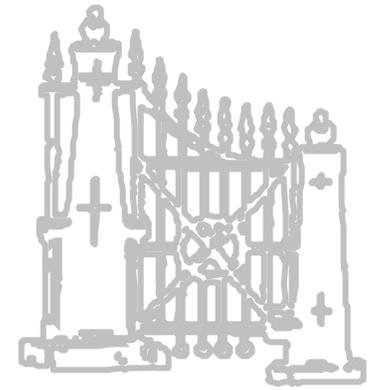


NDIA

Non-Lethal Defense IV

“Aversive Audible Acoustic Devices”



US Army ARDEC

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Committed To Excellence



Outline

- Background
- Acoustic Primer
- Types of Sound Generation Sources
- Useful Acoustic Regime
- Types of Aversity
- A3D System
 - Accomplishments
 - Future Plans
- Pay-off to the Warfighter/User



Acoustics – Background

- Definitions:
 - **Aversive**: A strong desire to avoid because of dislike, repugnance, etc.
 - **Audible**: Actually heard or capable of being heard, frequencies between 15 and 20,000 Hz
 - **Acoustic**: Sound or Sound Waves
 - **Device**: Consider as a Tool and not a Weapon



Acoustics Primer

- How does acoustics work
 - Acoustic energy/power is generated by compressing a medium (in this case air) to create a pressure wave
 - Acoustics are similar to mm/microwaves in many areas



Acoustics Primer

- Advantages of acoustic
 - Can be directional, depending upon frequency
 - Naturally provides area coverage, and hence area denial
 - Can provide tunable target effects
 - Anti-personnel
 - Anti-materiel



Acoustics Primer

- Advantages of acoustic (cont.)
 - Weather conditions
 - High relative humidity improves performance – not required
 - Countermeasures
 - Non-aural target effects have little if any countermeasures
 - Non-polluting



Acoustics Primer

- Disadvantages of acoustic
 - Frequency
 - High frequency
 - Increases atmospheric attenuation
 - Low frequency
 - Reduced directionality to omnidirectional
 - » Potential for increased fratricide
 - More energy/power from source which increases system weight/volume and logistics burden

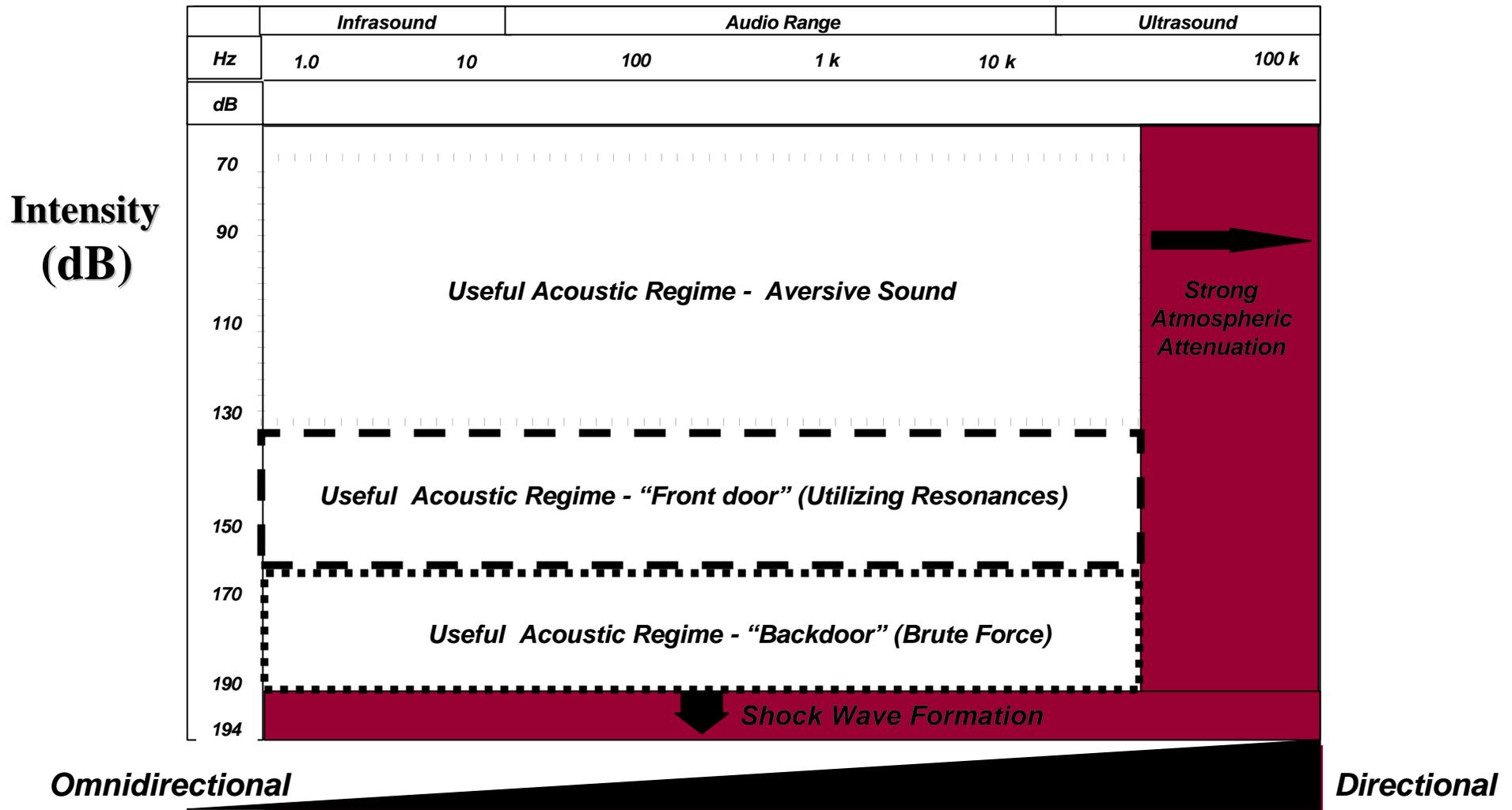


Acoustic Sources



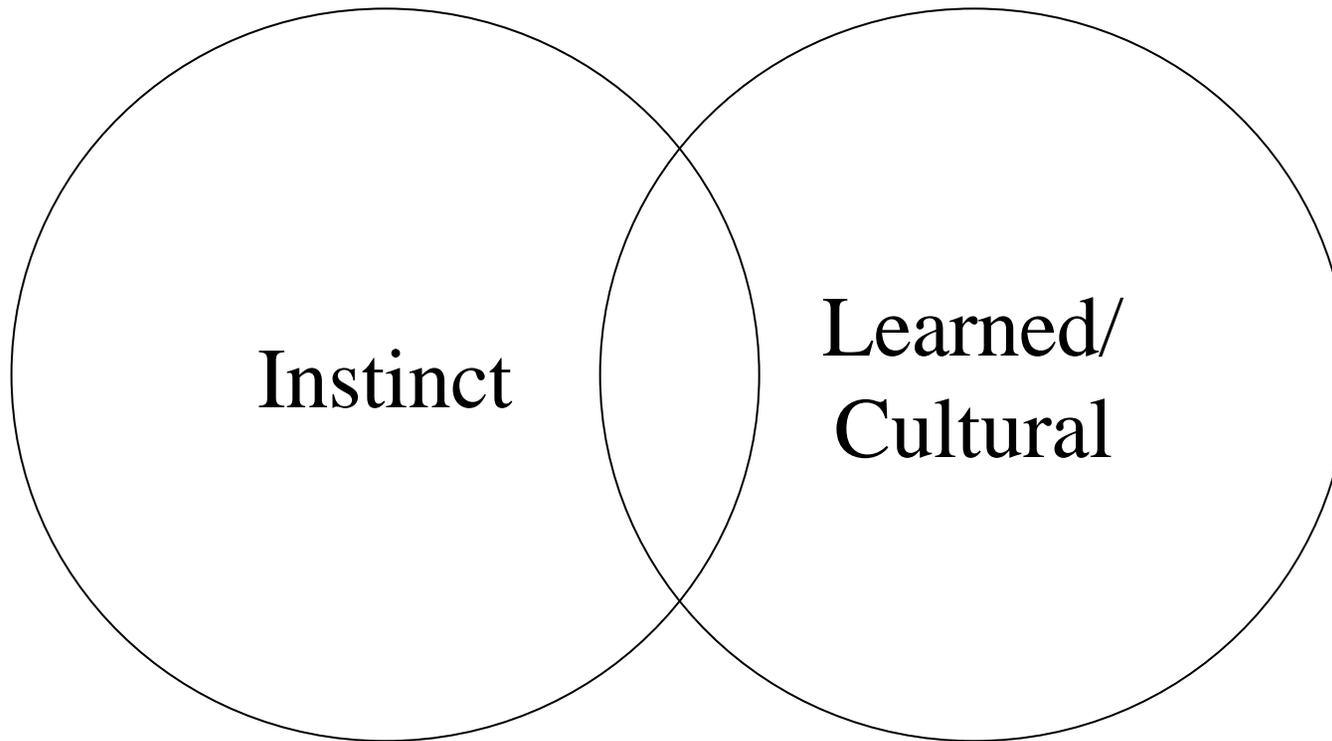


Useful Acoustic Regime





Types of Aversity





System Characteristics

- Effects
 - Audible Range
 - Non-Injurious Effects
 - Behavior Modification
 - Effects not Intensity Based
- Countermeasures
 - Hearing Protection not effective

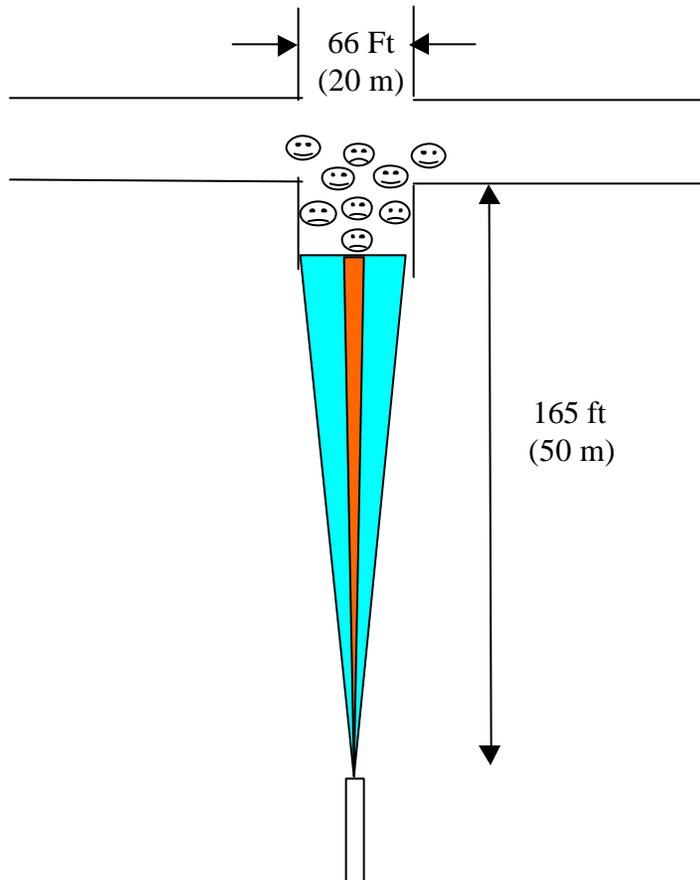


Operational Capabilities

- Increased Comfort Zone
 - Between Friendly Forces/Equipment and Belligerents
 - Potential to Contain/Reduce Escalation Factor
- Enhances Maneuverability
- Provides Force Protection



Application for Initial Device



 Mode 1:
Commander/Individual
Soldier Communicates to
Combatants, then bathe the
entire area with low/mid
intensity aversive sound

 Mode 2:
Commander/Individual
Soldier Communicates to
Individual Combatant(s). If
non-responsive bathe
individual combatants with
high intensity aversive
sound



Current Effort



Aversive Audible Acoustic Device (A3D)

- ILIR: To develop a handheld acoustic device capable of narrow beam transmission of aversive acoustic energy
- To be used at the CEP evaluations at Fort Knox
- Subject of a Pollution Prevention Device Proposal





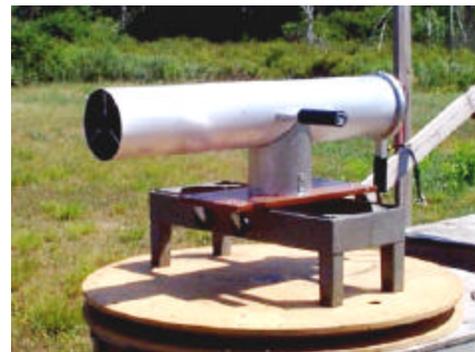
A3D Description



- Invented by Major Franz Gayl, Marine Corps
 - Designed for non-lethal force protection, area denial, delay/barrier applications
- Modulated acoustic source, employing synchronous and non-synchronous acoustic energy.
- The carrier frequency is in the audible domain

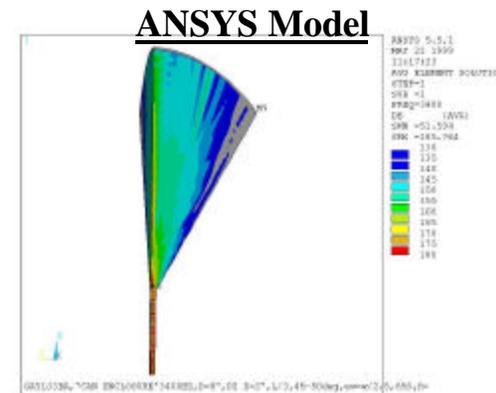
A3D Components

- Consists of:
 - 33 coaxial mounted off-the-shelf piezo-electric transducers housed in an aluminum tube
 - Backpack mounted signal generator/amplifier and 12v power supply



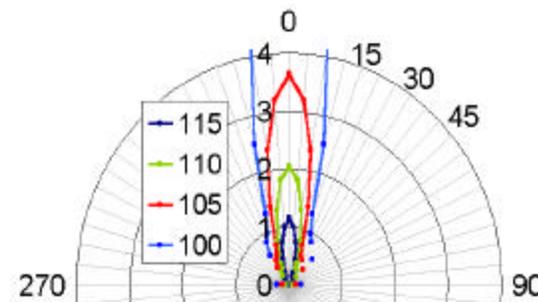
A3D Accomplishments

- Modeled the acoustic output of the original configuration
- Experimental verified the model and demonstrated the directionality of the device



Experimental Field Distribution Results

(Polar Plot of dB vs Range - Observed)

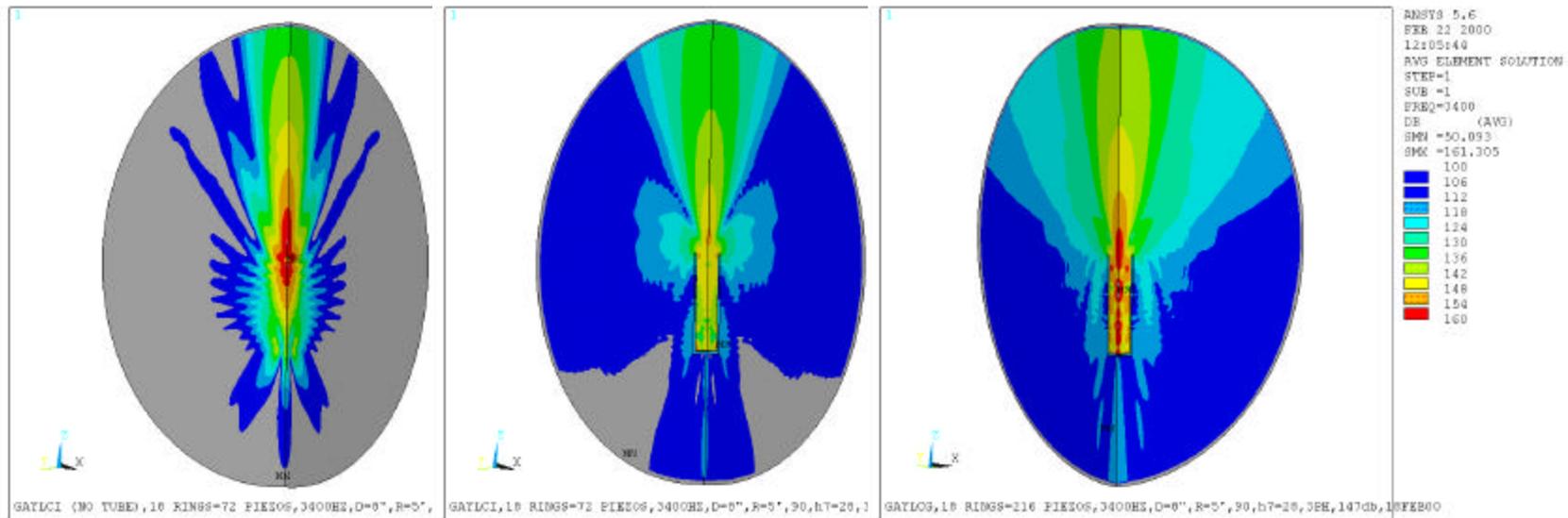




A3D Accomplishments



- Identified several new transducer candidates
- Modeled acoustic output patterns of several new transducer patterns





A3D Future Plans



- Develop a virtual controller to generate complex waveforms where phase, frequency, modulation (frequency and amplitude), and frequency hopping patterns are selectable
- Optimize the transducer pattern
- Identify aversive sounds



Bottom Line

Payoff To Warfighter/User

- Provides the User with capabilities which more closely match warfighting requirements
 - Area denial
 - Military operation other than war (MOOT)
 - Military operation in built-up areas (MOBA)
 - Military Operations in Urban Terrain (MOUT)
 - Facility protection
 - Law enforcement (prisons, crowd control)