

Bioeffects Research in Support of the Active Denial System (ADS):
A Novel Directed Energy Non-Lethal Weapon

Michael R. Murphy, James H. Merritt, Patrick A. Mason, John A. D'Andrea, Dennis W. Blick, and Dennis M. Scholl. Directed Energy Bioeffects Division, Human Effectiveness Directorate, Air Force Research Laboratory, Brooks AFB, Texas. 78235, USA.

The U. S. Military is considering the use of 95 GHz millimeter wave (MMW) electromagnetic energy in a novel, stand-off, non-lethal application in which the energy is beamed onto humans at a distance in a controlled manner, so as to raise the skin temperature to a level that is painful but not damaging (Dao, "Pentagon Unveils Plans for a New Crowd-Dispersal Weapon," New York Times, page A11, March 1, 2001). Known as Active Denial System, this energy beam NLW earned selection, designation, and investment in 2002 as an Advanced Concept Technology Demonstration (ACTD), which is led by the Security Forces within Air Combat Command acting on behalf of the sponsor, Joint Force Command.

As with any anti-personnel non-lethal weapon, human effects data are essential to demonstrate the safety, policy approval, and effectiveness of ADS. Researchers at the Air Force Research Laboratory and elsewhere have been collecting data applicable to this purpose for several years. Because MMW are absorbed superficially on the exposed body surfaces, research has focused on the skin and the cornea. Studies, many of them already published in the scientific literature, have investigated thresholds for detection, pain (aversion), and minimal damage from 94 GHz exposure to the skin and cornea using monkeys, rodents, and humans as research subjects. The possibility of long-term effects on skin cancer have been studied using the SENCAR mouse. More recently, these laboratory studies provided the basis for approval to conduct field research on volunteer subjects at operational distances and fluence. The results from such tests have increased our confidence in the potential effectiveness and safe operational envelope of the proposed system.