Frequently Asked Questions Regarding the Active Denial System

1. Why do we need this technology? The Active Denial System (ADS) is needed because it's the first non-lethal, directed-energy, counter-personnel system with an extended range greater than currently fielded non-lethal weapons. Most counter-personnel non-lethal weapons use kinetic energy (rubber rounds, bean bags, etc.). A kinetic-based system has a higher risk of human injury and its effectiveness varies in relation to the size, age, and gender of the target. The ADS, however, is consistently effective regardless of size, age, and gender and has a range greater than small arms range. The ADS will provide military personnel with a non-lethal weapon that has the same effect on all human targets.

2. What type of Department of Defense (DoD) missions will ADS support? The ADS will support a full spectrum of operations ranging in; non-lethal methods of crowd and mob dispersal, checkpoint security, perimeter security, area denial, port protection, infrastructure protection, and clarification of intent (identifying combatants from non-combatants). Most currently available non-lethal weapons use kinetic energy where the size and range of the target can limit or change the effectiveness of the weapon. The range of the ADS is 10 times greater than other non-lethal weapons, and will have the same compelling non-lethal effect on all human targets, regardless of size, age, and gender.

3. How long did it take to develop the ADS? The Air Force has conducted research on the effects and enabling technologies since the late 1980s. The present ground-based development effort, funded by the Joint Non-Lethal Weapons Program was initiated in 1997. The ADS was formally designated as an Advanced Concept Technology Demonstration (ACTD) in 2002. An ACTD is a DoD process to rapidly move mature technologies into the hands of the warfighter for military evaluation.

4. What is the status of the ADS ACTD program?
The ADS ACTD concluded 30 September 2007. The final year of the ADS ACTD was dedicated to the Extended User Evaluation (EUE), which was conducted at Moody Air Force Base, Georgia. On October 1, 2007 an ADS "bridge" program was established under the sponsorship of the Joint Non-Lethal Weapons Directorate. The purpose of the bridge effort is to facilitate a transition from the ACTD to an official program of record. The bridge effort is being led by the Air Force's Air Armament Center at Eglin Air Force Base, Florida with the Army as the deputy program manager.

5. Are there more than one Active Denial Systems?
Yes. The ACTD has produced two systems. The Active Denial System 1 has the technology integrated onto a High Mobility Multi-purpose Wheeled Vehicle (HMMWV, pronounced "humvee"). System 2 is the modular version of ADS that is transportable via a tactical vehicle.

6. Is ADS going to deploy anytime soon?
ADS System 2 is currently undergoing a Capabilities and Limitations Assessment (CLA) in support of a potential deployment.

7. Is ADS a laser? The ADS is not a laser and does not employ a laser as its source of directed energy. The source for the ADS energy is a gyrotron, which uses entirely different physics to generate the electromagnetic energy beam that is directed from the ADS system. The ADS generates a focused and very directional millimeter wave radio frequency beam. There is an eye-safe laser range finder associated with the system for range determination.

8. Is the beam radioactive? The beam is not radioactive nor does the ADS beam have radioactive materials associated with it.

9. Does this system work like a microwave oven? No, the ADS, a non-lethal directed energy weapon, projects a focused beam of *millimeter* waves (not microwave energy). A microwave oven uses much higher powers, for much longer times, resulting in higher temperatures and greater penetration of material. The millimeter wave frequency used in the ADS, on the other hand, only reaches a skin depth of about 1/64th of an inch.

10. How do you know it is safe? Testing on the safety and effectiveness of ADS has been underway for more than 12 years. This testing has included more than 10,700 human exposures. Adverse reactions are extremely rare, temporary, and consist of skin blisters. Exposure to active denial systems can also result in a temporary reddening of the skin. Research shows there is only a 1/10th of 1% chance of injury from ADS exposure. These findings have undergone six independent reviews. Normal, innate self-protect behaviors such as eye blink, head turn, and aversion all minimize the risk of injury. The energy only reaches a skin depth of about 1/64th of an inch, the equivalent of three sheets of paper. The sensation immediately ceases when the individual moves out of the beam. (For a detailed review of ADS human effects, please refer to the Human Effects Advisory Panel report - link)

11. Have there ever been any injuries associated with the Active Denial Systems? Yes. There have been two injuries associated with the Active Denial Systems exposure that have required medical attention. They were both second-degree burns. The first incident occurred in January 1999 and was the result of a laboratory mishap that resulted in a quarter size blister and necessitated only outpatient care. The second mishap occurred in April 2007 in which an airman was injured during a training exercise at Moody AFB. The airman received second degree burns (blisters) from an overexposure of the ADS due to procedural errors. The airman made a full recovery and returned to active duty. In an effort to minimize the risk of injury, changes were made to the engagement procedures, the procedural checklists, and the training processes to active denial systems controls. Additionally, a multiple-person validated compliance process and a software upgrade were incorporated. Research shows that there is only a 1/10th of 1% chance of injury associated with exposure to active denial systems. (see page 24 of the Human Effects Advisory Panel results – link)

12. Who participated in the testing? More than 700 volunteers have participated in the ADS testing including active duty military, reserve military, retired military, and Department of Defense civilians. All testing strictly adheres to the procedures, laws, and federal regulations governing human research. The tests involving humans have been reviewed by an Institutional Review Board (IRB) composed of a diverse group of qualified experts. Beyond the reviews conducted at the local level, research proposals are extensively reviewed by special committees at the Air Force Research laboratory and at the office of the Air Force Surgeon General. Humans participating in this research must be true volunteers. Each volunteer must read and sign a detailed voluntary consent form before participation. Copies of the blank consent form are available for review. The forms are drafted in compliance with 32 CFR Section 219, and Air Force Instruction 40-402. Solicitation of volunteers occurred by word of mouth. We have had no trouble getting enough volunteers.

13. What safeguards does the system have to prevent misuse of ADS? The ADS incorporates many levels of control to ensure a safe and effective repel effect. The hardware in the system includes 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 wind. The ADS also incorporates computer systems that limit shot duration. In addition, changes to engagement procedures, software upgrades, improved checklists, multiple-person validated compliance, and enhanced training processes to active denial systems controls have been incorporated to minimize the chance of injury.

14. Can this technology ever be lethal? The ADS was specifically designed as a non-lethal weapon. For this technology to become lethal, the energy beam exposure would have to be sustained and prolonged many times over the duration required to achieve the repel effect. The ADS incorporates many levels of control to ensure a safe and effective repel effect. The hardware in the system allows the operator to see the entire beam path and target area, and requires no adjustments for environmental factors, such as wind. In addition, changes to engagement procedures, software upgrades, improved checklists, multiple-person validated compliance, and enhanced training processes to active denial systems controls have been incorporated to minimize the chance of injury.

15. Does ADS cause cancer or affect fertility? No. Detailed human effects research has been conducted. We have done testing to determine whether or not short term and repeated exposure to this millimeter-wave energy may cause cancer. The results show that there is no risk of cancer for either the system operator or the targeted individual. We are very confident in this, and the independent review boards agree. A detailed report of the study appears in the peer review journal, Carcinogenesis (2001) 22: 1701-1708. Similar studies regarding fertility have recently been completed. Because the energy only reaches a depth of 1/64th of an inch, the energy can not affect reproductive organs. Experimental results showed no detrimental effects.

16. Is the beam more powerful, or possibly lethal, within a short distance of the antenna? No. While the intensity of the beam varies somewhat with range, the safety margin and effects calculations have taken the maximum beam intensity into account. The repel effect will be virtually identical at short or long ranges until the effects dissipate beyond the system's effective range.

17. What does exposure to ADS feel like? Many volunteer test participants liken the effect to the temporary heat felt from opening the door to a hot oven. The sensation dissipates when the target moves out of the beam. The sensation is intense enough that it causes a nearly instantaneous reflex action of the target to flee the beam.

18. If ADS hits you directly in the eye, will it blind you? No. We have conducted extensive studies on whether ADS can affect the eyes. The studies have all shown that natural blink reflex, aversion response, and head turn, all protect the eyes. The Air Force Research Laboratory has performed research proving that eyeglasses, contact lenses, binoculars, and night vision goggles do not increase the risk of eye injury from ADS exposure. (see page 13 of the Human Effects Advisory Panel report – link)

19. Is exposure to ADS harmful to subjects wearing jewelry, coins, glasses or metal? No, there are no adverse effects to subjects who are wearing any of these items.

20. Is ADS legal? Yes. The technology has undergone a full legal and treaty review and has been found to be compliant with the international legal obligations of the United States. These legal obligations include the law of war treaties and arms control agreements to which the United States is a party, customary international law, domestic law, and U.S. policy. These reviews have determined there are no legal prohibitions to the development and use of this technology when it is employed properly, and in accordance with appropriate tactics, techniques, and procedures.

21. Are you sure there won't be adverse effects years from now? As a result of the extensive human effects research completed on the ADS, we are very confident there will be no long-term adverse side effects. Numerous valid scientific studies have shown no link between energy in this region of the electromagnetic spectrum and adverse health effects. Human Effects studies related to exposure to the technology associated with the ADS include the following:

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Walters, T.J., Blick, D.W., Johnson, L.R. Adair, E.R., and Foster, K.R. Heating and pain sensations by millimeter waves: Comparison to a simple thermal model. Health Physics 78:259-267, 2000.