



# Joint Non-Lethal Weapons Program Human Effects Center of Excellence



## NDIA: Non-Lethal Defense V

28 March 2002  
Reston, VA

 	<p>Air Force Research Laboratory   AFRL Science and Technology for Tomorrow's Aerospace Force</p> <p><b>Joint Non-Lethal Weapons Program Human Effects Center of Excellence</b></p>
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# Human Effects

*“The business of Human Effects characterization is **absolutely fundamental** to the entire Non-Lethal Weapons Program”*

Col G. Fenton (Director JNLWD) 5 Dec 01

*Human Effects Testing and Characterization must be done for every system and it needs to be looked at very closely.*

LtGen E. Bedard (Chair JNLWP IPT, NDIA NLD-V 26 Mar 02)



Unclassified

# DOD Directive 3000.3: Policy Characterization for NLW



Technical Feasibility: **can it be built?**

- determine areas of human vulnerability
- develop biological criteria for effectiveness
- utilize data for reverse engineering



Unclassified

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## Operational Utility: **will it work?**

- determine variability range of effects
- biological countermeasures



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- risks of injury/lethality
- “relative reversibility”
- environmental impact
- effectiveness (user confidence)
- operator health and safety



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**HUMAN EFFECTS CHARACTERIZATION IS  
THE COMMON THREAD**



# Human Effects Center Of Excellence

## Brooks AFB, Texas



**Serves as the DoD central repository for NLW**

**Human Effects data including:**

**- Target Response Effectiveness**

- Effectiveness of the NLW against human targets

**- Risk of Unintended Effects**

- Health effects to the weapon user, human targets, and humans near the target

**• Supports NLW Program Managers:**

- Guides characterization of weapon Human Effects
- Assures Human Effects analyses are peer reviewed & appropriately applied throughout acquisition
- Manages NLW Human Effects research efforts

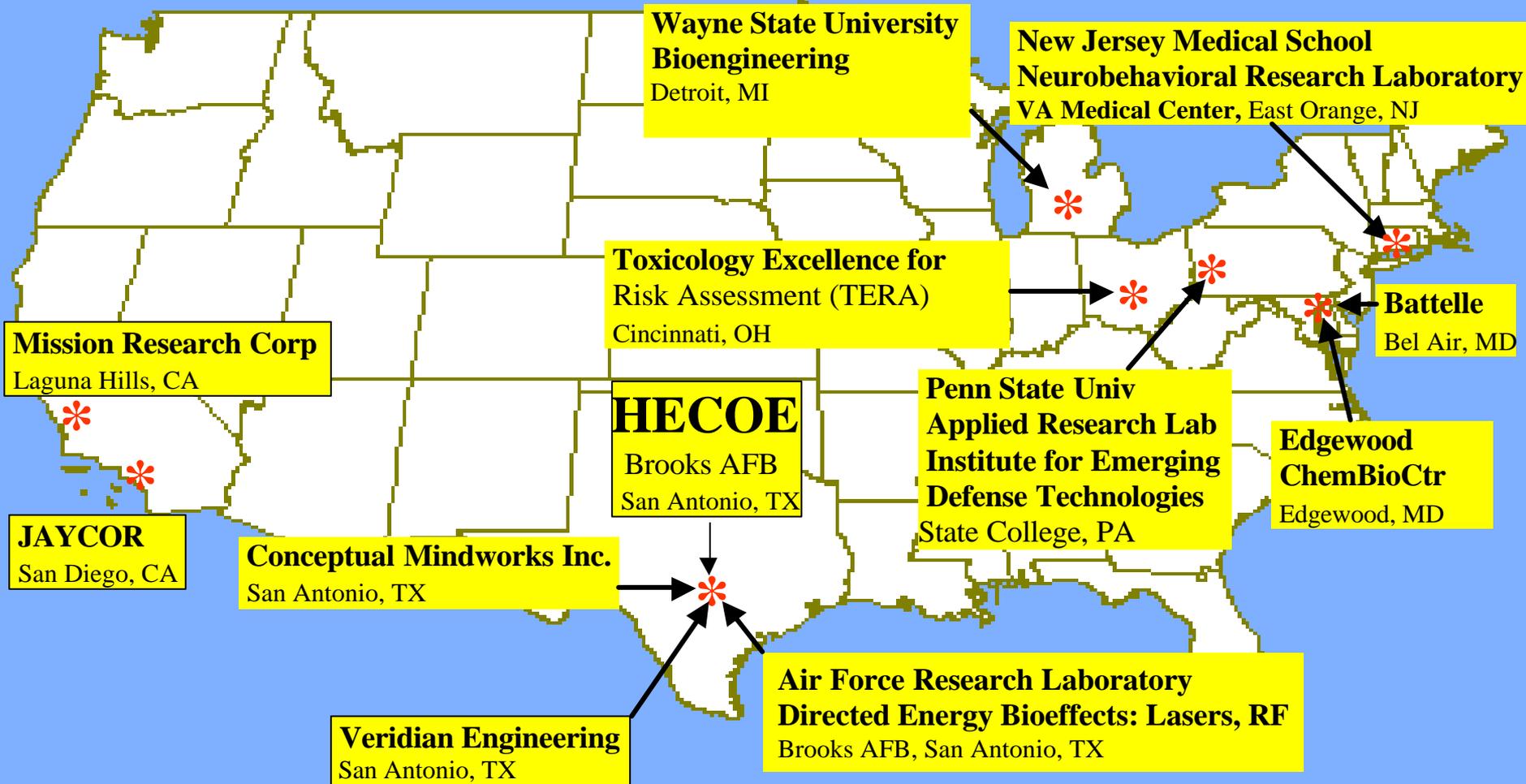
**• Helps Weapons Designers optimize effects and safety margins**



**HECOE Ribbon Cutting Ceremony  
June 7, 2001**



# NLW Bioeffects Resources





# The NLW Dilemma

- **Limited Data**

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- NL weapons have very little data on their effects and risks



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- **New Parameters**
  - Target Response **(Not just lethal anymore)**
  - Variations among human population **(Not just soldiers anymore)**



# JNLWP Human Effects Approach

Do the **best** with the **available tools**, occupational thresholds, literature review for existing data...

Near Term

(Now)

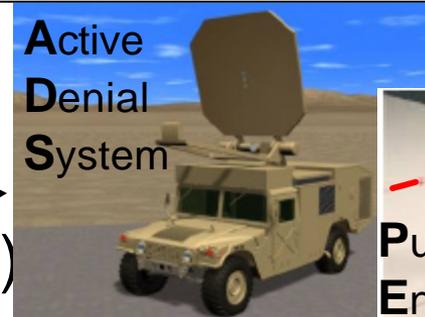


**Human Effects** evaluation **planning** helps PMs plan for developing appropriate characterization

Mid Term

(Next 5 Years)

Active Denial System



Pulsed Energy Projectile



Fully accessible **database** with a **wealth of knowledge** on each technology

Far Term

(5-10+ years)



Microwave  
Millimeter Wave  
Ultrawideband

- References
- Dose Response Data
- Modeling and Simulation Data
- Recommended Design Criteria
- Risk Assessments



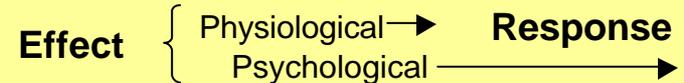
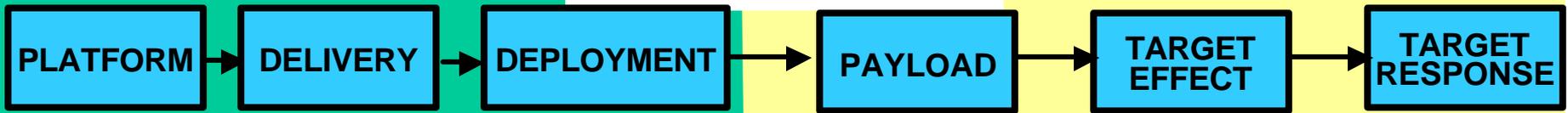
# HECOE Activities

- Conduct top-level scientific literature reviews
- Provide expert Target Human Effects data assessment
- Provide Human Effects evaluation for Analysis of Alternatives
- Identify data gaps, and best qualified to perform the research
- Assist program managers develop Human Effects data
- Provide management oversight of research efforts



# Non-Lethal Payload Analysis

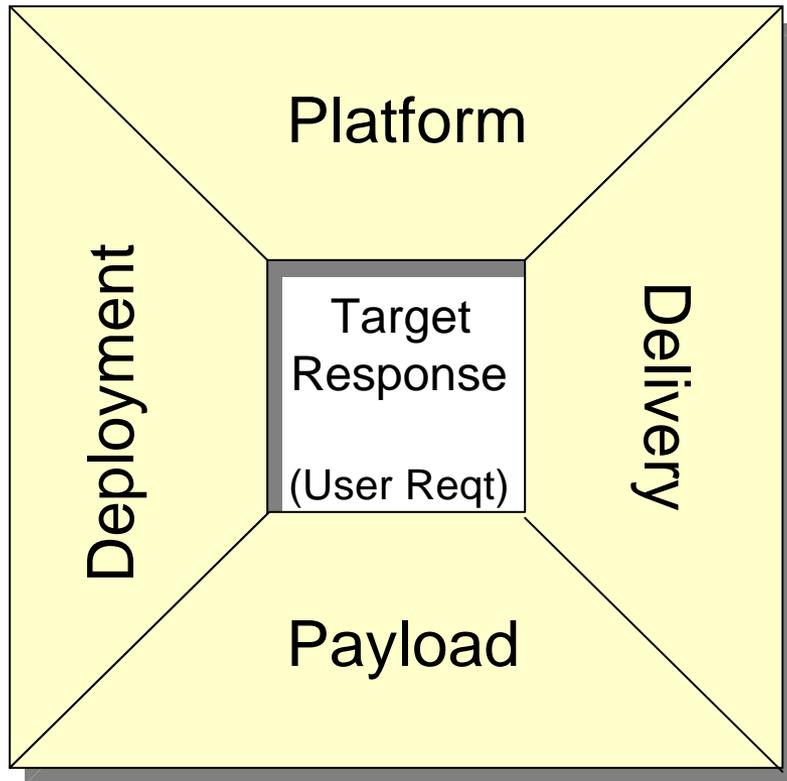
*Counter Personnel Engagement*  
NLW SYSTEM ELEMENTS



Carrier Material/State	Payload Substance	Target Physiological Effect				Target Response
		Means of Entry	Required Dosage	Desired Physiological Effect	Specified Population	Physio • Psycho
<i>OICW</i> • <i>NL Mortar</i> • <i>ERGM UAV</i> • • <i>M203 Mk 19</i> • • <i>Etc.</i>	<i>Liquid Aerosol Powder Object</i> • <i>Calmative Agent 2</i>	Inhaled	0.3 ml			Incapacitate individual(s) for 15 minutes
				Lethality Safety Margin & Operating Envelope	Males & Females ages 10 - 60 years	



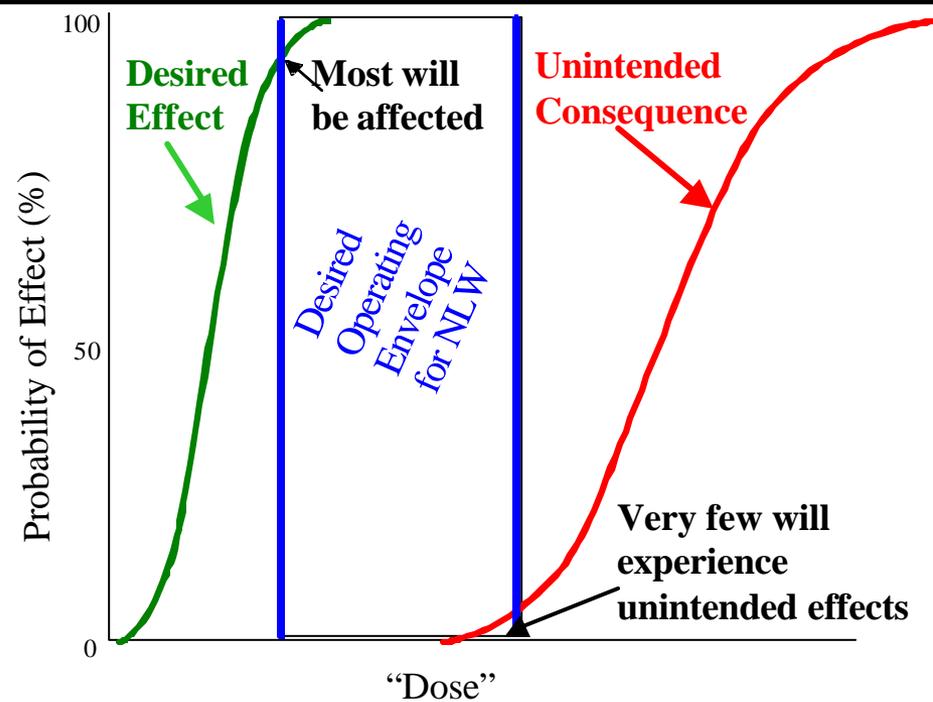
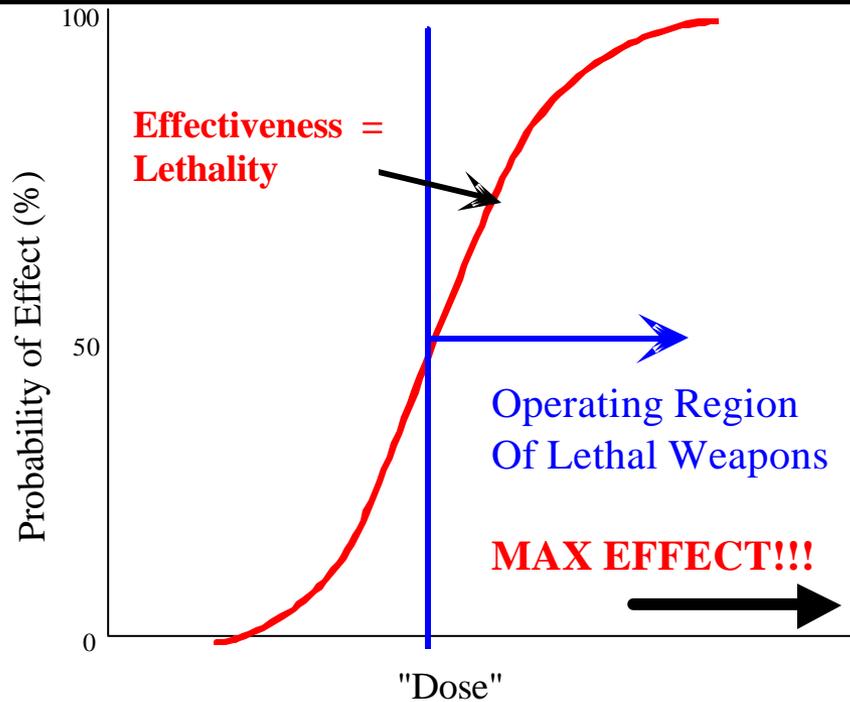
# Non-Lethal Weapon System Human Effects Analysis



- Desired Target Response should be well defined.
- All four components need to be considered
- Need to work with **User** to elicit measurable requirements in terms of Target Response
  - Time to response
  - Duration of response
  - State during recovery



# Establishing the Non Lethal Operational Envelope

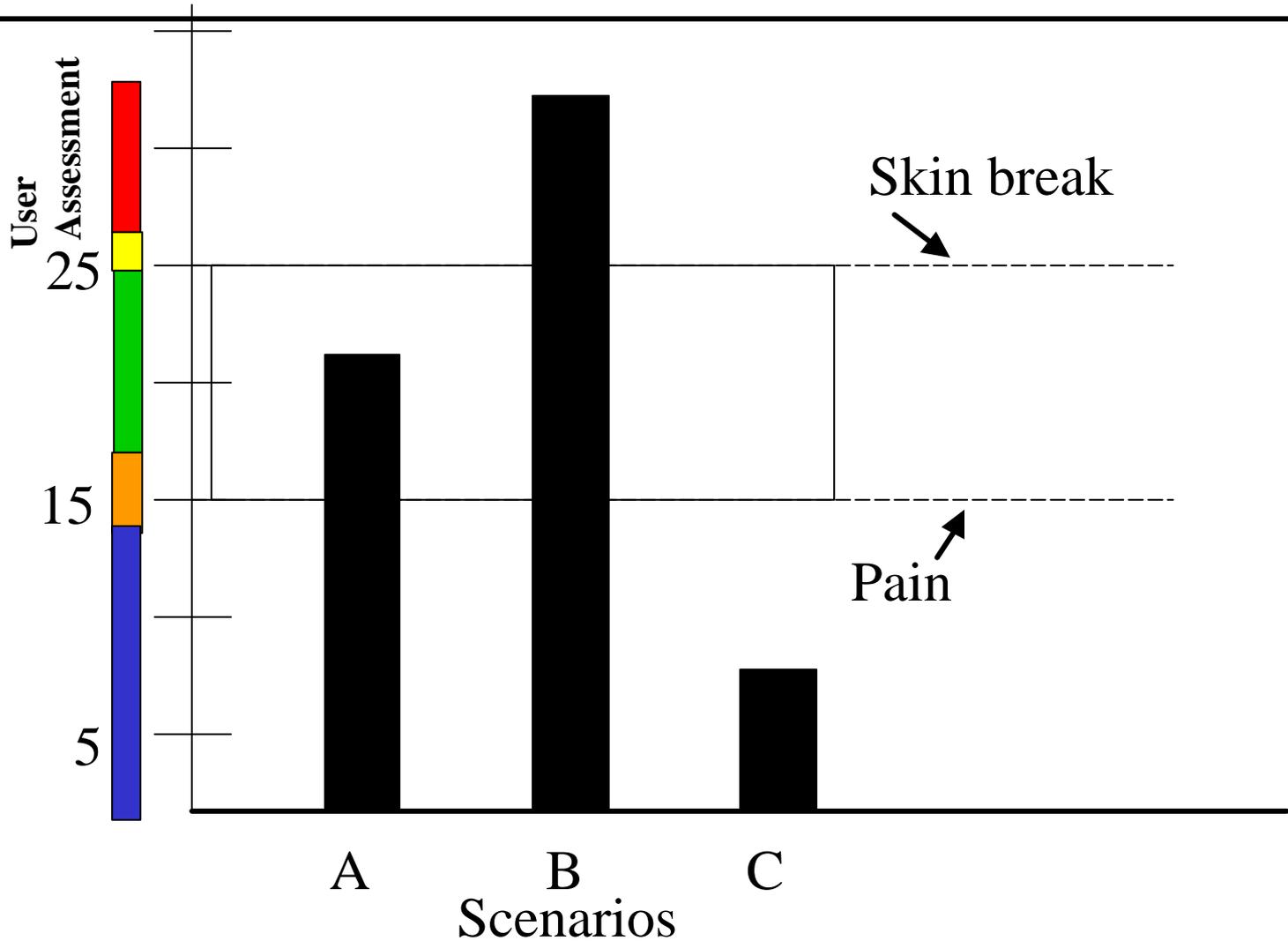


- Goal of lethal weapons has been to maximize the intended effect
- For NLW, we want to carefully bound the “dose” to balance desired effects (**Target Response**) with unintended consequences (**Risk**)
- The wider the Desired Operational Envelope the better



# Risk Characterization

Exposure Estimate (arbitrary units)





# Establish Credible Risk Characterization

## Tasking:

- Develop a risk/response characterization framework for NLW

## Methodology:

- Panel of world renowned risk experts to establish Credibility

## Payoffs:

- Facilitates field and acquisition decision making
- Aids in shaping design criteria
- Prioritizes research and testing required during development of NLW systems.



# Risk Characterization Workshops

## Internationally Recognized Expert Panel

Past Presidents of **Society for Risk Analysis**

Member on **National Academy of Sciences**

### Principal Areas of Panel Expertise

- Exposure Analysis
- Risk Assessment
- Comparative Risk
- Uncertainty
- Decision Analysis Methods
- Engineering
- Medicine

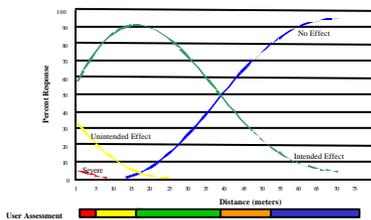
## Subject Matter Experts, Developers, and Users



# Risk Characterization Workshop Results/Recommendations

## Risk Characterization of Non-Lethal Weapons

*Report of Expert Workshop  
and  
Proposed Conceptual Framework*



### Toxicology Excellence for Risk Assessment

Dr. Michael Dourson  
Dr. Andrew Maier  
Jacqueline Patterson

### Department of Defense

Thomas Dayton  
*Veridian Engineering*

Dr. B. Jon Klauenberg  
*Joint Non-Lethal Weapons Human Effects Center of Excellence*

Maj. Noel Montgomery  
*Joint Non-Lethal Weapons Directorate*

*October 5, 2001*

- Risk Characterization Framework for NLW is “doable”
- Good Decision Analysis can be done with limited data
- Will assist in identifying research needs
- Will reduce unproductive acquisitions



# Four Steps to Characterizing Risk

## *Hazard Identification*

Determine relevant health effects & perform initial screen to decide if effects are as intended

## *Dose-Response*

β

Determine risk assessment techniques based on the availability & quality of data

## *Exposure Assessment*

β

Identify weapon use scenarios & quantify factors that influence the degree of exposure

## *Risk Characterization*

β

Integrate dose-response & exposure data into a format that promotes decision making

Probabilistic and point estimate methods are suggested as two examples of risk characterization metrics



# Human Effects Evaluation Support



The Non-Lethal Weapons  
Human Effects Center of Excellence



**The Non-Lethal 40mm  
Crowd Dispersal Cartridge:**

**A Human Effects Review**

**22 February 2001**



Authors:

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Mr. Daniel L. Gonzalez, Conceptual MindWorks, Inc.  
Ms. Roxanne Constable, Conceptual MindWorks, Inc.  
Dr. B. Jon Klauenberg, AFRL/HEDR

**AFRL HEDR TR 2001 0071**



The Non-Lethal Weapons  
Human Effects Center of Excellence



**The 66mm  
Vehicle Launched Non-Lethal Grenade**

**A Human Effects Review**

**1 May 2001**



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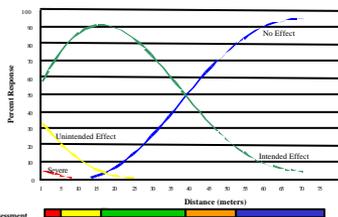




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## Risk Characterization of Non-Lethal Weapons

*Report of Expert Workshop and Proposed Conceptual Framework*



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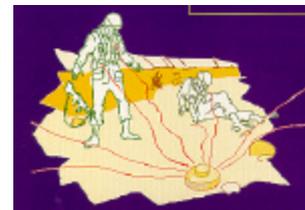
## The Joint Non-Lethal Weapons Human Effects Center of Excellence



## The Taser Area Denial Device

### A Human Effects Review

11 Oct 01



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- Mr. Daniel L. Gonzalez, Conceptual MindWorks, Inc.
- Dr. Clifford J. Sherry, Veridian Engineering
- Mr. Thomas E. Dayton, Veridian Engineering
- Ms. Roxanne Constable, Conceptual MindWorks, Inc.
- Dr. B. Jon Klauenberg, AFRL/HEDR/JNLW HECOE



# Human Effects Database

Master Repository of all NLW Human Effects Knowledge

- Literature and Documentation
- Modeling and Simulation Inputs
- Design Criteria
- Operational Parameters and Risk Assessments

NLW HUMAN EFFECTS DATA RETRIEVAL TOOL AND DATABASE FRONT END

ELECTROMAGNETIC ENERGY

MIDDLE LIGHT THERMAL MILLIMETER LOW FREQUENCY

GAMMA RAYS X RAYS ULTRAVIOLET RAYS INFRARED RAYS MICROWAVE MILLIMETER WAVE ELECTRICALS

ACOUSTIC CHEMICAL MECHANICAL/KINETIC

Acoustics & Opticals  
High Intensity Sound  
Infrasound  
Ultrasound

Obscurants  
Reactants  
Malodorants  
Calmatives  
Riot control agents  
Anti traction materials  
Foams  
Thermobaric  
Nanoparticles

Barriers  
Cloggers  
Entanglements  
Blunt impact

**Microwave**  
**Millimeter Wave**  
**Ultrawideband**

References  
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 Recommended Design Criteria  
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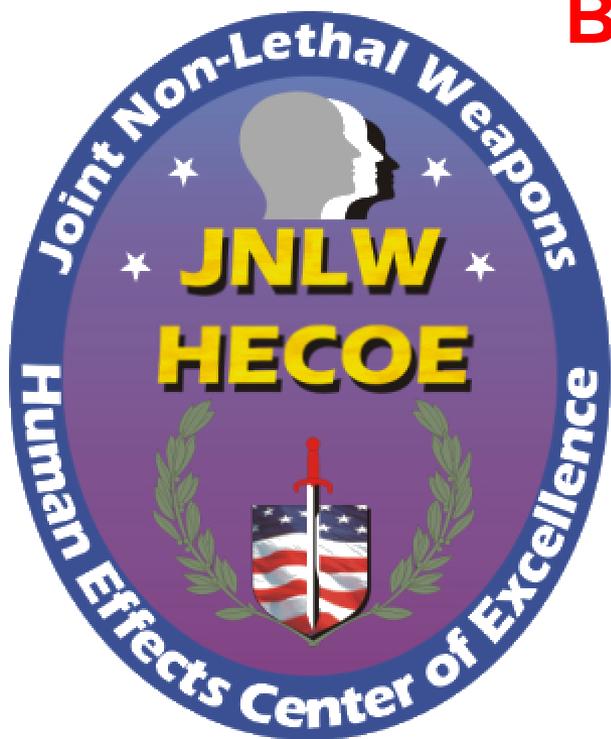
# HECOE: the “One Stop Shop”

- The HECO E plans to become the “one stop shop” for NLW Human Effects Data, Information, Evaluation, and Program Support
  - Easily accessible **resource of existing data**, design criteria, risk assessment
  - **Knowledge of expertise** in and outside of DoD to help Program Managers to find and utilize existing capabilities with minimal overhead
  - **Managerial oversight** to human effects research efforts acting as an honest broker on behalf of the Program Managers



# Thank you!!!

**Brochures and cards in the back**



**HECOE**

**AFRL/HEDR**

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