

Military May Microwave Iraqi Electronic Circuits

New Beams Destroy Without Killing

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A war with Iraq could allow the United States to debut a new -- and perhaps revolutionary -- class of weapons that can cripple an enemy's ability to fight without harming people or destroying buildings.

They are known collectively as "high-powered microwave weapons" (HPM). They use bursts of electromagnetic energy, delivered by low-impact bombs or "ray gun"-like devices, to disable or destroy the electronics that control everything from an enemy's radar to its laptops.

Although the pulse can easily incapacitate or even burn out microchips or circuitry, it is weak enough so that humans might not even know they had been attacked until their computers started to crash.

"These weapons are designed almost exclusively for destroying electronic systems," said defense analyst Loren Thompson, author of a recent study on high-powered microwaves and other "directed-energy" weapons. "They minimize collateral damage, overkilling and wasted effort. I tend to think this could make war more humane."

In particular, analysts point out, high-powered microwaves have an obvious attraction in an urban setting, where noncombatants are vulnerable. Iraqi President Saddam Hussein has concentrated his elite troops around Baghdad, apparently intending to make a U.S.-led invasion force its way into the capital.

"These weapons are tremendously important in the social and political realms," said John Arquilla, who teaches defense analysis at the Naval Postgraduate School, in Monterey, Calif. "If the world sees the United States acting with disproportionate force, it will be harder to make the case for an intervention on the side of democracy."

Research on high-powered microwave weapons is centered at Kirtland Air Force Base in Albuquerque. Officials there declined to discuss the program in detail, but an unclassified paper prepared at the Air War College in 2000 said that "several high-powered microwave technologies have matured to the point where they are ready for the transition . . . to deployment as operational weapons." Arquilla said he was "completely certain that some forms of these will be used in the coming conflict."

Although microwaves are nonlethal, they are also indiscriminate, and could interfere with the operation of electronic devices such as pacemakers or sophisticated hospital equipment. From a military standpoint, the biggest drawback is the possibility that the pulses end up damaging friendly electronics as they rebound

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through a battlefield.

"Our existing military infrastructure is currently almost defenseless against the type of energy pulse that an HPM would produce," Thompson said. "The benefits of the information age created a vulnerability not only for our enemies, but for ourselves."

High-powered microwave weapons make use of the same principle that causes static to invade a car radio beneath a power line. More power on a frequency approximating that of the radio can cause progressively worse damage, and at some point will shut down or burn out delicate electronics. The armed forces describe the range of possibilities as the "four D's -- deny, disrupt, damage or destroy."

"Anything that an enemy has that uses electronics could be vulnerable," said the University of New Mexico's Edl Schamiloglu, an electrical and computer engineer. "Radars, computers, infrared guidance systems -- you name it."

Schamiloglu said that the United States and the then-Soviet Union long ago recognized the potential of microwave weapons and began working on the technology in the 1960s. Scientists had noticed that in addition to blast and radiation effects, nuclear explosions generated extremely powerful bursts of radio waves.

Microwaves are the highest-frequency radio waves, and the frequencies approximate those employed in the delicate circuitry of modern digital electronics. Until recently, microwaves were useless as weapons because early electronics used robust low-tech components impervious to the relative shock of a mini-microwave surge. For this reason, the Soviets outfitted their MiG aircraft with vacuum tubes long after the tubes became obsolete, Schamiloglu said.

Microwave weapons today come in what Schamiloglu calls "two flavors." One, known as an "ultrawide band" weapon, uses an explosion to provide one quick, powerful burst of radiation over a broad range of frequencies. The likeliest method of delivery is via cruise missile, which can get the weapon close to the target without infecting friendly electronics.

"The chemical explosive generates a voltage spike that feeds power directly to a wide-band antenna," Schamiloglu said. The waves travel at the speed of light, so the microwave is beamed out by the antenna before the antenna is destroyed by the explosion, he added.

Once the waves are on their way, they will travel along any electrical circuit they encounter, and are particularly adept at taking advantage of enemy antennas and other devices as capable of receiving signals as they are of transmitting them. An antenna or other exposed sensor is called "the front door."

But it is not the only entrance. The emissions can also travel through cracks, seams, metal conduits or other "back door" avenues, crawling into hardened bunkers to disable electronics with a sudden, virtually undetectable power jolt. The microwaves will destroy the electronics even when the equipment is not operating.

Ultrawide band weapons are relatively simple, but have limited range because the waves dissipate over a broad frequency spectrum. The weapons' exact performance capabilities are classified information.

More useful for specific targets are the second "flavor" of weapons, known as "narrow band" microwaves. Their characteristics are not publicly known, but Schamiloglu said machines rather than bombs would deliver them. All would likely have batteries as a power source, a large capacitor to store the power and an antenna to fire the microwaves in a rat-a-tat burst, ray-gun style.

Narrow-band waves can be aimed at a target, making them less likely to damage friendly electronics. As a result, U.S. forces could use piloted aircraft or drones to fire them, but Arquilla suggested that "special warfare personnel" could infiltrate enemy defenses and hand-deliver either flavor.

"The question is: Will the general be willing to risk Special Forces?" Arquilla said. "Because of the close tie between the use of these weapons and the potential political and social benefits, I think this is a risk well worth taking."

Staff writer Kathy Sawyer contributed to this report.

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