar-irans-cruise-missile-capabilities-advance/>.
 59. Pasandideh.
 60. Missile Defense Advocacy Alliance, “Soumar,” 2019, <https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/iran/soumar-cruise-missile/>.
 61. “Saudi Arabia Oil Attacks: Weapons Debris ‘Proves Iran behind Them,’” *BBC*, September 18, 2019, <https://www.bbc.com/news/world-middle-east-49746645>.
 62. Pasandideh, “Under the Radar.”
 63. Pasandideh.
 64. Lister, “Source: ‘High probability,’”
 65. Turak, “How Saudi Arabia Failed.”
 66. Rahul Udoshi, “MAKS 2019: Iran Unveils Mobin ‘Cruise UAV,’” *Janes Defense Weekly*, August 29, 2019, <https://janes.com/article/90735/maks-2019-iran-unveils-mobin-cruise-uav>.
 67. Lachin Rezaian, “Iran Unveils Home-Made ‘Kaman 12,’ ‘Shahed 171’ Drones,” *Mehr News Agency*, January 30, 2019, <https://en.mehrnews.com/news/142037/Iran-unveils-home-made-Kaman-12-Shahed-171-drones>.



68. Pasandideh, "Under the Radar"; Jeremy Binnie, "Iran Unveils New Version of Armed Stealth UAV," *Janes Defense Weekly*, January 31, 2019, <https://www.janes.com/article/86085/iran-unveils-new-version-of-armed-stealth-uav>.
69. Natasha Turak, "Drone and Missile Debris Proves Iranian Role in Aramco Attack, Saudi Defense Ministry Claims," *CNBC*, September 18, 2019, <https://www.cnbc.com/2019/09/18/saudi-arabia-drone-and-missile-debris-proves-iranian-role-in-attack.html>.
70. Jose Pagliery, "The Inside Story of the Biggest Hack in History," *CNN Business*, August 5, 2015, <https://money.cnn.com/2015/08/05/technology/aramco-hack/>.
71. Pagliery.
72. Elias Groll, "Cyberattack Targets Safety System at Saudi Aramco," *Foreign Policy*, December 21, 2017, <https://foreignpolicy.com/2017/12/21/cyber-attack-targets-safety-system-at-saudi-aramco/>.
73. Nicole Perlroth and Clifford Krauss, "A Cyberattack in Saudi Arabia Had a Deadly Goal. Experts Fear Another Try," *New York Times*, March 15, 2018, <https://www.nytimes.com/2018/03/15/technology/saudi-arabia-hacks-cyberattacks.html>.
74. Collin Anderson and Karim Sadjapour, "Iran's Cyber Threat: Espionage, Sabotage, and Revenge," *Carnegie Endowment for International Peace*, January 4, 2018, 2, https://carnegieendowment.org/files/Iran_Cyber_Final_Full_v2.pdf.
75. James Andrew Lewis, "Iran and Cyber Power," *Center for Strategic and International Studies*, June 25, 2019, <https://www.csis.org/analysis/iran-and-cyber-power>.
76. Lewis.
77. Seth G. Jones et al., "Iran's Threat to Saudi Critical Infrastructure: The Implications of U.S.-Iranian Escalation," *Center for Strategic and International Studies*, August 5, 2019, <https://www.csis.org/analysis/irans-threat-saudi-critical-infrastructure-implications-us-iranian-escalation>.
78. Jones.
79. Jones.
80. Ratner, *Iran's Threats*, 7.
81. Ratner, 7.
82. Ratner, 7.
83. Ratner, 4-5; Kenneth Katzman et al., "Iran's Threat to the Strait of Hormuz," R42335, (Congressional Research Service, January 23, 2012), 1, 2, 4, <https://fas.org/sgp/crs/mideast/R42335.pdf>.
84. Ratner, *Iran's Threats*, 7.



85. Macrotrends, “WTI Crude Oil Prices—10 Year Daily Chart,” *Macrotrends*, August 21, 2019, <https://www.macrotrends.net/2516/wti-crude-oil-prices-10-year-daily-chart>; Public Policy Initiative, “The Political Economy of Oil in the Middle East,” *Wharton at University of Pennsylvania*, March 23, 2017, <https://publicpolicy.wharton.upenn.edu/live/news/1778-the-political-economy-of-oil-in-the-middle-east/for-students/blog/news.php>.
86. US Energy Information Administration, “World Oil Transit Chokepoints.”
87. Coy, “Strange Economics.”
88. Anjali Raval, “Shipping Industry Grapples with Threat in Strait of Hormuz,” *Financial Times*, July 21, 2019, <https://www.ft.com/content/Oeb38854-aafd-11e9-8030-530adfa879c2>.
89. Yun Li, “Oil Drops 5% One Day after Historic Surge as Saudis Signal Output to Return to Normal Soon,” *CNBC Markets*, September 17, 2019, <https://www.cnbc.com/2019/09/17/oil-slips-following-the-biggest-climb-in-history-after-saudi-attacks.html>.
90. Markets Insider, “Oil (Brent),” *Business Insider*, September 24, 2019, <https://markets.businessinsider.com/commodities/oil-price/usd?type=brent>.
91. Aya Batrawy, “Oil Shippers Continue Sailing through Strait of Hormuz—with Heightened Security,” June 21, 2019, <https://www.insurancejournal.com/news/international/2019/06/21/530110.htm>.
92. Reed, “How Tanker Attacks.”
93. Ethan Wolff-Mann, “Rising Oil Prices Are Both Good and Bad for the US Economy,” Yahoo Finance, September 17, 2019, <https://finance.yahoo.com/news/rising-oil-prices-are-both-good-and-bad-for-the-us-economy-132416210.html>.
94. Nelson D. Schwartz, “How an Oil Price Surge Could Hurt the U.S. Economy,” *New York Times*, September 17, 2019, nytimes.com/2019/09/17/business/economy/oil-prices.html.
95. Schwartz.
96. “What Are the Possible Causes and Consequences of Higher Oil Prices on the Overall Economy?” *Federal Reserve Bank of San Francisco*, November 2007, <https://www.frbsf.org/education/publications/doctor-econ/2007/november/oil-prices-impact-economy/>.
97. Data sourced from “Bloomberg Database,” *Bloomberg Professional*, October 11, 2019.
98. Gambrell, “Tankers Reported Damaged.”
99. Gambrell.
100. Kalin, “Saudi Oil Facilities Attacked.”
101. David B. Crist, *Gulf of Conflict: A History of U.S.-Iranian Confrontation at Sea*, Policy Focus #95, (Washington Institute for Near East Policy, June 2009), 1, <https://www.washingtoninstitute.org/uploads/Documents/pubs/PolicyFocus95.pdf>.



102. Crist, 1.
103. Authors' interview with Dr. Michael Connell, Principal Research Scientist at CNA, July 25, 2019. Michael Connell is an expert on Persian-Gulf security related issues, the armed forces of Iran, US-GCC security cooperation and adversary cyber policy and strategy.
104. Based on comments from Capt. Mike Martinez, senior military fellow at the Center for a New American Security and a captain in the US Navy.
105. Crist, *Gulf of Conflict*, 7-9. On April 14, 1988, the USS Samuel B. Roberts hit four mines while patrolling the Strait of Hormuz, which caused extensive fire and flooding and injured 10 US sailors. Four days later, President Reagan ordered a military response of naval and air proportions called Operation Praying Mantis that targeted two Iranian oil platforms that were important staging areas for the IRGCN, Sassan and Sirri. In addition to the destruction of these platforms, US Central Command sank numerous Iranian vessels, including the missile boat *Joshan*, and two Iranian naval combatants, the *Sablan* and *Sahand*. The destruction of most of Iran's naval capabilities led to a drastic decrease in small-boats attacks over the next few months.
106. Authors' conversation with Katherine Spector, Research Scholar at Columbia University's Center on Global Energy Policy, August 29, 2019. Katherine Spector focuses on traded and financial energy markets, with an emphasis on oil and natural gas.
107. Markets Insider, "Oil (Brent)," *Business Insider*, October 9, 2019, <https://markets.businessinsider.com/commodities/oil-price/usd?type=brent>.
108. Dan Lemothe, "U.S. to Send 1,800 Additional Troops to Saudi Arabia to Boost Defenses against Iran," *Washington Post*, October 11, 2019, https://www.washingtonpost.com/national-security/us-to-send-additional-troops-to-saudi-arabia-to-boost-defenses-against-iran/2019/10/11/7b8c8de6-ec42-11e9-9c6d-436a0df4f31d_story.html.
109. Lemothe.
110. Shiffrinson, "A Crude Threat," 185.
111. Shiffrinson, 185.
112. Shiffrinson, 177-178.
113. US Energy Information Administration, "Saudi Arabia."
114. US Energy Information Administration, "Saudi Arabia."
115. Shiffrinson, "A Crude Threat," 194.
116. US Energy Information Administration, "Crude Oil Production, Saudi Arabia, Monthly," July 2019, https://www.eia.gov/opendata/qb.php?category=1039874&sdid=STEO.COPR_SA.M.
117. "Saudi Arabia Restores Full Oil Output after Attacks, Focused on Aramco IPO," *Reuters*, October 3, 2019, <https://www.reuters.com/article/us-russia-oil-opec-sarabia/>



[saudi-has-restored-oil-output-after-attacks-focused-on-aramco-ipo-energy-minister-idUSKBN1WIONR](#).

118. Summer Said, Benoit Faucon, and Rory Jones, “Aramco’s Repairs Could Take Months Longer Than Company Anticipates, Contractors Say,” *Wall Street Journal*, September 22, 2019, <https://www.wsj.com/articles/aramcos-repairs-could-take-months-longer-than-company-anticipates-contractors-say-11569180194>.
119. Shiffrinson, “A Crude Threat,” 194; Geoffrey Kemp and John Alley Gay, *War with Iran: Political, Military, and Economic Consequences* (Lanham, Maryland: Rowman and Littlefield Publishers Inc., 2013), 116.
120. Shiffrinson, “A Crude Threat,” 195.
121. Shiffrinson, 194.
122. US Energy Information Administration, “United Arab Emirates.”
123. US Energy Information Administration, “United Arab Emirates.”
124. Robert Brelsford, “Takreer Lets Contract for Ruwais Refinery Repairs,” *Oil & Gas Journal*, June 30, 2017, <https://www.ogj.com/refining-processing/article/17289187/takreer-lets-contract-for-ruwais-refinery-repairs>.
125. Organization of the Petroleum Exporting Countries, “Saudi Arabia Facts and Figures.”
126. US Energy Information Administration, “Saudi Arabia.”
127. US Energy Information Administration, “Saudi Arabia.”
128. US Energy Information Administration, “Saudi Arabia.”
129. “Dubai (Port),” *vesseltracker.com*, August 22, 2019, <https://www.vesseltracker.com/en/Port/Dubai/Dashboard.html>; “Abu Dhabi (Port),” *vesseltracker.com*, August 22, 2019, <https://www.vesseltracker.com/en/Port/Abu%20Dhabi/Dashboard.html>.
130. US Energy Information Administration, “United Arab Emirates”; Port of Fujairah, “Oil Berth,” 2009, http://fujairahport.ae/?page_id=175.
131. “Fujairah Port: UAE’s Oil Lifeline outside of Strait of Hormuz,” *Agence-France Presse*, May 17, 2019, <https://tribune.com.pk/story/1975027/3-fujairah-port-uaes-oil-lifeline-outside-strait-hormuz/>.
132. Janet Nodar, “Port Panama City Operations Recover Amid Hurricane Repairs,” *JOC.com*, November 13, 2018, https://www.joc.com/port-news/us-ports/port-panama-citys-operations-improving-hurricane-repairs-continue_20181113.html.
133. The oil price calculations are the result of expert judgment rather than a detailed supply-and-demand balance and oil price model.
134. Mark Gunzinger and Chris Dougherty, “Outside-In: Operating from Range to Defeat Iran’s



Anti-Access and Area-Denial Threats,” *Center for Strategic and Budgetary Assessments*, 2011, 41–42, https://csbaonline.org/uploads/documents/CSBA_SWA_FNL-WEB.pdf.

135. Gunzinger, 41.
136. Missile Defense Project, “Fateh-110.”
137. Authors’ interview with Michael Connell, Principal Research Scientist at CNA, July 25, 2019; authors’ conversation with Chris Dougherty, Senior Fellow in the Defense Program at the Center for a New American Security, July 17, 2019. Chris Dougherty’s research focuses on defense strategy, strategic assessments, force planning, and wargaming.
138. The oil price calculations are the result of expert judgment rather than a detailed supply-and-demand balance and oil price model.
139. Ron Bousso and Tuqa Khalid, “IEA says oil markets ‘well supplied’ after attack in Saudi Arabia,” *Reuters*, September 14, 2019, <https://www.reuters.com/article/us-saudi-aramco-ia/iea-says-oil-markets-well-supplied-after-attack-in-saudi-arabia-idUSKBN1VZOIH>; and Spencer Kimball, “Trump authorizes release of oil from strategic petroleum reserve after Saudi attacks,” *CNBC.com*, September 15, 2019, <https://www.cnbc.com/2019/09/15/trump-says-he-has-authorized-release-of-oil-from-strategic-petroleum-reserve-if-needed-after-saudi-attacks.html>.



 COLUMBIA | SIPA
Center on Global Energy Policy

 Center for a
New American
Security

