

Ivana Ignjić*

*Faculty of Security Science, University of Banja Luka,
Republika Srpska*

Saša Mićin**

*Faculty of Security Science, University of Banja Luka,
Republika Srpska*

Predrag Ćeranić***

*Faculty of Security Science, University of Banja Luka,
Republika Srpska*

**OPERATIONAL APPLICATION
OF DIRECTED ENERGY WEAPONS:
CASE OF VENEZUELA
(Translation in *Extenso*)**

Abstract

This paper analyzes the development and potential operational use of Directed Energy Weapons – DEW, with particular emphasis on the Havana Syndrome and the U.S. operation *Absolute Resolve* conducted in Venezuela in 2026. The central hypothesis of the study is that the technical and technological development of these systems has reached a level that enables their practical application in

* E-mail address: ivana.ignjic@fbn.unibl.org; ORCID: 0009-0000-3308-5846.

** E-mail address: sasa.micin@fbn.unibl.org; ORCID: 0000-0002-2220-435X.

*** E-mail address: predrag.ceranic@fbn.unibl.org; ORCID: 0009-0005-7526-657X.

contemporary military and security operations. The research is based on the analysis of available scientific, media, and institutional sources, employing comparative methodology and a case study approach. The paper examines the phenomenon of Havana Syndrome as a possible indicator of the existence of microwave and other directed-energy systems capable of causing neurological, cognitive, and auditory disorders in humans. Particular attention is devoted to the microwave auditory effect and recent media reports suggesting the existence of portable electromagnetic devices associated with these symptoms. The second part of the paper analyzes Operation *Absolute Resolve*, during which the United States conducted a complex military-intelligence operation in Venezuela. Based on available reports and eyewitness testimonies, the study considers the possible use of an unidentified weapon referred to as a *discombobulator*, whose effects reportedly included disorientation, loss of balance, and physical impairment among members of the Venezuelan forces. The paper indicates that such effects demonstrate certain similarities with known directed-energy weapon systems. Special attention is given to the U.S. programs Active Denial System – ADS, Mob Excess Deterrent Using Silent Audio – MEDUSA, and Long Range Acoustic Device – LRAD, as examples of systems employing microwave and acoustic effects for military and security purposes. The analysis demonstrates that these weapons have been the subject of intensive development for decades, accompanied by substantial financial investments and the gradual enhancement of their operational mobility and effectiveness. The paper concludes that directed energy weapons no longer represent exclusively a theoretical or futuristic concept, but rather an increasingly significant component of contemporary warfare. Their further development may substantially influence the nature of future military and police operations, while simultaneously raising important security, medical, legal, and ethical questions about their control and consequences.

Keywords: directed-energy weapons, Havana Syndrome, ADS, MEDUSA, LRAD, microwave weapons, acoustic weapons, Absolute Resolve, contemporary warfare, security technologies.

INTRODUCTION

Maintaining technological superiority has become more challenging due to rapid innovation and the global spread of advanced technologies. China has increasingly used developments from the commercial sector to strengthen its military capabilities, reducing the traditional advantage once held by the United States in advanced weapons systems (Stekić 2025). Contemporary developments in science and technology are driving radical changes in the concept and design of weapons systems, with DEW development occupying a particularly significant position. Although research on the military applications of laser, microwave, and sonic systems has been ongoing for decades, this field remains shrouded in a high degree of secrecy. Global military powers such as the United States of America, the Russian Federation, and the People's Republic of China disclose information on the status of their projects only sporadically, thereby directly limiting the precision of scientific evaluation of the tactical and technical performance of these systems under real operational conditions. The lack of empirical data and the inability to verify the effects of DEW systems in combat environments have led these technologies to be viewed predominantly through theoretical models.

The emergence of the Havana Syndrome in 2016, and particularly the U.S. operation conducted in Caracas under the name Operation Absolute Resolve, which resulted in the arrest and detention of Venezuelan President Nicolás Maduro, initiated a new wave of interest among the international professional and academic communities in the fields of security and defense technologies. Havana Syndrome, also referred to as Anomalous Health Incidents – AHIs, represents one of the most controversial and complex security-medical phenomena of the contemporary era. Since the first reported cases among American and Canadian diplomats in Havana in 2016, this phenomenon has attracted intense attention from scientific, security, and political circles. Symptoms, including unusual sensory experiences, dizziness, cognitive impairments, and neurological and vestibular disorders, have subsequently been recorded among officials at other locations

worldwide, further deepening suspicions that the phenomenon may possess broader geopolitical and technological implications.

In the case involving Maduro, field reports, testimonies of surviving members of the Venezuelan presidential guard, and official accusations issued by the Venezuelan Ministry of Defense indicate that previously unseen and classified combat systems were allegedly employed during the operation. Testimonies describing mass disorientation, temporary paralysis, and physical side effects among defenders, accompanied by statements from officials in Washington regarding the use of advanced classified systems, the so-called *discombobulator*¹, have raised questions concerning the level of technological maturity and operational readiness of non-conventional weapon systems.

Based on the foregoing, the principal hypothesis of this paper is that the technical and technological development of directed-energy weapons has reached a level sufficient to ensure operational readiness and deployment under real-world conditions. The aim of the research is to examine the validity of this hypothesis through the analysis of available technical indicators, the application of comparative methodology, and a case study approach.

HAVANA SYNDROME AND NEW UNKNOWN WEAPONS

Since 2016, officials from the United States and Canada have reported cases of AHIs, also known as Havana Syndrome, which involve unusual sensory experiences followed by long-term neurological, cognitive, and balance-related symptoms (Dutta 2025). Subsequently, other individuals serving in similar roles in multiple locales (e.g., Austria, Germany, Russia, Vietnam, and within the continental U.S.) experienced similar subjective symptoms (Giordano 2025). Furthermore, Dutta states that the source of these incidents remains widely disputed, with major explanations ranging

¹ Meaning of discombobulate: to confuse someone or make someone feel uncomfortable (Cambridge Dictionary 2025).

from psychological and social influences to the possible use of directed-energy technology, making the issue a complex medical and international security concern. Havana Syndrome has presented a complex diagnostic challenge for both clinicians and government entities. All have described an acute onset of a constellation of subjective symptoms, including directional auditory phenomena, vertigo, cognitive disturbances, and pressure sensations, accompanied by objective neurological, vestibular, and autonomic disturbances (Giordano 2025).

On March 1, 2023, five U.S. intelligence agencies published the conclusions of a comprehensive investigation into Havana Syndrome and its possible causes. Their assessment found it highly improbable that the symptoms experienced by affected individuals were the result of attacks using sonic or microwave technology, and they found no convincing evidence connecting the incidents to the actions of a foreign adversary. According to their findings, many of the reported symptoms could be explained by existing medical conditions, psychological stress, reactions to environmental circumstances, and other ordinary factors (Bartholomew and Baloh 2023).

On January 13, 2026, CNN published an article stating that the Pentagon had acquired a device through an undercover operation, which is suspected to be linked to Havana Syndrome. In the final months of the Biden administration, Homeland Security Investigations, a branch of the Department of Homeland Security, acquired a device through an undercover operation funded by the Department of Defense. The Pentagon has spent more than a year examining the equipment because some investigators believe it may be linked to the unexplained health problems associated with Havana Syndrome. Reports indicate that the device remains under active testing and can emit pulsed radio-frequency waves. For several years, officials and academic researchers have suggested that this type of energy could potentially explain the neurological and physical symptoms linked to Havana Syndrome (Lillis et al. 2026).

The CBS News program “60 Minutes” presented an in-depth report on Havana Syndrome. Through investigative reporting, they established that undercover agents of the United States Department

of Homeland Security acquired a microwave weapon from a Russian criminal network in 2024 for \$15 million. They further state that the microwave weapon is “portable, concealable, and requires relatively little power, small enough to be carried by a person, operates silently, and does not produce heat”. The report also notes that the weapon is “programmable for different scenarios and can be operated by remote control” (60 Minutes 2026).

On February 14, 2026, The Washington Post published an article about another weapon that may be linked to Havana Syndrome. In 2024, operating under highly confidential conditions, a Norwegian government researcher developed a device capable of emitting microwave pulses and, in an attempt to demonstrate that the technology posed no danger to humans, tested it on himself. Reportedly, he experienced neurological effects resembling the symptoms associated with Havana Syndrome. The Norwegian government informed the CIA about the findings, leading to at least two visits to Norway in 2024 by representatives of the Pentagon and the White House. The experiment suggested that devices capable of releasing concentrated bursts of electromagnetic energy can influence human biological functioning (Strobel and Nakashima 2026). In the following days, this information was reposted by numerous media outlets, all of which cited The Washington Post as the original source. Even one of the largest Norwegian media outlets, Verdens Gang – VG, reported on the matter the same day, also referencing The Washington Post as its source (Tronstad 2026).

It is important to emphasize that the microwave auditory effect offers a possible scientific explanation for Havana Syndrome. Unlike normal hearing, microwave hearing does not depend on sound waves passing through the outer and middle ear. Instead, short pulses of microwave energy absorbed by brain tissue create rapid thermal expansion, producing pressure waves within the skull that travel to the cochlea, where they are interpreted as sound (Lin 2021).

On February 20, 2026, the U.S. War Department announced that the Anomalous Health Incidents Cross-Functional Team – AHI CFT will move to the Office of Research and Engineering. The Department emphasized that this change reflects a growing and increasingly

complex mission and will ensure that the team has the expert support needed to address current and future challenges (U.S. Department of War 2026).

OPERATION ABSOLUTE RESOLVE

In August of 2025, a covert team of CIA operatives entered Venezuela with the objective of gathering intelligence on President Nicolás Maduro. The agents operated secretly throughout Caracas for several months without being detected. Using intelligence on Maduro's daily activities, information from a source close to the Venezuelan leader, and surveillance conducted by stealth drones flying covertly above the city, the agency developed a highly detailed understanding of his movements and routines (Barnes, Pages, and Schmitt 2026). General Dan Caine, the chairman of the Joint Chiefs of Staff, said that intelligence gathered by the team allowed the United States to know "where Mr. Maduro moved, what he ate and even what pets he kept" (ABC News 2026). The operation resulted in a highly coordinated and rapidly executed mission that successfully removed Nicolás Maduro from Venezuela without any casualties on the U.S. side. President Trump praised the outcome, even though the operation sparked broader debate over the legality and justification of U.S. actions in Venezuela (Barnes, Pages and Schmitt 2026).

On January 3, 2026, U.S. President Donald Trump announced that Venezuelan leader Nicolás Maduro and his wife, Cilia Flores de Maduro, had been taken into custody during a joint overnight U.S. military operation conducted in Caracas. Trump also stated that the couple would be prosecuted in connection with a 2020 U.S. Department of Justice case involving several federal accusations, including drug trafficking and narco-terrorism (Olay 2026). Operation Absolute Resolve, the joint military and law enforcement operation aimed at capturing Nicolás Maduro and Cilia Flores de Maduro, was carried out after months of detailed planning and operational rehearsals involving U.S. joint forces and special operations personnel from several branches of the military. Air Force General Dan Caine, Chairman of the Joint Chiefs of Staff, stated that the operation also included close

coordination and extensive intelligence collaboration with multiple U.S. intelligence agencies (ABC News 2026).

Inside Venezuela, the mission began with a cyberoperation that disrupted power across large areas of Caracas, plunging the city into darkness and enabling aircraft, drones, and helicopters to approach undetected. More than 150 military aircraft, including drones, fighter jets, and bombers, participated in the operation, launching from approximately 20 military bases and naval vessels (Berg 2026). The operation started with overnight strikes targeting areas in and around Caracas, the Venezuelan capital. Venezuela subsequently declared a nationwide state of emergency, while the number of casualties and the full extent of the destruction remained yet to be confirmed. The Venezuelan government condemned the action as an “extremely serious military aggression” carried out by the United States. The operation followed months of escalating tensions, including a significant U.S. military buildup near the Venezuelan coast and several deadly attacks on suspected drug-trafficking vessels. In the weeks leading up to the operation, the United States had also ordered the seizure of sanctioned oil tankers while warning that ground operations could be launched to remove Maduro from power (UN News 2026). Air Force General Dan Caine stated that “the mission to extract the Maduros was so precise that it involved more than 150 military aircraft from across the Western Hemisphere launching in close coordination to provide cover for the ground-based extraction force in Caracas” (Olay 2026).

While many of the operational details remain vague and likely classified, the U.S. military appeared to overrun Venezuela’s air defenses, while special operations forces and law enforcement agencies participated in the raid on Maduro’s house. The operation appears to have been an overwhelming success on the tactical level, as the U.S. Air Force controlled the skies, Venezuela’s radars and electrical grid were jammed, and many of its air defenses were destroyed (Berg 2026).

On January 10, on the online *platform X*, social media influencer Mike Netter presented an interview with a Venezuelan security guard loyal to Nicolás Maduro. The security guard explained that all their radar systems had suddenly shut down without warning, and shortly afterward, numerous drones appeared above their positions, leaving

them unsure how to respond. He added that only a few helicopters arrived, no more than eight, carrying around 20 soldiers who appeared far more technologically advanced than any enemy they had previously encountered. Despite their numerical superiority, he emphasized that they stood no chance, as the opposing forces fired with extraordinary speed and precision, rendering them completely powerless. At one point, he recalled, the opposing forces deployed what he could only describe as an intense sound wave, after which he felt as though his head were exploding from the inside. He explained that they all began bleeding from the nose, some even vomiting blood, and soon collapsed to the ground, unable to move. According to his account, the twenty attackers suffered no casualties while killing hundreds of his men. He stressed that they were unable to compete with such advanced technology and weaponry, adding that he had never witnessed anything like it before, and that after the deployment of the sonic device, they were not even able to stand. After that, Mike Netter's post was shared on the online platform X by Karoline Leavitt, who is currently the Assistant to the President and the 36th White House Press Secretary, with the caption: "Stop what you are doing and read this [...]" (Leavitt 2026). Aside from that, the United States has provided no medical records, forensic evidence, or independent verification to support the claim, and it has not denied it either (Firstpost 2026).

Based on the previously presented interview, the question arises whether the United States used new, modern high-tech weapons. In an interview with the New York Post, President Donald Trump addressed this question, acknowledging that a new type of weapon had been used in Operation Absolute Resolve but stating that information regarding that weapon remains classified. During the interview, he referred to the weapon as the *discombobulator*. The offered further explanation for its name: "None of their equipment worked. Everything was discombobulated" (NBC News 2026). In an interview on "Katie Pavlich Tonight", President Donald Trump stated that there are weapons that no other country possesses and that the United States has weapons that no one knows about. When the host Katie Pavlich referred to the mentioned weapons as "sonic weapons" during the interview, Trump did not object (NewsNation 2026). President Donald Trump also stated

that they had used weapons that had never been used on battlefields (Montagu-Smith 2026).

On 23 January 2026, on the official X account of the Office of the Under Secretary of War for Research and Engineering, it was stated that the U.S. Department of War possesses directed-energy weapons and is scaling them (Department of War 2026). A day later, on 24 January 2026, in an interview with the New York Post, Donald Trump stated that a new weapon had been used and called it the “discombobulator” (Nelson, Goodin, and Schultz 2026). In the days that followed, several major media outlets reported the same information in their coverage. CNN published a report on January 25 (Iyer and Sciutto 2026), followed by PBS News on January 26 (PBS News 2026), and Al Jazeera on the same day (Montagu-Smith 2026). Most of these outlets focused primarily on the incident itself and the interview with the bodyguard, rather than engaging in an assessment of the nature or characteristics of the alleged weapon. In contrast, Al Jazeera presented the topic in considerably greater detail, identifying potential examples such as the Long Range Acoustic Device (LRAD) and the Active Denial System (ADS) (Montagu-Smith 2026), both classified as directed energy weapons.

The topic remained highly prominent in the media until the end of January, during which time the *discombobulator* was widely discussed. However, media attention declined in February, with fewer outlets continuing to report on the issue. One of the last notable reports was published by The New York Times on February 20, 2026 (McIntyre 2026).

AMERICAN PROGRAMS, TECHNOLOGICAL DEVELOPMENT, AND OPERATIONAL APPLICATION OF DIRECTED-ENERGY WEAPONS

The United States Department of Defense budget request for fiscal year 2025 in Science and Technology was 17.2 billion dollars (United States Department of Defense 2024). The United States Government Accountability Office (GAO) states that the United States is spending \$1 billion annually developing directed-energy

weapons, such as high-energy lasers and high-powered microwaves (U.S. Government Accountability Office 2023). In November 2025, the U.S. Department of War stated that “directed energy, hypersonics, and artificial intelligence are among the six technology focus areas”. Emil Michael, undersecretary of war for research and engineering, said that “focusing on directed energy will allow the department to rapidly scale high-energy lasers and high-power microwave systems, providing widely accessible defense capabilities with a low cost per shot” (Lopez 2025).

The global directed energy weapons market is projected to reach \$17.4 billion by 2029, up from \$ 9.24 billion in 2022. The growing demand is driven by increasing military operational requirements worldwide, particularly following the Russia–Ukraine war, by the effectiveness of DEWs against small drones and multiple targets, and by rising investments in research and development (Khurshid 2024). It has been alleged that, over the past two decades, the United States military may have employed three non-lethal directed energy weapons used against personnel. Those are Active Denial System (Raytheon Company 2019), Mob Excess Deterrent Using Silent Audio (Hambling 2020), and Long Range Acoustic Device (Lewer and Davison 2005).

According to the U.S. Department of War, Active Denial Technology – ADT generates a concentrated beam of directed energy intended to provide Joint Forces with a method of stopping, discouraging, or forcing back suspicious individuals while minimizing the risk of injury. The system uses an invisible beam of millimeter-wave radio-frequency radiation that travels at the speed of light and penetrates the skin to a depth of approximately 1/64 of an inch, roughly equal to the thickness of three sheets of paper. The exposure creates an intense heating sensation on the skin, causing the targeted person to instinctively move away from the beam (U.S. Department of War n.d.).

The development of an electromagnetic heating weapon was originally financed in 2002 by the U.S. Air Force Research Laboratory and the U.S. Department of Defense’s Joint Non-Lethal Weapons Directorate. The first version of the system, known as Active Denial System I, was tested and later deployed to Afghanistan in 2010. However, it was withdrawn only a few months later and has not been

used against enemy combatants in military operations since that time (Physicians for Human Rights 2020).

Also in 2010, the Los Angeles County Sheriff's Department revealed plans to deploy a new non-lethal weapon that emitted an invisible energy beam. The department intended to use Active Denial System I in a county jail as a tool for controlling inmates, particularly during fights and other violent disturbances. However, negative media coverage and opposition from the American Civil Liberties Union, which argued that the system threatened civil rights and liberties, ultimately stopped the weapon from being introduced (Weinberger 2014). The system has reportedly undergone more than 11,000 tests involving approximately 700 volunteers, including members of the media. According to the U.S. military, the probability of injury is estimated at only 0.1%, since the energy beam penetrates the skin to a depth comparable to three sheets of paper. Although the beam produces an intense, nearly unbearable heating sensation, military testing concluded that it does not cause lasting physical harm (Cairns 2010).

However, testing conducted on military volunteers documented several incidents involving skin burns, blistering, and persistent pain. Electromagnetic waves can penetrate roughly 0.5 mm beneath the skin, potentially reaching tissue below the dermal layer, where blood vessels, nerves, and glands are located. Certain areas of the body with thinner and more sensitive skin, particularly the face and eyelids, may therefore be especially vulnerable to injury. Prolonged exposure to the system can increase the risk of burns and damage to underlying tissue (Weinberger 2014). Joint Intermediate Force Capabilities Office – JIFCO continues to invest in ADS technologies. Investments in solid-state semiconductors aimed at reducing the size, weight, and power consumption of ADS units date back more than a decade, with the first experimental units delivered around 2011 and the latest version scheduled for delivery before the end of 2025 (Dechant et al. 2024).

Although significant progress has been made in developing and demonstrating the ADS technology, future improvements to the system are expected to focus on reducing the size, weight, and overall cost of the main ADS components (LeVine 2009). In his 2012 paper, Stew Magnuson discusses the size and weight limitations of the Active

Denial System (ADS), noting that the technology had been under development since the 1990s. In 2005, during the height of the Iraq War, engineers mounted the system on the rear of a Humvee. At the time his paper was published, the system still depended on a tactical vehicle for both transportation and power supply (Magnuson 2012). On April 4, 2017, an Active Denial System developed by the Joint Non-Lethal Weapons Directorate was presented during a counter-personnel demonstration conducted during the Weapons and Tactics Instructor course (Defense Visual Information Distribution Service 2017). As shown in the attached image in this article, the weapon still must be mounted on a tactical vehicle. In March 2025, the U.S. Department of War reposted older articles on ADS testing from 2012 on its official DVIDS website (Pellerin 2025), but there was no indication in those articles that a new ADS would be introduced. The size and weight of the ADS system would prevent its use in the Absolute Resolve operation.

In the early 2000s, the Sierra Nevada Corporation developed *MEDUSA* for the U.S. Navy. The system was intended to generate a microwave auditory effect strong enough to cause extreme discomfort and disperse groups of people. A major technological advancement of the project was the development of an electronic antenna capable of producing a narrow beam directed at a single target. Despite these innovations, *MEDUSA* remained at the prototype stage, and Sierra Nevada has not publicly commented on any further progress or later versions of the technology (Hambling 2020). *MEDUSA* was publicized in 2003. The system was intended to produce the microwave auditory effect, also known as the Frey effect² or “silent audio”, to create the perception of an extremely loud explosive sound. It was also described as capable of disturbing balance, inducing fever-like sensations, and triggering epileptic seizures (Kyriakopoulos 2025). In his paper, Deruelle states that a strong auditory sensation can be produced in the human head when it is exposed to carefully selected low-energy

² The Frey effect (also called the microwave auditory effect) is a phenomenon where pulsed microwave radiation can produce perceived sounds inside a person’s head, even though no external sound is present (MacDonald 2018).

microwave pulses. It is further specified that “the system should be portable, require little energy, and be able to control a crowd or a single individual” (Deruelle 2024).

The MEDUSA system is based on a combination of pulse parameters and pulse power, designed to elevate the perceived auditory effect to a level of discomfort to discourage personnel from entering a secured perimeter. While the project’s current status or results may remain classified, available information suggests that prototypes were built and power measurements were conducted to verify the necessary pulse specifications (Lin 2021). At present, the status of this program remains unknown (Deruelle 2024).

In his paper, Vinokur describes LRAD as “a giant loudspeaker that can deliver a shrill 145 dB tone or booms over a distance of more than 300 m, causing headaches and panic”. He further notes that the sound is significantly more powerful than that of a standard smoke detector and cannot be substantially reduced with earplugs (Vinokur 2004). One of the primary deterrent features of the LRAD is its siren system. It is specifically engineered to project sound within the frequency range to which human hearing is most sensitive, approximately 2,000–4,000 Hz. This design is intended to maximize discomfort for the targeted individual. The significance of the LRAD’s power lies in its potential to produce long-term physiological effects on the human body (English 2022). In their paper, Lewer and Davison suggest that some acoustic devices have been associated with side effects, including ear pain, dizziness, vomiting, and migraines. Also, Lewer and Davison further suggest that “such weapons, once fully developed, could potentially knock people off their feet” (Lewer and Davison 2005).

In a press release issued on April 2, 2025, Genasys reported orders totaling \$2.5 million from the U.S. military. These orders include LRAD systems for Army, Navy, and Air Force units stationed both domestically and internationally (Putnam 2025). The most recent documented use of an LRAD occurred on January 26, 2026, when the Minnesota State Patrol deployed a Long Range Acoustic Device during a protest in Maple Grove, Minnesota. The device was used to issue dispersal orders. Authorities stated that officers checked the volume,

delivered verbal warnings, and did not employ deterrent tones or sirens (James 2026). As shown on the Genasys website, LRAD systems can be deployed in multiple configurations, including vehicle-mounted systems such as the LRAD 950NXT, tripod-mounted setups, and portable carry configurations such as the LRAD 100X Carry Pack. Regarding LRAD size and weight, they do not pose a problem, and this weapon could have been used in Operation Absolute Resolve (Genasys 2024).

It should be noted that all three systems were introduced in the early 2000s. Consequently, more than two decades of sustained research, supported by substantial personnel and funding, could have led to significant advancements in their technological capabilities. The level of confidentiality surrounding these systems further contributes to their significance and limits a comprehensive assessment of their capabilities.

CONCLUSION

In conclusion, the development of directed-energy weapons represents one of the most significant technological trajectories in the evolution of modern armed forces, as evidenced by substantial United States investments, the growth of the global market, and the increasing operational relevance of these systems. Laser, microwave, and acoustic systems are being developed to enable rapid engagement, low operational costs, and effectiveness against multiple targets, particularly in the context of contemporary asymmetric threats and urban operations.

The case of the Havana Syndrome has raised questions regarding the potential use of microwave and other directed-energy systems against humans. Although U.S. intelligence agencies have not confirmed the existence of a foreign attack, numerous media reports, scientific analyses, and experimental findings suggest that technologies capable of producing neurological and auditory effects in humans do exist technically and are actively being researched. This indicates the need for further scientific, medical, and security-related research, as well as the development of international legal and ethical frameworks to regulate the use of such technologies.

Donald Trump's foreign policy was characterized by unpredictability and unconventional decision-making, largely shaped by the principles of deterrence, containment, and coercion (Proroković 2026). Operation Absolute Resolve reflected this strategy through the use of advanced military capabilities and strategic force projection without engaging in a prolonged large-scale war. Based on available information, Operation Absolute Resolve represents a contemporary mode of conducting military and intelligence operations that integrates cyber capabilities, unmanned systems, electronic warfare, precise coordination of special units, and potentially new forms of directed-energy weapons. The high level of coordination among U.S. military and intelligence structures, alongside simultaneous disruption of Venezuelan radar systems, communications, and electrical infrastructure, indicates technological superiority that enabled rapid, tactically effective execution of the operation without reported U.S. casualties.

Particular attention has been drawn to claims regarding the use of an unidentified weapon described as a *discombobulator*, whose alleged effects included disorientation, bleeding, loss of balance, and impaired mobility. Although there is no independently verified forensic or medical evidence conclusively confirming the use of such a system, eyewitness accounts, media reports, and indirect statements by U.S. officials have fueled speculation that this may represent an advanced form of directed-energy or acoustic-electromagnetic weapon system. Comparisons with existing technologies, such as ADS and LRAD, further indicate that these concepts have been the subject of military research and development for decades.

At the same time, the case of Absolute Resolve demonstrates the difficulty of distinguishing verified facts from information operations, psychological warfare, and media narratives in contemporary conflicts. The lack of transparency, the high level of classification, and reliance on limited sources leave many questions unresolved. Nevertheless, the increasing public discourse on technologies capable of affecting human physiology through sound, microwaves, or electromagnetic impulses suggests a possible transformation in future warfare.

Accordingly, Operation Absolute Resolve should not be viewed solely as an isolated military action, but also as a potential indicator of broader developments in new generations of non-lethal and directed-energy systems. Their possible use raises significant security, legal, ethical, and humanitarian issues, particularly regarding control, transparency, and consequences for human health.

The analysis of ADS, MEDUSA, and LRAD systems demonstrates that directed energy weapons have been the subject of intensive research and testing for decades. Although these systems are largely presented as “non-lethal”, available data indicate that they may cause serious physiological and neurological effects, including burns, hearing damage, loss of balance, cognitive impairment, and other health disorders. It is particularly significant that more portable and operationally flexible versions of these systems have been developed over time, increasing their potential applicability in various security and military scenarios.

Overall, directed-energy weapons are no longer purely futuristic concepts but rather a real and increasingly present component of modern warfare and security operations. Their continued development could significantly transform the nature of military and police operations, while simultaneously raising serious questions regarding the protection of human rights, medical consequences, and the control of such systems.

REFERENCES

- 60 Minutes. 2026. “Source: Havana Syndrome Investigation Is ‘a Massive CIA Cover-Up’ | 60 Minutes.” *YouTube*. March 8, 2026. <https://www.youtube.com/watch?v=C1jmAj9OUOs>.
- ABC News. 2026. “Gen. Caine, Chairman of the Joint Chiefs of Staff, Details Timeline of Venezuela Operation.” *YouTube*. January 3, 2026. <https://www.youtube.com/watch?v=qe2RuYI8KZY>.
- Barnes, Julian, Tyler Pager, and Eric Schmitt. 2026. “Inside ‘Operation Absolute Resolve,’ the U.S. Effort to Capture Maduro.” *The New York Times*. January 3, 2026. <https://www.nytimes.com/2026/01/03/us/politics/trump-capture-maduro-venezuela.html>.

- Bartholomew, Robert, and Robert Baloh. 2023. “‘Havana Syndrome’: A Post Mortem.” *International Journal of Social Psychiatry* 70 (2): 402–405. DOI: 10.1177/00207640231208374.
- Berg, Ryan C. 2026. “Maduro Captured: What Comes next for Venezuela?” *Center for strategic and international studies – CSIS*. January 3, 2026. <https://www.csis.org/analysis/maduro-captured-what-comes-next-venezuela>.
- Cairns, Dan. 2010. “US Withdraws ‘Heat Ray’ Gun from Afghanistan.” *BBC News*. July 27, 2010. <https://www.bbc.com/news/newsbeat-10765863>.
- Cambridge Dictionary. 2025. “Discombobulate.” *Cambridge Dictionary*. March 12, 2025. <https://dictionary.cambridge.org/dictionary/english/discombobulate>.
- Dechant, Jason A., Emily L. Coletta, Michael F. Fitzsimmons, Michael J. Lippitz, and Christina M. Patterson [Dechant et al.]. 2024. “Organizational Alternatives for the Department of Defense Non-Lethal Weapons Program – Defense Management Institute.” *Institute for Defense Analyses*. December 2024. <https://www.dmi-ida.org/knowledge-base-detail/Organizational-Alternatives-for-DODNLWP>.
- Defense Visual Information Distribution Service. 2017. “Active Denial System.” *DVIDS. U.S. Department of War*. April 4, 2017. <https://www.dvidshub.net/image/3294737/active-denial-system>.
- Department of War CTO. 2026. “Light-speed lethality, directed energy dominant.” *X*. January 23, 2026. <https://x.com/DoWCTO/status/2014702380944695709>.
- Deruelle, Fabien. 2024. “Microwave Radiofrequencies, 5G, 6G, Graphene Nanomaterials: Technologies Used in Neurological Warfare.” *Surgical Neurology International* 15 (2024): 439. DOI: 10.25259/sni_731_2024.
- Dutta, Aishik. 2025. “Havana Syndrome: A Scientific Review of an Unresolved Medical Mystery.” *Digital Journal of Clinical Medicine* 7 (3): 1–8. DOI: 10.55691/2582-3868.1256.
- English, Lawrence. 2022. “What’s an LRAD? Explaining the ‘Sonic Weapons’ Police Use for Crowd Control and Communication.” *The Conversation*. February 20, 2022. DOI: 10.64628/aa.7jyaecumuh.

- Firstpost. 2026. "Trump Reveals 'Secret Sonic Weapons' Used to Capture Maduro during Raid | Firstpost America | N18G." *YouTube*. January 22, 2026. <https://www.youtube.com/watch?v=HcBpBNevMcs>.
- Genasys. 2024. "LRAD 100X Carry Pack." *YouTube*. March 8, 2024. <https://www.youtube.com/watch?v=2ENPyqGXx70>.
- Giordano, James. 2025. "Evaluating Anomalous Health Incidents of the Havana Syndrome: The Case for a Structured Qu." *Institute for National Strategic Studies, National Defense University*. September 4, 2025. <https://inss.ndu.edu/Media/News/Article/4293362/evaluating-anomalous-health-incidents-of-the-havana-syndrome-the-case-for-a-str/>.
- Hambling, David. 2020. "The Microwave Weapons That Could Explain Why 'Havana Syndrome' Report Is Not Being Released (UPDATED)." *Forbes*. October 20, 2020. <https://www.forbes.com/sites/davidhambling/2020/10/20/the-microwave-weapons-that-could-explain-why-havana-syndrome-report-is-not-being-released/>.
- Iyer, Kaanita, and Jim Sciutto. 2026. "Trump Claims Secret 'Discombobulator' Weapon Was Used to Help Capture Maduro." *CNN*. January 25, 2026. <https://edition.cnn.com/2026/01/25/politics/trump-says-secret-discombobulator-weapon-was-used-to-capture-maduro>.
- James, Derek. 2026. "Minnesota State Patrol Uses Long Range Acoustic Device, First Used by Military, to Disperse Maple Grove Protesters." *CBS News*. January 27, 2026. <https://www.cbsnews.com/minnesota/news/minnesota-state-patrol-long-range-acoustic-device/>.
- Khurshid, Itfa. 2024. "Role of Directed Energy Weapons (DEWs) in Shaping the Future of Warfare in South Asia." *Strategic Perspectives* 2 (1): 79–104. <https://strategicperspectives.cissajk.org.pk/wp-content/uploads/2025/01/Role-of-Directed-Energy-Weapons-DEWs-in-Shaping-the-Future-of-Warfare-in-South-Asia.pdf>.
- Kyriakopoulos, Leandros. 2025. "Dangerous Listening: Warfare, Technology, and the Spectrum of Audibility." *Witnessing: A Journal of Critical Humanities and Socially Engaged Arts* 1: 51–100. DOI: 10.26238/witnessing.2025.01.07.
- Leavitt, Karoline. 2026. X (Formerly Twitter). January 10, 2026. <https://x.com/PressSec/status/2009997866425897308>.

- LeVine, Susan. 2009. "The Active Denial System: A Revolutionary, Non-Lethal Weapon for Today's Battlefield." *Center for Technology and National Security Policy, National Defense University*. June 2009. <https://apps.dtic.mil/sti/tr/pdf/ADA501865.pdf>.
- Lewer, Nick, and Neil Davison. 2005. "Non-Lethal Technologies: An Overview." *Disarmament Forum* 1 (2005): 37–51. https://communitynewsvictoria.wordpress.com/wp-content/uploads/2015/11/unidir_pdf-art2217.pdf.
- Lillis, Katie Bo, Natasha Bertrand, Priscilla Alvarez, Jim Sciutto, and Zachary Cohen [Lillis et al.]. 2026. "Pentagon Bought Device through Undercover Operation Some Investigators Suspect Is Linked to Havana Syndrome." *CNN*. January 13, 2026. <https://edition.cnn.com/2026/01/13/politics/havana-syndrome-device-pentagon-hsi>.
- Lin, James C. 2021. "The Havana Syndrome and Microwave Weapons [Health Matters]." *IEEE Microwave Magazine* 22 (11): 13–14. DOI: 10.1109/mmm.2021.3102201.
- Lopez, C. Todd. 2025. "War Department Narrows Technology Development Focus to Half Dozen Areas." *U.S. Department of War*. November 19, 2025. <https://www.war.gov/News/News-Stories/Article/Article/4337926/war-department-narrows-technology-development-focus-to-half-dozen-areas/>.
- MacDonald, James. 2018. "How a Microwave Weapon Might Work." *JSTOR Daily*. September 19, 2018. <https://daily.jstor.org/how-a-microwave-weapon-might-work/>.
- Magnuson, Stew. 2012. "Weight, Size Issues Stymie Fielding of Directed Energy Weapons." *National Defense*. August 1, 2012. <https://www.jstor.org/stable/27019438?seq=1>
- McIntyre, Jamie. 2026. "What Is This Mysterious 'Discombobulator' That Neutralized Venezuela's Defenses?" *Washington Examiner*. February 20, 2026. <https://www.washingtonexaminer.com/premium/4455488/what-is-discombobulator-that-neutralized-venezuela-defenses/>.
- Montagu-Smith, Nina. 2026. "The 'Discombobulator': Did US Use 'Secret Weapon' in Maduro Abduction?" *Al Jazeera*. January 26, 2026. <https://www.aljazeera.com/features/2026/1/26/the-discombobulator-did-us-use-secret-weapon-in-maduro-abduction>.

- NBC News*. 2026. "President Trump Talks Job Losses to A.I. And U.S. Operation in Venezuela in Exclusive Interview." *YouTube*. February 5, 2026. <https://www.youtube.com/watch?v=J8UxjCRZQpo>.
- Nelson, Steven, Emily Goodin, and Marisa Schultz. 2026. "Trump Reveals to the Post Secret 'Discombobulator' Weapon Was Crucial to Venezuelan Raid on Maduro." *New York Post*. January 24, 2026. <https://nypost.com/2026/01/24/us-news/trump-reveals-to-the-post-secret-discombobulator-weapon-was-crucial-to-venezuelan-raid-on-maduro/>.
- NewsNation*. 2026. "President Trump Reflects on First Year of Second Term | Full Interview." *YouTube*. January 21, 2026. <https://www.youtube.com/watch?v=FgtogCctzbY>.
- Olay, Matthew. 2026. "Trump Announces U.S. Military's Capture of Maduro." *U.S. Department of War*. January 3, 2026. <https://www.war.gov/News/News-Stories/Article/Article/4370431/trump-announces-us-militarys-capture-of-maduro/>.
- PBS News*. 2026. "Trump Says U.S. Used Secret 'Discombobulator' on Venezuelan Equipment during Maduro Raid." *PBS News*. January 26, 2026. <https://www.pbs.org/newshour/nation/trump-says-u-s-used-secret-discombobulator-on-venezuelan-equipment-during-maduro-raid>.
- Pellerin, Cheryl. 2025. "DOD Demonstrates Nonlethal, Directed-Energy Prototypes." *Digital visual information distribution system – DVIDS*. November 3, 2025. <https://www.dvidshub.net/news/511253/dod-demonstrates-nonlethal-directed-energy-prototypes>.
- Physicians for Human Rights. 2020. "Health Impacts of Crowd-Control Weapons: Directed Energy Devices." *Physicians for Human Rights*. October 28, 2020. <https://phr.org/our-work/resources/health-impacts-of-crowd-control-weapons-directed-energy-devices/>.
- Proroković, Dušan. 2026. "Russian-American Relations in Donald Trump's Second Term: Between Desires and Reality." *The Policy of National Security* 31 (1): 29–59. DOI: 10.5937/pnb31-64326.
- Putnam, Robert. 2025. "US Military Places \$2.5M in New and Follow-on LRAD by Genasys Communication Systems Orders." *Genasys*. April 2, 2025. <https://genasys.com/press-releases/genasys-announces-2-5m-in-us-military-orders/>.

- Raytheon Company*. 2019. "Raytheon Directed Energy Systems Down Multiple Drones in U.S. Air Force Exercise." *Raytheon Company*. April 30, 2019. <https://raytheon.mediaroom.com/2019-04-30-Raytheon-directed-energy-systems-down-multiple-drones-in-US-Air-Force-exercise>.
- Stekić, Nenad. 2025. "Military Interventions in the Unipolarity: Lessons for Security Dynamics of US-China Relations amid Trump's Second Term." *The Policy of National Security* 28 (1): 125–146. DOI: 10.5937/pnb28-55696.
- Strobel, Warren P, and Ellen Nakashima. 2026. "Researcher Skeptical of 'Havana Syndrome' Tested Secret Weapon on Himself." *The Washington Post*. February 14, 2026. <https://www.washingtonpost.com/national-security/2026/02/14/havana-syndrome-cia-norway-experiment/>.
- Tronstad, Live. 2026. "Storavis: Norsk Forsker Testet Hemmelig Våpen På Seg Selv – Fikk Mystisk Sykdom." *VG*. February 14, 2026. <https://www.vg.no/nyheter/i/9pKn5/havanna-syndromet-norsk-forsker-fikk-symptomer-etter-aa-ha-testet-vaapen>.
- U.S. Department of War. 2026. "War Department Announces Realignment of Anomalous Health Incidents Cross-Functional Team to the Office of Research and Engineering." *U.S. Department of War*. February 20, 2026. <https://www.war.gov/News/Releases/Release/Article/4411182/war-department-announces-realignment-of-anomalous-health-incidents-cross-functi/>.
- U.S. Department of War. n.d. "Active Denial Technology (ADT)." *U.S. Department of War*. Last accessed March 19, 2026. https://media.defense.gov/2025/Dec/30/2003849710/-1/-1/0/250922_AD_FACTSHEET_WEB.PDF.
- U.S. Government Accountability Office. 2023. "U.S. Directed Energy Weapons." *YouTube*. April 17, 2023. https://www.youtube.com/watch?v=X1toVupe_R8.
- UN News*. 2026. "US Actions in Venezuela 'Constitute a Dangerous Precedent': Guterres." *UN News*. January 3, 2026. <https://news.un.org/en/story/2026/01/1166698>.
- United States Department of Defense [USDD]. 2024. "Office of the Under Secretary of Defense." *United States Department of Defense*.

February 28, 2024. https://comptroller.war.gov/portals/45/Documents/defbudget/FY2025/FY2025_Weapons.pdf.

Vinokur, Roman. 2004. "Acoustic Noise as a Non-Lethal Weapon." *Sound & Vibration*. October 2004. <https://www.sandv.com/downloads/0410vino.pdf>.

Weinberger, Sharon. 2014. "US Military Heat-Ray: Set Phasers To... None." *BBC*. November 18, 2014. <https://www.bbc.com/future/article/20120718-set-phasers-to-none>.

Ивана Игњић*

*Факултет безбједносних наука, Универзитет у Бањој Луци,
Република Српска*

Саша Мићин**

*Факултет безбједносних наука, Универзитет у Бањој Луци,
Република Српска*

Предраг Ћеранић***

*Факултет безбједносних наука, Универзитет у Бањој Луци,
Република Српска*

ОПЕРАТИВНА ПРИМЈЕНА ОРУЖЈА УСМЈЕРЕНЕ ЕНЕРГИЈЕ: СЛУЧАЈ ВЕНЕЦУЕЛЕ

Резиме

Рад анализира развој и потенцијалну оперативну употребу оружја усмјерене енергије (*Directed Energy Weapons – DEW*), са посебним освртом на Хавана синдром и америчку операцију Апсолутна Одлучност (*Operation Absolute Resolve*) у Венецуели 2026. године. Полазна претпоставка рада јесте да је техничко-технолошки развој ових система достигао ниво који омогућава њихову реалну примјену у савременим војним и безбједносним операцијама. Истраживање је засновано на анализи доступних научних, медијских и институционалних извора, уз примјену компаративне методе и студије случаја. Појава Хавана синдрома 2016. године, а нарочито америчка операција изведена у Каракасу под називом Апсолутна Одлучност, која је резултирала хапшењем и привођењем венецуеланског предсједника Николаса Мадуре (*Nicolás Maduro*), покренула је нови талас интересовања

* Имејл адреса: ivana.ignjic@fbn.unibl.org; ORCID: 0009-0000-3308-5846.

** Имејл адреса: sasa.micin@fbn.unibl.org; ORCID: 0000-0002-2220-435X.

*** Имејл адреса: predrag.ceranic@fbn.unibl.org; ORCID: 0009-0005-7526-657X.

међународне стручне и научне јавности из области безбједности и одбрамбених технологија. У раду се разматра феномен Хавана синдрома као могући индикатор постојања микроталасних и других усмјерених енергетских система способних да изазову неуролошке, когнитивне и аудиторне поремећаје код људи. Посебна пажња посвећена је микроталасном аудиторном ефекту и новим медијским извјештајима који указују на постојање преносивих електромагнетних уређаја повезаних са овим симптомима. Други дио рада анализира операцију Апсолутна Одлучност, током које су Сједињене Државе извеле сложену војно-обавјештајну акцију у Венецуели. Извјештаји с терена, искази преживјелих припадника венецуеланске предсједничке гарде и званичне оптужбе Министарства одбране Венецуеле указују на то да су током ове операције употребљена до сада невиђена и класификована борбена средства. На основу доступних извјештаја и изјава очевидаца разматра се могућност употребе непознатог оружја означеног као *discombobulator*, чији су ефекти укључивали дезоријентацију, губитак равнотеже и физичке сметње код припадника венецуеланских снага. У раду се указује да такви ефекти имају одређене сличности са познатим системима оружја усмјерене енергије. Посебно су анализирани амерички програми *Active Denial System – ADS*, *Mob Excess Deterrent Using Silent Audio – MEDUSA* и *Long Range Acoustic Device – LRAD*, као примјери система који користе микроталасне и акустичне ефекте у војне и безбједносне сврхе. Анализа показује да су ова оружја већ деценијама предмет интензивног развоја, уз значајна финансијска улагања и постепено повећање њихове оперативне мобилности и ефикасности. Треба напоменути да су сва три ова система првобитно уведена почетком 2000-их година. Сходно томе, више од двије деценије континуираног истраживања, уз значајну подршку у људству и финансијама, могло је довести до значајних напретака у њиховим технолошким способностима. Ниво повјерљивости који окружује ове системе додатно доприноси њиховом значају и ограничава свеобухватну процјену њихових могућности. Полазећи од наведеног, главна претпоставка овог рада јесте да је техничко-технолошки развој оружја усмјерене енергије

достигао одговарајући ниво који обезбјеђује оперативну спремност и могућност употребе у реалним условима. Закључује се да оружја усмјерене енергије више не представљају искључиво теоријски или футуристички концепт, већ све значајнију компоненту савременог ратовања. Њихов даљи развој може значајно утицати на природу будућих војних и полицијских операција, али истовремено отвара важна безбједносна, медицинска, правна и етичка питања у вези са контролом и посљедицама њихове употребе.

Кључне ријечи: оружје усмјерене енергије, Хавана синдром, ADS, MEDUSA, LRAD, микроталасно оружје, акустично оружје, Апсолутна Одлучност, савремено ратовање, безбједносне технологије.

* This paper was received on May 18, 2026, and accepted for publication at the Editorial Board meeting on June 1st, 2026.