Microwave weapons are prime suspect in ills of US embassy workers

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WASHINGTON — During the Cold War, Washington feared that Moscow was seeking to turn microwave radiation into covert weapons of mind control.

More recently, the United States military itself sought to develop microwave arms that could invisibly beam painfully loud booms and even spoken words into people's heads. The aims were to disable attackers and wage psychological warfare.

Now, doctors and scientists say such unconventional weapons may have caused the baffling symptoms and ailments that, starting in late 2016, hit more than three dozen US diplomats and their family members in Cuba and China. The Cuban incidents resulted in a diplomatic rupture between Havana and Washington.

The medical team that examined 21 affected diplomats from Cuba made no mention of microwaves in its detailed report published in the Journal of the American Medical Association (Jama) in March.

But Mr Douglas Smith, the study's lead author and director of the Center for Brain Injury and Repair at the University of Pennsylvania, said in a recent interview that microwaves were now considered a main suspect and that the team was increasingly sure the diplomats had suffered brain injury.

"Everybody was relatively skeptical at first," he said, "and everyone now agrees there's something there." Mr Smith remarked that the diplomats and doctors jokingly refer to the trauma as the immaculate concussion.

Strikes with microwaves, some experts now argue, more plausibly explain reports of painful sounds, ills and traumas than do other possible culprits — sonic attacks, viral infections and contagious anxiety.

In particular, a growing number of analysts cite an eerie phenomenon known as the Frey effect, named after Mr Allan Frey, an American scientist. Long ago, he found that microwaves can trick the brain into perceiving what seem to be ordinary sounds.

The false sensations, experts say, could account for a defining symptom of the diplomatic incidents: the perception of loud noises, including ringing, buzzing and grinding. Initially, experts cited those symptoms as evidence of stealthy attacks with sonic weapons.

Members of Jason, a secretive group of elite scientists that helps the federal government assess new threats to national security, say it has been scrutinising the diplomatic mystery this summer and weighing possible explanations, including microwaves.

Asked about the microwave theory of the case, the State Department said the investigation had yet to identify the cause or source of the attacks. The FBI declined to comment on the status of the investigation or any theories.

The microwave idea teems with unanswered questions. Who fired the beams? The Russian government? The Cuban government? A rogue Cuban faction sympathetic to Moscow? And, if so, where did the attackers get the unconventional arms?

At his home outside Washington, Mr Frey, the scientist who uncovered the neural phenomenon, said federal investigators have questioned him on the diplomatic riddle and that microwave radiation is considered a possible cause.

Mr Frey, now 83, has travelled widely and long served as a contractor and a consultant to a number of federal agencies. He speculated that Cubans aligned with Russia, the nation's longtime ally, might have launched microwave strikes in attempts to undermine developing ties between Cuba and the US.

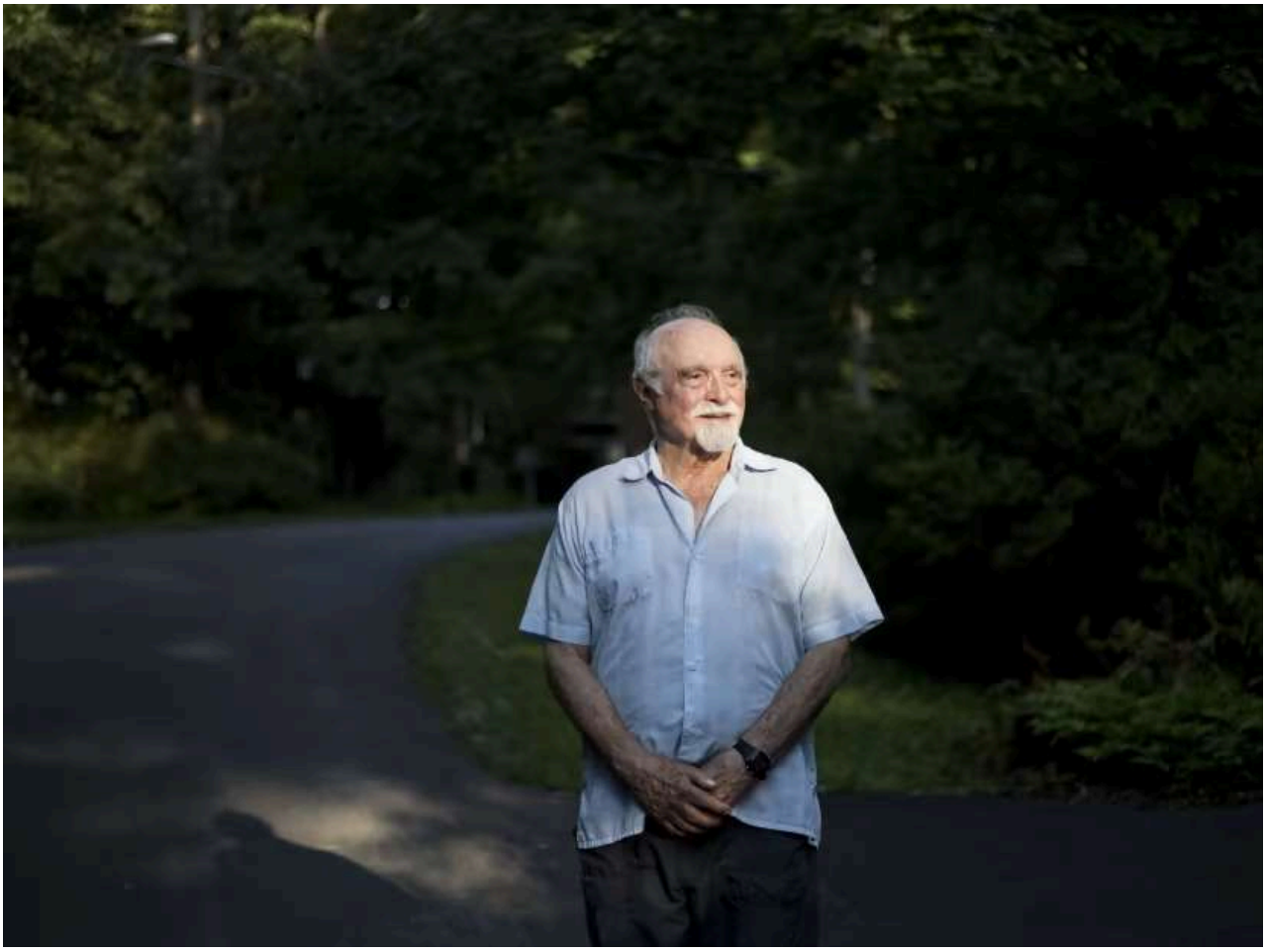
"It's a possibility," he said at his kitchen table. "In dictatorships, you often have factions that think nothing of going against the general policy if it suits their needs. I think that's a perfectly viable explanation."

A NEW CLASS OF WEAPONS

Microwaves are ubiquitous in modern life. The short radio waves power radars, cook foods, relay messages and link cellphones to antenna towers. They are a form of electromagnetic radiation on the same spectrum as light and X-rays, only at the opposite end.

While radio broadcasting can employ waves a mile or more in length, microwaves range in size from roughly a foot to a fraction of an inch. They are seen as harmless in such everyday uses as microwaving foods. But their diminutive size also enables tight focusing, as when dish antennas turn disorganised rays into concentrated beams.

The dimensions of the human head, scientists say, make it a fairly good antenna for picking up microwave signals.



Mr Allan Frey, at his home outside Washington. In 1960, he stumbled on an acoustic effect of microwaves that was eventually named after him. Photo: The New York Times

Mr Frey, a biologist, said he stumbled on the acoustic effect in 1960 while working for General Electric's Advanced Electronics Center at Cornell University. A man who measured radar signals at a nearby GE facility came up to him at a meeting and confided that he could hear the beam's pulses — zip, zip, zip.

Intrigued, Mr Frey travelled to the man's workplace in Syracuse and positioned himself in a radar beam. "Lo," he recalled, "I could hear it, too."

Mr Frey's resulting papers — reporting that even deaf people could hear the false sounds — founded a new field of study on radiation's neural impacts. Mr Frey's first paper, in 1961, reported that power densities 160 times lower than "the standard maximum safe level for continuous exposure" could induce the sonic delusions.

His second paper, in 1962, pinpointed the brain's receptor site as the temporal lobes, which extend beneath the temples. Each lobe bears a small region — the auditory cortex — that processes nerve signals from the outer and inner ears.

Investigators raced to confirm and extend Mr Frey's findings. At first they named the phenomenon after him, but eventually called it the microwave auditory effect and, in time, more generally, radio-frequency hearing.

The Soviets took notice. Not long after his initial discoveries, Mr Frey said, he was invited by the Soviet Academy of Sciences to visit and lecture. Toward the end, in a surprise, he was taken outside Moscow to a military base surrounded by armed guards and barbed-wire fences.

"They had me visiting the various labs and discussing the problems," including the neural impacts of microwaves, Mr Frey recalled. "I got an inside look at their classified programme."

Moscow was so intrigued by the prospect of mind control that it adopted a special terminology for the overall class of envisioned arms, calling them psychophysical and psychotronic.

Soviet research on microwaves for "internal sound perception," the Defence Intelligence Agency warned in 1976, showed great promise for "disrupting the behavior patterns of military or diplomatic personnel."

Furtively, globally, the threat grew.

The National Security Agency gave Mr Mark Zaid, a Washington lawyer who routinely gets security clearances to discuss classified matters, a statement on how a foreign power built a weapon "designed to bathe a target's living quarters in microwaves, causing numerous physical effects, including a damaged nervous system."

Mr Zaid said a NSA client of his who travelled there watched in disbelief as his nervous system later unraveled, starting with control of his fingers.

Washington, too, foresaw new kinds of arms.

In Albuquerque, New Mexico, Air Force scientists sought to beam comprehensible speech into the heads of adversaries. Their novel approach won a patent in 2002, and an update in 2003. Both were assigned to the Air Force secretary, helping limit the idea's dissemination.

The lead inventor said the research team had "experimentally demonstrated" that the "signal is intelligible." As for the invention's uses, an Air Force disclosure form listed the first application as "Psychological Warfare."

The Navy sought to paralyse. The Frey effect was to induce sounds powerful enough to cause painful discomfort and, if needed, leave targets unable to move. The weapon, the Navy noted, would have a "low probability of fatalities or permanent injuries."

In a twist, the 2003 contract was awarded to microwave experts who had emigrated to the United States from Russia and Ukraine.

It is unknown if Washington deploys such arms. But the Pentagon built a related weapon known as the Active Denial System, hailing it in a video. It fires an invisible beam meant to deter mobs and attackers with fiery sensations.

Russia, China and many European states are seen as having the know-how to make basic microwave weapons that can debilitate, sow noise or even kill. Advanced powers, experts say, might accomplish more nuanced aims such as beaming spoken words into people's heads. Only intelligence agencies know which nations actually possess and use such unfamiliar arms.

The basic weapon might look like a satellite dish. In theory, such a device might be hand-held or mounted in a van, car, boat or helicopter. Microwave arms are seen as typically working over relatively short distances — across the length of a few rooms or blocks. High-powered ones might be able to fire beams across several football fields, or even for several miles.

THE EPISODE IN CUBA

The Soviet collapse in 1991 cut Russia's main ties to Cuba, a longtime ally just 144km from the US. The shaky economy forced Moscow to stop providing Havana with large amounts of oil and other aid.

Mr Vladimir Putin, as Russia's president and prime minister, sought to recover the economic, political and strategic clout the Soviets had lost. In December 2000, months after the start of his first presidential term, Mr Putin flew to the island nation. It was the first visit by a Soviet or Russian leader since the Cold War.

He also sought to resurrect Soviet work on psychoactive arms. In 2012, he declared that Russia would pursue "new instruments for achieving political and strategic goals," including psychophysical weapons.

In July 2014, Mr Putin again visited Cuba. This time he brought a gift — the cancellation of some US$30 billion (S$41.15 billion) in Cuban debt. The two nations signed a dozen accords.

A Russian spy ship, Viktor Leonov, docked in Havana on the eve of the beginning of reconciliation talks between Cuba and the US in early 2015, and did so again in subsequent years. Moscow and Havana grew so close that in late 2016, the two nations signed a sweeping pact on defence and technology cooperation.

As a candidate, Mr Donald Trump faulted the Obama administration's normalisation policy as "a very weak agreement" and threatened to scrap it on reaching the White House. Weeks after he won the election, in late November 2016, the US embassy in Havana found itself battling a mysterious crisis.

Diplomats and their families recounted high-pitched sounds in homes and hotel rooms at times intense enough to incapacitate. Long-term, the symptoms included nausea, crushing headaches, fatigue, dizziness, sleep problems and hearing loss.

The State Department filed diplomatic protests, and the Cuban government denied involvement. In May, the FBI opened an investigation, and its agents began visiting Havana a half year after the incidents began. The last major one hit that summer, in August, giving the agents relatively little time to gather clues.

In September 2017, the Trump administration warned travellers away from Cuba and ordered home roughly half the diplomatic personnel.

Then-Secretary of State Rex Tillerson said the embassy's staff had been targeted deliberately. But he refrained from blaming Cuba, and federal officials held out the possibility a third party could have been responsible.

In October, Mr Trump expelled 15 Cuban diplomats, producing a chill between the nations. Administration critics said the White House was using the health issue as a pretext to end President Barack Obama's reconciliation policy.

The day after the expulsions, the Senate Foreign Relations Committee held a closed, top-secret hearing on the Cuba situation. Three State Department officials testified, as did an unnamed senior official of the Central Intelligence Agency.

THE HYPOTHESIS

In January, the spooky impact of microwaves on the human brain never came up during an open Senate hearing on the Cuba crisis.

But in a scientific paper that same month, Mr James Lin of the University of Illinois, a leading investigator of the Frey effect, described the diplomatic ills as plausibly arising from microwave beams. Mr Lin is the editor-in-chief of Bio Electro Magnetics, a peer-reviewed journal that explores the effects of radio waves and electromagnetic fields on living things.

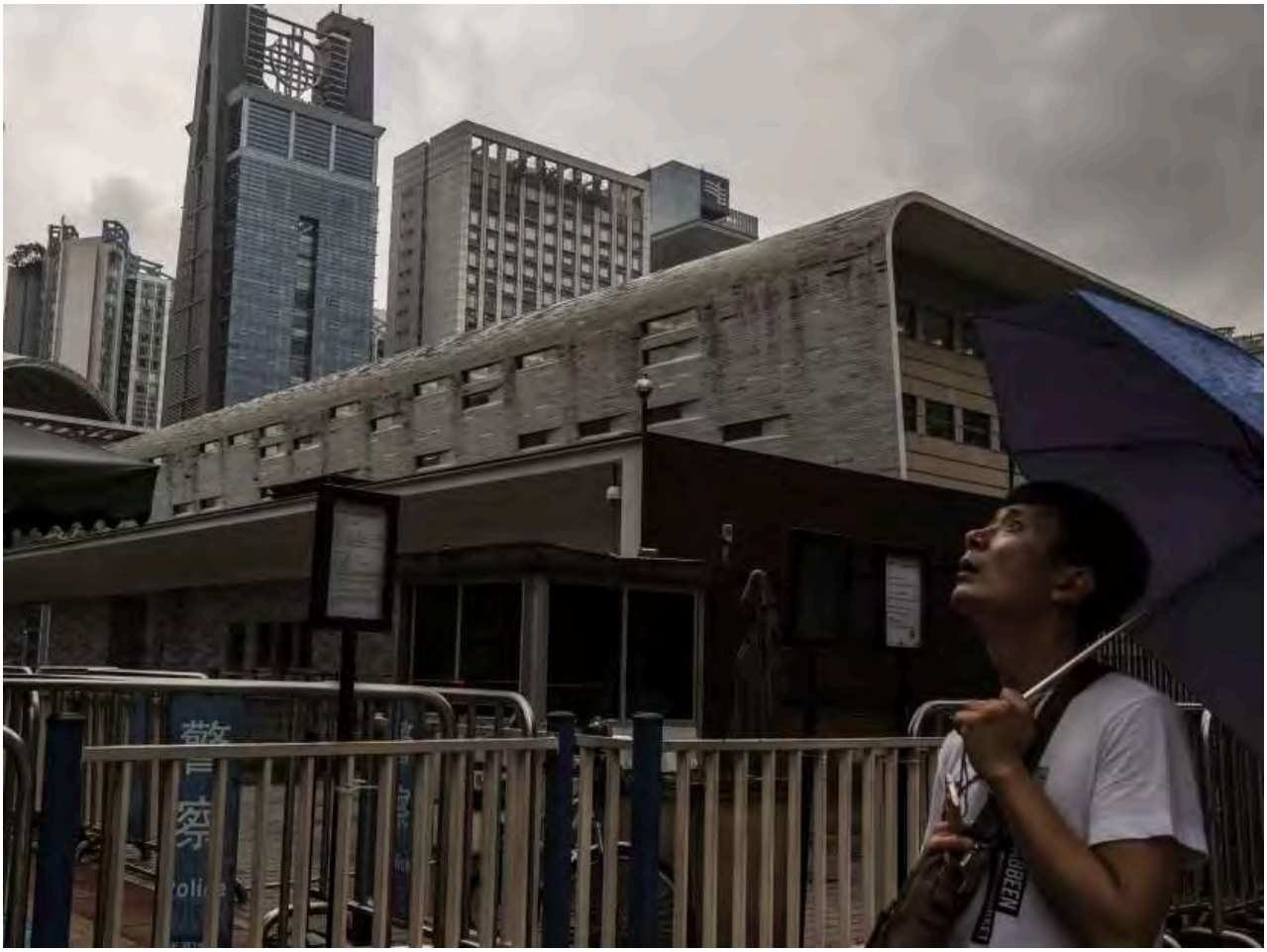
In his paper, he said high-intensity beams of microwaves could have caused the diplomats to experience not just loud noises but nausea, headaches and vertigo, as well as possible brain-tissue injury. The beams, he added, could be fired covertly, hitting "only the intended target."

In February, ProPublica in a lengthy investigation mentioned that federal investigators were weighing the microwave theory. Separately, it told of an intriguing find. The wife of a member of the embassy staff, it reported, had looked outside her home after hearing the disturbing sounds and seen a van speeding away.

A dish antenna could fit easily into a small van.

The medical team that studied the Cuba diplomats ascribed the symptoms in the March Jama study to “an unknown energy source” that was highly directional. Some personnel, it noted, had covered their ears and heads but experienced no sound reduction. The team said the diplomats appeared to have developed signs of concussion without having received any blows to the head.

In May, reports emerged that US diplomats in China had suffered similar traumas. Secretary of State Mike Pompeo called the medical details of the two groups “very similar” and “entirely consistent" with one another. By late June, the State Department had evacuated at least 11 Americans from China.



The high-pitched chirping that diplomats heard while working at the Consulate General of the United States in Guangzhou, China, might be explained by a phenomenon known as the Frey effect — radio-frequency hearing. Photo: The New York Times

To date, the most detailed medical case for microwave strikes has been made by Dr Beatrice Golomb, professor of medicine at the University of California, San Diego. In a forthcoming paper to be published in October in Neural Computation, a peer-reviewed journal of the MIT Press, she lays out potential medical evidence for Cuban microwave strikes.

She compared the symptoms of the diplomats in Cuba to those reported for individuals said to be suffering from radio-frequency sickness. The health responses of the two groups, Prof Golomb wrote, “conform closely.”

In closing, she argued that “numerous highly specific features” of the diplomatic incidents “fit the hypothesis” of a microwave attack, including the Frey-type production of disturbing sounds.

Scientists still disagree over what hit the diplomats. In July, Jama ran four letters critical of the March study, some faulting the report for ruling out mass hysteria.

But Mr Zaid, who represents eight of the diplomats and family members, said microwave attacks may have injured his clients.

“It’s sort of naive to think this just started now,” he said. Globally, he added, covert strikes with the potent beams appear to have been going on for decades.

Mr Francisco Palmieri, a State Department official, was asked during the open Senate hearing if “attacks against US personnel in Cuba” had been raised with Moscow.

“That is a very good question,” Mr Palmieri replied. But addressing it, he added, would require “a classified setting.”

For his part, Mr Frey says he doubts the case will be solved anytime soon. The novelty of the crisis, its sporadic nature and the foreign setting made it hard for federal investigators to gather clues and draw conclusions, he said, much less file charges.

“Based on what I know,” he remarked, “it will remain a mystery.” THE NEW YORK TIMES