



FACT SHEET

UNITED STATES AIR FORCE

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ACTIVE DENIAL SYSTEM

Advanced Concept Technology Demonstration

What is It? The Active Denial System (ADS) is a counter-personnel, non-lethal, directed energy weapon. The ADS projects a focused beam of millimeter waves to induce an intolerable heating sensation on an adversary's skin, repelling the individual without causing injury. This capability will add to the ability to stop, deter and turn back an advancing adversary, providing an option to lethal force. The ADS' non-lethal capabilities are designed to protect the innocent, minimize fatalities, and limit collateral damage.

The technology was originally developed by the Air Force Research Laboratory and matured under the sponsorship of the Department of Defense's Joint Non-Lethal Weapons Directorate. The ADS will provide our warfighters an extraordinary new capability – a non-lethal weapon with a range greater than traditional small arms.



Active Denial System
Advanced Concept Technology Demonstration System 1

How Does It Work? Active Denial Technology produces millimeter waves at a frequency of 95 gigahertz and uses an antenna to direct a focused, invisible beam toward a designated subject. Traveling at the speed of light, the energy strikes the subject and reaches a skin depth of about 1/64 of an inch, or the equivalent of three sheets of paper. It produces a heat sensation that within seconds becomes intolerable and forces the targeted individual to instinctively flee. The sensation immediately ceases when the individual moves out of the beam or when the operator turns off the system. There is minimal risk of injury from the beam because of the shallow penetration depth of energy at this short wavelength, the safety features designed into the system, and normal human instinctive reactions. These features include a bore sighted sensor suite that allows the operator to see the entire beam path and target area, and requires no adjustments for ballistics or windage. In addition, ADS incorporates (hardware and software) computer systems that limit shot duration and beam power to achieve a safe and effective, non-lethal, repel effect.

Scientific Research A large portion of the investment has been devoted to understanding the effects of this technology on the human body. This effort was made to ensure the effects of millimeter waves are well understood, and to ensure a wide safety margin exists between operationally useful levels of effects and those that may cause injury. The ADS has been the subject of an extensive test program that has been conducted in strict compliance with the procedures, laws, and regulations governing animal and human research. The tests have been reviewed and approved by a formal Institutional Review Board with oversight from the Air Force Surgeon General's Office.

An independent panel of non-governmental science and medical experts also periodically reviewed and advised on the planning aspects and results of the research and test activities. In a 2004 review of

the program, this independent panel concluded there is low risk of serious injury from exposure to the ADS beam. Additionally, the panel concluded that the risk of thermal eye injury is low, and that there was no evidence that millimeter wave energy promotes or co-promotes cancer. A detailed report of the study appears in the peer review journal, *Carcinogenesis* (2001) **22**: 1701-1708.

The Air Force Research Laboratory's Human Effectiveness Directorate at Brooks City-Base, Texas, conducted many years of successful and safe laboratory testing. In 2000, testing began at Kirtland Air Force Base, south of Albuquerque, New Mexico, using the new, full-scale Active Denial Technology Hardware Demonstrator pictured below. It enabled assessment of the potential military utility of the system.

System Evolution The Active Denial Technology Hardware Demonstrator (ADS System 0) represents the first integration of the key technology elements such as the millimeter wave source, cooling system, and antenna, among others. In 2001, ADS System 0 successfully demonstrated that the technology could achieve desired effects at distances beyond small-arms range, and set the stage for the next evolution of the system, ADS System 1. This next step involved the integration and packaging of all the system's components into a mobile, nearly militarized system. The configuration chosen was the High Mobility Multi-purpose Wheeled Vehicle (HMMWV). In 2002, ADS System 1 was placed under an Advanced Concept Technology Demonstration (ACTD) program, a Department of Defense process to rapidly move mature technologies into the hands of the warfighter for military evaluation.



Active Denial Technology Hardware Demonstrator (ADS System 0)

Under the ACTD Program, the Air Force Research Laboratory produced a HMMWV-mounted prototype, which was used in a series of three Military Utility Assessments (MUA) – Creech Air Force Base, Nevada, in August 2005; Ft. Benning, Georgia, in September 2005; and Eglin Air Force Base, Florida, in April 2006. These MUAs tested the performance of the prototype in a variety of simulated operational scenarios. The prototype ADS System 1 is now beginning the Extended User Evaluation phase, which will run throughout FY07. At the same time, a modular version, ADS System 2, is under construction and is scheduled to be completed in June 2007. The ADS System 2 is designed to operate in higher temperature environments and will be able to operate at either a fixed site or on the back of a tactically mobile truck.

Organizations Involved The ADS ACTD Program is being sponsored by the Office of the Deputy Under Secretary of Defense for Advanced Systems and Concepts, the Department of Defense Joint Non-Lethal Weapons Directorate, and the U.S. Joint Forces Command. The Air Force Research Laboratory's Directed Energy Directorate at Kirtland Air Force Base, New Mexico, is the technical manager and responsible for the ADS prototype development. The Laboratory's Human Effectiveness Directorate at Brooks City-Base manages the human effects characterization research and test program. The Air Combat Command at Langley Air Force Base, Virginia, is the operational manager and is leading the military services in developing the concepts of operation and managing the formal military utility assessment. The role of transition manager is shared by the Air Force's Electronic Systems Center at Hanscom Air Force Base, Massachusetts, and the Army's Program Manager for Directed Energy Applications at Huntsville, Alabama.

Related Links:

[Joint Non-Lethal Weapons Program ADS/ACTD Website](#)