

# Counterproliferation at Ten

*Transforming the Fight Against  
Weapons of Mass Destruction*

8-9 December 2003

## **BioDefense: The AF Approach**

**Major General Joseph E. Kelley, USAF**  
**Assistant Surgeon General**

# ***Headquarters U.S. Air Force***

---

*Integrity - Service - Excellence*

## **BioDefense: The AFMS Approach**

**Maj Gen Joseph Kelley**  
**Assistant Surgeon General**  
**USAF**

---



**U.S. AIR FORCE**

# Overview

- **Detect to Prevent**
  - **Biotechnology/EOS**
- **Detect to Treat**
  - **Air Force Installation Protection Programs**
  - **LRN**
- **Putting it all together**



# ***Headquarters U.S. Air Force***

---

*Integrity - Service - Excellence*

## **Detect to Prevent**

---

# ***Headquarters U.S. Air Force***

---

*Integrity - Service - Excellence*

## **Biotechnology Epidemic Outbreak Surveillance (EOS)**

---

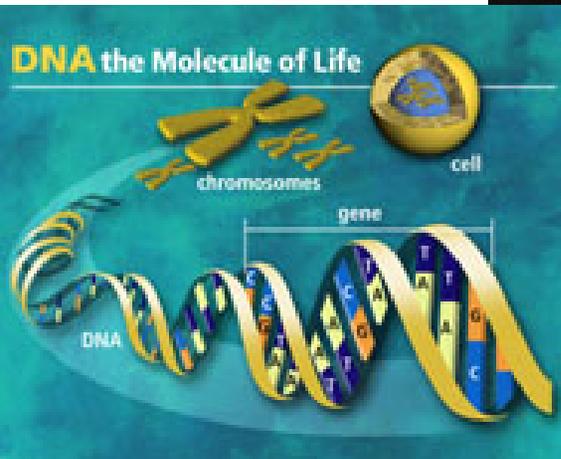


U.S. AIR FORCE

# The Future Biophysics

## Biotechnology the next revolution

Late 1980's 1990's 2000's → Future ?



**Genetic Programming**

Darwinian Invention and Problem Solving

John R. Koza  
Forrest H Benne  
David Andre  
Martin A. Keane

Ter Follow OFF  
Location OFF  
Traffic OFF

Players: 500  
Vehicle: F-22  
ID: 194

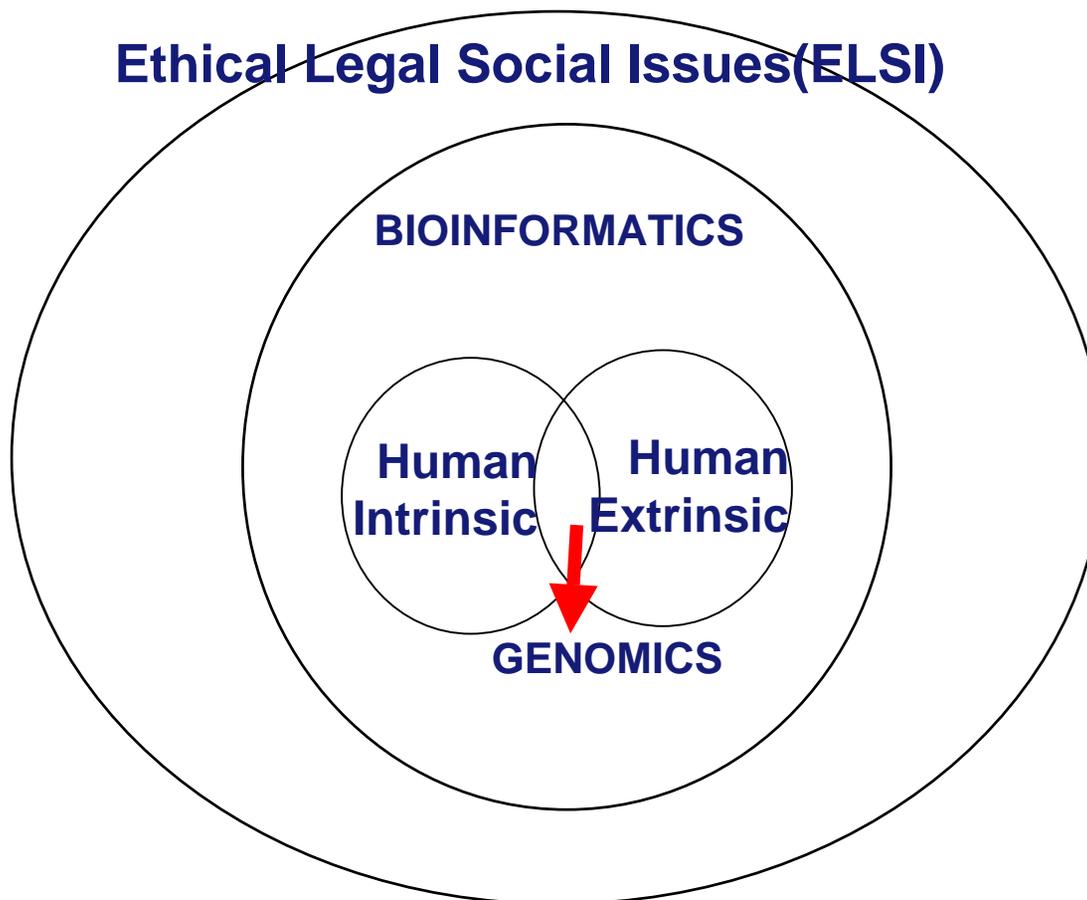
ID: 194  
Speed: 195.5  
Orientation: Position:  
H 341.05 X 20578.79  
P -0.06 Y 14236.18  
R -28.00 Z 267.50

Gene Lehman '96



U.S. AIR FORCE

# Key issues identified





U.S. AIR FORCE

# Why biotechnology



OFFICE OF THE SECRETARY OF DEFENSE  
2950 DEFENSE PENTAGON  
WASHINGTON, DC 20301-2950



CHIEF OF STAFF  
UNITED STATES AIR FORCE

DIRECTOR OF  
NET ASSESSMENT

2 November 2001

## MEMORANDUM FOR DISTRIBUTION

SUBJECT: Exploring Biotechnology – Opportunities for the Department of Defense

Over the last year my office has undertaken a study to examine the revolutionary potential that biotechnology might bring to the future of warfighting. The study looked at biotechnology in its broadest sense, from genetic research to systems engineering and organizational metaphors.

It is our belief that biotechnology, and its fusion with other new areas of science, holds revolutionary prospects for U.S. military capabilities. Embracing biotechnology in ways beyond our current expertise in bio-defense and medical applications would likely result in a strategic U.S. military advantage for the next several decades.

The study is organized to include a short historical perspective on the nature of revolutions in military affairs; a self-assessment of DoD's current position in biotechnology advancements; then a more detailed look into examples of potential use (exemplars) and the policy and organizational support that would be needed to bring these into fruition.

We also conclude that there are a number of significant impediments to realizing the potential that biotechnology offers the U.S. military. These include institutional, organizational, and policy issues, along with inadequate human and monetary capital.

I invite your attention to this assessment and welcome your comments on this key area of science that holds such promise for the U.S. in the future warfare environment.

*A. W. Marshall*  
A. W. MARSHALL

AQ/XO

*Do we have any effort on  
this subject?*

*J*

CSAF has seen

NOV 19



# It's our Heritage...

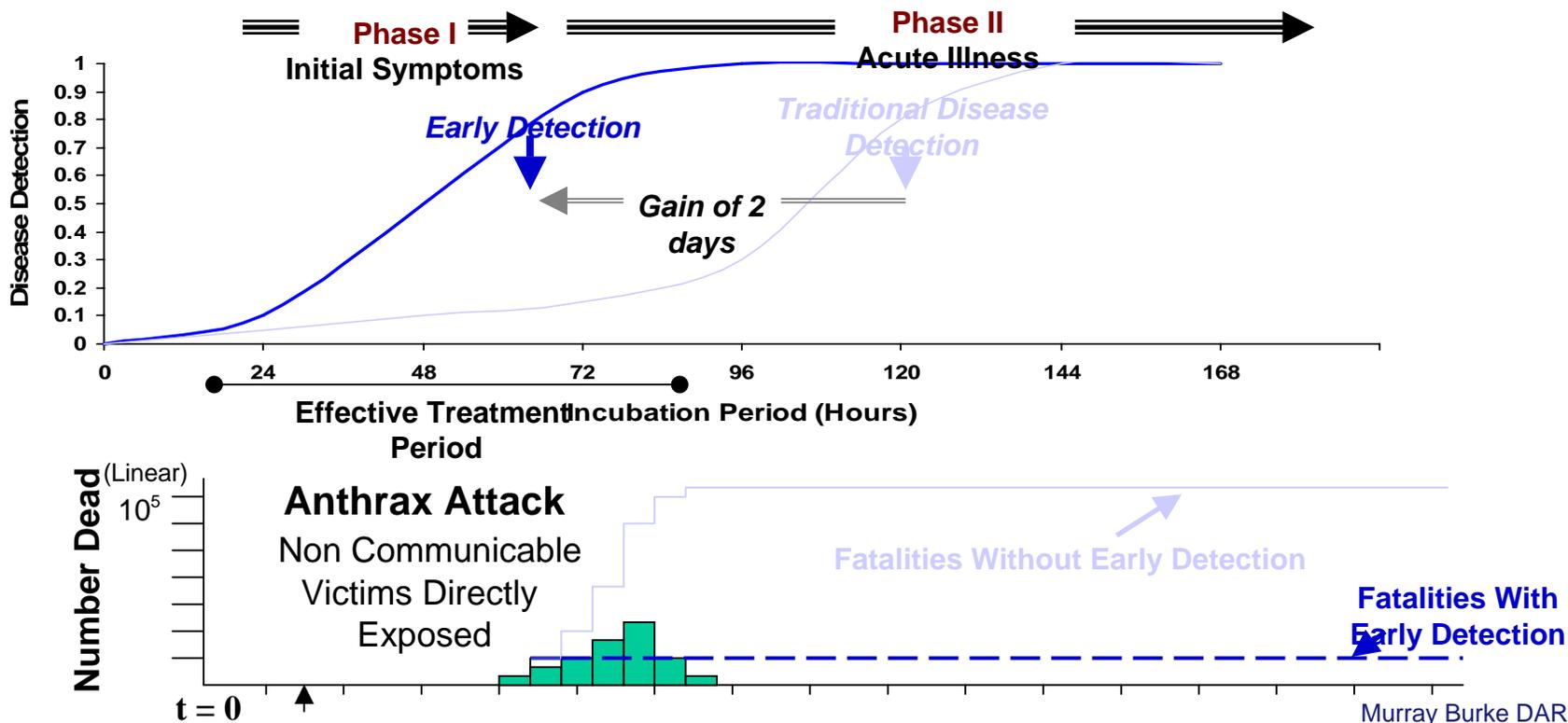
*Integrity - Service - Excellence*



U.S. AIR FORCE

# EOS Developing a critical capability

To develop a model biodefense system which decreases the loss of personnel, resources and time secondary to a natural or adversarial outbreak/release of an infectious agent.



Murray Burke DARPA



U.S. AIR FORCE

# Global Emerging Infections Systems

## GEIS Febrile Respiratory Illness (FRI) Surveillance

### Acute Respiratory Disease in Basic Military Trainees

GEIS surveillance projects are cooperative initiatives that involve all services of DoD.

June 98 - April 01

7191 throat cultures:

- > 60 % adenovirus
- 4.2% influenza A
- 1.5% influenza B
- 0.3% RSV
- 1.0% parainfluenza 1,2,or 3





U.S. AIR FORCE

# Projection of Extrinsic

Real time surveillance for forensic identification of biologic agent release using a bioshield



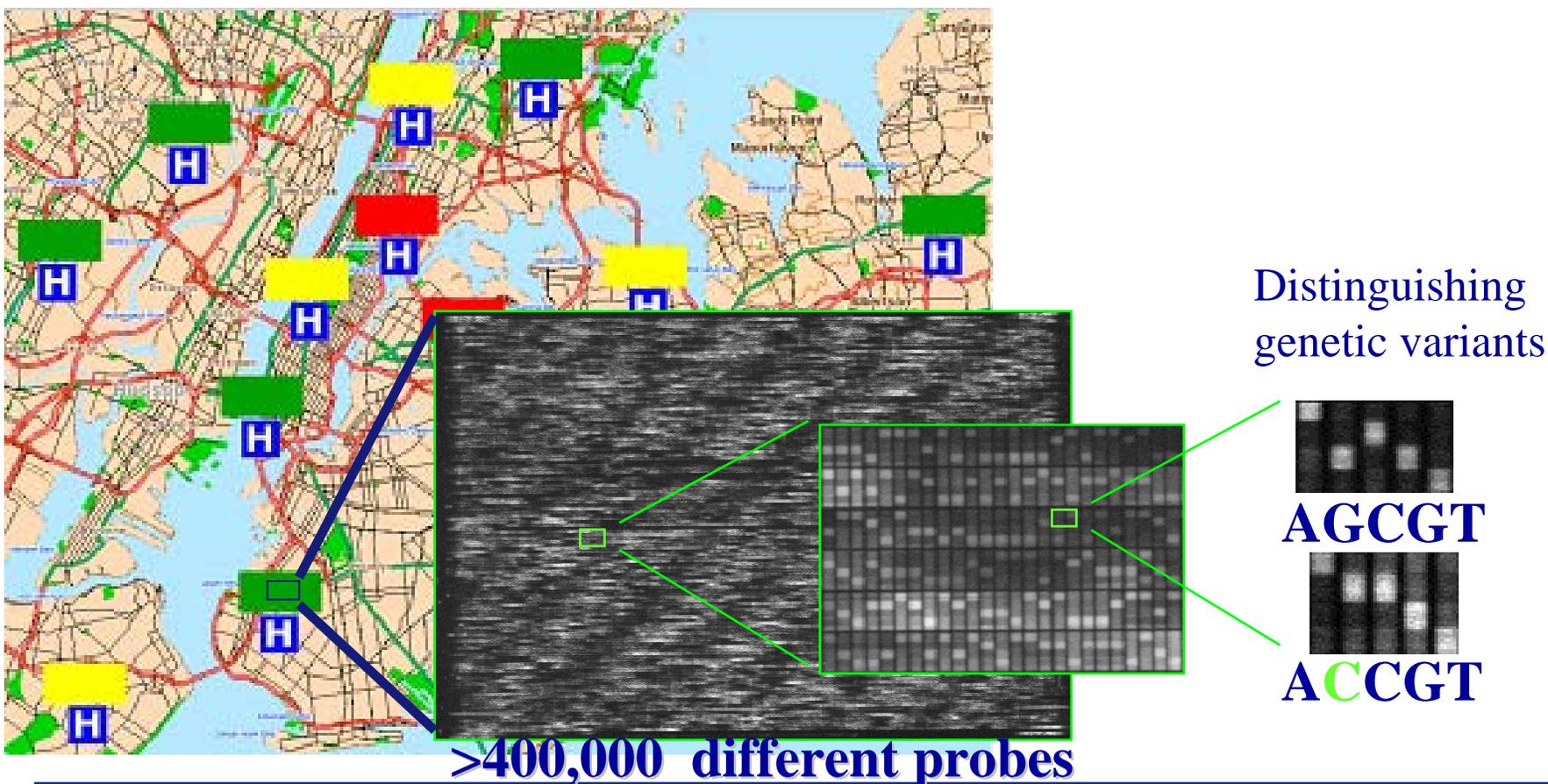
- ❖ Emergent detectors at multiple sites
- ❖ Uncertain performance as standalone units
- ❖ Coordinated as an interactive network of point of care nodes
- ❖ Reliable networks circuits using unreliable components (Claude Shannon)



U.S. AIR FORCE

# Projection of Extrinsic

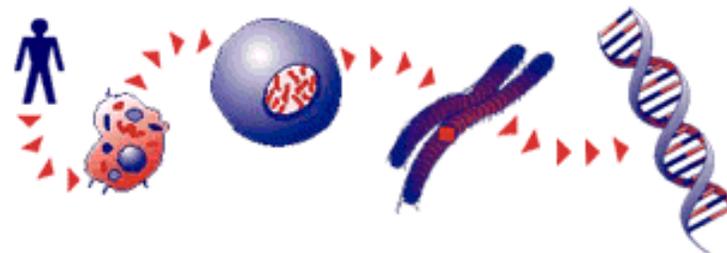
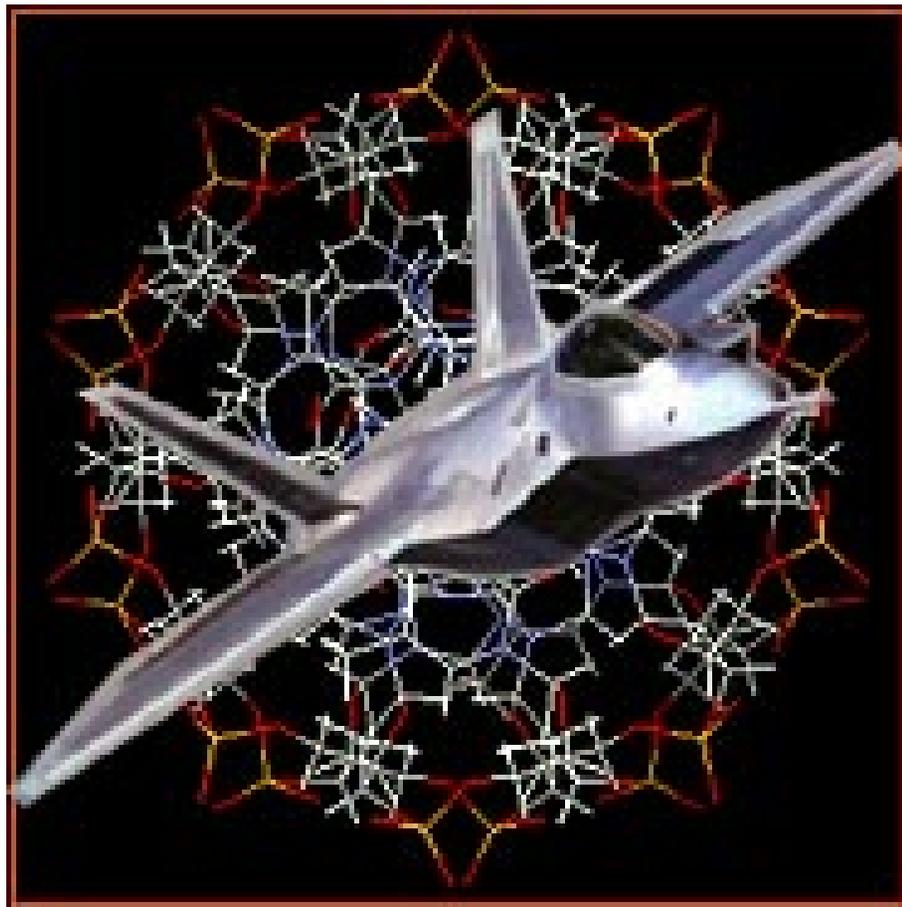
Real time surveillance for forensic identification of biologic agent release using a bioshield





U.S. AIR FORCE

# Projection of Intrinsic



Human performance enhancement



# ELSI

Bioregulators/modulators

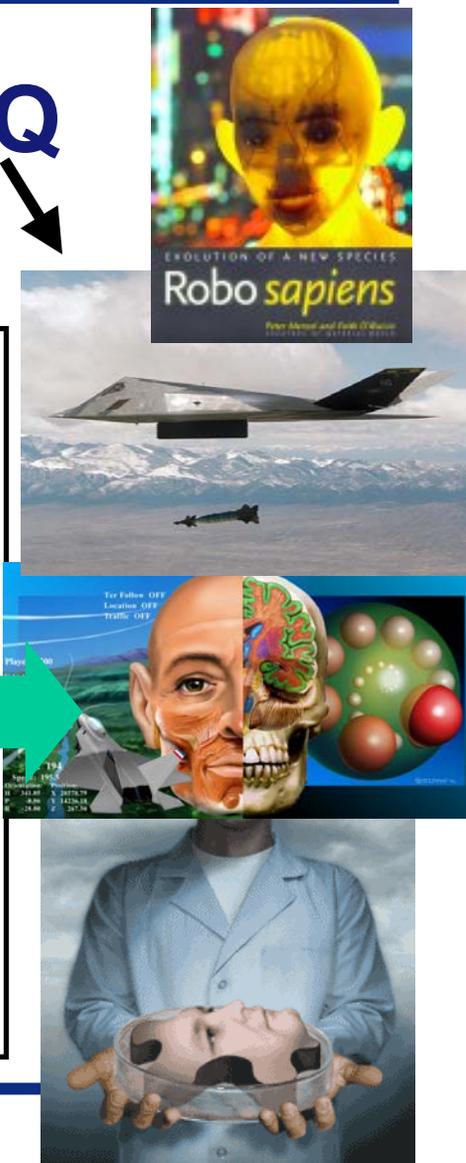
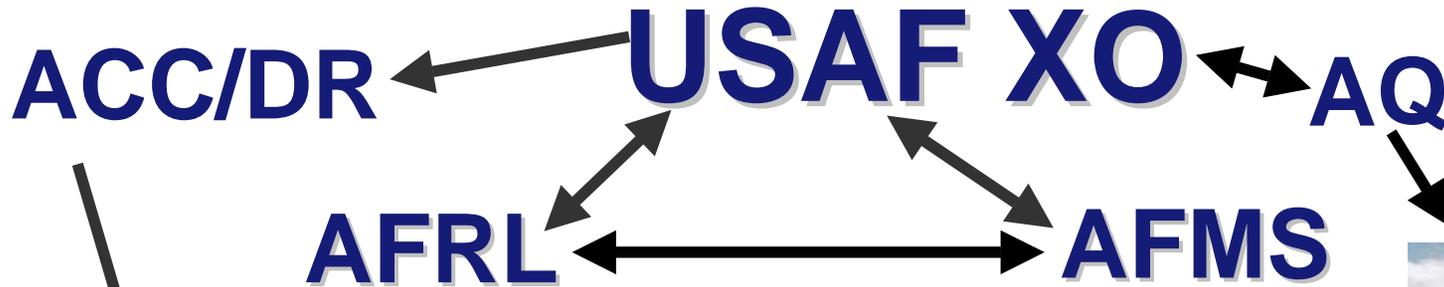
Physiological sensors





U.S. AIR FORCE

# Bringing it all together



Cellular Dynamics and Engineering

- Biotechnology threats
- Biotechnology capabilities

Biosensors

6.1

6.2

6.3

6.4

6.5

Decontamination

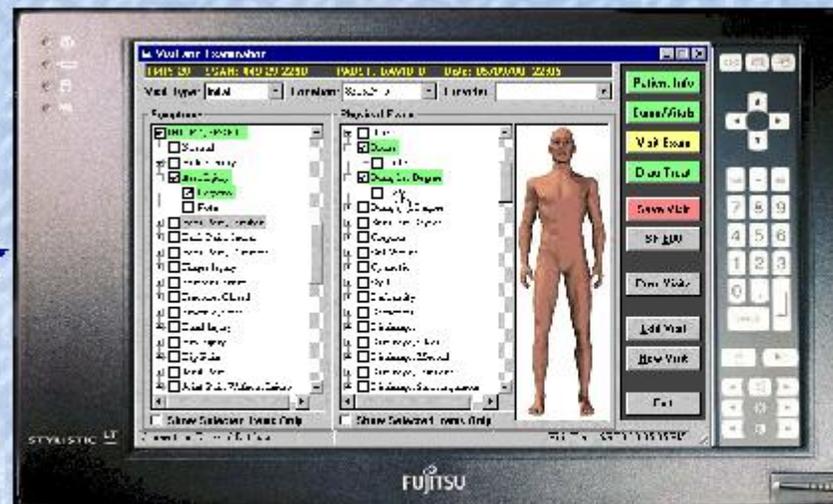
Biomaterials

Biocomputing

- FDA Approval
- Biotechnology partnerships
- ELSI issues



## Global Expeditionary Medical System



• Rugged Advanced Pathogen Identification Device (RAPID) is a portable system capable of fast laboratory confirmation using PCR techniques.



**A** Freeze-dried reagents In foil pack → **B** Reconstitute with liquid sample or water → **C** Load → **D** Run and read results

• **GEMS is the improved Medical Surveillance System (MSS), previously known as Desert Care -- GEMS allows for integration of patient evaluation, epidemiological analysis and Command and Control.**

• Patient Encounter Module (PEM) A paperless data linked tool for the front line medic to record and track individual patient assessments.

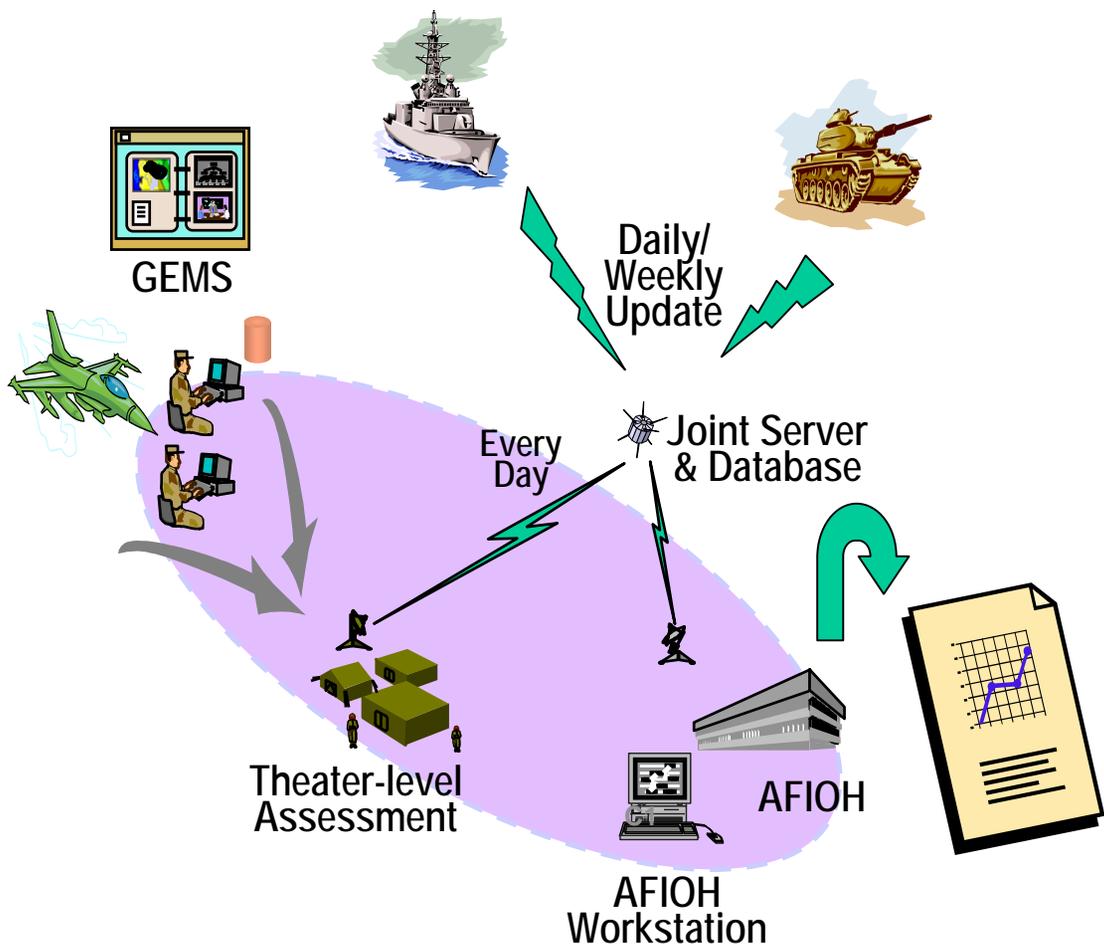
• Theater Epidemiological Module (TEM) An epidemiological analysis tool designed for far forward use as well as a robust reports system with advanced command and control surveillance.

• Theatre Occupational Module (TOM) Incorporates a standardized environmental baseline survey for initial and ongoing risk assessment.



U.S. AIR FORCE

# Collecting Deployment Health-related Data



- Disease and non-battle injury surveillance for current operations
  - Exposures
  - Health events
- Air Force, Army, Navy, Marine Corps field units collect data and submit
- Currently 7 days/week
- Results classified—daily/weekly reports delivered to customers via SIPRNet



U.S. AIR FORCE

# *Ruggedized Advanced Pathogen Identification Device (RAPID)*

- 35 Deployable Biological Augmentation Teams
- Identifies biological threat agents



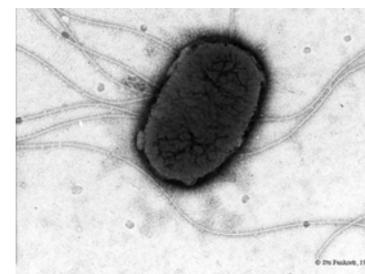
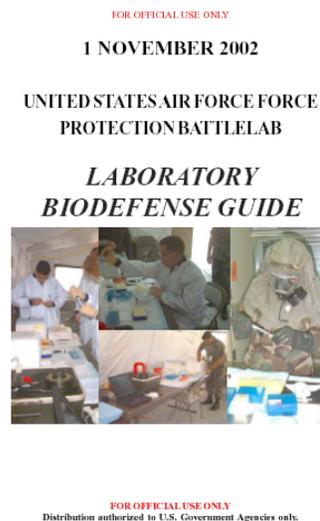
- Provides commander real time agent identification
- Facilitates command decisions i.e. prophylaxis, quarantine, isolate



U.S. AIR FORCE

# Laboratory Biodefense Guide

- Guide provides the team members with:
  - Clinical and Environmental sampling protocol for Chem/Bio agents
  - Water/Food Monitoring Strategies for contaminants
  - Standardized OI's for deployed or fixed sites in a field-hardy pocket sized guide
  - Basic "How To" for RAPID maintenance and troubleshooting





U.S. AIR FORCE

# Guide to Operational Surveillance of Medically Important Vectors and Pests

## ■ USAFSAM request

## ■ Guide provides:

- USAFSAM classroom to field training guide
- Critical medical information to include:
  - Control of vector-borne diseases
  - Reduction of impact on military mission

## ■ Fully illustrated, field-hardy and pocket-sized

## ■ Benefit to multi-services:

- Public health
- Civil engineer pest management personnel
- Military entomologists

FOR OFFICIAL USE ONLY  
01 November 2002  
UNITED STATES AIR FORCE  
FORCE PROTECTION BATTLELAB  
GUIDE TO  
OPERATIONAL SURVEILLANCE  
OF MEDICALLY IMPORTANT  
VECTORS AND PEST  
"OPERATIONAL ENTOMOLOGY"



Distribution authorized to U.S. Government agencies only.  
FOR OFFICIAL USE ONLY



# ***Headquarters U.S. Air Force***

---

*Integrity - Service - Excellence*

## **Detect to Treat**

# **Installation Protection Programs**

---



**U.S. AIR FORCE**

---

# **AF WMD Emergency Responder Program**



U.S. AIR FORCE

# *Medical Response Construct*

---

- **Casualty Prevention**
  - **Detection**
  - **Identification**
  - **Medical Surveillance**
  
- **Casualty Treatment**
  - **Decontamination**
  - **CBRNE treatment modalities**



# *Training & Exercise*

**U.S. AIR FORCE**

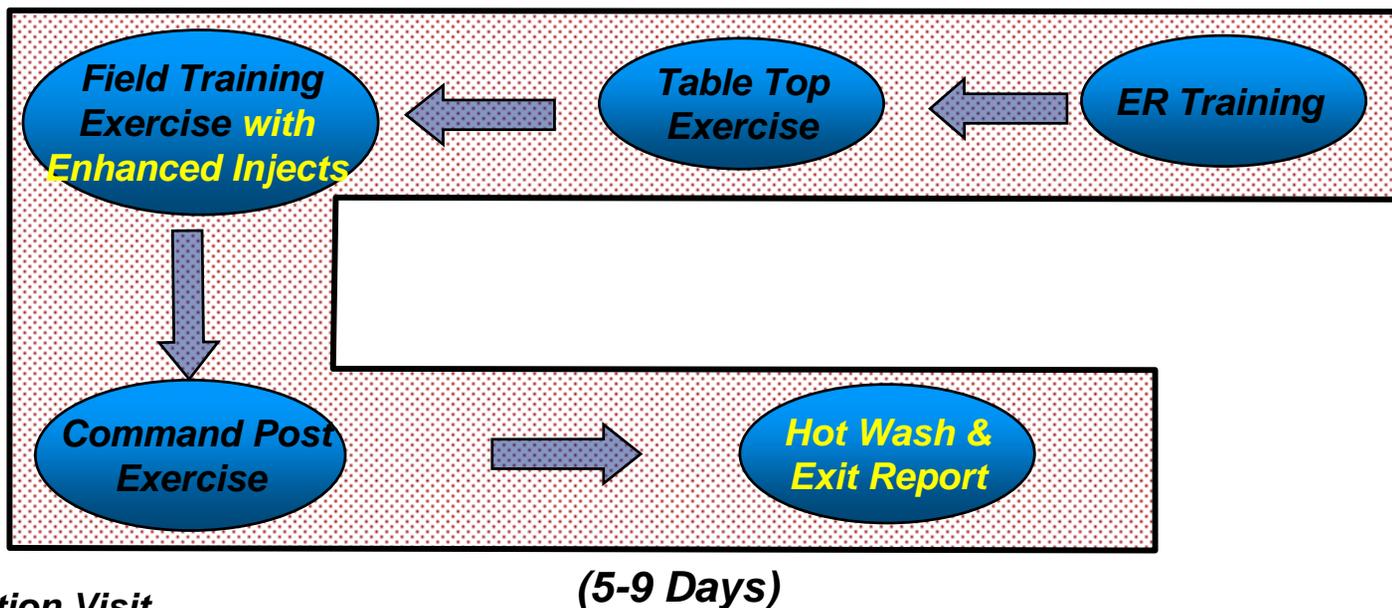
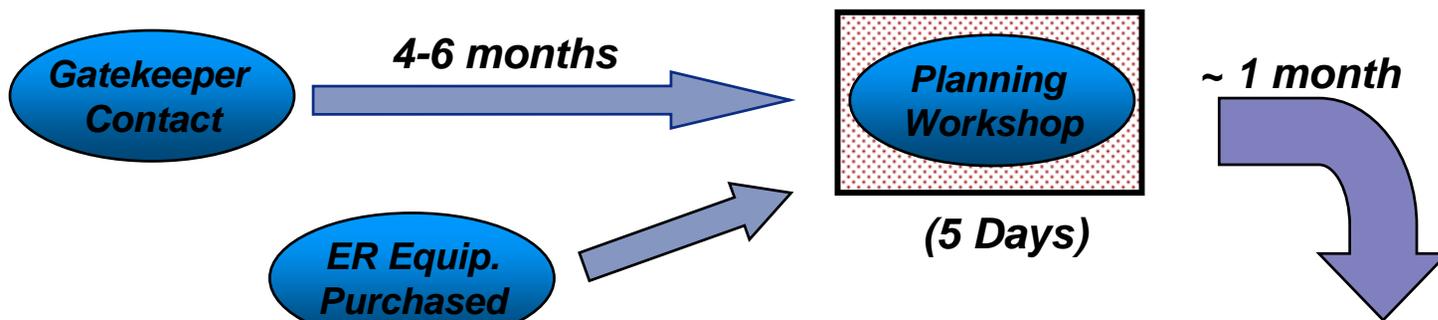
---

- **AF SMEs partner with Texas A & M University/Texas Engineering Extension (TEEX)**
  - **Cross-functional teams (SMEs)**
    - **Civil Engineering– Readiness, Fire, EOD**
    - **Medical –AF/SG Force Protection**
    - **Security Forces - HQ USAF Security Forces Center**
  - **2 separate one week visits per installation**
    - **Week 1- Planning Workshop**
    - **Week 2- Classroom training, table top exercise, field exercise**
  - **4-6 weeks between visits**



U.S. AIR FORCE

# AF WMD Emergency Response T & E Schedule

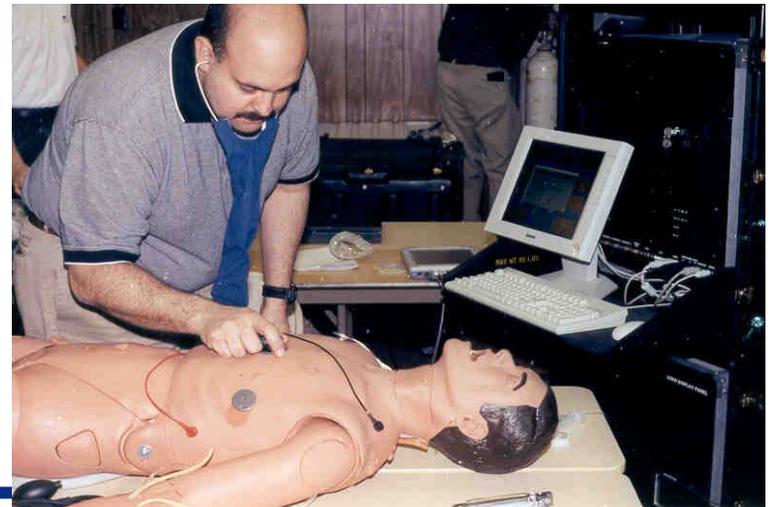


 Installation Visit



# WMD EMS Operations Course

U.S. AIR FORCE



*Integrity - Service - Excellence*



# Human Patient Simulator

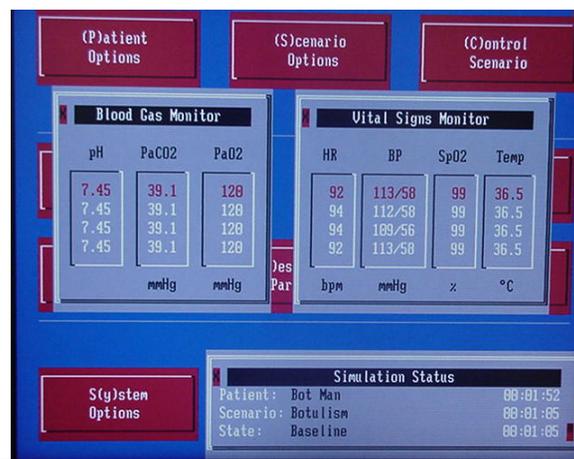
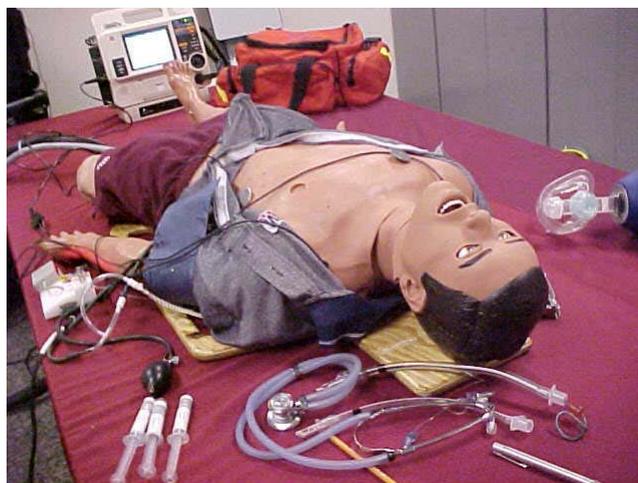
U.S. AIR FORCE

## Technology

- Advanced mobile health care management for first responders
- Provides “physiologically correct” patient presentations
- Provides “real time” patient

## Student Experience

- Promotes critical “thinking skills”
- Allows attainment of competency (performance) for WMD experiences
- Provides realistic WMD agent student experiences





U.S. AIR FORCE

# Joint Service Installation Pilot Program (JSIPP)





U.S. AIR FORCE

# JSIPP Tiered Approach and CBRN Capabilities

## Why a Tiered Approach?

- One Size does not fit all
- Assess Technical Adequacy
- Funds O&M Support
- Reduces Risk

**Tier 1: Emergency Responder equipment, CONOPS refinement & training**

**Tier 1 locations will not have CB Detection equipment installed**

**Pope AFB, 4Q FY03**

**Tier 2: ER & limited CB detection equipment, CONOPS refinement & training**

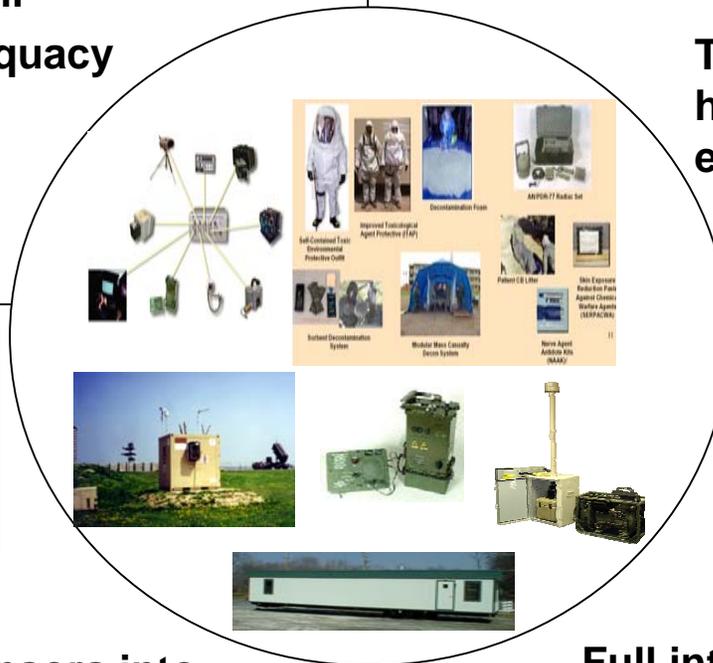
**Tier 3: ER & CB Detection equipment, integration, CONOPS refinement & training**

**Limited integration of sensors into existing installation Emergency Response network**

**Barksdale AFB, 2Q FY04**

**Full integration of sensors into existing installation Emergency Response network**

**Robins AFB, 2Q FY04**





# DoD Guardian Program

U.S. AIR FORCE

---

- **FY04:**
  - **Aviano**
  - **AF Academy**
  - *Langley (Guardian Program base)*
  - **Kadena**
  - *Tinker (Guardian Program base)*
  - **Barksdale (JSIPP training)**
  - **Yokota**
  - *Andrews (Guardian Program base)*
  - **Robins (JSIPP training)**
  - **Misawa**
  - *Wright-Patterson (Guardian Program base)*
  - **Guardian leveraging Services' WMD ER Programs & Lessons Learned from JSIPP**



**U.S. AIR FORCE**

# *Installation Protection*

## WMD Emg Response

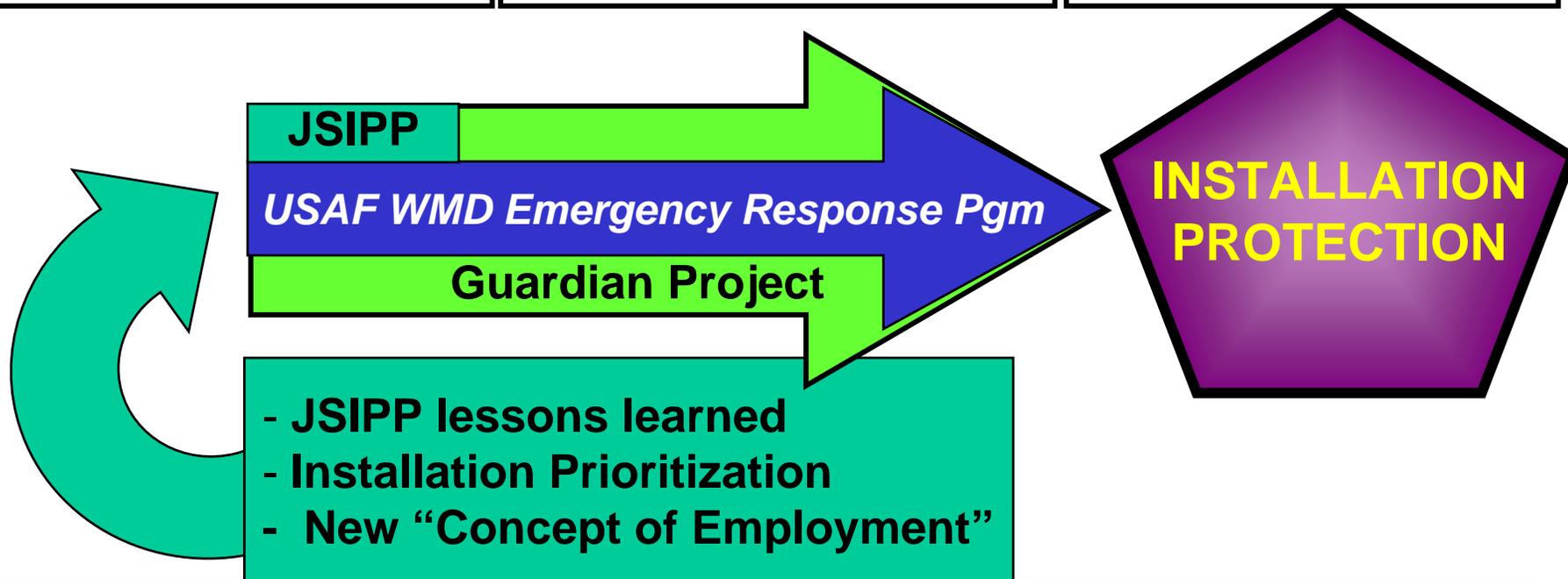
- WMD ER equip, training & exercises
- Partner w/ Texas A&M
- 4 pilot bases complete; 5 planned for FY04

## JSIPP

- Pilot Project
- Chem/Bio sensors, WMD ER equipment, training & exercises
- 9 DoD installations (3 AF)

## Guardian Project

- Chem/Bio sensors, WMD ER equipment, training & exercises
- 200 DoD installations
- FY04-FY09





# "CODE SILVER"

***A Medical Group-Oriented  
Chem-Bio Medical Readiness  
Program***







U.S. AIR FORCE

# CODE SILVER FOCUS: Integrated Response

Though Med Group Is Focus,  
Requires Integrated Airbase Response



and community

**TRAINING and EXERCISES**



# Detect to Treat

**U.S. AIR FORCE**



**Joint Biological Agent Identification &  
Diagnostic Systems**

**JBAIDS**

**Laboratory Response Network**

**LRN**



U.S. AIR FORCE

# Employment Concepts

## Mobile Platforms:

- Forward Surgical & Preventive Medicine Teams
- Hospital Ships

## Fixed & Forward Sites:

- Military Forward Deployed Labs
- Specialized “Fly away” Teams  
(FBI, CDC, DoD Biohazard Response Teams, etc.)
- General Hospitals
- Medical Centers
- Airfield Medical Triage Sites



Block I & II operated  
in sheltered  
environment

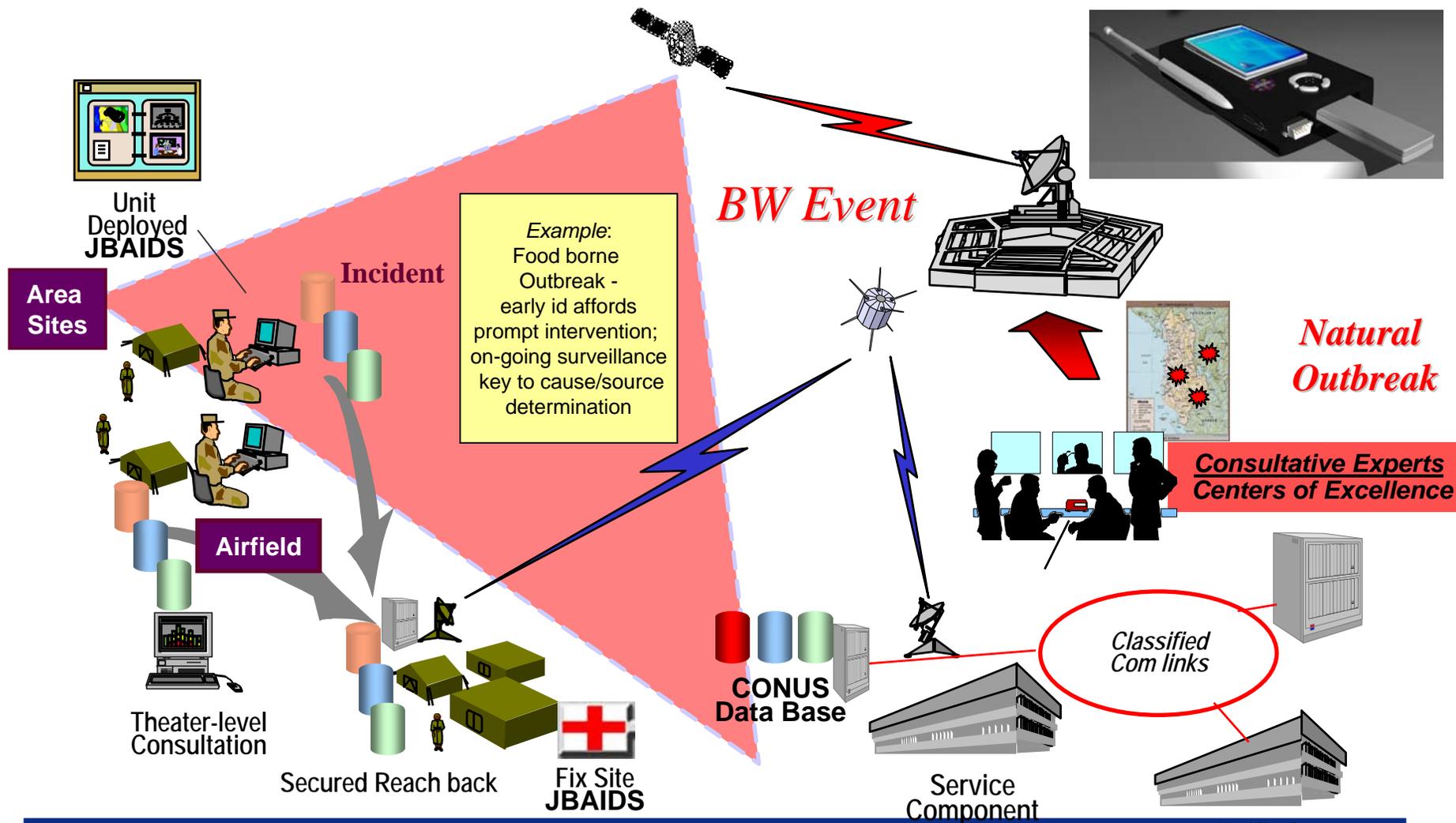
**“Standardized ... DoD Workhorse”**



U.S. AIR FORCE

# Integrated System

Artists' Concept Block III



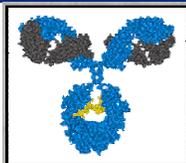
*Integrity - Service - Excellence*

Unified Command

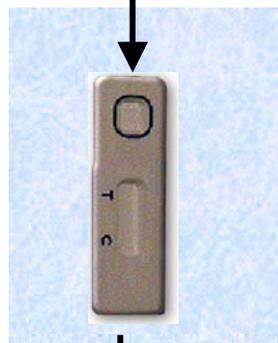


U.S. AIR FORCE

# Critical Reagents Program (CRP) Supports Multiple Technologies



Antibody  
Stockpile



ECL FASTubes

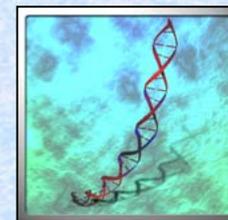
•ECL Assay Validation – AFIOH



Proficiency  
Testing



Threat Panels



DNA Panels



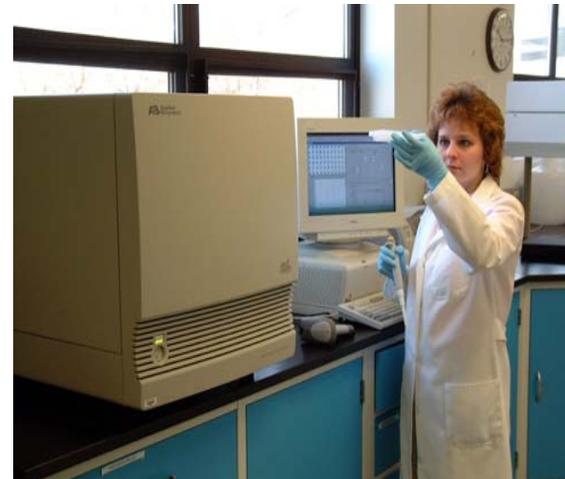
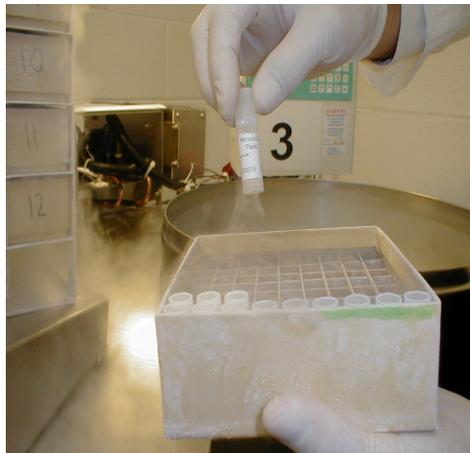
Taqman PCR Assays  
JBAIDS Assays





U.S. AIR FORCE

# CRP Production Thrusts



*Integrity - Service - Excellence*



# JBAIDS Block I Agents

First Tier: 10 Agents
Anthrax*
Brucella
Ebola-Marburg
Encephalitis virus
Glanders
Plague**
Q Fever
Smallpox**
Tularemia
Typhus

## Input for “Rack & Stack”

- Agent Threat Lists
- Medical Risk Assessment
- DoD Priorities

\*First agent for FDA clearance

\*\*Under consideration / 2<sup>nd</sup> Agent

Second Tier: 10 Agents
Cholera
CCHF
Cryptosporidium
Dengue Fever
<i>Escherichia coli</i>
Hantaan
Influenza
RFV
Salmonella
Shigella



# ***Headquarters U.S. Air Force***

---

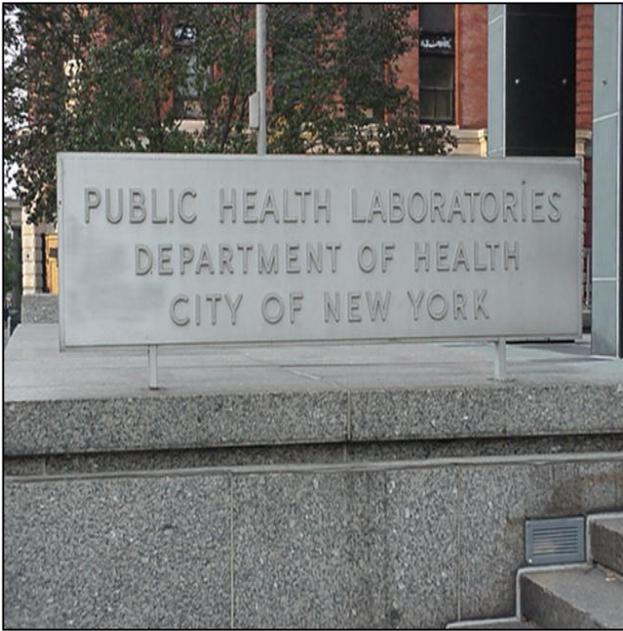
*Integrity - Service - Excellence*

## **Operation NOBLE EAGLE**

**Joint Biological Rapid Response Team  
Support for NYC Anthrax Testing**

**19 –25 October 2001**

---



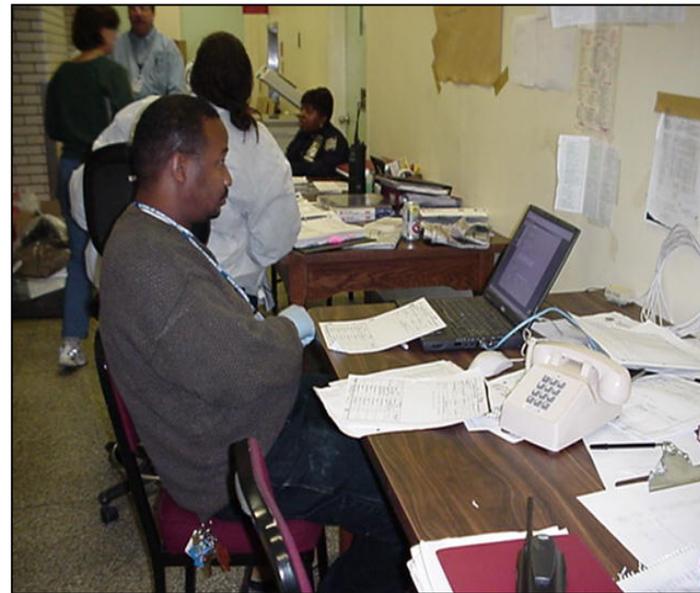
Decontamination Area



Temporary Storage



Sample Processing & Accessioning

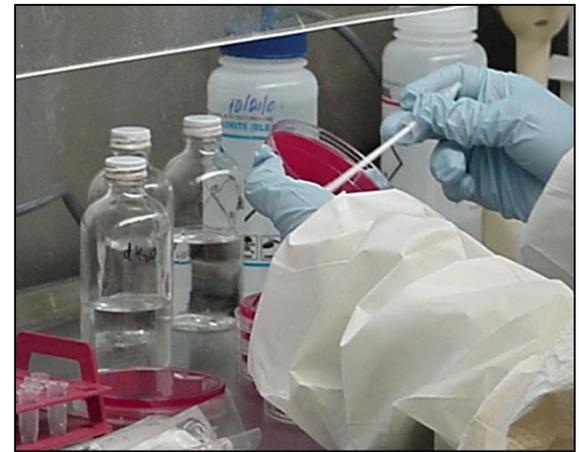




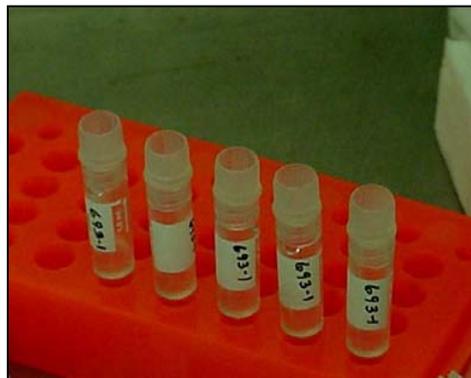
BSL 3 Processing Area



Sample Preparation



Culturing



Sample Aliquots



Hand Held Screen



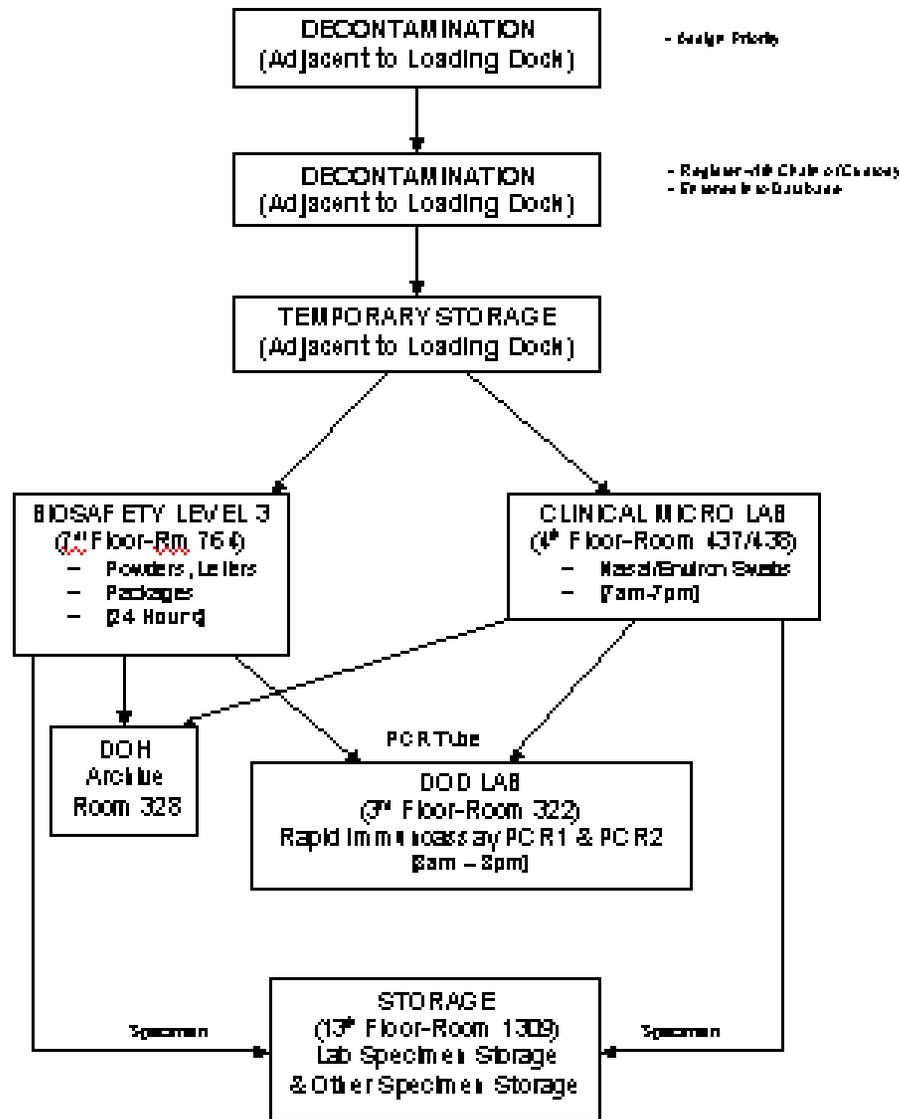
PCR



NYCDOH LABORATORY SPECIMEN RECEIVING FLOW SHEET  
FOR SUSPECTED ANTHRAX EXPOSED MATERIALS

10/28/01

ATTENTION: All specimens must be registered with CHAIN OF CUSTODY following decontaminating



# On-site Operations

- Over 2500 pieces of mail or material received in 17 days, all potentially evidence
- DOD Lab set up and operational within 90 minutes of arrival at DOH Laboratory
- 24/7 coverage; one 12 hr shift; 300+ samples/shift capable
- As of 1 Nov 01, 1129 specimens tested
- First 14 days: EIA screen → PCR → Culture
- Last 7 days: PCR & PCR of Pos Cultures
- Crafted / refined sample collection, processing, testing protocols
- Transitioned operations to NYC DOH; average 50 items received per day



# Preliminary Test Results

U.S. AIR FORCE

Specimens	Culture <sup>1</sup>	PCR <sup>2</sup>	Notes
Positive	36	36	Interlab PCR comparison: 99% - 99/100*
Negative	1030	1030	
Sensitivity		100%	*1 - Screen +
Specificity		100%	[Repeat PCR (from culture) pending]

1 -- culture growth, colony morphology, biochemical characterization –  $\delta$  hemolysis, colony morphology, Gram and capsule stains, phage & penicillin sensitivity, DFA

2 -- LF or PA screen – if positive, perform battery – LF or PA repeat, CAP and SASP

LF – PX01 marker  
PA – PX01 marker

CAP – PXO2 / capsule marker  
SASP – *Bacillus* marker

Test for DNA sequences associated with *Bacillus*, & *B. anthracis* pathogenicity



**U.S. AIR FORCE**

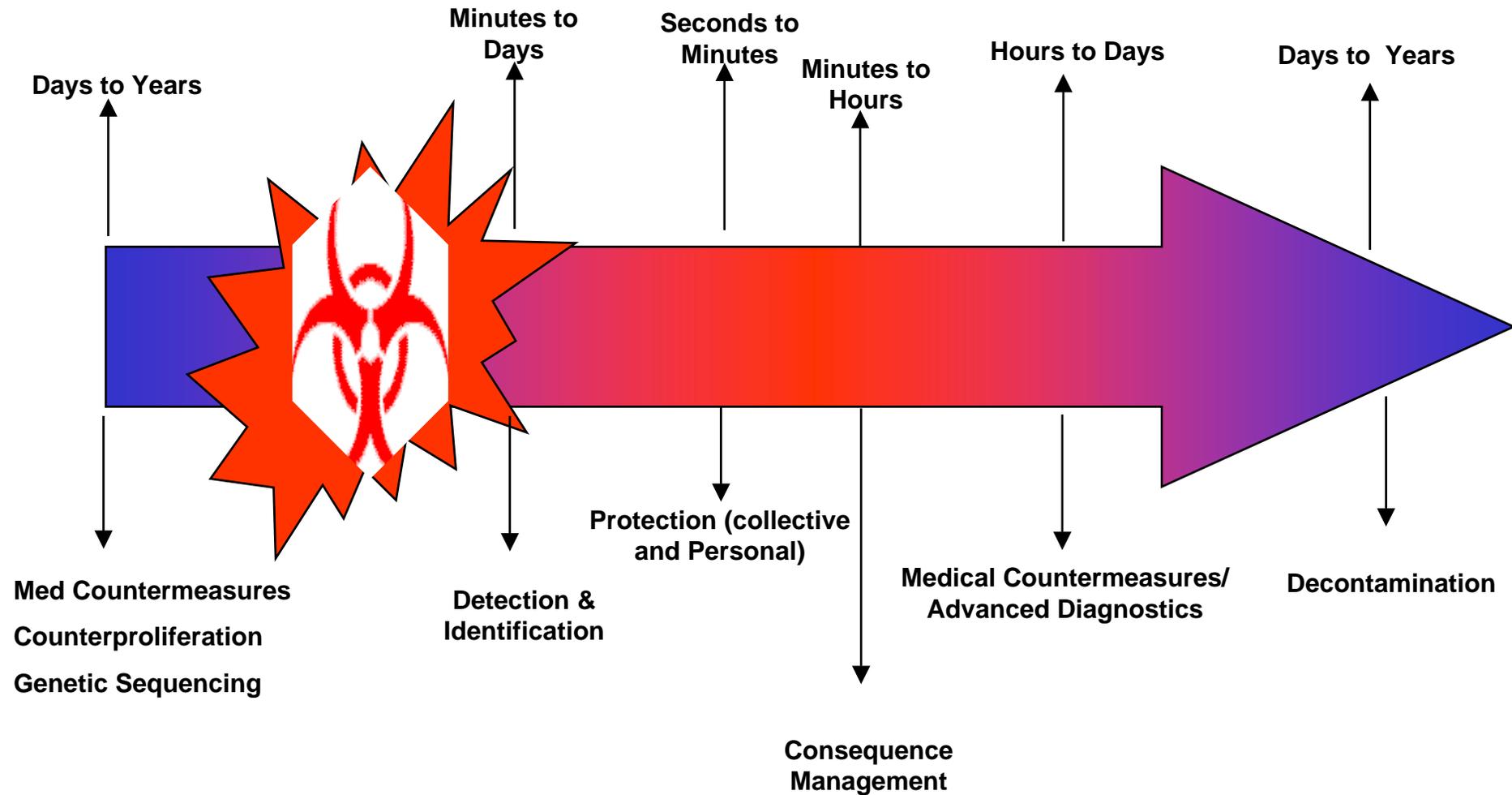
---

# Putting It All Together



U.S. AIR FORCE

# Spectrum of Biological Warfare





# Biodefense: Certain Weapons Pose Critical Risk

Intelligence Threat (HAZARD PROBABILITY)

		GREATEST		LEAST	
	Catastrophic	None	None	Ebola	None
Medical Risk	Critical	Anthrax	Smallpox	None	None
		Bot.Toxin	Encephalitis		
		Plague			
		Ricin			
	Marginal	None	Tularemia	Glanders	Mycotoxins (Tricothecene)
	Negligible	None	Enceph. virus (VEE)	Q-Fever Cholera	Brucellosis Typhus
		LEAST			

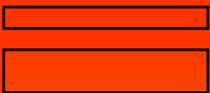
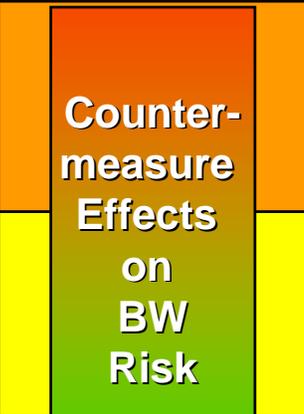
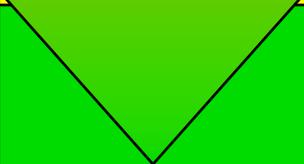
**High Risk and Threat Agents have the potential to severely degrade Air Operations -- Vaccines can manage some risk**



# Medical Countermeasures to Decrease Risk to Mission

- Pre-exposure
  - Food & water safety
  - Prevention (e.g., vaccines)\*
  - Early detection & ID\*
  - Protective equip (PPE)
- Post-exposure
  - Detection & ID\*
  - Protective equip (PPE)
  - Decontamination
  - Disease surveillance
  - Prevention (e.g., vaccines or antibiotics)\*
  - Treatment, symptomatic



<b>SEVERITY (MEDICAL IMPACTS)</b>	Catastrophic	
	Critical	
	Marginal	
	Negligible	

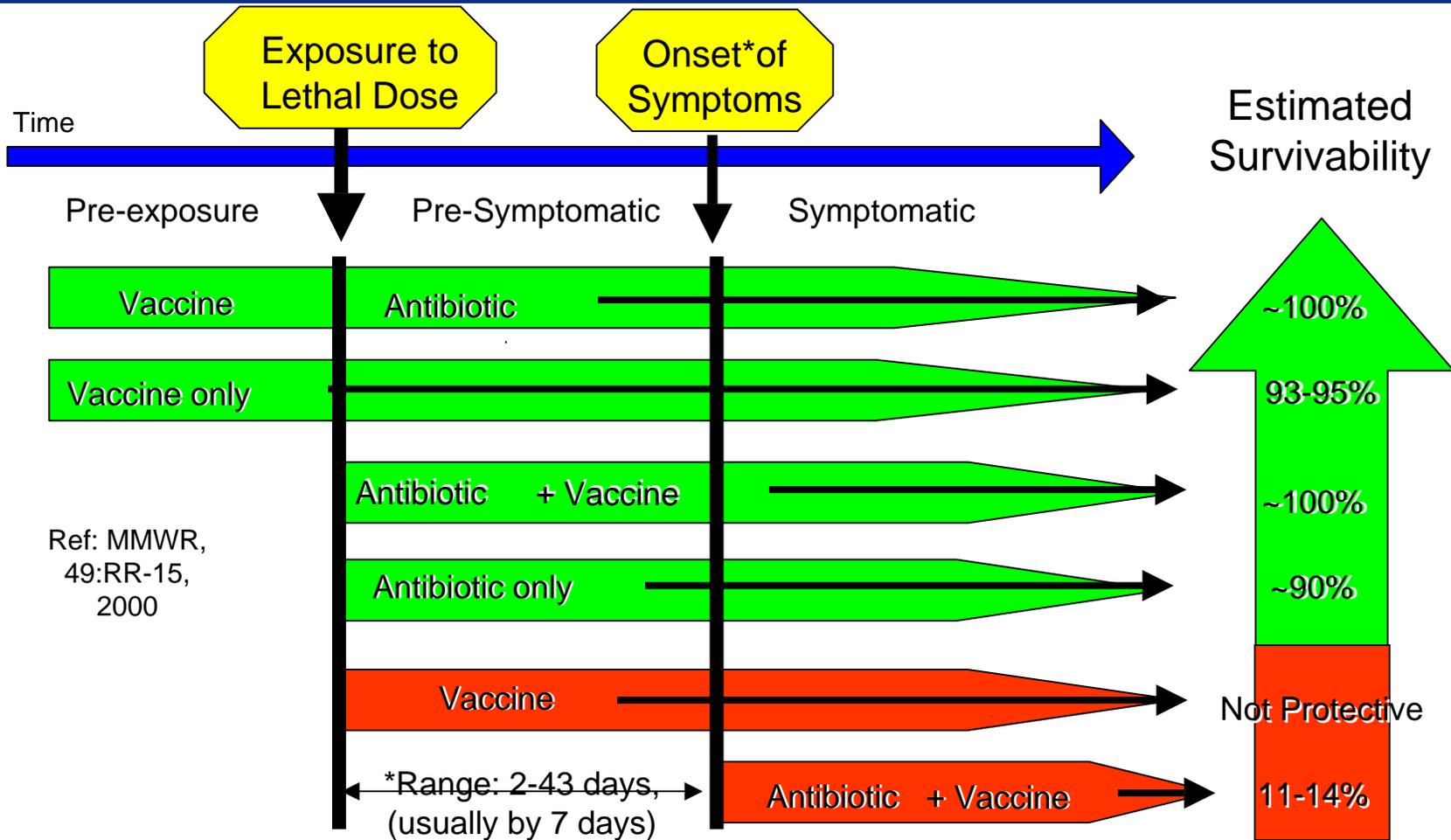
**Counter-measure Effects on BW Risk**

**Treatment, symptomatic** \*Countermeasures addressed in following status analysis



U.S. AIR FORCE

# Medical Countermeasures & Survivability Example: Anthrax



Note: Antibiotic = 30-60 days of Ciprofloxacin or Doxycycline at recommended dose, ideally begun in first 48 hours after exposure  
 Vaccine=Anthrax Vaccine Adsorbed (AVA)

(Case survival rate untreated ~3%)



**U.S. AIR FORCE**

# Questions?

