



Health Matters

The Havana Syndrome and Microwave Weapons

■ James C. Lin

Every few months, if not weeks, another mysterious attack on U.S. diplomatic and intelligence personnel is reported. Some of the attacks occurred years ago, while others were recounted as recently as July 2021 [1]–[3]. Over the past four or five years, nearly 200 U.S. personnel have reported similar attacks while working in places like Havana, Guangzhou, London, Moscow, Vienna, and Washington, D.C. The acute symptoms include headache and nausea immediately following the sounds of loud buzzing or bursts. The illness and symptoms have been called the “Havana Syndrome” after the place where cases were first reported. It refers to the range of symptoms first experienced by U.S. State Department personnel overseas.

The reported accounts from Havana and elsewhere include people localizing the sources of sound as coming from above or behind their heads, experiencing a directional sound that ceases if one steps away, or one individual would hear the sound but no one else in the same room would hear it. Thus, the process

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of elimination would preclude such suggested causes as flu, tropical diseases, ultrasound, psychosomatic mass hysteria, or swarming cicadas.

Assuming reported accounts are reliable, the microwave auditory effect provides a scientific explanation for the Havana Syndrome [4], [5]. Pulsed microwaves can create an acoustic wave inside the head [6], [7], [14]. It is plausible that the loud buzzing, burst of sound,

or pressure waves could have been covertly delivered using a beam of high-power pulsed microwave radiation rather than blasting the subjects with conventional sonic sources. Microwave hearing doesn't go through the ear; it goes directly from the brain tissue to the cochlea. Absorption of short pulses of microwave energy by brain tissues creates a rapid expansion of brain matter and launches an acoustic wave of pressure (sound

wave) that travels inside the head to the inner ear cochlea [7], [14]. The short high-power microwave pulses do not generate noticeable amounts of heat in the brain tissues.

Indeed, many researchers and government people have come to believe that the microwave auditory effect—induced by a targeted beam of high peak-power pulsed microwave radiation—may be the most likely scientific explanation for the Havana Syndrome. The U.S. National Academies of Sciences, Engineering, and Medicine released its report [8] examining the plausible causes of the described illnesses and makes the point that “among the mechanisms the study committee considered, the most plausible mechanism to explain these cases, especially in individuals with distinct early symptoms, appears to be directed, pulsed RF (microwave) energy.” Of course, until the truth is revealed, this specific matter will remain somewhat of a mystery. Nevertheless, the administration of President Joseph Biden says it is vigorously investigating the latest reports of the mysterious illness affecting American diplomats and intelligence personnel [9].

A growing number of researchers and government members think that some form of directed-energy microwave weapon may be involved in Havana Syndrome.

If the microwave auditory effect is weaponized at sufficiently high powers, in addition for the microwave pulses causing nonlethal primary auditory pathway injury, it is likely to produce lethal and/or nonlethal damages to brain tissues by the reverberating sonic shock waves. It would not be by microwave pulse-induced hyperthermia through excessive temperature elevation in the brain, nor by dielectric breakdown of brain, muscle, or skin tissues [10].

It is noteworthy that the U.S. government has announced a research program to develop a low-cost, low-weight, small-size wearable microwave weapon exposure detector [11]. The announcement acknowledged that directed-energy weapons, including microwave weapons, are a growing threat on the

battlefield. It also suggests that the determinants of microwave weapon’s antipersonnel effects are multifactorial and RF injuries may be situation-dependent. It envisions that in addition to being generally useful for a wide variety of military operations, commercial applications include industrial, manufacturing, and medical facilities in which personnel may be inadvertently exposed to high-power microwave sources.

Indeed, research in high-power microwaves continues worldwide, including the major military powers [12], [14].

It appears that the U.S. military has maintained some interest on the topic of microwave auditory effect and has awarded a research contract titled “Remote Personnel Incapacitation System” through the navy’s small business innovative research program [12], [13]. The initial goal of the project was to design and build a prototype nonlethal weapon based on the microwave auditory effect. The transient personnel incapacitation system is known as Mob Excess Deterrent Using Silent Audio (MEDUSA). The weapon relies on a combination of pulse parameters and pulse power to raise the auditory sensation to the “discomfort” level to deter personnel from entering a protected perimeter. While the status or outcome of this project may be privileged, there are indications that hardware was built and power measurements were taken to confirm the required pulse parameters enabling observation of the microwave auditory effect, which is an expected situation that was never in doubt.

The required microwave technology is mature and in general commercially available in many developed countries. Longer distances and higher power scenarios would require more bulky equipment and sophisticated aiming devices, but packable equipment is possible for closer range nonlethal applications [14]. This would not preclude the use of a much higher power microwave weapon located at farther distance from the intended targets to raise the auditory sensation to the “discomfort” levels. Also, existing hardware could be optimized to

meet some specific requirements in covert or finely targeted operations.

References

- [1] K. B. Williams and J. Herb. “US investigating possible mysterious directed energy attack near White House.” CNN. <https://edition.cnn.com/2021/04/29/politics/us-investigating-mysterious-directed-energy-attack-white-house/index.html> (accessed Apr. 29, 2021).
- [2] “Havana syndrome,” PBS. <https://www.pbs.org/newshour/tag/havana-syndrome> (accessed July 30, 2021).
- [3] D. Hruby and J. Hansler. “Austria probes reports of Havana syndrome among US diplomats in Vienna.” CNN. <https://www.cnn.com/2021/07/18/europe/austria-us-havana-syndrome-intl/index.html> (accessed July 18, 2021).
- [4] J. C. Lin, “The mystery of ‘sonic health attacks’ on Havana-based diplomats,” *URSI Radio Sci. Bull.*, no. 362, pp. 102–103, Sept. 2017.
- [5] J. C. Lin, “Strange reports of weaponized sound in Cuba [health matters],” *IEEE Microw. Mag.*, vol. 19, no. 1, pp. 18–19, Jan. 2018. doi: 10.1109/MMM.2017.2765778.
- [6] J. C. Lin and Z. W. Wang, “Hearing of microwave pulses by humans and animals: Effects, mechanism, and thresholds,” *Health Phys.*, vol. 92, no. 6, pp. 621–628, June 2007. doi: 10.1097/01.HP.0000250644.84530.e2.
- [7] J. C. Lin, “The microwave auditory effect,” *IEEE J. Electromagn., RF, Microw. Med. Biol.*, early access, Mar. 1, 2021. doi: 10.1109/JERM.2021.3062826.
- [8] National Academies of Sciences, Engineering, and Medicine. *An Assessment of Illness in U.S. Government Employees and Their Families at Overseas Embassies*. Washington, D.C.: The National Academies Press, Dec. 2020.
- [9] W. P. Strobel, “Havana syndrome task force to be led by veteran of hunt for Bin Laden,” *The Wall Street Journal*. <https://www.wsj.com/articles/havana-syndrome-task-force-to-be-led-by-a-veteran-of-hunt-for-bin-laden-11626885816> (accessed July 21, 2021).
- [10] J. C. Lin, “Sonic health attacks by pulsed microwaves in Havana revisited,” *IEEE Microw. Mag.*, vol. 22, no. 3, pp. 71–73, Mar. 2021. doi: 10.1109/MMM.2020.3044125.
- [11] “Wearable radio frequency weapon exposure detector,” SBIR STTR America’s Seed Fund, Alexandria, VA, DoD 2021.1 SBIR Solicitation, DHA211-005. [Online]. Available: <https://www.sbir.gov/node/1841633> (accessed Jan. 15, 2021).
- [12] J. Borge, “Microwave weapons that could cause Havana syndrome exist, experts say,” *The Guardian*. <https://www.theguardian.com/science/2021/jun/02/microwave-weapons-havana-syndrome-experts> (accessed June 3, 2021).
- [13] “Remote personnel incapacitation system,” Navy SBIR. <http://www.navysbirprogram.com/NavySearch/Summary/summary.aspx?pk=F5B07D68-1B19-4235-B140-950CE2E19D08> (accessed Aug. 2020).
- [14] J. C. Lin, *Auditory Effects of Microwave Radiation*. Cham: Springer, 2021.

