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CONSIDER USING EMERGING TECHNOLOGY
AS A BETTER WAY OF MANAGING ITS BORDER?**

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Monterey, CA; Naval Postgraduate School

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**NAVAL
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MONTEREY, CALIFORNIA

THESIS

**SHOULD THE GOVERNMENT OF BELIZE CONSIDER
USING EMERGING TECHNOLOGY AS A BETTER
WAY OF MANAGING ITS BORDER?**

by

Ivan C. Locario

December 2022

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC, 20503.			
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE December 2022	3. REPORT TYPE AND DATES COVERED Master's thesis	
4. TITLE AND SUBTITLE SHOULD THE GOVERNMENT OF BELIZE CONSIDER USING EMERGING TECHNOLOGY AS A BETTER WAY OF MANAGING ITS BORDER?			5. FUNDING NUMBERS
6. AUTHOR(S) Ivan C. Locario			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING / MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.			12b. DISTRIBUTION CODE A
13. ABSTRACT (maximum 200 words) As the world evolves and becomes more complex, border protection has become increasingly crucial for the safety of a nation. Belize's investment in border security has continuously been a topic of interest since its independence in 1981. This thesis investigates whether the use of emerging technology will assist the government of Belize in creating a better method of managing security at its border. It found that countries using the technology might have advantages countering transnational criminal organizations and managing their borders. Using biometrics and sensors (ground and aerial) to detect and deter cross-border illegalities on Belize's western border might help to control that border. It is recommended that Belize do further research and analysis into the use of emerging border technology and plan and prepare to implement the technology.			
14. SUBJECT TERMS emerging technology, national security, stakeholders, national security, privacy, ethical implications, border surveillance			15. NUMBER OF PAGES 117
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

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**SHOULD THE GOVERNMENT OF BELIZE CONSIDER USING EMERGING
TECHNOLOGY AS A BETTER WAY OF MANAGING ITS BORDER?**

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Major, Belize Army
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Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF SCIENCE IN DEFENSE ANALYSIS
(IRREGULAR WARFARE)**

from the

**NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

As the world evolves and becomes more complex, border protection has become increasingly crucial for the safety of a nation. Belize's investment in border security has continuously been a topic of interest since its independence in 1981. This thesis investigates whether the use of emerging technology will assist the government of Belize in creating a better method of managing security at its border. It found that countries using the technology might have advantages countering transnational criminal organizations and managing their borders. Using biometrics and sensors (ground and aerial) to detect and deter cross-border illegalities on Belize's western border might help to control that border. It is recommended that Belize do further research and analysis into the use of emerging border technology and plan and prepare to implement the technology.

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LIST OF ACRONYMS AND ABBREVIATIONS

BDF	Belize Defence Force
CBP	Customs and Border Patrol
DHS	Department of Homeland Security
FCD	Friends for Conservation Development
GNA	Argentine National Gendarmerie
GPS	global positioning system
IDENT	identify criminal aliens and repeat crossers
IWT	illegal wildlife trade
NGO	non-governmental organizations
OAS	Organization of American States
SIA	special interest aliens
SINAI	National Intelligence System
SISFRON	Integrated Border Monitoring System
SWB	southwest border
TBA	Tri-Border Area
TCO	transnational criminal organizations
UAV	unmanned aerial vehicles
UN	United Nations
USD	United States dollar

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EXECUTIVE SUMMARY

Should the government of Belize consider using emerging technology as a better way of managing its border? The research has shown that countries using emerging border technology may have more control over what occurs on their borders.

The research explores Belize's western border and the issue of cross-border illegalities and transnational crime. It looks at what border control measures presently exist in Belize and the reason behind the porous condition of the country's borders. Next, the research delved into two case studies, (1) South America Tri-Border Area (TBA) and (2) United States (U.S.)-Mexico Border, to see if the use of emerging border technology created better methods of management. The TBA comprises three countries, of which two are using the technology. In contrast, the other country is dependent on its partner's technology. The U.S.-Mexico border case study solely focuses on the method employed by the U.S. The research then compares its findings, looking at what method can be implemented in Belize. Note that the study focused on two technological devices: biometrics and motion sensors (ground and aerial).

According to the research, nations that use cutting-edge border technology may have more control over what happens at their borders. It does not show direct correlation between the technology and reduction in border crime or apprehensions, however. In the TBA the technology has reduced the number of troops being utilized and has reduced crime over the past decade. On the other hand, using the technology on the U.S.-Mexico border requires additional human resources to operate and maintain the equipment and respond to border issues. Furthermore, although the technology assists in better border control, it is very expensive to maintain.

Belize has suffered from similar border problems to the countries presented in the study and might benefit from increasing its use of technology. The TBA uses biometric technology at legal ports of entry that assist with facial recognition and license plate readers; this technology is needed in Belize. Aerial detecting sensors offering real-time correspondence to security forces on the ground are also being used in the TBA. If used in

Belize, this technology would allow security forces to respond promptly to the most trafficked locations. Using biometrics and sensors would create a better method of managing security on Belize's western border.

Based on the research, it is recommended that Belize highly consider using emerging border technology to manage security on its western border. There are numerous recommendations and implementation methods to consider, however. First, a comprehensive study is required to identify the best type of biometrics and sensors to utilize in Belize. Second, there should be a ten-year projection with an increasing budget, technical training, and equipment maintenance. Third, Belize should enhance cooperation with regional partners to share intelligence and reduce transnational crimes. Fourth, Belize must create a department responsible for documenting every incursion and illegal border crossing (statistical data). They are to collate and document findings and budgetary plans and produce quarterly reports on the effects of the use of the technology.

ACKNOWLEDGMENTS

First and foremost, I would like to give thanks to God, for through him all things are possible. “Give thanks to the LORD, for he is good. His love endures forever.”

I would like to extend my gratitude to my thesis advisors, Dr. Carter Malkasian and Professor Sean F. Everton. Your guidance and leadership were most appreciated.

Finally, I would like to thank my wife, Evalee, and my daughter, Janeva, for their unrelenting love and support. You picked up and moved with me to Monterey, leaving your job and school, and for that, I am most grateful. I could not have done this without the family’s support.

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I. INTRODUCTION

A. THESIS QUESTION

Should the government of Belize consider using emerging technology as better way of managing its border?

B. PROBLEM STATEMENT AND HYPOTHESIS

Managing border security has always been a priority for every nation; this comes at an insurmountable cost for many Third World countries, however, such as Belize. Since its independence in 1981, successive administrations in Belize have failed to create or invest significantly in border security policies to alleviate national security threats. This is evident based on the allotment of the annual budget to manage border security. Belize, bordered by Mexico to the north and Guatemala to the west and south, is strategically located for transnational criminal activity, such as human and drug trafficking, alongside numerous other border crossing illegalities. Furthermore, Belize's location in Central America, with its relaxed, welcoming identity, makes it even more tempting for potential criminal activities, including gang migration and other transnational crimes. These factors place Belize in the unfortunate position of becoming the major criminal hub in this region. In an effort for Belize to avoid becoming the transshipment point for drugs, human traffickers, and transnational crime, the government must create policies and invest more in its border security management. For the improved management of Belize's border, this study will undertake a comparative analysis of how the use of emerging technology could assist the government of Belize to create better methods of administering security at its border.

The continued increase in the demand and supply of drugs and human trafficking are only two examples of the daily national security threats that Belize's security forces face. Belize, ill-equipped to manage its porous borders, must seek ways of working more efficiently. These challenges allow the criminal elements to operate within Belize's border successfully. Despite these challenges, the security forces continue to monitor illegal cross-border activities.

Belize also has a long-standing dispute with Guatemala, in which that country continues to lay claim to the entire territory, stating Belize is a part of Guatemala. As a result, Guatemalans living near the border believe they can do as they desire, because they were taught that Belize belongs to their country (*Belice es nuestra*). The Guatemalan dispute and its effects, coupled with the war on drugs, Global War on Terror (now spanning over two decades), and the new and emerging threat of the “human caravan” of migrants from Central America has put an untenable strain on Belize’s ill-equipped security forces.

Belize’s security forces continue prioritizing their human capital in response to these threats. Consideration must now be made in using emerging border technology, however, coupled with either boosting the current security forces assets or creating a specialized Border Patrol Agency while strengthening border security policies. This supposition needs to be given high priority by the National Security Council of Belize to resolve these threats. Though a pressing concern, the adverse global financial effects of COVID19 have halted such activities; hence the government of Belize has not enhanced its border security. On the contrary, the criminal elements have taken advantage of this; thus, the security force continues to see an increase in illegal activities along the borders, including transnational crime.

Traffickers continue to operate with impunity, dominating by air, land, and sea, while the country’s Ministry of Defense grapples with finding ways to control the situation. Citizens in their quandary express their outrage and fear on local media talk shows regularly but to no avail. Although international assistance has been given, it is not enough, as transnational criminals continue to find ways of evading security forces. Often, drug traffickers are successful with their cargo and escape unimpeded by security forces, only leaving behind their mode of transportation, either intact or burnt. Thus, it is believed that the government of Belize and its security forces are seemingly fighting a losing battle, as defeating illegal transnational organizations comes at a high price.

This paper intends to present a comparative analysis to determine if implementing emerging innovative border technology can assist in reducing national and international threats on Belize’s border. The research limits itself to only two innovative technologies, however, namely biometrics and sensors. Studies in other countries have shown that having

emerging border technology has aided in decreasing transnational crime. As an illustration, Argentina now employs a smart border system (i.e., smart technologies without cross-border coordination) to safeguard its Bolivia-Paraguay borders against drug trafficking; the system makes use of sensors, detecting tools, and delivery vehicles.¹ A nation's federal government must make it a goal to apply technology and its skills to the capability of potentially playing a fundamental part in practical border protection.² Additionally, to keep border practices up to date with capabilities in current technology and sophisticated computer surveillance, funding must be sought.³ This study explores emerging technologies and whether the quality of security and safety will improve by its utilization on Belize's western border. There should also be consideration that employing the technology will alter the size and budget of the security forces.

C. LITERATURE REVIEW

1. The Importance of Border Security

It is difficult to compete with transnational organized crime, and law enforcement organizations have been seeking alternative methods. The Department of Homeland Security's (DHS) border security management presents a challenge for policy development and planning due to the variety of threats encountered at the border.⁴ Conversely, many countries lack the capabilities to properly secure their borders, which results in severe consequences such as incursions, exploitation of its natural resources, and illegal immigrants entering and benefiting from the basic provisions of services, namely health and education, provided by a government for its citizenry. Cope and Parks stated that, "countries tend to lack sufficient law enforcement manpower and deterrent capabilities to

¹ Eduardo Szklarz, "Argentina Launches First Smart Border Surveillance System in Latin America," *Diálogo Américas* (blog), December 10, 2019, <https://dialogo-americas.com/articles/argentina-launches-first-smart-border-surveillance-system-in-latin-america/>.

² Tamar Wilson, "Border Games: Policing the U.S.-Mexico Divide," *Review of Radical Political Economics* 34 (2002): 352–54, [https://doi.org/10.1016/S0486-6134\(02\)00144-4](https://doi.org/10.1016/S0486-6134(02)00144-4).

³ Peter Andreas, *Border Games: Policing the U.S.-Mexico Divide*, 2nd ed. (Ithaca, NY: Cornell University Press, 2009), <https://www.jstor.org/stable/10.7591/j.ctt7zhp4>.

⁴ Rosenblum et al., *Border Security Understanding Threats at U.S. Borders*, CRS Report R42969 (Congressional Research Service, Washington, DC, 2013), 2, <https://sgp.fas.org/crs/homsec/R42969.pdf>.

manage borders effectively.”⁵ Additionally, the border is where drug trafficking, smuggling, and terrorism collide, according to the United States U.S. Customs and Border Patrol (CBP).⁶

Some governments and policymakers find that adequately securing the border may cost the nation more money than they can afford and may take finances away from other social services that must be provided. Economic and social development difficulties that countries confront are neglected in favor of the massive amounts of government expenditure on national and homeland security issues.⁷ The better way of looking at border security, however, is by measuring the long-term effectiveness, risk, and safety of a nation. The DHS argued that “the calculation of risk is important because it allows DHS to determine best the potential effects of mission failure at the border and quantifiably measure the benefit of a given investment.”⁸

There are many challenging issues policymakers must consider when thinking about border safety, and security must be foremost. Border policy continuously shifts based on political and economic changes, however.⁹ Globalization, terrorist attacks, and the enormous movement of people (e.g., the “human caravan”) are cause for concern, as these issues present additional problems for a nation. Threat escalation may come from a network of actors who target weak borders and countries to challenge the rule of law.¹⁰ Goddard noted, “If we are serious about stopping the threat on the border, we have to dismantle the

⁵ John A. Cope and Andrew Parks, *Frontier Security: The Case of Brazil*, Strategic Perspectives, No. 20 (Washington, DC: National Defense University, 2016), 4, <https://doi.org/10.21236/AD1014327>.

⁶ Customs and Border Protection, “U.S. Customs and Border Protection (CBP) Use of Biometrics,” CBP Information Center, June 27, 2022, https://help.cbp.gov/s/article/Article1704?language=en_US.

⁷ Henry H. Willis et al., *Measuring the Effectiveness of Border Security between Ports-of-Entry* (Santa Monica, CA: RAND Corporation, 2010), 5, https://www.rand.org/pubs/technical_reports/TR837.html.

⁸ Willis et al., 1.

⁹ Gallya Lahav, “Migration and Security: The Role of Non-State Actors and Civil Liberties in Liberal Democracies,” in *UN Coordinator’s Meeting on International Migration, General Assembly* (New York, 2003), 89.

¹⁰ Patrick M. Cronin and Brian M. Burton, *Beyond Borders: Developing Comprehensive National Security Policies to Address Complex Regional Challenges* (Washington, DC: Center for a New American Security, 2010), 5, <https://www.cnas.org/publications/reports/beyond-borders-developing-comprehensive-national-security-policies-to-address-complex-regional-challenges>.

criminal organizations that carry the contraband and take away the tools that make them so effective.”¹¹ For this reason, some countries such as Belize have placed their military and police forces to protect their borders, while other countries have a specialized unit that deals solely with border protection and environmental issues along the borders. This calls for collaboration between the military, intelligence agencies, and law enforcement, regardless of their conventional areas of responsibility and authority.¹² While economic regulation and military defense have historically been the two main border issues, several governments are retooling and restructuring their border regulatory apparatus to put enforcement first.¹³ As these border threats loom, countries must think of ways to protect sovereignty, whether it is the use of human resources, walls, or advanced technologies. Building secure border barriers to prohibit cross-border activities would make it difficult for those trying to enter, thus reducing their chances of success.¹⁴ While this may work for the United States, it would not be considered by many countries due to bilateral policies, the terrain, and cost-effectiveness.

While Belize is incapable of protecting all its border from looming threats due to its geography, population size, and financial restrictions, the government of Belize has sought innovative ways such as cooperation and endowment from its neighbor and allies. Since border management is intricately institutionalized, there is a need for a high degree of information-sharing capacity that involves many more players in the border regions; it has the potential to be much more difficult.¹⁵ While this may be true for Belize, numerous lingering threats still need to be addressed. There is a 160-mile geopolitical divide between Belize and Mexico and another 165 miles between Belize and Guatemala. While each

¹¹ Terry Goddard, “How to Fix a Broken Border: Disrupting Smuggling at Its Source,” *Drugs-Forum* PART II OF III (2012): 2, <https://drugs-forum.com/ams/how-to-fix-a-broken-border-disrupting-smuggling-at-its-source.18066/>.

¹² “Bigo – 2006 – Internal and External Aspects of Security.Pdf,” 2, accessed March 10, 2022, <https://www.tandfonline.com/doi/pdf/10.1080/09662830701305831?needAccess=true>.

¹³ Peter Andreas, “Redrawing the Line: Borders and Security in the Twenty-First Century,” *International Security* 28, no. 2 (2003): 78–111, <https://www.jstor.org/stable/4137469>.

¹⁴ Paul Staniland, “Defeating Transnational Insurgencies: The Best Offense Is a Good Fence,” *Washington Quarterly* 29, no. 1 (2005): 31, <https://doi.org/10.1162/016366005774859698>.

¹⁵ Celene Navarrete et al., “Information Sharing at National Borders: Extending the Utility of Border Theory,” in *42nd Hawaii International Conference on System Sciences*, 2009, 2.

border creates different dilemmas, the need for more human resources and advanced equipment to secure both borders still exist. The DHS asserts that, “Protecting our borders from the illegal movement of weapons, drugs, contraband, and people, while promoting lawful entry and exit, is essential to homeland security, economic prosperity, and national sovereignty.”¹⁶ Lunenburg suggested, “A flexible and adaptable adhoc structure must be created in order to sufficiently address border security.”¹⁷ The preceding statement asserts and encourages those border agencies to utilize an innovative approach to carry out their mandate; this may include seeking international grants and funding for equipment and training.

While there are numerous legal border crossing points, these do not threaten Belize’s national security, as most criminals try to avoid security forces. The illegalities happen far away from the legal crossing points, which keep security forces contemplating their next move. Since there is no radar to track drug flights or speedboats operating nearby, transnational criminal organizations (TCOs) find Belize’s landscape and its ill-equipped security forces perfect as a transit hub.¹⁸ Border security control and examining what enters and leaves one’s country becomes difficult with limited resources. Successive governments continue to face evolving immigration issues; none thus far have made the necessary investments to properly secure their borders, however, which is anticipated to have grievous effects if not addressed. The government must have a compelling case to justify spending a lot of money on security measures, which is difficult to justify while forgoing initiatives that have been shown to save lives.¹⁹ It is a difficult decision but, considering the numerous border security threats Belize faces daily, it is imperative that more emphasis is given to its national security, for without that sense of protection from external threats, the citizens may suffer immensely.

¹⁶ U.S. Department of Homeland Security, “Border Security | Homeland Security,” 2022, <https://www.dhs.gov/topics/border-security>.

¹⁷ Fred C. Lunenburg, “Organizational Structure: Mintzberg’s Framework,” *International Journal of Scholarly, Academic, Intellectual Diversity* 14, no. 1 (2012): 1–8.

¹⁸ Edward Fox, “Mexico, Belize Meet to Discuss Border Security,” *InSight Crime* (blog), September 3, 2012, <https://insightcrime.org/news/brief/mexico-belize-border-security/>.

¹⁹ John Mueller and Mark G. Stewart, “Balancing the Risks, Benefits, and Costs of Homeland Security,” *Homeland Security Affairs* 7 (2011): 15, <https://www.hsaj.org/articles/43>.

Border safety is one of the essential components of a country's national security; Belize must take the necessary measures to address these issues. According to the DHS, border security is, "the act of protecting our borders from the illegal movement of weapons, drugs, contraband, and people, while promoting lawful entry and exit, is essential to homeland security, economic prosperity, and national sovereignty."²⁰ Nations have always sought to protect their borders; weak and porous borders permit easy access, eventually creating turmoil for a country's security. Policies must concentrate on processing information more rapidly and allowing low-risk persons or goods to enter the country with less stringent screening due to the rise in international passengers and the need to screen more people more efficiently.²¹

2. Using Technology

Belize's security forces have realized that border security without the necessary assets will not be sufficient against TCOs. Today's criminals have boosted their efforts and are now using technological devices to detect where border security units are located. Even the U.S. is left in the dark while the Mexican drug cartel prevails in the technological war.²² According to Wilson, "The U.S. Department of Homeland Security relies on a variety of electro-optical cameras, lasers, chemical detectors, X-rays, and other sensors to limit entry of illegal immigrants, drugs, and other contraband."²³ Hence, it is imperative that Belize's security units be retrofitted accordingly to be a contender in the fight. According to President Joe Biden, border officials will use new technology to combat human trafficking

²⁰ Office of Immigration Statistics, *Yearbook of Immigration Statistics: 2015* (Washington, DC: Department of Homeland Security, 2016), <https://www.dhs.gov/immigration-statistics/yearbook/2015>.

²¹ Rey Koslowski, "The Evolution of Border Controls as a Mechanism to Prevent Illegal Immigration," *Migration Policy Institute*, 2011, 12, <https://www.migrationpolicy.org/pubs/bordercontrols-koslowski.pdf>.

²² Buck Clay, "How Mexican Drug Cartels Are Winning the Technology War," SOFREP, April 3, 2016, <https://sofrep.com/news/mexican-cartels-winning-it-war/>.

²³ J.R. Wilson, "The Role of Technology in Securing the Nation's Borders," *Military Aerospace Electronics*, October 1, 2018, <https://www.militaryaerospace.com/unmanned/article/16707261/the-role-of-technology-in-securing-the-nations-borders>.

and smuggling activities as part of his objective “to enhance liberty and justice.”²⁴ Equally important, the U.S. and Mexico have collaborated under the Merida Initiative to protect the U.S. southwest border (SWB) and have spent substantial finances doing so.²⁵ While Belize cannot financially match the United States budget, much more can be done by using off-the-shelf security technology or seeking security sector assistance. Belize should conduct extensive research, observe other countries, and work on alternative measures. On October 1, 2019, Argentina unveiled its smart border system, which consists of sensors, radars, vehicles, and ships.²⁶ The 2001 Smart Border Declaration between the United States and Canada, which permitted improved border security measures between the two countries, gave rise to the phrase “smart border.”²⁷

Although still important, the days of monitoring the border only with human eyes and occasionally with antiquated techniques to identify repeat offenders and known criminals are over.²⁸ Belize can use numerous off-the-shelf technologies effectively until better equipment can be bought or donated by partner countries. For instance, border surveillance personnel use some of the latest commercially available computers and communications technology when monitoring borders and conducting search and rescue operations.²⁹ Being such a small country, Belize needs to consider what technological devices are most suitable for its budget and environment. Some countries have considered three different categories: integrated surveillance, multi-layered sensors, and single sensors.³⁰ Countries like: Brazil, Colombia, Mexico, Venezuela, Chile, Ecuador, and Peru

²⁴ Alex J. Rouhandeh, “Here Are New Technologies Biden Has Deployed at the Border,” *Newsweek*, March 2, 2022, <https://www.newsweek.com/here-are-new-technologies-biden-has-deployed-border-1684214>.

²⁵ Clare Ribando Seelke and Kristin Finklea, *U.S.-Mexican Security Cooperation: The Mérida Initiative and Beyond*, CRS Report No R41349, 19.

²⁶ Szklarz, “Argentina Launches First Smart Border Surveillance System.”

²⁷ “U.S.- Canada Smart Border/30 Point Action Plan Update,” President George W. Bush White House, December 6, 2002, <https://georgewbush-whitehouse.archives.gov/news/releases/2002/12/20021206-1.html>.

²⁸ Wilson, “The Role of Technology in Securing the Nation’s Borders.”

²⁹ Wilson.

³⁰ W. Alejandro Sanchez, “COHA Report: Drones in Latin America,” *Council on Hemispheric Affairs*, COHA, 2014, 10, <https://www.coha.org/coha-report-drones-in-latin-america/>.

all employ single-sensor equipment; on the other hand, Argentina uses integrated surveillance systems that are monitored by a control room.³¹ In contrast, CBP utilizes large-scale X-ray and gamma ray machines, its security forces, biometrics, and motion sensors as components of multilayer defense.³²

Having the border security technology needed to secure a nation, along with neighboring countries' bilateral cooperation, is one of the first steps to success. For instance, the length of the borders between the United States, Canada, and Mexico necessitates automated border surveillance utilizing various electro-optical techniques.³³ In addition, border security strategies coordinated and written by adjacent nations are the first step toward stability. For instance, Ecuador developed a global approach following the overthrow of the Venezuelan government that allowed migrants with the required biometrics to cross their borders and enter the adjacent countries.³⁴ As Belize continues to address its border security issues, there are many nations that they can observe for best practices on what action should be taken. With emerging technology on the rise, securing one's border should undoubtedly be easier; it is becoming more competitive, however. Like Ecuador, one of the technologies needed in Belize is biometrics, and the other is motion sensors.

Biometrics would allow security forces on the ground to relay real-time information to headquarters about those detained, knowing whether they are high-priority targets. By providing accurate, rapid, and high-assurance biometric identification information and analysis, biometrics serve crucial national security issues including counterterrorism and

³¹ Bonnie Berkowitz, Shelly Tan, and Kevin Uhrmacher, "Beyond the Wall: Dogs, Blimps and Other Things Used to Secure the Border," *Washington Post*, February 8, 2019, <https://www.washingtonpost.com/graphics/2019/national/what-is-border-security/>.

³² Homeland Security, "Multi-Layered Defense | Homeland Security," 2022, <https://www.dhs.gov/multi-layered-defense>.

³³ Stephen Flynn, "The Role of Border Technology in Advancing Homeland Security," Council on Foreign Relations, March 12, 2003, <https://www.cfr.org/report/role-border-technology-advancing-homeland-security>.

³⁴ Bruno Dupeyron, "Perspectives on Mercosur Borders and Border Spaces: Implications for Border Theories," *Journal of Borderlands Studies* 24, no. 3 (2009): 58–67, <https://doi.org/10.1080/08865655.2009.9695739>.

immigration.³⁵ Biometrics boost security organizations that exchange information and provide foreign partners the front-line capabilities they need to secure the nation, thus enabling countries to defend themselves against transnational threats.³⁶ With the use of biometrics, security personnel may measure and statistically analyze each person's distinctive physical and behavioral traits, such as the ability to recognize faces, fingerprints, and the iris and retina.³⁷ At the DHS, biometrics are used to verify visa applications to the United States, issue and administer correct immigration benefits, conduct background checks, and identify and prevent unauthorized entrance into the country.³⁸ According to the Post, the government is negotiating with other Central American countries to acquire fingerprints, iris scans, and data on distinguishing traits such as tattoos and scars from persons caught in Mexico.³⁹ Using this technology it would allow security forces working in the fields to know who are the persons of interest, allowing headquarter to advise on the next step to be taken.

On the other hand, using border surveillance systems (motion sensors), security forces can track surveillance data and know where the most trafficable area is. The process of detecting motion involves recognizing changes in an object's location in relation to its environment or changes in the environment in relation to an object.⁴⁰ This technology can detect movement and pick up any movement around its location. The current refugee crisis is one of today's hottest topics, which reverberates across so many aspects of politics,

³⁵ Department of Homeland Security, "Office of Biometric Identity Management | Homeland Security," 2022, <https://www.dhs.gov/obim>.

³⁶ Department of Homeland Security.

³⁷ Alexander S. Gillis, Peter Loshin, and Michael Cobb, "What Is Biometrics?," SearchSecurity, 2021, <https://www.techtarget.com/searchsecurity/definition/biometrics>.

³⁸ "Biometrics," Office of Biometric Identity Management, December 14, 2021, <https://www.dhs.gov/biometrics>.

³⁹ Chris Burt, "U.S. Homeland Security Collecting Migrant Biometrics in Mexico," Biometric Update, April 9, 2018, <https://www.biometricupdate.com/201804/u-s-homeland-security-collecting-migrant-biometrics-in-mexico>.

⁴⁰ Zosi, "What Is Motion Detection," Zosi Help Center Support, accessed October 11, 2022, <https://supports.zositech.com/hc/en-us/articles/360058437112-What-is-Motion-Detection>.

commerce, and everyday life.⁴¹ With this being one of Belize’s major threats, this form of technology should be considered. The Border Surveillance Systems (BSS) are a collection of surveillance technologies that help CBP locate, identify, detain, and deport those who are entering the country unlawfully at and between ports of entry while also upholding American law.⁴² Understanding Belize’s budgetary constraint would mean not affording all the advance technology like her neighboring countries, however. The use of off-the-shelf ground sensors and cameras with updated technological specs that can relay information in real time would be the most appropriate on Belize’s budget.⁴³

This research plans to explore the behavior of borders using technologies and whether the technology enhances border security. Then it will clearly indicate whether Belize should consider investing its finances in border technology or seek other preventative measures to secure its border. The research will use two case studies to examine the technologies’ impacts and outcomes by evaluating organizational effectiveness and benchmarking. It will also examine whether emerging technology will meet Belize’s objectives and justify or critique the use of the technology. These are the keys indicators that will justify whether Belize should employ such means. The case studies will also determine if using emerging border technology will reduce or increase the number of human resources needed to manage the border.

D. CHAPTER OUTLINE

1. Chapter II – Background leading to the problem. This chapter explores the historical experience of Belize as well as its border issues and territorial disputes. It covers the purpose of the borders, when they were established, and the reasons behind their porous state. It looks at the protective measures implemented to safeguard the country and why further advancement is needed. Finally, it delves into the concept of threats faced on

⁴¹ Tony Kingham, “Protecting Europe’s Borders with Second Generation Motion Detection Technology,” *Border Security Report*, May 7, 2020, <https://border-security-report.com/protecting-europes-borders-with-second-generation-motion-detection-technology-2/>.

⁴² Douglas Harrison, *Privacy Impact Assessment for the Border Surveillance Systems (BSS)*, DHS/CBP/PIA-022 (Washington, DC: Department of Homeland Security, 2014).

⁴³ Scott Luck, *Privacy Impact Assessment Update for the Border Surveillance Systems (BSS)*, DHS/CBP/PIA-022(a) (Washington, DC: Department of Homeland Security, 2018), 5.

Belize's western border and briefly discusses what security forces are doing to counter TCOs and cross-border illegalities.

2. Chapter III – Case Studies. South America Tri-Border Area (TBA) This chapter examines the use of emerging border technology and its effects on the area. It discusses how each country deals with border technology and how it has been utilized. The case studies were chosen to illustrate how other countries with similar issues take different approaches to address incursions, illegal entry, and the overall preservation of their natural resources and national security. Each country utilizes methods that work based on the country's financial constraints. The internal and external threats faced by the three countries may be similar; but they are dealt with differently.

3. Chapter IV – Case Studies. U.S. – Mexico Border. Similarly, this chapter examines the use of emerging border technology and whether it has enhanced the capabilities of the CBP. It further explores how the U.S. – Mexico border came into existence, when it used its first border technology, threats on the border, and the use of biometrics and sensors. It further measures the technology's success and determines if the technology alone will keep the border secure or whether there is a need for additional resources.

4. Chapter V – Summary, Recommendations, and Conclusion. – This chapter will evaluate and compare what the case studies revealed and make recommendations on whether Belize should consider using border technology. The chapter restates the problem, research question, and challenges the other states faces. Analysis and evaluations will be made on properly employing the technologies to better suit Belize's environment and the budgetary plan. Finally, it looks at the lesson learned and what considerations can be made for future development. The chapter concludes with a suggested step towards institutionalization of a systems thinking approach that will enable wider application of the analytic and modeling techniques.

E. LIMITATION OF RESEARCH AND MODEL

This geopolitical analysis of border protection/ smart border protection is on the Belize western border. The cases were studied to allow for more excellent reviews; however, it still limits the study to only the western hemisphere. With Belize's limited funding, her bordering counties' extensive budget, and the constant update in innovative border technology, there will be a need for more human resources to protect the border. There are also limited documents on Belize's border protection strategies and its way forward in protecting its borders. Finally, note that the study will only focus on two technological devices: biometrics and motion sensors.

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II. EVOLUTION OF THE BELIZE WESTERN BORDER

A. INTRODUCTION

The security of Belize's western territory bordering Guatemala continues to be a destabilizing situation and is challenged by transnational crime. The area has been through some evolutionary changes, which, unfortunately, have always presented multiple issues for Belize, with increasing threat levels. The main security threats stem from Guatemala's territorial claim that it continues to maintain against Belize. This claim has caused the borderland between the two countries to remain underdeveloped, creating a haven for criminal elements. Fortunately, this unfounded claim has gained traction in the international community, prompting the Organization of American States (OAS) and others in the international community to advocate for a peaceful resolution. As a result, the security of that section of Belize's border is now a shared endeavor among Belize, Guatemala, and the OAS as a mediator, which provides its expertise, and is respected by both countries.⁴⁴

Protecting Belize's western border comes with many challenges and threats, some of which security forces in Belize are not equipped to counter. The advantages of possessing a territory are only as big as a state's borders are distinct however, since a state's borders must be clearly defined for the contemporary state to function.⁴⁵ The dispute has caused a lingering effect on the border; there has been limited economic and infrastructural development, and any work done within that area must be agreed upon by both countries. Although the borderland issues are shared between the two countries, Belize is expected to bear most of the funding and responsibilities to implement and maintain critical systems to

⁴⁴ Montserrat Gorina-Ysern, "OAS Mediates in Belize-Guatemala Border Dispute," *ASIL Insights* 5, no. 20 (December 19, 2000), <https://asil.org/insights/volume/5/issue/20/oas-mediates-belize-guatemala-border-dispute>.

⁴⁵ Paul Gilbert, *The Philosophy of Nationalism* (New York: Routledge, 2019), <https://doi.org/10.4324/9780429496011>.

provide security and safety for its people.⁴⁶ These required resources include but are not limited to management, human resources, equipment, and continued liaison with their counterparts in Guatemala to protect the shared borderland. In addition, illegal trade issues have cost the government of Belize millions of dollars in investment; with transnational crime being a multi-billion-dollar organization, however, Belize needs to look at alternative measures.⁴⁷ This chapter will examine the history of Belize's border with Guatemala, border threats, security forces, and border incidents, to determine why the border is so porous and whether there is a need for alternative measure.

B. BACKGROUND OF THE REGION

Belize's western border with Guatemala has a long controversial history, which stems back to the Treaty of Tordesillas between Spain and Portugal.⁴⁸ Spain never settled in Belize, however, because it was believed to be "unsuitable for settlement" and "virtually abandoned." By 1638, evidence shows that the British had formed permanent settlements in Belize.⁴⁹ On many occasions, the Spanish attempted to challenge the occupation of the British with attacks from Yucatan; their efforts were futile, however. Finally, peace treaties between the United Kingdom and Spain granted the British rights to cut and ship logwood out of Belize.⁵⁰ In 1786, Spain agreed to extend the logging rights farther south to the Sibun River.⁵¹ On September 10, 1798, however, the last attempt by the Spanish to use

⁴⁶ "Ministry of National Security Refutes Allegations Made against BDF Patrol – Government of Belize Press Office," 2020, <https://www.pressoffice.gov.bz/ministry-of-national-security-refutes-allegations-made-against-bdf-patrol/>.

⁴⁷ Vejea Alvarez, "GOB and the U.S. Embassy Continue to Fight Transnational Crime in the Region," *Love FM*, 2021, <https://www.lovefm.com>.

⁴⁸ Britannica Encyclopaedia, "Treaty of Tordesillas | Summary, Definition, Map, & Facts | Britannica," 2022, <https://www.britannica.com/event/Treaty-of-Tordesillas>.

⁴⁹ Berl Francis, "Belize City, Belize (1638-)," BlackPast, December 22, 2014, <https://www.blackpast.org/global-african-history/places-global-african-history/belize-city-belize-1638/>.

⁵⁰ Assad Shoman, "Thirteen Chapters of a History of Belize, The Angelus Press Limited, Belize City, Belize," 1994, 44–45, <https://www.abebooks.com/9789768052193/Thirteen-Chapters-History-Belize-Shoman-9768052198/plp>.

⁵¹ Victor Bulmer-Thomas, review of *Assad Shoman, A History of Belize in 13 Chapters (2nd Edition, Belize City: Angelus Press, 2011), Pp. xvii 461, \$10.00, Pb.*, by Assad Shoman, *Journal of Latin American Studies* 44, no. 1 (2011): 206–8, <https://doi.org/10.1017/S0022216X11001362>.

force to assert sovereignty was repelled by the British settlers.⁵² In 1805, the settlers officially recognized the boundary in the north by the Rio Hondo, in the south by the Sarstoon River, and in the west by an imaginary line running due north from the Gracias A Dios Falls to the Rio Hondo.⁵³ In fact, since 1805, there have been no geographical changes to Belize's borders. Figure 1 highlights Belize's border with Guatemala to the south and west and Mexico to the north.



Figure 1. Western demarcation of Belize's border with Guatemala⁵⁴

Belize was still under British reign before 1981 and had British forces attached to the border patrol to assist with border infringements.⁵⁵ In January of 1978, the Belize Defence Force (BDF) was formed and would do joint border patrols with its British counterpart. While the security forces had the support of the British, they had all the

⁵² John R. Crook, "Introductory Note to the Special Agreement Between Belize and Guatemala to Submit Guatemala's [Sic] Territorial Insular and Maritime Claims to the International Court of Justice," *International Legal Materials* 48, no. 2 (2009): 250–52, <https://www.jstor.org/stable/25691364>.

⁵³ Shoman, "Shoman, Assad. Thirteen Chapters of a History of Belize."

⁵⁴ Adapted from Daniel Ortiz, "Guatemala Gets Ready For ICJ Referendum," Ambergris Caye Belize Message Board, accessed October 27, 2022, <https://ambergriscaye.com/forum/ubbthreads.php/topics/529924.html>.

⁵⁵ Bulmer-Thomas, "Assad Shoman, A History of Belize in 13 Chapters (2nd Edition, Belize City: Angelus Press, 2011), Pp. Xvii 461, \$10.00, Pb."

necessary equipment needed to manage any cross-border illegalities. Between the 1960s and early 1990s, the British had a fleet of air surveillance assets to assist with monitoring the border.⁵⁶ Additionally, ground troops had up-to-date maps and global positioning systems (GPS) and could quickly respond, which was high-level technology for that era. Unfortunately, the British departed Belize in 1994, taking their aerial surveillance equipment and leaving Belize impotent to defend its territory.

Although Belize has worked on countermeasures to secure the border, it still encounters numerous difficulties. The equipment used today by Belize's security forces is not up to date, and criminal organizations use this to their advantage. Security forces still use outdated GPS, maps, and cheap off-the-shelf drones. On the other hand, criminal organizations have protectors who are well-equipped with some of the best technology in Belize.

The alliance of transnational crime, local criminal organizations, and corruption is intense and outmatches security forces with limited resources to respond to illegal border activities. For this reason, criminals use the most advanced technology to evade security forces on the border. Shelley maintains that "Criminals have been very successful in exploiting the international inconsistencies in the system and the failure to regulate technology across jurisdictions" and Belize is no exception.⁵⁷ When criminals are captured on the border, security needs to bring them back to the nearest police or customs outpost to be processed. With the necessary technology, security forces can liaise with headquarters using biometrics to send the information. Ground and aerial sensors will allow security forces to know what location is the most active and respond with the right equipment to capture and detain criminals on the border. For this to work, Belize and Guatemala must work together and put aside their differences in the border dispute.

⁵⁶ J. Vitor Tossini, "British Forces in Belize – A Military Partnership in Central America," 2018, <https://ukdefencejournal.org.uk/british-forces-in-belize-a-military-partnership-in-central-america/>.

⁵⁷ Louise I. Shelley, "Organized Crime, Terrorism and Cybercrime," in *Security Sector Reform: Institutions, Society and Good Governance*, ed. Alan Bryden and Philipp Fluri (Baden-Baden, Germany: Nomos, 2003), 305, https://www.crime-research.org/library/Terrorism_Cybercrime.pdf.

Today, this dispute lingers and is one of the leading reasons why Belize’s western border is still underdeveloped. Many futile attempts have been made to secure the border through infrastructural development. Guatemala and Belize have had numerous discussions, but Guatemala refuses to acknowledge Belize as an independent state. This has led to seeking a mediating body through the OAS, which works closely with both countries, trying to resolve issues that may occur on the border.⁵⁸ While the Belize-Guatemala issue continues, Belize still faces numerous threats on its border, trying to manage the war on drugs, border incursion, the Global War on Terror, and the new and emerging threat of the “human caravan.” At the same time, it tries to develop its ill-equipped security forces with ways to manage its border better. Figure 2 shows the border demarcating points on the Belize-Guatemala border, where numerous illegal activities occur.



Figure 2. Two southern demarcation markers with Guatemala on Belize’s western border⁵⁹

⁵⁸ Gorina-Ysern, “OAS Mediates in Belize-Guatemala Border Dispute.”

⁵⁹ Source: Ortiz, “Guatemala Gets Ready For ICJ Referendum.”

C. BORDER ILLEGALITIES

The “supply and demand” age has spawned many difficult and seemingly insurmountable challenges for Belize. Security forces continue to be vigilant to combat border crossings and border illegalities as well as the scourges they have wrought on a vulnerable society. “Illegal trade,” as Belizeans colloquially call it, describes what has become the norm for a little country now ravaged by this illicit enterprise. The illegal trade has damaged Belize’s economic development, and this loss of revenue is now having trickling effects on its society. Frequent plane landings on highways and open fields make Belize’s scenario the real version of the popular Netflix series, *Narcos*.⁶⁰

Until the matter is settled in court, Belize continues to grapple with small settlements on the Guatemala side of the border encroaching on its territory. Illegal farming, cattle raising, illegal logging, gold panning, xate harvesting, animal poaching, and criminal acts on the tourism industry are some issues that manifest on the contested border, with limited resistance from local security forces.⁶¹ The hindrance to security forces, for the most part, is a lack of adequate resources. As a result, these illegal acts have flared up numerous times, causing undue tension between both countries. This increase in incidents is despite the bilateral agreements signed by both countries to respect the adjacency zone created by the OAS and for each territory’s borders. This issue is confirmed by the OAS, which stated that: “the territorial, aerial and maritime dispute between Belize and Guatemala had given rise, in the recent past, to serious incidents between the military forces of the two countries and to bloody confrontations with peasants and indigenous inhabitants, loss of life, destruction of crops in adjacent areas, and the incursion and capture of armed forces personnel.”⁶²

⁶⁰ “Drug Plane Lands Near Bladen, Police Officers Are Involved,” News 5, November 5, 2021, <https://edition.channel5belize.com/archives/226204>.

⁶¹ “Friends for Conservation and Development Sign Declaration of Good Intent with Guatemalan Environmental Organizations,” Breaking Belize News, February 28, 2019, <https://www.breakingbelizenews.com/2019/02/28/friends-for-conservation-and-development-sign-declaration-of-good-intent-with-guatemalan-environmental-organizations/>.

⁶² Gorina-Ysern, “OAS Mediates in Belize-Guatemala Border Dispute.”

1. **Illegal Logging**

Belize's security forces patrol along the southern and western borders and continuously encounter Guatemalans destroying its forest by doing illegal logging. In the Chiquibul Forest alone, by 2012 an economic value of United States dollars (USD) 3,058,075.00 was harvested. In addition, the harvesting was not done properly, wasting 30% to 35% of the lumber.⁶³ Additionally, in 2016, an estimated 3,754 ha. was deforested, compared to 2,888 ha in 2018.⁶⁴

2. **Gold Panning**

Gold panning in Belize is another illegal activity for villagers living on the Guatemala border. This threat to Belize's natural resources is difficult to manage as the Guatemalans living near the border believe that they are doing nothing wrong. Their government continues to stake a claim on Belize; hence they believe they are in Guatemalan territory. The recovered data shows that Guatemalan gold panners were operating in small groups up to 8 kms inside Belize.⁶⁵ The environment impacts have been detrimental to Belize's ecological cycle and have caused extensive erosion. While panning, the campers often cause forest fires and remove trees along the river, which leads to erosion and sedimentation. Between December 2019 and November 2020, 44 illegal gold panning activities were recorded.

3. **Agricultural Farming and Cattle Ranching**

Illegal farming and cattle ranching by Guatemalan farmers on the western borders has resulted in significant deforestation. By 2013, the cumulative area deforested in Belize

⁶³ Friends for Conservation and Development, *Illegal Logging in the Chiquibul Forest: An Economic and Ecological Valuation Assessment* (San Jose Succotz, Belize: Friends for Conservation and Development, 2012), 3, <https://www.fcdbelize.org/download/reports/Illegal%20Logging%20Booklet%202012.pdf>.

⁶⁴ Friends for Conservation and Development, *Agricultural Encroachments in the Chiquibul Forest, 2016 – 2018* (San Jose Succotz, Belize: Friends for Conservation and Development, 2018), 5, <https://www.fcdbelize.org/download/reports/CF-Deforestation-2016-2018.pdf>.

⁶⁵ "FCD Wants Government to Take Action to Stop Gold Panning in the Chiquibul," Love FM, April 26, 2017, <https://lovefm.com/fcd-wants-government-to-take-action-to-stop-gold-panning-in-the-chiquibul/>.

was estimated at 3,615 hectares, with another 2,575 hectares by 2019.⁶⁶ In 2019, Friends for Conservation Development (FCD) reported that, “Five aerial recce validated cross border incursions and a strategy to address cattle ranching was endorsed and adopted by the Ministry of National Security.”⁶⁷ Illegal cattle ranging has caused large areas on the border to be cleared, despite efforts by Belize’s security forces to deter them. This has also led to an increase in illegal marijuana cultivation. Both the security forces and the non-governmental organizations (NGOs) in Belize determined that there is an urgent need for more aggressive action on the part of the government on the western border.

4. Poaching and Illegal Wildlife Trade

Several targeted animals live on the western borders of Belize and have fallen prey to the illegal wildlife trade (IWT). Illegal poaching has increased, as patrols continue intercepting poachers on the main trail.⁶⁸ The poaching trade is estimated to represent hundreds of thousands of dollars yearly. Patrols in the area have managed to set up monitoring cameras and increase patrolling by foot and vehicle. The limited number of sightings, despite enhanced bio-monitoring patrol intensity, indicates that poachers are reportedly more evasive in carrying out their operations, which is why IWT continues to keep security personnel busy despite all of these measures.⁶⁹

5. Migration

Central American citizens see Belize as paradise due to its pristine waters and natural resources and its vast amount of undeveloped land and porous borders. This is

⁶⁶ Boris Arevalo and Derrick Chan, “Mitigating and Controlling Illegal Logging in the Chiquibul Forest,” *FCD Friends for Conservation and Development* (blog), 2012, <https://www.fcdbelize.org/resources/>.

⁶⁷ Friends for Conservation Development, *FCD Annual Report 2019* (San Jose Succotz, Belize: Friends for Conservation and Development, 2019), 8, https://www.fcdbelize.org/download/annual_report/FCD-Annual-Report-2019.pdf.

⁶⁸ “Five Men Charged \$6000 for Illegal Activities within a Wildlife Sanctuary – Government of Belize Press Office,” 2020, <https://www.pressoffice.gov.bz/five-men-charged-6000-for-illegal-activities-within-a-wildlife-sanctuary/>.

⁶⁹ Boris Arevalo, *Scarlet Macaw Biomonitoring Program: 2014 Nesting Season Final Report* (San Jose Succotz, Belize: Friends for Conservation and Development, 2014), 12, <https://www.fcdbelize.org/download/reports/Scarlet%20Macaw%20Final%20Report%202014.pdf>.

particularly true for people from Venezuela, Honduras, and El Salvador, who are grappling with severe threats from crime and gangs and are seeking refuge in Belize. This has resulted in a flood of migration that constitutes yet another security threat for Belize. Along with the increase in demand for services, such as education and health, because migration includes gang members, an increase in crime is inevitable.⁷⁰

“Human caravans” from Central America, mainly from Honduras, transit through Belize while headed to the United States U.S. This is another threat to be addressed by Belize’s border security. Belize attracts these transnational activities due to its very porous borders and its proximity and linkage to the Mexican border, the major entry avenue to the U.S. According to United Nations (UN) reports, “With more than 7000 Central American refugees now on the march through Mexico towards the southern border of the United States in search of safety and work, all countries involved are urged by the UN to liaise with key agencies on the ground providing support.”⁷¹

6. Drug Trafficking

Drug trafficking and illegal plane landings in Belize have been occurring for decades. Since 2018, however, those occurrences have become more frequent.⁷² Traffickers have become brazen in their operations, and this is because Belize lacks the technology to counter the drug trade. The U.S. State Department’s International Narcotics Control Strategy Report identifies Belize as an important transit nation for illegal narcotics coming from South America.⁷³ From sporadic landings to now, as frequent as four or more landings per month, Belize has had to rely on support from neighbors and the U.S. in order

⁷⁰ Benjamin Flowers, “‘Influx of Migrant Workers Posing a Problem for Belize,’ Says Foreign Minister Eamon Courtenay,” Breaking Belize News, March 26, 2022, <https://www.breakingbelizenews.com/2022/03/26/influx-of-migrant-workers-posing-a-problem-for-belize-says-foreign-minister-eamon-courtenay/>.

⁷¹ Adriana Zehbrauskas, “As Human Caravan Moves through Mexico, ‘Full Respect’ Needed for National Control of Borders: UN Chief,” UN News, 2018, <https://news.un.org/en/story/2018/10/1023852>.

⁷² “More Suspected Drug Planes Landing in Northern Belize,” News 5, August 21, 2018, <https://edition.channel5belize.com/archives/170592>.

⁷³ Bureau of International Narcotics and Law Enforcement Affairs, “Belize,” 2014, //2009-2017.state.gov/j/inl/rls/nrcrpt/2014/vol1/222848.htm.

to detect and intercept illicit operations.⁷⁴ Following the “shoot down” policy and the increase in border technology adopted by Honduras and Guatemala in 2012, drug plane landings noticeably increased in Belize.⁷⁵ Most of these shipments were destined for either Honduras or Guatemala before continuing their route north.⁷⁶ The increased capabilities of those countries have rendered Belize vulnerable due to the country’s limitations. Belize had no viable plan to address the uptick in landings and corruption in key quarters, particularly for law enforcement, and politicians are still grappling with how to make significant changes. Belize lacks resources and capabilities to combat drug trafficking. Administrative ineptitude and corruption have only set the country back against the formidable threats from the illicit drug trade. The fight against illicit drug trafficking by Belize’s security forces is one aspect of the response to the crisis; conversely, the social ills and influences it has had on the younger population are another.⁷⁷

D. SECURITY FORCES

Belize lacks the necessary resources and capabilities to combat illegal trade, which the criminal network has now realized. The security forces in Belize are composed of the Belize Police Department, the BDF, and the Belize Coast Guard.⁷⁸ Alongside the security forces, there are also smaller agencies like the Custom and Immigration Department and other small government and NGOs that assist in protecting Belize’s western border. Notably, while the security forces monitor the Belize-Guatemala border, there are still various limitations on how much can be accomplished, due to Belize’s lack of counter

⁷⁴ Nick Miroff, “Mexican Drug Cartels Reach Tiny Belize,” Pulitzer Center, October 13, 2011, <https://legacy.pulitzercenter.org/reporting/mexican-drug-cartels-reach-tiny-belize>.

⁷⁵ Marguerite Cawley, “Honduras Approves Drug Plane Shoot-Down Law, Bolivia Set to Follow,” *InSight Crime* (blog), 2017, <https://insightcrime.org/news/brief/honduras-approves-drug-plane-shoot-down-law-bolivia-set-to-follow/>.

⁷⁶ Christopher Woody, “Here’s How Drugs Are Getting Smuggled from South America to the US,” *Business Insider*, 2017, <https://www.businessinsider.com/heres-how-drugs-are-getting-smuggled-from-south-america-to-the-us-2017-9>.

⁷⁷ Sanchez, “COHA Report.”

⁷⁸ “Ministry of National Defence Acknowledges Security Forces,” Government of Belize Press Office, November 10, 2021, <https://www.pressoffice.gov.bz/ministry-of-national-defence-acknowledges-security-forces/>.

surveillance equipment.⁷⁹ Some limitations include the lack of human resources, equipment, border surveillance technology, and other pertinent resources. In addition, it must be stated that the by-laws that govern the military only allow them to support other agencies (Police, Customs, or Immigration officers), meaning they cannot arrest, despite being the main force working the border. Therefore, numerous changes must be considered as tension rises in South and Central America.

Though the security forces have limited resources, they have been performing exceptionally; however, they often request assistance from the U.S. and regional partners. For example, in *InSight Crime*, Katie Jones writes, “In 2019, the country’s Ministry of National Security revealed that authorities have been relying on a regional network which generates tracking information on suspect aircraft leaving South America.”⁸⁰ Although assistance has been given, it is not enough, and Belize needs to find effective and efficient ways of managing its borders.

Efforts have been made to preserve Belize’s territorial integrity and national sovereignty on its western border. The government, realizing the border complications, has increased military and police patrols. Security forces launch numerous border patrols (Adjacency Zone Patrols), and both the Belizean and Guatemalan militaries conduct joint operations; those conducting the illegal activities often evade law enforcement, however. In addition, narco-traffickers and their cargo often have fled the site by the time law enforcement arrives, leaving behind their aircraft intact or destroyed by fire.⁸¹ To preserve its nation’s integrity, Belize must now equip its law enforcement officers with the technology to counter its multi-million-dollar illegal trade.

⁷⁹ Geraldine Cook, “Belize Defence Force Integrates Efforts to Counter Security Threats,” *Diálogo Américas* (blog), 2021, <https://dialogo-americas.com/articles/belize-defense-force-integrates-efforts-to-counter-security-threats/>.

⁸⁰ Katie Jones, “Belize Officials, Police Help Hide Drug Planes,” *InSight Crime* (blog), March 1, 2021, <https://insightcrime.org/news/drug-planes-descend-belize-police-military-officials-arrested/>.

⁸¹ “Drug Traffickers Managed to Escape by Sea with Cargo; Narco Plane Left Intact,” *Breaking Belize News*, March 4, 2022, <https://www.breakingbelizenews.com/2022/03/04/drug-traffickers-managed-to-escape-by-sea-with-cargo-narco-plane-left-intact/>.

Most of these illegalities occurring on the western border are in remote areas, and with limited technology. By the time security forces respond, criminals are long gone. Instead, those captured need to be brought back to the nearest police station, which could be between four or five days away through the highlands of Belize. In addition, conflicts between security forces and traffickers on the border often result in confrontations. Unfortunately, many of the confrontations lead to injuries and sometimes death. To monitor the border, Belize must consider alternative border control measures, including surveillance technologies as force multipliers and documenting those crossing the border and committing illegal acts.

E. CONCLUSION

Belize's lack of border technology has placed them in a precarious situation while its security forces grapple with border protection. The criminal networks operating in the area seem to be better equipped and, for that reason, can evade security forces. The border dispute between Belize and Guatemala has caused criminal organizations to thrive in illegal logging, gold panning, agriculture and cattle farming, migration, illicit drug trading, and other illegalities. The contention between the countries, specifically at that border point, continues to escalate, with Belize getting most of its negative impacts. Despite the apparent handicap of Belize's security forces, they continue to defend its territory, which must be commended. Belize must therefore review its security tactics and make significant investments in its security forces' mission essential kits and emerging border technology. Using border technology can enhance the tracking of illegal activity and deter cross-border criminal acts.

III. CASE STUDY TRI – BORDER AREA (SOUTH AMERICA BORDER)

A. INTRODUCTION

The TBA between Argentina-Paraguay-Brazil has been under heavy surveillance by all three countries, as the criminal activities and terrorist threats have increased significantly over time. Intelligence agencies have sought ways to improve the TBA to counter the emerging criminal network and terrorist threat. Emerging border technology has been of growing importance in that area due to illegal activities. This chapter aims to examine if emerging border technology has assisted with border illegalities in the TBA. The chapter also intends to explore the effects of sharing information between those countries' intelligence agencies, which has neutralized threats within the TBA through the use of emerging technology. Finally, it will determine if the technology has increased the coverage area while requiring fewer troops.

Before one can understand and appreciate the need for surveillance technology, the brief history of the border situation must first be analyzed. The following literature will address the history of the borders, the illegalities, the origin behind the technology use by the countries, and finally the effectiveness of the border technology. The Triple Frontier, as its name implies, is made up of three cities: Foz do Iguacu in Brazil, Ciudad del Este in Paraguay, and Puerto de Iguaz in Argentina.⁸² The area plays a significant role because of its geographical location, as these cities are connected by major roads known to the criminal underworld. This region has been known for several illegalities such as illegal border crossings, illegal trade of goods and commerce, drug trafficking, and, most recently, the gathering of terrorist organizations. Although this area has been monitored in the past by a joint security task force, the criminal organization has sought ways of evading and continuing its activities. States must take into account various border control tactics, such as surveillance technology as force multipliers to help border agents discover borderland

⁸² Rex Hudson, *Terrorist and Organized Crime Groups in the Tri-Border Area (TBA) of South America* (Washington, DC: Library of Congress, Federal Research Division, 2003), 6, <https://apps.dtic.mil/sti/citations/ADA439846>.

threats, in order to effectively monitor and manage these borders from threats. Figure 3 shows the concern area of the TBA.



Figure 3. Concern area of the TBA⁸³

The best way to manage the border is through controlled border crossing points, enabling law enforcement to regulate licit and illicit trafficking. Traveling through such a checkpoint allows the state to determine eligibility; however, that is just in a perfect scenario. Today, the TBA security is more complex, especially in areas not adequately managed, allowing the area to be controlled by the criminal underworld. Latin America is renowned for having friendly borders and convenient access to its neighbors.⁸⁴ Vulnerabilities in border security exist in areas that are not regularly watched. Managing permeable land, sea, and air borders can be difficult, but thwarting domestic and foreign

⁸³ Source: Jeffrey Fields, "Islamist Terrorist Threat in the Tri-Border Region," National Threat Initiative, October 2002, http://web.archive.org/web/20050315054822/www.nti.org/e_research/e3_16b.html.

⁸⁴ Department of State, *2017 International Narcotics Control Strategy Report* (Washington, DC: Department of State, 2017), 194, <https://www.state.gov/2017-international-narcotics-control-strategy-report/>.

threats is essential.⁸⁵ Recently, smart border technology has been implemented in the TBA. Although not on par with the U.S., it has managed to assist law enforcement with control.

B. HISTORY OF THE TRI-BORDER

Many events contributed to the formation of the TBA, but the Ragamuffin War, which formed the borderlands of Argentina, Brazil, and Paraguay, was the main event that shaped the TBA. Brazil gained territory as a consequence of the struggle between Rio Grande do Sul and Brazil in 1840, which stretched along eastern Argentina and ended in Uruguay.⁸⁶ The second event was the Paraguayan War, or the Triple Alliance war, which shaped the southern cone of the TBA. As a result of the conflict, Paraguay suffered a disastrous defeat, losing up to 40% of its territory in 1870, giving Argentina the “finger shape” in the northeast that cuts across Paraguay and Brazil before coming to rest at the Triple Frontier.⁸⁷ Figure 4 shows this area.

⁸⁵ United Nations Office of Counter-Terrorism, “Border Security and Management,” UN Counter-Terrorism Centre (UNCCT), 2020, <https://www.un.org/counterterrorism/cct/border-security-and-management>.

⁸⁶ Catherine Davies, Hilary Owen, and Claire Brewster, *South American Independence: Gender, Politics, Text* (Liverpool, UK: Liverpool University Press, 2006).

⁸⁷ Leslie Bethell, *The Paraguayan War (1864-1870)* (New York: Institute of Latin American Studies, 1996), 9.



Figure 4. The cities of concern within the TBA⁸⁸

Although the TBA was already inhabited, its significant transformation started in the 1960s with industrialization. The economic growth started with the construction of the Itaipu Dam after negotiations between the governments of Paraguay and Brazil.⁸⁹ All three countries would soon enter into a trade agreement and rapidly develop economic infrastructure. Additionally, the TBA would become a tourist attraction, and by the 1970s, the Iguazu Falls would be given high priority for tourism by both Brazil and Paraguay. However, the cities soon became a shopping paradise for contraband and illegal trade.⁹⁰ The illegal trade gradually infiltrated the other cities and spawned an out-of-control crime rate. The population within the area grew rapidly, but there were no contributions to infrastructural development. This also led to increased commercial activity and illegal crossing and border trade, making the area challenging for law enforcement to manage.

⁸⁸ Source: R. Evan Ellis, “The Paraguayan Military and the Struggle against Organized Crime and Insecurity,” *Military Review* Online Exclusive (January 2019): 3, <https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2019-OLE/Jan/Paraguayan-Military/>.

⁸⁹ Steven Dudley, “Stretching the Border: Smuggling Practices and the Control of Illegality in South America,” *InSight Crime* (blog), November 3, 2010, <https://insightcrime.org/news/brief/stretching-the-border-smuggling-practices-and-the-control-of-illegality-in-south-america/>.

⁹⁰ Hudson, *Terrorist and Organized Crime Groups*, 4.

By the 1970s, an already unmanageable area would suffer from heightened illegal activities with the high influx of migrants. Immigrants from South America and the Middle East descended on the area hoping for job opportunities. According to Abbott, “The TBA, South America’s busiest contraband and smuggling center, is home to a large, active Arab and Muslim community consisting of a Shi’a majority, a Sunni minority, and a small population of Christians who emigrated from Lebanon, Syria, Egypt, and the Palestinian territories about 50 years ago.”⁹¹ With little law enforcement in the area, drug trafficking, money laundering, gun-running, cargo theft, and other criminal activities became rampant in the TBA. Besides all the other illegal activities, by the 1980s, authorities had a new threat; extremist terrorist groups were now using the TBA as a logistics and transshipment base. Since it established its first logistical and financial cells there and started leveraging its presence as a source of revenue in the 1980s, Hezbollah has called the TBA’s home.⁹² The corruption within the TBA by the extremist groups has been linked to the funding groups like Hezbollah and al-Qaeda. The TBA’s population increased from 60,000 to 700,000 between 1971 and 2001.⁹³ Daniel Lewis noted, “In 2012, the TBA population was estimated at one million nine hundred thousand people, which indicates a dynamic growth considering the fact that it only began its development in the 1960s.”⁹⁴

C. CRIMINAL ACTIVITIES IN THE TRI-BORDER AREA

The TBA has attracted numerous criminal networks for various reasons and intentions. The closeness of the three main cities in the TBA—the Argentine city of Puerto Iguazu, the Paraguayan city of Ciudad del Este, and the Brazilian city of Foz do Iguacu—allows criminal and terrorist organizations to operate more easily by preying on the weak

⁹¹ Philip K. Abbott, “Terrorist Threat in the Tri-Border Area: Myth or Reality?,” *Military Review* 84, no. 5 (2004): 51, <https://cgsc.contentdm.oclc.org/digital/collection/p124201coll1/id/178/rec/3>.

⁹² Zachary Leshin, “The Hezb’allah Threat in the Tri-Border Area,” *American Thinker*, February 28, 2018, https://www.americanthinker.com/articles/2018/02/the_hezbollah_threat_in_the_triborder_area.html.

⁹³ Leshin, 1.

⁹⁴ Daniel Lewis, James I. Matray, and George J. Mitchell, *A South American Frontier: The Tri-Border Region* (New York: Chelsea House Publications, 2006).

points of the local official institutions.⁹⁵ The TBA is a notoriously lawless region where illegal operations like money laundering, drug, and arms trafficking, extortion, sponsorship of terrorism, forgery, passport fraud, and piracy bring in billions of dollars yearly.⁹⁶ The United States—and TBA countries—have long been aware of a latent terrorist danger across the tri-border region, especially in the wake of the terrorist attacks of 2001.⁹⁷ The TBA offers a refuge that is physically, socially, economically, and politically very suitable to permitting organized crime in addition to Islamic terrorist organizations.⁹⁸ Baisotti noted that, “The triple border is considered—by many citizens as well—a free zone for crime and terrorism planning, collection of resources for this purpose, and others that could serve Hezbollah.”⁹⁹ However, citizens of all three countries do not see the border as impenetrable boundaries, but as an economic hindrance restricting household incomes.

Considering the proximity of the three border cities in TBA, it would emerge as the perfect location for regional and international crime. Lynn observed, “Apart from the local gangs and criminal clans who operated there, there were Colombian, Russian, and Chinese mafias, as well as criminal organizations from other parts of the world, including those from Africa who were running their criminal businesses in the area.”¹⁰⁰ Investigation into the illegalities at the TBA has shown that many legitimate businesses are connected to the criminal underworld to varying degrees. Over the years, it has also been noted that of the three states, Paraguay has the weakest legislation, where frequent violation of law and violent practices occur. As a result, numerous methods evolved of smuggling goods between Argentina, Brazil, and Paraguay, using land, air, and rivers and aided by corrupt law enforcement. Monitoring the illegal trajectories has become highly ineffective, as over

⁹⁵ “TBA Tri State Border Area,” Global Security, 2020, <https://www.globalsecurity.org/military/world/argentina/tba.htm>.

⁹⁶ Abbott, “Terrorist Threat in the Tri-Border Area,” 51.

⁹⁷ Pablo A. Baisotti, “The Triple Border, a Criminal Haven,” *Small Wars Journal*, January 12, 2021, <https://smallwarsjournal.com/jrnl/art/triple-border-criminal-haven>.

⁹⁸ Hudson, *Terrorist and Organized Crime Groups*, 2.

⁹⁹ José Edgardo Dipierrri et al., “Isonymic Relations in the Bolivia-Argentina Border Region,” *Human Biology* 88, no. 3 (2016): 191–200, <https://doi.org/10.13110/humanbiology.88.3.0191>.

¹⁰⁰ Josefina Lynn, *La Amenaza Terrorista en la Triple Frontera: Los problemas de seguridad en la frontera de Argentina, Brasil y Paraguay* (Chisinau, Moldova: Editorial Académica Española, 2011).

30,000 people travel among the three countries daily. As a result, the Brazilian government announced the creation of an “Integrated Control Center” in March 2015 to create mechanisms to better control the movement of products and scale back smuggling.¹⁰¹ Some of the more common illegal activities occurring at the TBA are:

1. Narcotics Trafficking

Drug trafficking is one of the most lucrative trades in the TBA, with the local gangs, mafias, and international criminal groups all competing. The lack of adequate law enforcement has made smuggling illegal substances easier, and after successful anti-drug operations in Colombia, Colombians took their drug operation into the TBA. According to the reports of the Argentinian special services, “the area of the city of Misiones, south of Puerto Iguazú, became a new base of drug smuggling, with the substances coming from Paraguay, among other places.”¹⁰² The entire endeavor to smuggle the drugs was organized by the group Friends of Friends (Amigos de Amigos).¹⁰³ The bulk of the drugs circulating in the TBA will not remain in the area and is destined for North America, Europe, and Africa.

2. Weapons Trafficking

The TBA has been known for smuggling weapons between all three countries and selling them on the international market. Assault rifles such the AR-15, Colt M-4, and AK-47, as well as their homemade variants, are among the illegal weapons sold.¹⁰⁴ Weapons are readily available and sold at an affordable price to local gangs and terrorist organizations that benefit from the illegal trade. A significant shipment of weaponry

¹⁰¹ Stanisław Kosmyńka, “The Problem of Organized Crime in the South American Tri-Border Area: Paraguay, Brazil and Argentina,” *International Studies. Interdisciplinary Political and Cultural Journal* 25, no. 1 (2020): 9–28, <https://doi.org/10.18778/1641-4233.25.02>.

¹⁰² Geraldine Cuervo Ceballos, “Transnational Organized Crime as a Hybrid Threat to Argentina, Paraguay and Brazil’s Triple Frontier,” *Revista Científica General José María Córdova* 16, no. 23 (2018): 43–61, <https://doi.org/10.21830/19006586.304>.

¹⁰³ Kosmyńka, “The Problem of Organized Crime,” 14.

¹⁰⁴ Kosmyńka, 14.

intended for Lebanon and Syria by sea was stopped in the Paraguayan portion of the TBA in July 2010.¹⁰⁵

3. Sexual Slavery

Within the TBA, criminal groups have also embarked on severe crimes such as human trafficking. Many women and boys (often under-aged) are abducted and forced into prostitution.¹⁰⁶ Luis Guillermo noted, “In June 2000, the Brazilian daily paper O Globo already informed about the growing involvement of organized criminal groups from Russia in recruiting (and often abducting) in these areas women who were then sent to brothels in Europe and Israel.”¹⁰⁷ Unknown numbers of rural citizens in Brazil, Paraguay, and Argentina have been coerced into prostitution by the promise of lucrative jobs but have then been taken to brothels and forced to engage in prostitution.¹⁰⁸ This is one of the main issues in the region, and it is thought that one or more mafias are in charge of this profitable sector. It is important to note that the region surrounding the three borders has developed into a central hub for sex tourism, drawing visitors from Canada, the United States, and Europe, in addition to Hispanics who frequently profit from child prostitution.¹⁰⁹

4. Falsification of Documents

Falsification of documents has become a driving force for criminal organizations in the TBA. Making driving licenses, passports, visas, and even birth papers has helped lawbreakers on the run. Investigations in Brazil, Argentina, and other nations revealed fake birth certificates and other fake documents.¹¹⁰ These documents typically identified the

¹⁰⁵ Kosmyinka, 20.

¹⁰⁶ Hudson, *Terrorist and Organized Crime Groups*, 10.

¹⁰⁷ Luis Guillermo Solís Rivera and Francisco Rojas Aravena, eds., *Crimen organizado en América Latina y el Caribe* (Santiago, Chile: FLACSO, Secretaría General: Catalonia, 2008).

¹⁰⁸ Kosmyinka, “The Problem of Organized Crime,” 13.

¹⁰⁹ Kosmyinka, 13.

¹¹⁰ Marcelo Rocha E. Silva Zorovich, “The Power of Organized Crime in Brazil: From Public and Social Challenges to the Effectiveness of Reforms,” in *Drug Trafficking, Organized Crime, and Violence in the Americas Today*, ed. Bruce M. Bagley and Jonathan D. Rosen (Gainesville, FL: University Press of Florida, 2015), 323–43, <https://doi.org/10.5744/florida/9780813060682.003.0016>.

TBA as the place of origin and were utilized to hide a person's identity or enable their illegal border crossing.¹¹¹

5. Money Laundering

The TBA purportedly has many front companies that launder money, which is an integral part of criminal organizations. Around the turn of the century, it was estimated that money laundering operations in the TBA generated annual revenues of roughly USD 12 billion, disrupting the local financial structure.¹¹² Thus, Paraguay is now considered one of the main scenes of this crime, as the banking legislation was easily out maneuverable.¹¹³ Furthermore, many articles have noted that the TBA flourishes from its illegal activities, which use money laundering as a source of funding terrorist organizations. As a result, legislation has been amended to impose harsher penalties for money laundering.¹¹⁴

6. Global War on Terrorism

While the TBA is not where the fight is on terrorism, it plays a vital role in recruiting and financing. Terrorists can use the TBA's potential cash resources, illegal weapons and cutting-edge technology, ease of mobility and concealment, and sympathetic population to recruit members and spread messages throughout the world.¹¹⁵ Carlos Altemberger, chief of Paraguay's antiterrorist unit, stated, "terrorists partly finance their operations by remitting dollars from Ciudad del Este to the Middle East."¹¹⁶ Argentine

¹¹¹ Sarah Nelson, "Fighting Terror in the Tri-Border Area | Wilson Center," 2019, <https://www.wilsoncenter.org/article/fighting-terror-the-tri-border-area>.

¹¹² Patricia Taft, David A. Poplack, and Rita Grossman-Vermaas, *The Crime-Terrorism Nexus: Risks in the Tri-Border Area* (Washington, DC: Fund for Peace, 2012), <https://issuu.com/fundforpeace/docs/ttcvr0905-threatconvergence-triborder-1204b>.

¹¹³ Camilo Andrés Devia Garzón and Dina Ortega Avellaneda, "Características y desafíos del crimen organizado transnacional en la Triple Frontera: Argentina-Paraguay-Brasil," *Criminalidad* 61, no. 1 (2019): 9–28, <https://dialnet.unirioja.es/servlet/articulo?codigo=6843864>.

¹¹⁴ Vanessa Neumann and Stuart Page, *The Many Criminal Heads of The Golden Hydra: The Tri-Border Area's Interlocking Arcs of Crime Create LatAm's #1 International Fusion Center* (New York: Counter Extremism Project, 2018), 100, <https://www.counterextremism.com/sites/default/files/The%20Many%20Criminal%20Heads%20of%20the%20Golden%20Hydra%20%28May%202018%29.pdf>.

¹¹⁵ Abbott, "Terrorist Threat in the Tri-Border Area," 51.

¹¹⁶ Hudson, *Terrorist and Organized Crime Groups*, 53.

officials believe Hezbollah is active in the TBA after a series of bombs in 1992 and 1994, which affected the Israel embassy and the Jewish community respectively.¹¹⁷ Dumitrascu stated, “Both American and Israeli intelligence indicates the involvement of cross-border illegalities by terrorist organizations such as Hezbollah, Hamas, Jamaat al-Islamiyya, Jihad, and Al-Qaeda were taking up their activity in the area of the Three Borders.”¹¹⁸ The groups have been linked to organized crime in obtaining funds from drugs, arms, people trafficking, financial embezzlement, and money laundering.¹¹⁹

D. BORDER SECURITY AND THE USE OF TECHNOLOGY (COUNTERMEASURES)

As criminal organizations have exploited the three countries, they all pursue measures to counter them, whether by individual tactics or merging forces in the TBA. The Security Plan for the Triple Border, which was signed in 1998 by Brazil, Argentina, and Paraguay, gave the phrase formal sanction.¹²⁰ The illegal activities are due to the TBA’s outstanding economic rewards and previously lax law enforcement. Criminal groups’ threats to territorial integrity and sovereignty, however, have caused all three counties to strengthen their security measures and venture into emerging border technology as a force multiplier.

Regional collaboration is imperative to reduce high tension in the TBA, using shared intelligence and border surveillance technology to improve productivity. Without the use of shared intelligence, the TBA will continue as a hotbed of corruption and terrorist activities. Using surveillance technology has brought numerous convictions and has reduced crime in the TBA. In addition, the TBA countries have signed on to numerous multilateral organizations such as the Inter-American Committee Against Terrorism, the

¹¹⁷ Neumann and Page, *The Many Criminal Heads of The Golden Hydra*, 57.

¹¹⁸ Alexandra Dumitrascu, “El Radicalismo Islámico en América Latina. De Hezbolá al Daesh,” *Instituto Espanol de Estudios Estratégicos*, “*Documento Opinión*,” no. 121 (2016): 1–14.

¹¹⁹ Adriana Dorfman, Rafael Francisco França, and Julian Mokwa Felix, “Between Triple Borders: Border Security across Latin America’s Southern Cone,” *Commonwealth & Comparative Politics* 59, no. 4 (2021): 451, <https://doi.org/10.1080/14662043.2021.1997189>.

¹²⁰ Dorfman, França, and Felix, 451.

OAS, the Financial Action Task Force, and The Southern Cone Common Market (Mercosur). With the information gained from these organizations, the country's security forces, the intelligence units, and the use of emerging border technology, there is a possibility that there will be even more reduction of crime in the TBA.

1. Brazil

Brazil has realized its shortfalls in the TBA and has merged its effort with local, regional, and international partners to enhance its border security measures. The focus on public safety has always been fundamental, which has resulted in investment in border security equipment and technology in the TBA. Because the issue was so widespread and garnered so much attention internationally, the federal government created the Public Security Department to coordinate a variety of law enforcement entities across the national territory.¹²¹ Brazil, one of the countries that manufactures most of its equipment, has developed communication satellites, sensors, radar systems integration (low altitude air radar), biometrics, and fully equipped launch vehicles to fight against crime in the TBA.

Brazil's improvement in border security technology has transformed its response to cross-border criminal activities. In 2011, securitization peaked with the adoption of the Strategic Border Plan (SBP), where the government embarked on a multi-billion-dollar project to deter and combat cross-border crime. For example, on the Brazil/Paraguayan border, border surveillance radars have been erected that detect low-flying aircraft suspected of smuggling. As air sensors detect a movement, the Federal Police (PF, in Portuguese) await ground coordinates before moving to the location to search for weapons, drugs, and other illegalities.¹²² By 2019, Brazil had installed border security technology on the Friendship Bridge on its border with Paraguay. The Brazilian city of Foz do Iguaçu, located in the Paraná state, and the Paraguayan city of Ciudad del Este are already connected by facial recognition cameras, license plate scanners, and acoustic gunshot

¹²¹ Daniele Andrews and Genard Burity, "Defense, Aviation and Security," Brazil Country Commercial Guide, January 22, 2022, <https://www.trade.gov/country-commercial-guides/brazil-defense-aviation-and-security>.

¹²² Nelza Oliveira, "Brazil Invests in Border Surveillance Radars," *Diálogo Américas* (blog), January 3, 2019, <https://dialogo-americas.com/articles/brazil-invests-in-border-surveillance-radars/>.

detection systems. The biometric system assisted with the seizures of over \$11 million in vehicles alone in 2020 while reducing the number of required human resources.

Although not all of Brazil's TBA is under surveillance by emerging border technology, the area covered seems to have improved significantly. The approach to security in the TBA has evolved over the past two decades, from just the to the use of surveillance technology. Joint patrol between the Federal Police and regional Army military command has now become routine and is driven by technological evidence and surveillance information for more convictions. Several significant projects are now being built, including new security command and control centers, surveillance technology, intelligence assistance, physical protection, and transit security.¹²³

As Brazil continues its fight against illegalities in the TBA, so too do they continue to develop countermeasures. A sensing and decision support system for operational employment, SISFRON was conceived in 2011 to support the Integrated Border Monitoring System.¹²⁴ The primary purpose was to guide and monitor border areas with a continuous flow of information to security forces using biometrics and motion sensors. The goal is to give state and federal military and security authorities the tools they need to stop illegal activities such as border disputes, environmental crime, cargo and vehicle theft, drug and contraband smuggling, and trafficking in guns.¹²⁵ Analysts who view it as a significant incentive for the Brazilian sector claim that it has helped law enforcement reduce criminal operations including arms trafficking, drug and contraband smuggling, cargo and vehicle theft, and environmental crime while also avoiding border confrontations.¹²⁶ State police agencies will increasingly rely on command and control centers, which will require modernization to enhance interoperability and data processing capabilities as contemporary law enforcement techniques are applied in the TBA. It is noteworthy that the

¹²³ Tamir Eshel, "LAAD 2011 Focus: Brazil's Homeland Security Investments," *Defense Update*: (blog), March 13, 2011, https://defense-update.com/20110313_brazil_hls.html.

¹²⁴ Domingos Zaparolli, "Border Surveillance," *Revista Pesquisa*, 2019, <https://revistapesquisa.fapesp.br/en/border-surveillance/>.

¹²⁵ Zaparolli.

¹²⁶ Zaparolli.

modern technological resources included in SISFRON enable the Ground Force combatant to operate in a highly complex technological environment, which will further assist in the fight against illegalities in the TBA.

2. Argentina

The effort to strengthen border security in the TBA has been a challenging battle for the Argentinian security forces. The Argentine National Gendarmerie's (GNA) mission is to combat organized crime, terrorism, and drug trafficking.¹²⁷ Their work in the TBA has not gone unnoticed; however, the criminal organization's strength has also overshadowed its success. The 1992 and 1994 bombings in Buenos Aires have been traced to the TBA and many other illegal activities that have left the Federal police baffled. For instance, to combat smuggling in the TBA in February 2000, Argentina's Secretariat of Internal Security dispatched 1,000 police personnel and four boats from the Naval Prefecture.¹²⁸ In just three days, the Argentine Air Force's surveillance mission discovered at least 15 unauthorized airstrips in the northern Argentine provinces of Misiones and Corrientes.¹²⁹ Additionally, roughly 30 unexplained flights were found, the majority of which originated in Paraguay.¹³⁰ Many of these missions were unsuccessful, not because the security forces were incapable but because the criminal organizations were already using technology to evade security forces.

To counter criminal organizations and their means of evading security forces, the Argentinian Ministry of Security continues to develop its security measures and has implemented border technology. By adding staff, technology, and equipment, they have expanded their nation's network of law enforcement intelligence fusion centers (Figure 5). This has strengthened their ability to enforce the law at high-risk ports of entry along their

¹²⁷ Hudson, *Terrorist and Organized Crime Groups*, 60.

¹²⁸ "Bartolome_2002_La Triple Frontera.Pdf," n.d., 7.

¹²⁹ Hudson, *Terrorist and Organized Crime Groups*, 61.

¹³⁰ "Bartolome_2002_La Triple Frontera.Pdf," 7.

northern border.¹³¹ The sharing of intelligence between the TBA nations has strengthened through human intelligence and digital/technological means. Argentina has opened a Digital Intelligence Laboratory in its north cone, which assists the GNA in using any digital device as a sensor to track location. Through the use of data from the cloud that criminals connect to, this technology links the physical device to crimes. Whatever is concealed in web browsing history, mapping apps, location data, online search history, and Wi-Fi connections may be utilized as evidence.¹³² In recognizing the security demand in the Southern Cone, Argentina has also ventured into smart border technology using ground sensors and biometrics.



Military personnel inside a mobile SISFRON Command and Control unitRobson Cesco / Embraer Defense & Security

Figure 5. Argentinian fusion center in operation¹³³

The use of smart border technology to protect Argentina since 2019 has been updated to rival that of the United States-Mexico border. The control center gets data from activated sensors at a border crossing; the data is immediately sent the control centers

¹³¹ “Country Reports on Terrorism 2019: Argentina,” Country Reports on Terrorism 2019, 2019, <https://www.state.gov/reports/country-reports-on-terrorism-2019/argentina/>.

¹³² Department of State, Bureau of Counterterrorism.

¹³³ Source: Zapparoli.

allowing security forces to have operational command of the environment.¹³⁴ The new system is to fight against the illegalities happening on the Argentinian border, using cutting-edge technology to enhance safety. The systems, which have been in use since October 1, 2019, complement the stationary sensors, radars, vehicles, and patrol ships that currently make up the region's first smart border surveillance system.¹³⁵ Biometrics and surveillance sensor technology have been used to monitor the air, land, and river borders dividing Paraguay from Brazil and Argentina. By using the border technology, there has been a noticeable reduction in crime in the TBA, seizing numerous drug shipments and covering more areas than before.

Argentina has combatted drug trafficking and illicit border crossings at the TBA by using border surveillance technology. This deterrent of cross-border smuggling is a force multiplier that aligns with the national defense mandate of the GNA's Repression and Prevention Police.¹³⁶ The surveillance sensors have been protecting the "hot border" with Paraguay, where security presence is porous. The sensor, when set off, will alert the security forces, who will be able to respond with proportional force. Argentine Secretary of Security Eugenio Burzaco told *Diálogo*. "The big problem in the region today is the advance of criminal groups, which take on new means to inflict damage, so smart border technology is now used in Puerto Iguazú in the Tri-border Area."¹³⁷ Using ground surveillance near the Paraguay border, GNA troops seized 98 kg of marijuana on June 8, 80 kg of marijuana on June 9, and over 152 kg of marijuana on June 10 near the Paraná River.¹³⁸ Through border control and surveillance operations, the GNA was able to

¹³⁴ "IAI Secures La Quiaca Border Crossing in Argentina," *Defense Update*: (blog), December 19, 2017, https://defense-update.com/20171219_argentina_border_security.html.

¹³⁵ Szklarz, "Argentina Launches First Smart Border Surveillance System."

¹³⁶ Royal Netherlands Marechaussee, "Argentinian National Gendarmerie," International Association of Gendarmeries and Police Forces with Military Statues, May 16, 2011, <http://www.fiep.org/member-forces/argentinian-national-gendarmerie/>.

¹³⁷ Szklarz, "Argentina Launches First Smart Border Surveillance System."

¹³⁸ Juan Delgado, "Argentine Security Forces Seize More than 700 Kg of Marijuana," *Diálogo Américas* (blog), July 31, 2020, <https://dialogo-americas.com/articles/argentine-security-forces-seize-more-than-700-kg-of-marijuana/>.

confiscate more than 4 tons of marijuana on June 21 in the province of Misiones, which is located near the Paraguayan border.¹³⁹

3. Paraguay

Paraguay, although its law enforcement in the TBA is not as advanced as the other two countries, has committed to work jointly. Paraguayans are also willing to participate in the region's Department of Defense-sponsored multilateral training exercises. The country, however, has a small armed force with a limited budget, which criminal organizations take advantage of. Paraguay's ability to police transnational threats such as narco-trafficking, money laundering, and terrorism has been questioned. Paraguay's cooperative spirit has supported the U.S. policy at a federal level within the TBA. In an effort to improve democracy through civic organizations, the State Department donated \$12 million of USAID money in 2001.¹⁴⁰ This, however, has caused many to question whether Paraguay's military needs this training due to the unstable nature of its governments, overlooking the country that has the most significant threat in the TBA and is least capable of managing its area.¹⁴¹

As criminals continue to organize themselves in Paraguay's TBA, the government seeks to counter the problem through new policies and laws. The government of Paraguay lacks the necessary tools to combat these terrorist threats, however, and several domestic laws and regulations encourage criminal conduct.¹⁴² Additionally, corrupt politicians collaborate with drug traffickers in the TBA, supporting the local terrorist organizations.¹⁴³ Neumann states, "The police, who are the most corrupt (90%) and have

¹³⁹ Juan Delgado, "Argentine Gendarmerie Seizes More than 4 Tons of Marijuana," *Diálogo Américas* (blog), July 22, 2021, <https://dialogo-americas.com/articles/argentine-gendarmerie-seizes-more-than-4-tons-of-marijuana/>.

¹⁴⁰ "U.S. Relations with Paraguay: Bilateral Relations Fact Sheet," Department of State, May 14, 2021, <https://www.state.gov/u-s-relations-with-paraguay/>.

¹⁴¹ State Department Bureau of Western Hemispheric Affairs.

¹⁴² Neumann and Page, *The Many Criminal Heads of The Golden Hydra*.

¹⁴³ Emanuele Ottolenghi, and John Hannah, "To Combat Illegal Immigration, Trump Should Target Latin America's Hezbollah-Narco Nexus," *Foreign Policy*, December 23, 2016, <https://foreignpolicy.com/2016/12/23/to-combat-illegal-immigration-trump-should-target-latin-americas-hezbollah-narco-nexus/>.

the greatest control over contraband flows, do not answer to the attorney general, but to the minister of the interior, appointed by the president. That means that the attorney general has little de facto investigative authority.”¹⁴⁴ The U.S. Department of State stated, “In 2018, Paraguayan President Mario Abdo Benitez inaugurated the new headquarters of the National Intelligence System (SINAI), its purpose of detecting, neutralizing and counterbalancing the actions of domestic and international terrorist groups, and of transnational criminal organizations.”¹⁴⁵ These regulations show initiatives to step up official action in order to stop the illegal crossing of borders and the trafficking of goods like technology, narcotics, and people.¹⁴⁶ Due to the lack of advanced border surveillance, however, Paraguay depends on its two border nations and assists in conducting joint operation when necessary.

E. CONCLUSION

This chapter has reviewed the use of emerging border security technology in the TBA and has found that the technology, when used, is effective. The emergence of smart border technology has revolutionized how the TBA is now safeguarded through ground and air sensors and biometrics. Illegal border crossings, illegal trade of goods and commerce, drug trafficking, and, most recently, the gathering of terrorist organizations can only be dealt with by using border surveillance. Using the technology as a force multiplier has reduced the number of troops being utilized and has reduced crime over the past decade. Brazil’s use of border security technology has led to a significant increase in seizures and crime reduction. Brazil also erected border surveillance radars on the Brazil/Paraguayan border, where they detected numerous illegal drug aircraft landing sites; these sites were reported to the authorities in Paraguay. In 2019, Brazil installed border security technology on the Friendship Bridge for facial recognition as well as license plate and acoustic gunshot detection. While hard statistics could not be obtained, with the sizable investment in border

¹⁴⁴ Neumann and Page, *The Many Criminal Heads of The Golden Hydra*, 111.

¹⁴⁵ U.S. Department of State, “Paraguay-Country Reports on Terrorism 2019: Paraguay,” United States Department of State, 2019, <https://www.state.gov/reports/country-reports-on-terrorism-2019/paraguay/>.

¹⁴⁶ Neumann and Page, *The Many Criminal Heads of The Golden Hydra*, 110–13.

security technology being made by Brazil, the hypothesis is that it is working to the benefit of the state.

In contrast, Argentina has made investments in intelligence fusion centers, enhancing technology to increase its capabilities for law enforcement at high-risk ports like the TBA. The technology is dispatched in real time to ground troops who fight against the illegalities happening on its border. Argentina now uses smart border surveillance as a force multiplier and has been working on the hot border with Paraguay.¹⁴⁷ It is important to note that recent technological advancements, including deploying unmanned aircraft drones to monitor the border region, have made it easier to govern this area.¹⁴⁸ Argentina employs surveillance technology as a smarter way to detect and deter cross-border illegal activities. The GNA's Repression and Prevention Police performs this duty in accordance with its role in Argentine national defense, which aims to prevent cross-border smuggling.¹⁴⁹ While the case study has shown that technology has assisted Brazil and Argentina since its implementation, it also shows that Paraguay's lack of border technology works against the state. Paraguay has not yet improved its border security due to budgetary constraints, but it has been working closely with the other two countries in the TBA.

¹⁴⁷ Mike LaSusa, "Argentina Profile," *InSight Crime* (blog), May 21, 2018, <https://insightcrime.org/argentina-organized-crime-news/argentina-profile/>.

¹⁴⁸ Kosmyinka, "The Problem of Organized Crime."

¹⁴⁹ Delgado, "Argentine Gendarmerie Seizes More than 4 Tons of Marijuana."

IV. U.S.-MEXICO CASE STUDY

A. INTRODUCTION

The US-Mexico borderlands are the most surveilled in the Americas. The history of this border dates to the 19th century, which evolved into what it is today. Subsequent to multiple territorial conflicts between both countries, the border now spans 1,954 miles between the two nations. The disputes resulted in major displacements, with the U.S. taking over portions of a town and city, and residents who lived in the same country would later need the proper documentation to visit family in another country. Peter Andreas, in the book *Border Games*: stated, “the U.S. southern border is the most heavily protected border regions, and the most traveled land crossing on earth.”¹⁵⁰ The U.S.-Mexico border is the most traversed worldwide because of bilateral and economic agreements. There are also the concerns of illegal crossing, trafficking of goods and commerce, smuggling of humans, drug and arms trafficking, and the threat of terrorist activities. The threat environment is constantly evolving. While there are many legal crossing points along the border, some portions of the border are unprotected by either legal entry points or walls; however, the use of emerging border technology is utilized to cover some of these areas. The following chapter examines the origin behind the border, the threats faced by both countries on the border, the use of emerging technology as a force multiplier, and whether the technology utilized is mutually beneficial and effective.

Despite various law enforcement agencies safeguarding the U.S.-Mexico border, criminal organizations continue to identify ways of evading them. Security is controlled mainly by the CBP on the U.S. side of the border. The CBP fully supports using technological devices to assist in border control. The need for different sensors and biometrics to monitor the border is rapidly expanding; the days of border monitoring by human eyes are no longer practicable. Because a significant portion of the border does not have legal entry points, these surveillance systems assist in combating illegal threats.

¹⁵⁰ Peter Andreas, *Border Games: Policing the U.S.-Mexico Divide*, 2nd ed. (Ithaca, NY: Cornell University Press, 2009).

However, the data and statistics collected by the technology will determine if they were effective in proper border control and management. Thus far, emerging technology has proven helpful based on some statistics from operations conducted. For example, CBP was able to detect and capture contraband goods and was able to prosecute and convict perpetrators; however, that alone is still not stopping the inflow of illegalities from Mexico into the U.S. While many technology companies are bidding for contracts to secure the border, some citizens take it upon themselves to secure their area, and others think it is unjust to stop the inflow of migrants. Nevertheless, CBP continues embracing technology to screen and secure incoming people and cargo at the borders.

B. BACKGROUND OF THE REGION

Since the inception of the border, it has been used for economic and bilateral relations between the U.S. and Mexico. Both countries have sought to secure their territories through national interest commerce and joint security cooperation. The terrain has presented border challenges; while some areas are easy to control, others threaten U.S. national security. In the past century, the security officer would patrol the dusty and rugged path using personal knowledge, experience, instincts, guts, and luck to stop any illegal activity. Meyers rehashed, “Seventy-five immigration inspectors on horseback began enforcing immigration laws on the U.S.-Mexico border in 1904, a border that was not even formalized until the 1848 Treaty of Guadalupe Hidalgo ended the Mexican-American war.”¹⁵¹ As part of the stringent Immigration Act of 1924, the United States Congress formed the first Border Patrol in 1924, hiring 450 border agents to prevent unauthorized border crossings.¹⁵² The Border Patrol almost doubled in strength by 1930, and throughout World War II, the organization continued to develop with a focus on national security.¹⁵³

¹⁵¹ Deborah Waller Meyers, “U.S. Border Enforcement: From Horseback to High-Tech,” *MPI Insight*, no. 7 (November 2005): 2, <https://www.migrationpolicy.org/research/us-border-enforcement-horseback-high-tech>.

¹⁵² Art, History and Archive, “The Immigration Act of 1924 | U.S. House of Representatives: History, Art & Archives,” n.d., <https://history.house.gov/Historical-Highlights/1901-1950/The-Immigration-Act-of-1924/>.

¹⁵³ Deborah W. Meyers, Demetrios G. Papademetriou, and T. Alexander Aleinikoff, *Reorganizing the U.S. Immigration Function: Toward a New Framework for Accountability* (Washington, DC: Carnegie Endowment for International Peace, 1998).

“However, by 1975, the government installed 177 of the Pentagon’s Vietnam-era ground sensors along the U.S.-Mexico border, laying the foundation for the germinal elements of what has become a virtual fence,” as demonstrated by Hellerstein.¹⁵⁴

As border control became more complex, the U.S. enacted the Immigration Reform and Control Act of 1986 (IRCA). Controlling illegal immigration, legalization, and reform of Legal Immigration were the three main tenets of IRCA, as reflected in the control act.¹⁵⁵ However, the issues of drugs, migration, and illegal commerce, made border patrol units seek structures to deter illegal activities using their technological equipment and approach. The development of new agencies, and the use of the military, aided by technology, all assisted in border control. The use of an influx of helicopters, night vision goggles (NVGs), infrared radar equipment, and mobile surveillance technology was implemented to combat the threat. Again, in 1993, in response to border concerns, President Clinton set aside \$45 million to employ 600 extra Border Patrol agents and buy new, cutting-edge equipment.¹⁵⁶ By 1997 the CBP launched Operation Rio Grande near McAllen and Laredo, Texas.¹⁵⁷ The results of the operation caused the U.S. government to install over 13,000 ground sensors through the Integrated Surveillance Intelligence System (ISIS) program.¹⁵⁸

Again, many of these technologies originated from the military, and the military assisted in maintaining and operating the equipment during the construction phase.¹⁵⁹ Cornelius, “Death at the Border,” commented, “Operations included the addition of hundreds of agents and motion-detection sensors in the selected sectors; construction of

¹⁵⁴ Erica Hellerstein, “Between the U.S. and Mexico, a Corridor of Surveillance Becomes Lethal,” *Coda Story* (blog), July 14, 2021, <https://www.codastory.com/authoritarian-tech/us-border-surveillance/>.

¹⁵⁵ Max Zimny and Catherine Waelder, “Immigration Reform and Control Act of 1986: A Union Perspective,” *The Labor Lawyer* 3, no. 4 (1987): 737, <https://www.jstor.org/stable/40861960>.

¹⁵⁶ “U.S. Commission on Immigration Reform,” Federation for American Immigration Reform, June 2003, <https://www.fairus.org/issue/legal-immigration/us-commission-immigration-reform>.

¹⁵⁷ Wayne A. Cornelius, “Death at the Border: Efficacy and Unintended Consequences of U.S. Immigration Control Policy,” *Population and Development Review* 27, no. 4 (2001): 661–85, <https://www.jstor.org/stable/2695182>.

¹⁵⁸ Nichols Martin, “GAO: CBP Improvement Plan Lacks Some Important Details,” Executive Gov, July 17, 2019, <https://executivegov.com/2019/07/gao-cbp-improvement-plan-lacks-some-important-details/>.

¹⁵⁹ Meyers, “U.S. Border Enforcement,” 4.

high-intensity, stadium-type lighting, new roads, and miles of steel fencing; and installation of an automated fingerprint system to identify criminal aliens and repeat crossers (IDENT).”¹⁶⁰ In order to collect biographical information on migrants detained at the border, border agents began utilizing cameras, biometrics, and scanners on the southwest frontier in 2001.¹⁶¹

Since the September 2001 attacks, the U.S. has had a stern operational command over its southern border and has invested millions of dollars in border technology as a force multiplier. Koslowski stated that after the terrorist attacks, “the Bush administration endeavored to create a ‘smart border’, which must integrate actions abroad to screen goods and people before they arrived in sovereign U.S. territory.”¹⁶² Unmanned aerial vehicles (UAVs) were included as a next-generation detection tool in a technological project to monitor the border that was started by the DHS in 2005.¹⁶³ The government allocated around \$1.5 billion to create a tower-based and ground-based surveillance system, but between 2006 and 2011, ground sensor issues caused the initiative to be scrapped.¹⁶⁴ In 2012, however, there were more than 12,000 new and enhanced ground sensors deployed along the southern border.¹⁶⁵ According to a February 2021 report from the DHS’s Office of Inspector General, “Congress appropriated more than \$743 million to CBP to fund border security technology between 2017 to 2020.”¹⁶⁶ A hundred-million-dollar contract was granted to a new company in 2020, to retrofit the SWB with new and improved surveillance technology.¹⁶⁷

¹⁶⁰ Cornelius, “Death at the Border,” 663.

¹⁶¹ U.S. Department of Homeland Security, “Homeland Threat Assessment October 2020,” 2020, 4.

¹⁶² Koslowski, “The Evolution of Border Controls,” 3.

¹⁶³ “Fact Sheet: Secure Border Initiative,” Department of Homeland Security, November 2, 2005, https://web.archive.org/web/20080312173504/www.dhs.gov/xnews/releases/press_release_0794.shtm.

¹⁶⁴ Hellerstein, “Between the U.S. and Mexico.”

¹⁶⁵ Jordan Smith, “CBP Has Improved Border Tech, but Challenges Remain,” MeriTalk, March 1, 2021, 1, <https://www.meritalk.com/articles/cbp-has-improved-border-tech-but-challenges-remain/>.

¹⁶⁶ Hellerstein, “Between the U.S. and Mexico.”

¹⁶⁷ Nick Miroff, “Trump Administration Hires Tech Firm to Build a Virtual Border Wall, an Idea Democrats Have Praised,” *Washington Post*, 2020, https://www.washingtonpost.com/immigration/trump-virtual-border-wall/2020/07/02/7b380490-b0ac-11ea-a567-6172530208bd_story.html.

C. BORDER THREATS

Security measures at the U.S.-Mexico border have improved significantly since the 1990s; however, criminal organizations have also improved their strategies. Although a wall was erected as a deterrent, it only slowed the process of committing an illegal act. As previously stated, a significant section of the border lacks a security wall, creating a haven for criminal organizations that have managed to maneuver those areas. Since the 1990s, there have been several programs created by the two countries to curb the illegalities on the border. With the combined alliance between drug cartels and Jihadis, border and immigration enforcement officers are up against vigorous opponents, which causes sophisticated constraints.¹⁶⁸ A High-Intensity Drug Trafficking Area initiative was established in 1990 to reduce trafficking and other narcotics-associated movements on the SWB; it would cooperate with regional systems for controlled interdiction, intelligence, investigation, and judicial processes.¹⁶⁹ The Merida Initiative is yet another effort that gives the U.S. and Mexico joint responsibility for combating the drug-fueled violence that affects residents on both sides of the border.¹⁷⁰

1. Drugs Trafficking

Most illicit drugs are smuggled into the U.S. via its SWB, and distribution is made to other parts of the country from there.¹⁷¹ Although the movement of drugs on the southern border can be traced to the U.S.'s prohibition era, the major drug problems peaked in the late 1990s. Drug trafficking continues to affect the U.S. southern border; with the innovative border technology instituted by the security forces, however, criminal organizations continuously have to change their techniques to evade authorities. Despite

¹⁶⁸ Christopher Holton, "The Terror Threat on the Southern Border," *National Security Policy* (blog), January 7, 2019, <https://centerforsecuritypolicy.org/the-terror-threat-on-the-southern-border/>.

¹⁶⁹ Josephine Wolff, "How Would the U.S. Respond to a Nightmare Cyber Attack?," *Scientific American*, July 23, 2013, <https://www.scientificamerican.com/article/how-would-us-respond-nightmare-cyber-attack/>.

¹⁷⁰ Wolff.

¹⁷¹ Kevin L. Perkins and Anthony P. Placido, "Drug Trafficking Violence in Mexico: Implications for the United States," *FBI News*, May 5, 2010, 1, <https://www.fbi.gov/news/testimony/drug-trafficking-violence-in-mexico-implications-for-the-united-states>.

the defense mechanism implemented, drug transshipments have managed to remain a major threat for CBP officers as criminal organizations are relentless and undeterred. Most of the southern border is vulnerable to drug smuggling due to migrants and visitors passing through the border daily and the vast areas not under surveillance. The Declaration on Drug Demand Reduction Cooperation was signed by senior leaders from the U.S. and Mexico in February 2010 as a declaration of their commitment to reducing the use of illicit drugs and an acknowledgement of the necessity of cooperation with other regional partners.¹⁷²

2. Terrorist Threat

Law enforcement believes that the drug cartels are involved in trafficking terrorist organizations (Al Qaeda, Al Shabaab, and Hezbollah) operatives into the U.S. Bensman asserted that, “From only public realm reporting, 15 suspected terrorists have been apprehended at the U.S.-Mexico border, or en route, since 2001.”¹⁷³ Over the years, numerous terrorists linked to different countries have been detained using biometrics on the southern border. The Washington Post reported, “The Border Patrol has nabbed 78 people on a terrorist watch list so far this fiscal year, according to new Department of Homeland Security data.”¹⁷⁴ The U.S. has used sensors to determine movement on the border; it has also used biometrics to screen and identify high-risk or special interest aliens (SIA). In Fiscal Year 2017, the SIA prevented more than 3,700 people who were on the terrorism watchlist from entering or leaving the country—an average of 10 people per day.¹⁷⁵

¹⁷² Wolff, “How Would the U.S. Respond to a Nightmare Cyber Attack?”

¹⁷³ Todd Bensman, *Have Terrorists Crossed Our Border? An Initial Count of Suspected Terrorists Encountered En Route and at the U.S. Southwest Border Since 2001* (Washington, DC: Center for Immigration Studies, 2018), 1, <https://cis.org/Report/Have-Terrorists-Crossed-Our-Border>.

¹⁷⁴ The Washington Times <https://www.washingtontimes.com> and Stephen Dinan, “Surging Number of Suspected Terrorists Nabbed Jumping Mexico Border This Year,” The Washington Times, 2022, <https://www.washingtontimes.com/news/2022/sep/20/surging-number-suspected-terrorists-nabbed-jumping/>.

¹⁷⁵ Depart of Homeland Security, “Myth/Fact: Known and Suspected Terrorists/Special Interest Aliens | Homeland Security,” 2019, <https://www.dhs.gov/news/2019/01/07/mythfact-known-and-suspected-terroristsspecial-interest-aliens>.

3. Mexican Cartel

The Mexican drug cartels are the most significant criminal organization on the U.S.-Mexico border, with control over what happens at the border; what they cannot control themselves is contracted out. The cartels affect how CBP patrols the border, the economy, and the flow of drugs into the United States.¹⁷⁶ They are the biggest suppliers of illegal narcotics for the U.S., bringing marijuana, methamphetamine, fentanyl, and cocaine through the U.S.-Mexico border.¹⁷⁷ A constant flow of drugs and other illegal trade over the border by the cartels makes it difficult for security forces to control the border. The U.S. border with Mexico, at 1,900 miles, is targeted by the cartels, flooding the U.S. with fentanyl, leading to nearly 108,000 overdose deaths in 2021.¹⁷⁸

As previously stated, the Mexican cartels flooded the U.S. with drugs, undocumented immigrants, and guns; this is a tactic used to divert officials' attention from the bulk of their activities. Suárez emphasized that "Cartels play an increasing role in the surge of migrants fueling the most recent immigration crisis at the U.S.-Mexico border, with monies from this trade going through U.S. banks and financial service."¹⁷⁹ Holton stated, "According to law enforcement personnel in Arizona cartels are buying real estate on both sides of the border to set up staging areas and camps."¹⁸⁰ In addition, the cartels employ sophisticated communications equipment, sometimes even more advanced than that in the hands of U.S. law enforcement, utilizing scouts and snipers in vital areas along trafficking routes—as far north as Phoenix.¹⁸¹ The Mexican cartel has been able to corrupt

¹⁷⁶ Stephen Buerger, "The Cartel and Its Effect on the United States," *Law and Justice in Real Time* (blog), December 15, 2015, <https://hub.wsu.edu/law-justice-realttime/2015/12/15/the-cartel-and-its-effect-on-the-united-states/>.

¹⁷⁷ U.S. Department of Homeland Security, "Homeland Threat Assessment October 2020," 26.

¹⁷⁸ Isabel Vincent, "Mexican Cartels Exploiting Border Chaos to Smuggle Fentanyl into US," *New York Post*, June 10, 2022, <https://nypost.com/2022/06/10/cartels-exploiting-border-chaos-to-smuggle-fentanyl-into-us/>.

¹⁷⁹ Karol Suárez, "Cartels Reap Growing Profits in the Smuggling of Migrants across the US-Mexico Border," *Courier-Journal*, July 1, 2021, <https://www.courier-journal.com/story/news/investigations/2021/07/01/mexican-cartels-fuel-immigration-crisis-at-us-border/5290082001/>.

¹⁸⁰ Holton, "The Terror Threat on the Southern Border."

¹⁸¹ Holton.

top border security officials and build strong relationships inside CBP and DHS, which is an added layer to the threat.

4. Migration

Over the past two years, the number of migrants arriving at the U.S.-Mexico border has increased dramatically; however, technology has managed to contain the flow. Although today it may seem that the numbers in migration are rocketing, the numbers were higher in the early 2000s, when the border lacked the technology and resources needed.¹⁸² These numbers will only increase with the rising tension in Latin America as Latin Americans travel in what is now called the ‘human caravan.’ Pew Research reported, “The U.S. Border Patrol reported more than 1.6 million encounters with migrants along the U.S.-Mexico border in the 2021 fiscal year, more than quadrupling the number of the prior fiscal year and the highest annual total on record.”¹⁸³

Migrants will continue crossing as long as there is a demand for their labor; however, the concern expands with the additional triple effect of drugs, human trafficking, and terrorism. Although technology has created a deterrent for migrants, it has caused migrants to use more dangerous routes and has now created a humanitarian issue. Most of the migration smuggling rings are linked to transnational criminal smuggling organizations paying billions of dollars annually.¹⁸⁴ According to the DHS, “The Biden administration launched an ‘unprecedented’ operation to disrupt human smuggling networks; in July authorities arrested 3,533 individuals connected to human smuggling networks and 262 busts, including stash houses, tractor trailers, and compartment and rail carloads.”¹⁸⁵ This

¹⁸² Camilo Montoya-Galvez, “The Facts behind the High Number of Migrants Arriving at the Border under Biden,” CBS News, August 31, 2022, <https://www.cbsnews.com/news/immigration-biden-us-mexico-border/>.

¹⁸³ Marc R Rosenblum, Irene Gibson, and Sean Leong, “Fiscal Year 2021 Southwest Border Enforcement Report,” *Office of Immigration Statistics*, 2022, 1.

¹⁸⁴ U.S. Immigration and Customs Enforcement, “Human Smuggling Equals Grave Danger, Big Money,” 2022, <https://www.ice.gov/features/human-smuggling-danger>.

¹⁸⁵ Priscilla Alvarez, “First on CNN: Human Smugglers Peddle Misinformation to US-Bound Migrants on Facebook, Watchdog Says,” CNN Politics, July 27, 2022, <https://www.cnn.com/2022/07/27/politics/human-smuggling-misinformation/index.html>.

indicates that migration continues to be one of the most significant threats at the U.S.-Mexico border. Figure 6 details migrant encounters at the SWB.

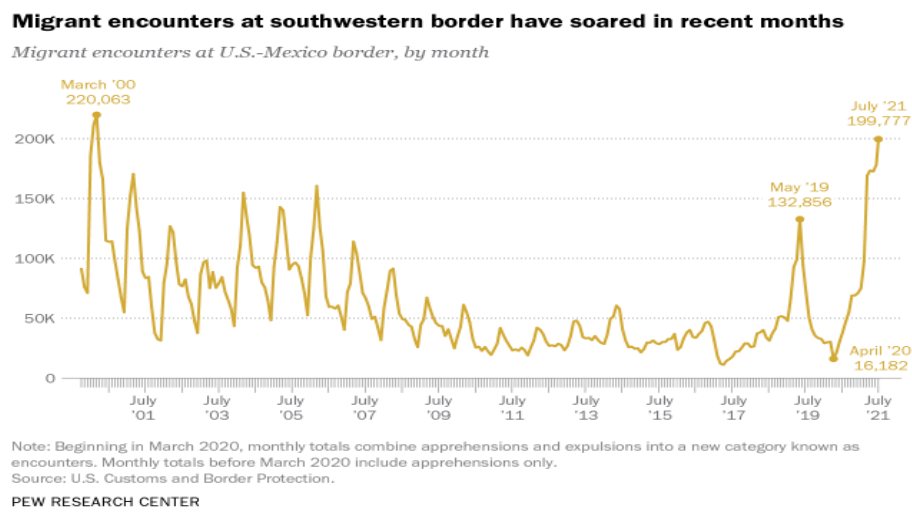


Figure 6. CBP migrant encounters between 1960 and 2021¹⁸⁶

5. Human Trafficking

Migrants who have taken up the challenge of seeking a better life in the U.S. arrive at the U.S.-Mexico border and are taken advantage of by criminal organizations. Every day, powerful criminal networks and individual traffickers take advantage of other people for forced labor or commercial sex activities, usually by using coercion, deception, or force, or by enticing minors under the age of 18 to engage in such actions.¹⁸⁷ Axel Weden states, “The drug cartels, locally referred to as ‘la mafia,’ control an extensive network of human traffickers and informants, who extort for money, kidnap and kill migrants at will.”¹⁸⁸

¹⁸⁶ Source: John Gramlich, “Migrant Encounters at U.S.-Mexico Border Are at a 21-Year High,” *Pew Research Center* (blog), 2021, <https://www.pewresearch.org/fact-tank/2021/08/13/migrant-encounters-at-u-s-mexico-border-are-at-a-21-year-high/>.

¹⁸⁷ Department of Homeland Security, “DHS Center for Countering Human Trafficking Observes World Day Against Trafficking in Persons | Homeland Security,” 2022, <https://www.dhs.gov/news/2022/07/29/dhs-center-countering-human-trafficking-observes-world-day-against-trafficking>.

¹⁸⁸ Axel Storen Weden, “Deadly Human Trafficking Business on Mexico-US Border,” *Al Jazeera*, January 24, 2016, <https://www.aljazeera.com/features/2016/1/24/deadly-human-trafficking-business-on-mexico-us-border>.

Migrants start their journey with a “coyote” and are forced to pay what is stipulated by the gangs and cartels; those who refuse to pay are killed. According to Customs and Border Patrol, “smuggling and traffickers fee revenues estimated a total of \$411.5 million in February 2019, taking people from Mexico and Central American countries to the U.S. border – which amounts to an average of \$14.6 million for each day.”¹⁸⁹ The fees migrants have to pay to illegally transit to the U.S. are exorbitant and leave them penniless or unable to meet the cost. The cartel would force them to work as drug mules, carrying drug-filled backpacks. The cartel illegally controlling both sides of the U.S.-Mexico border has used human trafficking to increase their incomes. Most migrants are left in “debt bondage” caused by the high-cost trafficking imposed, which sometimes leaves them with no choice but to become mules for the cartel.¹⁹⁰

D. BORDER SECURITY TECHNOLOGIES

The capacity to identify, dissuade, and respond to all threats has increased thanks to technology, which acts as a priceless force multiplier.¹⁹¹ Huerta explained that “Surveillance and biometrics are traditionally masked as protection against drug trafficking and organized crime, but it is often used as a tool to scrutinize and oppress people who seek a better livelihood.”¹⁹² For example, aerial and ground sensors and biometrics have greatly improved the security measures at the U.S.-Mexico border making it harder for migrants to penetrate the border. The Office of the Inspector General stated, “When items of interest are detected, the systems transmit alerts— motion, video, or photograph—to

¹⁸⁹ Mark Moore, “US-Mexico Border Traffickers Earned as Much as \$14M a Day Last Month,” *New York Post*, March 22, 2021, <https://nypost.com/2021/03/22/us-mexico-border-traffickers-earned-as-much-as-14m-a-day-last-month/>.

¹⁹⁰ Human Trafficking Search, “Human Trafficking Meets Human Smuggling at the Southern Border,” *HTS Blog* (blog), February 19, 2019, <https://humantraffickingsearch.org/human-trafficking-meets-human-smuggling-at-the-southern-border/>.

¹⁹¹ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain,” 4, accessed November 8, 2022, <https://www.oig.dhs.gov/sites/default/files/assets/2021-02/OIG-21-21-Feb21.pdf>.

¹⁹² Erika Huerta, “Surveillance Technology: U.S. and the US-Mexico Border,” *Information Visualization* (blog), December 21, 2021, <https://studentwork.prattsi.org/infovis/visualization/surveillance-technology-us-and-the-us-mexico-border/>.

Border Patrol command center workstations.”¹⁹³ Again Hellerstein describes “Beginning in 1997, two surveillance programs were rolled out that placed cameras and ground sensors in urban border crossings in San Diego, Arizona, and Texas. .”¹⁹⁴ Over time the technology has improved. Figure 7 shows the number of surveillance technologies employed by U.S. law enforcement organizations between 2006 and 2020. According to Huerta, “Since 2016, there’s been a gradual increase every year and between 2018 and 2019, a spike increase of over 1,000 cases were registered.”¹⁹⁵

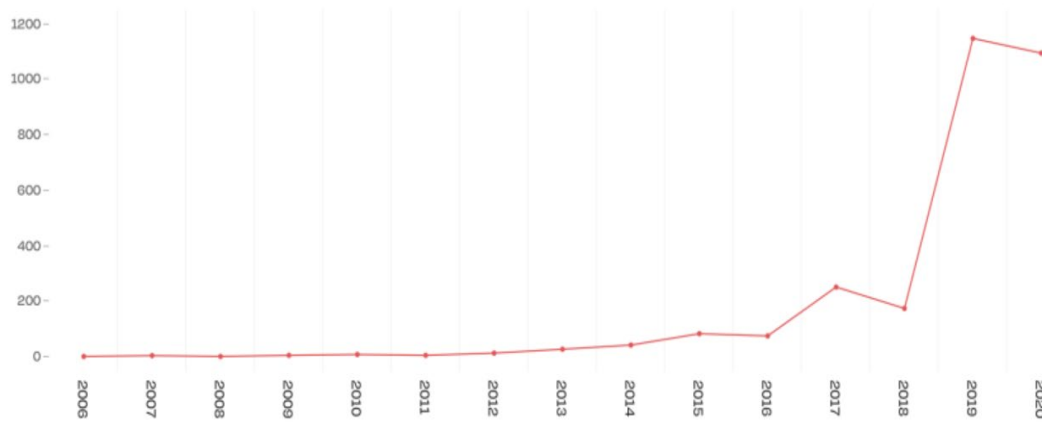


Figure 7. Number of surveillance technologies used between 2006 and 2020¹⁹⁶

1. Ground Sensors

The government put 177 ground sensors from the Pentagon’s Vietnam period there in 1975, creating the first ground sensor network on the U.S.-Mexico border.¹⁹⁷ Between 1975 and 2012, ground sensors expanded to over 12,000, and by 2020 there were over

¹⁹³ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain,” 21, accessed October 31, 2022, <https://www.oig.dhs.gov/sites/default/files/assets/2021-02/OIG-21-21-Feb21.pdf>.

¹⁹⁴ Hellerstein, “Between the U.S. and Mexico.”

¹⁹⁵ Huerta, “Surveillance Technology,” 3.

¹⁹⁶ Source: Huerta, “Surveillance Technology.”

¹⁹⁷ Hellerstein, “Between the U.S. and Mexico.”

20,000 ground sensors on the U.S. southern border alone.¹⁹⁸ Patrol on the U.S.-Mexico border relies on different types of ground sensors to deter movement on the border. For example, a series of underground seismic ground sensors can distinguish vehicle movement and human movements crossing the border; when triggered, it sends a signal to the Border Patrol headquarters, which can respond promptly. As technology becomes more advanced, so do these sensors; by 2020, ground sensors could detect the difference between humans, animals, and vehicular traffic.

2. Aerial Sensors

Aerial sensors and unmanned aircraft systems are promising new technology but were designed for military purposes. These aerial sensors are UAVs or drones and are being used on the U.S. southern border. The aerial sensors respond to the activation of ground sensors, after which they move to that location, capture images, and relay them to the CBP headquarters. Military-style Predator drones have been employed by CBP to monitor the border since 2006, among other types.¹⁹⁹ The Predator drones are technologically advanced to the point that they can detect footprints in the sand from nine miles high. Other drones use different cameras, radars, or infrared and can recognize targets from miles away. DHS drones spent 19,000 hours in the air scanning the United States' SWB between 2011 and 2016. ACLU reported that "UAVs can utilize technology such as infrared cameras and laser illuminators, so surveillance is possible at any time of the day or night."²⁰⁰

3. Biometrics

Using biometrics at the U.S.-Mexico border to measure an individual's physical characteristics, biometric scans, fingerprints, facial recognition, and iris has made the border more secure. The 9/11 Commission Report prompted CBP to start using fingerprints

¹⁹⁸ Smith, "CBP Has Improved Border Tech."

¹⁹⁹ Dara Kerr, "Drones, Sensors and AI: Here's the Tech That's Being Used at the Border," CNET, <https://www.cnet.com/news/politics/drones-sensors-and-ai-heres-the-tech-thats-being-used-at-the-border/>.

²⁰⁰ "Border Security Technologies," ACLU, September 30, 2022, <https://www.aclu.org/other/border-security-technologies>.

to verify visitors entering and leaving the country.²⁰¹ The government launched an automated biometric identification program during the Clinton administration, which collected fingerprints, photographs, biographical data, and arrest records from migrants.²⁰² These devices are present at almost all legal entry points. However, patrols in the fields now carry a handheld device that can send fingerprint and facial recognition to the headquarters from illegal entry points. With this technology, patrols can determine whether those found on the border are persons of interest. For the CBP, biometric technology can significantly increase information security due to the uniqueness of each individual. On the U.S.-Mexico border, biometrics have been found to be convenient, reliable, and productive while boosting security forces' efficiency. In addition, implementing the technology has significantly increased the return on its investment, improving accuracy and accountability. Figure 8 shows the employment of technology on the U.S.-Mexico border.

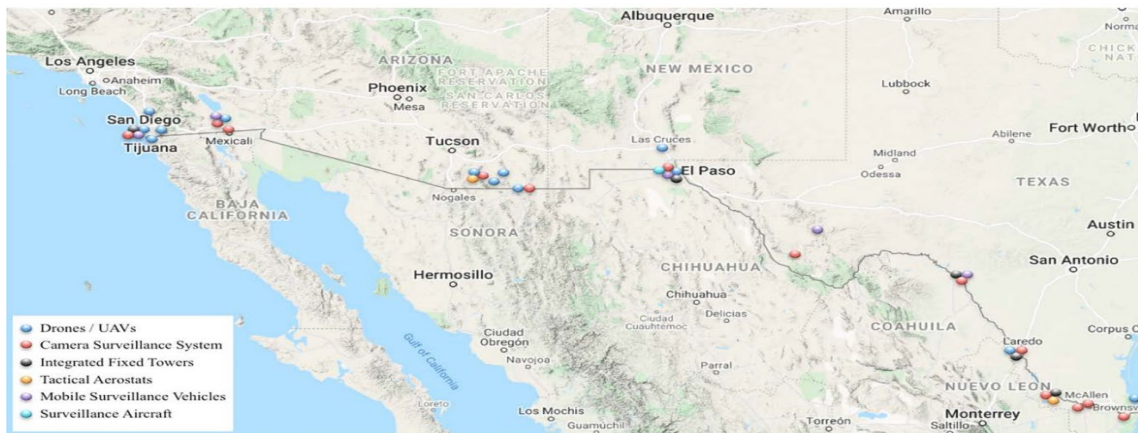


Figure 8. U.S.-Mexico border technology employment map.²⁰³

²⁰¹ “U.S. Customs and Border Protection (CBP) Use of Biometrics.”

²⁰² Hellerstein, “Between the U.S. and Mexico.”

²⁰³ Electronic Frontier Foundation, “Explore the Data: Surveillance Tech in Southwestern Border Communities,” cited in Jeffrey S. Jordan, “How Do Smart Border Technologies Alter the Geopolitics of the Borderlands and Contribute to Stability or Instability in the Western Hemisphere?” (master’s thesis, Naval Postgraduate School, 2020), 68, <http://hdl.handle.net/10945/66663>.

E. MEASURING SUCCESS AT THE BORDER

1. How Secure Is the Southern Border Now?

Using border technology, boosting the border enforcement officers and adding extra miles of fencing has made the U.S. southern border more secure. CBP has realized that neither technology nor staff can work alone—both must work in unison. Recognizing that the three main missions for the southern border are (1) illegal drug control, (2) counterterrorism, and (3) illegal migration control, there has been increased training, education, technology, and exercises.²⁰⁴ While the area is vast, however, Border Patrol staff have tried their best to control issues on the SWB, and the use of technology has increased their range.²⁰⁵

According to DHS, using technology in the southern border environment is an invaluable force multiplier for increasing situational awareness.²⁰⁶ These technologies are often less expensive, less intrusive, and are greater force multipliers than building physical barriers.²⁰⁷ According to the Office of the Inspector General, “Commonly used systems and tools include fixed and mobile surveillance equipment, agent-centric devices, unmanned aircraft, and sensor detection systems and devices.”²⁰⁸ To complement the enhance technology, CBP has constantly increase its staff.

2. How Effective Is the Increased Staff and Its Technology?

Technology has had a small effect on the number of troops needed at the border. Technology’s role as a force multiplier has been somewhat muted, countered by the need

²⁰⁴ Willis et al., *Measuring the Effectiveness of Border Security*, 13.

²⁰⁵ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain,” 23.

²⁰⁶ Commissioner R. Gil Kerlikowske, “Technology: Force Multiplier and Facilitation Tool | U.S. Customs and Border Protection,” U.S. Customs and Border Protection, 2016, <https://www.cbp.gov/newsroom/blogs/technology-force-multiplier-and-facilitation-tool>.

²⁰⁷ Nation Immigration Forum, “Border Security Along the Southwest Border: Fact Sheet,” National Immigration Forum, 2019, <https://immigrationforum.org/article/border-security-along-the-southwest-border-fact-sheet/>.

²⁰⁸ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain,” 5.

for operation and maintenance of the equipment. Today, CBP is a top law enforcement organization dedicated to safeguarding its SWB's safety, security, and prosperity. The SWB has always been a significant concern for the country, with CBP seeing the need to increase its strength over the years. Today, almost 17,000 law enforcement officers are working on the border, with this area being the busiest port of entry in the world. Although there have been new and improved technological devices implemented over the years between FY 1992 and 2013, there was a constant increase in employment on the border and only slight decrease in the number of border patrol officers between FY 2013 and 2020.

CBP is the first unified border organization in the U.S., uniting customs, immigration, border security, and agricultural protection under one mission-driven organization while upholding the rule of law. In response to a spike in illegal immigration in the 1980s and 1990s, the Border Patrol increased staffing and adopted cutting-edge technology. The Border Patrol's workforce more than doubled between 1993 and 2000, largely because of worries about the massive number of undocumented immigrants crossing the border.²⁰⁹ The effectiveness of the technology and increased staff has always been questioned, however, while many believed that a border wall would be more appropriate. Table 1 indicates the staff increase between FY 1992 and 2020.

²⁰⁹ Peter Andreas, "Politics on Edge: Managing the US-Mexico Border," *Current History* 105, no. 688 (2006): 2, <https://www.jstor.org/stable/45318695>.

Table 1. United States Border Patrol staffing on the southwest border (1991-2020)²¹⁰

Fiscal Year	Southwest Border Staff	Fiscal Year	Southwest Border Staff	Fiscal Year	Southwest Border Staff
1991	-----	2001	9,147	2011	18,506
1992	3,555	2002	9,239	2012	18,516
1993	3,444	2003	9,840	2013	18,610
1994	3,747	2004	9,506	2014	18,114
1995	4,388	2005	9,891	2015	17,418
1996	5,333	2006	11,032	2016	17,026
1997	6,315	2007	13,297	2017	16,605
1998	7,357	2008	15,442	2018	16,608
1999	7,706	2009	17,408	2019	16,731
2000	8,580	2010	17,535	2020	16,878

Between FY 1991 and FY 2000, the number of CBP agents doubled, and doubled its number again between FY 2000 to 2010.²¹¹ This could be accredited to the flow of migrants crossing the border, which would reach a record high in FY 2000. However, between 2017 and 2020, CBP invested in sensor surveillance technology equipped with artificial intelligence to detect movement on the border and know where CBP agents are located. As a result, with enhanced technology, there has been a decrease in the number of CBP officers employed on the border.

3. Does Technology and Increased Staff Influence Apprehension?

While technology is being used as a force multiplier, there is no concrete research done to show that it assists in apprehensions. Today, CBP relies on technology to guard the SWB, which is often more cost-effective, less intrusive, and a stronger force multiplier than building physical barriers.²¹² Technology has only slowed determined migrant

²¹⁰ “U.S. Border Patrol Fiscal Year Staffing Statistics (FY 1992 – FY 2020) (508).Pdf,” accessed October 26, 2022, <https://www.cbp.gov/sites/default/files/assets/documents/2021-Aug/U.S.%20Border%20Patrol%20Fiscal%20Year%20Staffing%20Statistics%20%28FY%201992%20-%20FY%202020%29%20%28508%29.pdf>.

²¹¹ “U.S. Border Patrol Fiscal Year Staffing Statistics (FY 1992 – FY 2020) (508).Pdf.”

²¹² National Immigration, “Border Security Along the Southwest Border: Fact Sheet,” National Immigration Forum, 2019, <https://immigrationforum.org/article/border-security-along-the-southwest-border-fact-sheet/>.

movement, as migrants continue crossing the U.S.-Mexico border, hoping for a better life. Although barriers are created, CBP continues to apprehend high numbers of migrants yearly. After the 1980s, apprehension numbers climbed to a record high in 2000. Table 2 demonstrates how the number of apprehensions fluctuated over the years.

Table 2. Southwest border apprehensions (1991–2020)²¹³

Fiscal Year	Border Apprehensions	Fiscal Year	Border Apprehensions	Fiscal Year	Border Apprehensions
1991	1,077,876	2001	1,235,718	2011	327,577
1992	1,145,574	2002	929,809	2012	356,873
1993	1,212,886	2003	905,065	2013	414,397
1994	979,101	2004	1,139,282	2014	479,371
1995	1,272,390	2005	1,171,396	2015	331,333
1996	1,507,020	2006	1,071,972	2016	408,870
1997	1,368,707	2007	858,638	2017	303,916
1998	1,516,680	2008	705,005	2018	396,579
1999	1,537,000	2009	540,865	2019	851,508
2000	1,643,679	2010	447,731	2020	400,651

It should be noted that there has been fluctuation in apprehension, although there has been increase in technology and border patrol officers. The National Immigration Forum stated, “This represented a decline of approximately 25 percent from FY 2016 levels (409,000 border apprehensions) and a decline of more than 80 percent from the record-high levels of FY 2000 (1.6 million border apprehensions).” Documentation shows that CBP apprehended fewer than 304,000 people in FY 2017, the lowest number since FY 1971, or nearly 50 years ago, which can be attributed to border technology.²¹⁴

Consequently, the CBP budget increased because of the expansion of personnel and technology from over \$1.1 billion in FY 2000 to \$3.8 billion in FY 2017 and to almost \$4.3

²¹³ “U.S. Border Patrol Monthly Encounters (FY 2000 – FY 2020) (508).Pdf,” accessed October 25, 2022, <https://www.cbp.gov/sites/default/files/assets/documents/2021-Aug/U.S.%20Border%20Patrol%20Monthly%20Encounters%20%28FY%202000%20-%20FY%202020%29%20%28508%29.pdf>.

²¹⁴ National Immigration Forum, “Border Security Along the Southwest Border.”

billion in FY 2018, which is a record amount of funding.²¹⁵ The National Immigration Forum says that, “While U.S. taxpayers spent an average of \$656 per Border Patrol apprehension in FY 2000, that number rose to \$10,831 in FY 2018 – an increase of about 1,650 percent.”²¹⁶ On the contrary, smugglers were charging between \$100 and \$300 prior to the late 2000s depending on staging location; an additional fee of \$1000–\$3,000 would be charge once arriving at the final destination.²¹⁷ According to DHS, “More recently, smuggling fees for Mexicans and Central Americans reportedly have been as high as \$1,200 for the initial staging payment and up to \$8,000 at the final destination.”²¹⁸

Despite technology, the Border Patrol also calculates that in FY 2019, over 150,000 people successfully avoided capture and vanished into the U.S.²¹⁹ Accordingly, research has been done as to the effect and reason behind the number of migrants fleeing their country, this has been coined the “Push and Pull factors.”²²⁰ In fact, the push factor speaks to the Northern Triangle countries of Central America, where many people are suffering from violence, insecurity, and famine. In contrast, the pull factor is noted by the booming U.S. economy, which causes many to venture to its borders.

4. Has There Been a Decrease in Transnational Crime?

The use of technology and increase in border agents have caused TCOs to change their techniques and seek other ways of committing cross-border illegalities. The Border Patrol has relied on technology to support border patrol operation in an environment where agents find it difficult to patrol. The technology assists by sending grid coordinates so quick response using aerial mobility can be achieved. In addition, certain areas on the southern border can inhibit physical access; with technology, patrols can now know when there is a

²¹⁵ National Immigration Forum.

²¹⁶ National Immigration Forum, “Border Security Along the Southwest Border,” 2.

²¹⁷ “17_0914_estimates-of-Border-Security.Pdf,” 13, accessed November 5, 2022, https://www.dhs.gov/sites/default/files/publications/17_0914_estimates-of-border-security.pdf.

²¹⁸ “17_0914_estimates-of-Border-Security.Pdf,” 13.

²¹⁹ John Davis, “Border Crisis: CBP’s Response | U.S. Customs and Border Protection,” 2022, <https://www.cbp.gov/frontline/border-crisis-cbp-s-response>.

²²⁰ Davis.

breach in security. Table 3 points out illegalities in conveyance, firearms, ammunition, and currency and again highlights apprehensions. Table 4 gives a detailed account of the illegal drugs found along the border.

Table 3. Number of conveyances, firearms, ammunition, currency, and apprehensions (2011–2020)

Year	Conveyances	Firearms	Ammunition (rounds)	Currency (value)	Apprehensions
2011	10,297	523	41,156	\$9,849,274	327,577
2012	9,452	577	124,837	\$5,535,732	356,873
2013	9,074	524	29,796	\$4,750,598	414,397
2014	8,687	475	63,493	\$7,351,640	479,371
2015	7,832	316	12,819	\$4,401,155	186,017
2016	8,256	346	15,323	\$7,652,390	408,870
2017	7,388	369	13,938	\$5,169,593	303,916
2018	8,391	314	18,302	\$6,665,864	396,579
2019	9,017	299	8,882	\$5,862,399	851,508
2020	9,461	486	19,586	\$6,356,877	400,651

Table 4. Type of drugs seized at the southwest border (2010–2020)

Year	Marijuana (pounds)	Cocaine (pounds)	Heroin (ounces)	Methamphetamine (pounds)	Ecstasy (pounds)	Other Drugs* (pounds)
2011	2,518,211	8,763	6,191	1,838	2	255
2012	2,297,662	5,992	6,383	3,430	101	415
2013	2,428,419	3,910	8,937	3,446	4	484
2014	1,920,411	4,443	9,205	3,771	1	227
2015	1,536,499	4,294	8,237	6,429	7	86
2016	1,292,105	4,183	8,961	8,215	8	843
2017	857,888	6,174	15,182	10,273	1	554
2018	458,834	4,838	11,302	10,273	1	891
2019	262,903	4,826	12,336	6	3	1345
2020	253,230	4,194	8,611	20,317	1	1,085

Incomparable technology, personnel, and resources have been deployed to the SWB in hopes of stopping transnational crime. According to the Drug Policy Fact, “From

FY 2009–2011, the Department of Homeland Security has seized 41 percent more drugs, 74 percent more currency, and 159 percent more weapons along the SWB as compared to FY 2006–2008.”²²¹ They further stated that the border crisis is not just migrants seeking asylum but TCOs trafficking weapons, drugs, and hardened criminals. The Border Patrol increased its officers from 8,580 in FY 2000 to 16,878 in 2020. Over 23,000 people were arrested, and more than 35,700 pounds of illegal substances were seized as a result of Operation Guardian Support during FY18, which affected all 8 southwestern border regions.²²² Although the seizures continue to fluctuate, technology has managed to be a major part of border security, as TCOs are also using the technology to their advantage.

5. What Are the Negative Factors of Using Border Technology?

Although the technology used on the border has significantly supported the mission, CBP faces additional challenges that reduce its effectiveness. Smith reports that, “Only 28% of the planned surveillance and subterranean technology solutions were used, even after receiving more than \$700 million in funding since FY 2017.”²²³ The system’s incomplete status limits what can be accomplished, with specific sectors still working on obsolete systems.²²⁴ More technology requires more human resources to monitor the equipment and teams to respond to threats or breaches on the border. Evidence proves that although border security technology has been effective, it has increased the staffing needed to monitor the technology, respond to the threat, and maintain it. Additionally, CBP lacks a defined methodology and accurate data to evaluate the efficacy of technology.²²⁵

²²¹ Real Reporting Foundation, “Southwest Border Counternarcotics Strategy,” Collection, Drug Policy Facts (Real Reporting Foundation, November 7, 2022), 26, <https://www.drugpolicyfacts.org/node/2373>.

²²² “CBP-Border-Security-Report-FY2018.Pdf,” 7, accessed October 27, 2022, <https://www.cbp.gov/sites/default/files/assets/documents/2019-Mar/CBP-Border-Security-Report-FY2018.pdf>.

²²³ “17_0914_estimates-of-Border-Security.Pdf,” 1.

²²⁴ “17_0914_estimates-of-Border-Security.Pdf,” 1, accessed October 20, 2022, https://www.dhs.gov/sites/default/files/publications/17_0914_estimates-of-border-security.pdf.

²²⁵ Smith, “CBP Has Improved Border Tech,” 23.

6. Efficacy of the Technology

As a barrier to people, terrorists, terrorist weapons, and contraband entering the nation between legitimate ports of entry, CBP needs effective technology that complements the physical wall in order to gain total operational control of the SWB.²²⁶ Since the implementation of ground and aerial sensors and biometrics CBP has been heavily reliant on the technology. However, as mentioned earlier, there has been much debate about whether the technology is needed, its effectiveness, cost, and privacy for those living near the border. Table 5 shows the technology implementations and the year they were installed. There have been difficulties with the technology's application, however, such as a lack of staff to properly utilize the surveillance technologies or maintain existing IT systems and infrastructure locally.²²⁷ CBP officers, however, have maintained that the use of cutting-edge technologies has increased situational awareness and operational efficiency along the SWB.²²⁸ Senior agents said that surveillance towers and UAS have further improved the Border Patrol's capabilities by sending alarm signals to field agents and enabling quicker responses.²²⁹ Table 5 assesses the effect technology and increased staff have on apprehension and illegal cross-border activities. It looks at the years certain technologies were implemented and compares the number of staff to apprehensions.

²²⁶ "Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain," 25.

²²⁷ "Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain," 7.

²²⁸ "Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain," 9.

²²⁹ "Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain," 9.

Table 5. Efficiency of border staff against implementation of new technology²³⁰

Fiscal Year	Border Apprehensions	Southwest Border Staff	Apprehensions Per Officer	Technology Implemented
1994	979,101	3,747	261.30	The Immigration and Naturalization Service developed IDENT-Biometrics
1997	1,368,707	6,315	216.73	Integrated Surveillance Intelligence System (ISIS) motion, infrared, seismic, and magnetic sensors
2000	1,643,679	8,580	191.57	ISIS 1,300 Sensors
2001	1,235,718	9,147	135.09	Surveillance cameras, biometrics, and scanners
2002	929,809	9,239	100.63	Visa Entry Reform Act, Upgrade to Biometrics
2004	1,139,282	9,506	119.84	Intelligence Reform and Terrorism Prevention Act (IRTPA) – Upgrade to Biometrics
2006	1,071,972	11,032	97.17	Military-style MQ-9 Reaper Predator drones
2011	327,577	18,506	17.70	Arizona Technology Plan (ATP)
2017	303,916	16,605	18.30	AeroVironment’s Raven and Puma small, unmanned aircraft systems. Integrated Fixed Tower (IFT) systems
2018	396,579	16,608	23.87	Remote Video Surveillance Systems (RVSS) Mobile Video Surveillance Systems (MVSS)
2019	851,508	16,731	50.89	Innovative Towers
2020	400,651	16,878	23.73	Small Unmanned Aerial Surveillance (sUAS) Team Awareness Kit (TAK)

²³⁰ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain.”

Table 5 shows that with the increase in staff and increase in the use of technology, there has been a decrease in apprehensions. This could be because of greater lawful entry of goods and travelers through a port of entry, where specific technology and detection sensors are also used. We know from the previous tables that the total number of migrant encounters has also decreased, which suggests more are entering legally. Numbers of agents may have increased because the technology may require more personnel, even though the end result is fewer apprehensions. Although technology has also been an integral part of the southwest border; while illegal traffics can be detected, agents are needed to respond. The net effect, however, is greater border security. With the increase in staff and the use of emerging technology, illegal activities, such as human trafficking and smuggling of illicit drugs, have decreased. The DHS has been collaborating with a group of partners, including CBP and the Department of Defense, to develop a series of technological demonstrations that began in April 2021.²³¹

Predator B drones, a variation of the military’s MQ-9 Reaper drone, have been used by CBP’s Air and Marine Operations since the FY 2006 along the border.²³² According to GAO’s February 2017 report, “Based on CBP data provided for fiscal year 2015, annual obligations for CBP’s Predator B program were approximately \$42 million and the cost per flight hour was \$5,878.”²³³ When CBP drones do fly, they make a small difference in border security; from 2013 to 2016, fewer than 8,000 of the 1.7 million apprehensions made by the Border Patrol were due to drones.²³⁴ The number of these seizures or detentions that would have taken place without the use of drones has not been estimated by the CBP, and the drone only allow officers to position the drone based on illegal

²³¹ Department of Homeland Security Science and Technology, “Feature Article: Evaluating Border Security Technologies in the Plains of North Dakota | Homeland Security,” accessed December 6, 2022, <https://www.dhs.gov/science-and-technology/news/2021/06/10/feature-article-evaluating-border-security-technologies-plains-north-dakota>.

²³² *Border Security: Additional Actions Needed to Strengthen Collection of Unmanned Aerial Systems and Aerostats Data*, GAO-17-152, accessed November 20, 2022, <https://www.gao.gov/assets/gao-17-152.pdf>, 5.

²³³ *Border Security*, 6.

²³⁴ David J Bier and Matthew Feeney, “Efficacy and Privacy Implications” 5 (2016): 2.

entry.²³⁵ However, recorders show that in 2014, however, only 2% of the mission resulted in the detection of illegal crossing. The Government Accountability Office found that “drones detected only 21,384 suspected border crossers from 2014 to 2016.”²³⁶ Smaller hand-launched drones, such as the Raven and Puma, unmanned aircraft systems from AeroVironment, have been tested by CBP since September 2017.²³⁷ Even with the drone, the chart shows that there have been fluctuations in the number of apprehensions and seizures over the years.

In remote border regions, field technology solutions, including tower-based cameras, image sensors, and ground sensors, provide constant surveillance.²³⁸ The devices send motion, video, or photographic alerts—when objects of interest are found—to the Border Patrol command center workstations.²³⁹ Although ground sensors of all types are being utilized, however, staffing numbers have increased since 1992, with only a slight fall in number in 2015. On the contrary, even though technology is being used, apprehensions fluctuate. For example, in 1994, with the introduction of IDENT, the number of apprehensions continued to increase; with the use of ISIS ground sensors, however, apprehension numbers decreased. It can also be noted that when a new technology is implemented, there is a change in the number of apprehensions. Since 2017, border technology has not only detected and deterred migrants but has also helped those in dire need on the border, where rescue teams had to be dispatched. Despite the fluctuation in the number of migrants apprehended, CBP has noted that they still do not know how much of it is because of technology. CBP has always stipulated that using emerging border technology is a force multiplier and increases situational awareness for the agents on the ground.

²³⁵ Bier and Feeney, 3.

²³⁶ U. S. Government Accountability Office, “Intelligence Community: Additional Actions Needed to Strengthen Workforce Diversity Planning and Oversight,” 2020, <https://www.gao.gov/products/gao-21-83>.

²³⁷ Bier and Feeney, “Efficacy and Privacy Implications,” 1.

²³⁸ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain,” 18.

²³⁹ “Office of Inspector General – CBP Has Improved Southwest Border Technology, but Significant Challenges Remain,” 18.

F. CONCLUSION

Border security has been the essential mission of the U.S. since the inception of its borders; over the years, however, it has become immensely complex. Cross-border unlawful activity has long been a threat to the United States' southern border, with numerous measures being implemented. These measures include creating a border protection force, employing emerging technology, and on several occasions, using the military. Today the border is protected by the DHS, with CBP at the helm taking responsibility for safeguarding the SWB from illegal entry, dangerous people, and other illegalities. It is specifically the responsibility of CBP's U.S. Border Patrol to stop individuals, terrorists, terrorist weapons, and contraband from entering the country between legitimate ports of entry. However, with the border spanning almost 2000 miles, adequate technology has complemented the human resources to ensure CBP's effectiveness and control on the border.

The increase in border threat over the years has caused CBP to increase the number of both security forces and technology. One of the main threats on the border is migration, which can be detected in the number of apprehensions shown in Table 2. Even with technology the numbers still seem to fluctuate over the years, however, while the budget continues to increase.

Although technology has been deemed a force multiplier and has assisted border patrol operations, there are limited resources specifying its effectiveness. In fact, using the technology has required additional manpower to operate and maintain the equipment. The effectiveness of border surveillance technology can be measured, and it shows that while equipment by itself cannot stop unauthorized cross-border movement, it may help with monitoring over vast regions that would otherwise go unnoticed. Ground and aerial sensors assist in detecting trafficable area, while biometrics gives automated recognition of individuals faces and fingerprints. Even after receiving more than \$700 million in funding since FY 2017, CBP has only implemented 28% of the monitoring technology, according to a frequently cited statistic.

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V. SUMMARY, RECOMMENDATIONS, AND CONCLUSION

A. INTRODUCTION

This thesis sought to determine whether implementing emerging border technologies at Belize's western border would positively impact its management and protection. Based on the in-depth research and analysis conducted and presented, emerging border technologies, such as ground and aerial sensors and biometrics, could improve Belize's border security. These tools can detect and deter illegal border movement, while biometric data can assist in identifying detainees and migrants to keep criminals from entering Belize.

This chapter will first review the findings of the TBA, observing how the technology is employed and its effectiveness in the working environment. Additionally, it compares the TBA environment to Belize to see if the techniques utilized can be effectively implemented. Second, it reviews the U.S.-Mexico case study looking at measures and practices used and whether they can be implemented in Belize. Within the U.S.-Mexico study with will review cost effectiveness, maintenance, and human resources to properly manage the technology. It will then make a comparative assessment and determine if the technology will suit Belize's environment. Finally, recommendations will be made on what measures and steps can be taken before Belize fully commits to emerging border technology.

B. ASSESSMENT ON THE TRI-BORDER AREA

The TBA comprises three countries working in unison to counter cross-border illegalities in an environment where transnational crime is prevalent. While some countries are more technologically advanced than others, they understand that the threat is shared; hence, there must be inter-agency intelligence cooperation. Sharing intelligence and using technology assists the countries in countering and neutralizing the threat. It is also understood that, like the other countries mentioned in this thesis, they face a similar threat, a threat that, if not dealt with, will create a rogue state. Since the implementation of surveillance technology, the TBA has seen a reduction in transnational crimes and an

increase in convictions. Furthermore, with the advent of emerging border technologies, ground, air, and biometric sensors have completely changed how the TBA is presently protected.

The TBA now uses border surveillance as its primary source to prevent unauthorized border crossings, illicit trade in products and services, drug trafficking, and, most recently, the assembling of terrorist groups, which has become a global threat. Over the past few years, using technology as a force multiplier has decreased the number of troops needed and decreased certain criminal acts in the TBA. For example, adopting border security technologies in Brazil (TBA) has significantly increased the number of drug seizures and decreased crime. The effectiveness of border technology in Brazil resulted in the erection of surveillance radar that allows for monitoring illegal aerial traffic. In addition, in 2019, Brazil equipped the Friendship Bridge with border security equipment, a tool that can recognize faces, registration plates, and audio gunshots. Likewise, Argentina has invested in intelligence fusion centers, introducing technology to boost its ability to police the law in risky ports like the TBA. Argentina also uses smart border surveillance as a force multiplier, with the technology being dispatched in real time to ground troops who fight against the illegalities on the border. All these emerging technologies have significantly improved border security in the TBA.

While the introduction of border technology has benefited Brazil and Argentina, it has also demonstrated how Paraguay's lack of border technology has been detrimental to countering illegalities on its border. Although precise figures could not be obtained, the assumption is that Brazil and Argentina's significant investment in border security technologies is helping their countries.

C. ASSESSMENT ON U.S.-MEXICO BORDER

No concrete statistics were available to indicate that technology alone has significantly changed statistics on the U.S. SWB. Since the early 1970s, however, border technology has effectively complemented border security officers. In fact, CBP has stated that technology has enhanced situational awareness and improved the ability to detect, deter, and respond to all threats. For example, the case studies show that biometrics have

improved border security, making it hard for an immigrant to cross the border without being scanned, taking physical features from every individual. In addition, whether aerial, underground, or erected with surveillance cameras, the sensor has been proven to assist border patrol agents in detecting movement in order to respond promptly.

The influx of migrants toward the U.S. southwest border has prompted them to invest billions of dollars in containing the situation, however CBP lack the capabilities properly assimilate how the technology has improved the border. The border spans almost 2000 miles, covered by either a border wall, sensor technology, or aerial detection; however, this has come with an enormous cost to the U.S. government. Over the years, there have been considerable increases in the budget allotted for the SWB. For example, in FY 2000, the budget was at \$1.1 billion; by FY 2018, the budget increased to \$4.3 billion. As a result, the cost of detaining a migrant went from \$656 in F.Y. 2000; to \$10,831 in F.Y. 2018, which is a significant change.

Finally, although border security has been greatly assisted by technology, CBP encountered additional difficulties that decreased its efficacy. As the old adage states “progress brings problems,” and that is exactly the effects felt by CBP with the implementation of emerging technology. The better the technology, the more staff and financial resources are required to ensure its proper upkeep. This is especially true as certain areas are too remote to respond even when the technology detects incursion. CBP has used military-style Predator drones to monitor the border, increasing its operation cost. Using emerging border technology as a force multiplier comes at an inflated cost that many countries cannot afford especially if the technology is overly advanced.

D. COMPARATIVE ASSESSMENT

Both case studies revealed that using emerging border technology has assisted as a force multiplier and has improved situational awareness and border security measures. While the TBA is not as technologically advanced as the U.S., the technology has decreased illegal cross-border activities. After a review of the case studies, there is limited research and documentation to show the effectiveness of the technology in the TBA. On the other hand, emerging technology has been used at the U.S. border for decades, and the

benefits have been seen. Notably, over the years the budget has increased, human resources have increased, and the technology has improved, but the effects of the technology has not been forthcoming. A correlation between border technology and the reduction in border crime or migration has not yet been established. Both case studies have shown that technology alone does not cause the effect. In addition, it must be noted that TCOs have also moved to the use of emerging technology as a means to evade security forces. Both studies suggested that, in an era of rapid change, border technology is a possible way counter TCO.

E. WILL THE TECHNOLOGY WORK IN BELIZE?

As seen in the case studies, emerging border technology positively enhances the countries utilizing it. The question remains, however: Will the technology work in Belize?

The TBA is similar to that of Belize, with a thick jungle area, large rivers, and mountainous terrain. Unlike the TBA, however, Belize is not yet suffering from terrorist threats but has similar cross-border illegal activities. In addition, the TBA uses border technology and displays a high level of regional collaboration, making the technology more effective. Belize is already working closely with its regional partners; like Paraguay, Belize has benefitted from the technology its partners use.

Brazil had installed border security technology on the Friendship Bridge on its border with Paraguay. The technology assists with facial recognition, license plate reading, and acoustic gunshot detection. This technology would assist Belize on its western bridge with Guatemala, one of its busiest trading routes. Additionally, Brazil uses security command and control centers, surveillance equipment, intelligence support, physical protection, and transport security, all simple methods that can easily be accomplished within Belize's budget, to make its border security more effective. With the use of biometrics and motion sensors, these simple precautions have successfully directed and monitored border regions in Brazil. After conducting a thorough structural feasibility assessment that will project a five to 10 years strategy, these methods should be implemented in Belize and will be beneficial. Similar to Brazil, it will help Belizean law enforcement lessen criminal operations, including smuggling of weapons, drugs,

contraband, cargo and vehicle theft, and environmental crime. It will also help prevent border conflicts between security forces and civilians entering and leaving the country.

Argentina uses biometric and sensor devices that can track the location and movement of security forces on the ground, allowing for real-time correspondence. This technology will work and is most needed in Belize. As Belize's military continues to patrol the border, there is a need for a device to track patrol movement and improve situational awareness. Aerial detecting sensors can monitor ground activities; with certain areas being so isolated, however, there is a need to improve real-time correspondence. More advanced than the other countries in the TBA, Argentina is on the verge of using cutting-edge border technology to enhance safety. While Belize is just starting its quest for emerging border technology, Belize can apply and implement the more applicable techniques. For instance, if a motion sensor is activated, the security personnel will be notified and will be able to respond with proportionate force. Another technology used in Argentina that will work in Belize's setting are radars, which will allow aerial sensors (UAV and drone) to fly and track activities on the border, such as illegal narcotics planes coming into Belize's air space.

On the other hand, the U.S.-Mexico border and the technology used are too advanced and too expensive for Belize's security budget. Belize does not need high-quality border technology on its explorative quest, however; it can use simple technology methods and lessons learned to structure its project path properly. The U.S.-Mexico border has several different landscapes, and Belize needs to see which one suits its environment. Because of Belize's thick jungle canopy, the aerial sensors would have to be equipped with infrared and thermal imaging. The biometric devices would work perfectly in Belize's environment to measure an individual's physical characteristics, biometric scans, fingerprints, facial recognition, and iris. The U.S. uses two types that can be implemented in Belize, the stationary ones that can be used at the legal entry points and handheld devices that security forces can take into the field. One lesson that should be learned is that Belize should do proper documentation to determine the effects of using the technology over time. Biometric technology can significantly increase information security due to the uniqueness of each individual; Belize would now be able to share information with its partners through

Interpol. Ground and aerial sensors will be able to detect movement on Belize's western border, allowing the security forces to know which areas are most trafficable, reducing the number of troops needed to patrol vast areas and responding promptly. This technology would be effective on Belize's western border.

F. RECOMMENDATIONS

As Belize continues its quest to properly secure its border, numerous threats and push-and-pull factors must be considered. While these factors are being considered, the government and its security forces must determine how best to keep Belize's border safe. It is of equal importance that the government and people of Belize have confidence that the security forces operating on its border will make the adjustments needed to keep the country safe. If Belize is to implement emerging border technologies, there are some recommendations to be made:

A complete review and analysis of what type of ground and aerial sensor would work in Belize's environment.

A complete review and analysis of two types of biometrics: (1) a static biometric at each border legal entry point and (2) a roaming biometric that security forces can use in the field. Both biometric systems must be able to recognize faces and fingerprints. This will assist security forces in bringing detainees captured on the border to the nearest police station, so that they can be issued with an Order to Leave (OTL) the country.

- Identify the best locations to erect a signal tower on the western border to have the technology relay information in real time.
- Offer technical training in using, understanding, and maintaining of ground and aerial sensor technology.
- Offer enhanced training in using biometric technology both at stationary border sites and field devices.
- Offer to enhance training and tactics to implement the necessary reforms needed for officers and agents to be better equipped to respond to the border threat.

- Produce a concept paper to consider the cost, practicality, and effectiveness of the technology before investing in it.
- Enhance Belize-Guatemala cooperation regarding joint intelligence on illegal border activities.
- Create a department responsible for documenting every incursion and illegal border crossing (statistical data). They are to collate and document findings and budgetary plans and produce quarterly reports on the effects of the use of the technology.

G. FUTURE RESEARCH

Although this research was focused on sensors and biometrics and looked at only two case studies in this region, other studies can be conducted. Studies can be done on other technological devices that have assisted in border safety and security, pinpointing why those devices may be better for future security development. Focusing on border instability and mass immigration in other regions of the world can offer a better understanding of why emerging border technology has become so necessary. Future research can investigate the possibilities of Belize having fusion centers and incorporating artificial intelligence to integrate mass data collection. The capacity to separate important surveillance data from unimportant data would help increase border security awareness. Sorting and interpreting vast amounts of data is crucial for effective operations as command-and-control centers continue to examine vast swaths of border surveillance data.

Finally, a system thinking perspective model should be presented to measure both the actual and desired state of border security in Belize. This can be achieved by looking at systems thinking measures to disrupt dark networks on Belize's western border. The government can identify inherent causal factors, which can assist in the planning and implementation. By underscoring the illegal dynamic relationship of the problem coupled with complex feedback to the system and those involved, operations can be undertaken using improved technological countermeasures. Additionally, by understanding the system structure and its behavior, the government and law enforcement agencies can gain new technological capabilities with high strategic leverage that will succeed over time. Using

the border as a complex adaptive system (CAS) and through the use of graphic system dynamics models, it explores how technology can assist and how long (timestamp) it would take to effect change. This would allow the government and its stakeholders to have a visual outlook on how the system would work rather than making assumptions.

H. CONCLUSION

For there to be effective border control and security, a complex organizational system is required to think strategically on the best way forward. The government of Belize and its security ministries have been working and implementing different systems, looking for the approach that will be most cost-effective and efficient. An issue as such requires cross-sector collaboration as the organizations working together need to achieve a mutually beneficial outcome. Border technology, although costly, is an investment in the safety and security of the nation. It will reduce criminal activity on the border and prevent them from reaching the inner cities. Investing in border technology will reduce incursions and illegal activities on the border. This determination was arrived at based on the in-depth analysis presented in this thesis research, proving that emerging technology can positively assist countries in better securing its borders. At the end of the day, Belize's government will see the results and find its investment cost-effective.

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