U.S. Coast Guard Academy – School of Leadership & Management

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Digital Transformation of USCG Drug Interdiction Operations

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Abstract

This paper explores ways for the United States Coast Guard to digitize the drug interdiction mission using modernized technology including drones and neural networks for vessel anomaly detection. It aims to demonstrate the need for more effective hit rates and busts due to the vast number of overdoses facing American citizens with the influx of fentanyl making it to the country. Through research, we synthesized these possible solutions to increase yields, accuracy, and efficiency in drug interdiction operations. First, we examined the use of flying drones to locate drug traffickers and track their courses. Second, we investigated the application of submersible drones for underwater detection. Finally, we theorized using artificial intelligence to analyze Coast Guard data and predict the actions of drug traffickers. These digital approaches offer promising advancements in operational effectiveness and can truly help to mitigate the amounts of narcotics making it into the United States leading to overdoses and many deaths.

Background

Drug smugglers have been using the Gulf of America and Gulf of California to smuggle drugs into the United States for decades. Fueled by the high demand and the rewards for selling, drug smugglers have continued to adapt and find better ways to elude the United States Border Patrol and United States Coast Guard.

In the early 1970s when drug smugglers from Mexico and Columbia started to smuggle cocaine and marijuana in the United States, they used a variety of methods. From planes, to boats, and trucks. At the time there was very little border patrol, so drug smuggling did not have the same sophistication as today. They would simply have them in bags in trucks, planes, and boats. However, in 1982, with the creation of the South Florida Drug Task Force there was an increase

of security in the region causing many cartels to try to develop the method that they use to transport drugs. The cartels began to use a variety of methods to hide their shipments. One that they found very effective was to simply load up drugs on a very fast boat and have it run across the Gulf of America at night. They also started using semi-submersible which are not as obvious to the naked eye. With these new challenges arising, the United States Coast Guard and United States Border Patrol are looking for new strategies to effectively stop the smuggling of illegal drugs into the United States.

As the drug trafficking technology has advanced so has the technology used by the United States Military. While the use of unmanned arial vehicles (drones) dates to World War One in the past 10 years there have been serval large advancements on the capabilities of smaller more portable drones. In the early 2000s, drones that were used for surveillance were the size of small airplanes. Now, there are drones that can fit into a backpack. Drones like the RQ-11 and the Puma AE are equipped with cameras that can see small details even from high up in the air and are able to transmit real time video feed.

Over the years drug smuggling has caused an increasingly challenging issue for the United States as the numbers of military personnel and needed recourses are significantly depleted. The United States Coast Guard is the primary United States force that works on drug interdiction operations and has been spearheading the issue for decades. They primarily focus on search operations and interdiction to prevent the drug trafficking to the United States. Currently, the United States Coast Guard predominately uses search patterns and boarding teams to interdict vessels and seize illegal narcotics. One of the current concerns with the United States Coast Guard's drug interdiction operations, is that search patterns can be time-consuming and ineffective, making it difficult to locate and intercept suspected drug smuggling vessels (Campos, 2014). To

help mitigate this issue and aid in the cutter man's ability to track vessels, the United States Coast Guard has been working on newer technology called SeaWatch to help cutters improve situational awareness and tracking abilities on ships. This new technology in time should be able to improve the United States Coast Guard's ability to accurately locate and track vessels (United States Coast Guard, 2021). Additionally, in February of 2025 the President increased military presence at the boarder to allow the United States Navy to work with the United States Coast Guard to utilize unmanned sea drones to help search, locate, and track smugglers as they are coming into the United States (Phillips, 2025). This additional technology and support from the Navy have increased the United States Coast Guard's abilities to respond and react accordingly to the issue at hand. With the United States Coast Guard being the primary United States force that interdicts drugs, they require advanced techniques and technologies such as SeaWatch and sea drones to track, locate, and interdict vessels and smugglers as they attempt to bring illicit narcotics into the United States.

Problem Statement

While drug interdiction is one of the primary missions of the United States Coast Guard and it has been highly successful with about "52% of the total United States government seizures of cocaine," it could be improved with the advanced use of technology that has become available today (100 Pickman and Howard, 2020). Additionally with the increases in illegal drugs and contraband these issues are continuing to become more complex and adversaries more challenging than ever before (100 Pickman and Howard, 2020). According to the department of homeland security, "In April 2021, provisional data suggested that, for the first time, the number of United States overdose-related deaths had surpassed 100,000 over a 12-month period, with 75,673 of those attributed to opioids, particularly fentanyl" (2 Kusnezov et al, 2023) demonstrating the necessity for improved interdiction methods. While 52% is an impressive success rate, there are

still many civilians being impacted by the illicit trafficking of drugs into the United States. The problem the United States Coast Guard faces today is an evolving threat that uses technology and all available means to traffic and smuggle contraband on the high seas. Additionally, the United States Coast Guard faces a tremendous issue when it comes to the pure outnumbering of United States Coast Guard personnel to drug traffickers as pictured below (see Figure 1) showing just one seizure by the United States Coast Guard of approximately 54,500 pounds of cocaine and 15,800 pounds of marijuana. It is nearly impossible for units to track all drugs coming across the boarders without more effective ways of locating them and predicting their traveling routes. Historically, the United States Coast Guard has been effective, but it needs to adapt and digitally transform to combat the advancing threats.

Figure 1

United States Coast Guard Drug Seizure

Note. Picture from Navy Times, (2022). https://www.navytimes.com/news/your-navy/2022/05/05/new-ruling-threatens-coast-guards-high-seas-counter-drug-mission/.

There are several areas of the United States Coast Guard that could be digitally transformed to increase effectiveness in counter drug operations, primarily the use of air and sea drones. Drones are already being used to track and research sea life such as sharks, whales and dolphins. A recent

study used drones to conduct: "an average of 90 survey flights ... during each three-week field trip, capturing approximately 25,000 images...scientists successfully identified 149 animals" (Fearon, 2021). Another demonstrates how European nations are using unmanned drones to search for people lost at sea: "This research aims to design a drowning recognition model for ocean surveillance and rescue in the event of people in danger in the sea" (2 Rakotondraibe, Fang, Saniie, n.d). Both these uses of unmanned drones demonstrate an effective use of emerging technology to solve real world problems and show that it is possible to use them to detect humans as well as wildlife. This could be further extended to the recognition of vehicles' movement patterns and traffickers through facial recognition. AI neural networks are currently being studied to detect vessel movement and anomaly detection. These neural networks are a type of machine learning that can use pattern recognition to make decisions and detect. Radar data and vessel type are used as a baseline for deep learning (Czaplewski and Dzwonkowski, 2022). The study previously mentioned could be used with unmanned drones to create an effective targeting method for vessels with illicit drugs.

Thesis

The United States Coast Guard's current mission of drug interdiction while successful compared to other governmental agencies could be greatly improved using unmanned drones trained on AI neural networks to detect vessel movement anomalies, individuals with trafficking records, and vessels that are already being tracked for repeated offenses.

Methodology

This paper aims to provide a strategy to increase the effectiveness of the United States Coast Guard's drug interdiction mission using unmanned drones and AI neural networks as a

digital transformation. The methodology section outlines the research design and analysis strategies used to explore the topic.

A mixed methodology approach was used including research documented by scholars and information technology professionals. These reports were synthesized into an analysis that gained an insight into the need for increased effective operations within the drug interdiction mission and targeted technology that could be used to improve this.

Data was collected through a synthesis of research of emerging technologies and networks that could improve vessel detection as well as a current state of the illicit trafficking crisis. Scholarly journals, articles and governmental reports were analyzed to provide support for the study. Data was analyzed by looking at a broad range of data then narrowing it down to specific issues. This began with the initial state, and narrowing the focus to drug interdiction and how unmanned drones could allow for broader digitization. Then analyzing the target outcome and researching a potential solution through digitization of the current state.

Limitations include a lack of access to classified material about United States Coast Guard assets and their current capabilities. While there are estimates of how many drugs get through, a challenge is that not all deaths can be accurately counted and attributed to drug overdoses or the trafficking that occurs across the borders.

Possible solutions

The United States Coast Guard has had a steady increase in drug interdiction missions for decades, and as the cartels continue in their advancements there is an increased need for high-tech solutions. The United States Coast Guard operates on a man-to-man basis; they require boots on the ground to interdict and track the smuggled drugs across the border; the only problem is that

one of limitations of the United States Coast Guard is its need for more personnel as the influx of drug smuggling has significantly increased over the years.

One of the solutions to the problem at hand is to utilize moder-day technology to our benefit. Drones have been a major industry in the military for many decades, and they are used across a wide variety of missions throughout all branches. The Army, Navy, Marines, and Air Force use drones to complete their missions daily, and the United States Coast Guard could significantly benefit from adopting this technology. Through the development of unmanned underwater sea drones, the United States Coast Guard could locate, intercept, and track drug smuggling vessels much quicker and provide real-time coordinated information to deployable units to help pick up vessels and smugglers much more efficiently. Fox News recently reported that with the increased presence at the border, cartels have been looking for alternative routes to smuggle drugs. The article also discussed how with this shift, the United States Coast Guard can utilize unmanned sea drones to fill in any gaps in surveillance coverage to aid in the tracking and interdiction of drug smuggling vessels (Phillips, 2025). Modern-day technology such as drones provides an avenue of coverage much more advanced and thorough, that can aid in a significant benefit for the United States Coast Guard. With advanced tools such as underwater unmanned sea drones, the United States Coast Guard could significantly deplete the number of drugs that make it across the border protecting United States citizens and preventing the drug epidemic from spreading further.

When it comes to improving Maritime Drug Interdiction, the United States Coast Guard needs a concrete plan when it comes to preparation and intelligence gathering. Another way of utilizing our technology and cyber warfare in drug interdiction is by maximizing Geospatial Analysis with Artificial Intelligence for tracking drug trafficking routes and making a connection with satellite imagery to monitor suspicious activities. This research encourages the United States

Coast Guard to maximize collaboration with the National Geospatial-Intelligence Agency (NGA) to effectively use cutting-edge technology. Together with proper and cohesive geospatial analysis and cyber awareness training for certain units. According to OMEN, artificial intelligence (AI), open-source intelligence (OSINT), and geospatial intelligence (GEOINT) are currently being embraced by law enforcement agencies all over the world (OMEN, 2025). An effective use would be to map and analyze smuggling routes and hotspots. In this way, the USCG may control the high ground against drug cartels and syndicates by predicting their next steps even before it has commenced.

To aid in the United States Coast Guard's ability to interdict drug smuggling vessels, crews need the ability to be able to track vessels in real-time. One solution to increasing the crew's capabilities is to implement more advanced technologies and tracking devices on the cutters themselves. In an article published by the United States Coast Guard, they discuss how vessels are instituting a program called SeaWatch which is a control system that improves situational awareness and tracking (United States Coast Guard, 2021). SeaWatch systems generate overlays on electronic chart displays to give accurate navigational information and assist deployable units in accurately locating the suspected vessels (United States Coast Guard, 2021). Through implementing this system on all cutters, the United States Coast Guard will improve their abilities to locate, track, and interdict drug smuggling vessels through the combined information sensors and displays on the system. Advanced technologies such as SeaWatch significantly assist vessels as they gather information and use it to provide real-time information to boarding team crews.

Conclusion

Overall, the drug interdiction mission the United States Coast Guard performs is essential and in need of digital transformation. This need comes from the fact that cartels continue to find new ways to smuggle illicit materials into the United States and there are many deaths related to drug overdoses. The path forward based on this research is to use unmanned drones trained on AI neural networks to detect vessel movement anomalies, individuals with trafficking records, and vessels that are already being tracked for repeated offenses. This would allow for the United States Coast Guard to improve hit rate on vessels trafficking narcotics and decrease deaths related to overdoses in the United States.

Additionally, utilizing unmanned drones both in the air and sea will provide more resources for the Coast Guard without needing more personnel on the ground. Utilizing modern technology gives the military many advantages when it comes to keeping their members safe and provides more detailed and specific reports that humans cannot always obtain. The United States Coast Guard needs more advanced ways to counter the drug trafficking problem, and unmanned drones with advanced technological recourses, will significantly aid in their abilities to combat this mission.

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