SEPTEMBER 2025

A Playbook for Winning the Cyber War

Part 4: Evaluating Iran's Cyber Strategy

Julia Dickson Emily Harding

A Report of the CSIS Intelligence, National Security, and Technology Program

CSIS | CENTER FOR STRATEGIC &
INTERNATIONAL STUDIES

SEPTEMBER 2025

A Playbook for Winning the Cyber War

Part 4: Evaluating Iran's Cyber Strategy

AUTHORS
Julia Dickson
Emily Harding

A Report of the CSIS Intelligence, National Security, and Technology Program

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

About CSIS

The Center for Strategic and International Studies (CSIS) is a bipartisan, nonprofit policy research organization dedicated to advancing practical ideas to address the world's greatest challenges.

Thomas J. Pritzker was named chairman of the CSIS Board of Trustees in 2015, succeeding former U.S. senator Sam Nunn (D-GA). Founded in 1962, CSIS is led by John J. Hamre, who has served as president and chief executive officer since 2000.

CSIS's purpose is to define the future of national security. We are guided by a distinct set of values—nonpartisanship, independent thought, innovative thinking, cross-disciplinary scholarship, integrity and professionalism, and talent development. CSIS's values work in concert toward the goal of making real-world impact.

CSIS scholars bring their policy expertise, judgment, and robust networks to their research, analysis, and recommendations. We organize conferences, publish, lecture, and make media appearances that aim to increase the knowledge, awareness, and salience of policy issues with relevant stakeholders and the interested public.

CSIS has impact when our research helps to inform the decisionmaking of key policymakers and the thinking of key influencers. We work toward a vision of a safer and more prosperous world.

CSIS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely those of the author(s).

Center for Strategic & International Studies
1616 Rhode Island Avenue, NW
Washington, DC 20036
202-887-0200 | www.csis.org

Acknowledgments

The authors would like to extend their gratitude to those who agreed to be interviewed and to their foreign partners who contributed valuable insights from the front lines of this fight. The authors would also like to thank Rex Booth and Dana Stroul for graciously providing valuable feedback, Susan Hines for helping with the project contract, and the CSIS iDeas Lab for offering their design expertise.

This report is made possible by project support from the Smith Richardson Foundation.

Contents

Authors' Note About the Series

Photo Source: Emanuele Mazzoni/Adobe Stock

This report is part of a series on the future of cyber warfare. This section examines how Iran fights in the cyber domain, including the core elements of Tehran's strategy for conducting cyber operations, how that strategy fits in a larger foreign policy context, and who the frontline fighters are in this new mode of conflict.

Part 1 of this series offers a broad introduction to the report, covers key takeaways from the comparative studies and wargames, and summarizes the authors' recommendations. Part 2, 3, and 4 examine how Russia, China, and Iran, respectively, fight in the cyber domain, and Part 5 examines U.S. cyber practices. Part 6 tests how U.S. policymakers view cyber operations as part of the spectrum of war, peace, and irregular warfare, illuminated by a set of wargames. Finally, Part 7 fully explains the new playbook that will close the gap between how the United States and its adversaries fight and succeed in the cyber domain.

Overview of Iran's Cyber Playbook

In July 2022, Albanian government networks began to crash. Ransom notes appeared from "HomeLand Justice," but it was clear the attackers were not Albanian. The attackers collected and then either deleted or leaked classified information, including the identities of undercover intelligence officers and emails from the director of intelligence. As *Foreign Policy* put it at the time: "all aspects of the lives of Albanian citizens, from births to marriages to deaths, were thrown into disarray."[1]

Iran, angry at Albania's hosting of an Iranian opposition group that it classifies as a terrorist organization, had used an intensive cyberattack to coerce and punish the country. Though Albania's systems largely were restored within weeks, Iran hit Tirana again in September 2022 and a third time in December 2023. By the December attack, Albania had learned hard lessons and was resilient enough to avoid severe consequences.[2]

Iran can fairly be described as a rising, aggressive cyber actor. Persistent cyber operations for domestic surveillance as well as years of constant confrontation with Israel and Saudi Arabia have given Tehran significant experience in this domain. Two key events catalyzed Iran's cyber focus: (1) a set of regime-threatening protests in 2009 called the Green Movement, and (2) the discovery of the Stuxnet virus, which targeted Iran's nuclear program.[3] More recently, Iran has shown a willingness to escalate dramatically and to engage in high-profile attacks. In addition to the attack on Albania in 2022, for instance, Iran attempted to interfere in the 2020 and 2024 U.S. elections and attacked water infrastructure in the United States in 2013 and again in 2023.[4]

In the wake of the Green Movement, also known as “Iran’s Twitter Revolution,” Tehran found it necessary to develop cyber capabilities in order to maintain the strength of the regime. As millions of Iranians took to the streets to protest the presidential elections, protestors also gathered on social media sites and conducted distributed denial of service (DDoS) attacks against government websites.[5] According to analysis by the Carnegie Endowment for International Peace, the government became acutely aware that the internet “could be used as an instrument of mass mobilization and represented a significant challenge to the regime’s long-held information monopoly.”[6]

In response to the protests, the regime developed tools to control its domestic cyberspace and surveil its population. Government-affiliated groups defaced websites associated with the political opposition, Israeli businesses, and social media sites. Official government groups also conducted DDoS attacks against critical websites and spied on government critics. The surveillance and censorship eventually paralyzed the Green Movement, and the strategy, tools, and threat actors that developed during this period laid the groundwork for Iran’s modern cyber operations.[7]

Likewise, the discovery of the Stuxnet attack may have encouraged Tehran’s development of offensive, retaliatory tools. Stuxnet, a series of exploits that infected Iran’s nuclear facilities around 2009, caused not only digital problems but also physical damage. Centrifuges, in particular, seem to have been affected by the code.[8] Not long after, in 2011, Iran launched attacks against at least six big American banks and a small dam in New York.[9] The country then hit Saudi Aramco, the largest Saudi oil company, in 2012, destroying an estimated 35,000 computers.[10] Since then, Iranian hackers have conducted thousands of cyberattacks, primarily against Israel, the United States, and Saudi Arabia.[11]

Tehran has committed millions of dollars to developing its cyber capabilities. According to a report by the Institute for National Security Studies at Tel Aviv University, “some 18 percent of Iranian university students were reportedly studying computer science” by the late 2010s and “Iran’s cyber budget jumped twelvefold between 2013-2021.”[12] The regime uses compulsory military service to channel these technologically knowledgeable graduates into the state security apparatus, including the two components best known for carrying out cyberattacks: the Islamic Revolutionary Guard Corps (IRGC) and the Ministry of Intelligence ( ).[13]

Cooperation with other countries has also contributed to Iran’s cyber capabilities. Tehran and Moscow have signed numerous cyber cooperation agreements, starting with a preliminary agreement in 2015.[14] In 2017, the two countries signed a memorandum of understanding for cooperation on information technology and communications-related issues, including “internet governance [and] network security.”[15] Further, they signed an updated agreement in 2021 to share information related to “the fight against crimes committed with the use of information and communications technology,” which includes cooperation in detecting cyber intrusions, technology transfer, and combined training.[16] Moscow is also supplying Tehran with technology. For example, in 2023, the Kremlin provided Tehran with powerful communications-surveillance capabilities and advanced software for hacking dissidents’ systems and phones.[17]

China has also contributed to Iran's defensive cyber capabilities. In 2021, the two countries signed a 25-year strategic agreement, which was leaked on social media and published by Iranian news sites. It includes both military and cybersecurity cooperation, and as part of this agreement, Beijing will help Tehran build its 5G telecommunications infrastructure and assert greater control over its cyberspace by sharing knowledge and technologies related to digital surveillance and online censorship.[18]

While Tehran is rapidly improving its cyber capabilities, they somewhat lag behind other advanced cyber actors. In 2017, an Israeli general assessed that Iran is "not state of the art" nor the "strongest superpower in the cyber dimension," but is nonetheless quickly improving its cyber capabilities.[19] Iranian leaders are known to oversell the nation's offensive cyber capabilities as part of their military propaganda, and Tehran lacks an advanced and organized security apparatus, so the most sophisticated kinds of cyberattack (such as Stuxnet or the Russian actions in Ukraine) are still beyond Iranian capabilities.[20]

Although Tehran is not yet as advanced as Russia or China, the United States and its allies should not underestimate this adversary. Tehran has demonstrated a brazen willingness to attack civilian critical infrastructure and will likely continue to reach for destructive tools. Poorly defended targets in the United States (of which there are many) are vulnerable; they include smaller banks or local power companies, or poorly secured pipeline control systems. Further, Iran conflates Israel and the United States, viewing the latter as a legitimate target in retaliation for Israeli actions. As the *2023 Annual Threat Assessment* from the Office of the Director of National Intelligence states: "Iran's growing expertise and willingness to conduct aggressive cyber operations make it a major threat to the security of the U.S. and allied networks and data."[21]

Although Tehran is not yet as advanced as Russia or China, the United States and its allies should not underestimate this adversary. Tehran has demonstrated a brazen willingness to attack civilian critical infrastructure and will likely continue to reach for destructive tools.

Core Elements of Iran’s Strategy

Iran has emerged as an aggressive cyber actor unburdened by concerns about norms and international law. In developing its offensive and defensive cyber capabilities, the country has two main goals: (1) to create a “technological envelope” to protect its critical and sensitive infrastructure from cyberattacks, and (2) to counter adversaries in cyberspace.[22] Central to the second goal is “forward defense,” a concept holding that militarily confronting adversaries outside of Iran’s borders is preferable to fighting them within Iran.[23] Offensive cyber operations are an important component of this hybrid strategy, suggesting that Iran will continue to invest in developing its cyber capabilities.[24]

This section will cover several key features of Iran’s cyber strategy: sophisticated social engineering campaigns to gain access to networks, cyber-enabled influence operations, disruptive and destructive attacks, and the use of proxies to carry out these various methods of attack.

As part of their cyber operations, Iranians have become particularly adept at crafting sophisticated social engineering campaigns. According to a 2022 report by Insikt Group, Iranian hackers are capable of social engineering in ways that are similarly as advanced as Russia’s advanced persistent threat (APT) groups, demonstrating the capability to understand and dissect foreign societies, political systems, and languages. Iranian APTs “use many of the studied ‘principles of influence’ and overlap with human intelligence (HUMINT) recruitment processes” to target their victims. They are known for employing a variety of approaches such as using “charismatic sock puppets” and creating fake prospective job opportunities to connect with victims.[25] They also pose as journalists and think tank experts seeking comments on a particular topic.[26] Some examples of advanced social media campaigns include the following:

- An Iranian APT known as Imperial Kitten used the social media persona "Marcella Flores" to engage with a subsidiary of an aerospace defense contractor. The APT friended the victim on Facebook in 2019, if not before, and actively had conversations with the victim on both corporate and personal communication platforms in 2020. In early June 2021, Imperial Kitten delivered a malicious email in an attempt to infect the victim's system with malware. In mid-July, Facebook announced that it removed a network of fake users, including Marcella Flores, from its platform.[27]
- Israel's Shin Bet internal intelligence agency announced in late July 2023 that Iranian hackers created fake LinkedIn profiles and initiated conversations with Israeli citizens, specifically civil servants and researchers, eventually moving to email. The Israeli agency managed to thwart the campaign.[28]

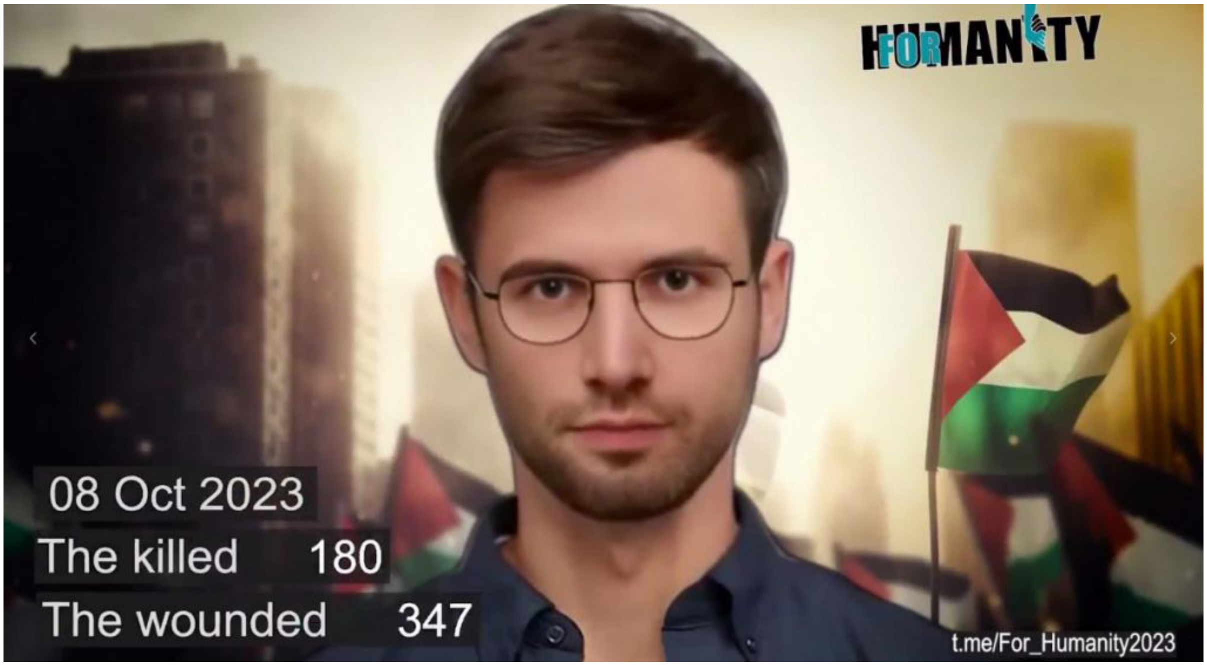
Another key component of Iran's recent cyber strategy is the use of cyber-enabled influence operations. These operations have become significantly more common since mid-2022 and surged in particular as the Israel-Hamas conflict broke out in October 2023. They "combine offensive computer operations with messaging and amplification in a coordinated and manipulative fashion to shift [victims'] perceptions, behaviors, or decisions" and further the regime's strategic objectives, according to Microsoft.[29] Tactics include leaking sensitive data to undermine public trust in institutions and posting hacked material to social media pages to drive fear in Iranian adversaries and boast about Iran's capabilities. Iranian threat actors adopted this technique as a way to boost, exaggerate, and compensate for Iran's lower level of technical capability.[30]

Table 1: Cyber-Enabled Influence Operation Methods

Cyber Method	▪ Stealing data ▪ Website defacement ▪ Ransomware ▪ DDoS attacks
Influence Method	▪ Data leaks ▪ Sharing stolen data on social media or via SMS and email ▪ Impersonating victims ▪ Sock puppets

Source: "Iran turning to cyber-enabled influence operations for greater effect," Microsoft Threat Intelligence, May 2, 2024, https://www.microsoft.com/en-us/security/security-insider/intelligence-reports/iran-turning-to-cyber-enabled-influence-operations-for-greater-effect.

Throughout Israel's war in Gaza, Iranian APTs have used cyber-enabled influence operations to intimidate Israelis and criticize the Israeli government's military strategy and handling of hostages, with the ultimate goal of polarizing Israeli society and eventually destabilizing the country. Iran also uses this technique against Israel's allies to undermine support for Israel's military campaigns.[31] In one instance, Emennet Pasargad, an Iranian-state-affiliated front company, interrupted multiple broadcast channels in the United Arab Emirates, the United Kingdom, and Canada. The front company accessed the news stations' internal networks and used this access to broadcast their own content. Their video began with an AI-generated newscaster reading a message saying, "We had no choice but to deliver this to you," before showing unverified graphic images of Palestinians killed or injured by the Israeli military.[32]



Iran-backed hackers interrupt news broadcasting with AI-generated content.

Source: "Iran Surges cyber-enabled influence operations in support of Hamas," Microsoft Threat Intelligence, February 26, 2024, https://www.microsoft.com/en-us/security/security-insider/intelligence-reports/iran-surges-cyber-enabled-influence-operations-in-support-of-hamas.

In early July 2024, then-Director of National Intelligence Avril Haines issued a formal statement about Iranian influence operations directed at Americans. She warned:

> In recent weeks, Iranian government actors have sought to opportunistically take advantage of ongoing protests regarding the war in Gaza, using a playbook we've seen other actors use over the years. We have observed actors tied to Iran's government posing as activists online, seeking to encourage protests, and even providing financial support to protesters.[33]

Haines also stated that Americans were protesting to express their authentic views on the war in Gaza and highlighted that expressing those opinions is a core part of being a democracy. However, her larger warning was that Iran was hiding its true identity, pushing additional protest action, and seeking to foment unrest through these campaigns.

Tehran's willingness to conduct disruptive, even destructive, attacks against civilian targets makes it a cyber adversary requiring additional focus. In short, Tehran is predictably aggressive, but against unpredictable targets, and its attacks can range from feckless to highly destructive. In 2012, for example, Tehran targeted one of the world's largest oil companies, Saudi Aramco, using a phishing email and a wiper to partially wipe or completely destroy an estimated 35,000 computers in a few hours. While the attack failed to impact oil production, it froze all payment systems and prevented gasoline tank trucks from processing payments. CNN reported in a deep dive on the attack that "Managing supplies, shipping, contracts with governments and business partners—all of that was forced to happen on paper. . . . After 17 days, the corporation relented and started giving oil away for free to keep it flowing within Saudi Arabia" and to ensure the country had a sufficient supply as Saudi Aramco worked to bring the systems back online.[34]

The use of proxies and front organizations is another important component of Iranian strategy that allows the country to maintain a level of plausible deniability. For instance, a group called "Cutting Sword of Justice" claimed responsibility for the attack on Saudi Aramco, citing it as an act of retaliation for supporting the Al Saud regime and its crimes and atrocities against citizens in Syria, Lebanon, and Egypt, amongst others. Iran denied any involvement in the attack, but U.S. intelligence attributed it to Tehran.[35] For more about proxies and front organizations, see page 23.

How Cyber Strategy Fits into Foreign Policy

Iran views cyber as a cost-effective, low-risk tool for harassing its adversaries abroad. Iran uses cyberattacks as one tool in its asymmetric tool kit, enabling a less risky way to challenge nations that it could not compete with in a conventional armed conflict. Using cyber tools, Tehran can damage conventionally stronger opponents and quickly collect intelligence on a variety of strategically valuable targets while maintaining a level of deniability. The intended outcomes of the attacks range from espionage and embarrassment of an adversary to real, lasting damage against an enemy that is conventionally stronger.[36]

Iran also uses cyber operations as a defense mechanism for maintaining stability at home, specifically to ensure regime survival. Domestic surveillance is a strong focus of the regime's cyber operations. Iranian threat actors, for example, frequently target current Iranian government officials (such as diplomats) and their families as well as reformist politicians and journalists. Tehran collects personal information and monitors the political and personal networks of these individuals who are of strategic interest to the Iranian government. This allows the regime to watch for potential rivals and obtain sensitive information that can later be used for blackmail.[37]

Another key component of Tehran's strategy is to control its domestic information space to prevent Western values and culture from "corrupting" Iranian society. Iran views cyberspace as "a cultural battlefield between Iran and the Western world." The IRGC persistently blocks international news sites, social media sites such as Facebook and Twitter, and other popular media sites such as

YouTube and Netflix, with the aim of "block[ing] the West's use of cultural and political ideals to subvert the Iranian State."[38] In February 2024, Tehran implemented a partial ban on the use of virtual private networks (VPNs), an escalation in enforcement following the 2022 decision to punish the purchase and sale of VPNs.[39]

To further control its information space, Iran is developing the National Information Network (NIN), a local intranet entirely supported by domestic infrastructure. According to the U.S. Department of the Treasury, the NIN is "being used to disconnect the Iranian people from the global internet."[40] As it will be completely under government control, the NIN, once operational, will allow the government to keep critical infrastructure online when it imposes internet blackouts to silence criticism. Such control is already evident; in 2019, as protests erupted over a petrol-rationing scheme that significantly raised oil prices, the Iranian government imposed an internet blackout that cut access for most of the country for a week. Services such as banking transactions were able to continue, and local versions of other internet-based tools such as a navigation app and a search engine also remained online and even gained customers.[41] When the NIN becomes fully operational, the government will have full control over the information available to the Iranian population, limiting the accessibility of foreign news and reducing Iran's vulnerability to cyberattacks.[42]

While many cyber intrusions are used to monitor and control the Iranian population and thus maintain the strength of the regime, Iran also conducts destructive cyberattacks. Tehran notably does not make a discernible distinction between operations carried out against domestic and foreign adversaries. The same cyber tools developed and used against domestic organizations and Iranian citizens have since been used against adversaries as disparate as the U.S. defense industry, Persian-language women's development programs, and Saudi government institutions. The same threat actors also target both domestic and international organizations and individuals.[43]

The same cyber tools developed and used against domestic organizations and Iranian citizens have since been used against adversaries as disparate as the U.S. defense industry, Persian-language women's development programs, and Saudi government institutions. The same threat actors also target both domestic and international organizations and individuals.

In conducting destructive cyberattacks, Iran tends to portray itself as a victim that is simply responding to an attack on its own infrastructure to "deflect attention away from its own actions."[44] For example, upon discovery of the Stuxnet intrusion against its nuclear facilities in 2010, Iran launched a series of attacks against U.S. assets, including against dozens of U.S. banks and a small dam in New York.[45] Similarly, in 2020 following a fire at its Natanz power plant that Iranian officials attributed to a cyberattack, Iran's head of civilian defense said that Iran would retaliate against any country that carries out cyberattacks against its nuclear sites.[46]

In its offensive operations, Iran's brazenness and disregard for international norms makes the country a particularly dangerous adversary. Tehran does not shy away from targeting civilian critical infrastructure, having already attacked the financial sector, pipelines, dams, and water facilities, which "can enable actions that harm the public and cause devastating humanitarian consequences."[47]

While Iran has increasingly turned to cyber operations as a tool in its tool kit for irregular conflict, Tehran may not be ready to fully integrate cyber into active conflict operations. Tehran continues to support groups involved in conflicts in Gaza, Iraq, Yemen, and Syria, but cyber operations have not featured in those wars. Part of the reason is likely the difficulty of executing tactical cyber operations, which requires intensive coordination and seamless communication. Instead, Iran has continued to pursue cyber-enabled influence operations and cyber operations on the margins of conflict. Although past attacks in these conflicts have not been particularly damaging, Tehran's rapidly developing tool kit may lead to more destabilizing and escalatory attacks in the future.

Throughout the war in Gaza, a complex Iranian influence campaign called Emerald Divide has sought to "psychologically manipulate Israeli citizens to take real-world actions that exacerbate ideological divisions within Israeli society and undermine the Israeli government," according to Sean Minor, a senior threat intelligence analyst at Insikt Group.[48] While Emerald Divide has been operational since at least 2021, the group has focused on the ongoing conflict in Gaza since the attacks on October 7, 2023. One such effort, the "Tears of War" Telegram channel, posts content related to the Hamas-captured hostages and Israeli victims to encourage Israelis to partake in anti-government protests and raise internal conflict.[49]

How Iran Approaches Deniability

Tehran rarely claims responsibility for cyber operations and instead tends to emphasize its defensive capabilities while touting claims of victimhood.[50] Overall, Iran provides conflicting information about its offensive cyber operations—it simultaneously burnishes its capabilities while consistently denying involvement in attacks.[51]

Just as it does in other warfare domains, Tehran relies on proxies and front organizations to maintain a degree of separation and plausible deniability, which emboldens the government to vehemently deny involvement in cyber operations. In general, the use of proxies has been a key aspect of Iran's military strategy since the Iranian Revolution. Tehran has a robust network of proxies such as Hezbollah and Hamas that it uses as channels for action in conflicts throughout the Middle East.[52] Similarly, Tehran conducts many of its cyber operations using cyber proxies that disguise themselves as hacktivists or pan-Islamists. By doing so, Iran avoids definite attribution, preserving its claims of victimhood. However, cyber defenders have increasingly been able to identify hallmarks of IRGC and MOIS campaigns. For more information about proxy and front organizations, see page 23.

Implementation: Campaigns or Opportunism?

While Iranian actors tend to be reactive, exploiting opportunities for cyberattacks as they arise, they are patient and persistent in their social engineering campaigns. Many of Iran's cyber efforts are designed to be splashy and public, both making a political statement and causing actual damage. Those are generally presented as retaliatory attacks—activism attempting to right a social wrong. It is not clear, however, how far in advance Iran attempts to establish these accesses for later exploitation. In other words, which comes first, the desire to retaliate or the capability, held in reserve?

Following Israel's invasion of Gaza, Iran demonstrated its opportunistic tendencies to quickly react in support of Gaza. In one such attack, Malek Team, an Iranian actor likely associated with the MOIS, leaked personal data from an Israeli university. When publishing the data on Twitter, Malek Team used hashtags to support Hamas and later shifted messaging to belittle Israeli prime minister Benjamin Netanyahu. The group either took advantage of any vulnerability it found quickly or repurposed existing access to support its campaign against Israel, regardless of the relevance of the data or victim to the conflict.[53] For more information about Iranian attacks during the war in Gaza, see the case study on page 36.

Similarly, the *2023 Annual Threat Assessment of the U.S. Intelligence Community* highlighted that "Iran's opportunistic approach to cyberattacks makes critical infrastructure owners in the United States susceptible to being targeted by Tehran."[54] This warning came to fruition in November 2023 when an Iranian cyber persona linked with the IRGC Cyber-Electronic Command targeted a programmable logic controller manufactured by Unitronics (an Israeli company) at a water utility in Pennsylvania. The group, known as CyberAv3ngers, left a warning on the screen of the device: "Every equipment 'made in Israel' is CyberAv3ngers legal target." While the water utility has no intrinsic value to Iran, all poorly defended systems in adversary countries are potential targets, allowing Tehran to engage with adversaries without spending a significant amount of time carefully crafting a campaign. Even partially successful attacks that result in no significant damage or disruption of services are used in Iranian propaganda to further its strategic agenda.[55] In this case, the extent of the attackers' access prompted the water facility managers to switch to manual operations out of concern that safety was compromised.

U.S. election infrastructure is another critical sector that Tehran has targeted in furtherance of its strategic goals. Similar to its initial attacks in support of Gaza, Iran's 2020 campaign against U.S. election systems attempted to advance Tehran's long-term strategic goals—to undermine Americans' faith in the U.S. electoral system, sow discord in American society, and "undercut the reelection prospects of President Trump," according to an unclassified report by the U.S. National Intelligence Council.[56] A press release published by the U.S. Department of the Treasury stated that Iranian hackers attempted to compromise 11 state voter websites but were only successful in exploiting one. Despite failing 10 times, Tehran's single success had the potential to spread fear and undermine faith in electoral systems; it also allowed the country to download the personal information of over 100,000 voters. Posing as a far-right group, hackers subsequently sent emails to tens of thousands of Democratic voters, including many whose data had been stolen from the successful attack, threatening violence if they did not vote for Trump.[57] Iran has shown the capability to adapt and advance its tactics in other domains, suggesting that it will continue to learn from failures and grow their cyber capabilities.

In addition, Iranian hackers claiming to be Proud Boys volunteers sent Facebook messages and emails to Republican members of Congress as well as people associated with the Trump campaign. According to the U.S. Department of the Treasury, the messages claimed that the Democratic Party was “planning to exploit ‘serious security vulnerabilities’ in state voter registration websites to ‘edit mail-in ballots or even register non-existent voters.’” The hackers also sent a video purporting to show someone fraudulently casting ballots via the Federal Voting Assistance Program for military and overseas voters.[58] The fraud, however, never actually took place.

While most attacks are opportunistic, Iranian hackers are known to invest considerable time and resources into developing advanced social engineering campaigns. Mandiant Intelligence, for instance, reported that to gain access to victims’ email accounts or install Android malware on their mobile devices, APT42 “uses highly targeted spear-phishing and social engineering techniques designed to build trust and rapport with their victims.”[59] In May 2024, Mandiant reported that the group was “posing as journalists and event organizers . . . to deliver invitations to conferences or legitimate documents,” which allowed the APT to harvest credentials and gain access to cloud environments.[60]

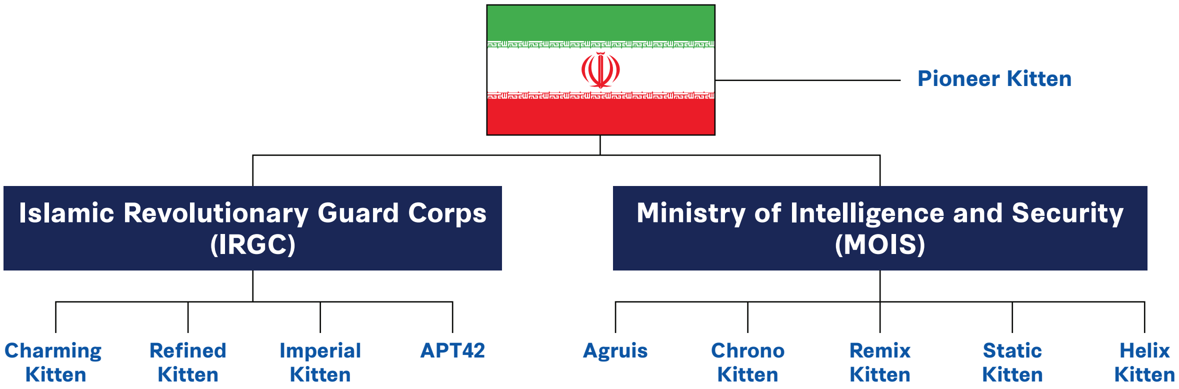
Cybersecurity researchers have also witnessed increased collaboration between Iranian-state affiliated actors, suggesting a degree of pre-planning. Two groups that Microsoft tracks as Storm-0861 and Storm-0842 collaborated on destructive cyberattacks in Israel and Albania. In both attacks, Storm-0861 provided initial access and Storm-0842 executed wiper malware. Similarly, Microsoft reported collaboration between an MOIS-affiliated group, Argius (Pink Sandstorm), and Hezbollah cyber units.[61]

Organization of Capabilities

Who Are the Fighters?

Two main organizations lead offensive cyber operations for the Iranian regime: the IRGC and the MOIS. The following section will discuss the IRGC, MOIS, and the APTs associated with each. This is not an exhaustive list, given that researchers have identified as many as 40 separate APTs, and it is still unclear how much their activities and personnel overlap. There is more publicly available information about the groups discussed below, many of which have conducted some of Iran's more high-profile attacks.

Figure 1: Iranian Offensive Cyber Actors



Source: CSIS research.

IRANIAN REVOLUTIONARY GUARD CORPS (IRGC)

The IRGC is a branch of the Iranian armed forces that was established after the Iranian Revolution in 1979 to protect the new Islamic political system and regime. Since its establishment, the IRGC has taken on an exceedingly large role in executing Iran's foreign policy, particularly via Iran's covert, asymmetric operations abroad. The IRGC has ties to regional armed groups, including Hezbollah in Lebanon, militant groups in Iraq, and Hamas in Gaza. It has considerable influence in domestic politics as well because key positions are appointed by the country's supreme leader, Ali Khamenei, and are answerable to him, bypassing the president's office.[62] The United States designated the IRGC as a terrorist organization in 2019.[63]

The IRGC is composed of ground, naval, land, and air forces as well as cyber-focused units, which have conducted cyberattacks against many targets in Israel, the United States, and Saudi Arabia, among others. The IRGC also is the parent organization of the Basij, a civilian paramilitary organization that manages a legion of cyberwar volunteers recruited from universities and religious schools who also act as a proxy hacker force. While the exact number is unknown, Iranian leadership claims to have 120,000 basij cyber warriors. The volunteers are sometimes referred to as "cyber war commandos."[64]

APTs associated with the IRGC include Refined Kitten, Charming Kitten, Imperial Kitten, APT42, and Pioneer Kitten, each of which are detailed below.

Refined Kitten

Table 2: Aliases of Refined Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Refined Kitten	APT33	HOLMIUM	Peach Sandstorm	Cobalt Trinity	Elfin

Refined Kitten has been active since at least 2013 and is likely tied to the IRGC, according to CrowdStrike.[65] The group is known for gathering intelligence on companies in the United States, Saudi Arabia, and South Korea, with a particular interest in the military and commercial aviation sectors and the energy sector, especially companies with ties to petrochemical production.[66] These targets are in line with Iranian strategic interests, which include gaining insights into Saudi military aviation capabilities, supporting Iranian decisionmaking regarding Saudi Arabia, and expanding Iran's petrochemical production to grow its competitiveness within the region. Although the group's activities mainly focus on intelligence gathering, there have been suspected links between Refined Kitten and destructive attacks such as the Shamoon wiper-malware attacks in 2018.[67]

Refined Kitten is known for using relatively sophisticated tactics, including custom-built malware and advanced social engineering strategies. This adversary often uses targeted spear-phishing campaigns to gain initial access. In one instance, Refined Kitten sent recruitment themed emails to employees of aviation-related organizations that contained links to malicious application files.

These files also contained job descriptions and links to legitimate job postings that were relevant to the targeted individuals.[68]

Notable attacks by Refined Kitten include the following:

- In 2023, Microsoft reported that Refined Kitten was carrying out password spray activity against thousands of organizations in the satellite, defense, and pharmaceutical sectors, which was likely an attempt to gain initial access and collect intelligence in line with Iranian strategic interests. When these campaigns were successful, Refined Kitten used "a combination of publicly available and custom tools for discovery, persistence, and lateral movement," with a few instances of data exfiltration reported.[69]
- From mid-2016 to 2017, Refined Kitten compromised a U.S. aerospace organization and targeted a Saudi corporation with aviation holdings, according to Mandiant. To do so, the group sent targeted spear-phishing emails and registered domains that masqueraded as Saudi aviation and Western organizations.[70]
- According to a 2018 report by McAfee, Refined Kitten is responsible for Shamoon Version 3 wiper-malware attacks in December 2018 that used a supply chain attack to target organizations in the Middle East through their suppliers in Europe. To gain initial access, Refined Kitten hackers created websites that closely resembled legitimate job-posting websites, many of which were related to the Middle Eastern energy sector. Some of the websites contained malicious application files, while others had victims log in using their corporate credentials.[71] Similarly, in September 2017, Mandiant (then FireEye) assessed that Refined Kitten likely has ties to earlier uses of Shamoon malware.[72]

Charming Kitten

Table 3: Aliases of Charming Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Charming Kitten	APT35	PHOSPHORUS	Mint Sandstorm	Cobalt Illusion	Magic Hound

Charming Kitten is an Iranian APT, likely affiliated with the IRGC, that is known for targeting military, diplomatic, and government personnel; private companies in the media, energy, and telecommunications sectors; and organizations and companies in the defense industrial base.[73] The group has been active since at least 2014 and typically conducts long-term, resource-intensive operations to collect intelligence and surveil Iranians and foreign citizens who have strategic value.[74]

According to Mandiant, Charming Kitten has "historically relied on marginally sophisticated tools . . . suggesting a relatively nascent development capability. However, the breadth and scope of [its] operations, particularly as it relates to its complex social engineering efforts, likely indicates that the group is well resourced in other areas."[75] The group relies on spear phishing to gain initial access and occasionally utilizes strategic web compromises and password spray attacks against externally facing web applications.

Attacks attributed to Charming Kitten include the following:

- In February 2017, Palo Alto Networks reported that Charming Kitten targeted organizations that are either based in Saudi Arabia or have interests in Riyadh in the energy, government, and technology sectors. The campaign, dating to mid-2016, was focused on espionage.[76] Charming Kitten disguised malicious files as holiday greeting cards, job offers, and government documents from Saudi Arabia's Ministry of Health and Ministry of Commerce and used custom tools, including "droppers, downloaders, executable loaders, document loaders, and IRC bots," to carry out the campaign.[77]
- In 2020, the group targeted medical research organizations in Israel, focusing particularly on targets in oncology, genetics, and neurology.[78]
- In September 2020, Microsoft reported that Charming Kitten "continued to attack the personal accounts of people associated with the Donald J. Trump for President campaign." Between May and June 2020, the threat actor attempted to sign in to administration officials' and campaign staffs' personal or work accounts but was unsuccessful.[79]
- In January 2023, Germany's Federal Office for the Protection of the Constitution warned that, since the end of 2022, Charming Kitten had been conducting cyberattacks against Iranian dissident organizations and individuals such as lawyers and human rights activists residing both inside and outside of Iran.[80] The group used advanced spear-phishing tactics to gain access to targets' accounts.[81]

Nemesis Kitten is generally classified as a sub-group of Charming Kitten. For more information about Nemesis Kitten, see the section on Najee Technology and Afkar Systems on page 25.

Imperial Kitten

Table 4: Aliases of Imperial Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Imperial Kitten	APT35, UNC1549	CURIUM, BOHRIUM	Crimson Sandstorm, Smoke Sandstorm	Cobalt Fireside	Tortoiseshell

Imperial Kitten has been active since at least 2017 and, according to CrowdStrike, is affiliated with the IRGC. Mandiant tracks Imperial Kitten's activity under APT35 (the same as Charming Kitten) and UNC1549. Microsoft also tracks this threat actor under two different names, Crimson Sandstorm and Smoke Sandstorm.[82] Imperial Kitten's activity is characterized by its use of social engineering techniques, specifically creating false social media profiles and using job recruitment-themed content to deliver custom malware. This APT has targeted multiple industries, including defense, technology, telecommunications, maritime, energy, and consulting companies.[83] Examples of such activities include the following:

- In November 2023, CrowdStrike reported that Imperial Kitten conducted a series of cyberattacks against organizations in the transportation, logistics, and technology sectors the month prior. These attacks utilized public scanning tools, one-day exploits, SQL injection, and stolen VPN credentials for initial access before moving laterally and exfiltrating data. Similarly, between 2022 and 2023, Imperial Kitten conducted strategic web compromise operations, targeting organizations in the same sectors.[84]
- In February 2024, Mandiant reported that Imperial Kitten was targeting the aerospace, aviation, and defense industries of countries in the Middle East, including Israel and the United Arab Emirates, as well as potentially Turkey, India, and Albania. The threat group used a fake recruiting website hosting a malicious payload to do so. According to Mandiant, the link between these attacks and the IRGC is "noteworthy given the focus on defense-related entities and the recent tensions with Iran in light of the Israel-Hamas war."[85]

APT42

Table 5: Aliases of APT42

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Charming Kitten	APT42	PHOSPHORUS	Mint Sandstorm	Cobalt Illusion	Damselfly, Crooked Charms

APT42 has been active since at least 2015 and is responsible for at least 30 confirmed operations. Mandiant previously tracked APT42 as UNC788 and assesses with moderate confidence that the group operates on behalf of the IRGC Intelligence Organization. Other cybersecurity researchers combine Charming Kitten's (APT35) activity with that of APT42, but Mandiant assesses with moderate confidence that Charming Kitten and APT42 are separate groups that both "operate on behalf of the IRGC but originate from different missions and contracts or contractors based on substantial differences in their respective targeting patterns and tactics, techniques and procedures." Similarly, though Microsoft reports a connection between Nemesis Kitten (UNC2448) and APT42, Mandiant "has not observed any technical overlaps between APT42 and UNC2448."[86]

APT42 has targeted the personal and corporate email accounts of current and former Iranian government officials, policymakers, political figures, members of the Iranian diaspora, opposition groups, journalists, and academics. It also targets organizations in the following sectors: civil society, education, government, healthcare, legal, manufacturing, media, entertainment, and pharmaceutical. However, unlike other groups associated with the IRGC, APT42 does not target the defense industrial base or focus on the collection of personally identifiable information. Instead, it seeks out "enemies or opponents of the regime, specifically gaining access to their personal and mobile devices." The group relies primarily on highly targeted social engineering efforts to build trust with their victims. APT42 has targeted organizations and individuals in at least 14 countries, including Australia and the United States, as well as countries in the Middle East and Europe.[87] Notable attacks include the following:

- In May 2024, Mandiant reported that APT42 was observed masquerading as journalists and event organizers. The group spent considerable time building rapport with their victims, typically individuals perceived as being a threat to the regime, such as NGO leaders and human rights activists. APT42 eventually sent a link to a legitimate conference invitation or other document, which prompted victims to enter credentials. Upon harvesting credentials, the group gained access to cloud environments and covertly exfiltrated data of strategic value to Iran.[88]
- In another campaign beginning in 2021, APT42 impersonated news sources such as the *Washington Post*, *The Economist*, and the *Jerusalem Post* to target journalists and researchers with spear-phishing campaigns.[89]

MINISTRY OF INTELLIGENCE AND SECURITY (MOIS)

The MOIS (VEVAK in Farsi) is one of the two most powerful intelligence branches in Iran, alongside the IRGC Intelligence Organization. The MOIS is the primary civilian intelligence organization, and all other intelligence services are required to share information with the MOIS. Notably, the MOIS reports to the president rather than the supreme leader and "is assessed to be more technical and less ideology-driven than IRGC leaders."[90]

The MOIS's main priority is to collect domestic intelligence. To do so it "spies on Iranians abroad, collects intelligence on other governments, counters foreign intelligence plots, and works with allied intelligence agencies."[91] The organization is known to be responsible for signals intelligence and collecting information from electronic communications.

APTs associated with the MOIS include Static Kitten, Helix Kitten, Remix Kitten, Agrius, and Chrono Kitten. The section below details these APTs.

Static Kitten

Table 6: Aliases of Static Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Static Kitten	UNC3313 TEMP.Zargos	MERCURY	Mango Sandstorm	Cobalt Ulster	MuddyWater

Static Kitten has been active since at least 2017. In January 2022, U.S. Cyber Command reported that this APT is a "subordinate element" within the MOIS.[92] This adversary is known for targeting organizations located in the Middle East and Eurasia, including telecommunications, local government, defense, oil, and natural gas companies. Static Kitten is most known for cyber espionage campaigns and intellectual property (IP) theft but is believed to occasionally deploy ransomware, perhaps to cover its tracks.[93] According to Microsoft, Static Kitten has collaborated with another threat actor, tracked as DEV-1084 (also known as Storm-1084 and as the DarkBit persona); Static Kitten gains initial access before DEV-1084 carries out destructive actions.[94] Static

Kitten typically exploits publicly reported vulnerabilities and mainly uses open-source tools and strategies.[95] Notable attacks by Static Kitten include the following:

- In February 2022, Static Kitten attacked what Mandiant describes as a "Middle Eastern government." According to Mandiant, Static Kitten gained access to the system through a targeted phishing email. The group moved quickly and used new, targeted malware that also possessed backdoor functionalities and publicly available remote-access software. Mandiant assessed that Static Kitten "conducts surveillance and collects strategic information to support Iranian interests and decision-making."[96]
- In early November 2023, Deep Instinct's Threat Research Team reported that Static Kitten unleashed a new social engineering campaign aimed at Israeli organizations. The group targeted two Israeli organizations with spear-phishing emails and used subsequent access to conduct reconnaissance.[97]

Helix Kitten

Table 7: Aliases of Helix Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Helix Kitten	APT34	EUROPIUM	Hazel Sandstorm	Cobalt Gypsy	OilRig

Helix Kitten has been active since at least 2015 and is known to target organizations in the aerospace, energy, financial, government, hospitality, and telecommunications industries across the Middle Eastern region, mostly for espionage purposes. According to the Cybersecurity and Infrastructure Security Agency (CISA), Helix Kitten works on behalf of the Iranian government, likely the MOIS.[98] According to a Palo Alto Networks report, Helix Kitten attacks are "not particularly sophisticated" but are "extremely persistent in the pursuit of their mission objective," and have become more sophisticated over time, following the general trend of Iranian cyber capabilities.[99] Notable attacks by Helix Kitten include the following:

- In an interesting attack in 2019, Venomous Bear, a Russian APT that has been attributed to the Russia's Federal Security Service (FSB), hijacked Helix Kitten's infrastructure and used it to deliver malware against a target in the Middle East. Symantec found no evidence to suggest that the two groups were collaborating and instead assessed that Venomous Bear's use of Helix Kitten's infrastructure "appears to have been a hostile takeover."[100]
- During the 2023 annual Cyber Security Weekend for the Middle East, Türkiye, and Africa, Kaspersky researchers warned of increased IT supply chain attacks by Helix Kitten that targeted high-profile government entities to collect credentials and sensitive data about their targets. The APT used social engineering techniques and exploited software and other technical vulnerabilities to gain initial access, and Kaspersky reported that "the group has updated their arsenal, resorting to persistent, stealthier ways of infiltrating their targets through third-party IT companies."[101]

- In August 2023, Helix Kitten attempted to use a supply chain attack to gain access to targets within the government of the United Arab Emirates (UAE). The group created a fake IT company website and sent a malicious job recruitment form to a target IT company; the form, when opened, deployed malware to collect sensitive information. From there, Helix Kitten looked to target government clients, "using the victim IT group's email infrastructure for command-and-control communication and data exfiltration."[102]

Remix Kitten

Table 8: Aliases of Remix Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Remix Kitten	APT39	DEV-0589	Storm-0589	Cobalt Hickman	Chafer

Remix Kitten is an Iranian APT known to target the Middle East and the United States. The group has been active since at least 2014 and has a particular focus on the telecommunications sector as well as the travel and hospitality industries. Remix Kitten has engaged in the widespread theft of personally identifiable information in order to "perform monitoring, tracking, or surveillance operations against individuals, collect proprietary or customer data for commercial or operational purposes that serve strategic requirements related to national priorities, or create additional accesses and vectors to facilitate future campaigns."[103] According to the U.S. Department of the Treasury, Remix Kitten is "owned or controlled" by the MOIS.[104] Notable attacks by Remix Kitten include the following:

- According to Symantec, Remix Kitten compromised a major telecommunications services provider in the Middle East in 2017 and likely attempted to attack a major travel reservations firm. The same year, Remix Kitten attacked nine organizations in Israel, Jordan, the UAE, Saudi Arabia, and Türkiye using seven new tools. The attacks hit airlines, aircraft services, document management software, software and IT services companies working with the air and sea transport sectors, engineering consultancies, and payroll services to "facilitate widescale surveillance of targets."[105]
- Remix Kitten targeted air transportation organizations and government entities in Kuwait and Saudi Arabia in a campaign that began in 2018. Researchers believe Remix Kitten gained initial access through a social engineering campaign, and the attacks used custom-built tools and living-off-the-land tactics. The attacks on Kuwait were more sophisticated, as the hackers were able to move laterally.[106]

Agrius

Table 9: Aliases of Agrius

Microsoft (old)	Microsoft (new)	Other
AMERICUM DEV-0022	Pink Sandstorm	Agrius, Agonizing Serpens

Agrius has been active since 2020 and is known for conducting destructive wiper and fake ransomware attacks, mainly against Israeli organizations. It has been attributed to the MOIS.[107] According to Palo Alto Networks, Agrius steals sensitive information, posts it on Telegram and Instagram channels, and wipes as many endpoints as possible. This adversary has both developed custom tools and used known hacking techniques.[108] Notable attacks by Agrius include the following:

- Palto Alto Networks found that Agrius targeted the Israeli higher education and technology sectors throughout 2023, stealing personal information such as intellectual property and personally identifiable information and disabling endpoints using custom wipers. The group then posted the stolen data on social media and Telegram channels. Agrius hackers exploited internet-facing web servers, then deployed multiple web shells to get a foothold in a network.[109]

Chrono Kitten

Table 10: Aliases of Chrono Kitten

CrowdStrike	Microsoft (old)	Microsoft (new)	Secureworks	Others
Chrono Kitten	DEV-0133	Storm-0133	Cobalt Lyceum	Siamese Kitten, Lyceum, HEXANE

Chrono Kitten has been active since at least 2018 and is known for targeting oil, gas, and telecommunications companies in Africa and the Middle East for espionage purposes. While some cybersecurity researchers combine this group with Helix Kitten, according to MITRE ATT&CK, this group's tactics, techniques, and procedures are similar to those used by Helix Kitten and Refined Kitten, but it is tracked separately due to differences in victims and tools.[110] Notable attacks include the following:

- In 2019, Secureworks reported that Chrono Kitten focused on South African targets in mid-2018, and the group launched a campaign against Middle Eastern oil and gas organizations in May 2019. Chrono Kitten gains initial access using account credentials obtained through password spraying or brute-force attacks. The group then sends spear-phishing emails with malicious Excel attachments from the compromised accounts.[111]
- In August 2021, ClearSky, an Israeli cybersecurity company, reported a campaign by Chrono Kitten focusing on Israeli IT companies.[112]

UNCLEAR IRANIAN GOVERNMENT AFFILIATION

Pioneer Kitten

Table 11: Aliases of Pioneer Kitten

CrowdStrike	Mandiant	Microsoft (old)	Microsoft (new)	Secureworks	Other
Pioneer Kitten	UNC757	RUBIDIUM	Lemon Sandstorm	Cobalt Foxglove	Fox Kitten

Pioneer Kitten has been active since at least 2017, targeting mainly North American and Israeli organizations in the "technology, government, defense, healthcare, aviation, media, academic, engineering, consulting and professional services, chemical, manufacturing, financial services, insurance, and retail" sectors. Pioneer Kitten is likely connected to the Iranian government, but cybersecurity researchers from CrowdStrike assess that this APT is most likely a "contract element operating in support of the Iranian government, rather than one operated by the government itself" due to certain behaviors and traits. Pioneer Kitten potentially overlaps with the IRGC's Refined Kitten as well as the MOIS's Helix Kitten and Remix Kitten, but "CrowdStrike intelligence considers these claims to be circumstantial and lacking in sufficient corroborative data to enable confirmation of such relationships."[113] Attacks by Pioneer Kitten include the following:

- In September 2020, CISA reported that Pioneer Kitten targeted U.S. organizations in the information technology, government, healthcare, financial, insurance, and media sectors. The group "conducts mass-scanning tools . . . to identify open ports . . . [then] exploits CVEs [common vulnerabilities and exposures] related to VPN infrastructure to gain initial access to a targeted network." The threat actor then exfiltrated data and has been observed selling stolen data on an online hacker forum.[114]
- Pioneer Kitten is likely responsible for a 2020 attack on a local government website that was to report the 2020 election results. The U.S. military discovered the breach. and disrupted the attack before the results were finalized.[115]

OTHER GOVERNMENT ENTITIES

Other government entities that have a role in Tehran's defensive cyber operations include the following:

- **Supreme Council of Cyberspace (SCC):** Established by Supreme Leader Ayatollah Ali Khamenei in 2013, the SCC is responsible for managing cyberspace policy, coordinating offensive and defensive cyber operations, and blocking websites, including social media sites. It also has a role in various censorship efforts.[116] All state agencies are required to cooperate with the SCC, so it has almost complete control over Iran's domestic cyberspace.[117]
- **National Cyberspace Center:** The National Cyberspace Center is owned or controlled by the SCC and is responsible for developing tactics to control Iran's domestic information space and "preparing for a cultural war" between Iran and the West.[118] It has prevented Iranians from using VPNs to access blocked content.[119]

- **National Passive Defense Organization:** A quasi-military body, the National Passive Defense Organization (NPDO) is in charge of making Iran's critical infrastructure more resilient. One of the NPDO's main roles is to use "all national cyber and non-cyber resources to deter, prevent, deny, identify, and effectively counter any cyberattack against . . . Iran's national infrastructure by either hostile foreign states or groups supported by them." In addition to defense, the NPDO also helps coordinate citizen surveillance and supposedly works with the IRGC to conduct offensive cyberattacks.[120]

NONGOVERNMENTAL

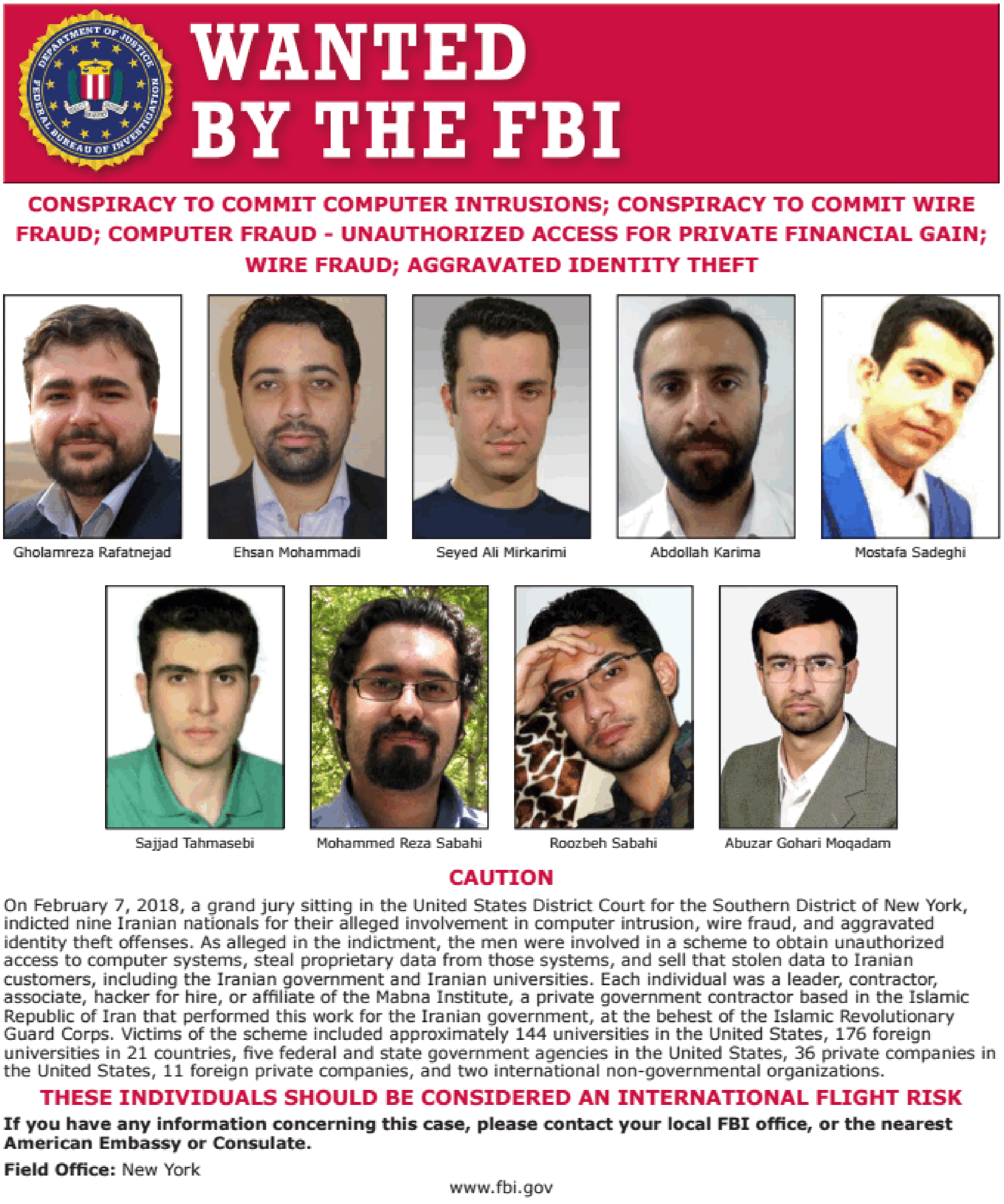
In conducting computer network operations, Tehran often relies on a diverse ecosystem of cyber actors that act on behalf of the Iranian government. A proxy-based approach is a feature of Iranian cyber operations and reflects Tehran's approach in conflict zones like Syria and Yemen, where Iran employs both direct and indirect means to exert influence on decisionmaking. Assessments of the Iranian state's control over its cyber proxies point to cases where the groups operate without strict restraints. The means and logistics of a cyber response are often as much determined by the proxies as they are by the state.[121] The use of proxies provides Iran with a level of deniability and the ability to maintain that it is a victim in the global cyberwar.[122]

Proxies and Front Organizations

Iranian companies are known to have perpetrated attacks, in affiliation with the IRGC and MOIS, against a range of targets, including universities, election apparatuses, and critical infrastructure. The section below describes several proxy organizations that have been responsible for high-profile hacks.

MABNA INSTITUTE

Since its founding in 2013, the Mabna Institute has helped Iranian universities and other research institutions steal foreign scientific resources. The Mabna Institute employs and hires individuals that use cyber operations to steal intellectual property, academic research, emails, and other sensitive information on behalf of both the Iranian government and private companies. In March 2018, the U.S. Department of Justice indicted nine individuals working at the Mabna Institute for conducting cyber operations on behalf of the IRGC. They are believed to have hacked 144 universities and 36 private companies in the United States, 176 foreign universities in 21 different countries, and 11 foreign private companies.[123]



WANTED BY THE FBI

CONSPIRACY TO COMMIT COMPUTER INTRUSIONS; CONSPIRACY TO COMMIT WIRE FRAUD; COMPUTER FRAUD - UNAUTHORIZED ACCESS FOR PRIVATE FINANCIAL GAIN; WIRE FRAUD; AGGRAVATED IDENTITY THEFT

Gholamreza Rafatnejad

Ehsan Mohammadi

Seyed Ali Mirkarimi

Abdollah Karima

Mostafa Sadeghi

Sajjad Tahmasebi

Mohammed Reza Sabahi

Roozbeh Sabahi

Abuzar Gohari Moqadam

CAUTION

On February 7, 2018, a grand jury sitting in the United States District Court for the Southern District of New York, indicted nine Iranian nationals for their alleged involvement in computer intrusion, wire fraud, and aggravated identity theft offenses. As alleged in the indictment, the men were involved in a scheme to obtain unauthorized access to computer systems, steal proprietary data from those systems, and sell that stolen data to Iranian customers, including the Iranian government and Iranian universities. Each individual was a leader, contractor, associate, hacker for hire, or affiliate of the Mabna Institute, a private government contractor based in the Islamic Republic of Iran that performed this work for the Iranian government, at the behest of the Islamic Revolutionary Guard Corps. Victims of the scheme included approximately 144 universities in the United States, 176 foreign universities in 21 countries, five federal and state government agencies in the United States, 36 private companies in the United States, 11 foreign private companies, and two international non-governmental organizations.

THESE INDIVIDUALS SHOULD BE CONSIDERED AN INTERNATIONAL FLIGHT RISK

If you have any information concerning this case, please contact your local FBI office, or the nearest American Embassy or Consulate.

Field Office: New York

www.fbi.gov

Mabna hackers wanted by the Federal Bureau of Investigation.

Source: "Iranian Mabna Hackers," Federal Bureau of Investigation, March 23, 2018, https://www.fbi.gov/wanted/cyber/iranian-mabna-hackers.

NAJEE TECHNOLOGY HOOSHMAN FATER LLC AND AFKAR SYSTEM YAZD COMPANY

The U.S. Department of the Treasury sanctioned both Najee Technology and Akfar System in September 2022 for "their roles in conducting malicious cyber acts, including ransomware activity" in affiliation with the IRGC Intelligence Organization. According to the press release, these cyber actors had been active in the United States and other countries, particularly in the Middle East, since at least 2020. They have launched campaigns against personnel working in defense, diplomacy, and government as well as private companies in the media, energy, business services, and telecommunications sectors.[124]

Microsoft Threat Intelligence tracks these two companies under the name DEV-0270—also known as Nemesis Kitten and UNC2448—and it is thought to be a sub-actor of Charming Kitten. According to Microsoft, while Nemesis Kitten conducts cyberattacks on behalf of the government of Iran, "judging from their geographic and sectorial targeting, which often lacked a strategic value for the regime," some of their attacks are likely "a form of moonlighting for personal or company-specific revenue generation."[125] Notable attacks by the group include the following:

- In February 2021, cyber actors hacked a New Jersey municipality. After gaining access, employees from the two companies created unauthorized accounts, escalated their privileges, and moved laterally to other parts of the network. They also established persistent remote access to a domain registered by the owner, managing director, and chairman of the board of Najee Technology.
- In March and April 2021, hackers affiliated with the companies launched their first known ransomware activities against several small businesses, including a law firm, an accounting firm, and a construction contractor.
- In June 2021, a group, composed of employees of the two companies, gained access to a hospital's supervisory control and data acquisition systems. They exfiltrated data and encrypted at least one device. U.S. government law enforcement partners were able to notify the hospital of the attack before it impacted patient care.[126]

EMENNET PASARGAD

Emennet Pasargad is an Iranian cyber company that was formerly known as Eeleyanet Gostar and Net Peygard Samavat Company. Microsoft tracks the company as Cotton Sandstorm (formerly NEPTUNIUM). In 2019, the U.S. Department of the Treasury sanctioned the Net Peygard Samavat Company for its involvement in a malicious cyber campaign that aimed to gain access to and implant malware on the systems of U.S. counterintelligence agents. At that time, the company was noted to work with the MOIS and the IRGC Cyber Electronic Command (IRGC-CEC). The company subsequently rebranded to Emennet Pasargad in an attempt to evade U.S. sanctions.[127]

Since at least 2020, Emennet Pasargad has targeted companies, primarily in Israel, using cyber-enabled information operations, including data theft and the subsequent leak of data, sometimes followed by the deployment of destructive encryption malware. To avoid attribution, Emennet Pasargad conducted these campaigns under fake personas, including posing as hacktivist or cybercriminal groups. For example, between 2020 and 2022, Emennet Pasargad operated under the persona "Hackers of Savior" in multiple campaigns against Israel. In 2021, the group used the persona "Deus" while targeting an Israeli call service center.[128]

In 2021, the Treasury Department sanctioned Emennet Pasargad for its attempts to interfere in the 2020 U.S. elections on behalf of the Iranian government. Between August and November 2020, the company "executed an online operation to intimidate and influence American voters, and to undermine voter confidence and sow discord." Hackers obtained voter information, sent threatening emails to voters, and created disinformation campaigns related to election security. They also obtained access to accounts of media entities, which gave them the ability to edit and create fake content, but the Federal Bureau of Investigation managed to thwart that access before it was used.[129] Emennet Pasargad actors also claimed affiliation with the Proud Boys.[130]

Other notable companies include the following:

- **Rana Intelligence Computing Company:** The government of Iran used this front company to target Iranian dissidents, journalists, and international companies in the travel sector as well as the government networks of Iran's neighboring countries and foreign organizations in the academic, travel, and telecommunications sectors. Individuals working at Rana provided support for MOIS cyberattacks.[131]
- **ITSecTeam and MERSAD:** Seven Iranian individuals who worked at these two companies were indicted in March 2016 on computer hacking charges. They performed work for the Iranian government, including the IRGC, and were indicted for their involvement in an extensive campaign that included over 176 days of DDoS attacks primarily against targets in the U.S. financial sector. The campaign began in December 2011, with attacks occurring sporadically until September 2012, when hackers began conducting attacks almost every week. The campaign lasted until mid-2013 and was able to disable bank websites and prevent customers from accessing their accounts online.[132]
- **Ravin Academy:** The Ravin Academy is a cybersecurity and hacking training school from which the MOIS recruits. It also assists the MOIS with a range of needs such as information security training, threat hunting, digital forensics, malware analysis, penetration training, and reverse engineering.[133]

Hacktivist Groups

Iran's hacktivist network is constantly evolving and growing. In particular, since Hamas's attack on Israel on October 7, 2023, and Israel's subsequent invasion of Gaza, Iranian hacktivists have been increasing their attacks against both Israeli and non-Israeli targets, especially targets in the United States. The Iranian government hides behind hacktivist organizations as they do with front organizations. The section below details some of the most well-known hacktivist groups.

CYBERAV3NGERS

CyberAv3ngers is a hacktivist group that has been active since at least February 2022 but came to the fore during the Israel-Hamas conflict. While most cybersecurity researchers track this group as a hacktivist group, CISA classifies CyberAv3ngers as an IRGC-affiliated APT.[134] The group is particularly active on social media and has claimed several attacks against critical infrastructure sectors, often publicizing both actual and overstated successes. For example, some of their claims about compromising Israeli infrastructure have been proven false.[135]

In a notable attack in November 2023, CyberAv3ngers targeted a municipal water authority in Pennsylvania. The hackers shut down a device that monitors and regulates water pressure at a pumping station, claiming the attack was meant to target the Israeli company, Unitronics, the maker of the industrial control system. Luckily, the staff switched to manual pumping quickly, and there was no impact on the water supply or on the health of the residents who rely on the company's water and sewer services. CyberAv3ngers has also reportedly targeted a brewery in Pittsburgh, an aquarium, Israel's railway infrastructure, and several Israeli water facilities.[136]

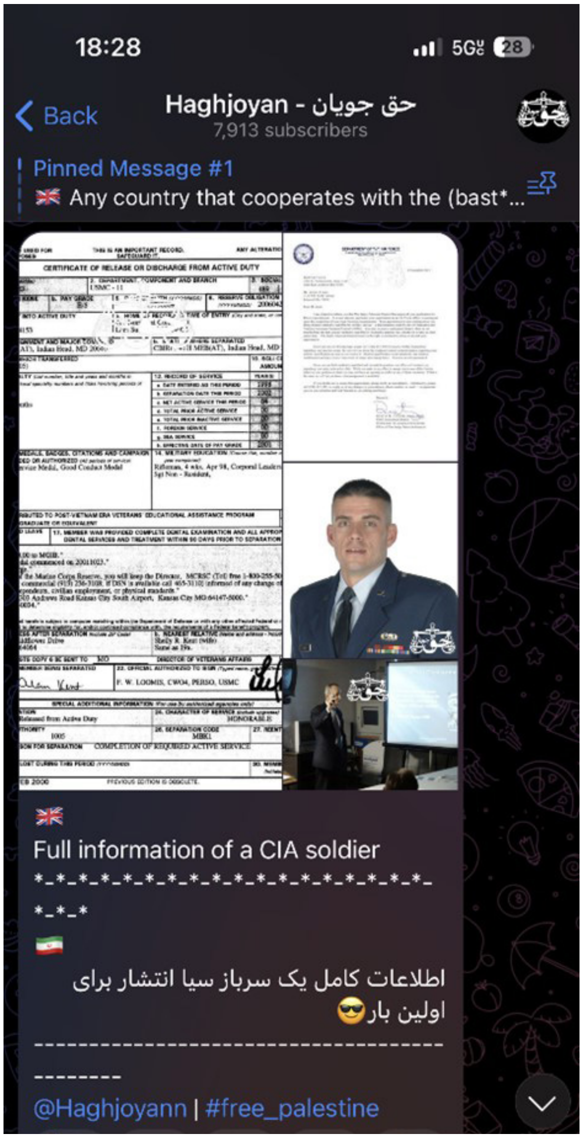
HAGHJOYAN

Haghjoyan is another Iranian hacktivist group that emerged during the Israel-Gaza conflict. The group self-identifies as "Iran's cyber army" on their popular Telegram channel, which had over 40,000 subscribers at one point (see the images on page 28). Haghjoyan's early attacks primarily targeted Israel, but the group's focus has expanded to include the United States. The group is known for focusing on data leaks, defacement attacks, and propaganda. In one notable attack, Haghjoyan claimed to have targeted several Israeli water pumps, electricity distribution units, and virtual network computing systems at gas stations, highlighting the dangerous reality that this group could disrupt critical infrastructure.[137]

CYBER TOUFAN AL-AQSA

Cyber Toufan Al-Aqsa ("Toufan" means flood in Arabic and is very likely a reference to Hamas's October 7th attack on Israel, known as "Toufan Al-Aqsa") is a relatively new hacktivist group that only recently emerged, in November 2023, but has already managed to attack more than 100 Israeli organizations. According to SOCRadar, the group's operations "bear the hallmarks of a sophisticated entity, potentially state-sponsored."[138] Cyber Toufan has been able to rapidly rise in notoriety and carry out complex cyberattacks that "suggest a level of support and resources that are not typically available to independent hacker collectives."[139] The group has leaked sensitive data from private companies and Israeli government targets, including the Ministry of Health, the Ministry of Welfare and Social Security, and Max Security (an Israeli cybersecurity company); Israeli branches of multinational companies such as Ikea, ACE Hardware, and Toyota; and companies that did business with Israeli companies such as Berkshire eSupply and SpaceX.[140] Cyber Toufan's wiper malware has caused significant damage to many of these organizations, and the group is known for spreading follow-on attacks down the supply chain.

The vast array of these actors is telling. Iran has a variety of tools to choose from and is willing to deploy a range of tools and actors against several consistent targets: the United States, Israel, and the Gulf states. These attacks also show determination and persistence in the tactics, techniques, and procedures of these actors.



Haghjoyan - حق جویان

7,913 subscribers

Pinned Message #1

🇬🇧 Any country that cooperates with the (bast*...

🇬🇧

Full information of a CIA soldier

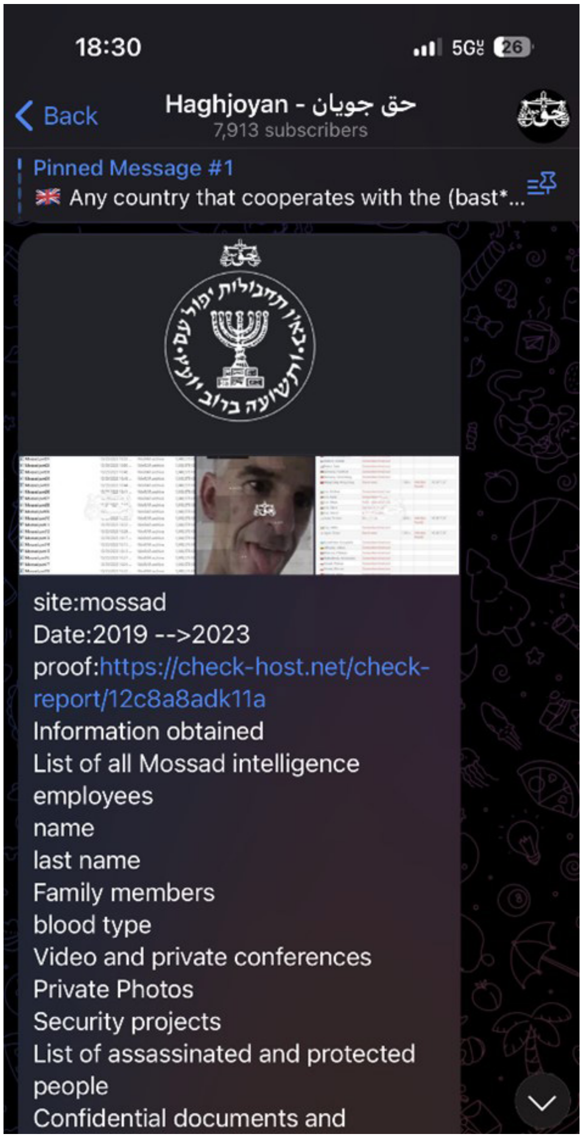
*_

*_*_*

🇮🇷

اطلاعات کامل یک سرباز سیا انتشار برای اولین بار 😎

@Haghjoyann | #free_palestine



Haghjoyan - حق جویان

7,913 subscribers

Pinned Message #1

🇬🇧 Any country that cooperates with the (bast*...

site:mossad
Date:2019 -->2023
proof:https://check-host.net/check-report/12c8a8adk11a
Information obtained
List of all Mossad intelligence employees
name
last name
Family members
blood type
Video and private conferences
Private Photos
Security projects
List of assassinated and protected people
Confidential documents and

Screenshots of Haghjoyan's Telegram distributing stolen data of alleged CIA and Mossad employees.

Source: Haghjoyan, Telegram, Screenshot, Haghjoyan distributes CIA and Mossad personnel data. February 16, 2024.

Case Study 1

Deserts vs. Sands

"Do you see that desert out there? I want to show you something." You pick up your cell phone and you call somewhere in Nebraska and you say, "Ok let it go." So there's an atomic weapon, goes over ballistic missiles, the middle of the [Iranian] desert, that doesn't hurt a soul. . . . Then you say, "See? The next one is in the middle of Tehran. So, we mean business. You want to be wiped out? Go ahead and take a tough position and continue with your nuclear development."

—Sheldon Adelstein, 2013[141]

These comments from Sheldon Adelstein, the owner of the Sands Casino in Las Vegas, from a 2013 panel sparked outrage in Tehran. Adelstein had been asked how he would handle the ongoing talks with Iran about its nuclear program, to which he casually proposed that the United States launch a nuclear weapon at Iran, instead of pursuing diplomatic negotiations, to send a message and get the country to stop pursuing its own nuclear program.[142] A few months later, in early 2014, Tehran retaliated with a malware bomb aimed at his casino.[143]

The attack on the Sands Casino was not particularly sophisticated–it was a brute force password attack on a smaller casino. Tehran then used that access to find the credentials of a systems engineer and plant the malware. The attack destroyed about three-quarters of the casino's Las Vegas servers, and cost the company an estimated $40 million.[144] A year later, Director of National Intelligence James Clapper attributed the hack to the Iranian government in a congressional testimony.[145]

This attack set a dangerous precedent, demonstrating Iran's willingness to target privately held companies, similar to North Korea's attacks on Sony Pictures only a year later.[146] The U.S. government was not the cavalry, coming to help. Adelstein's comments were his own, and even though the attacker was a nation-state, the U.S. government did not view protecting the Sands Casino as its responsibility. The business recovered, but Tehran was able to exact a heavy cost.

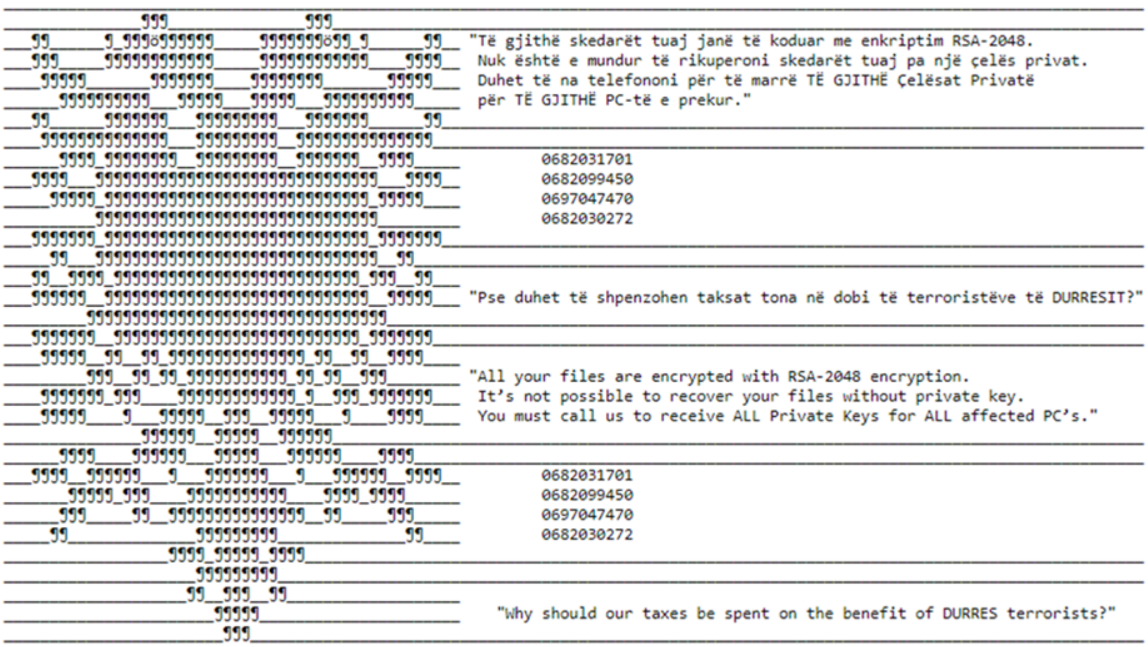
In 2013, Iran's cyber capability was still new. In the years since, however, Tehran's cyber activity has grown bolder and more ambitious, from DDoS attacks to wiper malware to an attempt to undermine the 2020 and 2024 U.S. elections.

Case Study 2

Tehran Targets Tirana

In 2022, Tehran hit Albania with perhaps the most aggressive and disruptive cyberattacks against a foreign government during peacetime to date. In response, Tirana made the unprecedented decision to fully sever diplomatic ties with Tehran.[147] The attacks, part of Iran's larger foreign policy strategy, aimed to retaliate against Albania for offering refuge to thousands of members of the People's Mujahedeen of Iran (Mujahedeen-e-Khalq, or MEK), an Iranian opposition movement that Tehran considers a terrorist organization and a potential threat to the regime. Tirana's 2013 offer of refuge entangled Tirana in the geopolitical standoff between the United States and Iran.[148] In its devastating cyberattacks on Albania, Tehran sent a clear signal that it would seek revenge against those who act against its interests.

On July 15, 2022, Iranian cyber actors calling themselves HomeLand Justice hit the government of Albania with a destructive cyberattack that shut down government services and websites, including the e-Albania portal which then offered 1,225 electronic services to Albanian citizens.[149] Several groups, all of which Microsoft linked to MOIS-affiliated Helix Kitten, conducted the attack. A group Microsoft tracks as DEV-0861 gained initial access to the network in May 2021 and maintained continuous network access for over a year. Throughout that time, DEV-0861 and DEV-0166 accessed and exfiltrated data and harvested credentials from Albanian government networks while moving laterally. Another MOIS-affiliated group, which Microsoft tracks as DEV-0842, deployed both the ransomware and wiper malware (See Figure 2 on page 33). The ransomware image contained an anti-MEK political ransom note, which "closely mirrored the messaging used in cyberattacks against Iran . . . suggesting an intent to signal the attack as a form of retaliation" for earlier attacks.[150] Further, the MEK was planning to host a "Free Iran World Summit" on July 23-24, 2022, in Durrës, Albania. The ransom note referenced Durrës, saying “Why should our taxes be spent on the benefit of DURRES terrorists?”[151]



```
"Të gjithë skedarët tuaj janë të koduar me enkriptim RSA-2048.
 Nuk është e mundur të rikuperoni skedarët tuaj pa një çelës privat.
 Duhet të na telefononi për të marrë TË GJITHË Çelësat Privatë
 për TË GJITHË PC-të e prekur."

        0682031701
        0682099450
        0697047470
        0682030272

"Pse duhet të shpenzohen taksat tona në dobi të terroristëve të DURRESIT?"

"All your files are encrypted with RSA-2048 encryption.
 It’s not possible to recover your files without private key.
 You must call us to receive ALL Private Keys for ALL affected PC’s."

        0682031701
        0682099450
        0697047470
        0682030272

   "Why should our taxes be spent on the benefit of DURRES terrorists?"
```

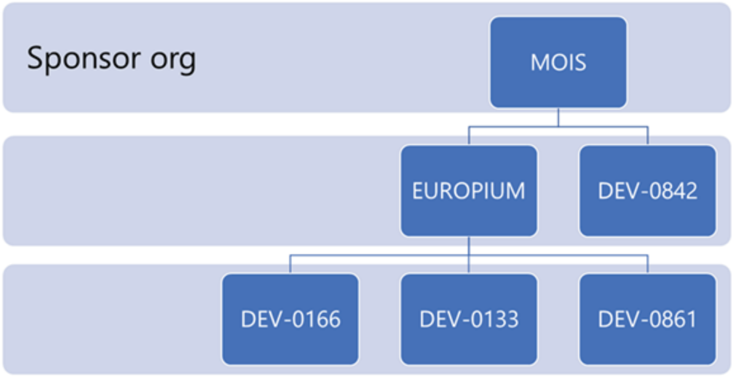
HomeLand Justice ransom note.

Source: Mandiant, “ROADSWEEP Ransomware-Likely Iranian Threat Actor Conducts Politically Motivated Disruptive Activity Against Albanian Government Organizations,” Google Cloud Blog, August 4, 2022, https://www.microsoft.com/en-us/security/blog/2022/09/08/microsoft-investigates-iranian-attacks-against-the-albanian-government.

Leading up to the destructive attack, HomeLand Justice had created a website and various social media profiles on which they circulated anti-MEK messages. Following the attack, the group officially claimed credit and posted videos of the attack on their website. They also leaked Albanian government data between late July and mid-August on the group’s social media accounts.[152]

Despite the severity of the attack, Tirana was able to recover relatively quickly. An Albanian government official highlighted that Iran had aimed to completely paralyze Albania’s government infrastructure, but that Albania was able to prevent the spread of the ransomware and recover most of the data from a backup within a matter of days.[153] On August 12, 2022, the government reported, “All the online public services for the citizens and businesses and government websites in Albania have been fully restored and are normally accessible after almost four weeks of intense counterattacks against a massive and synchronized cyber attack.” The report indicated that 1,214 of the 1,225 services provided on the e-Albania platform were fully accessible, with a few others, such as the ability to issue diplomas, not yet restored.[154]

Figure 2: MOIS-Affiliated Groups Involved in the July 2022 Cyberattack



- DEV-0842 deployed the ransomware and wiper malware.
- DEV-0861 gained initial access and exfiltrated data.
- DEV-0166 exfiltrated data.
- DEV-0133 probed victim infrastructure.

Only a few months later, Tehran targeted Tirana once more. The September 2022 attacks used similar tactics, techniques, and procedures and were "likely done in retaliation for public attribution of the cyber attacks in July."[155] The second attack targeted the Albanian police force's Total Information Management System (TIMS), which stores information about people entering and leaving the country. The attack forced police departments across the country to take the TIMS offline for 24 hours.

Albania benefited from its strong partnerships with the United States and NATO in recovering from these attack; both the U.S. government and private sector partners came to Tirana to help with the investigation and recovery.[156] Albanian Prime Minister Edi Rama tweeted on July 24: "the good news is that the aggression was successfully repelled by an Albanian-American super team, that no data was deleted, that public services are back to work!"[157]

In response to these attack, the Albanian government fully cut diplomatic ties with Tehran, forcing Iranian embassy staff to leave the country within 24 hours.[158] Ties have not been restored. The United States also condemned the attack because it "violated the peacetime norm of not damaging critical infrastructure that the public relied on."[159]

In December 2023, Iran, again posing as HomeLand Justice, attacked the Albanian parliament, ONE Albania, and Air Albania. The attackers used the hashtag #DestroyDurresMilitaryCamp.[160] In February 2024, they attacked the Albanian Institute of Statistics.[161]

These attacks exemplify many tactics commonly associated with Iranian hacking groups, including their use of fake personae to avoid attribution and retaliatory messaging, but they also represent an "aggressive escalatory step," according to Mandiant's vice president of intelligence, John Hultquist. Prior to this attack, Iran had only conducted disruptive cyberattacks in the Middle East, suggesting that the country's risk tolerance for using destructive cyber tools against its adversaries, including those outside of the region, may be increasing. Hultquist also emphasized "whatever deterrents we believe exist between us and them may not exist at all." [162] So, as Tehran continues to increase its cyber capabilities, it will likely be willing to target the United States and its allies with similarly destructive and disruptive cyberattacks.

Case Study 3

Iranian Cyberattacks During the Israel-Hamas War

Before Hamas attacked Israel on October 7, 2023, and Israel subsequently invaded Gaza, Israel was already a top target of Iranian cyberattacks. Following the war's commencement, Iranian actors seemed to use existing accesses to make a statement, even if the connection between the target and the war was slim at best. Iran soon increased the frequency and sophistication of its cyberattacks in order to undercut support for the war and collect intelligence on key decisionmakers.[163] At first, attacks mainly aimed at quickly stirring public discord, but eventually they became more targeted and focused on disruption. Iran's tactics in Israel and against Israeli allies demonstrate key components of its evolving cyber strategy, including its opportunistic operations, use of advanced social engineering campaigns, increasing use of cyber-enabled influence operations, and reliance on proxies.

Immediately following October 7, Iranian threat actors conducted a series of clearly opportunistic cyberattacks combined with influence operations designed to mislead and exaggerate Iranian capabilities and access. Iranian hackers quickly boosted their cyber operations in support of Gaza, utilizing pre-existing access and re-leaking old data. For instance, on October 8, Malek Team—likely an MOIS-affiliated cyber persona—leaked personal data from an Israeli university on Twitter. Without any clear link to the Israel-Hamas conflict, Microsoft Threat Intelligence concluded that the attack was most likely based on preexisting access and was opportunistic in nature; Malek Team saw a new opportunity within its existing capabilities and took it.[164]

Iran also re-leaked old data and published ambiguous details and false information about supposedly successful cyberattacks in state media. For instance, Tasnim News Agency, a news outlet affiliated with the IRGC, stated on Twitter that the CyberAv3ngers attacked Israel's Dorad powerplant "at the same time as the 'Al-Aqsa Storm,'" but the group already had claimed to have conducted a cyberattack against an Israeli electricity company the evening before Hamas's attack. Further, a Kaspersky report found that the images posted on CyberAv3nger's Telegram were from a 2022 attack by Moses Staff, another Iranian group, which has no known affiliation with CyberAv3ngers.[165] The confusing information and false claims of Iran's successes are part of Iran's broader influence operations that seek to intimidate Israel by overstating Iran's capabilities. These attacks—both real and exaggerated—aimed to affect Israeli citizens' and allies' beliefs about the conflict, and thereby their behavior, but did not actually cause significant disruption or damage.

As the war progressed, however, a growing number of groups shifted their focus to Israel, and attacks moved from being opportunistic or fabricated to being more carefully planned and somewhat destructive. Microsoft Threat Intelligence found that 9 groups were targeting Israel during the first week of the war, increasing to 14 groups after two weeks of conflict; the number of attacks more than doubled in the first month. Further, multiple groups affiliated with the IRGC and MOIS focused on the same targets, "suggesting coordination, common objectives set in Tehran, or both."[166]

During this second phase of the war from mid- to late October 2023, Iranian groups conducted more disruptive attacks while continuing to publish misleading and false information and rely on influence activity to exaggerate the effects of their attacks and abilities. For instance, on October 18, the IRGC's Shahid Kaveh Group used custom ransomware to target Israeli security cameras. Soldiers of Solomon, one of Iran's cyber personas, then claimed it had hacked security cameras and stolen data from the Nevatim air base. In actuality, the footage was from nowhere near the military base; it was from a town north of Tel Aviv with a street named Nevatim.[167]

Throughout this period, Iran-linked threat actors continued to use advanced social engineering campaigns to target individuals of strategic interest to the Iranian government. In one instance, Charming Kitten sent emails to a series of targets, pretending to be a notable individual. The group posed as a journalist from a well-known news outlet reporting on the conflict in Gaza. After building rapport, Charming Kitten sent a follow-up email, including a link to a malicious domain. These campaigns targeted research and academic institutions in Belgium, France, Gaza, the United Kingdom, and the United States, and they were first spotted in November 2023.[168]

As the war continued to progress, so too did the scope of Iran's activities. By late November, Iranian groups had begun targeting countries that Iran perceives as supporting Israel, as well as Israeli-made systems in countries around the world. These destructive attacks highlight Tehran's willingness to attack civilian critical infrastructure, its general disregard for international norms, and its willingness to conduct potentially escalatory acts when operating in the cyber domain. In December 2023, the Iranian front HomeLand Justice used wiper malware against Albania's parliament, two local telecommunications companies, and Air Albania (a local airline).[169] Microsoft Threat Intelligence assesses that two MOIS-affiliated groups collaborated on this destructive attack: One provided access to the network and the other executed wiper malware. See the case study on page 32 for more about Iran's attacks on Albania.[170] In another instance, IRGC-affiliated

CyberAv3ngers targeted and compromised programmable logic controllers made by Israeli company, Unitronics. The group hacked a small western Pennsylvania water authority using this Israeli system, warning that "every equipment made in Israel is CyberAv3ngers legal target."[171]

At the same time, Iran's cyber-enabled influence operations also grew more sophisticated, utilizing new advanced techniques. In February 2024, Iranian hackers used artificial intelligence (AI) for the first time as a key component of a cyber-enabled influence campaign. State-backed actor Emennet Pasargad interrupted multiple broadcast channels to broadcast this deepfake. See page 25 for more information about this attack.[172] The threat from Iran is likely to grow as its operations and capabilities continue to advance, becoming more carefully targeted and destructive and utilizing emerging technologies.

About the Authors

Julia Dickson is a research associate with the Intelligence, National Security, and Technology (INT) Program at CSIS. Her research interests include cybersecurity and cybercrime and the role of technology in conflict. Prior to joining CSIS, she was awarded a Fulbright grant and spent a year teaching English in Osh, Kyrgyzstan. She was also previously a research assistant at the Wilson Center, an intern for the Conventional Defense Program at the Stimson Center, and a communications and outreach intern at the International Crisis Group. She holds a BA in international studies with a minor in French from the Johns Hopkins University.

Emily Harding is director of the Intelligence, National Security, and Technology (INT) Program and vice president of the Defense and Security Department at CSIS. As the head of the INT Program, she provides thought leadership on the most critical issues facing intelligence professionals and on the future of intelligence work. She also serves as vice president of the Defense and Security Department, where she is responsible for leading a team of world-renowned scholars providing policy solutions that shape national security. Drawing on her decades of experience in national security, Emily has established herself as an expert on how technology is revolutionizing national security work. Harding has served in a series of high-profile national security positions at critical moments. While serving as deputy staff director on the Senate Select Committee on Intelligence, she led the committee's investigation into Russian interference in the 2016 elections, which was lauded for its bipartisanship. At CIA, she led analysts and analytic programs through moments of crisis, including shepherding the Iraq Group during the attempted Islamic State takeover. During a tour at the National Security Council, she served as director for Iran. After leaving the White House, her team ran the first Office of the Director of National Intelligence-led presidential transition, where she was responsible for briefing the incoming administration. Harding is an adjunct lecturer at the Johns Hopkins School of Advanced International Studies. Her analysis has appeared in the *Wall Street Journal*, BBC, NPR, Bloomberg, and other outlets. Harding holds a master's degree from Harvard University's Kennedy School of Government and a bachelor's degree from the University of Virginia.

Endnotes

[1] Ayman Oghanna, “How Albania Became a Target for Cyberattacks,” *Foreign Policy*, July 24, 2024, https://foreignpolicy.com/2023/03/25/albania-target-cyberattacks-russia-iran/.

[2] “A Cyberattack Targets Albanian Parliament’s Data System, Halting Its Work,” AP News, December 26, 2023, https://apnews.com/article/albania-cyberattack-parliament-iran-cc1a03b58bd753bbe935ad74f1abc0f7.

[3] Alex Campbell et al., “How Does Iran Conceive of Cyber as Part of Its National Strategy?,” Columbia School of International Public Affairs, 2019, https://www.sipa.columbia.edu/how-does-iran-conceive-cyber-part-its-national-strategy.

[4] Mark Thompson, “Iranian Cyber Attack on New York Dam Shows Future of War,” *TIME*, March 24, 2016, https://time.com/4270728/iran-cyber-attack-dam-fbi/.

[5] James P. Farwell and Darby Arkelian, “What Does Iran’s Cyber Capability Mean for Future Conflict?,” *Whitehead Journal of Diplomacy and International Relations* (Winter/Spring 2013), https://ciaotest.cc.columbia.edu/journals/shjdir/v14i1/f_0028742_23336.pdf.

[6] Colin Anderson and Karim Sadjadpour, *Iran’s Cyber Threat: Espionage, Sabotage, and Revernge* (Washington, DC: Carnegie Endowment for International Peace, 2018), https://carnegieendowment.org/files/Iran_Cyber_Final_Full_v2.pdf.

[7] Ibid.

[8] Kim Zetter, “An Unprecedented Look at Stuxnet, the World’s First Digital Weapon,” *Wired*, November 3, 2014, https://www.wired.com/2014/11/countdown-to-zero-day-stuxnet/.

[9] Nicole Perlroth, “Attacks on 6 Banks Frustrate Customers,” *New York Times*, September 30, 2012, https://www.nytimes.com/2012/10/01/business/cyberattacks-on-6-american-banks-frustrate-customers.html; and Thompson, “Iranian Cyber Attack on New York Dam Shows Future of War.”

[10] “Connect the Dots on State-Sponsored Cyber Incidents - Compromise of Saudi Aramco and RasGas,” Council on Foreign Relations, accessed July 25, 2024, https://www.cfr.org/cyber-operations/compromise-saudi-aramco-and-rasgas; and Nicole Perlroth, “In Cyberattack on Saudi Firm, U.S. Sees Iran Firing Back,” *New York Times*, October 24, 2012, https://www.nytimes.com/2012/10/24/business/global/cyberattack-on-saudi-oil-firm-disquiets-us.html.

[11] David E. Sanger, “U.S. Indicts 7 Iranians in Cyberattack on Banks and a Dam,” *New York Times*, March 24, 2016, https://www.nytimes.com/2016/03/25/world/middleeast/us-indicts-iranians-in-cyberattacks-on-banks-and-a-dam.html; “Iran Cyber Threat Overview,” Sekoia (blog), June 5, 2023, https://blog.sekoia.io/iran-cyber-threat-overview/.

[12] Chuck Freilich, “Part 2: Iran’s Cyber Strategy, Institutions, and Capabilities,” in *The Iranian Cyber Threat: The Institutions and Praxis of Iran’s Cyber Strategy* (Washington, DC: Institute for National Security Studies, February 2024), https://www.inss.org.il/wp-content/uploads/2024/02/Part-2.pdf.

[13] Clint Watts, “Iran Accelerates cyber ops against Israel from chaotic start,” Microsoft Threat Analysis Center, February 6, 2024, https://blogs.microsoft.com/on-the-issues/2024/02/06/iran-accelerates-cyber-ops-against-israel/.

[14] “Iran, Russia Agree on Cyber-Defense Cooperation: Official,” Tasnim News Agency, June 13, 2015, https://www.tasnimnews.com/en/news/2015/06/13/768309/iran-russia-agree-on-cyber-defense-cooperation-official.

[15] “Россия и Иран подписали меморандум о сотрудничестве в области связи и ИТ” [Russia and Iran signed a memorandum of cooperation in the field of communications and IT], Министерство цифрового развития, связи и массовых коммуникаций Российской Федерации [Ministry of Digital Development, Communications, and Mass Comunications of the Russian Federation], March 28, 2017, https://digital.gov.ru/ru/events/36659/.

[16] “Iran, Russia Sign Information Security Cooperation Pact,” Ministry of Foreign Affairs of the Islamic Republic of Iran, January 26, 2021, https://en.mfa.ir/portal/NewsView/625777.

[17] Dov Lieber, “Russia Supplies Iran with Cyber Weapons as Military Cooperation Grows,” *Wall Street Journal*, March 27, 2023, https://www.wsj.com/articles/russia-supplies-iran-with-cyber-weapons-as-military-cooperation-grows-b14b94cd.

[18] Golnaz Esfandiari, “Iran to Work With China to Create National Internet System,” Radio Free Europe Radio Library, September 4, 2020, https://www.rferl.org/a/iran-china-national-internet-system-censorship/30820857.html.

[19] James Andrew Lewis, “Iran and Cyber Power,” CSIS, *Commentary*, June 25, 2019, https://www.csis.org/analysis/iran-and-cyber-power.

[20] Campbell et al., “How Does Iran Conceive of Cyber as Part of Its National Strategy?”

[21] “Iran Cyber Threat Overview and Advisories,” Cybersecurity and Infrastrure Agency (CISA), accessed August 24, 2024, https://www.cisa.gov/topics/cyber-threats-and-advisories/advanced-persistent-threats/iran.

[22] Gabi Siboni and Sami Kronenfeld, “Iran’s Cyber Warfare,” Institute for National Security Studies, *INSS Insight*, no. 375 October 15, 2012, https://www.files.ethz.ch/isn/154842/No375_15OCT2012.pdf.

[23] Alex Vatanka, “Whither the IRGC of the 2020s? Is Iran’s Proxy Warfare Strategy of Forward Defense Sustainable?,” New America, January 15, 2021, https://www.newamerica.org/future-security/reports/whither-irgc-2020s/ii-introduction.

[24] Amr Yossef, “Upgrading Iean’s Military Doctrine: An Offensive ‘Forward Defense’,” Middle East Institute, December 10, 2019, https://www.mei.edu/publications/upgrading-irans-military-doctrine-offensive-forward-defense.

[25] A sock puppet is a false online identity. Iranian hackers are known for creating fake social media profiles and emails to have elaborate conversations with their victims. After building trust, the sock puppet sends a malicious link or attachment.

[26] “Social Engineering Remains Key Tradecraft for Iranian APTs,” Insikt Group, March 30, 2022, https://www.recordedfuture.com/blog/social-engineering-remains-key-tradecraft-for-iranian-apts.

[27] Ionut Arghire, “Iranian Spies Maintained Social Media Persona for Years Before Targeting Defense Contractor,” SecurityWeek, July 28, 2021, https://www.securityweek.com/iranian-spies-maintained-social-media-persona-years-targeting-defense-contractor/.

[28] “Israel Busts Iran’s Phishing Network Active in LinkedIn,” Iran International, July 31, 2023, https://www.iranintl.com/en/202307308905.

[29] “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence, February 26, 2024, https://www.microsoft.com/en-us/security/security-insider/intelligence-reports/iran-surges-cyber-enabled-influence-operations-in-support-of-hamas.

[30] “Iran and the Rise of Cyber-Enabled Influence Operations,” Dark Reading, August 16, 2023, https://www.darkreading.com/cybersecurity-operations/iran-and-the-rise-of-cyber-enabled-influence-operations-.

[31] “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

[32] Kat Duffy, Kyle Fendorf, and Cecilia Marrinan, “Cyber Week in Review: February 16, 2024,” Council on Foreign Relations, February 16, 2024, https://www.cfr.org/blog/cyber-week-review-february-16-2024.

[33] “Statement from Director of National Intelligence Avril Haines on Recent Iranian Influence Efforts,” Office of the Director of National Intelligence, July 9, 2024, https://www.dni.gov/index.php/newsroom/press-releases/press-releases-2024/3842-statement-from-director-of-national-intelligence-avril-haines-on-recent-iranian-influence-efforts.

[34] Jose Pagliery, “The inside Story of the Biggest Hack in History,” CNN Money, August 5, 2015, https://money.cnn.com/2015/08/05/technology/aramco-hack/index.html.

[35] “Shamoon (2012),” Cyber Law toolkit, September 17, 2021, https://cyberlaw.ccdcoe.org/wiki/Shamoon_(2012).

[36] Center for Security Studies, *Hotspot Analysis: Iranian cyber-activities in the context of regional rivalries and international tensions* (Zurich: ETH Zurich, May 2019), https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/20190507_MB_HS_IRN%20V1_rev.pdf.

[37] Anderson and Sadjadpour, *Iran’s Cyber Threat*.

[38] “Iran,” Freedom House, 2022, https://freedomhouse.org/country/iran/freedom-net/2022; and Paul Bucala and Caitlin Shayda Pendleton, “Iranian Cyber Strategy: A View from the Iranian Military,” Critical Threats, November 24, 2015, https://www.criticalthreats.org/analysis/iranian-cyber-strategy-a-view-from-the-iranian-military.

[39] Maziar Motamedi, "Iran unveiled plan for tighter internet rules to promote local platforms," Al Jazeera, February 24, 2024, https://www.aljazeera.com/news/2024/2/24/iran-unveils-plan-for-tighter-internet-rules-to-promote-local-platforms.

[40] "Treasury Sanctions Iranian Company Aiding in Internet Censorship," U.S. Department of the Treasury, June 2, 2023, https://home.treasury.gov/news/press-releases/jy1518.

[41] "After internet blackout, Iranians take stock," Al Jazeera, November 27, 2019, https://www.aljazeera.com/economy/2019/11/27/after-internet-blackout-iranians-take-stock.

[42] Raksha Kumar, "As the world focuses on Ukraine, Iran is on the verge of becoming an internet black hole," Reuters Institute for the Study of Journalism, April 5, 2022, https://reutersinstitute.politics.ox.ac.uk/news/world-focuses-ukraine-iran-verge-becoming-internet-black-hole.

[43] Anderson and Sadjadpour, *Iran's Cyber Threat*.

[44] Ibid.

[45] David E. Sanger, "U.S. Indicts 7 Iranians in Cyberattacks on Banks and a Dam," *New York Times*, March 24, 2016, https://www.nytimes.com/2016/03/25/world/middleeast/us-indicts-iranians-in-cyberattacks-on-banks-and-a-dam.html?module=inline; and

"Iran Cyber Threat Overview," Sekoia (blog), June 5, 2023, https://blog.sekoia.io/iran-cyber-threat-overview/.

[46] "Iran threatens retaliation after what it calls possible cyber attacl on nuclear site," Reuters, July 3, 2020, https://www.reuters.com/article/idUSKBN24424H/.

[47] "Treasury Sanctions Actors Responsible for Malicious Cyber Activities on Critical Infrastructure," U.S. Department of the Treasury, February 2, 2024, https://home.treasury.gov/news/press-releases/jy2072.

[48] A. J. Vicens, "How an Iranian-Linked Influence Campaign Pivoted after Oct. 7 Attack on Israel," *CyberScoop* (blog), May 8, 2024, https://cyberscoop.com/how-an-iranian-linked-influence-campaign-pivoted-after-oct-7-attack-on-israel/.

[49] Ibid.

[50] Anderson and Sadjadpour, *Iran's Cyber Threat*.

[51] Anderson and Sadjadpour, *Iran's Cyber Threat*.

[52] Ashley Lane, "Iran's Islamist Proxies in the Middle East," Wilson Center, September 12, 2023, https://www.wilsoncenter.org/article/irans-islamist-proxies.

[53] "Iran Surges cyber-enabled influence operations in support of Hamas," Microsoft Threat Intelligence.

[54] "Iran Cyber Threat Overview and Advisories," CISA, accessed August 26, 2024, https://www.cisa.gov/topics/cyber-threats-and-advisories/advanced-persistent-threats/iran.

[55] Erika Stanish, "Municipal Water Authority of Aliquippa hacked by Iran-backed cyber group," CBS News, November 23, 2023, https://www.cbsnews.com/pittsburgh/news/municipal-water-authority-of-aliquippa-hacked-iranian-backed-cyber-group/.

[56] "Foreign Threats to the 2020 US Federal Elections," National Intelligence Council, March 10, 2021, https://www.dni.gov/files/ODNI/documents/assessments/ICA-declass-16MAR21.pdf.

[57] "Treasury Sanctions Iraian Cyber Actors for Attempting to Influence the 2020 U.S. Presidential Election," U.S. Department of the Treasury, November 18, 2021, https://home.treasury.gov/news/press-releases/jy0494.

58 Office of Public Affairs,, “Two Iranian Nationals Charged for Cyber-Enabled Disinformation and Threat Campaign Designed to Influence the 2020 U.S. Presidential Election,” U.S. Department of Justice, November 18, 2021, https://www.justice.gov/opa/pr/two-iranian-nationals-charged-cyber-enabled-disinformation-and-threat-campaign-designed.

59 Mandiant, “APT42: Crooked Charms, Cons, and Compromises,” Google Cloud, September 7, 2022, https://www.mandiant.com/resources/blog/apt42-charms-cons-compromises.

60 Ofir Rozmann et al., “Uncharmed: Untangling Iran’s APT42 Operations,” Mandiant, Google Cloud, May 1, 2024, https://cloud.google.com/blog/topics/threat-intelligence/untangling-iran-apt42-operations.

61 “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

62 “Iran’s Revolutionary Guards,” Council on Foreign Relations, April 17, 2024, https://www.cfr.org/backgrounder/irans-revolutionary-guards.

63 “Islamic Revolution Guard Corps (IRGC),” National Counterterrorism Center, March 2022, https://www.dni.gov/nctc/ftos/irgc_fto.html.

64 Lewis, “Iran and Cyber Power.”

65 Adam Meyers, “Who is REFINED KITTEN?,” *CrowdStrike* (blog), December 12, 2019, https://www.crowdstrike.com/blog/who-is-refined-kitten/.

66 Jacqueline O’Leary et al., “Insights into Iranian Cyber Espionage: APT33 Targets Aerospace and Energy Sectors and has Ties to Destructive Malware,” Mandiant, September 20, 2017, https://www.mandiant.com/resources/blog/apt33-insights-into-iranian-cyber-espionage.

67 “APT33,” Council on Foreign Relations, accessed August 26, 2024, https://www.cfr.org/cyber-operations/apt-33.

68 Meyers, “Who is REFINED KITTEN?”

69 “Peach Sandstorm password spray campaigns enable intelligence collection at high-value targets,” Microsoft Threat Intelligence, September 14, 2023, https://www.microsoft.com/en-us/security/blog/2023/09/14/peach-sandstorm-password-spray-campaigns-enable-intelligence-collection-at-high-v alue-targets/.

70 Jacqueline O’Leary et al., “Insights into Iranian Cyber Espionage: APT33 Targets Aerospace and Energy Sectors and has Ties to Destructive Malware,” Mandiant, September 20, 2017, https://www.mandiant.com/resources/blog/apt33-insights-into-iranian-cyber-espionage.

71 Thomas Roccia, “Shamoon Attackers Employ New Tool Kit to Wipe Infected Systems,” McAfee, December 19, 2018, https://www.mcafee.com/blogs/other-blogs/mcafee-labs/shamoon-attackers-employ-ne w-tool-kit-to-wipe-infected-systems/.

72 O’Leary et al., “Insights into Iranian Cyber Espionage.”

73 “Charming Kitten,” CrowdStrike, accessed August 26, 2024, https://www.crowdstrike.com/adversaries/charming-kitten/.

74 “Magic Hound,” MITRE Corporation, last updated January 8, 2024, https://attack.mitre.org/groups/G0059/.

75 “Advanced Persistent Threats (APTs),” Mandiant, accessed August 26, 2024, https://www.mandiant.com/resources/insights/apt-groups.

[76] Bryan Lee and Robert Falcone, “Magic Hound Campaign Attacks Saudi Targets,” Unit 42 by Palo Alto Networks, February 15, 2017, https://unit42.paloaltonetworks.com/unit42-magic-hound-campaign-attacks-saudi-targets/.

[77] Eduard Kovacs, “Iranian Spies Target Saudi Arabia in ‘Magic Hound’ Attacks,” SecurityWeek, February 16, 2017, https://www.securityweek.com/iranian-spies-target-saudi-arabia-magic-hound-attacks/.

[78] “Advanced Persistent Threats (APTs),” Mandiant.

[79] Tom Burt, “New cyberattacks targeting U.S. elections,” Microsoft, September 10, 2020, https://blogs.microsoft.com/on-the-issues/2020/09/10/cyberattacks-us-elections-trump-biden/.

[80] “Advisory on cyber espionage against critics of the Iranian regime in Germany,” Federal Office for the Protection of the Constitution, BfV Cyber-Brief Nr. 01/2023, August 10, 2023, https://www.verfassungsschutz.de/SharedDocs/kurzmeldungen/DE/2023/2023-08-10-cyber-brief-01-2023.html?nn=679196#Start.

[81] “Germany says Charming Kitten Hackers target Iran dissidents,” *Deutsche Welle*, August 10, 2023, https://www.dw.com/en/germany-says-charming-kitten-hackers-target-iran-dissidents/a-66493687.

[82] “Imperial Kitten,” CrowdStrike, accessed August 26, 2024, https://www.crowdstrike.com/adversaries/imperial-kitten/; And “Charming Kitten,” CrowdStrike, accessed August 26, 2024, https://www.crowdstrike.com/adversaries/charming-kitten/.

[83] “IMPERIAL KITTEN Deploys Novel Malware Families in Middle East-Focused Operations,” *CrowdStrike* (blog), November 9, 2023, https://www.crowdstrike.com/blog/imperial-kitten-deploys-novel-malware-families/.

[84] Ibid.

[85] Ofir Rozmann, Chen Evgi, and Jonathan Leathery, “When Cats Fly: Suspected Iranian Treat Actor UNC1549 Targets Israeli and Middle East Aerospace and Defense Sectors,” Mandiant, Google Cloud, February 27, 2024, https://cloud.google.com/blog/topics/threat-intelligence/suspected-iranian-unc1549-targets-israel-middle-east.

[86] Mandiant, “APT42: Crooked Charms, Cons, and Compromises,” Google Cloud, September 7, 2022, https://cloud.google.com/blog/topics/threat-intelligence/apt42-charms-cons-compromises.

[87] Ibid.

[88] Rozmann et al., “Uncharmed.”.

[89] Ibid.

[90] Connor Bradbury, “Profiles: Iran’s Intelligence Agencies,” *The Iran Primer*, April 5, 2023, https://iranprimer.usip.org/blog/2023/apr/05/profiles-iran%E2%80%99s-intelligence-agencies.

[91] Maxime A. and Sekoia TDR, “Iranian Cyber Threat Overview,” *Sekoia* (blog), June 5, 2023, https://blog.sekoia.io/iran-cyber-threat-overview.

[92] “Iranian intel cyber suite of malware uses open source tools,” U.S. Cyber Command, January 12, 2022, https://www.cybercom.mil/Media/News/Article/2897570/iranian-intel-cyber-suite-of-malware-uses-open-source-tools/.

[93] “MuddyWater,” SOCRadar, January 2, 2023, https://socradar.io/dark-web-profile-muddywater-apt-group/.

[94] “MERCURY and DEV-1084: Destructive attack on hybrid environment,” Microsoft Threat Intelligence, April 7, 2023, https://www.microsoft.com/en-us/security/blog/2023/04/07/mercury-and-dev-1084-destructive-attack-on-hybrid-environment/.

[95] “MuddyWater,” SOCRadar, January 2, 2023, https://socradar.io/dark-web-profile-muddywater-apt-group/.

[96] Ryan Tomcik, Emiel Haeghebaert, and Tufail Ahmen, “Left on Read: Telegram Malware Spotted in Latest Iranian Cyber Espionage Activity,” Mandiant, Google Cloud, February 24, 2022, https://cloud.google.com/blog/topics/threat-intelligence/telegram-malware-iranian-espionage/.

[97] Simon Kenin, “MiddyWater eN-Able spear-phishing with new TTPs,” Deep Instinct Threat Lab, November 1, 2023, https://www.deepinstinct.com/blog/muddywater-en-able-spear-phishing-with-new-ttps.

[98] “Iranian Government-Sponsored MuddyWater Actors Conducting Malicious Cyber Operations,” CISA, February 24, 2022, https://www.cisa.gov/news-events/alerts/2022/02/24/iranian-government-sponsored-muddywater-actors-conducting-malicious.

[99] Bryan Lee and Robert Falcone, “Behind the Scenes with OilRig,” Unit42, April 30, 2019, https://unit42.paloaltonetworks.com/behind-the-scenes-with-oilrig/.

[100] “Waterbug: Espionage Group Rolls Out Brand-New Toolset in Attack Against Governments,” Symantec, June 20, 2019, https://symantec-enterprise-blogs.security.com/blogs/threat-intelligence/waterbug-espionage-governments.

[101] “Kaspersky experts warn of increase IT supply chain attacks by OilRig APT in the Middle East and Turkiye,” Kaspersky, May 8, 2023, https://me-en.kaspersky.com/about/press-releases/2023_kaspersky-experts-warn-of-increased-it-supply-chain-attacks-by-oilrig-apt-in-the-middle-east-and-turkiye.

[102] Dan Raywood, “Iran’s APT34 Hits UAE With Supply Chain Attack,” Dark Reading, August 2, 2023, https://www.darkreading.com/cyberattacks-data-breaches/iran-apt34-uae-supply-chain-attack.

[103] “Advanced Persistent Threats (APTs),” Mandiant.

[104] “Treasury Sanctions Iranian Ministry of Intelligence and Minister for Malign Cyber Activities,” U.S. Department of the Treasury, September 9, 2022, https://home.treasury.gov/news/press-releases/jy0941.

[105] “Chafer: Latest Attacks Reveal Heightened Ambitions,” Symantec, February 28, 2018, https://symantec-enterprise-blogs.security.com/threat-intelligence/chafer-latest-attacks-reveal-heightened-ambitions.

[106] Liviu Arsene, “Iranian Chafer APT Targeted Air Transportation and Government in Kuwait and Saudi Arabia,” Bitdefender, May 21, 2020, https://www.bitdefender.com/blog/labs/iranian-chafer-apt-targeted-air-transportation-and-government-in-kuwait-and-saudi-arabia/.

[107] “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

[108] Or Chechik et al., “Agonizing Serpens (Aka Agrius) Targeting the Israeli Higher Education and Tech Sectors,” Unit 42 at Palo Alto Networks, November 6, 2023, https://unit42.paloaltonetworks.com/agonizing-serpens-targets-israeli-tech-higher-ed-sectors/.

[109] Dan Raywood, “Iran-Linked Agrius APT Group Targets Israeli Education, Tech Sectors,” Dark Reading, November 7, 2023, https://www.darkreading.com/cyberattacks-data-breaches/iran-linked-agrius-apt-group-israeli-education-tech-sectors.

[110] “Hexane,” Mitre Corporation, accessed August 26, 2024, https://attack.mitre.org/groups/G1001/.

[111] “Lyceum takes Center Stage in Middle East Campaign,” Secureworks, August 27, 2019, https://www.secureworks.com/blog/lyceum-takes-center-stage-in-middle-east-campaign.

[112] “New Iranian Espionage Campaign by ‘Siamesekitten’–Lyceum,” ClearSky, August 17, 2021, https://www.clearskysec.com/siamesekitten/.

113 Alex Orleans, “Who Is PIONEER KITTEN?,” CrowdStrike, August 31, 2020, https://www.crowdstrike.com/blog/who-is-pioneer-kitten/.

114 “Iran Based Threat Actor Exploits VPN Vulnerabilities,” CISA, September 15, 2020, https://www.cisa.gov/news-events/cybersecurity-advisories/aa20-259a.

115 Joseph Menn, “Oiran gained access to election result website in 2020, military reveals,” *Washington Post*, April 24, 2020, https://www.washingtonpost.com/technology/2023/04/24/election-2020-iran-hacking/. AJ Vicens, “Microsoft says Iranian hackers combined influence ops with hacking for maximum impact,” Cyberscoop, May 2, 2023, https://cyberscoop.com/iranian-information-operations-hacking-microsoft-report/.

116 “Treasury Sanctions Senior Iranian Officials Overseeing Violent Protest Suppression and Censorship,” U.S. Department of the Treasury, April 24, 2023, https://home.treasury.gov/news/press-releases/jy1436.

“Supreme Council of Cyberspace,” United Against Nuclear Iran, accessed August 26, 2024, https://www.unitedagainstnucleariran.com/sanctioned-person/supreme-council-of-cyberspace-scc.”

117 “Iran,” Center for Internet and Society at Stanford Law School, accessed August 26, 2024, https://wilmap.stanford.edu/country/iran.

118 Catherine A. Theohary, “Iranian Offensive Cyber Attack Capabilities,” Congressional Research Service, IF11406, January 13, 2020, https://sgp.fas.org/crs/mideast/IF11406.pdf.

119 “Treasury Sanction Individuals and Entities for Human Rights Abuses and Censorship in Iran, and Support to Sanctioned Weapons Proliferators,” U.S. Department of the Treasury, January 12, 2018, https://home.treasury.gov/news/press-releases/sm0250.

120 Farzin Nadimi, “Iran’s Passive Defense Organization: Another Target for Sanctions,” Washington Institution for Near East Policy, August 16, 2018, https://www.washingtoninstitute.org/policy-analysis/irans-passive-defense-organization-another-target-sanctions.

121 Tim Maurer, Cyber Mercenaries: The State, Hackers, and Power (Cambridge: Cambridge University Press, 2018).

122 Campbell et al., “How Does Iran Conceive of Cyber as Part of Its National Strategy?”

123 “Treasury Sanctions Iranian Cyber Actors for Malicious Cyber-Enabled Activities Targeting Hundreds of University,” U.S. Department of the Treasury, March 23, 2018, https://home.treasury.gov/news/press-releases/sm0332.

124 “Treasury Sanctions IRGC-Affiliated Cyber Actors for Roles in Ransomware Activity,” U.S. Department of the Treasury, September 14, 2022, https://home.treasury.gov/news/press-releases/jy0948.

125 “Profiling DEV-0270: PHOSPHORUS’ ransomware operations,” Microsoft Threat Intelligence, September 7, 2022, https://www.microsoft.com/en-us/security/blog/2022/09/07/profiling-dev-0270-phosphorus-ransomware-operations/.

126 “Treasury Sanctions IRGC-Affiliated Cyber Actors for Roles in Ransomware Activity,” the U.S. Department of the Treasury, September 14, 2022, https://home.treasury.gov/news/press-releases/jy0948.

127 “U.S. Sanctions Iran for Election Hacking,” U.S. Institute of Peace, *The Iran Primer*, November 19, 2021, https://iranprimer.usip.org/blog/2021/nov/18/us-sanctions-iran-election-hacking.

128 “Iranian Cyber Group Emennet Pasargad Conducting Hack-and-Leak Operations Using False-Flag Personas,” Federal Bureau of Investigation, October 20, 2022, https://www.ic3.gov/Media/News/2022/221020.pdf.

129 “Treasury Sanctions Iran Cyber Actors for Attempting to Influence the 2020 U.S. Presidential Election,” U.S. Department of the Treasury, November 18, 2021, https://home.treasury.gov/news/press-releases/jy0494.

130 Catalin Cimpanu, “US charges Iranian hackers for spoofed Proud Boys emails threatening US voters,” The Record, November 17, 2021, https://therecord.media/us-charges-iranian-hackers-for-spoofed-proud-boys-emails-threatening-us-voters.

131 “FBI Releases Cybersecurity Advisory on Previously Undisclosed Iranian Malware Used to Monitor Dissidents and Travel and Telecommunicaitons Companies,” Federal Bureau of Investigation, September 17, 2020, https://www.fbi.gov/contact-us/field-offices/boston/news/press-releases/fbi-releases-cybersecurity-advisory-on-previously-undisclosed-iranian-malware-used-to-monitor-dissidents-and-travel-and-telecommunications-companies.

132 “Seven Iranians Working for Islamic Revolutionary Guard Corps-Affiliated Entities Charged for Conducting Coordinated Campaign of Cyber Attacks Against U.S. Financial Sector,” U.S. Department of the Treasury, March 24, 2016, https://www.justice.gov/opa/pr/seven-iranians-working-islamic-revolutionary-guard-corps-affiliated-entities-charged.

133 “Treasury Sanctions Iranian Officials and Entities Responsible for Ongoing Crackdown on Protests and Internet Censorship,” U.S. Department of the Treasury, October 26, 2022, https://home.treasury.gov/news/press-releases/jy1048.

134 “IRGC-Affiliated Cyber Actors Exploit PLCs in Multiple Sectors, Including U.S. Water and Wastewater Systems Facilities,” CISA, December 1, 2023, https://www.cisa.gov/news-events/cybersecurity-advisories/aa23-335a.

135 “Dark Web Profile: CyberAv3ngers,” SOCRadar, December 22, 2023, https://socradar.io/dark-web-profile-cyber-av3ngers/.

136 AJ Vicens, “U.S. government sanctions Iranian officials over Pennsylvania water facility hack,” Cyberscoop, February 2, 2024, https://cyberscoop.com/u-s-government-sanctions-iranian-officials-over-pennsylvania-water-facility-hack/.

137 “Dark Web Profile: Haghjoyan,” SOCRadar, December 28, 2023, https://socradar.io/dark-web-profile-haghjoyan/.

138 “Dark Web Profile: Cyber Toufan Al-aqsa,” SOCRadar, December 28, 2023, https://socradar.io/dark-web-profile-cyber-toufan-al-aqsa/; “Claims of cyberattack on Israeli power plant found to be false: Report,” *The Hindu*, October 18, 2023, https://www.thehindu.com/sci-tech/technology/gadgets/claims-of-cyberattack-israeli-power-plant-false/article67433778.ece.

139 “Dark Web Profile: Cyber Toufan Al-aqsa,” SOCRadar, December 28, 2023, https://socradar.io/dark-web-profile-cyber-toufan-al-aqsa/.

140 Nate Nelson, “’Cyber Toufan’ Hacktivists Leaked 100-Plus Israeli Orgs in One Month,” Dark Reading, January 4, 2024, https://www.darkreading.com/cyberattacks-data-breaches/-cyber-toufan-hacktivists-leaked-100-plus-israeli-orgs-in-one-month.

141 Connor Simpson, “Sheldon Adelson Has an Idea: Lob a Nuclear Bomb in the Iranian Desert,” *The Atlantic*, October 23, 2013, https://www.justice.gov/opa/pr/north-korean-regime-backed-programmer-charged-conspiracy-conduct-multiple-cyber-attacks-and.

142 Ibid.

143 Sean Gallagher, “Iranian Hackers Used Visual Basic Malware to Wipe Vegas Casino’s Network,” Ars Technica, December 12, 2014, https://arstechnica.com/information-technology/2014/12/iranian-hackers-used-visual-basic-malware-to-wipe-vegas-casinos-network/.

144 “Iran’s Cyber Attack on Billionaire Adelson Provides Lesson on Strategy,” Claims Journal, January 6, 2020, https://www.claimsjournal.com/news/national/2020/01/06/294849.htm.

145 Jose Pagliery, “Iran Hacked an American Casino, U.S. Says,” CNN Money, February 27, 2015, https://money.cnn.com/2015/02/27/technology/security/iran-hack-casino/index.html.

146 “North Korean Regime-Backed Programmer Charged With Conspiract to Conduct Multiple Cyber Attacks and Intrusions,” Office of Public Affairs, U.S. Department of Justice, September 6, 2018, https://www.justice.gov/opa/pr/north-korean-regime-backed-programmer-charged-conspiracy-conduct-multiple-cyber-attacks-and.

147 Ayman Oghanna, “How Albania Became a Target for Cyberattacks,” *Foreign Policy*, March 25, 2023, https://foreignpolicy.com/2023/03/25/albania-target-cyberattacks-russia-iran/.

148 Harun Karclc, “How Albania Ended Up in Iran’s Cyber Crosshairs,” *Foreign Policy*, November 8, 2022, https://foreignpolicy.com/2022/11/08/albania-iran-cyberattack-mek-us-israel/.

149 “e-Albania Partially Restored after Cyber Attack,” Albanian Daily News, July 20, 2022, https://albaniandailynews.com/news/e-albania-partially-restored-after-cyber-attack.

150 “Microsoft investigates Iranian attacks against the Albanian government,” Microsoft, April 2023, https://www.microsoft.com/en-us/security/blog/2022/09/08/microsoft-investigates-iranian-attacks-against-the-albanian-government/.

151 A. J. Vicens, “Hackers Deploy New Ransomware Tool in Attacks on Albanian Government Websites,” CyberScoop, August 4, 2022, https://cyberscoop.com/iran-hack-albania-ransomware-mek/.

152 “Iranian State Actors Conduct Cyber Operations Against the Government of Albania,” U.S. Department of Justice and the Cybersecurity and Infrastructure Security Agency, September 21, 2022, https://cisa.gov/sites/default/files/publications/aa22-264a-iranian-cyber-actors-conduct-cyber-operations-against-the-government-of-albania.pdf.

153 Interview with General Director of the National Authority on Electronic Certification and Cybersecurity of Albania and National Coordinator for Cyber Security, October 13, 2023.

154 “Online Services Via e-Albania Portal Rully Restored,” Government of Albania, August 12, 2022, https://www.kryeministria.al/en/newsroom/sherbimet-publike-online-rikthehen-ne-normalitet-te-plote-ne-e-albania.

155 “Iranian State Actors Conduct Cyber Operations Against the Government of Albania,” CISA, September 23, 2022, https://www.cisa.gov/news-events/cybersecurity-advisories/aa22-264a.

156 “Albania cuts Iran ties over cyberattack, U.S. vows further action,” Reuters, September 7, 2022, https://www.reuters.com/world/albania-cuts-iran-ties-orders-diplomats-go-after-cyber-attack-pm-says-2022-09-07/.

157 “Lajmi i mirë është se agresioni është zmbrapsur me sukses nga një superskuadër shqiptaro-amerikane, se asnjë e dhënë nuk është fshirë, se shërbimet publike janë kthyer në punë! Vazhdon operacioni i forcimit të mureve mbrojtëse dhe hetimit për identifikimin e sigurtë të agresorit!” Edi Rama, Twitter post, July 24, 2022, 9:08 am, https://twitter.com/ediramaal/status/1551192528669605888.

158 Elona Elezi, “Albania blames Iran for cyberattacks,” *Deutsche Welle*, September 16, 2022, https://www.dw.com/en/albania-once-again-the-target-of-cyberattacks-after-cutting-diplomatic-ties-with-iran-and-expelling-diplomats/a-63146285.

159 “Albania cuts Iran ties over cyberattack, U.S. vows further action,” Reuters, September 7, 2022, https://www.reuters.com/world/albania-cuts-iran-ties-orders-diplomats-go-after-cyber-attack-pm-says-2022-09-07/.

160 “Pro-Iranian Hacker Group Targeting Albania with No-Justice Wiper Malware,” The Hacker News, January 6, 2024, https://thehackernews.com/2024/01/pro-iranian-hacker-group-targeting.html.

161 Llazar Semini, “A cyberattack targets Albanian Parliament’s data system, halting its work,” Associated Press, December 26, 2023, https://apnews.com/article/albania-cyberattack-parliament-iran-cc1a03b58bd753bbe935ad74f1abc0f7; and “Albanian authorities accurse Iranian-backed hackers of cyberattack on Institute of Statistics,” Associated Press, February 14, 2024, https://apnews.com/article/albania-iran-hackers-cyberattack-statistics-e80780e2d927394589c3d8903e36d066.

162 Lily Hay Newman, “An Attack on Albanian Government Suggests New Iranian Aggression,” *Wired*, August 4, 2022, https://www.wired.com/story/iran-cyberattack-albania/.

163 “Tool of First Resort: Israel-Hamas War in Cyber,” Google, February 2024, https://services.google.com/fh/files/misc/tool-of-first-resort-israel-hamas-war-cyber.pdf.

164 “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

165 Securelist, “A hack in hand is worth two in the bush,” AO Kaspersky Lab, 16 October 2023, https://securelist.com/a-hack-in-hand-is-worth-two-in-the-bush/110794/.

166 “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

167 “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

168 James Coker, “Iranian Phishing Campaign Targets Israel-Hamas War Experts,” Infosecurity Magazine, January 18, 2024, https://www.infosecurity-magazine.com/news/iranian-phishing-israel-hamas/.

169 Daryna Antoniuk, “Wiper malware found in analysis or Iran-linked attacks on Albanian institutions,” The Record, January 8, 2024, https://therecord.media/albania-parliament-telecoms-airline-cyberattacks-wiper-malware.

170 “Iran Surges cyber-enabled influence operations in support of Hamas,” Microsoft Threat Intelligence.

171 “IRGC-Affiliated Cyber Actors Exploit PLCs in Multiple Sectors, Including U.S. Water and Wastewater Systems Facilities,” CISA, December 1, 2023, https://www.cisa.gov/news-events/cybersecurity-advisories/aa23-335a; and Vicens, “U.S. government sanctions Iranian officials over Pennsylvania water facility hack.”

172 Dan Milmo, “Iran-backed hackers interrupt UAE TV streaming services with deepfake news,” *The Guardian*, February 8, 2024, https://www.theguardian.com/technology/2024/feb/08/iran-backed-hackers-interrupt-uae-tv-streaming-services-with-deepfake-news.

COVER PHOTO LEENA MARTE/CSIS; MOCKO/ADOBE STOCK

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

1616 Rhode Island Avenue NW
Washington, DC 20036
202 887 0200 | **www.csis.org**