

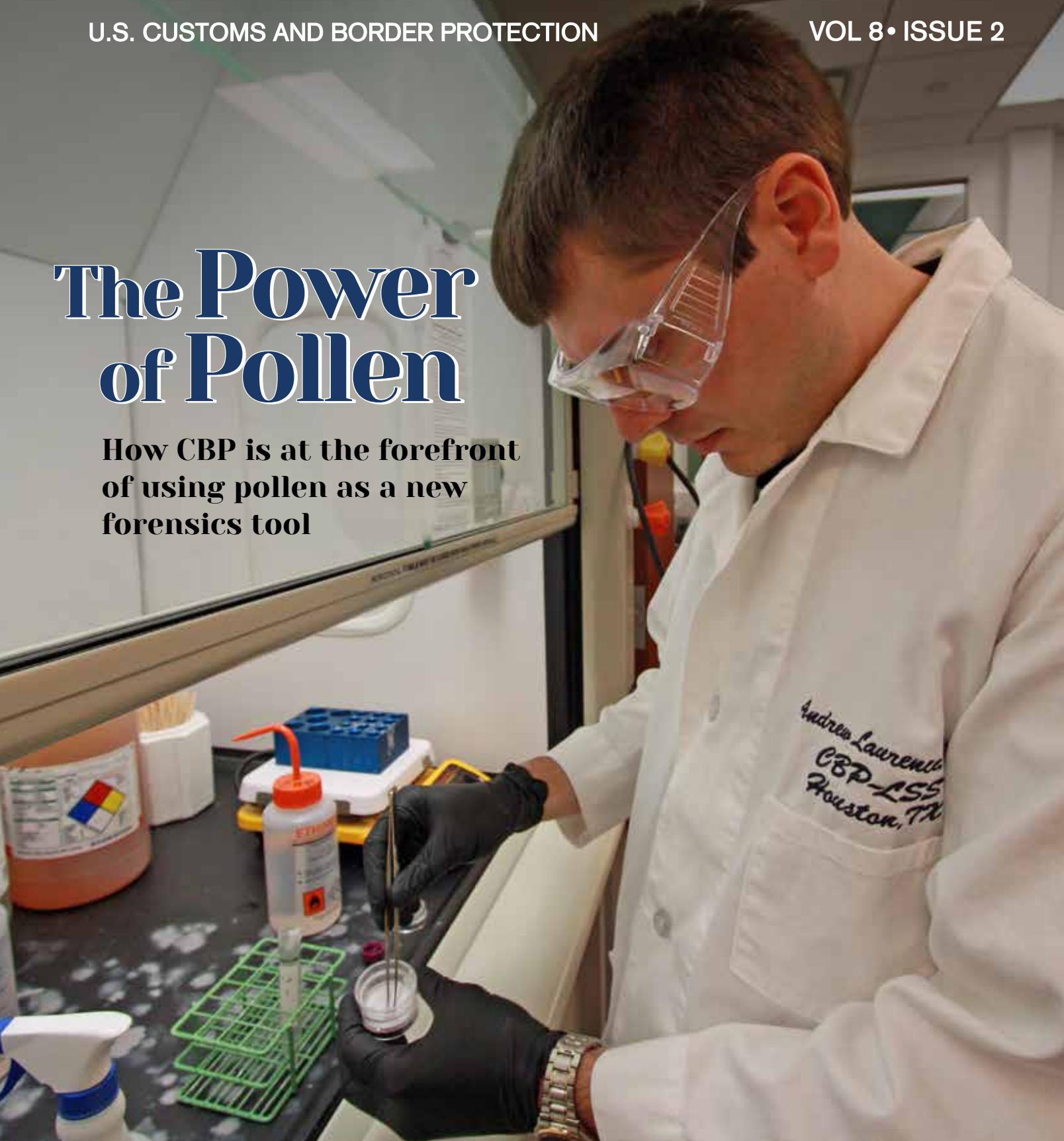
FRONTLINE

U.S. CUSTOMS AND BORDER PROTECTION

VOL 8 • ISSUE 2

The Power of Pollen

How CBP is at the forefront of using pollen as a new forensics tool



An Air and Marine Operations weapons crew sits aboard a Black Hawk helicopter during a disabling fire weapons test. The weapon disables noncompliant vessels in day and night conditions when a suspect vessel fails to yield. Photo by James Tourtellote



U.S. Customs and Border Protection



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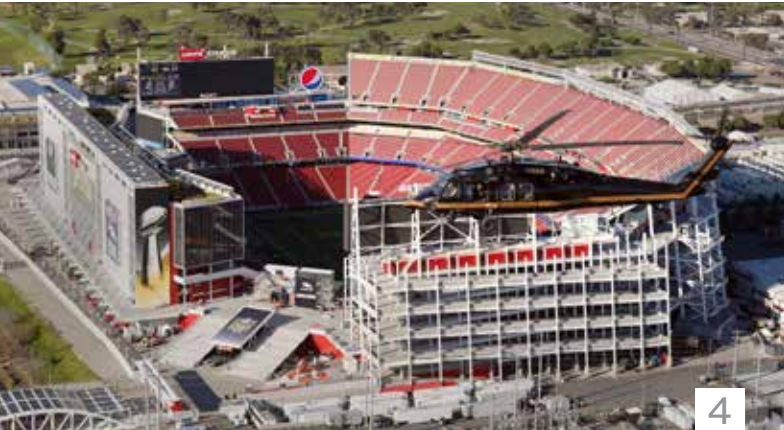
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CBP scientist Andrew Laurence processes a pollen sample at the CBP Houston lab. CBP is leading the U.S. law enforcement community in using this new forensic tool for investigations and intelligence. Photo by Yolanda Choates

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**SECRETARY OF
HOMELAND SECURITY**

Jeh Johnson

**COMMISSIONER, U.S.
CUSTOMS AND BORDER
PROTECTION**

R. Gil Kerlikowske

**ASSISTANT COMMISSIONER,
CBP OFFICE OF PUBLIC
AFFAIRS**

Philip J. LaVelle

EDITOR

Laurel Smith

MANAGING EDITOR

Jason McCammack

PRODUCTION MANAGER

Tracie Parker

STAFF WRITERS

Warren Byrd, Paul Koscak,
Marcy Mason

STAFF PHOTOGRAPHERS

Donna Burton, Glenn Fawcett,
James Tourtellotte

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To contact Frontline editors with messages, contributions or delivery concerns:

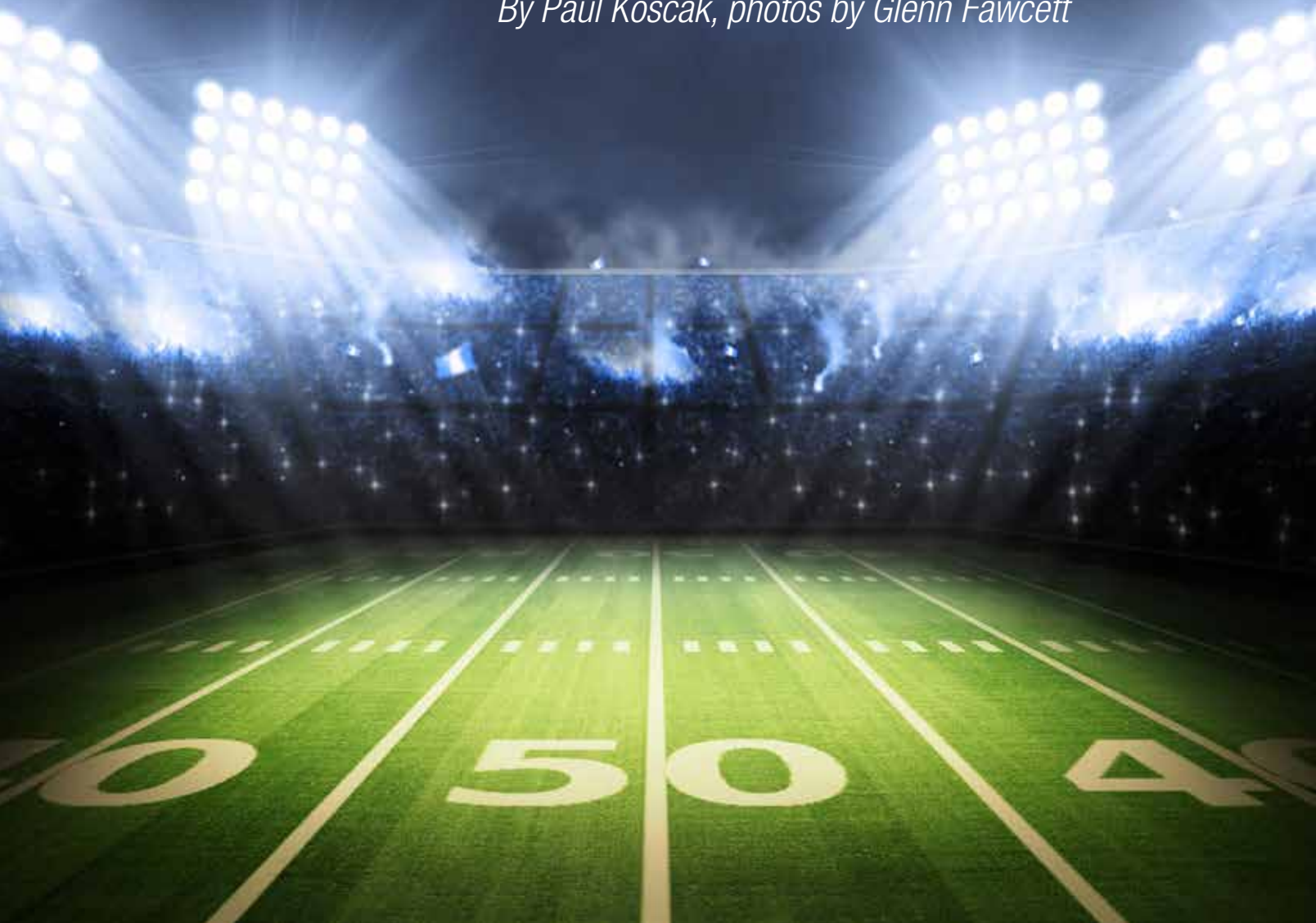
Email • frontline@cbp.dhs.gov

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GAME OVER

CBP's expertise, exclusive equipment
boost Super Bowl safety

By Paul Koscak, photos by Glenn Fawcett



Super Bowl 50 tested the 129 U.S. Customs and Border Protection agents and officers who contributed to the event's success. While there were no incidents and fans enjoyed the game without worrying about their safety, security didn't come without obstacles.

"This was the largest event the NFL ever held," said James Vick, CBP operations chief, OFO, during Super Bowl and program manager at the San Francisco Field Office. Although planning for Super Bowl 50 began right after Super Bowl 49, protecting the expected record crowds coming to celebrate a milestone half-century of championship football required a well-defined strategy.

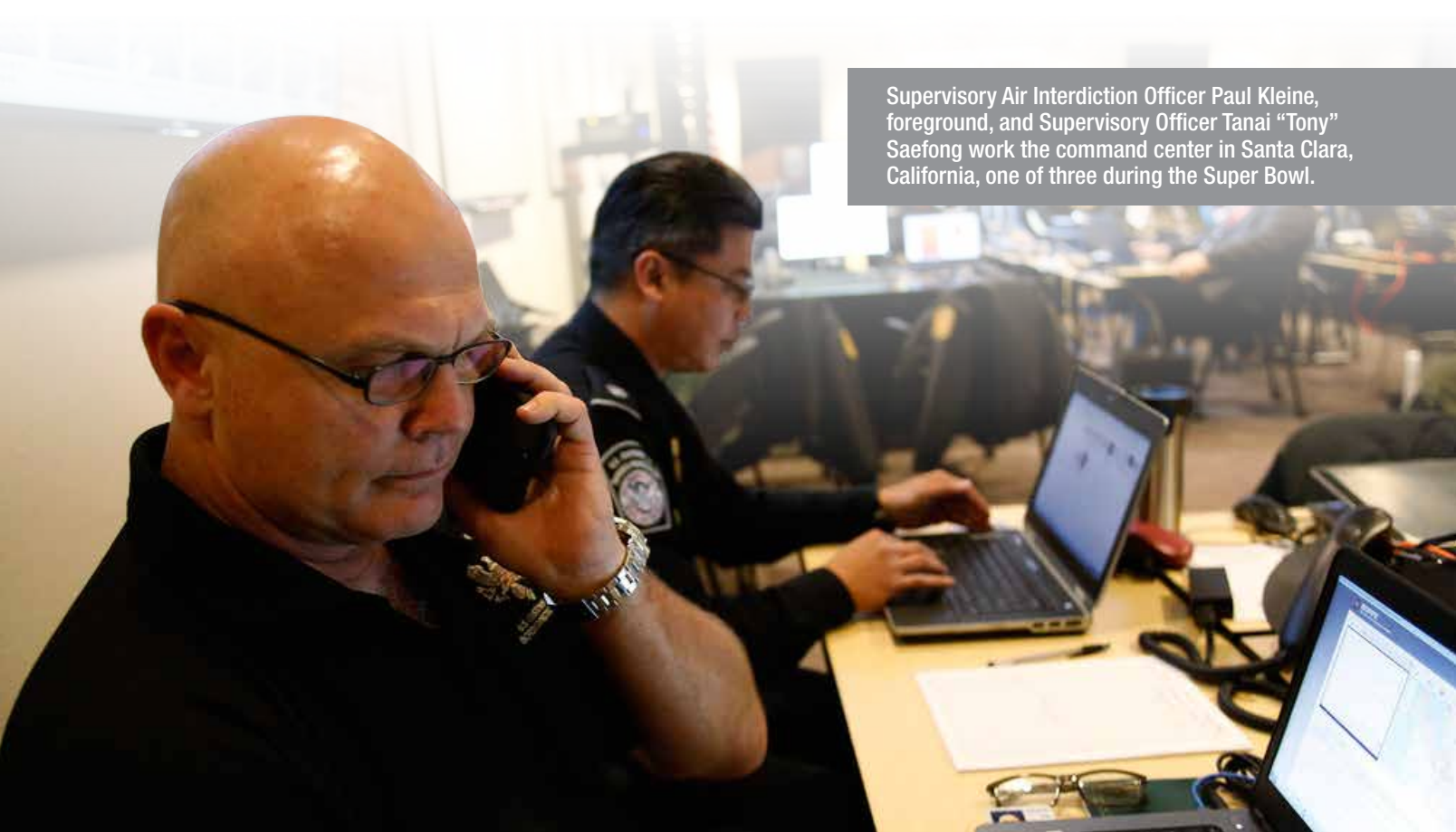
Another challenge for CBP was the game's location. Unlike the previous year's Super Bowl in Phoenix, where assets could be concentrated close by, in San Francisco they were stretched from the City by the Bay to Levi's Stadium, in Santa Clara, nearly 50 miles away, said Vick.

"It was difficult because of the distance and traffic," he said.

Then the terrorist attacks in Paris and San Bernardino by Islamic terrorists altered planning, requiring CBP, in partnership with FBI intelligence, to pause and determine what measures to take. "That changed things," Vick noted. However, "the FBI was happy to have us."

Super Bowl security was directed from three command centers, one just a few miles from the stadium, where CBP shared its expertise with local, state and federal law enforcement as well as military staff. Civilian components provided weather service and monitored electrical networks to detect tampering.

The centers coordinated ground and air assets and ensured essential equipment and supplies were delivered. Most importantly, the centers allowed the different agencies to communicate – the "big pipe" as it was called – explained Paul Kleine, a supervisory air interdiction officer.



Supervisory Air Interdiction Officer Paul Kleine, foreground, and Supervisory Officer Tanai "Tony" Saefong work the command center in Santa Clara, California, one of three during the Super Bowl.

The Santa Clara command center had two wall monitors, one a monster 12 feet by 5 feet, displaying real time video covering the region. Operators could spot incidents, such as traffic, an accident or a protest, for instance, and advise law enforcement or even game officials traveling from their hotel to the stadium.

Essential equipment included an X-ray machine suspended from a truck, called mobile radiation portals. The machine was kept busy scanning truckloads of beer, bread, wine, furniture, lights, portable toilets and potato chips arriving at Levi's Stadium.

The portals could scan an entire tractor trailer or a small van in just a few minutes, delivering sharp images of their contents. Anything radioactive would also be detected. That could mean a possible explosive, or just granite or kitty litter. Those items emit natural radioactivity, said CBP Officer Fred Ho.

If the portal detected radiation or a vehicle was suspected of carrying a bomb, it would be moved into a U-shaped barricade built from stacks of shipping containers filled with dirt. The structure was designed to contain any blast. Officers also carried small personal radiation detectors clipped to their service belt.

About 300 vehicles per day delivered goods right up until game time. None of that volume could be managed without the experience and equipment CBP brought to the staging area, according to Brian Humphrey, director of field operations, San Francisco Field Office.

A second CBP vetting operation was underway at San Francisco's Pier 54 from 1 to 9 a.m. Those deliveries supported Super Bowl City, a fan village built near the city's downtown waterfront and the NFL Experience, a football interactive theme park fabricated across from San Francisco's Moscone Center.

"The most exciting thing is the technological support we bring to law enforcement," Humphrey said. "No other law enforcement operation or private entity has our capability."

Then there was security from the sky. CBP's Air and Marine Operations provided eight aircraft—three Black Hawk helicopters, three Cessna C-550



Trucks line up next to Levi's Stadium for X-ray scanning before deliveries are authorized.



An AMO Blackhawk helicopter strikes a commanding presence at Levi's Stadium.

Citations, two AS350 A-Star helicopters and 65 agents. The operation was positioned at Moffett Field, just a stone's throw by air to Levi's Stadium.

Securing the airspace surrounding Levi's Stadium was among AMO's tasks. Aircrews watched for errant aircraft violating the restricted area, said John Priddy, the director of operations at the San Diego Air and Marine Branch. Typically, restricted airspace extends to a designated altitude in a radius of several miles surrounding an event.

"If someone [an aircraft] invades that space, we intercept them and get them to exit," he said. Interceptions follow protocols established by the FAA and pilots are expected to comply. For example, if a military or law enforcement aircraft flies next to an intruding aircraft and lowers its landing gear, that's a signal for the intercepted aircraft to land. Several airspace violations occurred during Super Bowl 50.

AMO also maintained aircraft in the air and standby aircraft on the ground to assist law enforcement in case an incident erupted or even to insert a tactical team, said

Ned Leonard, detection enforcement officer at the San Diego Air and Marine Branch.

Aircraft were equipped with a special camera that transmits footage of the area being flown in nearly real time. The video was fed into CBP's intranet, giving law enforcers anywhere, authorized to receive the transmission – including officials at CBP headquarters in Washington, D.C. – with the big picture of the activities, explained Leonard.

"The video can be recorded, played back and evaluated if someone spots something suspicious," he added. There was also a darker side of Super Bowl 50: scammers trying to dupe fans with fake Super Bowl merchandise, even tickets. Some were street hawkers, flea market merchants and vendors. Others were warehouse operators and retail dealers.

Their paraphernalia included jerseys, caps, rings and the like – just about any apparel and souvenir sporting team colors, numbers and the Super Bowl 50 logo.

But CBP officers, working with other law enforcement partners, weren't fooled. They confiscated a bonanza of phony Super Bowl goods being sold as the real thing.

The federal team, working with police in San Jose, San Francisco and Oakland, presented the stockpile at a news conference.

Still, the display was just a small part of the 450,000-netted counterfeit sports items worth an estimated \$39 million. “This is a rip-off for local business owners who play by the rules,” said Dolores DiBella, an NFL attorney. The NFL also seized about 1,300 websites selling the merchandise. This year, 41 merchants were arrested.

Certain giveaways revealed phony Super Bowl merchandise. For example, hats with a poor quality NFL hologram; a shirt that lacked the hologram; or NFL logos attached with mismatched stitching. Sometimes the price is too good to be true. On display were hefty gold Super Bowl rings, supposedly diamond studded. Street price: just \$100, according to DiBella.

“What’s the big deal?” Brian Humphrey, CBP’s director of field operations in San Francisco, rhetorically remarked. “This potentially funds criminal organizations. And the quality is poor. If the product is electrical, it could pose a fire hazard. That jersey won’t last long.”

Tracing the source of the fake goods can be difficult, said Humphrey, because shipments are purposely routed through several countries. “China is the worst offender,” he noted.

Super Bowl fakery was just one episode. Bogus brand name shoes were a big problem, Humphrey explained. CBP’s Operation Super Fake seized \$432,000 in counterfeit footwear, and \$2.1 million in overall fake merchandise.

Perhaps the brashest forgeries were Super Bowl tickets. One ticket could fetch as much as \$25,000, making the strip of paper worth more than moon rocks. To defeat the counterfeiters, the NFL safeguarded tickets with protections on par with modern currency. The real tickets sported NFL logo holograms made with heat sensitive ink. When the hologram is rubbed it disappears. As it cools, the logo returns. Other ticket images were visible only under black light.

Countering the crooks meant fans could only get into the game with paper tickets; no electronic or PDF tickets were accepted.

Overall, support and coordination with law enforcement was a big part of CBP’s role, said Tanai “Tony” Saefong, a supervisory officer at San Francisco International Airport. “It was a success in that there were no incidents. However, we were ready to respond.” **F**



These genuine Super Bowl tickets use heat sensitive ink and Super Bowl holograms to thwart counterfeiters.

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The Power of Pollen

**How CBP is at the forefront of
using pollen as a new forensics tool**

By Marcy Mason



Thousands of fir pollen grains are dispersed haphazardly by the wind. Only a few will reach their desired destination and pollinate another fir tree.
Photo by William Friedman

Last June, when the partially decomposed body of an unidentified little girl, known as Baby Doe, was found in a trash bag on a beach on Deer Island in Boston Harbor, the National Center for Missing & Exploited Children contacted U.S. Customs and Border Protection's forensic pollen expert, Andrew Laurence, for help. The center, which assists law enforcement agencies and families with missing and exploited children cases, wanted to know if Laurence, one of the world's foremost forensic palynologists and one of only two forensic palynology experts in the U.S., could do pollen analysis to determine where the body was from.

"We thought that pollen could give investigators a little more insight into whether Baby Doe was from the local area or not," said Carol Schweitzer, a senior forensic case specialist at the National Center for Missing & Exploited Children based in Alexandria, Virginia.

Schweitzer presented the idea to the Massachusetts State Police, who were receptive. "We put Andy in contact with the Massachusetts state crime lab and they submitted the evidence directly to him. They sent two blankets, a pair of polka-dotted pants, and a hair sample," said Schweitzer.

Laurence, who has helped the center identify the geographical origins of other children, did his analysis at CBP's Houston lab. He found more than 30 different types of pollen grains. Most were common to the Northeast. "There was a lot of pine, oak, birch, and a little bit of spruce," he said.

But then, there were the unexpected types of pollen that he found. Baby Doe's clothing and blankets contained two types of *Cedrus* or cedar pollen grains. "Cedar is not native to North America," said Laurence. One of the species in the sample was cedar of Lebanon.

“It didn’t grow in New England until the early 1900s, when the Arnold Arboretum of Harvard University in Boston imported a specific variety of the trees that now grow throughout the area,” said Laurence. But it was the second species of cedar that clinched it. “The only place I could find the second type of cedar was the Arnold Arboretum, so I knew that Baby Doe was from the Boston area,” he said.

In less than two weeks, Laurence delivered the results. “It was a very helpful tool,” said Trooper Daniel Herman, the detective from the Massachusetts State Police homicide division investigating the case, who had never used pollen analysis before. “We had hundreds of leads and calls coming in from all over the country. The pollen analysis indicated that the child had spent a significant part of her life in the Boston area. So it was encouraging news for us. It helped us narrow down our search and focus the effort we put into leads.”

Although pollen analysis has been used for forensic purposes for several decades, it is a new technique for U.S. law enforcement. As the only U.S. federal

agency with a forensic palynologist on staff, CBP is leading the U.S. law enforcement community in using this new forensic tool for investigations and intelligence.

UNKNOWN FIELD

Forensic palynology, not a widely known field, is defined as using pollen and spores to solve criminal or civil legal issues. Essentially, there are two types of forensic palynology. The first is when pollen is used to investigate crimes. The second is when pollen is used to determine the geographical location or “geolocation” of items or people.

“Every location in the world has a unique pollen print—just like a fingerprint,” said Vaughn Bryant, a professor of anthropology and the director of the palynology laboratory at Texas A&M University in College Station, Texas, who is regarded as “the father of forensic palynology” in the U.S. “The kind of pollen that you would find in a sample from Washington, D.C., is different from Chicago, is different from Dallas, is different from Houston or anyplace else.”



Andrew Laurence, CBP scientist and forensic pollen expert, uses a forensic vacuum to take a pollen sample from Baby Doe’s pants at the CBP Houston lab. Photo by Shannon Ferguson

Similarly, every plant has its own unique pollen grain. “There are about 300,000 species of plants in the world. Each one produces a unique type of pollen. There are no two species that produce exactly the same type,” said Bryant.

Plants disperse pollen differently too. It’s their method of reproduction and there are two main strategies – insects and animals or the wind. “Insect pollinated plants are not distributed very far, and the pollen is sticky. It doesn’t go anywhere. It’s designed specifically for insects and animals like hummingbirds to track it from one plant to another,” said Bryant. “Whereas a pine tree produces upwards of two to three hundred million pollen grains. Why? Because it’s dispersed by the wind, a very haphazard method of pollination. Millions of grains are distributed hoping that a few will get to the right spot.”

One of the reasons that pollen is so well-suited to forensic investigations is because pollen is everywhere. “Any object that is exposed to the environment is collecting pollen,” said Laurence, one of Bryant’s former students and his protégé. “We can analyze pollen to reconstruct the environment of where that object came from or the different places that it’s been. For example, we can trace the route of a truck as it travels through different ecological and vegetation zones, because as the truck travels, it’s collecting different types of pollen grains,” he said. “We also can analyze clothing and tell where someone has been. Pollen can hang onto clothing for quite some time even after repeated washings,” said Laurence. “So even if you wash your clothes several times, the pollen will still be there from the day you bought the clothes. It becomes embedded in the fabric.”

Pollen is also indoors. “When people are going in and out of a building, they’re collecting pollen,” said Laurence. “They bring the pollen in on their clothes and it transfers into the air inside the building. There

can be up to 10,000 pollen grains per cubic meter of air, roughly the space inside a home refrigerator,” said Laurence.

Moreover, pollen is extremely resilient. It stays intact and doesn’t lose its physical structure. “Under the right preservation conditions, pollen is virtually indestructible,” said Laurence. “Pollen grains could be 20 million years old, more than 200 million years old – before the age of dinosaurs, or even go back as far as when the first plant life appeared on earth 450 million years ago.”

However, forensic pollen analysis isn’t ideal for every type of situation. “If you have a sample that has been exposed to the local environment for a couple of days, chances are it’s so heavily contaminated with local pollen that it would be difficult to determine where it actually came from,” said Laurence.



A microscopic cedar pollen grain found on Baby Doe’s clothing was one of the indicators that pinpointed the unidentified little girl was from the Boston area. Photo by Andrew Laurence

HISTORICAL ROOTS

The earliest reported case of forensic pollen analysis successfully being used as criminal evidence occurred in Austria in 1959. Pollen found on the soles of a suspect's muddy boots was linked to the site where a man had disappeared while vacationing along the Danube River near Vienna. From the pollen, investigators were able to identify the precise location where the suspect must have walked while getting mud on his boots. When confronted, the shocked suspect confessed to the crime and showed authorities where he had killed the victim and buried the body. Both locations matched the findings of the pollen evidence and the suspect was convicted of murder.

During the 1960s and 1970s, there were other European criminal cases that used pollen as a forensic tool to link suspects to events or crime scenes. In America, forensic palynology took root in 1975, when Bryant, a botanist who had studied pollen at archaeological sites, started to analyze pollen for forensic purposes. The U.S. Department of Agriculture, USDA, tapped his expertise for a loan subsidy program to help U.S. honey farmers. Bryant tested honey samples, identifying the pollen content, to determine if the honey was produced domestically, one of the requirements of participating in the program.

Unbeknownst to Bryant, it was a huge undertaking. "I had absolutely no idea what I was getting into," said Bryant. "I had never looked at honey before and thought it would be relatively easy. What I did not realize is that just in North America alone, not counting the rest of the world, there are probably somewhere close to 90,000 to 100,000 different plant species that could potentially be used for pollen or nectar."

After five years of identifying pollen, Bryant became an expert. But then the price of honey on the world market soared and the USDA ended its honey

subsidy program. In 1980, Bryant wasn't able to find anyone in the U.S. who wanted to hire him for his forensic palynology skill. "No one at that time was doing forensic palynology anywhere in the world except New Zealand," said Bryant.

In the 1990s, interest in using forensic palynology re-emerged in countries such as the United Kingdom, but the U.S. lagged behind. It wasn't until after Sept. 11 that pollen was used as a forensic tool. One of the U.S. intelligence agencies contacted Bryant about using his forensic palynology skill for security purposes. "I was looking at samples that had been collected by the intelligence community from places where terrorists were active. There were samples of everything from rugs to cars to people to dwellings to weapons—even bombs," said Bryant.

Then, just as his work with the intelligence agency was winding down, CBP reached out to Bryant. "We had intelligence gaps related to the movement of narcotics. We wanted to know more specifically where the drugs were coming from, how they were grown, and how the cartels were operating so that we could strengthen our interdiction efforts," said Patricia Coleman, acting director of CBP's Office of Intelligence. "Other countries were using forensic palynology as evidence in criminal investigations. They were having success, so we thought maybe this could be an answer to our intelligence gap. We decided to take samples from drug seizures that were made along the Southwest border to determine the origin of the marijuana," said Coleman.

SURPRISING CONNECTION

One of the first samples that Bryant tested was from an 8,000-pound marijuana seizure taken from a warehouse in San Diego in November 2011. The warehouse was connected to the Kern Street Tunnel, a drug tunnel that ran beneath the border of Tijuana, Mexico and Otay Mesa, California. The Border Patrol and special agents from Homeland Security Investigations, HSI, raided the warehouse and found the drugs loaded in a tractor trailer.





Vaughn Bryant, professor of anthropology and the first forensic palynologist in the U.S., takes a sediment sample to analyze its pollen content at Texas A&M University in College Station, Texas. Photo by Yolanda Choates

Two weeks later an 8,646-pound marijuana seizure was made at a ranch in Starr County, Texas, by a Drug Enforcement Administration, DEA, task force. “The two seizures were in two different states, more than a thousand miles apart, but the forensic pollen analysis revealed that there was a shared nexus where the marijuana was cultivated or packaged,” said Steven Goldfarb, a watch commander in the Counter Network Division at CBP’s National Targeting Center who is currently assigned to the DEA’s Special Operations Division. “From an intelligence perspective, we concluded that the same drug trafficking organization was responsible for the growth site and the distribution of both marijuana shipments. This is important from an enforcement standpoint because it lets us know who our adversaries are and it gives us insight into what is going on beyond our borders. This is really the basis of what forensic palynology brings to the table for us.”

CBP also made another eye-opening discovery. “The presumption was that the marijuana moving through Texas was coming from the cartels that controlled the states south of Texas. But that’s not what we were seeing,” said Coleman. “The pollen testing showed that the drug shipments seized in Texas were coming from Sonora, which is south of Arizona.”

A few months later, Bryant did pollen testing on another batch of shipments. This time with Laurence’s help. Between March and May of 2012, CBP officers and Border Patrol agents made numerous marijuana seizures on the southern border near El Paso, Texas. Further inland, state and local law enforcement agencies also made several marijuana seizures that involved heavy farm equipment used to smuggle the drugs. “We thought there was some connection among these shipments because the drug seizures were coming through the same channels,” said Goldfarb. “Through forensic pollen analysis, we discovered that all of the

marijuana had a specific pollen type, a ‘key marker’ that stands out. It’s a pollen that generally points to a very precise location. In this case, the plant was sagebrush,” he said.

Although there are more than a 100 species of sagebrush in the U.S., in Mexico, there is only one known species, which only grows in a few isolated locations. “We were able to narrow down very precisely a particular area of Mexico where the marijuana was cultivated,” said Goldfarb.

“This tied into a bigger case involving a specific drug trafficking organization in Mexico that was under investigation. The pollen analysis linked this organization to the marijuana seizures in Texas,” he said. “It was interesting because the seizures were done in different places at different times, but they all traced back to one location.”

CBP shared information with the Mexican government, and in June 2012, Mexican authorities raided a farm outside of the city of Chihuahua in north central Mexico, where they seized 400 kilograms of marijuana and 13 sacks of marijuana seed that weighed almost 300 kilograms.

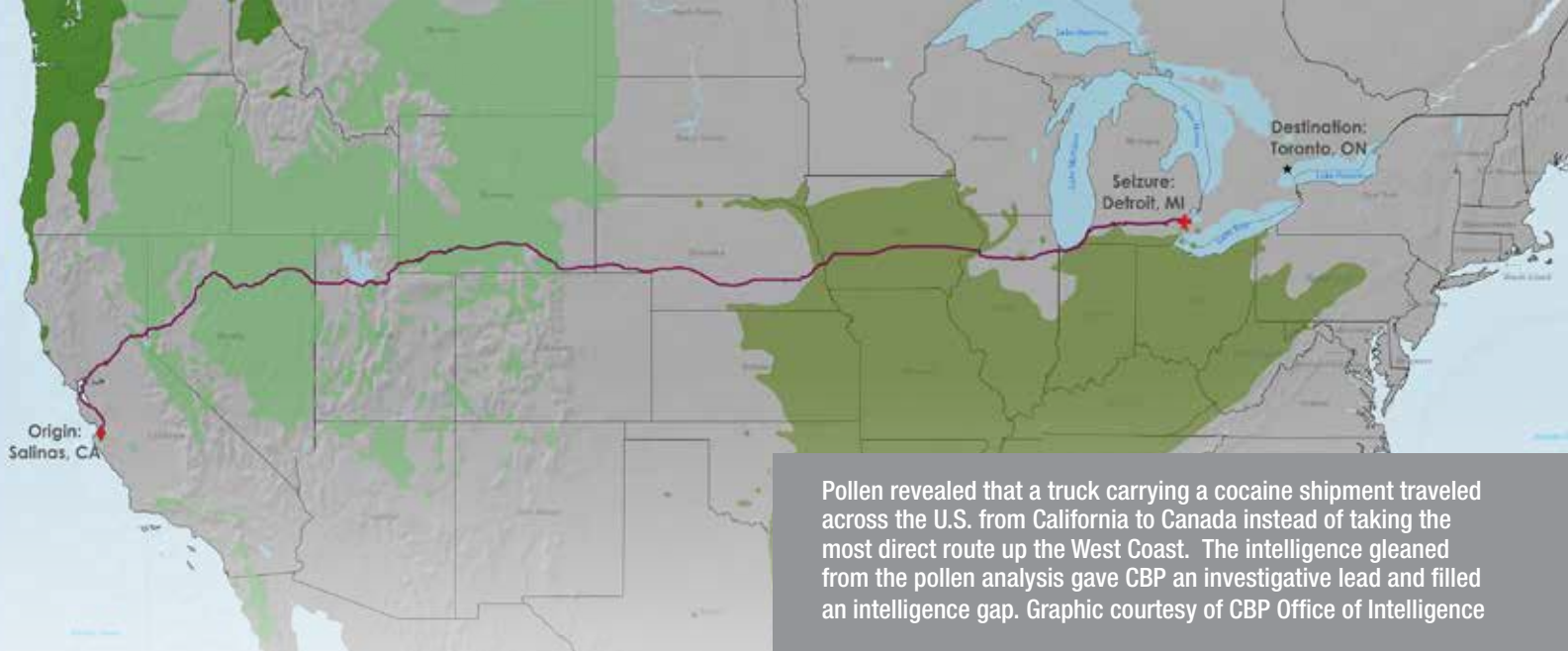
MORE THAN MARIJUANA

For more than a year, CBP’s Office of Intelligence used pollen to track the flow of marijuana shipments. “Then it became bigger. We weren’t looking at just marijuana anymore,” said Coleman. “We were looking at other narcotics such as cocaine, heroin, and crystal methamphetamine. Basically, we were using science to tell a story, to piece it altogether, to find out who was involved, how the drugs were made, where they came from, and what routes they traveled.”

By this point, it had also become apparent that CBP needed to hire a full-time forensic palynologist. “Once we started getting results, things took off,” said Coleman. “We couldn’t keep up with the demand. We literally had a backlog.” But Bryant was a professor with classes who did private work on the side, so he wasn’t available. Instead, he recommended Laurence, one of his graduate students, who shared his passion for forensic palynology and had proven to be gifted in the field. When Laurence finished his doctorate in anthropology, he started working full-time at CBP’s Houston lab.



A Border Patrol agent from CBP’s Critical Incident Team takes a pollen sample from a panga boat. Photo courtesy of CBP



Pollen revealed that a truck carrying a cocaine shipment traveled across the U.S. from California to Canada instead of taking the most direct route up the West Coast. The intelligence gleaned from the pollen analysis gave CBP an investigative lead and filled an intelligence gap. Graphic courtesy of CBP Office of Intelligence

One of the cocaine cases that Laurence worked on was a drug bust in Detroit in November 2013. The cocaine, which was not destined for the U.S. market, was seized from a truck before it exited the country to Canada. “Our Office of Intelligence wanted to know where the cocaine came from and where the truck went,” said Laurence. “So I tested the pollen in the truck’s air filter.”

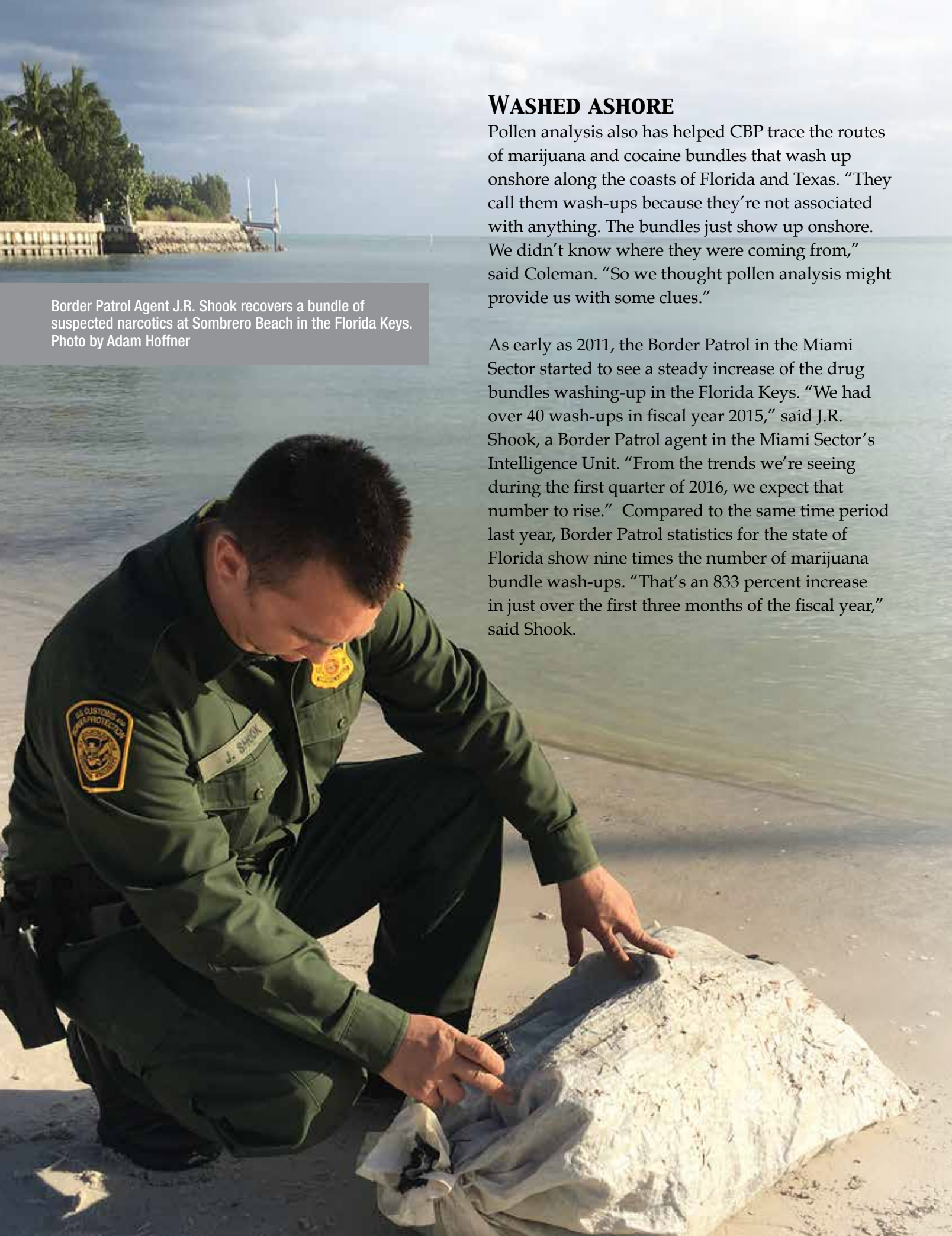
The truck’s manifest, which listed its contents, indicated that the truck had travelled from Salinas, California. “We wanted to verify that,” said Laurence. The pollen revealed that the truck did originate in Salinas, drove up the coast to San Francisco, and then turned east, traveling along Interstate 80 through Nevada, Utah, Wyoming, Nebraska, Iowa, and Illinois until it eventually arrived in Detroit, where the cocaine was seized.

“It was a curious route,” said Goldfarb. “The question is, ‘Why would you take your shipment all the way to Detroit when you can go straight up to Canada through the state of Washington?’ It was evident that there was a drug deal going on and this gave us an investigative lead. Just like on the Mexican side of the border, there are different cartels in Canada that have control of specific regions,” said Goldfarb, adding that this is not a route that is commonly used for narcotics smuggling. “If we give that information to the highway patrol, they could occasionally do some enforcement and stop the movement of cocaine through the United States.”

Another unexpected finding from the pollen analysis involved panga fishing boats. While panga boats are legitimate fishing vessels, drug cartels use the boats to move narcotics up the West Coast. “Initially the panga boats would leave Mexico from the Baja California peninsula and jut up to the San Diego coastal area,” said Coleman. “But in 2012, we started to see a lot of panga movement further north up the Pacific Coast and it was becoming a problem.”

CBP’s Office of Intelligence wanted to get a better idea of how the cartels were operating, so pollen was tested on abandoned boats. “We analyzed the interior of the boats, wiping them down the sides as well as inside the engines and the engine covers,” said Laurence. “The boats contained lots of pine, lots of oak, and a few spruce or fir pollen grains. In Mexico, fir trees only grow in the highest elevations of the mountains.”

“What we derived from this in an intelligence sense is that they were loading the boats discreetly at the higher elevations and then driving them to the water to launch them,” said Coleman. “By analyzing the pollen, we gained a new insight into the cartel’s operation—how they were actually transporting the marijuana,” she said. “Once again, this finding enabled us to give information to the Mexican government to do enforcement.”



Border Patrol Agent J.R. Shook recovers a bundle of suspected narcotics at Sombrero Beach in the Florida Keys. Photo by Adam Hoffner

WASHED ASHORE

Pollen analysis also has helped CBP trace the routes of marijuana and cocaine bundles that wash up onshore along the coasts of Florida and Texas. “They call them wash-ups because they’re not associated with anything. The bundles just show up onshore. We didn’t know where they were coming from,” said Coleman. “So we thought pollen analysis might provide us with some clues.”

As early as 2011, the Border Patrol in the Miami Sector started to see a steady increase of the drug bundles washing-up in the Florida Keys. “We had over 40 wash-ups in fiscal year 2015,” said J.R. Shook, a Border Patrol agent in the Miami Sector’s Intelligence Unit. “From the trends we’re seeing during the first quarter of 2016, we expect that number to rise.” Compared to the same time period last year, Border Patrol statistics for the state of Florida show nine times the number of marijuana bundle wash-ups. “That’s an 833 percent increase in just over the first three months of the fiscal year,” said Shook.

When bundles are found, the Border Patrol sends samples to Laurence for testing. “The majority of the wash-ups are bundles of marijuana from the Caribbean, especially Jamaica,” said Coleman. “What clued us in was the samples we examined are loaded with fern spores, more than would be typical of an area where fern plants grow. There are only a few areas that have that many ferns and one of them is Fern Gully, a winding, scenic stretch of road in Jamaica,” said Coleman.

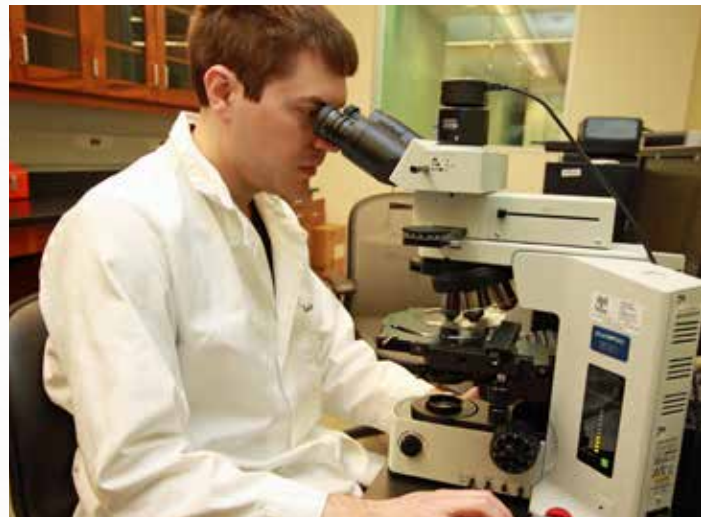
The information gleaned from the pollen analysis has been valuable. “Prior to the pollen testing, we had no idea where the narcotics were originating from, so when a bundle would land on the beach, HSI would just seize it and there wasn’t an investigation,” said Shook. “No smuggler was caught; no information was captured; the drugs were just destroyed,” he said. “With pollen analysis, we’re now able to pinpoint where the narcotics originated and the probable routes and methods used to smuggle them into the country. That, in turn, helps us counter the threat.”

Before long, the pollen testing was expanded to gather intelligence on other aspects of CBP’s mission including seized weapons, currency, and even identifying routes of travel and places of origin of criminals, potential terrorists, and other persons of interest. “We’re looking to apply forensic pollen analysis to matters of national security,” said Coleman. “We’re looking at travel routes of people who are traveling to the U.S. These are people who have already been identified by CBP systems that are used to determine risk associated with travel,” she said. “Pollen can trace a person back to a certain location. In light of foreign fighters and concerns about individuals coming to the U.S., this is an avenue for us to explore, to find out if people have been in conflict zones.”

PROCESSING POLLEN

The pollen analysis process is arduous and labor intensive. “Pollen processing itself is a very long process. There are a lot of chemical steps as well as physically washing the samples,” said Laurence. “Normally, it takes four to six hours to process a sample if everything goes well. That includes vacuuming the sample to extract the pollen.” But there are often complications. For example, if a cocaine sample isn’t completely pure, the impurities need to be dissolved. “It takes time to figure out what those impurities are and what can dissolve them,” said Laurence. Other times there could be a lot of sediment in the sample that traps the pollen. “This adds a lot of extra steps and a lot more time,” he said.

After a sample is processed, Laurence identifies the pollen with a microscope. “I sit down and count the pollen grains. How long that takes depends on how many grains are in the sample, what the sample is, where it came from, and what types of pollen grains are there,” he said. “While I’m counting, I’m identifying and if there are lots of different pollen grains, it could take a long time to determine what everything is as well as matching it against known pollen types. If I’m looking at pollen from regions where there isn’t a lot of information, it could take even longer.”



Forensic palynology requires long hours at the microscope. Samples of pollen grains can take anywhere from a few hours to several days to count and identify. Here, CBP scientist Andrew Laurence analyzes a sample using a microscope at the CBP Houston lab. Photo by Yolanda Choates

One of Laurence's biggest challenges is knowing what grows in various places around the world. In some countries, like the U.S., extensive pollen mapping studies have been done. Other places such as the Middle East, South America, and Mexico, information is scant. "It's either because of political reasons or some places are just very difficult to get to like the Amazon," he said.

He and Bryant also rely on reference collections, databases, books, and other forensic palynologists; however, there are few. "There are only a handful of forensic palynologists in the world, maybe five," said Jen O'Keefe, the past president of AASP – The Palynological Society, an international palynology association based in Houston. "It's very hard to identify people with the right skill set to do this. You have to be extremely exacting and careful in the laboratory. You also need an incredible memory for shapes and sizes and for where you last saw something. Plus you need to have the patience and stamina for long hours at the microscope."

O'Keefe estimates that there are 1,000 palynologists worldwide. "About half work in the petroleum industry," she said. Petroleum companies use pollen to determine the earth's oil producing geological time periods to decide where to drill.

One of the reasons it has taken so long for forensic palynology to gain recognition is its rarity. "Andy is the only person in the United States doing forensic palynology full time," said Bryant. "Nobody else is doing this stuff full time, not even me."

COLD CASE WARMS UP

But pollen's forensic value is undeniable. For example, in April 2015, by using pollen analysis, Laurence was able to breathe new life into a cold case investigation that had been stymied. The case, which dates back to 1976, involved a young, unidentified woman whose battered body had been dumped in the woods near Lorraine Park Cemetery, a few miles southwest of Baltimore in Woodlawn, Maryland.

The National Center for Missing & Exploited Children contacted Laurence about the case and asked if he would be willing to do pollen testing to help the Baltimore County Police Department, which had been actively working on the case for 39 years. "It was a new tool that the police were unaware of," said Schweitzer. "But they were willing to keep trying new things."

"The pollen analysis gave us something to work on," said Baltimore County homicide Detective David Jacoby, the investigator on the case. "We didn't have any leads. We didn't have any tips. We had our suspicions of what part of the country she may have been from, but that was essentially it."

The Baltimore County Police sent Laurence evidence from the case, which, fortunately, had been well preserved. "I analyzed two handkerchiefs, a pair of socks, one leather shoe, and a sweater," said Laurence. Interestingly enough, the results were strikingly similar to the findings in the Baby Doe case. "There were similar types of pollen from the Massachusetts area. It had cedar in it and there was a lot of soot in the sample from an industrial area of a major city. But the big difference was this sample mostly had pollen from a disturbed habitat," he said.

In a disturbed habitat, the land has been modified or changed. "It has been altered by humans or natural elements such as fire," said Laurence. "In this case, the pollen types and concentrations did not coincide with the environment where the body was found – an open, wooded area. The pollen was from a city."

Laurence also could not find a single record of cedar growing in Baltimore. Aside from that, the sample contained pollen from mountain hemlock trees, *Tsuga mertensiana*, a plant native to the Pacific Northwest. None of the other pollen in the sample, however, matched the West Coast. "The plant types were common in the Northeast," he said. Laurence did more research and found that the only two places in the Northeast that grew both cedar and mountain

hemlock were the New York Botanical Garden in New York City and the Arnold Arboretum in Boston. “Based on the pollen, it could have been either location, but the investigators had a lead suggesting Massachusetts,” said Laurence.

When the Baltimore County Police received the results, they were ecstatic. “It gave us hope,” said Jacoby. “We had our suspicions that she was from that particular area, but the pollen propelled us in that direction and gave us a place to start. Now we’re moving this investigation forward. The pollen was really a significant tool.”

“It’s amazing that pollen, a small microscopic particle, could have such a great impact on criminal investigations,” said Coleman. “Sometimes the findings that come out of pollen analysis are things we would never even venture to think about. It’s like a new discovery, a new piece of information that supports existing intelligence or counters what we know,” she said. “It gives us irrefutable, scientific evidence that allows us to rethink how we look at the processes, the procedures, and the tactics of the criminal enterprise, but perhaps what’s most exciting are the endless possibilities of pollen as a forensic tool.” **F**



Flowering cherry trees and forsythia bloom at the Arnold Arboretum of Harvard University in Boston during early spring. Two of the forensic pollen cases CBP scientist Andrew Laurence analyzed were geographically traced to the Arnold Arboretum. Photo by Jon Hetman

Editor's note:

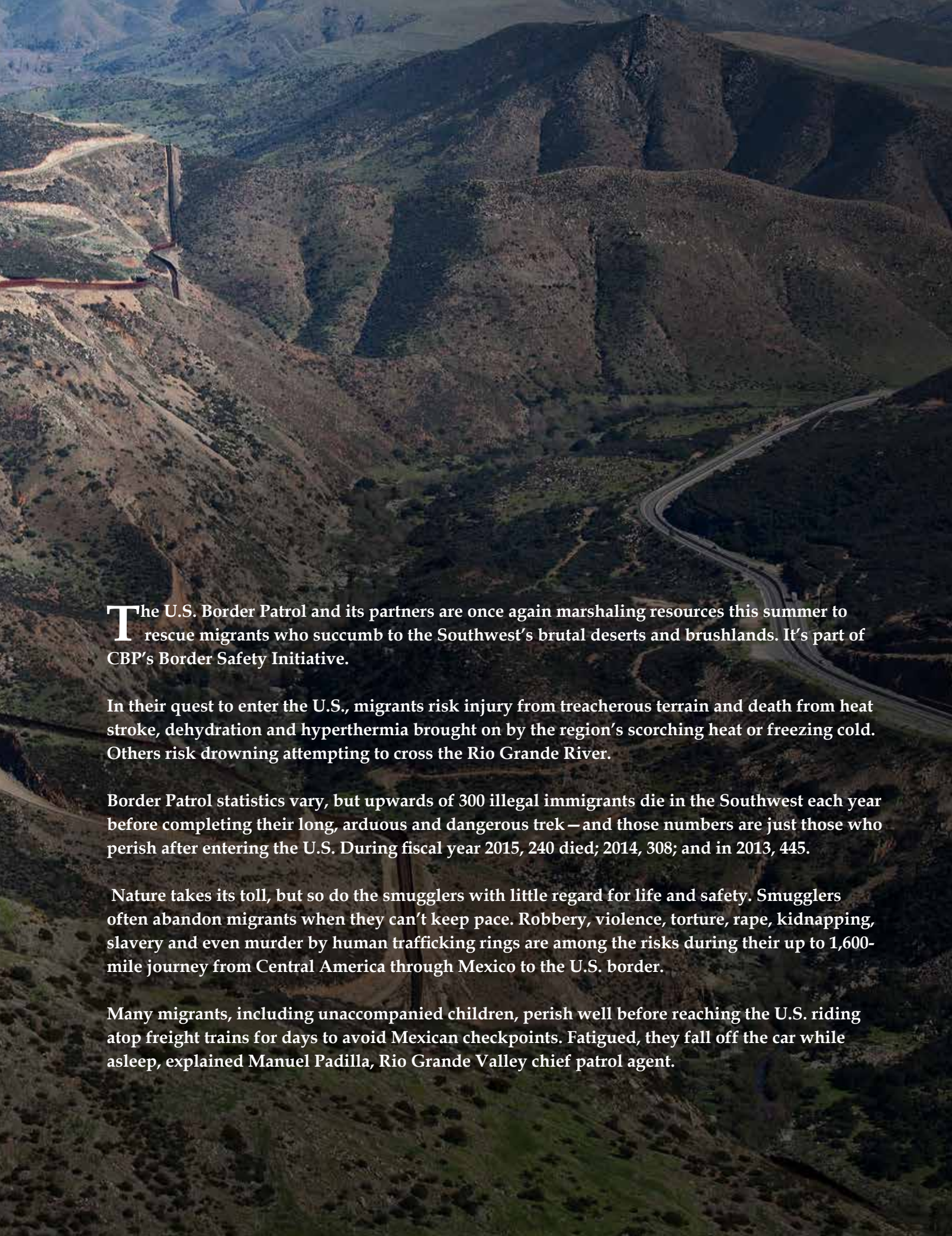
On September 18, 2015, after a three-month search for her identity and cause of death, Baby Doe was identified as Bella Bond, a 2-year old toddler from Boston. Bond's identity was discovered from a publicity generated tip. Police arrested Bond's mother and her boyfriend. In December 2015, both were indicted by a grand jury. Bella Bond's mother, Rachelle Dee Bond, was charged with being an accessory after-the-fact to her daughter's murder and her boyfriend, Michael Patrick McCarthy, was charged with first-degree murder for the child's death. Rachelle Bond also was charged with larceny for allegedly continuing to accept public assistance after her daughter's death. Both Rachelle Bond and Michael McCarthy are awaiting trial.

An aerial photograph of a rugged, mountainous landscape. A winding road, possibly a dirt or gravel road, snakes through the terrain, which is covered in sparse, dry vegetation and rocky outcrops. The road starts in the upper right and curves down and then across the middle of the frame. The overall scene is desolate and appears to be in a high-altitude or semi-arid region.

A Perilous Journey

**CBP humanitarian program
aims to save lives**

By Paul Koscak



The U.S. Border Patrol and its partners are once again marshaling resources this summer to rescue migrants who succumb to the Southwest's brutal deserts and brushlands. It's part of CBP's Border Safety Initiative.

In their quest to enter the U.S., migrants risk injury from treacherous terrain and death from heat stroke, dehydration and hyperthermia brought on by the region's scorching heat or freezing cold. Others risk drowning attempting to cross the Rio Grande River.

Border Patrol statistics vary, but upwards of 300 illegal immigrants die in the Southwest each year before completing their long, arduous and dangerous trek – and those numbers are just those who perish after entering the U.S. During fiscal year 2015, 240 died; 2014, 308; and in 2013, 445.

Nature takes its toll, but so do the smugglers with little regard for life and safety. Smugglers often abandon migrants when they can't keep pace. Robbery, violence, torture, rape, kidnapping, slavery and even murder by human trafficking rings are among the risks during their up to 1,600-mile journey from Central America through Mexico to the U.S. border.

Many migrants, including unaccompanied children, perish well before reaching the U.S. riding atop freight trains for days to avoid Mexican checkpoints. Fatigued, they fall off the car while asleep, explained Manuel Padilla, Rio Grande Valley chief patrol agent.

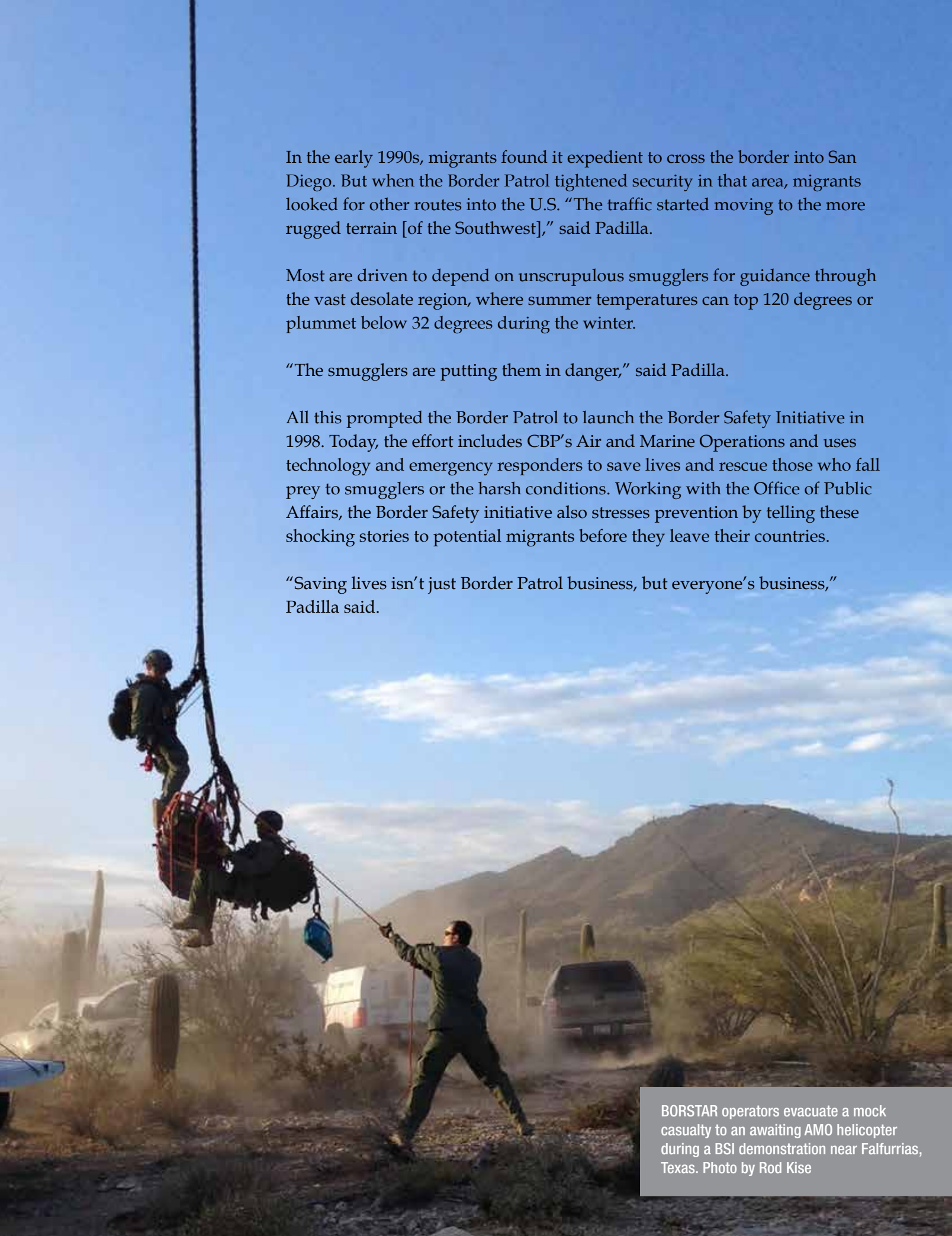
In the early 1990s, migrants found it expedient to cross the border into San Diego. But when the Border Patrol tightened security in that area, migrants looked for other routes into the U.S. “The traffic started moving to the more rugged terrain [of the Southwest],” said Padilla.

Most are driven to depend on unscrupulous smugglers for guidance through the vast desolate region, where summer temperatures can top 120 degrees or plummet below 32 degrees during the winter.

“The smugglers are putting them in danger,” said Padilla.

All this prompted the Border Patrol to launch the Border Safety Initiative in 1998. Today, the effort includes CBP’s Air and Marine Operations and uses technology and emergency responders to save lives and rescue those who fall prey to smugglers or the harsh conditions. Working with the Office of Public Affairs, the Border Safety initiative also stresses prevention by telling these shocking stories to potential migrants before they leave their countries.

“Saving lives isn’t just Border Patrol business, but everyone’s business,” Padilla said.



BORSTAR operators evacuate a mock casualty to an awaiting AMO helicopter during a BSI demonstration near Falfurrias, Texas. Photo by Rod Kise

The Border Patrol's BORSTAR units play a major role in the initiative. These search, trauma and rescue specialists locate people in distress and render medical care in all weather conditions and terrain. In most cases, BORSTAR agents offer the only hope for those stranded in the desert since other emergency help is usually in a city many miles away.

BORSTAR agents are aided by search and rescue dogs during their patrols – Labradors, German Shepherds and Belgian Malinois. Their keen sense of smell allows them to track migrants who sometimes wrap their shoes in carpet to hide evidence of their journey. These well-trained dogs can locate the stranded, recover human remains or follow roaming groups of migrants, significantly reducing search time, explained Jesse Esquivel, a supervisory Border Patrol agent who works the Del Rio Sector in Texas.

He manages a team of 10 agents who comb the desert every day. "We search the high-risk areas," he said, regions migrants frequent to avoid detection.

"They are remote, not close to towns. Being out there, we can also respond quickly."

"Water is an issue, some drink from stock ponds polluted by cattle," said Esquivel, "This causes even more problems."

Local law enforcement and the Border Patrol share a 911 emergency telephone system that can locate stranded migrants. Calls from stranded migrants are transferred to the Border Patrol cell and tower signals provide GPS coordinates of the caller, accurate within 100 yards.

Rescue beacons are one of the most innovative tools to assist the distressed. The towers are placed along known smuggling routes and in areas experiencing numerous rescues or fatalities. The beacons are high intensity blue lights visible up to 10 miles at night or in low-light conditions.

Victims simply press a large red button to activate the beacon. Directions are displayed in English, Spanish and Tohono O'odham along with a pictorial guide for those who can't read. (Tohono O'odham is the language and name of a Southwest tribal nation.)

Some beacons are equipped with an emergency telephone and they're are well used. There were 70 activations during fiscal year 2013; 139 in 2014; 158 in 2015 and 120 as of March 31 this year.



A BORSTAR team renders first aid to an injured migrant.
Photo by CBP



Air and Marine Operations conducts a drill to prepare for rescue missions of injured migrants via a Blackhawk helicopter. Photo by CBP

CBP's Air and Marine Operations partners with the Border Patrol to save lives. A-Star and Blackhawk helicopter crews add significant range to the searches. Blackhawks have emergency medical technicians on board, carry medical supplies and are equipped to hoist injured migrants from the desert.

All U.S. Border Patrol agents can offer basic medical care. The Border Patrol also employs more highly trained personnel, including 4,150 first responders, 730 emergency medical technicians and more than 70 paramedics. Overall, the Border Safety Initiative has resulted in 1,898 rescues from fiscal year 2012 until now, saving more than 29,000 lives. Those numbers attest to CBP's commitment that all lives matter, including those who break the law.

Outreach Campaigns

While CBP invests significant resources to rescue those in distress, the initiative also focuses on prevention. CBP, along with the Department of Homeland Security and the State Department, use a wide range of avenues to reach potential migrants. CBP's communication campaigns emphasize the perils migrants will endure on the journey and that there's no path to citizenship.

The latest campaign shares testimonials of migrants describing horrific experiences; involves outreach through embassies in El Salvador, Honduras, Guatemala and Mexico and publicizes these dangers in newspapers, radio and television in those countries.

Commissioner R. Gil Kerlikowske launched a similar campaign in 2014 with a press conference in the Rio Grande Valley. Following that event, the Office of Public Affairs engaged news media in Houston, Laredo, Miami, Los Angeles, New York and Washington, D.C., resulting in 427 news stories available to 13 million television, 6 million radio and 3 million print news consumers.

In 2015, OPA's Jaime Ruiz conducted 32 interviews, many of which were broadcast live, reaching millions of Spanish-language audiences throughout the U.S. Earlier this year, U.S. Border Patrol Sectors hosted media and stakeholder events in San Diego, Laredo, Texas, Del Rio, Texas, and the Rio Grande Valley in Texas.

CBP also reaches out to local officials, landowners, international delegations from Central America, non-governmental organizations, law enforcement agencies and congressional staff, resulting in a productive exchange of ideas. Some events focus on the Border Patrol technology and resources. Other activities allow participants to experience the harsh terrain and weather conditions migrants encounter during their perilous journey.

In May, for example, the Rio Grande Valley Sector enclosed news media in a semi-trailer to experience firsthand the heat, lack of air and isolation some migrants suffer at the hands of smugglers. The event drew four non-governmental organizations, four legislative staff, two landowners and 29 reporters. Participants witnessed a BORSTAR K-9 team follow migrant tracks in the desert; a mock rescue, complete with triage; and a helicopter extraction.

While media and stakeholder events are ultimately designed to deter potential migrants, they also foster collaboration and understanding, and address concerns raised by some organizations.



Manuel Padilla Jr., Rio Grande Valley chief patrol agent, speaks to congressional staff members, consulates, local stakeholders and the media at the Falfurrias checkpoint, Texas, during a BSI event. Photo by Rod Kise

“When you build bridges we see each other as people, not caricatures,” said Juanita Molina, director of the Border Action Network, a human rights group that advocates for border and immigrant communities. Her six-year association with the Border Patrol, getting to know agents and the dangers they face, and an understanding that both organizations share some common goals has influenced her perspective.

“What we share is to take death out of the immigration equation,” she said. “Our goal is to save lives. We all see this devotion by the Border Patrol.” **F**



TRY FIRST, BUY LATER

Novel Acquisitions Plan Stresses Trials Before Purchasing, Huge Savings Foreseen

by Paul Koscak

Purchasing major field equipment is pretty standard. In its simplest form, a requirement comes from the field, headquarters calls for bids, proposals are evaluated and a purchase is negotiated. Typical government procedure.

But what if the equipment fails to perform as expected?

That's a concern the U.S. Border Patrol's special operations group and the Office of Field Operations special response team wrestled with after getting stuck with equipment that demonstrated well, but fell short when tested in the field, said Jerry Turner, assistant chief patrol agent assigned to the Office of Intelligence.

When evaluating new and emerging technology the focus is usually more on its capability than how useful it may be for the officers and agents in the field, said Turner. "Most engineers don't have an operational mindset of their equipment," said Turner. "That's why it's important to place the equipment in the hands of the end user."

During some joint CBP and U.S. Army training exercises nearly two years ago, Turner noticed that the Army did just that. Equipment considered for purchase first had to pass muster in actual field tests evaluated by three teams, or cells, as they're called.

This special operations team in an urban setting evaluated a mobile intelligence, surveillance and reconnaissance transmitter for dogs. The device allows handlers to remotely monitor what the dog sees and hears and permits commands. Photo by Jeffrey Swenson

A blue cell applies the equipment in a scenario based on actual border security field operations. A red cell probes for vulnerabilities and works to overcome the equipment. Meanwhile, a white cell made up of scientists, engineers and soldiers assesses the technology and then works to fix any shortcomings revealed by the exercise. Then the equipment is used in another scenario to see how it adapts.

Turner took that model the Army calls the Adaptive Red Team/Technical Support and Operational Analysis process (ART/TSOA) – a try-before-you-buy program, really – and brought it to CBP. The program is benefiting CBP special operations units. Before applying the new approach to acquisitions, CBP first teamed with the Army in testing potential technology as well as the program.

Ten members of the Border Patrol's special operations group became blue and red cell members, while staff from the Office of Intelligence were observers in a five-day event at the Quantico, Virginia, Marine Corp Base in June 2014. Nine scenarios involving intelligence, surveillance and reconnaissance technologies were evaluated.

A year later, CBP was part of another ART/TOSA event at Quantico that brought together more than 400 participants from several federal agencies as well as the Army and Navy to test 25 technologies in 12 field scenarios. For instance, local law enforcement asks for assistance after a criminal organization takes control of a town along the U.S.-Mexico border. Responding to an urban terrorist attack involving mass casualties and hostages, provided the background for another exercise. By coincidence, the Paris terrorist attack happened just three days before that exercise.

After each scenario, the white cell is briefed on equipment performance, shortcomings and recommendations for improvements. This give-and-take dialogue is the core of the program – allowing new equipment to be redesigned to fit the mission before any purchase is made.



BORTAC agent assesses the Android Tactical Assault Kit during an exercise at Camp Blanding, Florida. Using smartphone technology, the device is reinforced to function in rugged field conditions and shows law enforcers a geographical depiction of their surroundings using interactive moving maps, video, voice and text. Photo by Jeffrey Swenson

Acquisition, said Turner, has traditionally been a top-down process, without much feedback from the officers and agents in the field. “The red team model changes the way technology is viewed, which is down-up,” he said. It also offers an efficient way to identify alternatives and vulnerabilities and it builds collaboration between the operational and technical communities, he added.

Equipment flaws are most likely to be revealed in the field, said Border Patrol Agent Gary Pettifor, who works the special response team during the red team events. For instance, the team tested an electronic perimeter fence that worked great in

open fields but failed in wooded areas, where trees blocked the signal. His team is currently evaluating equipment that can pinpoint gunfire and locate a rampant shooter at small locations, such as a building or plaza.

Unlike shopping for equipment at trade shows, the ART/TSOA program matches the end user with the engineers and scientists who understand the technology, not sales representatives, “who you’ll get calls from all the time,” said Pettifor.

Building on that experience, the Office of Intelligence along with the special operations group and special response team, reached a milestone in October 2015 — they held the first CBP exclusive ART/TSOA red team event in El Paso, Texas. Since then, two more ART/TSOA exercises have taken place.

Mark Borkowski, assistant commissioner for CBP’s Office of Technology Innovation and Acquisition, said demonstrating equipment in field conditions is important for both government and industry. “These exercises allow CBP to see first-hand how new and emerging technology can aid in accomplishing our mission,” he explained. “It can help us procure the right equipment for our agents and officers based on their direct feedback.”

Red team events, Borkowski added, are an excellent way for entrepreneurs to showcase their products. “We’ll be having many more of these events in the future,” he said.

Turner expects to eventually present the program for agency-wide consideration.

“It’s crawl, walk, run,” he said, defining how he sees the program progressing. “Right now, it’s crawling.” **F**

A hand-held light-measuring device that can screen people unobtrusively from a safe distance for explosives, illegal drugs or even the ingredients to prepare them as well as other substances was evaluated during the ART/TSOA event in El Paso, Texas. Photo by Jeffrey Swenson



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The Office of Field Operations Drill Team competes in the Steve Young Honor Guard Competition in Washington, D.C. The competition is part of National Police Week. Photo by Josh Denmark

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