USSOCOM Chemical, Biological, Radiological Conference & Exhibition

Responding to the Terrorist CBRN Threat: "Preparation or Panic"

Tampa, FL

6-8 December 2005

Agenda

Tuesday, 6 December 2005

Welcome Remarks: MG Barry Bates, USA (Ret), NDIA
Joint Program Executive Office, BG Steve Reeves, USA, PEO Chem/Bio Defense

Joint Scienc & Technology, Dr. Charles R. Gallaway, Director, Joint Science Technology Office for Chemical & Biologica Dfense, DTRA

Doing Business with USSOCOM, Mr. Joe Daum, USSOCOM

Reducing the Threat of Nuclear and Radiological Terrorism, Mr. Kurt Westerman, National Nuclear Security Administration

Avon M53 Protective Mask for USSOCOM, Mr. Wayne Scheurer, Avon Protection Systems

Wednesday, 7 December 2005

Chemical Homeland Security Suite (C-HoSS), Dr. George R. Thompson, Chemical Compliance Systems

Radiological Emergency Response, Ms. Rhonda Hopkins, Bechtel Nevada

Use of Recombinant Butyrylcholinesterase in Responding to Chemical Weapon Attack, Dr. Gary D. Dorough, PhamAthene

Reliable Discrimination of High Explosive/Chem/Bio/Artillery Susing Acoustic IGS, Mr. Sachi V. Desai, US Army ARDEC

Real-Time First Bite Detection, Mr. Andrew Behar, VivoMetrics Government Services

Polymer Technology for the Lock-Down/Removal of Radiological Contamination, Ms. Jayne Shelton, Isotron Corporation

Modeling Tool for Prediction and Mitigation of CBRNE Events, Mr. John P. Daugherty, CTC

Terrorist Motivations to Employ CBRN Weapons, Mr. Robert C. Neumann, EAI Corporation

USAF Counter-Biological Warfare Effort, Lt Col Donna M. Hudson, USAF

Thursday, 8 December 2005

Keynote Presentation, Question & Answer Session: MG John Doesburg, USA (Ret), Center for Homeland Security and Counterproliferation

Responding to Multiple Ebola Attacks: The Need for Coordinated Preparedness, Ms. Dorothy A. Canter, John Hopkins University

Capture, Contain, Treat and Dispose of Decontamination Runoff on Site, Mr. Primo L. Acernese, TerraGroup Corporation

National Guard CBRN Response: Achieving Unity of Effort Between Local/State/Federal, COL Thomas D. Hook, USA, National Guard Bureau

CBRN Detectors for Early Warning of CBRN Events in Transit Environments, Mr. Francesco Pellegrino, Lockheed Martin

Using smart Threads to Interdict Radioactive Materials, Mr. Carter D. Hull, Chief Technology Officer, Nucsafe

USSOCOM Chemical, Biological, Radiological Conference & Exhibition

Responding to the Terrorist CBRN Threat: "Preparation or Panic"

December 6-8, 2005
Event #6630

NDIA
NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Tampa Convention Center
Tampa, Florida

CONFERENCE OBJECTIVE

Responding to the Terrorist CBRN Threat: **"Preparation or Panic"**

This years CBRN Conference will focus on synchronizing nationwide CBRN defense efforts in order to create a unity of effort in combating terrorist CBRN threats.

Environment: Tight budgets, undefined threats, and a lower sense of urgency by the public as we move further away from 9-11 and the Anthrax attacks of 2002.

Challenge: How does the CBRN defense community continue to fight terrorists who seek CBRN weapons; prepare for a potential CBRN attack; and simultaneously defend current and future CBRN defense programs from the budget axe?

Two Alternatives: Continue to thwart terrorist CBRN efforts and institute expanded and effective defensive and consequence management plans or hope that the enemy will not get these weapons, and be willing to accept panic and casualities if they do.

Conference Goals: CBRN defensive preparations are difficult, man-power intensive, and expensive. Additionally, there is no overwhelming indication of a successful program; other than no attack has occured. While panic is free, we owe the American public a better alternative.

USSOCOM seeks to bring together members of the CBRN defense community to share information concerning ongoing and future efforts in order to gain a synergy and unity of CBRN defense effort. We all must plan together, develop smart and efficient strategies for providing the warfighter with the tools he or she needs to defeat the threat, and be prepared to make the tough decisions of what we really need versus what we might like.

"The Department of Defense finds this event meets the minimum regulatory standards for attendance by DoD employees. This finding does not constitute a blanket approval or endorsement for attendance. Individual DoD component commands or organizations are responsible for approving attendance of its DoD employees based on mission requirements and DoD regulations."

CONFERENCE AGENDA

Monday, 5 December 2005

0800 - 1600	Registration Opens/Exhibit Booth Set Up

Tuesday, 6 December 2005

0800 - 0900	Registration and Continental Breakfast
0900 - 0915	Administrative Remarks *TSgt David Durand, USAF, USSOCOM, CBRN*
0915 - 0945	Introductions & Conference Purpose, Overview of SOF CBRN Activities *LTC John Campbell, USA, USSOCOM, CBRN*
0945 - 1000	Opening Remarks and Introduction of Keynote Speaker *GEN Bryan Brown, USA, USSOCOM Commander*
1000 - 1100	Keynote Presentation (Question & Answer Session) *Mr. Tom Brokaw (Invited)*
1100 - 1115	Break in Exhibit Hall
1115 - 1200	Joint Program Executive Office *BG Steve Reeves, USA, PEO Chem/Bio Defense*
1200 - 1330	Lunch in Exhibit Hall
1330 - 1415	Joint Science & Technology *COL Ben Hagar, USA, DTRA*
1415 - 1445	CBRN Threat Update *Mr. Mark Sheddan, USSOCOM* *Ms. Kristen Zajac, CENTCOM*
1445 - 1515	Doing Business with USSOCOM *Mr. Joe Daum, USSOCOM*
1515 - 1530	Break in Exhibit Hall
1530 - 1600	Reducing the Threat of Nuclear and Radiological Terrorism *Mr. Kurt Westerman, National Nuclear Security Administration*
1600 - 1700	Demo: Improved Improvised Explosive Device (IED) Detection by Military Working Dogs *Mr. George Heib, CTC*
1700 - 1900	Exhibit Visit and Networking Social in Exhibition Hall

CONFERENCE AGENDA

Wednesday, 7 December 2005

0700 - 0800	Registration & Warrior Sponsor Continental Breakfast
0800 - 0830	Homeland Security Suite (HoSS) CBR *Dr. George R. Thompson, Chemical Comp Systems*
0830 - 0900	Terahertz Sensing for Pre-Release of CBRNE *Dr. Matthew Campbell, SPARTA, Inc.*
0900 - 0930	Enabling Critical Infrastructure Protection with Bioaerosol Alarms *Dr. Charles Call, MesoSystems Tech., Inc.*
0930 - 1000	Radiological Emergency Response *Ms. Rhonda Hopkins, Bechtel Nevada*
1000 - 1030	Break/Exhibit Visit
1030 - 1100	Use of Recombinant Butyrylcholinesterase in Responding to Chemical Weapon Attack *Dr. Gary D. Dorough, PharmAthene*
1100 - 1130	Reliable Discrimination of High Explosive/Chem/Bio Artillery Using Acoustic UGS *Mr. Sachi V. Desai, US Army ARDEC*
1130 - 1200	Real-Time First Bite Detection *Mr. Andrew Behar, VivoMetrics Government Services*
1200 - 1330	Lunch/Exhibit Visit
1330 - 1400	Polymer Technology for the Lock-Down/Removal of Radiological Contamination *Dr. John Whitaker, Isotron Corporation*
1400 - 1430	Modeling Tool for Prediction and Mitigation of CBRNE Events *Mr. George McAllister, CTC*
1430 - 1500	Break/Exhibit Visit
1500 - 1530	Terrorist Motivations to Employ CBRN Weapons *Mr. Robert C. Neumann, EAI Corporation*
1530 - 1600	USAF Counter-Biological Warfare Effort *Lt Col Donna M. Hudson, USAF*
1600 - 1700	Demo: 112th Chemical Recon Detachment (Conference Participants will witness a live demonstration)
1700 - 1800	Exhibit Visit

Thursday, 8 December 2005

0700 - 0800	Registration & Continental Breakfast
0800 - 0830	Responding to Multiple Ebola Attacks: The Need for Coordinated Preparedness *Ms. Dorothy A. Canter, John Hopkins University*
0830 - 0900	Capture, Contain, Treat and Dispose of Decontamination Runoff on Site *Mr. Primo L. Acernese, TerraGroup Corporation*
0900 - 0930	CRE Tactical Infrared Spectral Sensor for Detection/Identification of TIC from a UAV *Mr. Aaron Brown, Critical Response Engineering, Inc.*
0930 - 0945	Break
0945 - 1015	National Guard CBRN Response: Achieving Unity of Effort Between Local/State/Federal *COL Thomas D. Hook, USA, National Guard Bureau*
1015 - 1045	Avon M53 Protective Mask for USSOCOM *Mr. Wayne Scheurer, Avon Protection Systems*
1045 - 1115	CBRN Detectors for Early Warning of CBRN Events in Transit Environments *Mr. Francesco Pellegrino, Lockheed Martin*
1115 - 1245	Lunch
1245 - 1330	Demo: CBRN Joint Capability (Conference Participants will witness a live demonstration)
1330 -1500	CBRN Equipment Demonstrations
1515 - 1530	Passport Drawing (Must be present to win!)
1530 - 1545	End of Conference Remarks *LTC John Campbell, USA, USSOCOM, CBRN*

CONFERENCE INFORMATION

Hotel Information

A block of rooms have been reserved at the hotels listed below:

Tampa Marriott Waterside Hotel & Marina
700 South Florida Avenue
Tampa, FL 33602
(800) 228-9290
(813) 221-4900
Government Rate: $84.00
Industry Rate: $164.00

Hyatt Regency Tampa
Two Tampa City Center
Tampa, FL 33602
(800) 233-1234
(813) 225-1234
Government Rate: $84.00
Industry Rate: $159.00

In order to ensure the discounted NDIA rate, you must make your reservations early and ask for the NDIA room block. Rooms will not be held after Thursday, November 10, 2005 and may sell out before then. Rates are also subject to increase after this date.

** The government per diem rate is available only to active duty or civilian governemnt employees. ID will be required upon check-in. Retired military ID's do not qualify.**

Conference Information

You may view the conference information at: http://register.ndia.org/interview/register.ndia?~Brochure~6630. For further information, contact Carissa Mirasol, Meeting Planner at (703)247-2588 or via e-mail at cmirasol@ndia.org. For exhibit questions, please contact Tina Mercardo at (703)247-2582 or tmercardo@ndia.org.

Conference Registration and Registration Fees

Registration Fees

	Early Before 10/25/05	Regular 10/25/05 to 11/25/05	Late after 11/25/05
Government/Academia	$400	$440	$485
Industry NDIA Member	$575	$635	$700
Industry non-NDIA Member	$625	$690	$760
Active Duty	$300	$330	$365

Registration Process

To register online for this conference visit the following link: http://register.ndia.org/interview/register.ndia?~Brochure~6630 or visit the NDIA web site at www.ndia.org and select Schedule of Events. Then select 2005 December and scroll down to the USSOCOM CBRN Conference & Exhibition then scroll down the page to "Register" and select. Review your information and then select "Submit" one time only and then select "Confirm". On-line registration will close after November 25, 2005. You must register on-site after this date.

-or-

You may fax the completed registration form contained in this brochure or available on-line to (703)522-1885. Please do not fax registration forms after November 25, 2005. You will need to register on-site after this date.

-or-

You may mail the completed registration form contained in this brochure or available on-line to: Event #6630, National Defense Industrial Association, 2111 Wilson Boulevard, Suite 400, Arlington, VA 22201-3061. Mailed registration forms must be received by November 25, 2005. You will need to register on-site after this date.

● **Refunds** ●

Registrants who cannot attend the 2005 USSOCOM CBRN Conference & Exhibition must provide written notification (via e-mail to cmirasol@ndia.org or fax to 703-522-1885) to NDIA before October 25, 2005 to avoid a cancellation fee. Cancellations received between October 26, 2005 and November 25, 2005 will receive a refund minus a $75.00 cancellation fee. No refunds will be given to cancellations received after November 25, 2005 however, ***substitutions are welcome in lieu of cancellations.***

● **Attire** ●

Appropriate dress for this conference is business casual attire for civilians and class B uniform or uniform of the day for military.

● **Identification Badges** ●

At the time of registration check-in, each registrant will be issued an identification badge. Please be prepared to show a government issued I.D. Badges must be worn at all conference functions.

● **Attendee Roster** ●

An attendee roster will be distributed at the conference. In order to appear in the attendee roster, you must be registered by

CONFERENCE INFORMATION

November 25, 2005. An updated roster WILL NOT be dissiminated during or after the conference.

Promotional Partner Opportunities

Increase your company or organization exposure at this premier event by becoming a Promotional Partner. A Promotional Partnership ($5,000) will add your company name to the back cover of the on-site brochure as well as main platform recognition throughout the conference, signage at all events including the opening reception, a 350-word organization description in the on-site brochure and a hotlink from the conference webpage to your company website. For more information, please contact Tina Mercardo at (703)247-2582 or tmercardo@ndia.org.

ADA

NDIA supports the Americans with Disabilities Act of 1990. Attendees with special needs must call (703)522-1820 prior to November 25, 2005 and refer to Event #6630.

National Defense Magazine

Advertise in National Defense and increase your company's exposure at this conference and all other NDIA conferences. For more information, contact Dino Pignotti at (703)247-2541 or via e-mail at dpignotti@ndia.org.

Inquiries

For questions regarding the conference, contact Carissa Mirasol at 703-247-2588 or via e-mail at cmirasol@ndia.org.

USSOCOM
Chemical, Biological, Radiological & Nuclear Conference & Exposition
Tampa Convention Center
December 6-8, 2005 - Event # 6630

National Defense Industrial Association
2111 Wilson Boulevard, Suite 400
Arlington, VA 22201-3061
(703) 522-1820 • (703) 522-4656 fax
www.ndia.org

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3 Ways to sign up:
1. Online with a credit card at www.ndia.org
2. By fax with a credit card — Fax: (703) 522-1885
3. By mail with a check or credit card

❑ Address change needed

NDIA Master ID/Membership # ____________ Social Security # ____________
(if known—hint: on mailing label above your name) *(last 4 digits – optional)*

Prefix ____________
(e.g. RADM, COL, Mr., Ms., Dr., etc.)

Name First ________ MI ____ Last ____________

Military Affiliation *(e.g. USMC, USA (Ret.) etc.)* ____________ Nickname *(for Meeting Badges)* ____________

Title ____________

Organization ____________

Street Address ____________

Address *(Suite, PO Box, Mail Stop, Building, etc.)* ____________

City ________ State ____ Zip ________ Country ________

Phone ____________ ext. ______ Fax ____________

E-Mail ____________

Signature* ____________ Date ________

Preferred way to receive information

Conference information ❑address above ❑Alternate *(print address below)* ❑ E-mail

Subscriptions ❑ address above ❑ Alternate *(print address below)*

Alternate Street Address ____________

Alternate Address *(Suite, PO Box, Mail Stop, Building, etc.)* ____________

City ________ State ____ Zip ________ Country ________

** By your signature above you consent to receive communications sent by or on behalf of NDIA, its Chapters, Divisions and affiliates (NTSA, AFEI, PSA, NCWG, WID) via regular mail, e-mail, telephone, or fax. NDIA, its Chapters, Divisions and affiliates do not sell data to vendors or*

By completing the following, you help us understand who is attending our meetings.

Primary Occupational Classification. *Check ONE.*

- ❑A. Defense Business/Industry
- ❑B. R&D/Laboratories
- ❑ C. Army
- ❑ D. Navy
- ❑ E. Air Force
- ❑ F. Marine Corps
- ❑ G. Coast Guard
- ❑ H. DOD/MOD Civilian
- ❑ I. Gov't Civilian (Non-DOD/MOD)
- ❑ J. Trade/Professional Assn.
- ❑ K. Educator/Academia
- ❑ L. Professional Services
- ❑ M. Non-Defense Business
- ❑ N. Other ________

Current Job/Title/Position.
Check ONE.

- ❑A. Senior Executive
- ❑ B. Executive
- ❑ C. Manager
- ❑D. Engineer/Scientist
- ❑E. Professor/Instructor/Librarian
- ❑F. Ambassador/Attaché
- ❑G. Legislator/Legislative Aide
- ❑ H. General/Admiral
- ❑I. Colonel/Navy Captain
- ❑ J. Lieutenant Colonel/ Commander/Major/ Lieutenant Commander
- ❑ K. Captain/Lieutenant/Ensign
- ❑ L. Enlisted Military
- ❑ O. Other ________

Year of birth ________
(Optional)

Registration Fees

	Early Before 10/25/05	Regular 10/25/05 to 11/25/05	Late After11/25/05
Government/Academia	❑$400	❑$440	❑$485
Industry NDIA member	❑$575	❑$635	❑$700
Industry non-NDIA member	❑$625	❑$690	❑$760
Active Duty	❑$300	❑$330	❑$365

Cancellations received prior to 11/25/05 will receive a refund of the registration fee minus a $75 cancellation fee. No refunds for cancellations received after 11/25/05. **Substitutions Welcome!**

[1] Registration fees for non-NDIA members include a one-year non-refundable NDIA membership—$15.00 will be applied for your subscription to *National Defense* magazine.

Payment Options

❑Check *(payable to NDIA)*
❑Cash
❑Government PO/Training Form #
❑VISA
❑MasterCard
❑American Express
❑Diners Club

Credit Card Number Exp. date

Signature Date

Questions? Contact Carissa Mirasol
Meeting Planner
(703) 247-2588 email: cmirasol@ndia.org

Mail to: NDIA, Event #6630
2111 Wilson Boulevard, Suite 400
Arlington, VA 22201

Fax to: (703) 522-1885

Exhibitor Information

NDIA invites you to exhibit your products and services at the 2005 USSOCOM Chemical, Biological, Radiological, & Nuclear Conference and Exhibition, December 6-7, 2005.

Exhibit Rates

NDIA Corporate Members*:
$1,950 per 10' x 10' booth
**rate applies to Government agencies*

Non-Members:
$2,450 per 10' x 10' booth

Exhibit Rate Includes:

- Networking functions in exhibit hall
- Two complimentary registrations
- Two reduced rate registrations
- Conference attendee list
- Company profile online
- 24 hour security for exibit hall
- Fabric back and side drape
- Company ID sign

Reserve your Booth:

You can reserve your booth two ways:

1. Take advantage of NDIA's paperless online reservation system!

Reserve online, in real time at http://exhibtis.ndia.org.

2. Request an exhibitor contract that can be mailed with check or faxed with credit card. Contact:

Tina Lynn Mercardo
Exhibits Department
T: 703-247-2582
F: 703-522-1885
E: Tmercardo@ndia.org

Exhibit Schedule*

Move-In:
Monday, Dec. 5: 10am - 6pm

Exhibit Hours:
Tuesday, Dec. 6: 11am - 7pm
Wednesday, Dec. 7: 8am - 3pm

Move-out:
Wednesday, Dec. 7: 3pm - 8pm
**Schedule is subject to change*

Exhibitor Registration

For each booth space that your Company occupies, you will receive two complimentary full conference registrations and two reduced rate conference registrations at a cost of $300 each.

Complimentary badges must be assigned online before November 25, 2005. After November 25, any unused complimentary badge allotment will be converted to regular exhibitor registration at the on site rate of $300 each.

After your allotment of 4 badges per booth is filled, you must register all additional personnel as attendees, at attendee rates. After November 25, you cannot transfer attendee registrations to unused exhibitor registrations.

To register your exhibit staff, log into your account and go to the "Manage Badges" area.

2005 USSOCOM CBRN CONFERENCE
TAMPA CONVENTION CENTER ~ TAMPA, FLORIDA
EXHIBIT FLOOR PLAN

To Reserve Booth Space in real time, go to http://exhibits.ndia.org.

For questions or to receive more information, contact:
Tina Lynn Mercardo~ Associate Director, Exhibits ~ NDIA
Tel: 703-247-2582 ~ Fax: 703-522-1885 ~ Tmercardo@ndia.org

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December 6-8 , 2005

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NBC Decontamination

Capture, Contain, Treat and Dispose of Decon Runoff On Site

OBJECTIVES

- Consider the logistical and practical challenges that face federal, state and local agencies concerned with mass casualty decontamination, and subsequent decontamination runoff issues
- A quick look at current methods, mind sets and mistakes
- Explore alternatives and a new approach

BACKGROUND

- **Mass decontamination operations require water and subsequent handling and treatment of contaminated runoff**
- **Current mind set: EPA has stated, that, in accordance with liability in CERCLA, the run-off is not a primary concern????**

EPA First Responders Liability Guidelines Statement:

- "Once any imminent threats to human health and life are addressed, first responders should immediately take all reasonable efforts to contain the contamination and avoid or mitigate environmental consequences."
- "First responders would not be protected under CERCLA from intentional contamination such as washing hazardous materials down the storm-sewer during a response action as an alternative to costly and problematic disposal or in order to avoid extra effort."

USEPA Chemical Safety Alert
Office of Solid Waste and Emergency Response **EPA 550-F-00-009**
July 2000 www.epa.gov/ceppo/

THE PROBLEM

- Current decontamination procedures do not address the safe, secure and economic handling of decontamination runoff.

- Lack of preparation and training potentially allows perpetrators the windfall of poisoned land, water and economic disruption. (scenario 1)

- Traditional mind set views saving human life and environmental protection as mutually exclusive concepts

THE PROBLEM

REALITY CHECK

MASS CASUALTY VICTIMS VS GALLONS

5000 casualties X 8 GPP = 40,000 gallons

20,000 casualties x 8 GPP = 160,000 gallons

35,000 casualties x 8 GPP = 280,000 gallons

100,000 casualties x 8 GPP = 800,000 gallons

Military Tanker Truck Capacity – 5000 gallons

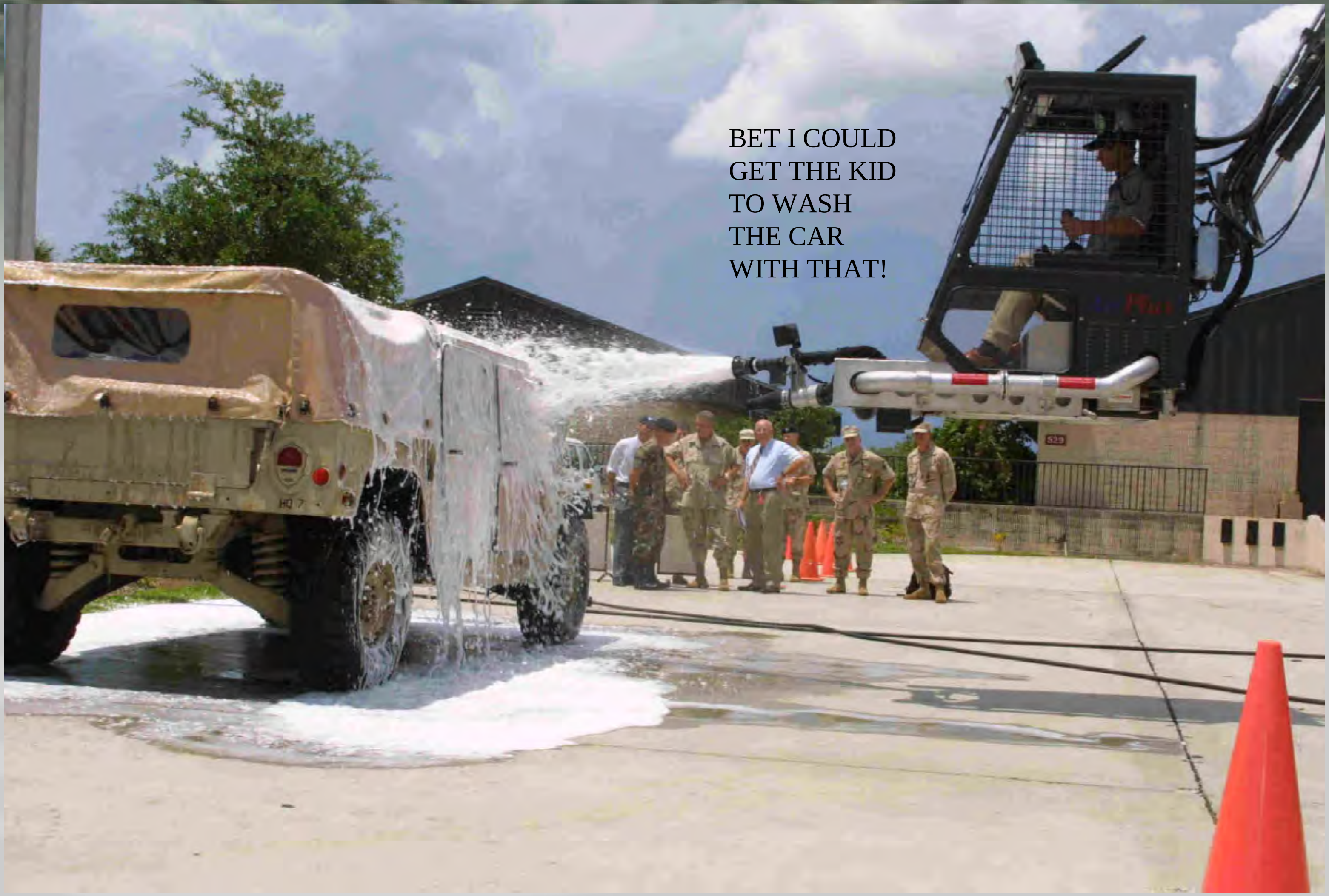
Current Decon Runoff Options

1. **Raw Discharge** – unacceptable environmental impact

2. **Dilution** of contaminated runoff

3. **Haul Away** – potential spread of contamination outside the hot/warm zone – coordination logistics with mass casualty incident decon problematic


DID YOU SEAL THE MRE CONTAINERS?
NO, I THOUGHT YOU DID!


BET I COULD GET THE KID TO WASH THE CAR WITH THAT!


DECON SHOWER
DECON SHOWER
WHAT DO WE DO WHEN THE BAG'S FULL?
TELL THEM TO BE PATIENT, TANKER IS ON THE WAY

RECOMMEND SOLUTION

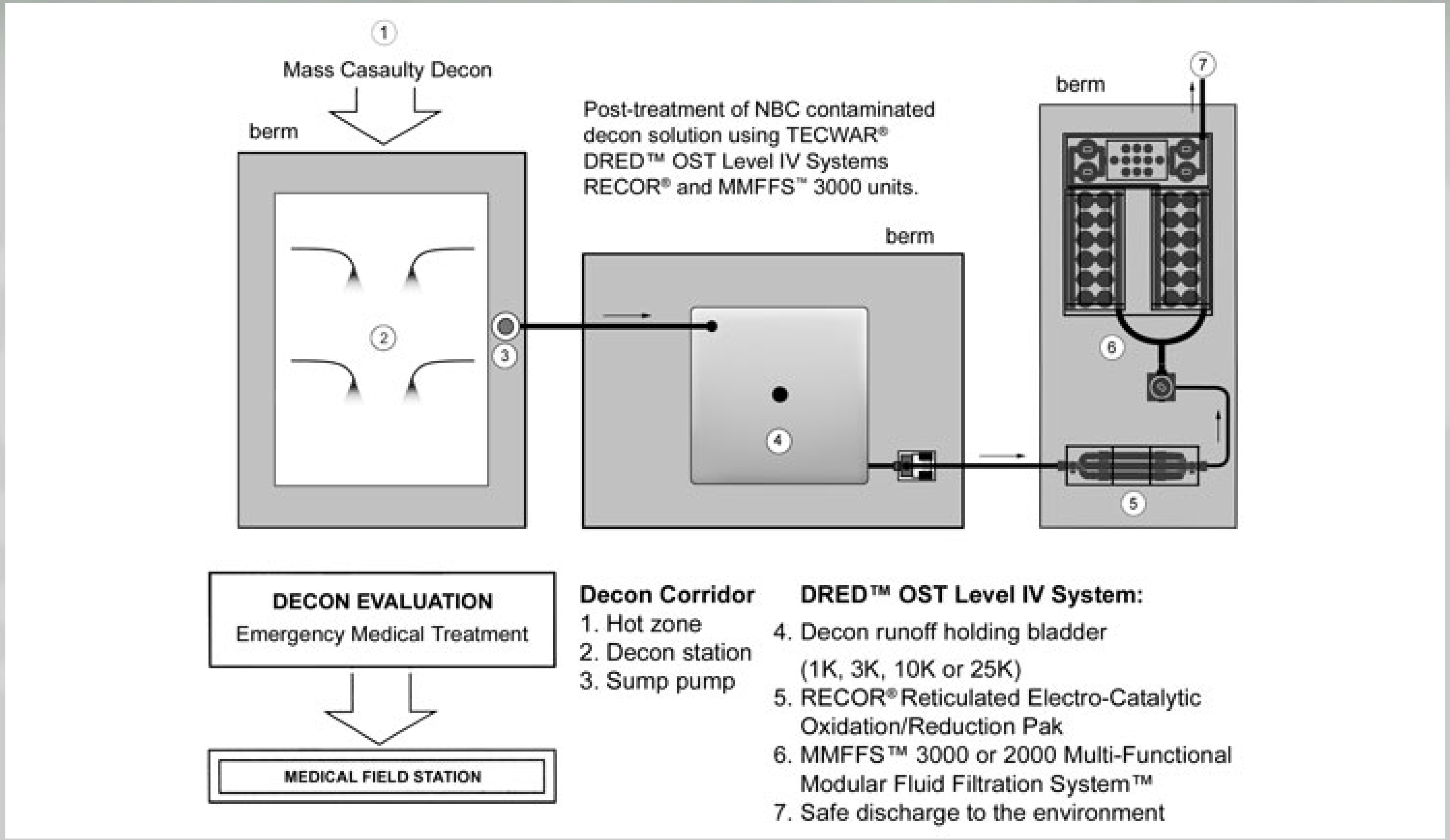
1. **Capture, contain, treat and dispose on-site** – minimizes first responders liability, mitigates environmental impact, avoids risk of spreading contamination during transport and allows uninterrupted decontamination of victims

2. **Equipment Profile**
   1. Portable
   2. Modular
   3. Scalable
   4. User Friendly/Minimal Technical-Operational Training
   5. Disposable Components
   6. Adaptable to any Decontamination Corridor

Decontamination runoff treatment system components

1. 1K pillow tank with all fittings, vents and adaptors to accomadate ¾", 1", 2" feed hose
2. Berm for pillow tank
3. 10' section of 2" hose
4. Diesel powered 125 poly pump 2" inlet and outlet
5. 10' section of hose
6. Berm for DRED™ OST System
7. RECOR® Reticulated Electro-Catalytic Oxidation/Reduction Pak
8. 10' section of hose
9. Tri-Flo bag filter
10. 10' section of hose
11. MMFFS™ 3K Multi-Functional Modular Fluid Filtration System™
12. 30' section of hose

Decontamination corridor footprint



Decon Runoff Treatment Process Flow

STAGE I

CONTAINMENT BAG WITH CONTAMINATED DECON SOLUTION

Calcium Hypochlorite
HTH
.5% topical application

STAGE II

PRE-FILTRATION

Tri-Flow Pre-Filtration

50-25-5 MICRON
SOLIDS
PARTICULATES
TSS

STAGE III

ECR

Neutralize HTH
Heavy metals Adsorption
Microorganisms inactivated

STAGE IV

Filtration Systems CONTACTORS

NBC
Inorganic / Organic Contaminants

STAGE V

POLISHER BANK I

5 MICRON
FILTRATION

Organic Contaminants

STAGE VI

LIFE® REACTOR

(Liquid Internal Filtration Effect)

(CONTACTOR SUPPORT)

STAGE VII

POLISHER BANK II

1 MICRON
FINAL FILTRATION

Organic Contaminants

Complete Decon Corridor

Conclusion

- How prepared is the organization to respond to a strike scenario involving a mass casualty NBC incident and subsequent decontamination operation?
- An effective response requires a coordinated plan for first responders and support personnel that is based upon pre-positioned assets.
- Training strategy must include realistic mass casualty drills and environmental impact of response operations
- Budgets / Assets must include a disaster response plan addressing all of the above
- Procurement Strategy must be streamlined to support mass casualty incidents

?
Are we ready

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TACTICAL ENVIRONMENTAL COMPONENTS - WATER ASSET RECOVERY

Tactical Water Purification Systems

- Military Field Applications
- Potable Water for Disasters
- Emergency Water Supply
- NBC Decontamination

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

Strength through Industry & Technology

National Defense Industrial Association

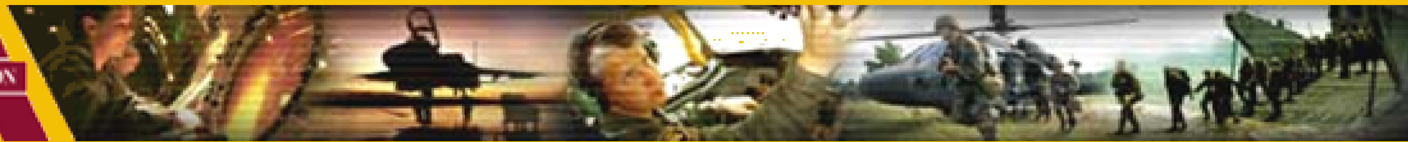
NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

"The Premier Defense Association!"

The Voice of the Industrial Base

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION



Strength through Industry & Technology

Vision

America's leading Defense Industry association promoting National Security

Mission

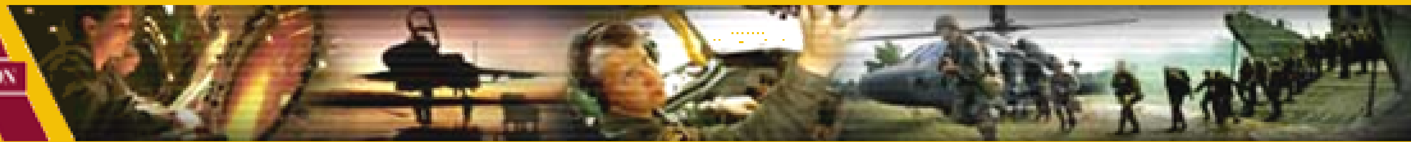
- **ADVOCATE: Cutting-edge technology and superior weapons, equipment, training, and support for the War-Fighter and First Responder**
- **PROMOTE: A vigorous, responsive, Government - Industry National Security Team**
- **PROVIDE: A forum for exchange of information between Industry and Government on National Security issues**

"If I were inviting a colleague to join, I'd say the most compelling reason is the prestige of NDIA membership." *-- NDIA member*

The Voice of the Industrial Base

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

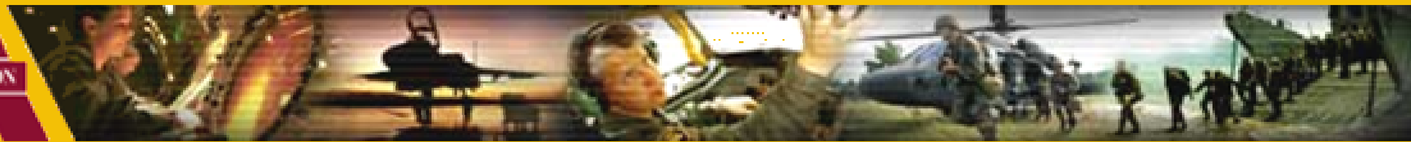
Strength through Industry & Technology



CBRN Activities

✓ C-B Coll Pro Conf & Exb	Jun 21-23 '05	Monterey
✓ S&T / C-B Info Systems	Oct 24-28 '05	Albuquerque
✓ SOCOM CBRN Conf	Dec 6-8 '05	Tampa
✓ C-B Individ Protection	Mar 7-9 '06	Charleston
✓ JPEO CBD APBI	Apr 10-11 '06	Wash, DC
✓ WWCC	27-29 Jun '06	Leonard Wood

www.ndia.org



New Events

- ✓ **Joint Improvised Explosive Device Defeat (JIEDD) Task Force**
  Jan 24-25, 2006 — Washington, DC

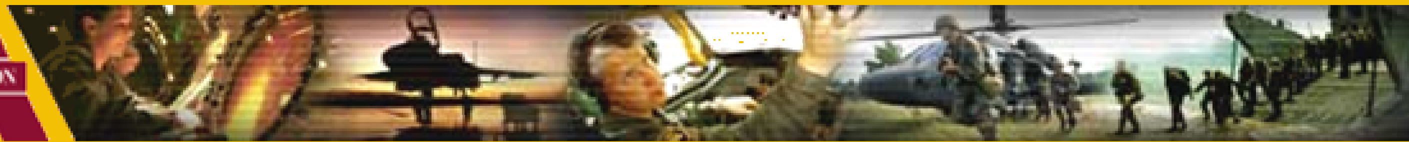
- ✓ **Marine Corps Systems Command APBI**
  Apr 12-14 — Baltimore, MD

Homeland Security / Defense

- ✓ **Homeland Security Symposium & Exhibition**
  Mar 29-Apr 1, 2006 — Arlington, VA

- ✓ **Defense Industrial Base Critical Infrastructure Protection (DIB/CIP) Symposium & Exhibition**
  May 9-11, 2006 — Miami, FL

www.ndia.org



Divisions

The vehicles through which members get involved……

30 Total: 25 - Operations, 5 - Government Policy

Populated by corporate member volunteers - a few government members

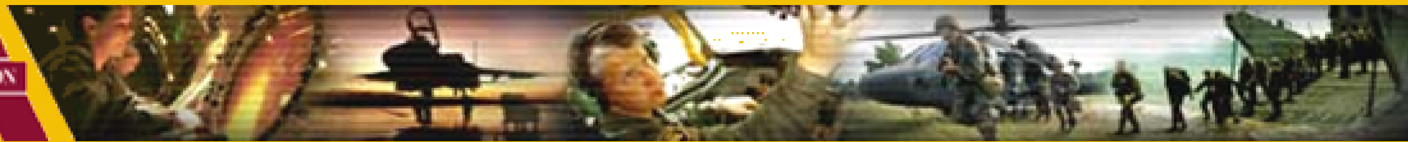
Nationally oriented - all chartered – DoD sponsors

Studies, conferences, seminars, meetings & symposia

Strive for revenue neutrality

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

Strength through Industry & Technology



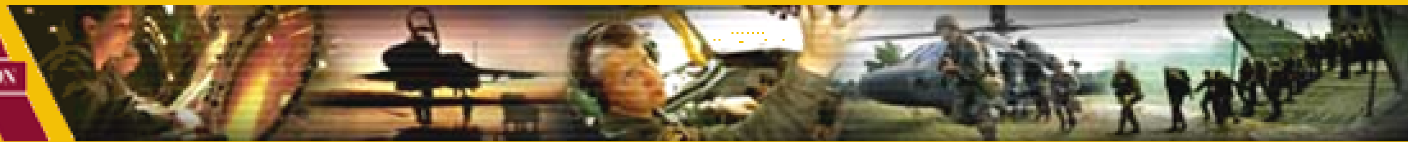
Manufacturing Division

- ✓ Advocate national support for defense manufacturing
- ✓ Identify impediments to achieving greater US defense manufacturing excellence; propose solutions
- ✓ Spotlight promising technologies & processes
- ✓ Engage in manufacturing study efforts
- ✓ Conduct forums designed to highlight defense manufacturing issues, achievements & challenges
- ✓ Promote advancements in defense manufacturing capabilities

bbates@ndia.org

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

Strength through Industry & Technology



National Defense Industrial Association

NDIA

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

"Your Premier Defense Association!"

The Voice of the Industrial Base

Responding to the Terrorist CBRN Threat: “Preparation or Panic”

First Bite:

Utilizing Medical Surveillance to Identify CB Threats

Andrew Behar

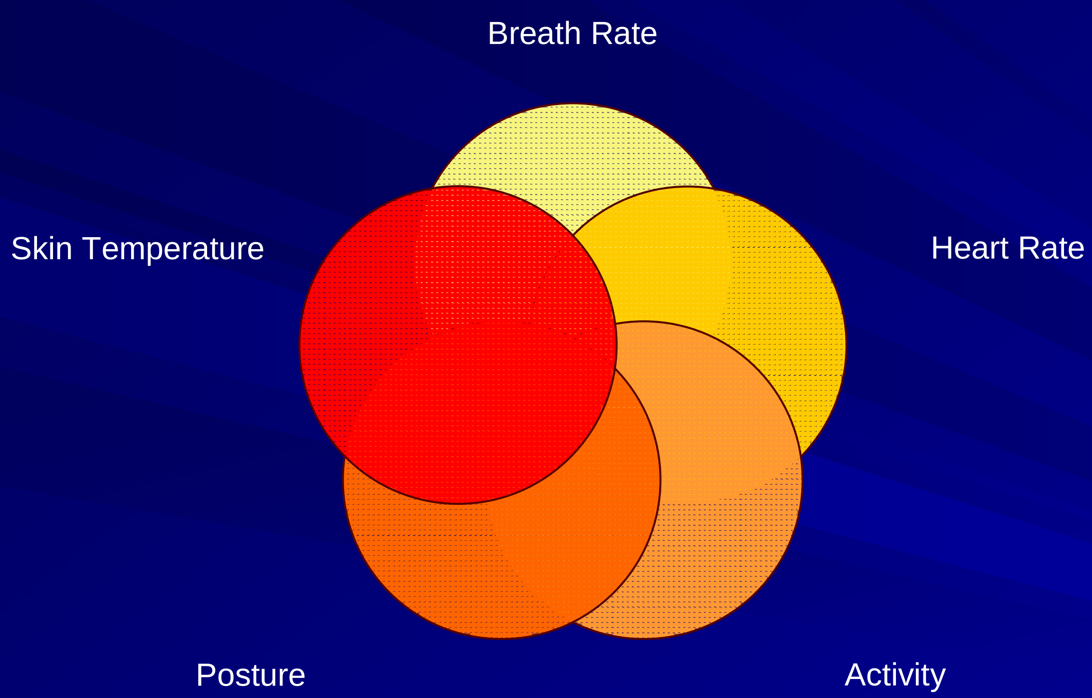
President

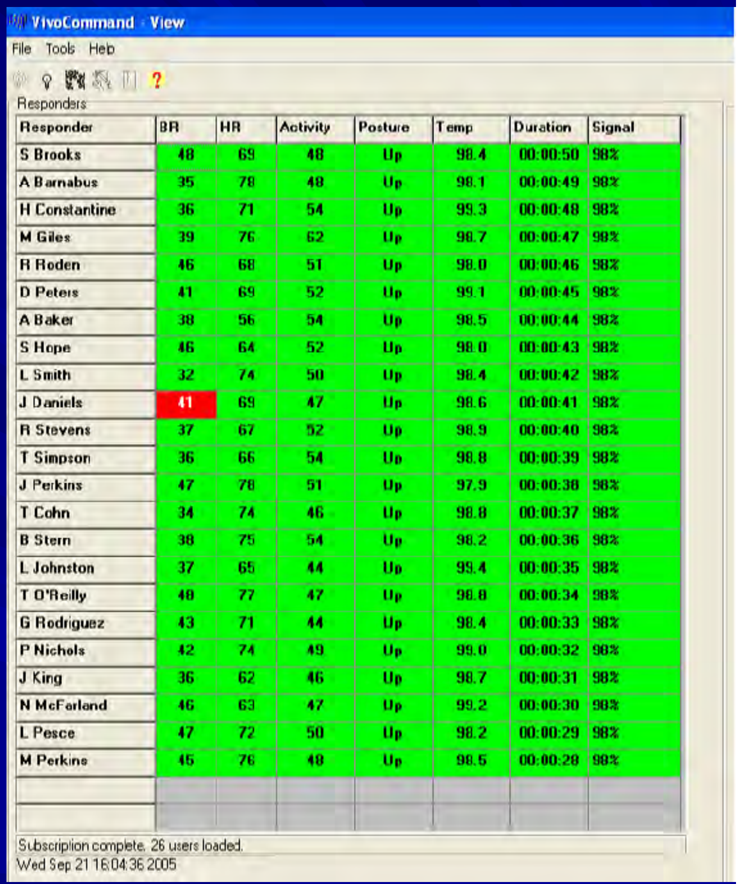
VivoMetrics Government Services

First Bite

- Physiologic signature at the first moment of exposure to a chemical or biological agent
  - Anthrax, Small Pox, Sarin, VX, Plague, Ebola, Botulinum Toxin and other toxic agents.
- This would present as changes in respiratory, cardiac, posture, activity and temperature
- Presently there is no correlated data showing physiologic reaction to CB exposure
  - Animal studies need to be done to provide correlates to human reactions.
  - Basic understanding of physiologic responses can provide an initial deployable system.

First Bite Signature





VivoCommand - View

File Tools Help

Responders

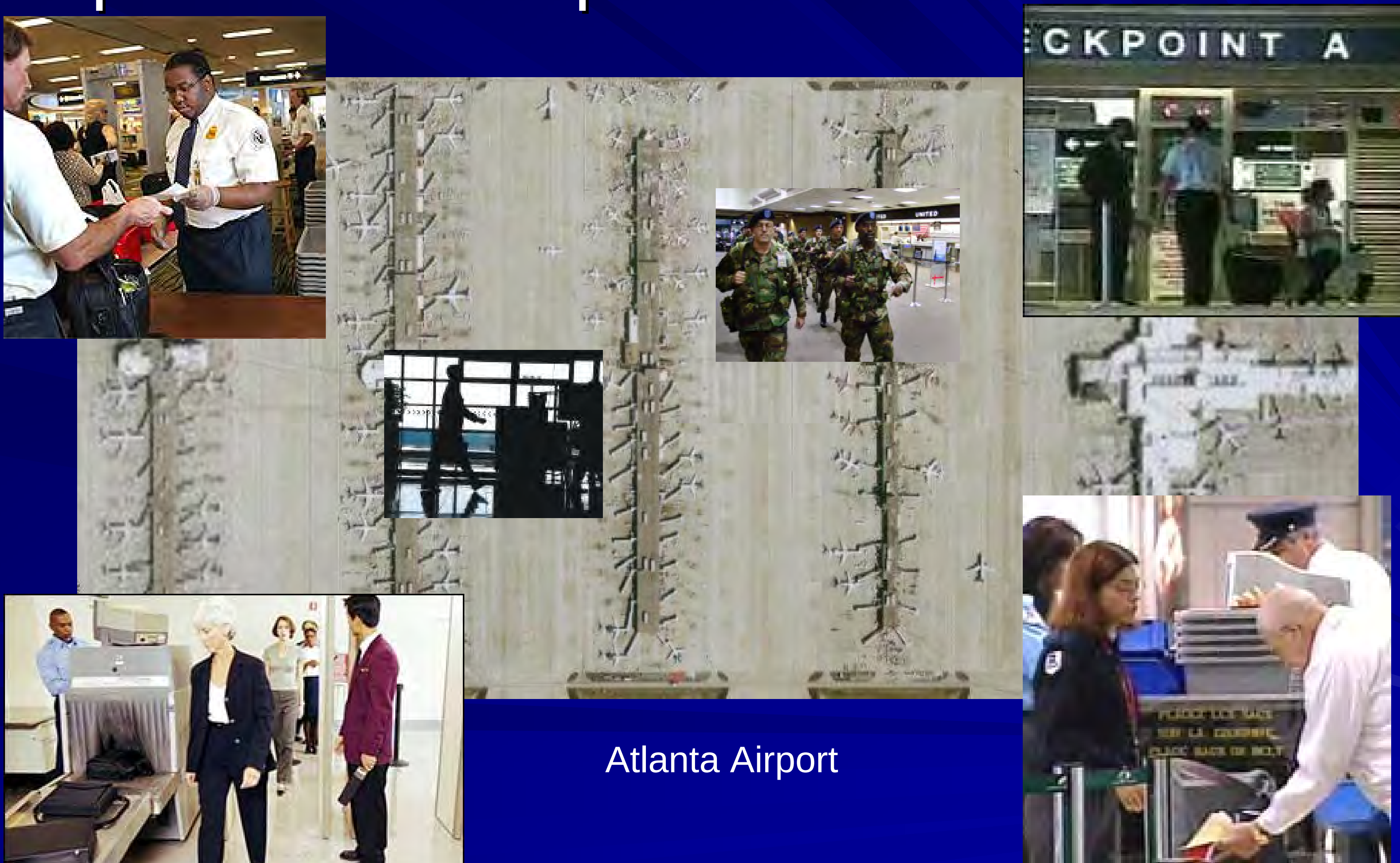
Responder	BR	HR	Activity	Posture	Temp	Duration	Signal
S Brooks	48	69	48	Up	98.4	00:00:50	98%
A Barnabus	35	78	48	Up	98.1	00:00:49	98%
H Constantine	36	71	54	Up	99.3	00:00:48	98%
M Giles	39	76	62	Up	98.7	00:00:47	98%
R Roden	46	68	51	Up	98.0	00:00:46	98%
D Peters	41	69	52	Up	99.1	00:00:45	98%
A Baker	38	56	54	Up	98.5	00:00:44	98%
S Hope	46	64	52	Up	98.0	00:00:43	98%
L Smith	32	74	50	Up	98.4	00:00:42	98%
J Daniels	41	69	47	Up	98.6	00:00:41	98%
R Stevens	37	67	52	Up	98.9	00:00:40	98%
T Simpson	36	66	54	Up	98.8	00:00:39	98%
J Perkins	47	78	51	Up	97.9	00:00:38	98%
T Cohn	34	74	46	Up	98.8	00:00:37	98%
B Stern	38	75	54	Up	98.2	00:00:36	98%
L Johnston	37	65	44	Up	99.4	00:00:35	98%
T O'Reilly	48	77	47	Up	98.8	00:00:34	98%
G Rodriguez	43	71	44	Up	98.4	00:00:33	98%
P Nichols	42	74	49	Up	99.0	00:00:32	98%
J King	36	62	46	Up	98.7	00:00:31	98%
N McFarland	46	63	47	Up	99.2	00:00:30	98%
L Pesce	47	72	50	Up	98.2	00:00:29	98%
M Perkins	45	76	48	Up	98.5	00:00:28	98%

Subscription complete. 26 users loaded.
Wed Sep 21 16:04:36 2005

Multi-parameter physiologic algorithm fuses 5 vectors to determine health status

First Bite Signature Analysis

Monitoring garments worn by security personnel can provide data in real-time



Atlanta Airport

"Canary in a Coal Mine"

Atlanta Airport
"Normal" for Tuesday 11:00am
52 airport security personnel being monitored continuously

“Canary in a Coal Mine”

Atlanta Airport
“Warning” for Tuesday 11:22 am
3 officers showing 23% increased coughing and shortness of breath, elevated heart rates and “out of normal” activity

"Canary in a Coal Mine"

Atlanta Airport
"Alert" for Tuesday 11:26am
5 additional officers with increased wheezing, 2 supine with respiratory spasms and elevated HRV

This concept can be scaled

Atlanta
"The Pulse of the City"

LifeShirt worn by hazmat personnel can also improve first responder safety

The LifeShirt System

- Pharmaceutical trials
  - Pfizer, J&J, Schering Plough, Aventis, Takeda, GSK
- Academic Studies
  - NIH, Mayo Clinic, Yale, Johns Hopkins,
- Military
  - Air Force, Army, FLARE program, WRAIR
- Homeland Security
  - ODP Fire and Safety Grants
- Extreme environments
  - Aconcagua, Indy 500, Mount Rosa, Mount Everest, Sahara Ultra-Marathon: "Race Against the Planet"
- Over 120,000 hours of data collected in 150 studies

Responding to the Terrorist CBRN Threat: “Preparation or Panic”

First Bite:
Utilizing Physiologic Responses to CB Threats

Andrew Behar

President

VivoMetrics Government Services

Enabling Critical Infrastructure Protection with Low-cost Bioaerosol Alarms

Charles Call and Ezra Merrill

USSOCOM CBRN Conference and Expo
December 6-8, 2005

Overview

- The bio-terror challenge
- Approaches to address the problem
- AirSentinel bioaerosol alarm

The bio-terror challenge

MESOSYSTEMS

O'Hare Airport

The bio-terror challenge

MESOSYSTEMS

Kirtland AFB

The bio-terror challenge

MESOSYSTEMS

Baghdad **Baghdad "Green Zone"**

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Source: CNN.com http://www.globalsecurity.org/military/world/iraq/images/spot_baghdad__27aug02_zones.jpg

The bio-terror challenge

MesoSystems

Addressing the challenge…

- Four models (architectures)
- Operational effectiveness
- Cost of ownership

Four Options For Bio-threat Detection

- Do nothing
- Dry filters and laboratory PCR
  - BioWatch
  - BASIS
- Integrated systems
  - DoD- JBPDS and JPS
  - USPS- BDS
  - DOE- RAIDS
- Two-tier surveillance
  - Alarm (e.g., AirSentinel) + PCR

Do Nothing Model

- Cross your fingers and hope nothing happens in your building
- Building occupants are the ‘canaries’
- Response time is very slow
- Cost is attractive
- Damage would be catastrophi

Dry Filters + PCR

MESOSYSTEMS

- Key Features
  - Response time is slow
  - False alarm rate is very low
  - Sensitivity is relatively high
  - Probability of detection is relatively high
- Cost
  - Initial cost is low
  - Operating cost is very high
  - Total cost of ownership is high

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Integrated Systems

- Key Features
  - Response time is fast
  - False alarm rate is low
  - Sensitivity is very high
  - Probability of detection is high
- Cost
  - Initial cost is high
  - Operating cost is moderate to high
  - Total cost of ownership is high

Two-tier surveillance: Alarm + PCR

MESOSYSTEMS

Key Features

- Response time is fast
- False alarm rate is low
- Sensitivity is moderate
- Probability of detection is high

Cost

- Initial cost is low
- Operating cost is low
- Total cost of ownership is low

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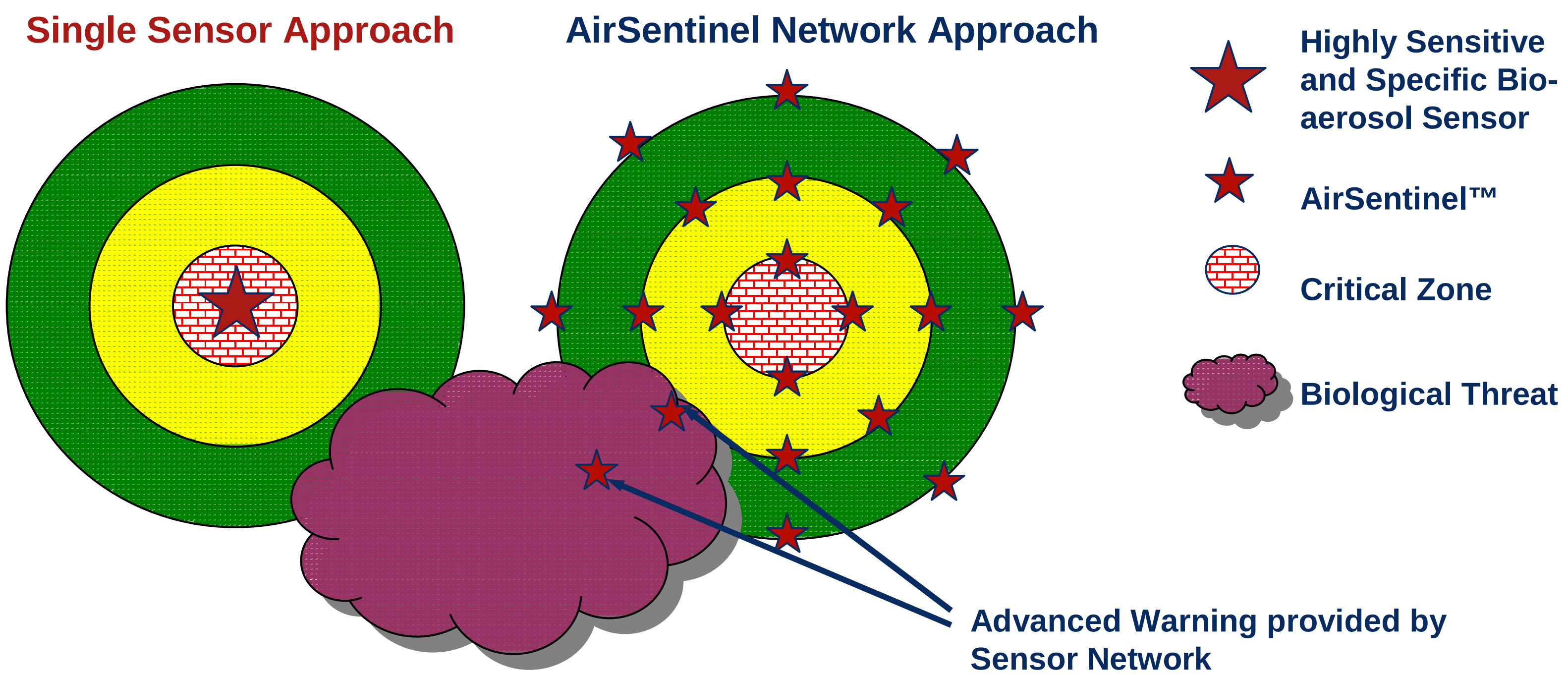
Deployment Model



- A distributed network of inexpensive, real-time biological sensors gives advanced warning of a biological agent release
- Deployment is directly analogous to smoke alarm and response in large buildings (investigate before evacuate)

Cost Modeling Assumptions

MesoSystems

- Cost of integrated system is $250,000/unit
- Cost of DFU or Alarm (e.g., AirSentinel®) is $1000/unit
- All equipment life is 5 years (straight line depreciation)
- Cost of assay is $250/suite of agents (includes all labor costs to collect sample, run assays, report results)
- Cost of maintenance contract is 10% of capital cost
- 200,000 sq. ft. commercial office building with 4 air handler zones and one mailroom

Cost Modeling Results: Base Case

MesoSystems

	DFU + PCR	Integrated Systems	Alarm + PCR
# of Units	5	5	200
# of Assays / year	1,000	250	125
Cost / Sensor Point	1,000	250,000	1,000
Cost / PCR Assay	300	300	300
Initial Cost	$5,000	$1,250,000	$200,000
Operating Cost / year	$300,500	$200,000	$57,500
Cost of Ownership	$301,500	$450,000	$97,500
Annual Cost / SQ.FT.	$1.51	$2.25	$0.49

Cost of Ownership and the cost/sq. ft. of protecting commercial office space is significantly lower for "Alarm + PCR" model.

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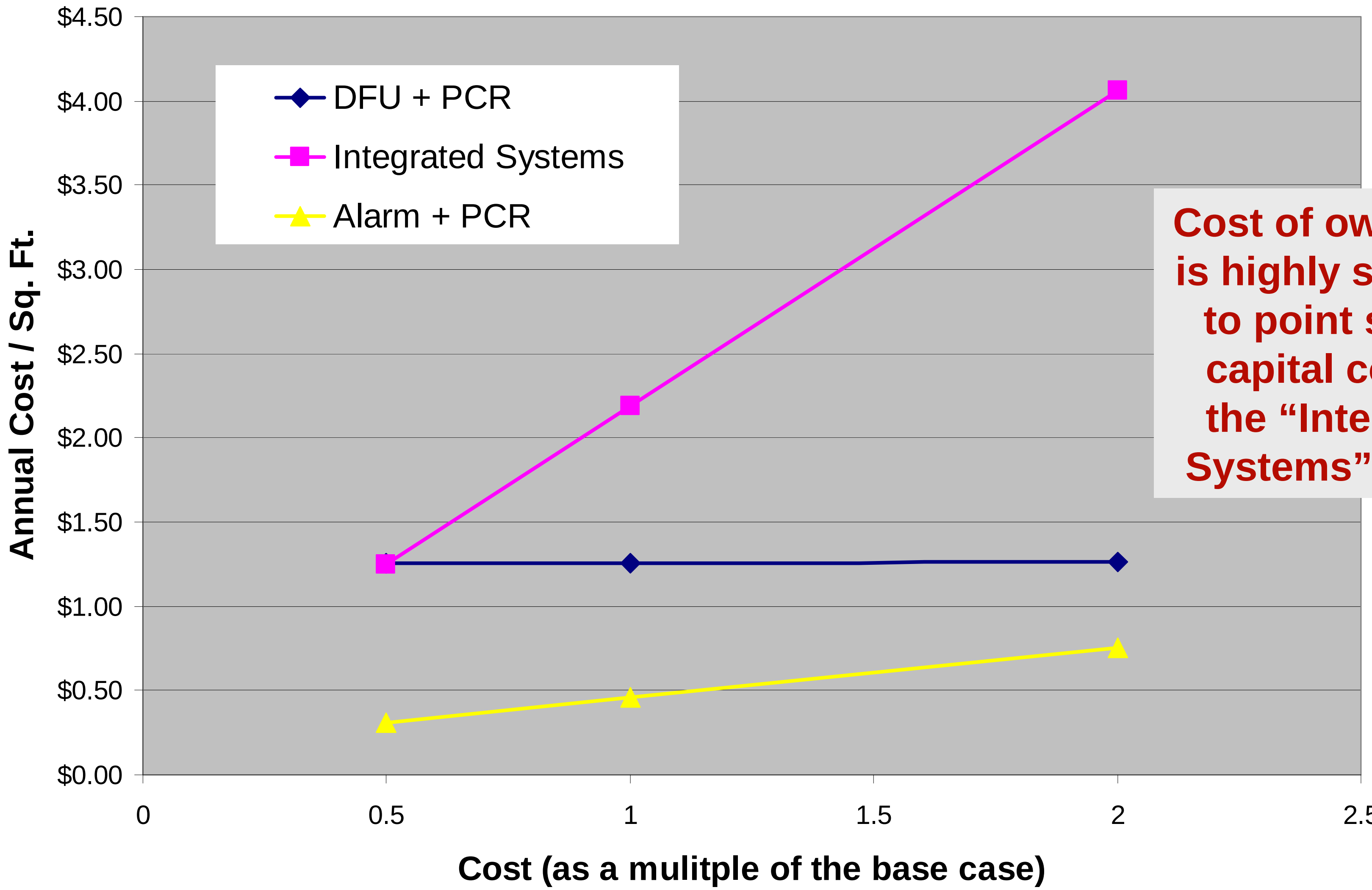
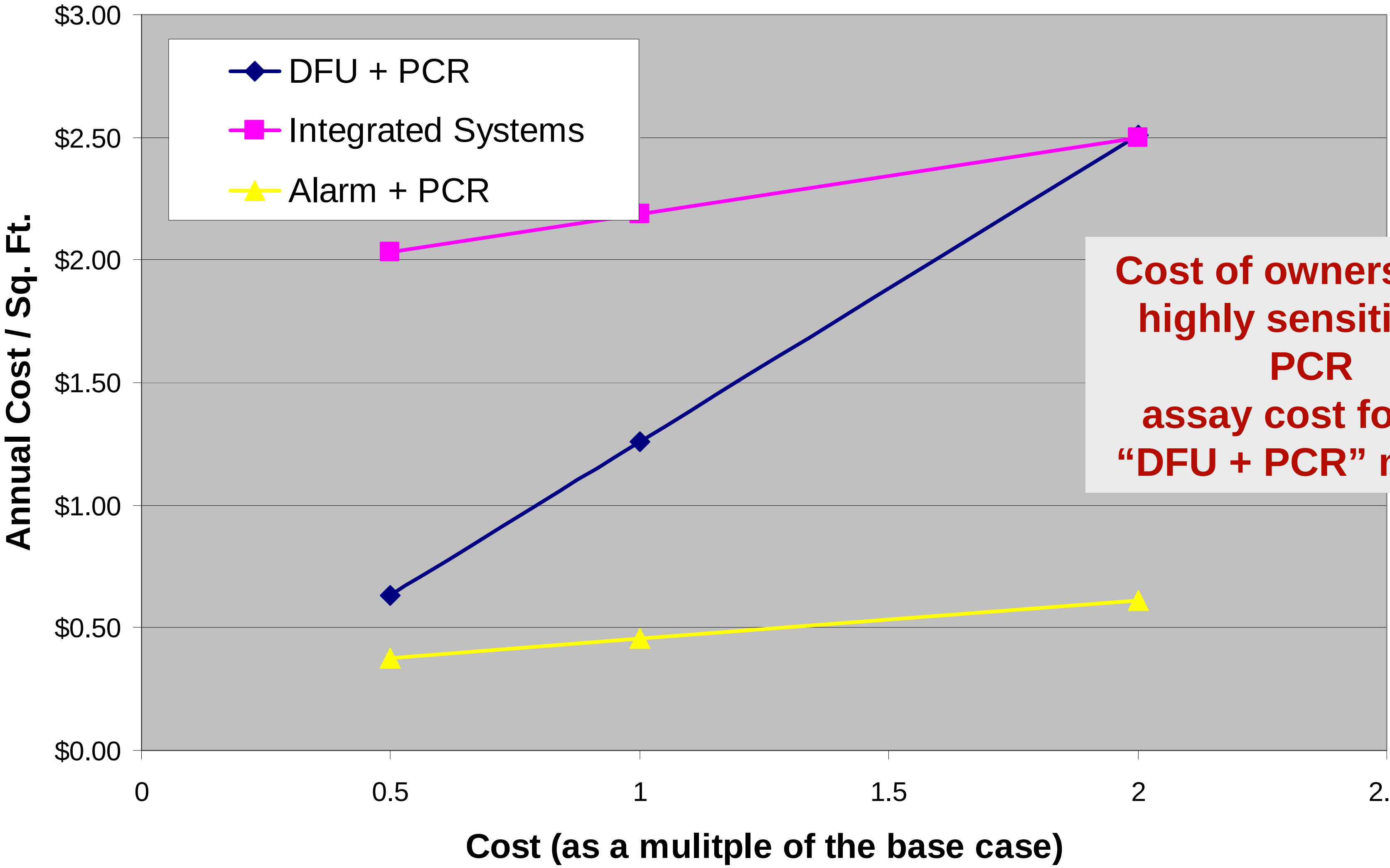
Sensitivity to Capital Cost



Cost of ownership is highly sensitive to point sensor capital cost for the "Integrated Systems" model.

Sensitivity to PCR Assay Cost



Cost of ownership is highly sensitive to PCR assay cost for the "DFU + PCR" model.

AirSentinel® Bioaerosol Sensor

MESOSYSTEMS

Early warning bio-threat sensor for building security

Detects concentration changes in airborne biological particles

BioBadge™
Removable Air
Sample Disk

Current Capabilities

- Wall/ceiling mounted
- Integrated sample capture capability
- Sensor network can communicate with/through building control system
- Output compatible with most building HVAC communication/

  control standards (LON, BACNet, etc.)
- Wireless networking option

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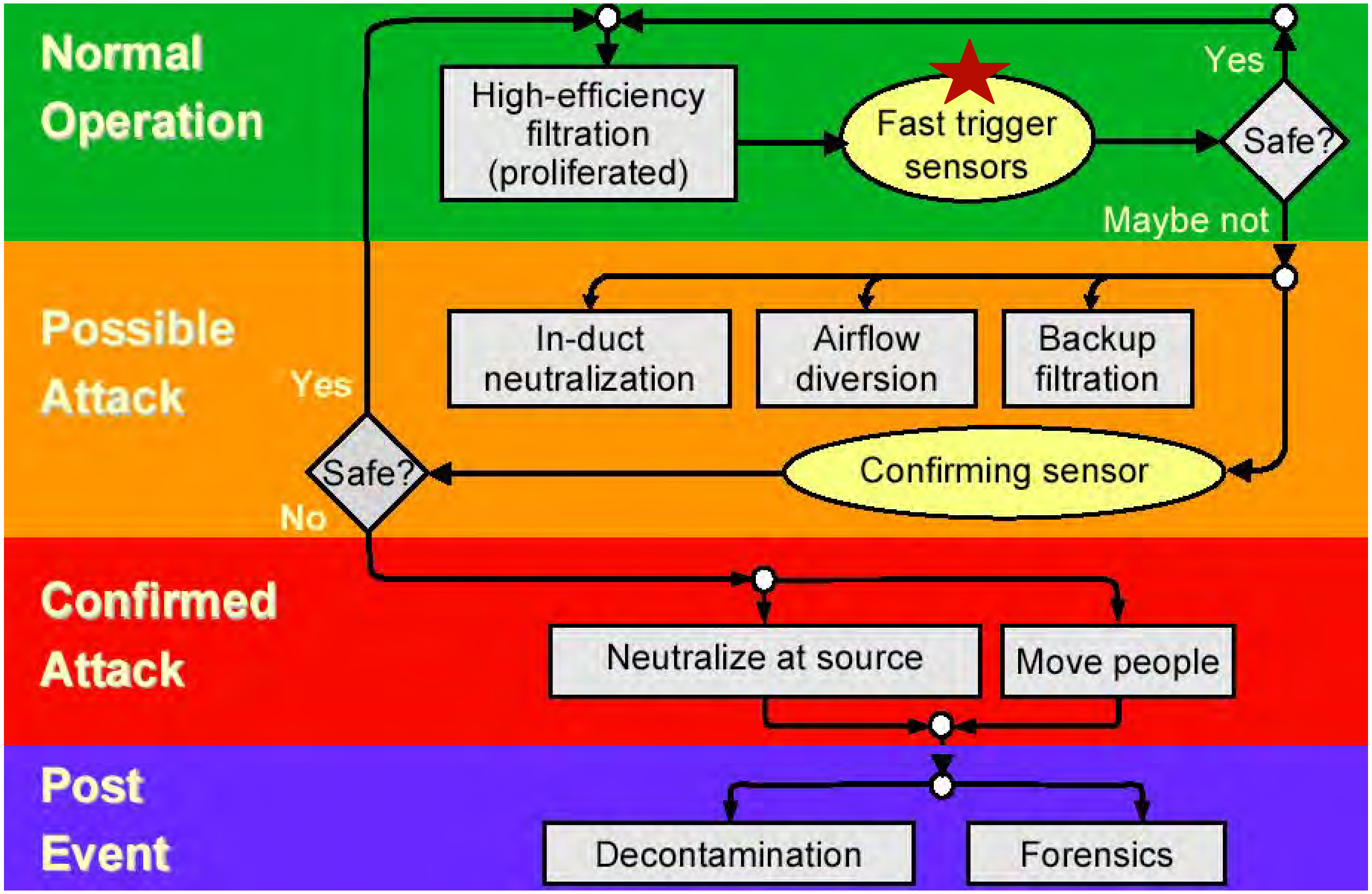
How the Sensor Is Used

A model for implementing bioaerosol sensors as part of a anti-terror building protection strategy:



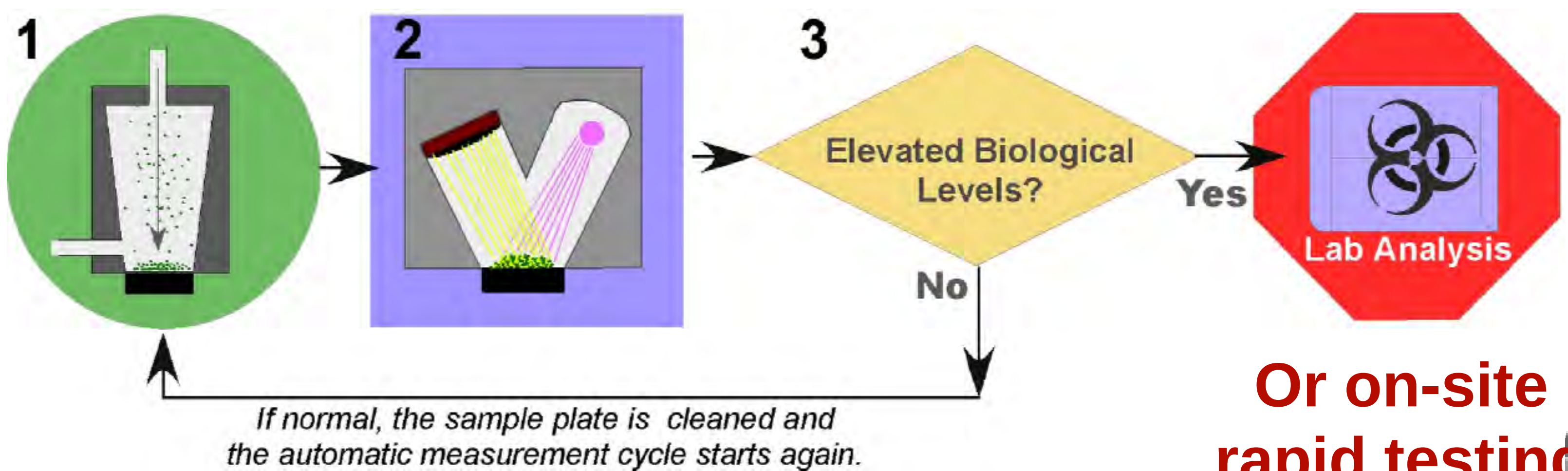
Source: DARPA

How the Sensor Works

1. Indoor air is pumped into an impactor where particles are collected on sample plate.

2. Particles on the plate are exposed UV light. A photo detector measures the florescence of particles. The fluorescence intensity in wavelengths associated with biological particles is measured.

3. If elevated levels of fluorescence (associated with biological particles) is detected, a retrievable sample is taken for lab analysis. A silent alarm indicates the need for sample collection and can trigger "low regret" protective measures.

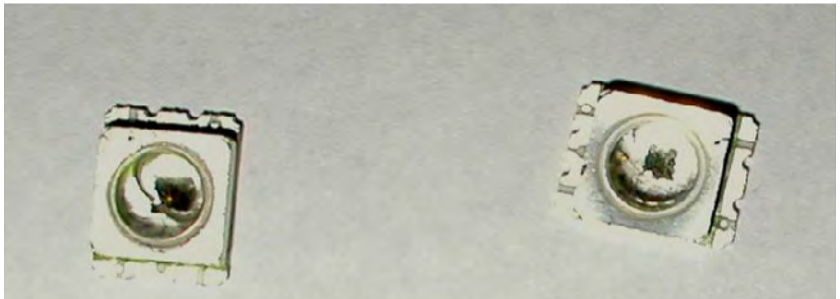


Or on-site rapid testing

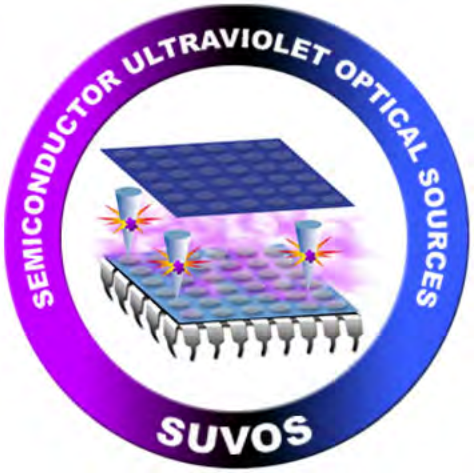
UV Light Emitting Diodes (LEDs)

MesoSystems

- Developed with funding from DARPA's SUVOS program
- 365 nm from Nichia or 340 nm narrow band UV light output (Cree or SET)
- 280 nm narrow band LED's (Sensor Electronic Tech.)



Source: Cree, Inc.



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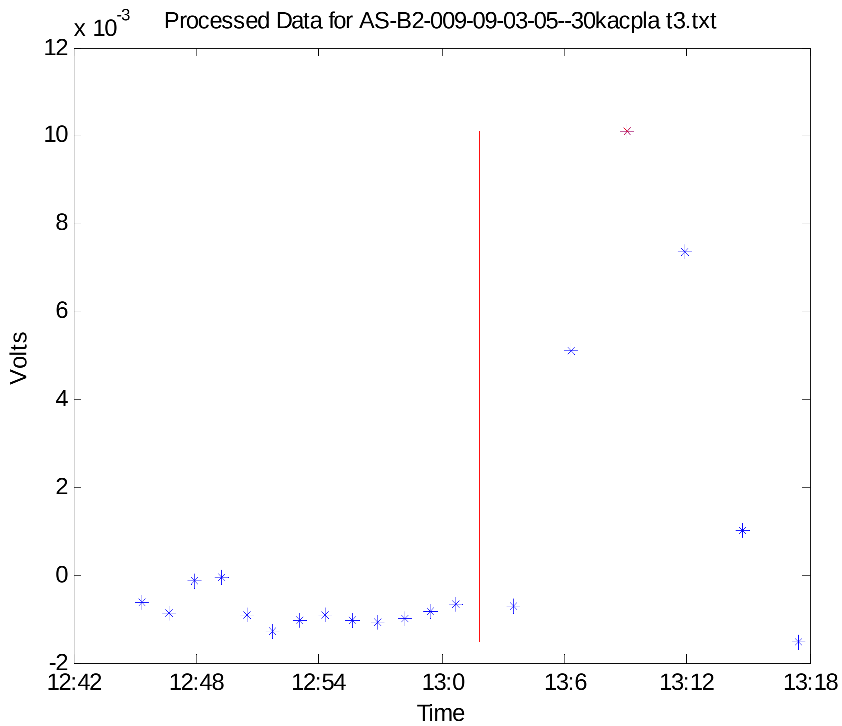
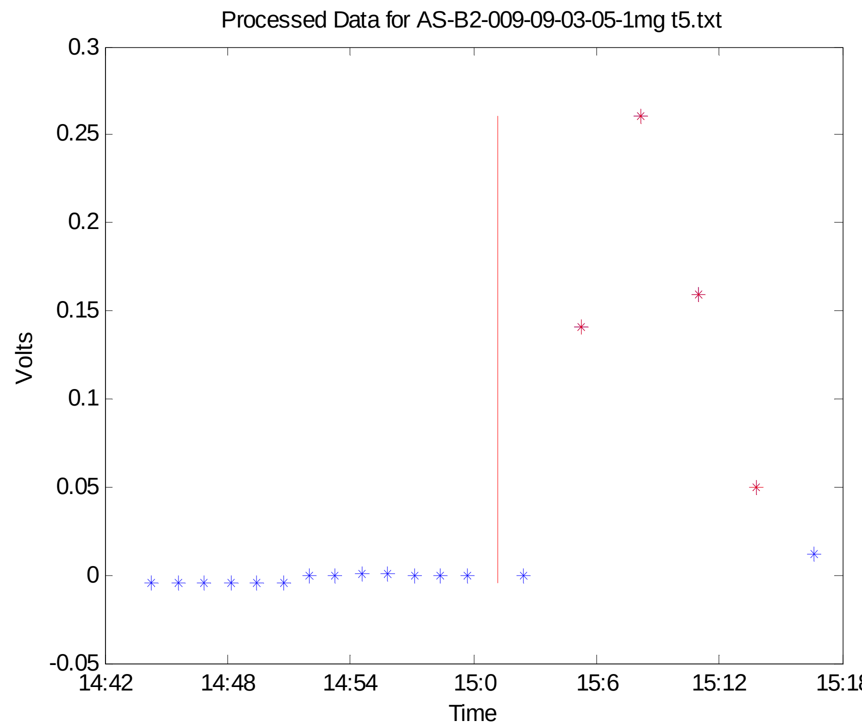
Signal respose to releases





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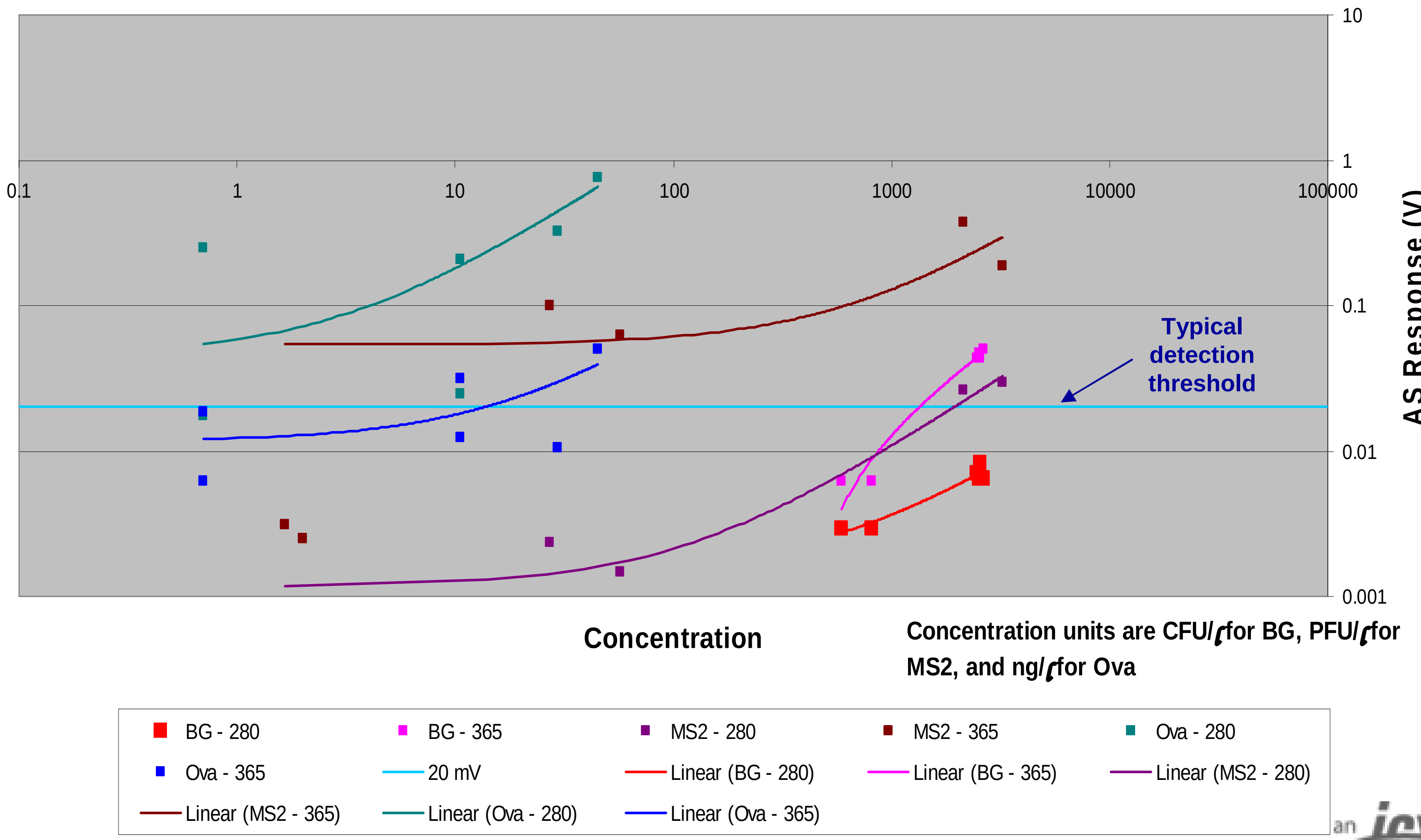
Dose Response Curves

AS Testing, Battelle HVADS, Tests 1-26, 20-22 June 2005, AS-19 (280) & AS-24 (365)
Uses HVADS Preliminary Referee Data, Norm. to Average PMT



Results from June Testing at BMI

MesoSystems

"Dose-response curves" indicated sensitivity ranges are expected:

► Bg spores:	1000-3000 cfu/l
► Erwinia cells:	100-1000 cfu/l
► Ovalbumin:	0.1-10 ng/l
► MS2 virus:	1000-10,000 pfu/l

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Cost Targets

Model:	Cost:*	When available:
Prototypes (Gen-2)	$5k - $10k	Now
Pre-production	$3-5k	3/06
Production	$500-$2,000	3/07

*** Exact cost will depend on level of customization, manufacturing volumes, etc.**

Path to Deployment

- NSERP agency testing in Q405
- SafetyACT application submitted in Q1O6

US Federal Funding Acknowledgements

MesoSystems

- DARPA/SPO
  - Paul Benda (PM Pentagon Shield)
- DTRA
  - Larry Pollock and Ngai Wong (CBDIF Program)
- Marine Corps
  - Adam Becker
- DHS (through Sandia National Labs)
  - Susanna Gordon (PM PROACT)
- DARPA/MTO
  - John Carrano (indirect support from SUVOS program)

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Take home messages

MesoSystems

- The practical approach:

  Very low-cost Tier 1 biosensors coupled to very low FAR Tier 2

- Model fits for the tactical force:

  JBTDS+JBAIDS

- Model fits for chemical detection

npany

Mitigating the Effects of Alleged EBOLA Attacks at Multiple Airports

Dorothy A. Canter, Ph.D.
JHU Applied Physics Laboratory

USSOCOM CBR Conference and Exhibition
Tampa, FL
December 8, 2005

z11.05.35.1;PP

Presentation

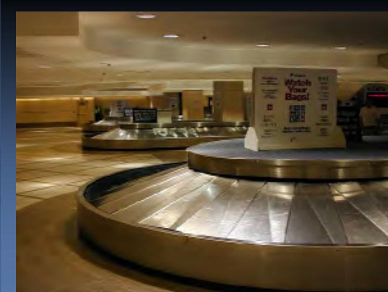
- USSOCOM Scenario/Presentation Assumptions
- Ebola Virus Information
- Ebola Notional Incident Timeline
- Ebola Best Case Decontamination Timeline
- Ebola Notional Public Health Timeline
- Recommended Preparedness Activities
- Potential Roles for Military in Responses to Bioterrorism

USSOCOM-Specified EBOLA Scenario

- **Reports on blogs/websites that “Freedom Fighters” infected airline passengers at O’Hare, Logan, Hartsfield and Heathrow Airports with Ebola virus**
- **Police, FBI, TSA find crude devices in airports**
- **Devices, environmental samples sent to labs for analysis**
- **Boston police officer reports over nonsecure radio “We found the bioweapon in the trash..”**
  - picked up by media

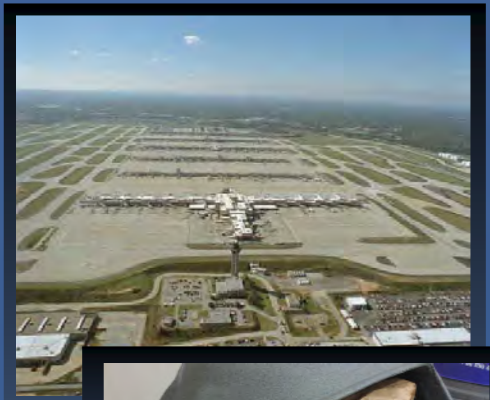
USSOCOM-Specified EBOLA Scenario

- **Delta Flight 20, low on fuel, told to hold approach pattern to Frankfurt Airport and await further instructions**
- **Leader of Hartsfield baggage handlers union tells members to stop unloading aircraft**
- **CNN reporter, wearing respirator, broadcasts *"Breaking News"***



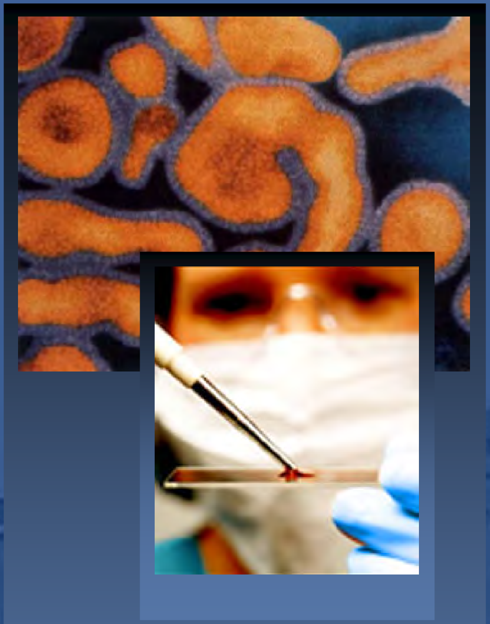
My Assumptions

- Releases occur at same time at all airports
- Blogs/websites report incidents within one hour of releases
- Devices found in trash of food court area in secure area of terminal at all four airports
- Delta flight originated at Hartsfield Airport
- Incidents will yield confirmed attacks at Hartsfield, Logan and Heathrow Airports; O'Hare incident will be hoax
- No sensitive electronic equipment (e.g., scanning equipment) affected by attacks
- Best case response based upon significant preparedness and response planning/training



EBOLA Virus

- Fragile, RNA-containing Filovirus; causes Ebola Hemorrhagic Fever (EHV)
- Incubation period of 2-21 days
- Symptoms include sudden onset of fever, weakness, muscle pain, headache; followed by vomiting, diarrhea, rash, impaired kidney/liver function, and internal/external bleeding
- High mortality – no known treatment, only supportive medical care



EBOLA Virus

- Human-to-human transmission through contact with bodily fluids
  - Risk greatest during latter stages of disease when viral loads highest
- Cases must be isolated from other patients
  - Soiled clothing/bed linens must be disinfected
- Health care workers must use strict barrier nursing techniques
  - Non-disposable protective equipment must be disinfected prior to re-use
- Airborne transmission uncertain

EBOLA Virus

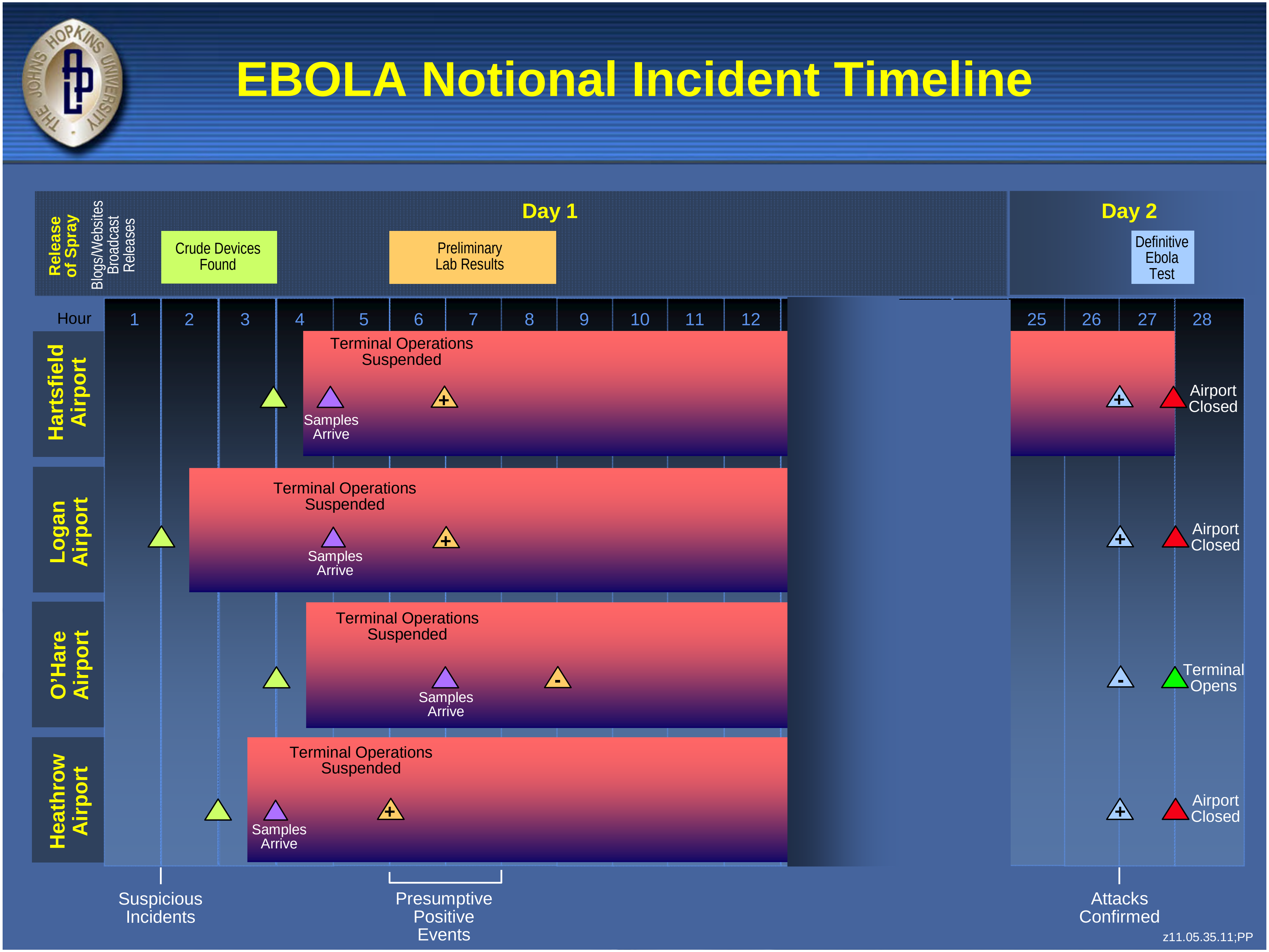
Facts About EBOLA Incidents

- **No potentially exposed passengers, airline or airport workers will become ill for about 2-21 days, if at all**
- **None of the above persons will be able to transmit the virus before becoming ill**
- **If anyone develops EHF, that person(s) will need to be isolated**
- **Fragile virus, if viable, will not live long in air or on nonporous surfaces (at most several days)**
- **No antimicrobial products registered by EPA for use against Ebola virus, but number of products are registered for use against viruses, including Vaccinia virus, on hard, non-porous sources**
- **Barrier nursing equipment available in CDC Strategic National Stockpile (SNS)**

Phases of EBOLA Airport Incidents

- **Suspicious Incidents**
  - Sufficient evidence to consider as credible threats, no analytical laboratory confirmation
  - Online reports + finding of devices
- **Presumed Positive Events**
  - Positive findings in PCR, virus isolation, antigen detection tests
    - Available within hours*
  - US analyses done at CDC, USAMRIID only – BL-4 facilities
- **Confirmed Attacks**
  - Definitive tests at CDC/USAMRIID yield positive findings
  - Results available within ½ to ¾ day*

Source: Tom Ksiazek, CDC


EBOLA Notional Incident Timeline
Release of Spray
Blogs/Websites Broadcast Releases
Crude Devices Found
Day 1
Preliminary Lab Results
Day 2
Definitive Ebola Test
Hour
1
2
3
4
5
6
7
8
9
10
11
12
25
26
27
28
Hartsfield Airport
Terminal Operations Suspended
Samples Arrive
Airport Closed
Logan Airport
Terminal Operations Suspended
Samples Arrive
Airport Closed
O'Hare Airport
Terminal Operations Suspended
Samples Arrive
Terminal Opens
Heathrow Airport
Terminal Operations Suspended
Samples Arrive
Airport Closed
Suspicious Incidents
Presumptive Positive Events
Attacks Confirmed
z11.05.35.11;PP

Other Notional Activities During Suspicious Incident Phase of Attacks

- Airport managers alert Mayors who alert Governors who alert Secretary, DHS, and President
- Airports give media interviews
- Delta flight diverted to US air base in Germany
- Hartsfield baggage handlers unload baggage after meeting with airport management and receipt of Fact Sheets and FAQs
- Airports on high alert globally

Other Notional Activities During Presumptive Positive Phase of Attacks

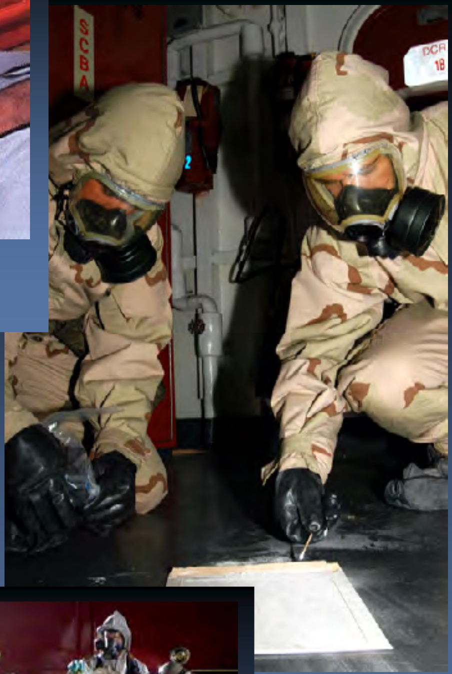
- US airports activate Incident Command System
- EOCs activated (EPA, CDC, HSOC); PFOs appointed by DHS
- Interagency Committee on Domestic Response Preparedness holds secure teleconference/prepares for next steps
- Decision to federalize National Guard units in affected cities if attacks are confirmed
- Continuing interactions among governmental units and airport management

Other Notional Activities During Presumptive Positive Phase of Attacks

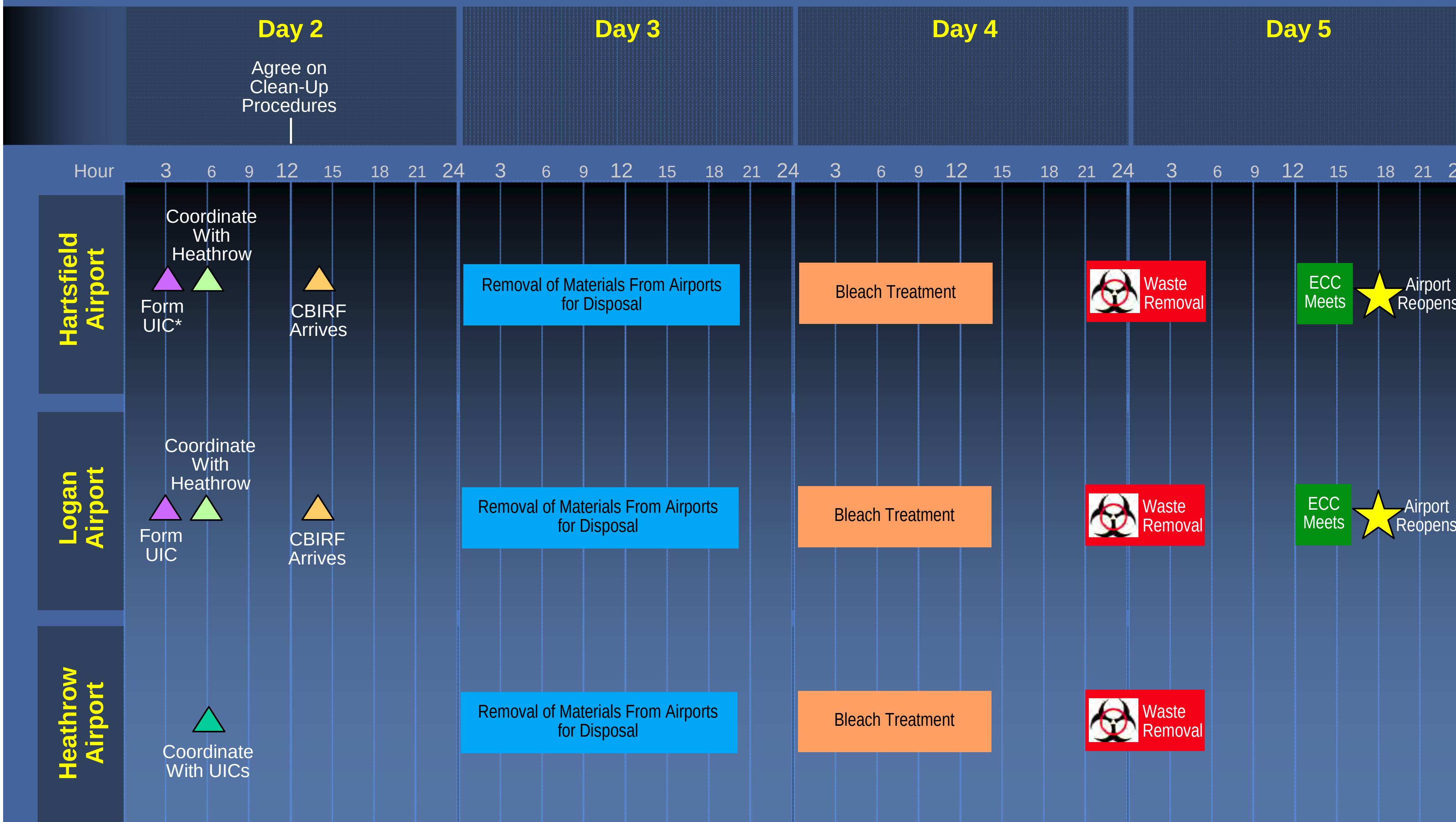
- Interactions among all airports
- CDC/local health departments confer on potential public health responses
- Continuing airport briefings of media, distribution of Fact Sheets/FAQs
- Delta flight lands at Hartsfield/passengers quarantined
- Airlines notify passengers/flight crews on affected planes

Responses to Confirmed Attacks

- Decontamination Activities
- Public Health Activities
- Forensic Activities
- International Coordination



EBOLA Best Case Decontamination Timeline



* Unified Incident Commands

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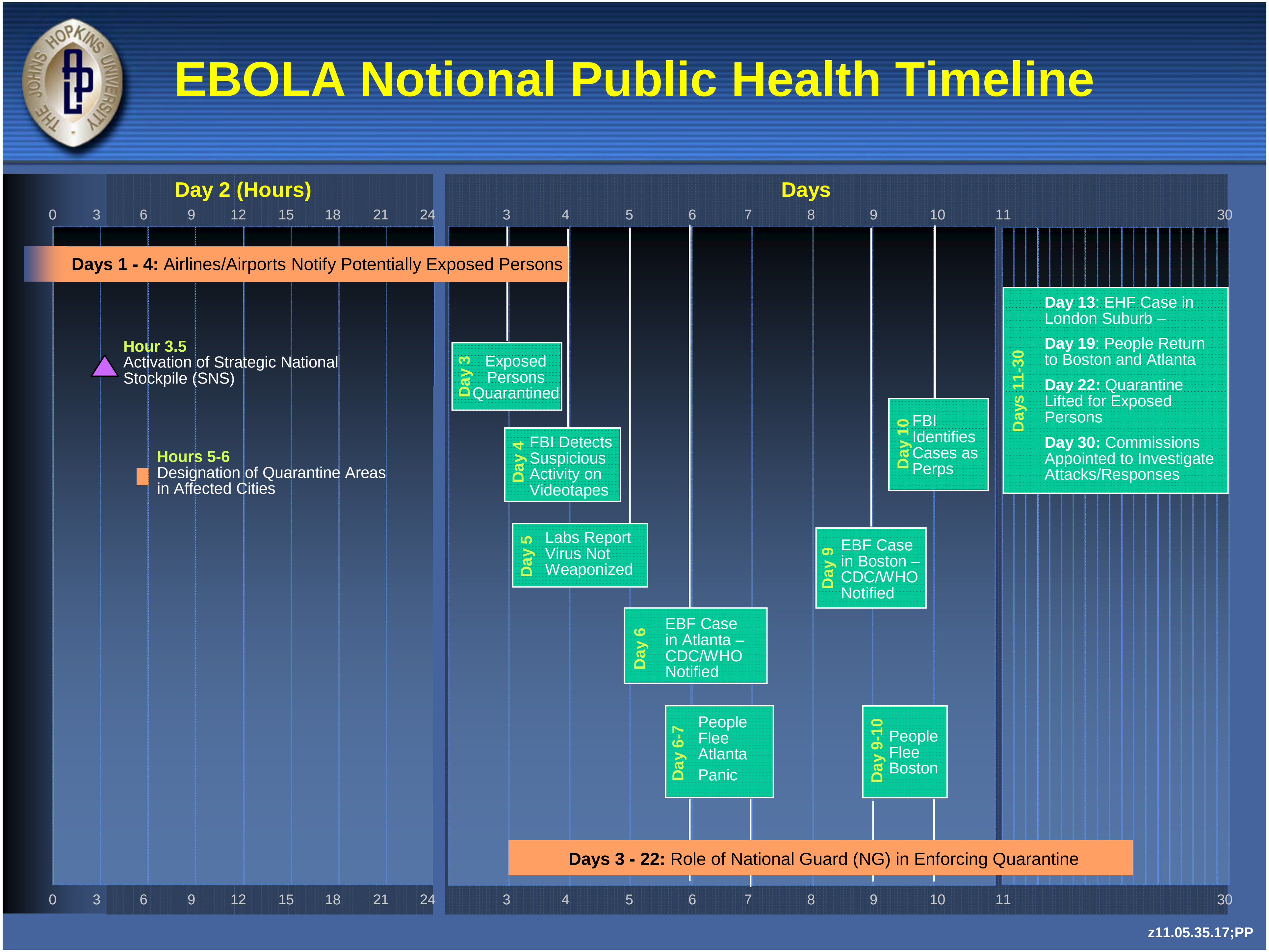
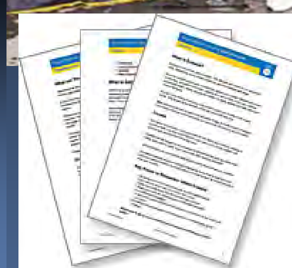

EBOLA Notional Public Health Timeline
Day 2 (Hours)
0 3 6 9 12 15 18 21 24
Days
3 4 5 6 7 8 9 10 11 30
Days 1 - 4: Airlines/Airports Notify Potentially Exposed Persons
Hour 3.5
Activation of Strategic National Stockpile (SNS)
Hours 5-6
Designation of Quarantine Areas in Affected Cities
Day 3
Exposed Persons Quarantined
Day 4
FBI Detects Suspicious Activity on Videotapes
Day 5
Labs Report Virus Not Weaponized
Day 6
EBF Case in Atlanta – CDC/WHO Notified
Day 6-7
People Flee Atlanta Panic
Day 9
EBF Case in Boston – CDC/WHO Notified
Day 9-10
People Flee Boston
Day 10
FBI Identifies Cases as Perps
Days 11-30
Day 13: EHF Case in London Suburb –
Day 19: People Return to Boston and Atlanta
Day 22: Quarantine Lifted for Exposed Persons
Day 30: Commissions Appointed to Investigate Attacks/Responses
Days 3 - 22: Role of National Guard (NG) in Enforcing Quarantine
0 3 6 9 12 15 18 21 24
3 4 5 6 7 8 9 10 11 30
z11.05.35.17;PP

Response Assumptions

- Significant preparedness and response planning, including regular training, has occurred in advance
- Teams are ready and equipment is pre-positioned
- Responses are 24/7
- Interagency coordination alive and well
- Effective audibles were called when needed at all airports and immediately communicated to other airports

Recommended Preparedness Planning Activities

- Fact Sheets and FAQs on biothreat agents available at all US airports
  - Cover public health, decontamination, and notification/management issues for top bioterrorism agents
  - Also distributed to First Responders, police
  - Regularly updated
- Coordinated preparedness and response training, including table tops
  - Address both public health and decontamination issues



Recommended Preparedness Planning Activities

Decontamination Related Activities

- Prototypical Health and Safety Plans (HASPs) for airports
- Designated areas of airport for detainment of persons potentially exposed to bio agents
- Guidance on decontamination procedures for various biothreat agents
- Availability of portable PPE decon units/pre-determined sites for their location

Recommended Preparedness Planning Activities

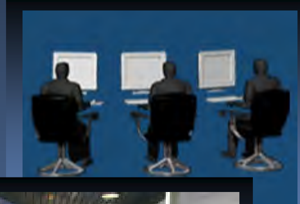
Decontamination Activities (cont'd)

- **Reachback**
  - **Current lists of contractors with demonstrated experience in bioagent decontamination, waste removal**
  - **Existing relationships with waste disposal facilities**
- **Templates for remediation action plans**
- **Creation of Technical Advisory Committee(s) to provide guidance to airports on terrorism incidents – both real and hoaxes**
  - **Possibly regional/national**

Recommended Preparedness Planning Activities

Interagency Committee on Domestic Response Preparedness

- **Purpose**
  - **Planning for improved responses to multiple domestic terrorist attacks with potentially catastrophic consequences**
    - **Research/Training/Coordination**
  - **Advisory role during actual responses**
- **Co-chaired by DHS, DOD, and DHHS**
- **Membership**
  - **Civilian federal agencies: DHS (OP, TSA, FEMA), EPA, CDC (NIOSH, NCID), NIH, DOT, FAA, FBI, CIA, DOS**
  - **DOD agencies: SOCOM, NORTHCOM, STRATCOM, others**
  - **State/local advisors**
  - **Member/surrogate from each agency - electronically connected at all times on secure equipment**



Potential Roles for Military in Responses to Bioterrorism

- Transport of samples to analytical labs
- Analysis of clinical/environmental samples
- Role of CBIRF/CST units in decontaminations
- Use of National Guard armories as potential quarantine centers/distribution of SNS meds
- Role for USSOCOM OCONUS in identifying/neutralizing terrorist cells

Need to be Prepared for the Next Bioattack, Not Just the Last One!

If you have seen one bioattack, you've seen one bioattack

We need to be complete and flexible to respond to asymmetric attacks

Contact Information

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Applied Physics Laboratory

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Scenario Based Logic Modeling Tool for Planning and Mitigation of Terrorist Events

John (Pat) Daugherty
Senior Transportation Security Analyst
December 2005

Overview

- Scenario Based Logic Modeling Tool Concept
- Secondary Flashpoint and Tertiary Impact
- Impact of secondary and tertiary events on response ability
- Summary

Basic Concept
Scenario Based Logic Modeling Tool

WHAT?

- Conceptual computer-based model to allow emergency management to anticipate the Secondary and Tertiary events post-CBRNE attack.

WHY?

- Mitigate secondary and tertiary geometric impact of a CBRNE terrorist attack.

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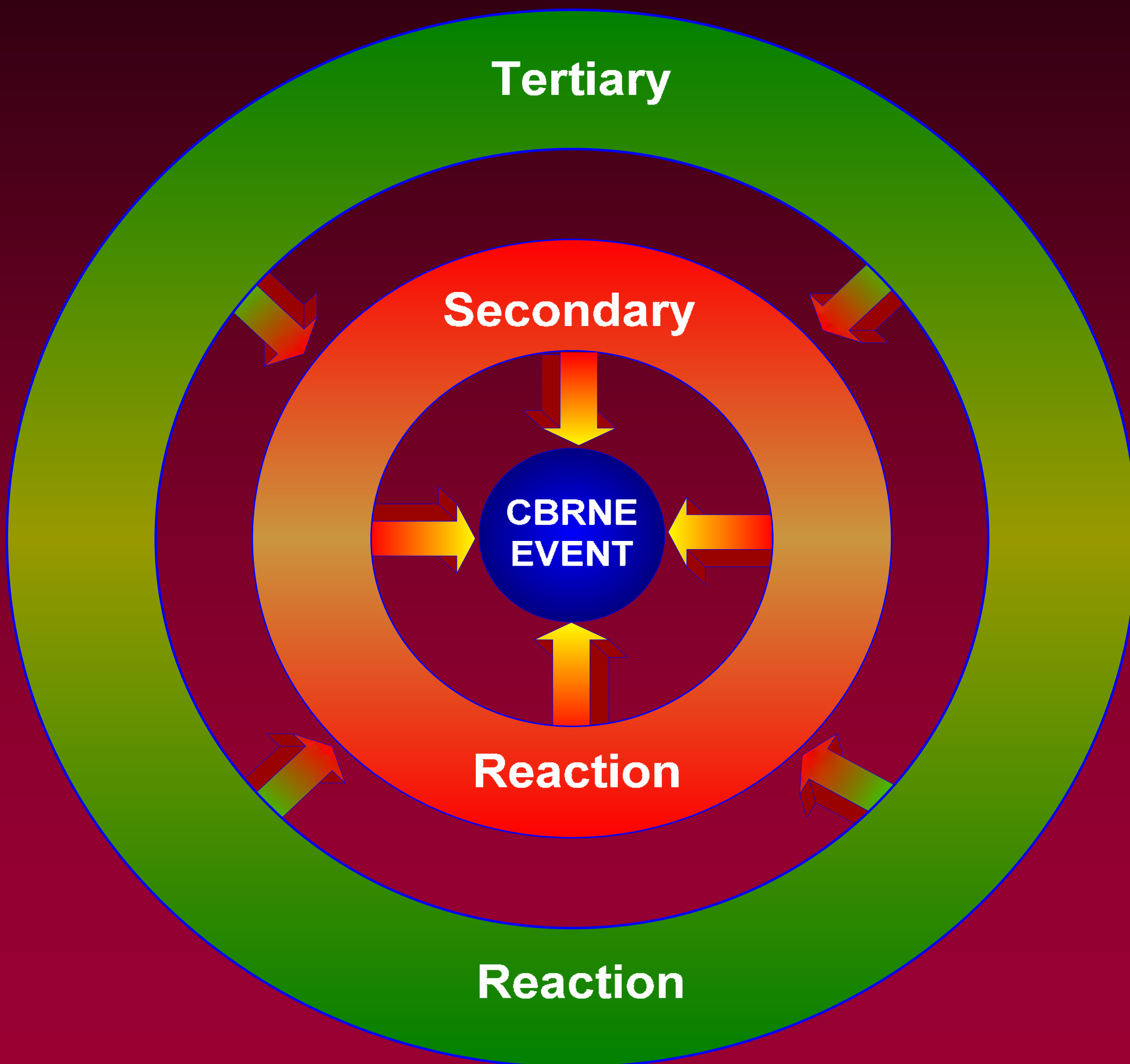
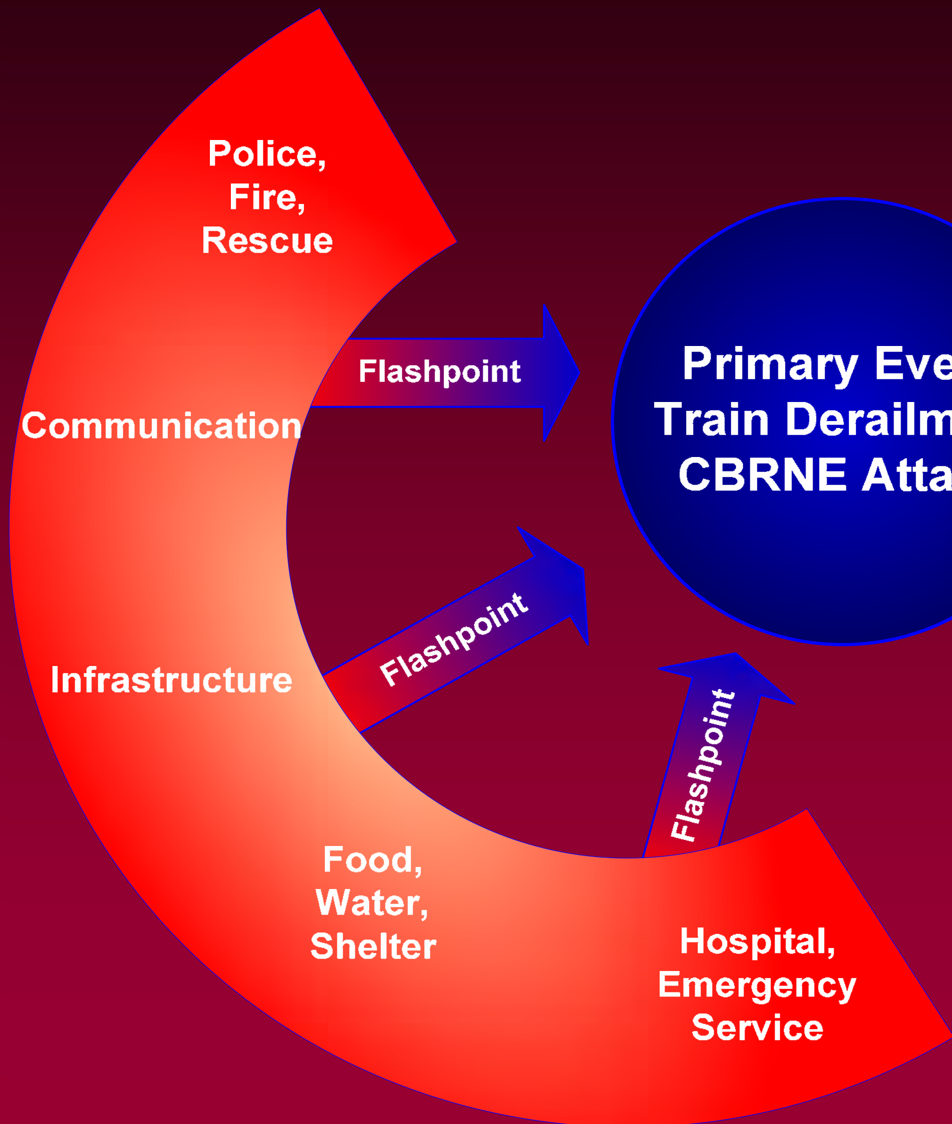
Big Picture



Secondary Flashpoint



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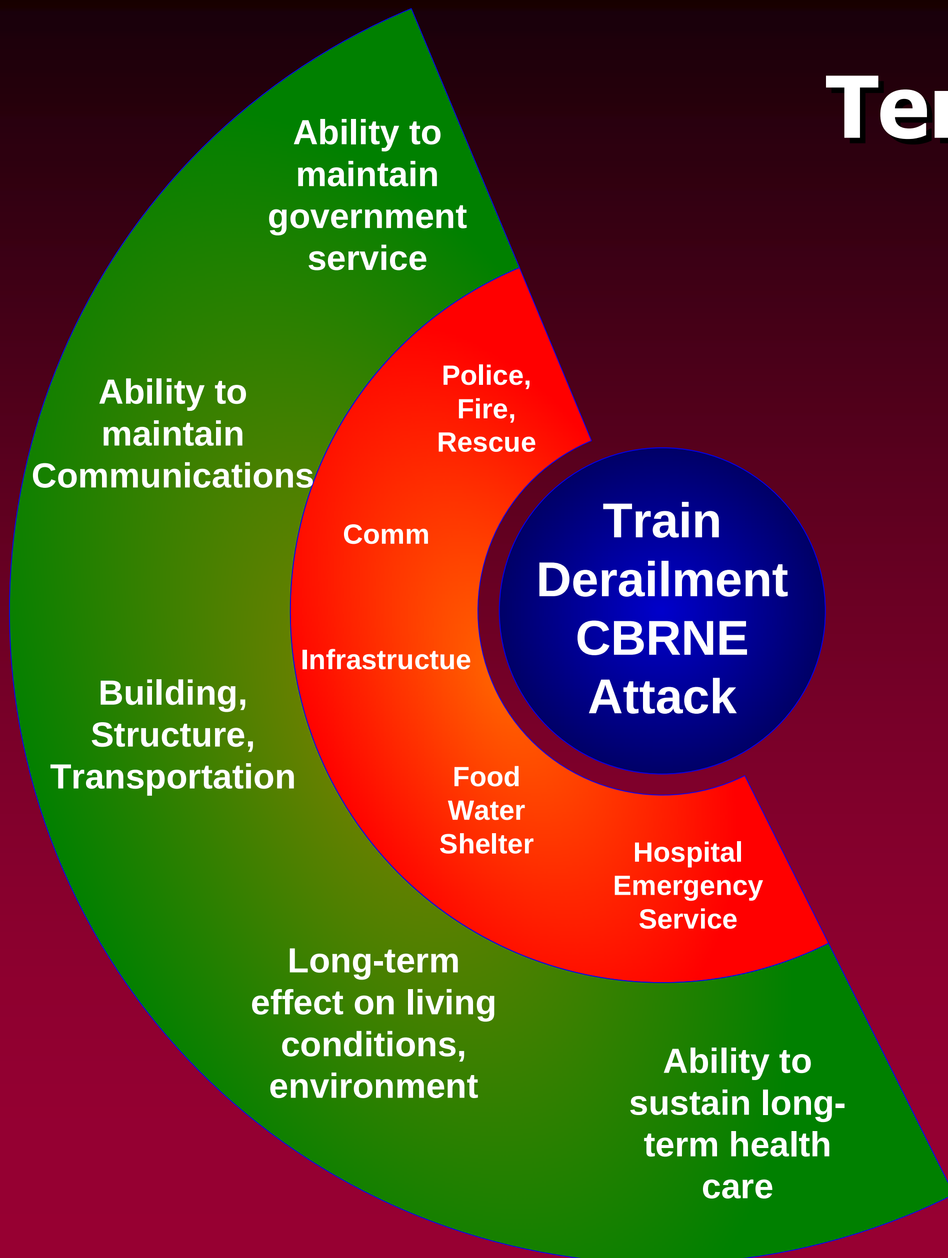
Photos from www.wikipedia.org

Tertiary Impact



Photos from www.wikipedia.org

Scenario Based Logic Modeling Tool - Concept

- Planning
  - Provide insight to improve decision makers
    - Situational Awareness
    - Long-Term Response Mitigation
    - Ability to facilitate timely effective response
      - When taking Secondary Flashpoint and Tertiary Impact into consideration

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Scenario Based Logic Modeling Tool - Concept

- Execution Tool
  - Provide first responder command element with:
    - Enhanced span of control
    - Relevant information to provide effective response
      - Secondary Flashpoint
      - Tertiary Impact
  - Provide decision makers with:
    - Short and long-term effect on:
      - Infrastructure, Communication, Emergency Care, Basic Necessities (Food, Water, Shelter), Police and Rescue Response

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Scenario Based Logic Modeling Tool - Technical

- Database containing (examples)
  - After action reports
  - Known effects of CBRNE event
  - Long-term after effects of CBRNE event
  - Contamination ROE
  - Medical material needed after a CBRNE event
- Logic application
  - Using basic modeling concepts, such as Boolean and Fuzzy Logic, probabilities can be established that support mitigation planning

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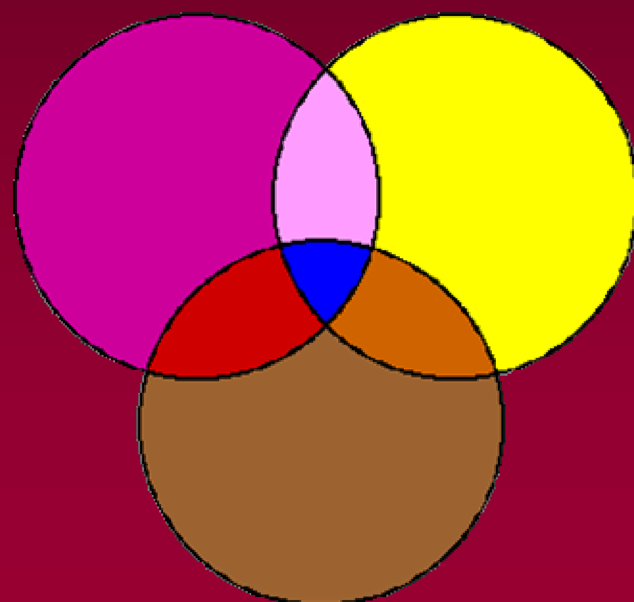
Boolean Logic
Scenario Based Logic Modeling Tool

- Use of Boolean and Fuzzy Logic
  - Boolean Logic
    - **And Not Or Nor**

Strawberry *and* Vanilla *and* Chocolate



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Fuzzy Logic
Scenario Based Logic Modeling Tool

- Fuzzy logic is a superset of conventional (Boolean) logic that has been extended to handle the concept of:
  - Partial truth -- truth values between "completely true" -- "completely false"
- Uses **If/Then** concept

If the company president and all the company directors sell all of the stock they own, ***then*** we must sell.

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Fuzzy Logic

Scenario Based Logic Modeling Tool

- A set of input data from an array of sensors is fed into the control system.
  - "Fuzzification" converts the discrete values into a range of values.
  - Fuzzified inputs are evaluated against a set of production rules.
  - Output data are "defuzzified" as distinctive control commands.
- Adding the human thought pattern is very important.
  - ***If*** the engine is hot, ***then*** turn the engine off.
  - ***If*** a chemical agent has been used, ***then*** check the water for contaminants.

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Combining Boolean and Fuzzy Logic

- The key is to combine these two logic concepts to arrive at the “best possible solution.”

  If a train is de-railed ***and*** it has CBRNE/HAZMAT on board ***and*** it is ***not*** near a large city ***then*** your next action will be to ?????

  If a train is de-railed ***and*** it has CBRNE/HAZMAT on board ***and*** it is near a nuclear facility, ***not*** near a large city, ***then*** your next action will be to ?????

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Impact on Secondary and Tertiary Response

- What impact does a CBRNE attack have?
  - What are the Secondary flashpoints?
  - What is the Tertiary Impact?
- What are the post-event flashpoints?
  - Examples of previous post-event flashpoints.
  - Examples of previous post-event Impact.

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Sarin Gas Attack on Tokyo, Japan

- On March 20, 1995, an unprecedented terrorist attack took place in Japan. On this day, a highly toxic chemical, sarin, was dispersed inside a subway killing 12 people and poisoning an additional 3,794. This infamous case, known as the “Sarin Subway Attack”, was a CBRNE terrorist attack masterminded by Chizuo Matsumoto, also known as Shoko Asahara, the leader of the religious cult “Aum Shinrikyo.”

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Information derived from www.wikipedia.org

Sarin Gas Attack on Tokyo, Japan

- Secondary Reaction
  - More than 7,000 people inundated hospitals in the area
    - 12 fatalities
  - Transportation system shut down
  - Widespread panic
- Tertiary Reaction
  - 3 to 4 weeks later
    - Animals in the area found dead
    - Discovered that air-conditioning systems contributed to infected victims
    - Water in surrounding area contaminated

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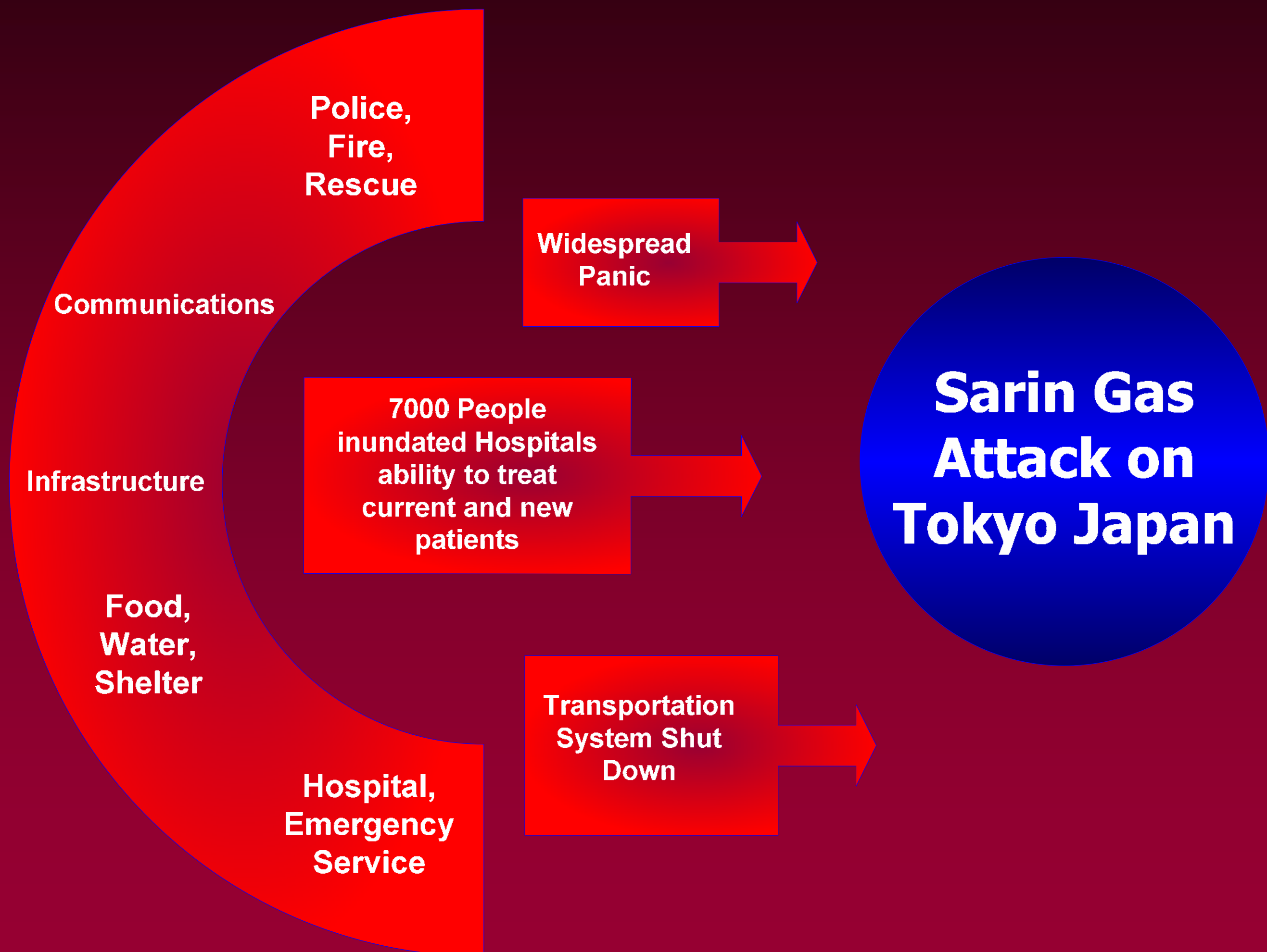
Sarin Gas Attack on Tokyo, Japan



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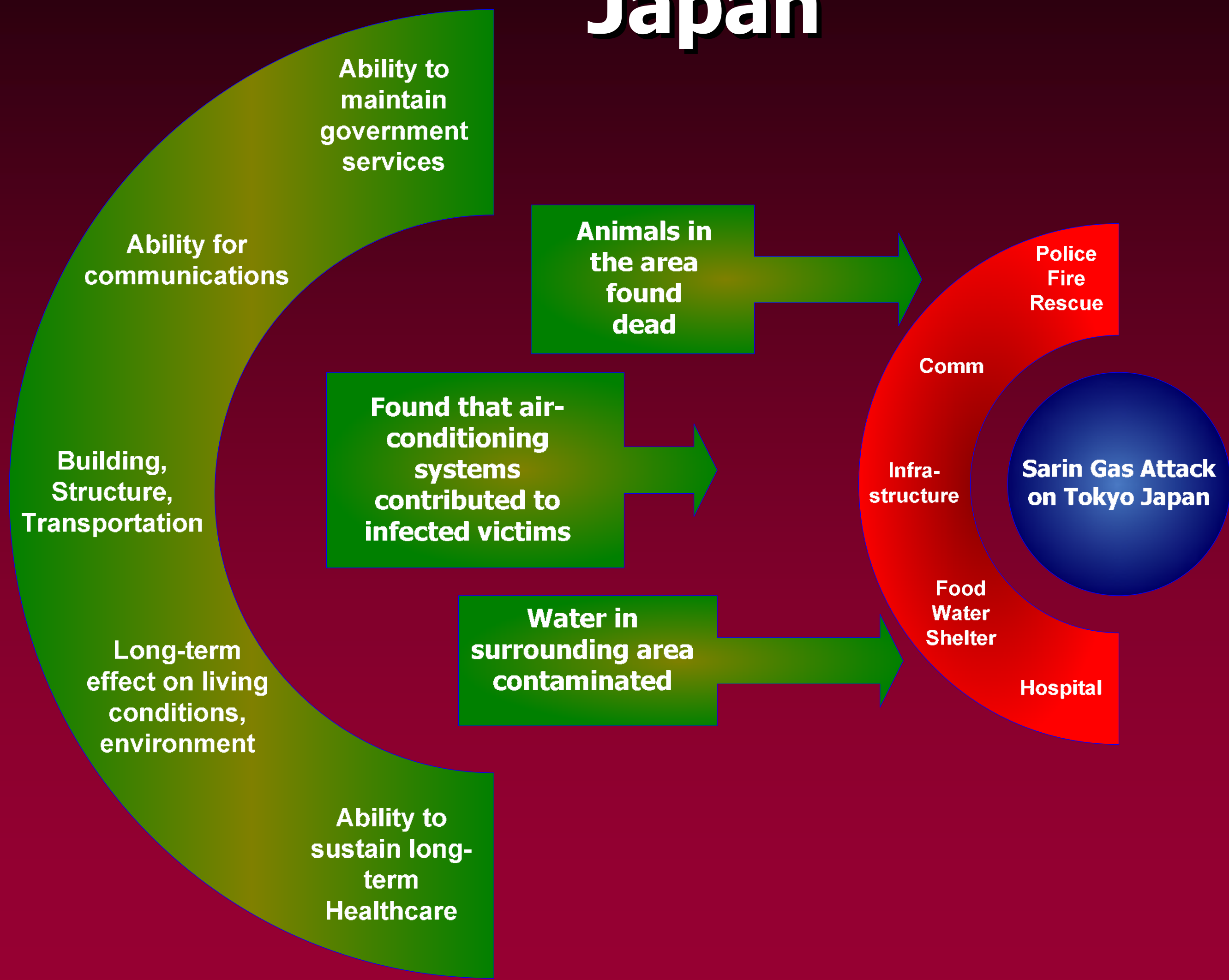
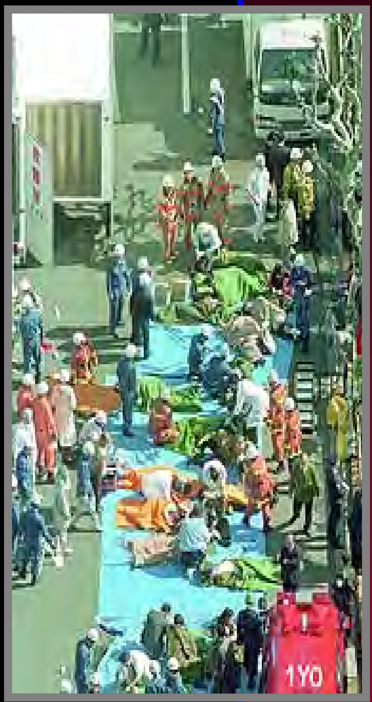
Sarin Gas Attack on Tokyo, Japan



Sarin Gas Attack on Tokyo, Japan



- Final investigation and report showed:
  - "We must be involved in managing the consequences when an act of chemical terrorism occurs."

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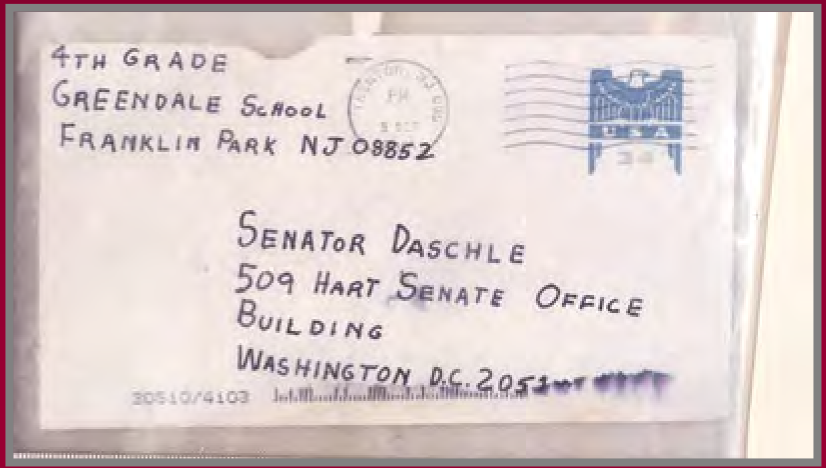
Information derived from www.wikipedia.org

Anthrax Attack on the U.S.

- The **2001 anthrax attacks** in the U.S. occurred over the course of several weeks beginning on September 18, 2001 (after the September 11, 2001 attacks). Letters containing anthrax bacteria were mailed to several news media offices and two U.S. Senators, killing five people.



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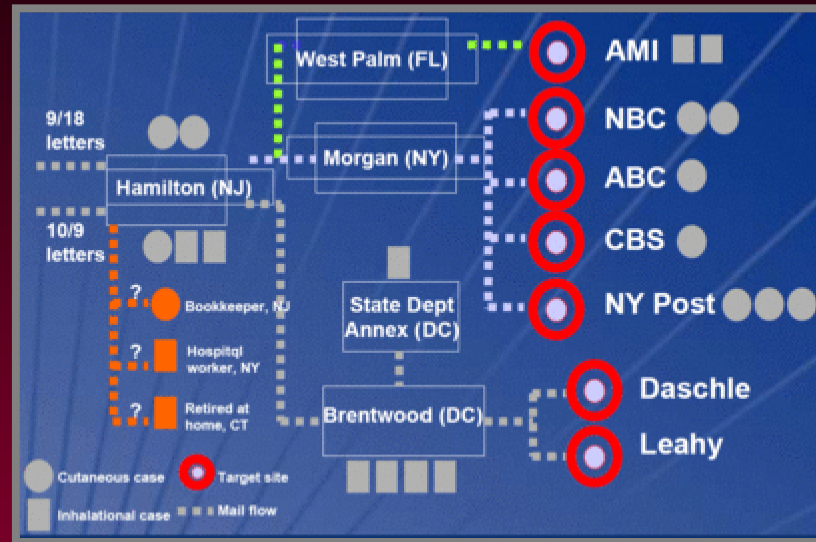
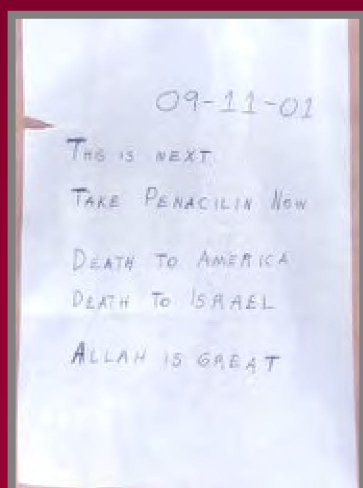
Anthrax Attack on the U.S.

- Seven letters are believed to have been mailed, resulting in twenty-two infections. Five people died.




09-11-01

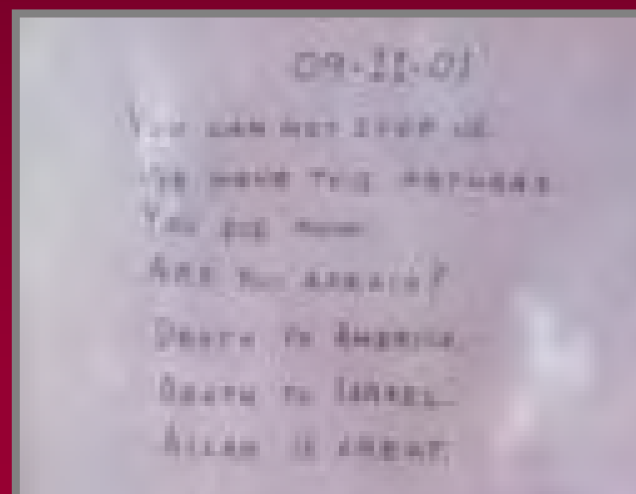
THIS IS NEXT

TAKE PENACILIN NOW

DEATH TO AMERICA

DEATH TO ISRAEL

ALLAH IS GREAT



Anthrax Attack on the U.S.

- The secondary effects of the Anthrax attack
  - First Responders
    - Potential contamination of responder personnel
    - Contamination of postal workers
    - Contamination of government personnel
  - Infrastructure
    - Contamination of postal buildings
    - Contamination of government offices
  - Health Care Issues
    - Potential contamination of health care providers

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Anthrax Attack on the U.S.

- The tertiary effects of the Anthrax attack
  - Contamination and Clean-up
    - Infrastructure
      - Long-term building closures, contamination of personnel
      - Long-term postal service closures
  - Political Effects
    - Millions spent in legislation
    - Long-term public panic (more than seen with 911 attack)
  - Health Effects
    - Long-term contamination effects and health problems

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CBRNE Conference Scenario #1

- Spent nuclear fuel rods are supplied by Iran and shipped in a cargo container to Colombia then flown to Mexico and loaded on human mules used to smuggle drugs across the border. They are met in Arizona by sleeper cell agents who take the fuel rods by car toward its final destination.
- Three men get off subway cars at three different locations in downtown New York and head toward the New York Stock Exchange. Simultaneous explosions echo down the densely packed street. The immediate area around the Exchange is shut down for months as decontamination efforts take place. Major financial transactions in the U.S. are slowed immensely due to the loss of the NYSE. Casualties after the event continue to mount as those in the immediate vicinity demonstrate varied levels of contamination. Several hospitals in New York finally begin to open due to contaminated patients being brought to them after the attack, prior to knowledge that the explosions were actually dirty bombs.

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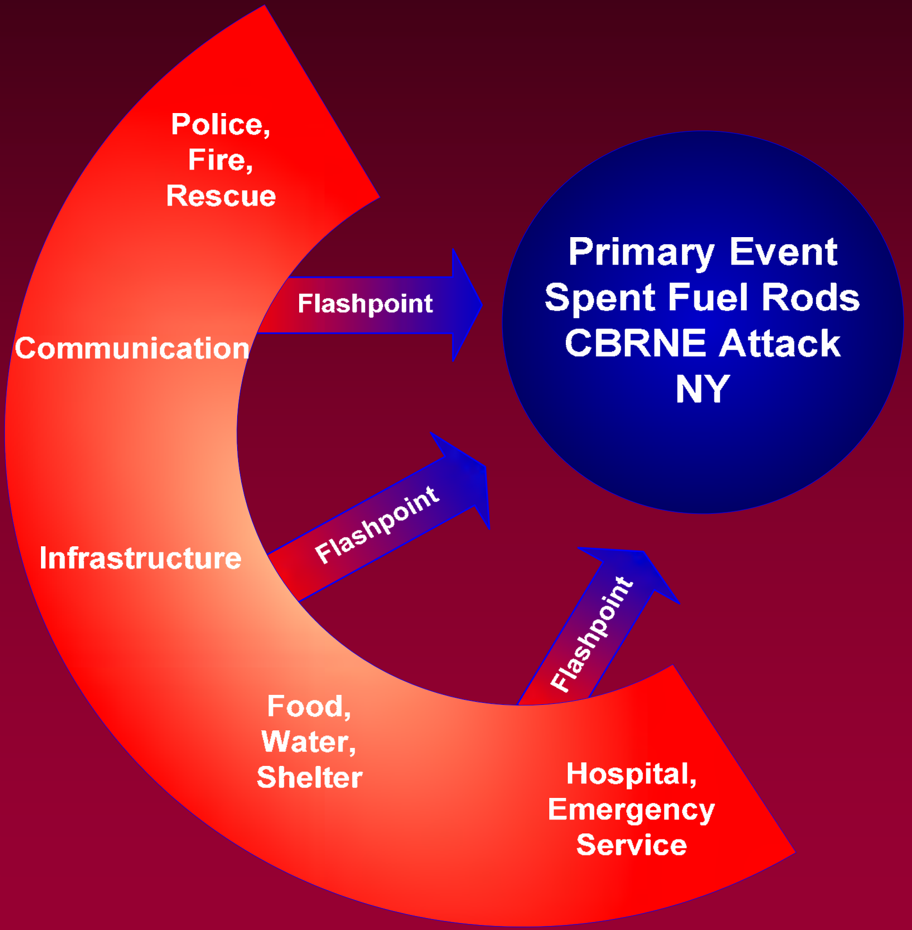
CBRNE Scenario #1



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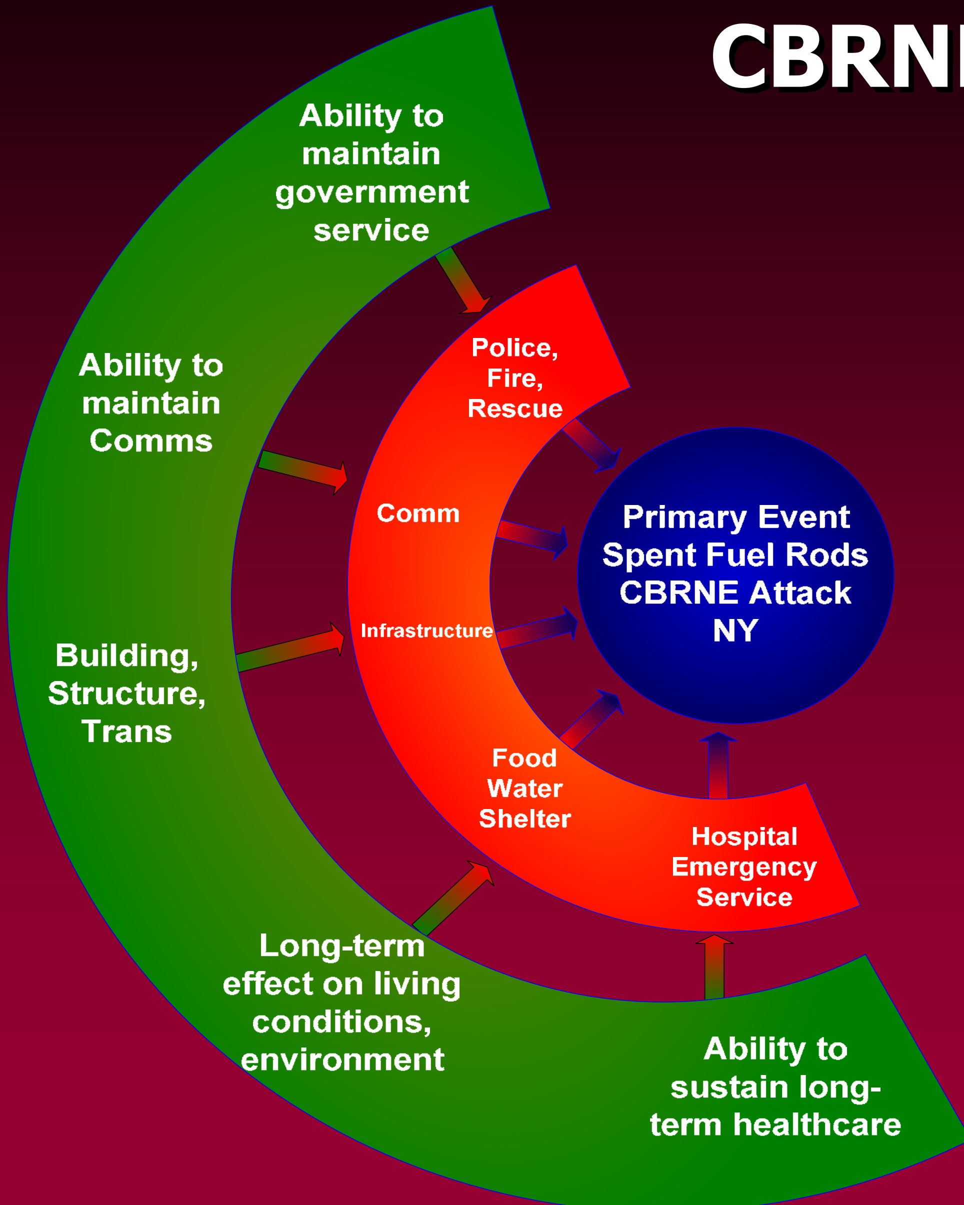
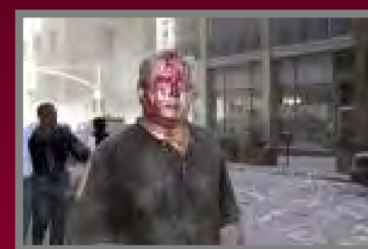
Photos from www.wikipedia.org

CBRNE Scenario #1





Photos from www.wikipedia.org

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CBRNE Scenario #1

- Police, Fire and Rescue
  - Short-term (explosion/unknown event)
    - Cordon within 15 Minutes
    - Detection within 2-3 hours
    - Triage with 30 minutes
    - This gives a 2-2 1/2 hour period of unknown contaminated population
  - Long term
    - Situational control of contaminated area
    - Provide services outside affected area

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CBRNE Scenario #1

- Communication and Infrastructure
  - World Financial Market
    - Short-term
      - NYSE unusable
        - Stock Prices
        - Value of dollar
    - Long-term
      - Interest rates/investments
      - Job loss, general inflation
  - Transportation
    - Short-term explosion
      - Subway and road closures
    - Long-term contamination
      - Subway, busses, taxis, ferries, airports

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CBRNE Scenario #1

- Shelter, food and water
  - Short-term and long-term contamination
    - Detection, Containment and Decontamination
  - Physical building damage
  - Access to and from contaminated area (after detection)
  - Containment of potential radiation (after detection)
    - Psychological effects of containment

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CBRNE Scenario #1

- Hospital, Emergency Care
  - Short-term (2-3 hours)
    - Radiation not detected
      - Route, Ambulance, Hospital, Personnel
      - Casualties with unknown situation
    - Radiation detected (after 3 hours)
      - All personnel and infrastructure affected is lost
      - Huge decontamination situation
      - Inundated by patients (NY)
  - Long-term (24 hours to years)
    - Effects of personnel and patients
      - Months or years before hospitals are usable
      - Chronic radiation sickness

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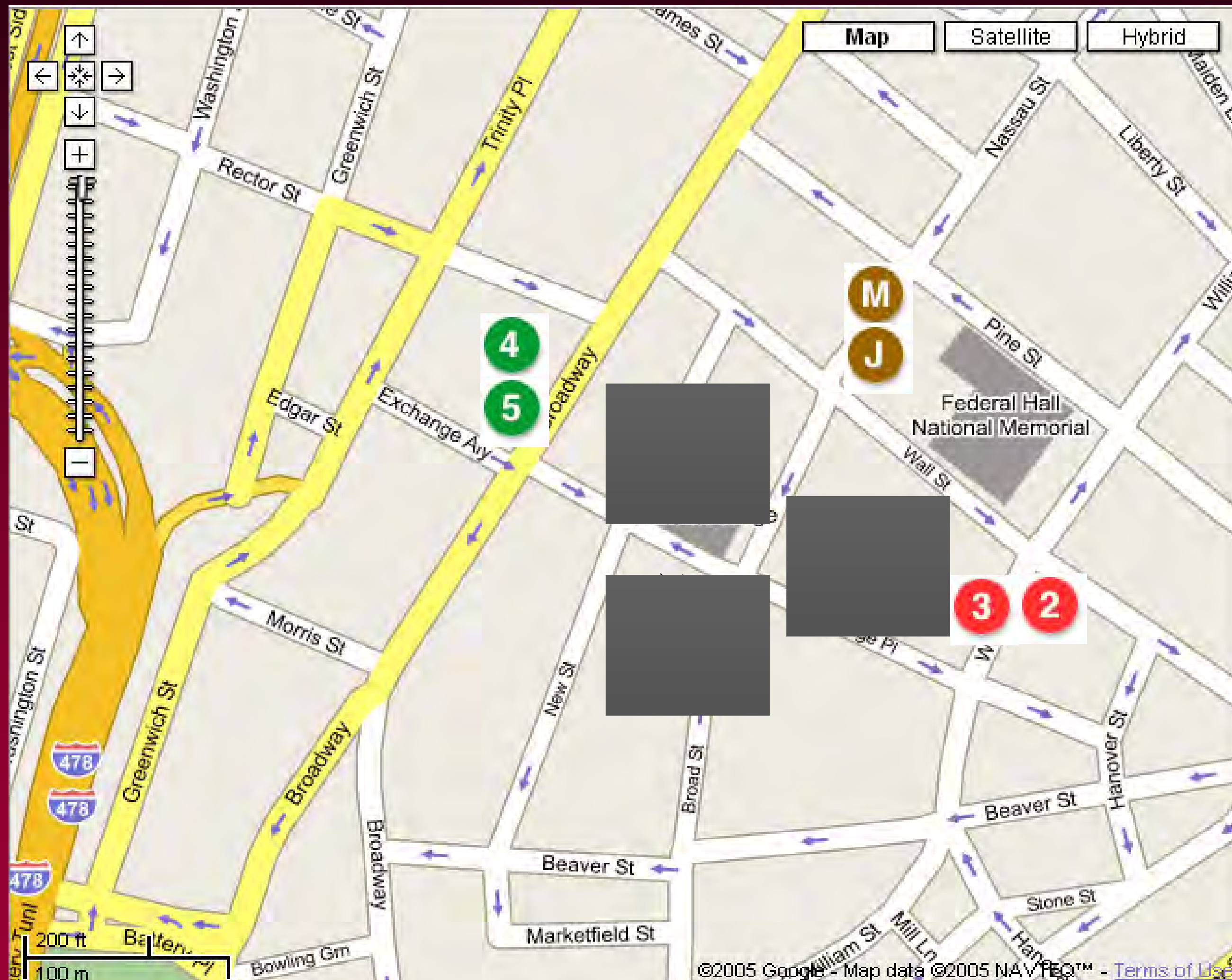
New York Stock Exchange



Typical explosive cordon (300 m)

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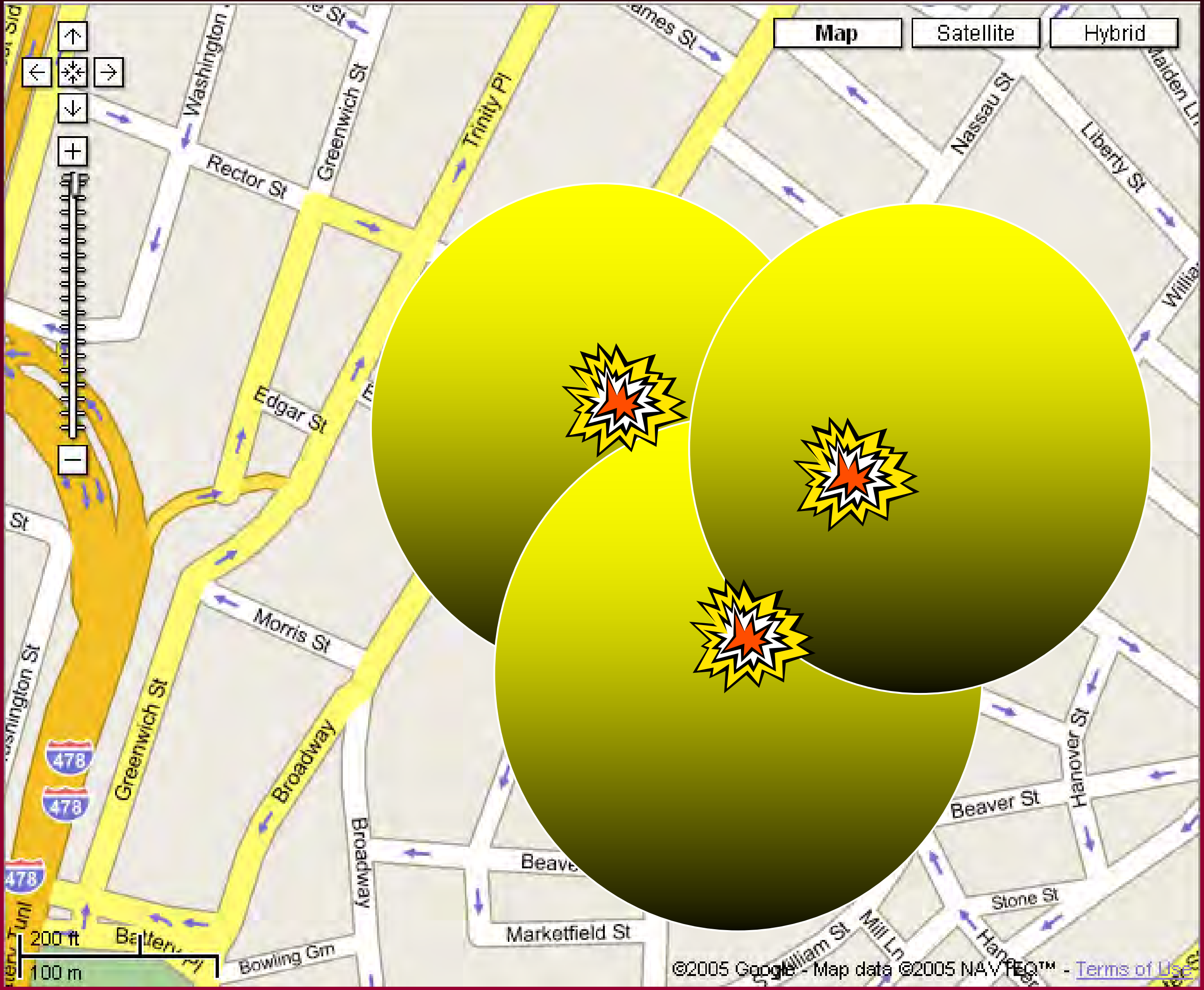
New York Stock Exchange



Potential Hazard Area – Not to scale

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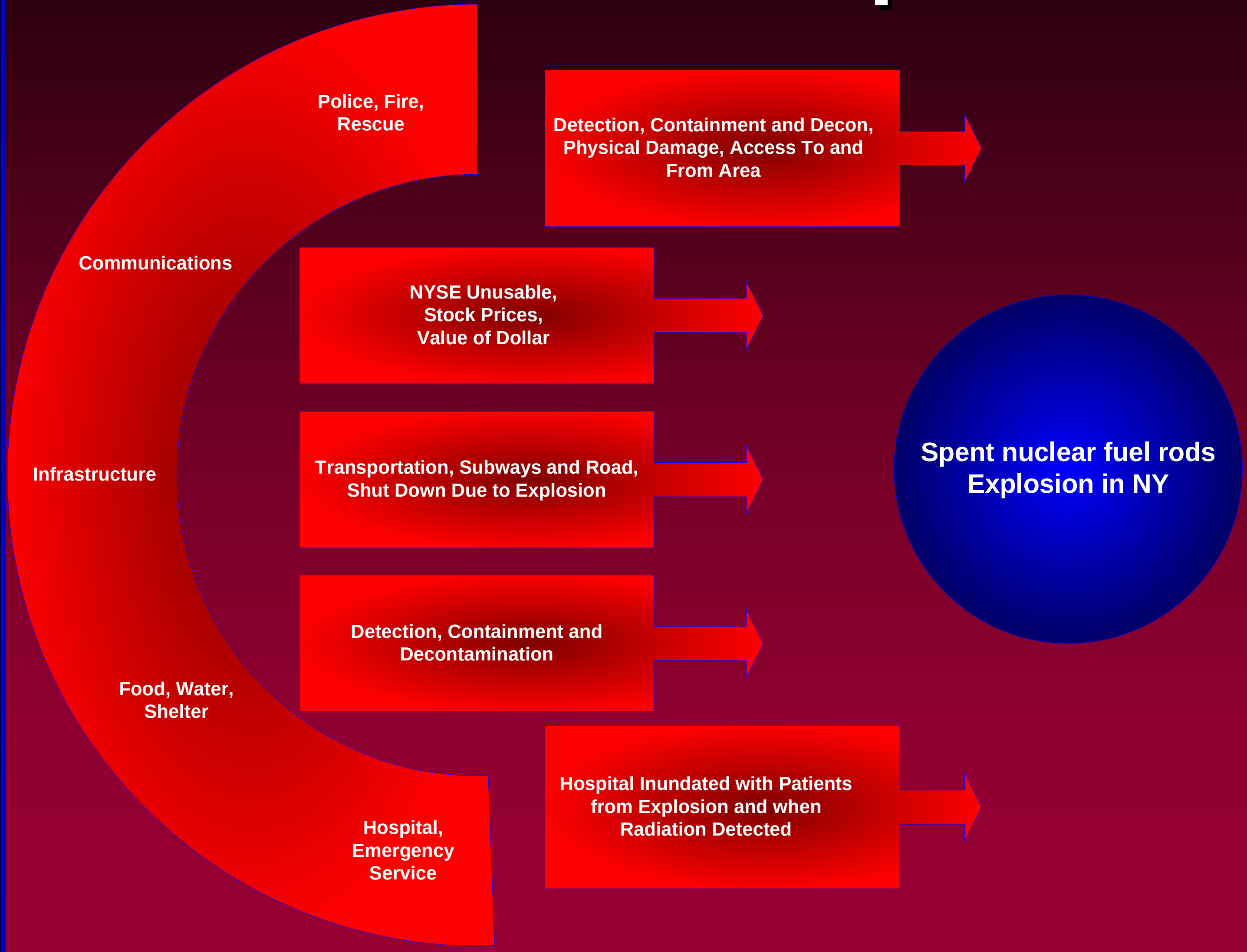
Nuclear Fuel Rod Explosion in NY



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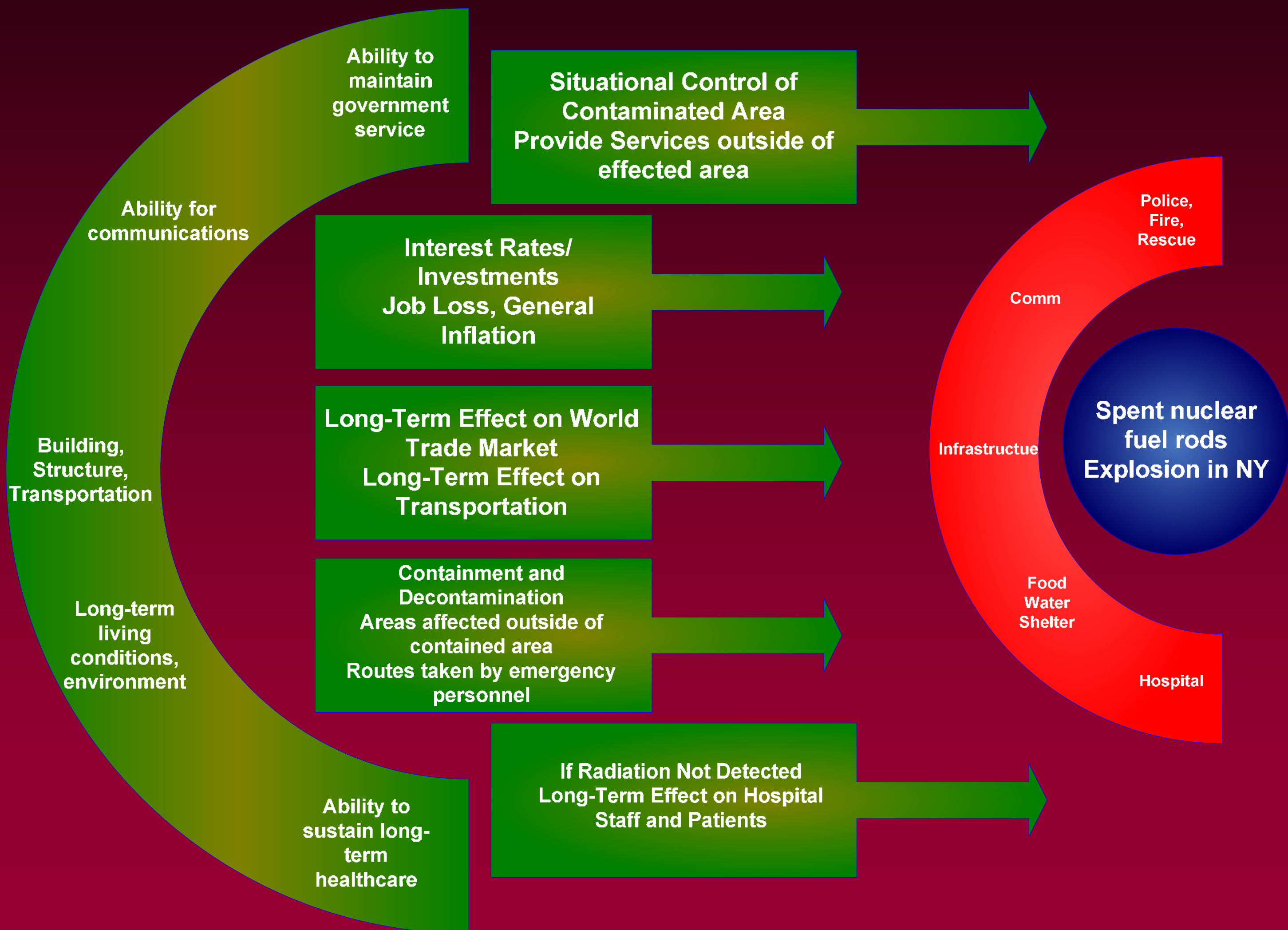
Nuclear Fuel Rod Explosion in NY



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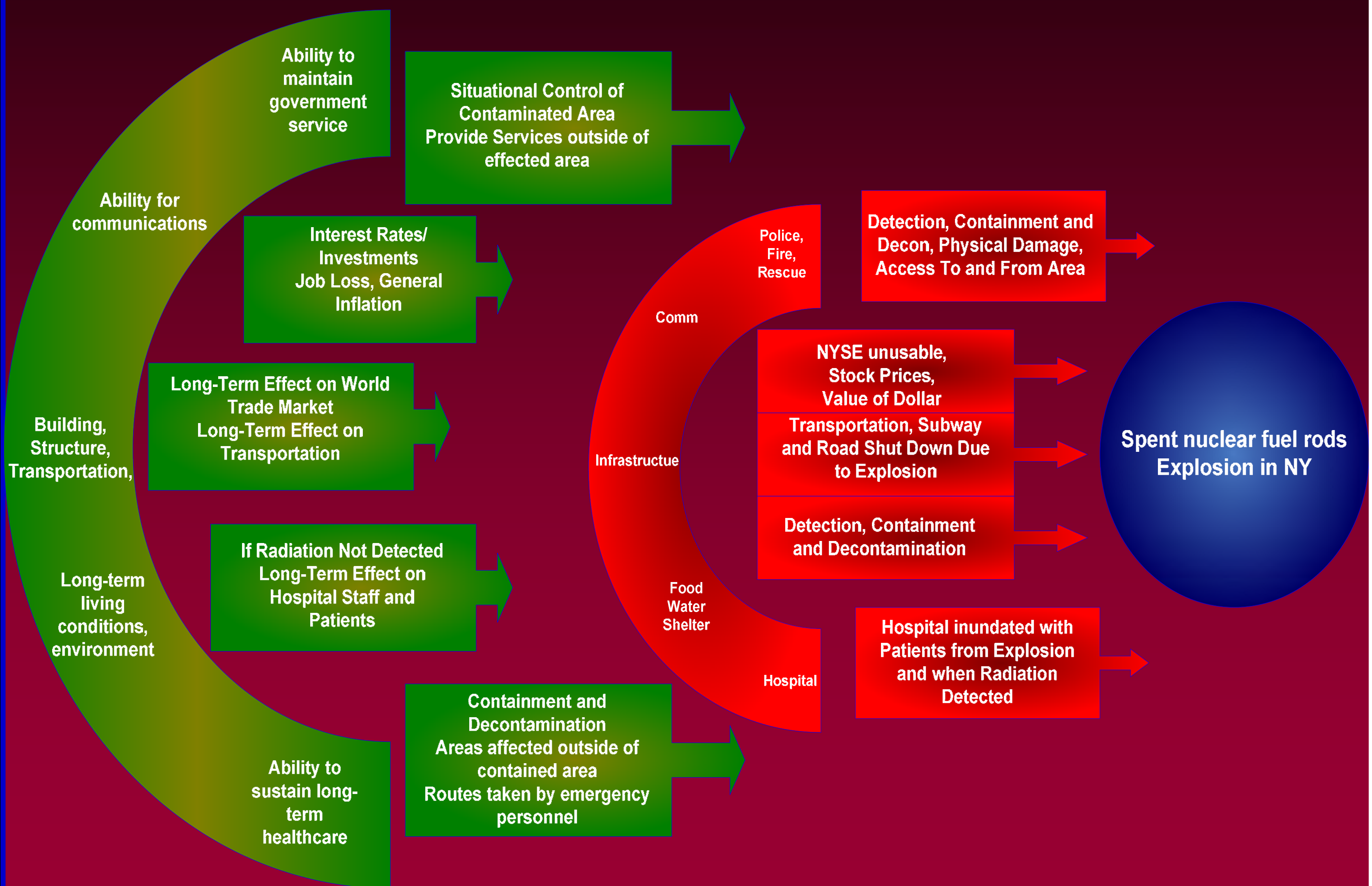
Nuclear Fuel Rod Explosion in NY



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Summary

WHAT?

- Conceptual computer-based model to allow emergency management to predict the Secondary and Tertiary events post-CBRNE attack.

WHY?

- Mitigate secondary and tertiary geometric impact of a CBRNE terrorist attack.

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Bottom Line

- We have spent billions of dollars on security and response of a terrorist attack
  - Not enough time and effort is put into mitigating the long-term response effect of a CBRNE Terrorist attack
  - Understanding what effect a CBNRE Terrorist Attack has and what can happen weeks, months or even years after that event, could help us be better prepared to handle the long-term response efforts

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Thank you for your time

Pat Daugherty
Senior Transportation Security Analyst
(843) 460-6326
daugherj@ctc.com

"It's not a question of ***if*** but ***when*** a CBRNE Terrorist Attack on the United States will happen."

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SPECIAL OPERATIONS TECHNICAL INDUSTRIAL LIAISON OFFICER

DOING BUSINESS WITH

USSOCOM

USSOCOM Chemical, Biological, Radiological Conference & Exhibition

05 December 2005

Dr. Joseph R Daum
Technical Industrial
Liaison Representative

OVERVIEW

- SOCOM Acquisition Authority
- Identifying SOCOM Business Opportunities
- TILO Process

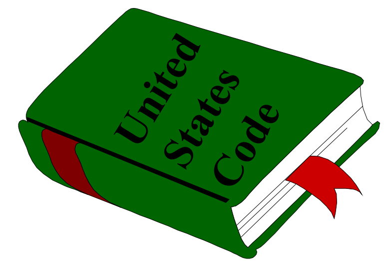
USSOCOM ACQUISITION MISSION

Provide Rapid and Focused Technology, Acquisition and Logistics Support to SOF Warfighters

ACQUISITION AUTHORITY

COMMANDER USSOCOM's Authority

(10 USC Section 167)



- Develop and Acquire Special Operations-Peculiar Equipment
- Acquire Special Operations-peculiar Material, Supplies, and Services
- Head of Agency for Acquisition Authority
- Head of Contracting Activity

DEFINITION
SPECIAL OPERATIONS-PECULIAR

"Special Operations (SO)- Peculiar. Equipment, materiel, supplies, and services required for SO activities for which there is no Service-common requirement. These are limited to items and services initially designed for, or used by, SOF until adopted for Service-common use by other DOD Forces; modifications approved by the Commander in Chief, U.S. Special Operations Command (USCINCSOC) for application to standard items and services used by other DOD forces; and items and services approved by the USCINCSOC as critically urgent for the immediate accomplishment of an SO activity."

Source: DODD 5100.3, "Support of the Headquarters of Combatant and Subordinate Joint Commands", certified current as of March 24, 2004

WHO MANAGES SOF ACQUISITION PROGRAMS?

Program Management Structures

Milestone Decision Authority →	**USSOCOM**		**MILDEP**
Program Manager →	**USSOCOM**	**MILDEP**	**MILDEP**
%, by quantity, of MFP-11 Acq Programs →	52%	22%	26%

- **SOAE is initial MDA for all programs.** Program structure is approved at or before Milestone B.
- Policy and procedures vary by structure:
  - For **USSOCOM MDA-USSOCOM PM programs**, D70-1 & SOAL SOP apply. Exceptions are noted in Acquisition Decision Memoranda (ADMs).
  - For **USSOCOM MDA-MILDEP PM programs**, responsibilities and exceptions to SOCOM procedures are defined in Program Specific MOAs
  - For **MILDEP MDA programs**, USSOCOM policy and procedures normally do not apply

USSOCOM ACQUISITION PRINCIPLES

- Deliver Capability To The User Expeditiously

- Exploit Proven Techniques And Methods

- Keep Warfighters Involved Throughout The Process

- Take Risk And Manage It!

IDENTIFYING SOCOM BUSINESS OPPORTUNITIES

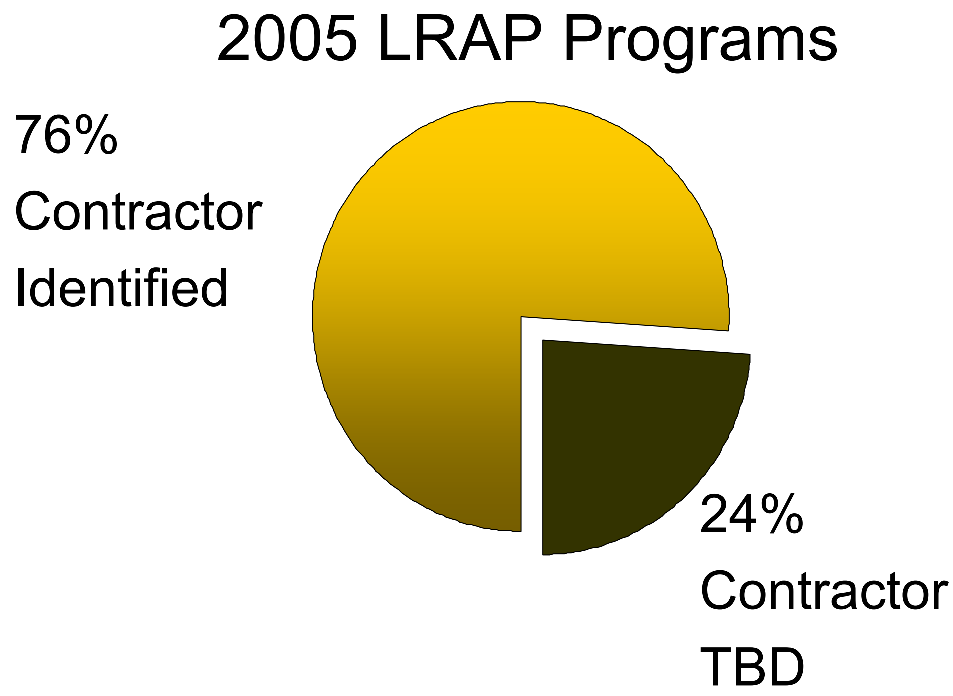
- Prime Contract Opportunities
- Subcontracting Opportunities
- Future Technology Interest
- Teaming
- Comparative Testing Program

PRIME CONTRACT OPPORTUNITIES

- Long Range Acquisition Plan
- APBI PEO Briefings
- APBI PEO Side Bars
- Primary Office of Responsibility Solicitations

SUBCONTRACTING OPPORTUNITIES

- LRAP
- APBI
  - PEO Briefings
  - Side Bars
  - APBI Exhibits
- FedBizOps



FUTURE TECHNOLGOY INTEREST

- APBI Key Note Address
- APBI Director of Technology Briefing
- Technology Execution Plan
- SOAL-T APBI Exhibit

TEAMING

- Integrate Products w/ Existing Systems
- Communication Early to Reduce Cost/Risk
- Increase Sponsor Probability
- Promote Total System Responsibility

COMPARATIVE TESTING PROGRAM

- Consists of:
  - Foreign Comparative Testing (FCT) Program - to test and evaluate world class, foreign, non-developmental equipment that demonstrate potential to satisfy DOD requirements.
  - Defense Acquisition Challenge (DAC) Program – to evaluate new technologies/enhancements to improve operational capability, sustainability and manufacturability, reduce costs or expedite fielding of ongoing acquisition programs – emphasis on small domestic industry.
- Both programs are:
  - Congressionally mandated
  - Managed by OSD, AT&L administered by Services/SOCOM
  - Competitive
  - Source of non MFP-11 RDT&E funds for test/evaluation
  - "Test to procure"
  - A method to expedite fielding
- To submit a proposal:
  - Information can be found at https://cto.acqcenter.com
  - USSOCOM POC is MAJ Glenn (813) 828-9422 or glenne@socom.mil

INFORMATION SOURCES

- FEDBIZOPS
- Solicitations from USSOCOM and our industry partners
- Technology Broad Area Announcements (BAAs) from USSOCOM and our partners
- Small Business Innovation Research BAAs
- Defense Challenge Program BAAs
- SOCOM Advanced Planning Briefing to Industry (APBI)
- Long Range Acquisition Plan (LRAP)
- Technology Execution Plan

APBI

SOF Week/Advance Planning Briefing to Industry

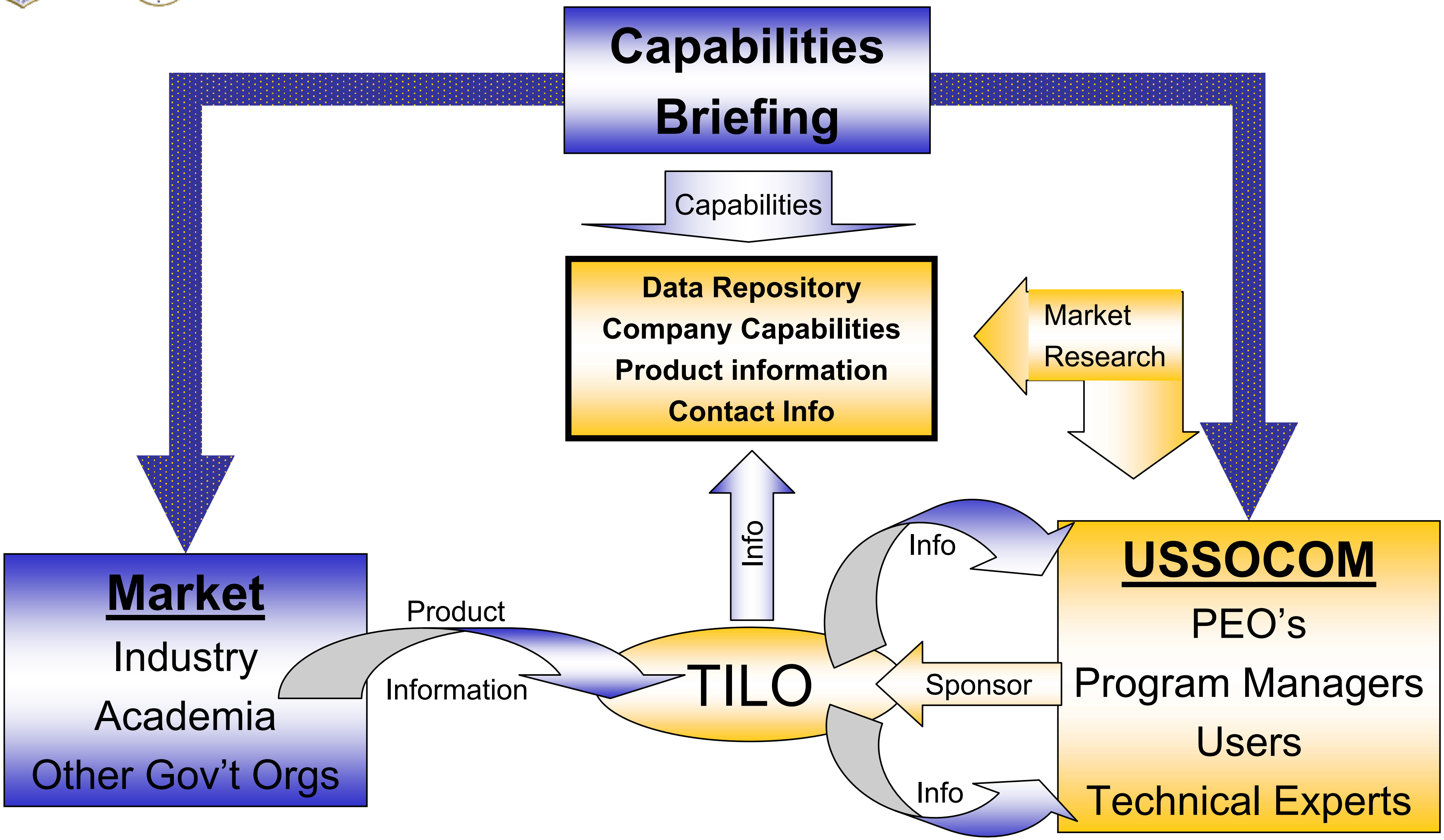
June 19-23, 2006

For Exhibitor and Registration

Information go to:

www.meetingmattersplus.com

TILO PROCESS



TILO PROCESS

- Contractor Submits:
  - White Paper
  - Briefing
  - Company Information
- TILO Staffs Information To USSOCOM
- Identify USSOCOM Sponsor
- Schedule Briefing With Sponsor
- Announce Briefing To Command

INFORMATION REQUIRED

- Firm/Address/Phone
- Product/Service Description
- Proposed Dates
- Classified??
- Audio/Visual Support Needed
- Target Audience?*

HOW TO CONTACT

Mail:	**HQ USSOCOM** **Attn: SOAL-MT** **7701 Tampa Point Blvd.** **MacDill AFB, FL 33621-5323**
Fed Ex:	**HQ USSOCOM** **SOAL-MT (Dr. Joseph R. Daum)** **Bldg. 501, Room 235**
Phone:	**(813) 828-9482**
Fax:	**(813) 828-9488**
E-mail:	**tilo@socom.mil**
Web site:	**http://soal.socom.mil**

Reliable Discrimination of High Explosive and Chem/Bio Artillery Using Acoustic Sensors

By: Myron E. Hohil, Sachi Desai, and Amir Morcos
US Army RDECOM-ARDEC
Acoustic & Networked Sensors Team US ARMY Acoustic Center or Excellence

Chemical and Biological Weapon Threats and Needs

- Determining if an incoming artillery round contains High Explosive material or Chemical/Biological agent on the battlefield.
- Providing field commanders with greater response time using a stand alone acoustic sensor.
- Giving greater situational awareness to threatened soldiers.

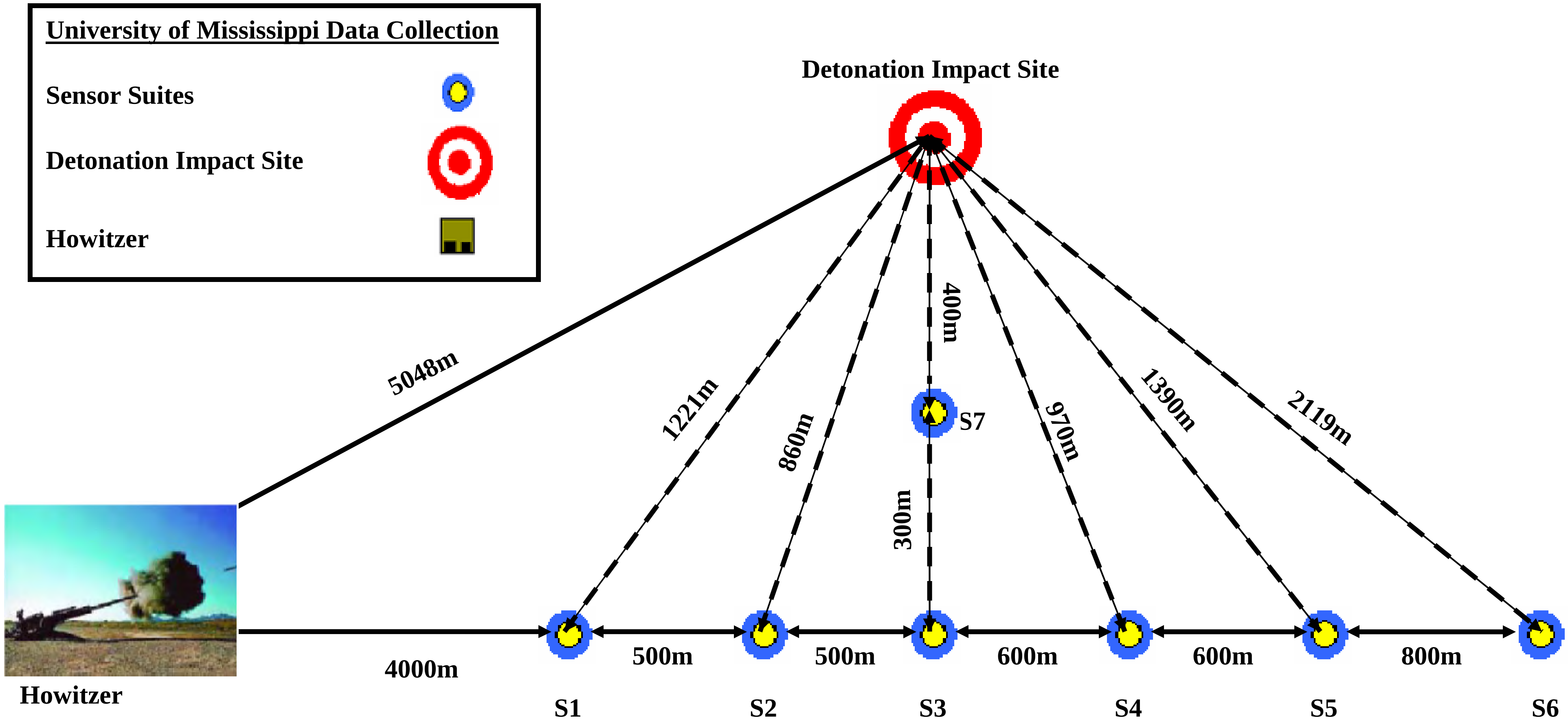
Motivation and Purpose

- ARMY is currently developing Acoustic Sensor Systems for battlefield surveillance.
- The **<u>long range propagation</u>** of acoustic blast waves from heavy artillery blasts introduces a feature for using acoustics and other disparate sensor technologies for the early detection, localization, and identification of CB threats.
- This added information integrated into the COP will.
  - Allow a field commander to make **rapid and accurate judgments** that insure greater safety and lessen exposure for the soldiers.
  - Could help **reduce the time-consuming, manpower** intensive and dangerous tasks associated with identifying the airburst.
- Our work is intended to promote the reliability associated with using acoustic sensor technologies to discriminate between conventional, i.e. high explosive (HE), and CB artillery blasts using features that remain robust with long range wave propagation and degradation, firing time and detonation point (air/ground).

Acoustic Signature Data Collection of Blast Events

- Yuma Proving Ground Data Collection.
  - Conducted by National Center of Physical Acoustics (NCPA) in cooperation with ARDEC.
  - 39, rounds fired.
  - 3 categories of rounds were used, HE, Type A CB, and Type B.
- Dugway Proving Grounds Data Collection.
  - Conducted by DPG Team and U.S. Army Edgewood Chemical Biological Center (ECBC) .
  - 265, rounds fired.
  - 2 categories of rounds were used, HE and Type A CB.

Yuma Proving Ground (YPG) Test Layout

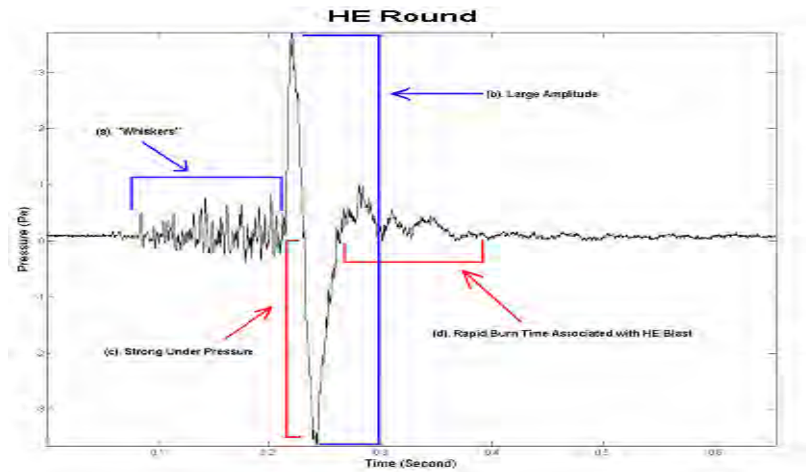


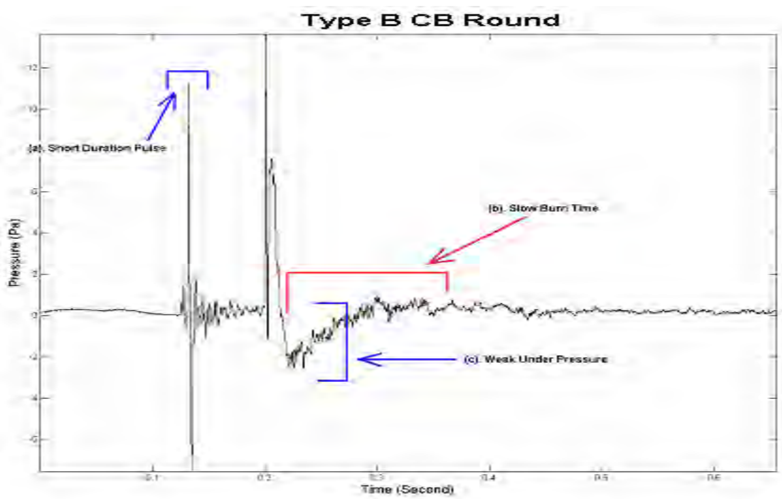
Typical Round Variants

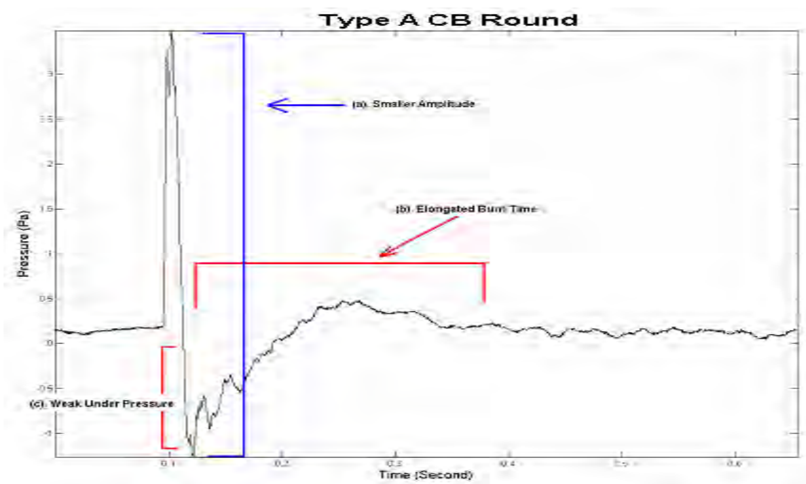
HE rounds display precursors to the main blast generated by Supersonic Shrapnel Elements.

CB Type A rounds display an elongated burn time and a weak underpressure.

CB Type B rounds display a short pulse prior to the main blast. The main blast displays an elongated burn time followed by a weak underpressure.

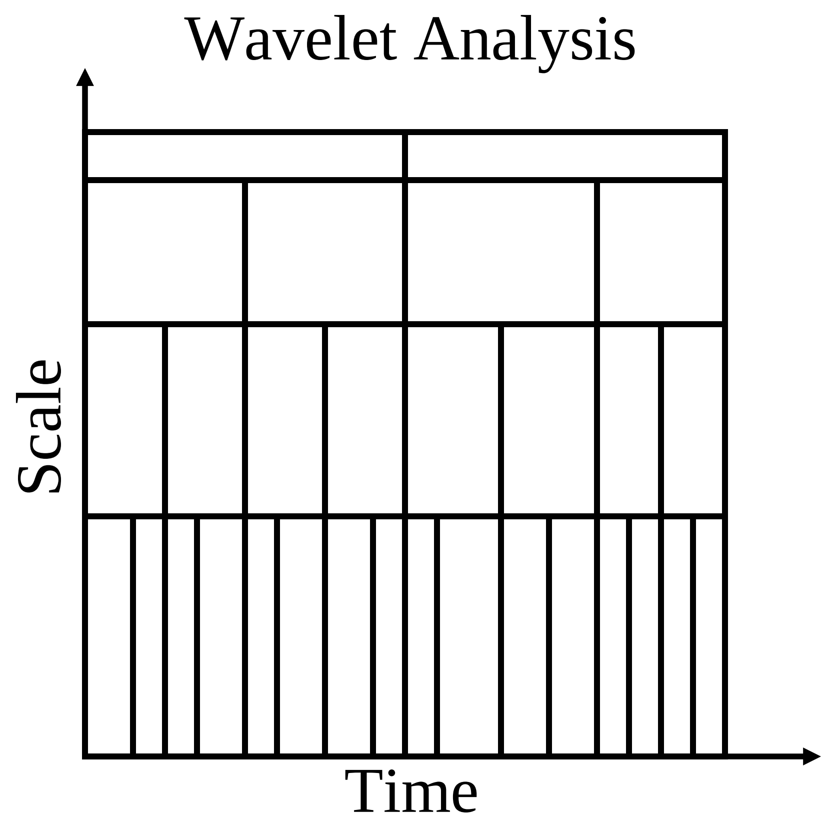






Wavelets

- Efficiently represent non-stationary, transient, and oscillatory signals.
- Desirable localization properties in both time and frequency that has appropriate decay in both properties.
- Provide a scalable time-frequency representation of artillery blast signature.



Discrete Wavelet Transform (DWT)

- Derived from subband filters and multiresolution decomposition.
  - Coarser Approximation.
  - Removing high frequency detail at each level of decomposition.
- Acts like a multiresolution transform.
  - Maps low frequency approximation in coarse subspace high frequency elements in a separate subspace.

Defining Parameters

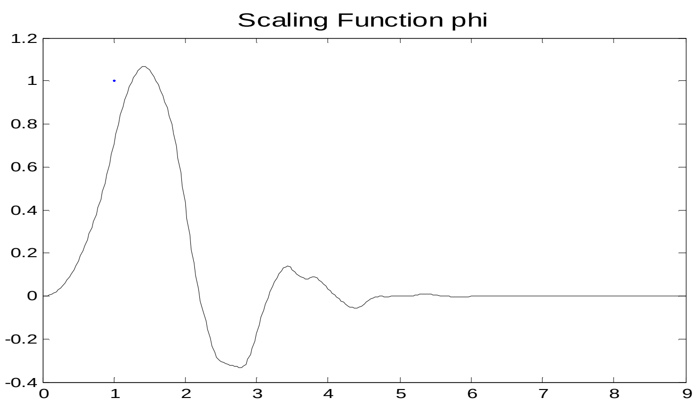
Scaling Function

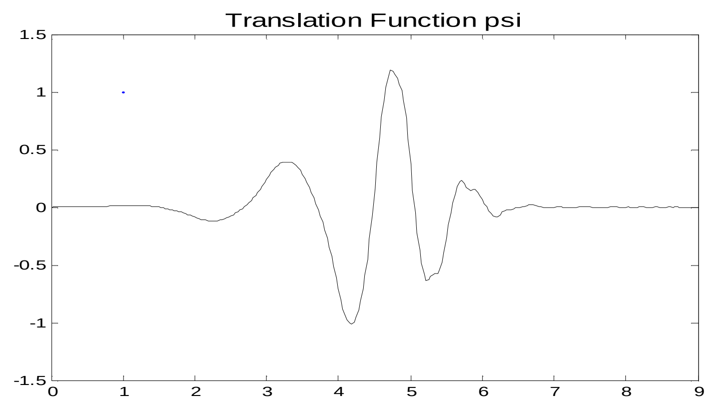
$$\phi(x) = 2^{1/2} \sum_{k=0}^{L-1} h_{k+1} \phi(2x - k)$$

Wavelet Function

$$\psi(x) = 2^{1/2} \sum_{k=0}^{L-1} g_{k+1} \phi(2x - k)$$

Daubechies Wavelet, n = 5

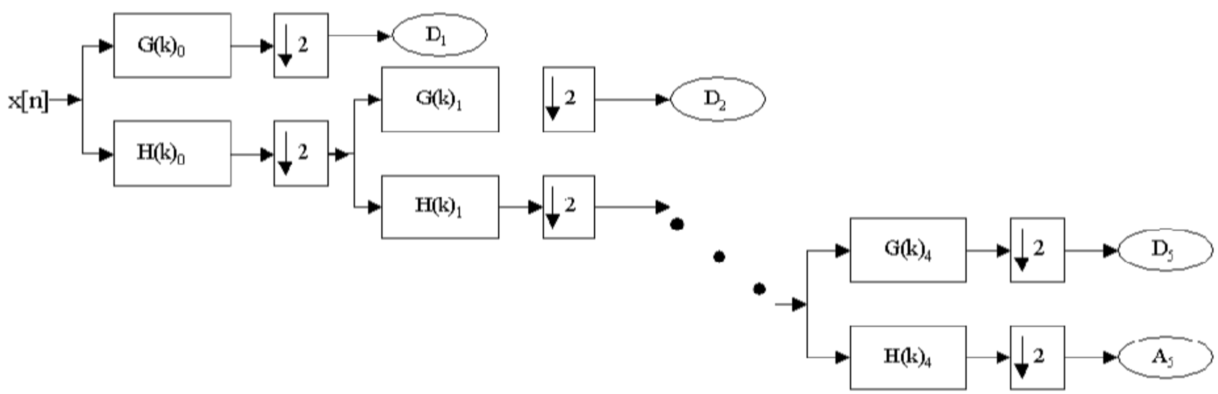




- Representation of the scaling and translation function of db5.
  - Scaling function resembles blast signature of the HE and CB rounds.
  - Provides the ability to approximate signal with the characteristic wavelet.

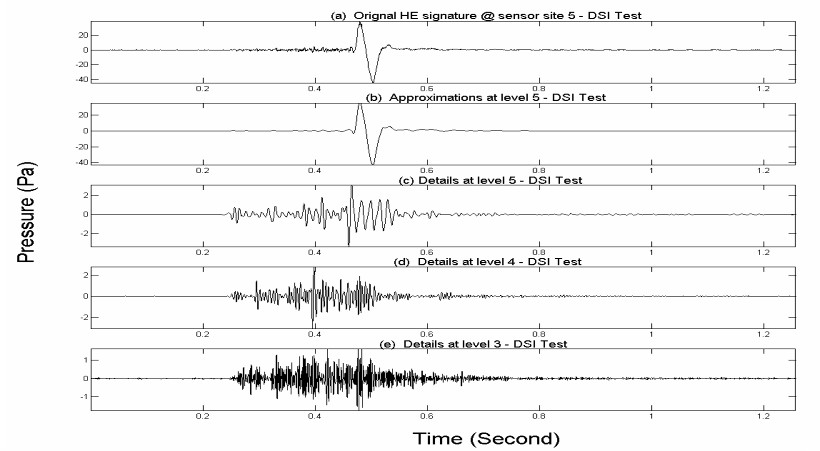
Multiresolutional Analysis

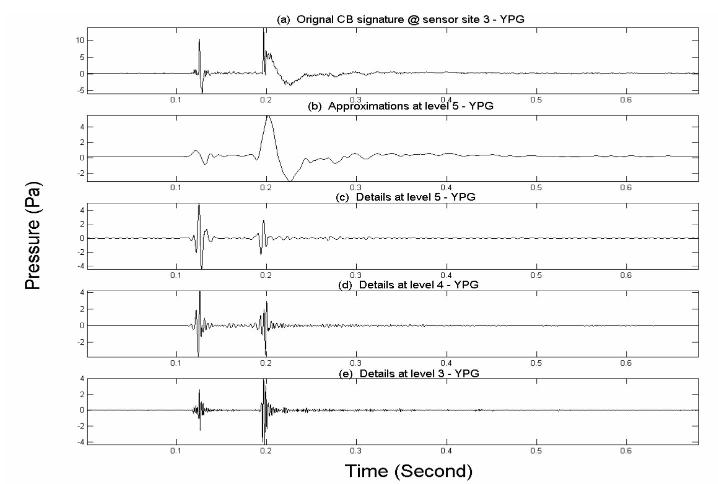
- Using a series of successive high pass and low pass filters to create a set of subspaces.
  - High pass filter obtains the details of the signatures while the low pass filter obtains a coarse approximation of the signal.
- The resulting banks of dyadic multirate filters separate the frequency components into different subbands.
  - Each pass through gives you resolution of factor 2.

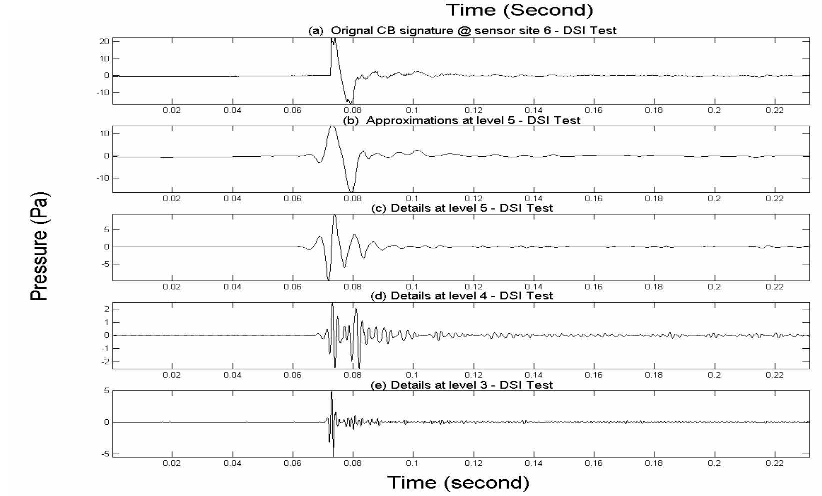


Effects of Wavelet Decomposition

- Wavelet decomposition to level 5 of three varying blast types from varying ranges.



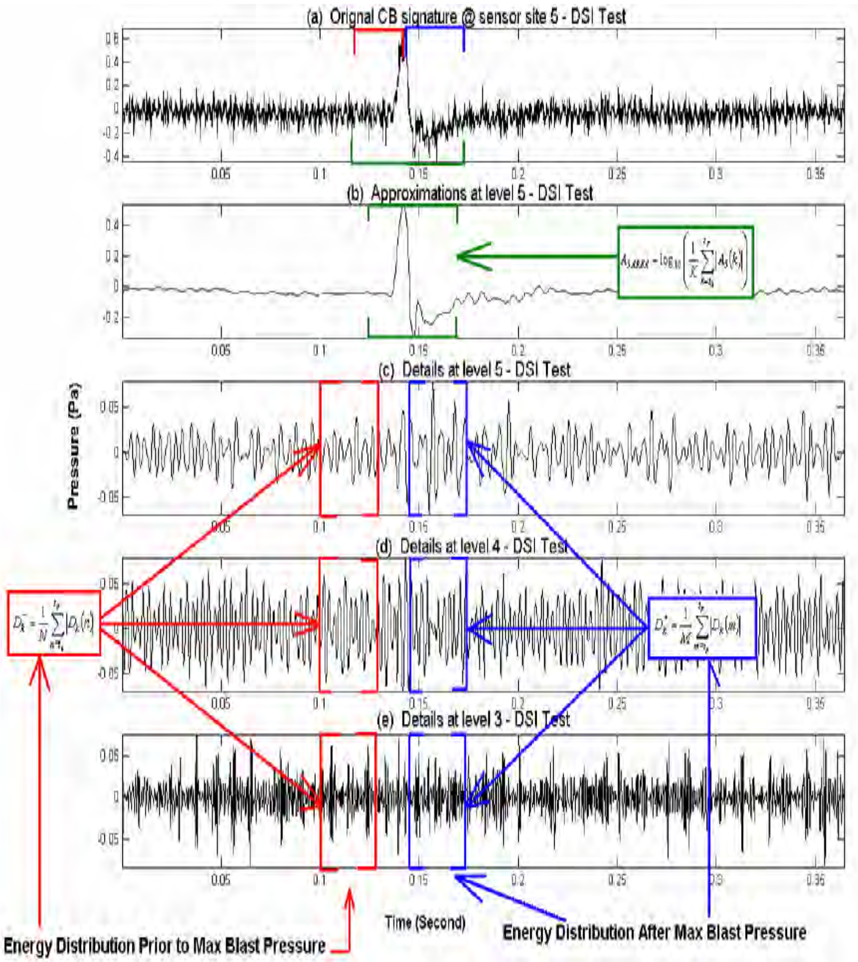


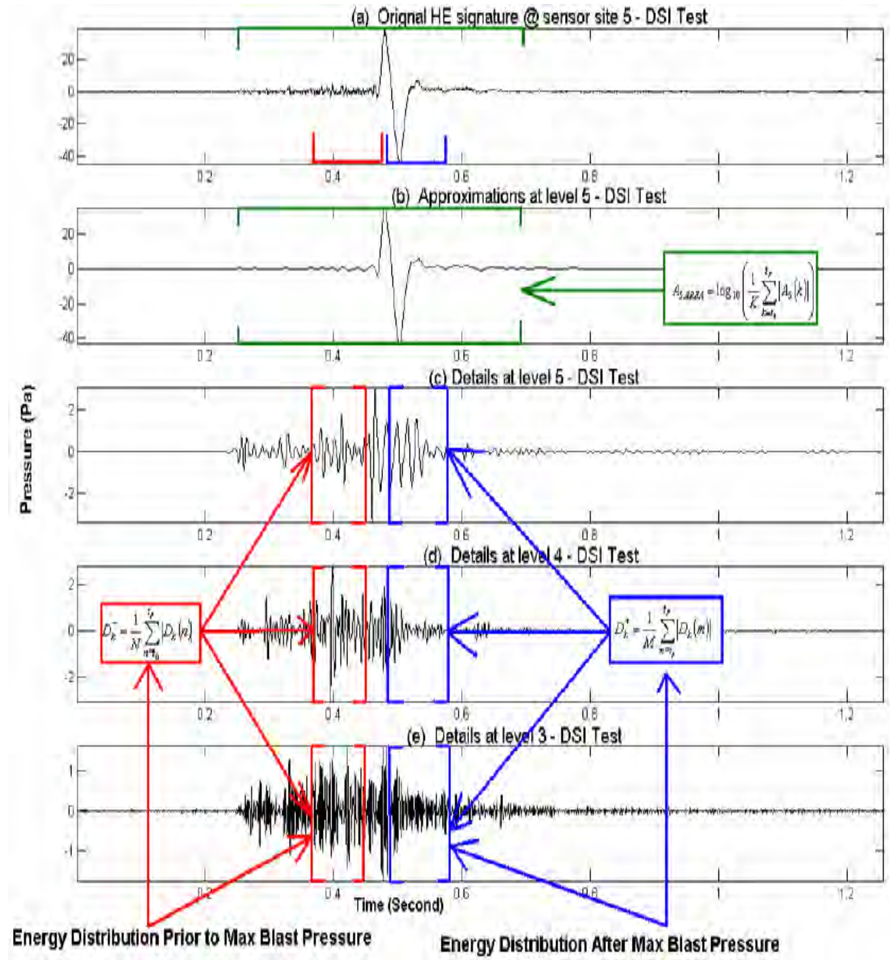


Wavelet Extracted Features

- Comprised of primitives derived from the normalized energy distributions within the details at level 5, 4, and 3 of the wavelet decomposition.
- Distribution of blast type differ greatly when taken prior to the max pressure, $D_k^- = \frac{1}{N}\sum_{n=t_0}^{t_P} |D_k(n)|$, with respect to distribution after the max blast, $D_k^+ = \frac{1}{M}\sum_{m=t_P}^{t_F} |D_k(m)|$.
- Resulting Ratio. $x_{Dk} = \log_{10}\left(\frac{D_k^-}{D_k^+}\right)$
- A5 area is a feature derived from wavelet coefficients at level 5.
- Integrating the magnitude of the area for the coefficients between the start and stop times.
- $$A_{5AREA} = \log_{10}\left(\frac{1}{K}\sum_{k=t_0}^{t_F} |A_5(k)|\right)$$

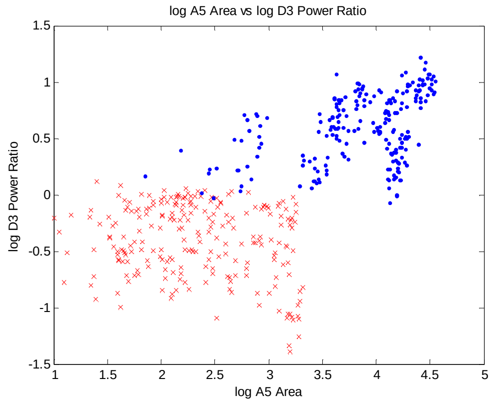
Extracted Features Using DWT

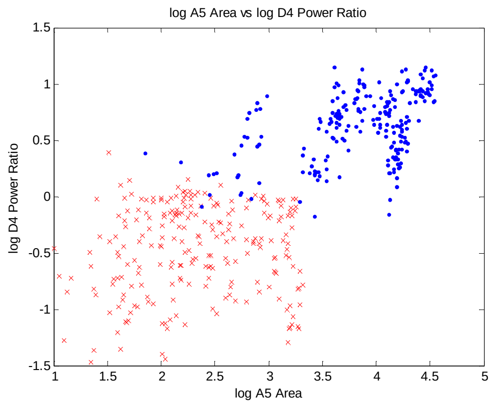




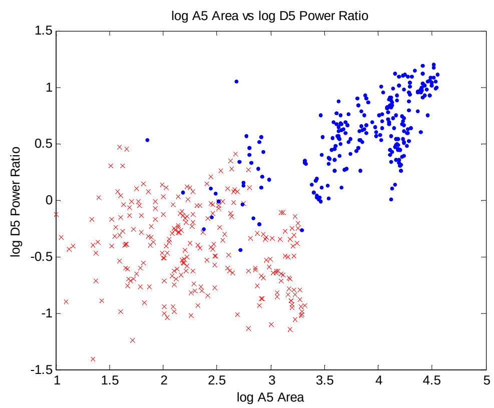
4-tuple Feature Space

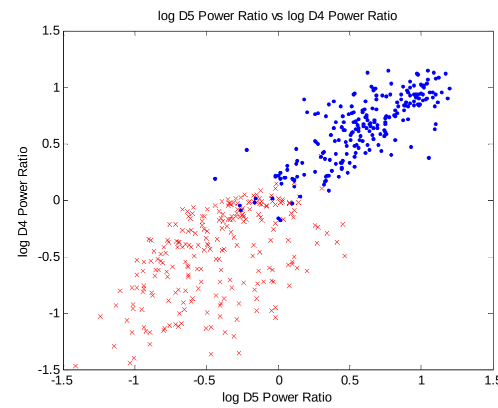
- This energy ratio leads to the discover of 4 features with A5 area that are not amplitude dependent.
- Our n-tuple feature space thus becomes a 4-tuple space, $x^p = \left\lfloor x_{D5}^P, x_{D4}^P, x_{D3}^P, A_{5AREA}^P \right\rfloor$, to be applied for classification.

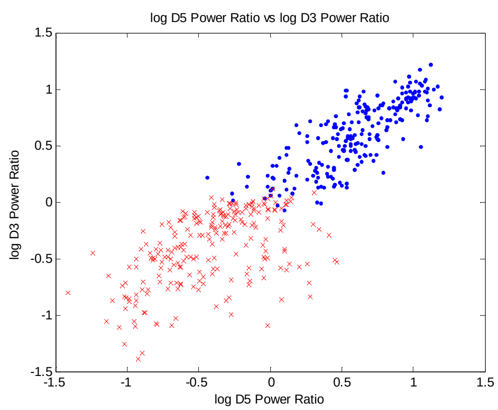


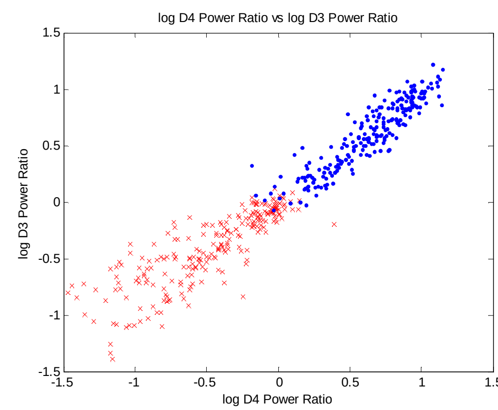


2-D Feature Space Realization



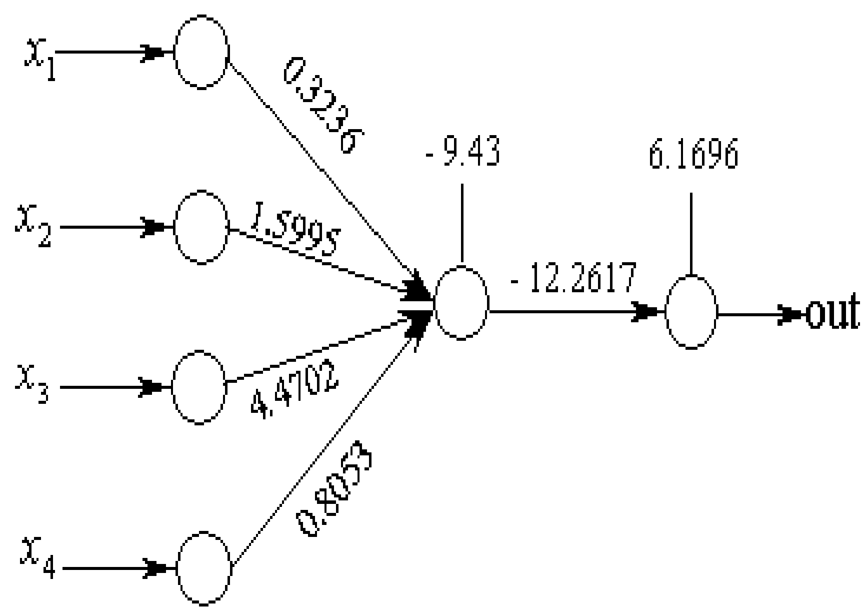






Results of Training Neural Network From Dugway Data

- Feature Space created using DWT.
  - 4-tuple feature vector.
  - $x^p = \left[x_{D5}^P, x_{D4}^P, x_{D3}^P, A_{5AREA}^P \right]$
  - 22 randomly selected vectors from 461 signatures.
- Trained Neural Network to trained output data of 0.
  - Single hidden layer neuron.
  - Total error in equation after training is less then 5e-3.
  - Learning rate of 0.1.



Results of HE/CB Discrimination

- Experiment 1.
  - Applying a neural network with the weights in the table 1 to DPG data, 99.1% Correct Classification.
- Experiment 2.
  - A neural network containing 4 hidden layer neurons trained using entire DPG dataset tested against NCPA dataset, 96.9% Correct Classification.

w_{i1}	w_{i2}	w_{i3}	w_{i4}	v_{j1}
11.6967	0.5343	-0.4958	-2.4991	-13.4966
4.6377	1.2455	3.5569	5.3068	13.3761
4.7023	0.9875	7.3951	8.902	-15.3761
-5.2246	1.481	2.6982	4.1203	-19.6513
-2.8169	1.4847	-18.9732	-23.6088	-14.286

Experiment #	Training Data	Test Data	Classification	Percentage
1	**11 CB (DSI)**	**225 CB (DSI)**	**225 CB / 0 HE**	**100%**
	11 HE (DSI)	**214 HE (DSI)**	**210 HE / 4 CB**	**98.10%**
2	**236 CB (DSI)**	**166 CB (YPG)**	**165 CB / 1 HE**	**99.40%**
	225 HE (DSI)	**57 HE (YPG)**	**51 HE / 6 CB**	**89.50%**

Blind Results of HE/CB discrimination

- Experiment 3.
  - Utilizing the neural network containing 4 hidden layers neurons trained against the entire "known" DPG data set was then tested against the "blind data" the results once compared with the truth resulted in 98.3% and 95.7% reliable classification.

w_{i1}	w_{i2}	w_{i3}	w_{i4}	v_{j1}
11.6967	0.5343	-0.4958	-2.4991	-13.4966
4.6377	1.2455	3.5569	5.3068	13.3761
4.7023	0.9875	7.3951	8.902	-15.3761
-5.2246	1.481	2.6982	4.1203	-19.6513
-2.8169	1.4847	-18.9732	-23.6088	-14.286

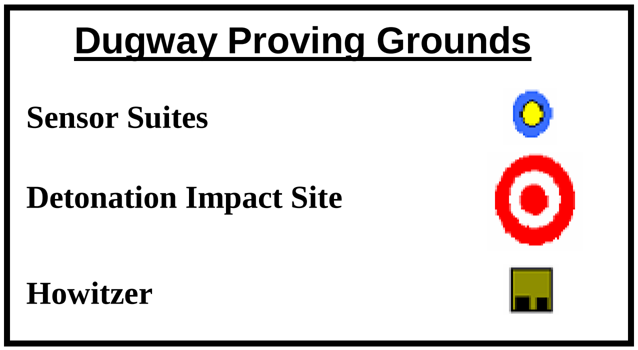
Experiment #	Training Data	Test Data	Classification	Percentage
3	236 CB (Blind)	230 CB (Blind)	226 CB / 4 HE	98.3 %
	225 HE (Blind)	184 HE (Blind)	176 HE / 8 CB	95.7 %

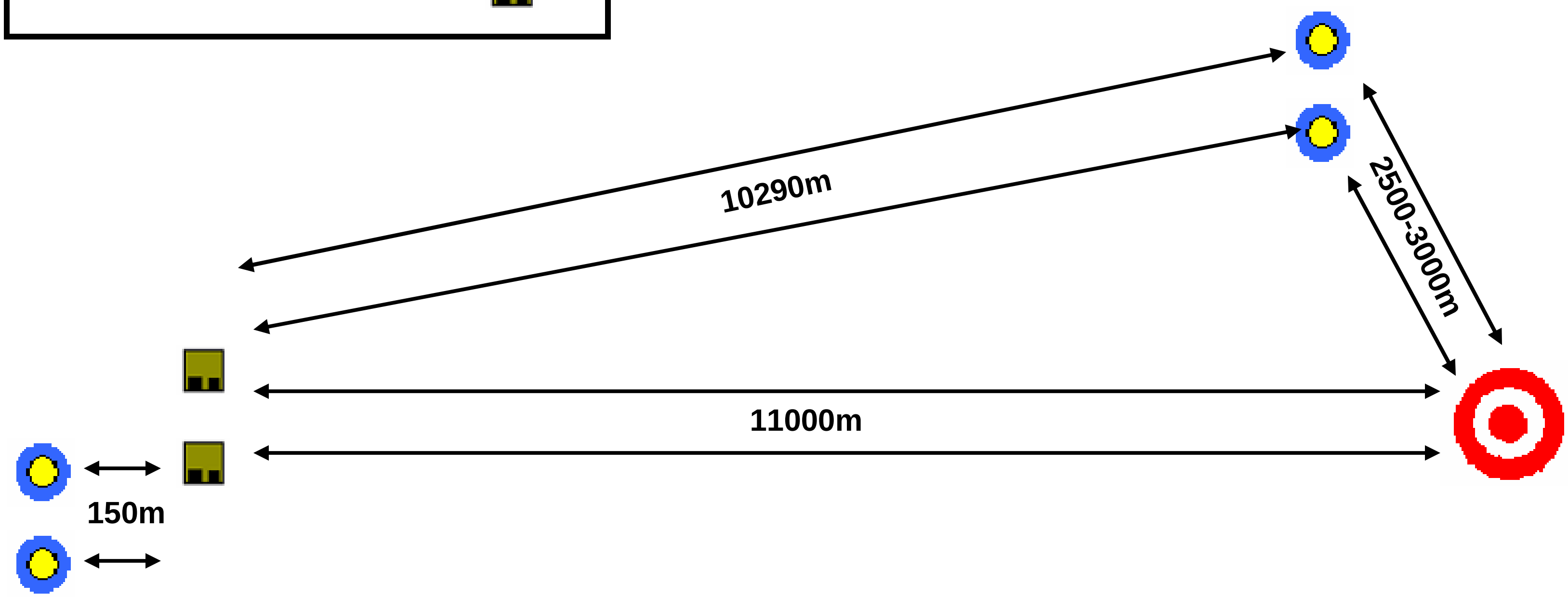
Experiment 4 Real Time Implementation

- Portable Area Warning Surveillance System (PAWSS).
  - 1yr Limited Objective Experiment (LOE).
  - Focused on the utility of cascading detection methodologies.
  - Combines Stand-off CBRN systems to address both force/installation protection.
- LOE Outcomes.
  - Operable Products leading to fully designed products that are sustainable.
  - Demonstration of capabilities within simulated battlefield environments of layered wide area cascading detection.

PAWSS LOE Test Layout

Artillery Variant	# of Rounds
HE	24
CB	48





Real Time Performance

- During June 21st and June 22nd, 2005 a proof of concept test was conducted for the acoustic CBRN discrimination algorithm.
  - PAWSS Test Site, DPG.
    - Acoustic System 2.5km-3km from Impact Zone at elevations of 400m-1000m.
  - A C++, real time algorithm was tested at DPG as part of the acoustic portion of PAWSS LOE conducted by JPM for NBC Contamination Avoidance at ECBC.
  - A total of 72 HE/CB rounds were detonated.
    - A howitzer fired 24 HE, and 48 CB rounds.
- Single Round Volley Results.
  - 38 Airburst Detonation (14 HE, 24 CB), **100%** Correct Classification.
- Multiple Round Volley.
  - CBRN Algorithm Never Benchmarked in Lab vs. Multiple Rounds.
    - 2 Rounds simultaneously fired followed by a 3rd round fired soon as possible.
  - 34 Airburst Detonation (10 HE, 24 CB).
    - 17 events, each event consisted of 2 detonations.
  - 83% Overall Correct Discrimination of HE/CB.
    - 100% discrimination on all HE rounds.
    - 100% acoustic detection of all events.
    - 28 correctly discriminated from 34 detonations.

PAWSS LOE Summary

- PAWSS LOE was conducted June 19th-28th.
- Implemented real time version of CBRN Discrimination at PAWSS LOE conducted by ECBC.
- 100% single volley discrimination, never tested against dual volley, still 83%, also all event starts were detected for 100%.
- Assist in transition and support of acoustic element CBRNEWS ATD extending LOE efforts.

Event Type	# of Events	Discriminated Correctly
Single Round	38	38/38; 100%
Dual Round	34	28/34; 83%

Conclusion

- Features extracted facilitate robust classification.
  - Reliable discrimination of CB rounds, **98.3%** or greater of single volley events.
- The features this algorithm is based on go beyond previous amplitude dependent features.
  - Degradation due to signal attenuation and distortion is nullified and **exceeds 3km** in range propagation.
- Scalable time frequency representation uncovered non-readily detectable features.
  - Subband components remove higher frequency noise features.
  - Isolating the details of higher oscillatory components.
- Real time verification at PAWSS LOE of CBRN Discrimination Program Implemented in C++.
  - Single volley round discrimination in real time for all variants was **100%.**
  - Dual volley round discrimination in real time for all variants was **83%,** and detected an event **100%** of the time.
- Wavelets can be possibly used to discriminate varying types of artillery projectile launches from impacts independent of range.
  - Utilizing wavelets and other signal processing techniques to perform a similar task as described within with refinement for the problem.
- Future Considerations.
  - Networking of sensors can provide TDOA abilities to further localize a threat.

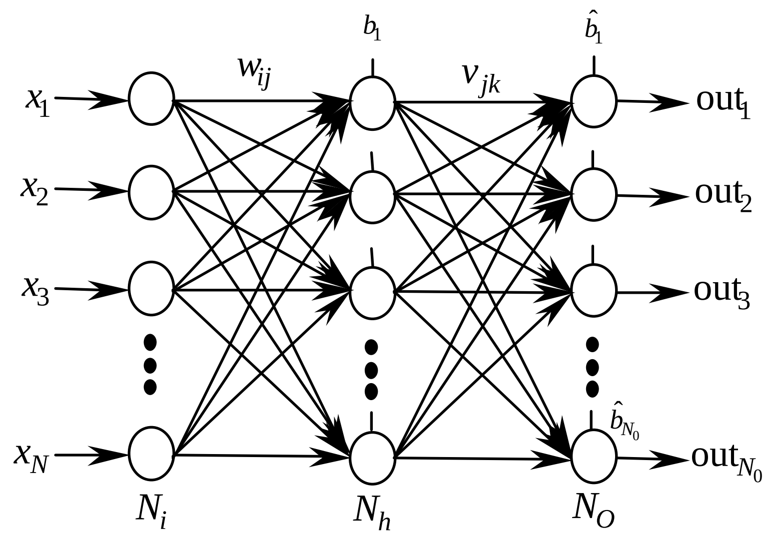
Acknowledgements

- Chris Reiff from Army Research Lab for his assistance in providing data sets from the DSI test.
- David Sickenberger and Amnon Birenzvige at Edgewood Chemical and Biological Center (ECBC) providing detailed documentation about the test at DSI.
- Edward Conley from JPM NBC Contamination Avoidance Office allowing us to participate in the PAWSS LOE.

Backup

Neural Network

- Realize non-linear discriminant functions and complex decision regions to ensure separability between classes.
- Standard Multilayer Feedforward Neural Network.
- Number of hidden layer neurons depend on complexity of required mapping.



Typical Met. Condition at PAWSS Test

UT-BATTELLE

Oak Ridge National Laboratory

MG(R) John C. Doesburg
Director, Homeland Security Programs
Director, Center for Homeland Security

December 2005

“Imagination is more important than knowledge …”

“The important thing Is not to stop questioning …”

**“If we knew what it was we were doing,
it wouldn’t be called research, would it?”**

Albert Einstein

Oak Ridge National Laboratory's research framework

National Security

Energy

Environment

Applied to compelling national problems

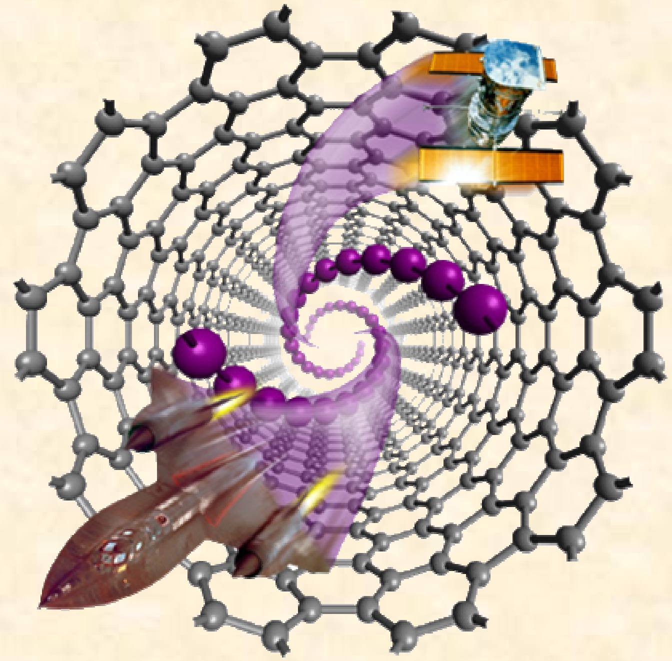
Integrating scientific themes:

Nanoscale R&D, ultrascale computing, systems biology

Intellectual foundations in science, engineering, and technology

Our aspiration:
Best lab in the world at what we do

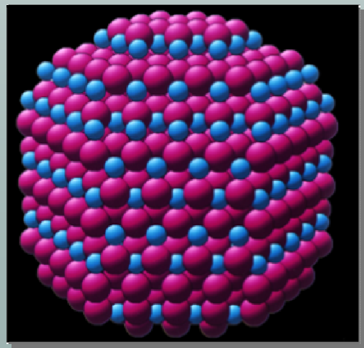
- **Control of functionality at the nanoscale**
- **Leadership-class computing for the frontiers of science**
- **Integration of biology and ecology, based on the foundation of understanding molecular-level interactions**
- **Integration of science, technology, and thought leadership for energy**
- **Innovative solutions that improve national, homeland, and global security**



The Nano-Info-Bio Nexus

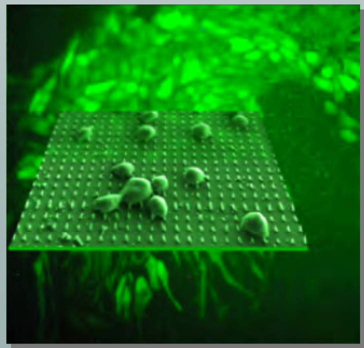
We can expect revolutionary solutions to compelling problems in national security, energy, the environment, and medicine as we begin to

Develop a detailed understanding of the processes by which molecules organize and assemble themselves



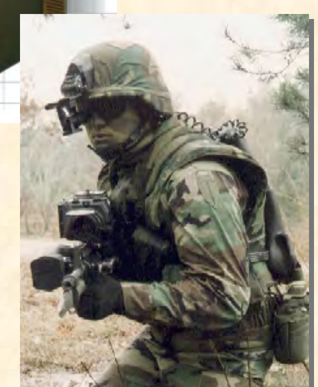
Apply the principles of physics and chemistry to the modeling of biological systems at the atomic and molecular level

Model and simulate the behavior of complex systems



We are applying our S&T resources to national and homeland security

- **Deploying integrated systems for incident awareness, detection, and response**
- **Creating tools for information management, synthesis and analysis**
- **Expanding modeling and simulation for threat analysis and response planning**
- **Delivering enhanced protection and new capabilities to warfighters**
- **Applying advanced materials to security applications**
- **Detecting, preventing, and reversing the proliferation of weapons of mass destruction**



We have significant strengths in key areas

Radiological and nuclear weapons countermeasures

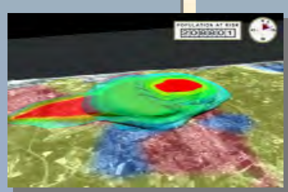
- RDD attribution studies, forensics program development, and decontamination of the aftermath
- Active interrogation technologies
- Radiation detection technologies and new materials

Chemical and biological

- Mass spectrometry
- Bioinformatics
- Host-pathogen interactions

Threat vulnerability testing and assessment

- Geospatial science
- Plume/effect modeling
- Cybersecurity technology

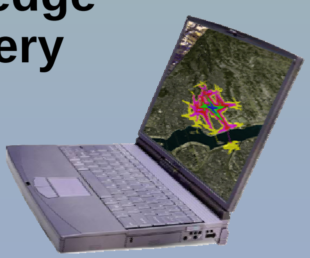


Infrastructure protection

- Vulnerability assessment and mitigation

Crosscutting

- Sensor technologies
- Knowledge discovery



Significant advances in sensors and detectors

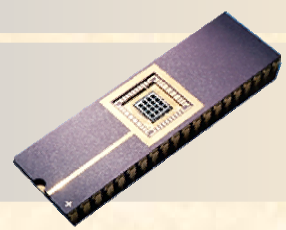
Block II Chemical-Biological mass Spectrometer Detector

Microcantilever sensors for detection of explosives and chemicals

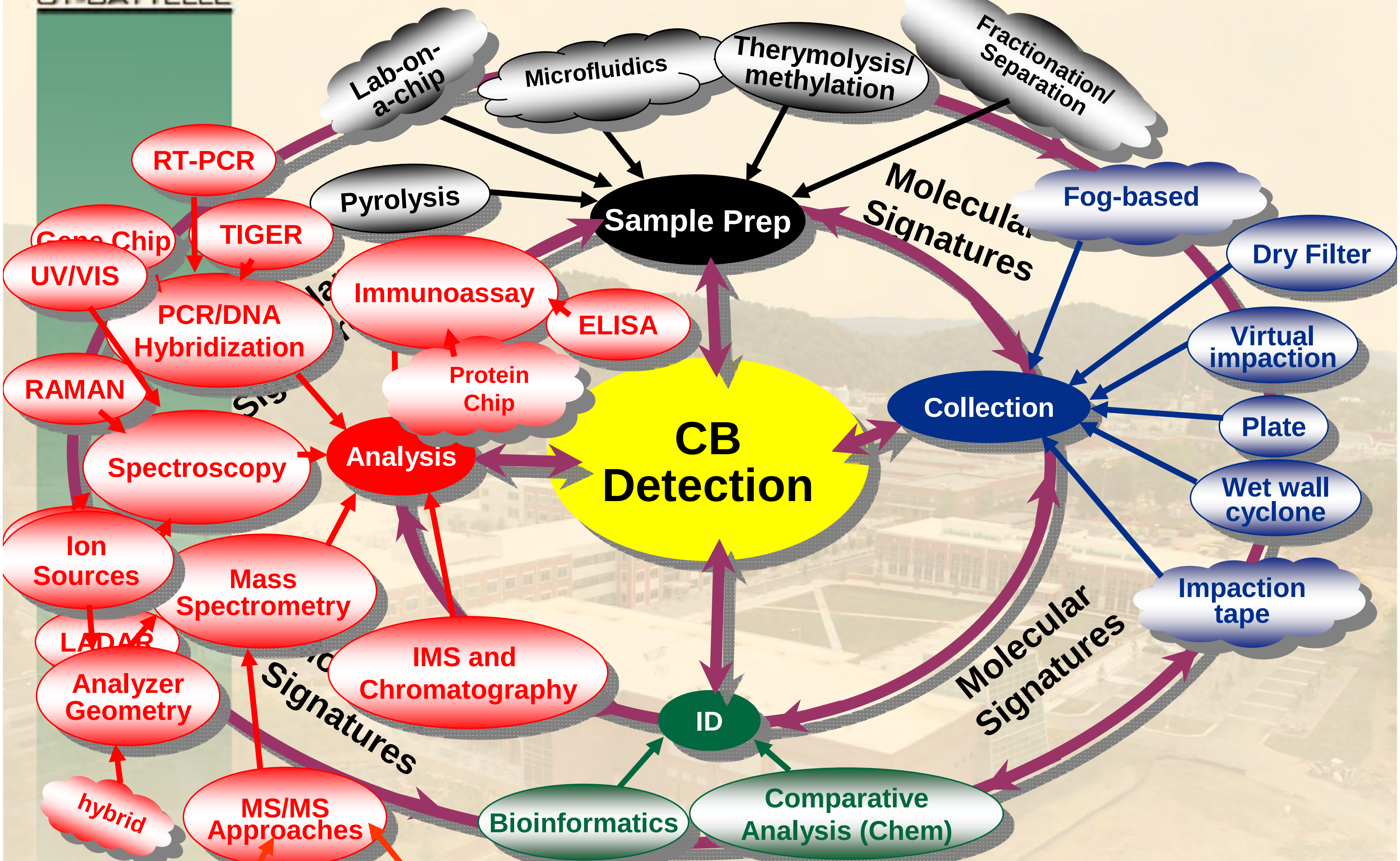
AquaSentinel for water supply protection

RAMiTS for detection of chemical agents and other hazardous chemicals

Biochip for detection of bacteria, viruses, and toxins



System of Systems Approach for CB Detection



Infrastructure protection

- **Modeling, simulation, and analyses used to assess vulnerabilities, consequences, and risks**
  - **Vulnerability Interactive Site Analysis Code (VISAC)**
  - **HYTRAS**
  - **LandScan**
  - **TRAGIS**
- **Real-time support to decision makers during crises and emergencies**
  - **HPAC**
  - **OREMS**
  - **SensorNet**

Infrastructure revitalization at ORNL is expanding our capabilities

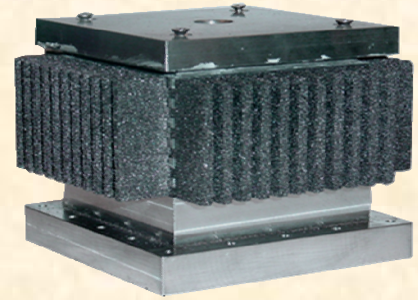
State-of-the-art vivarium housing ORNL's genetically distinctive mouse colony

Multiprogram Research Facility

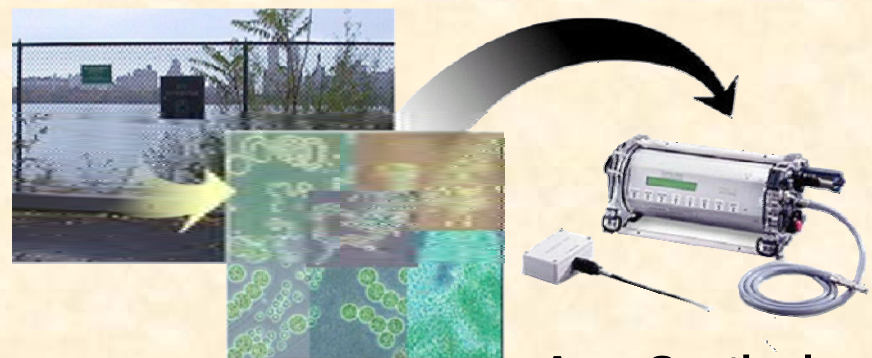
- 200,000 ft^2
- Light labs, computing space, and offices
- Capable of handling the full range of national and homeland security work

Partnerships are essential to our success

- **Other national laboratories**
- **Universities**
  - **UT-Battelle/ORNL core universities**
  - **UT-ORNL Center for Homeland Security and Counterproliferation**
- **Other government agencies**
- **Education/Training With Industry Program (U.S. Air Force and U.S. Army)**
- **ORAU post-docs**
- **Industry**
  - **National Security Technology Consortium**
  - **United Defense**
  - **National Safe Skies Alliance**
  - **NucSafe**

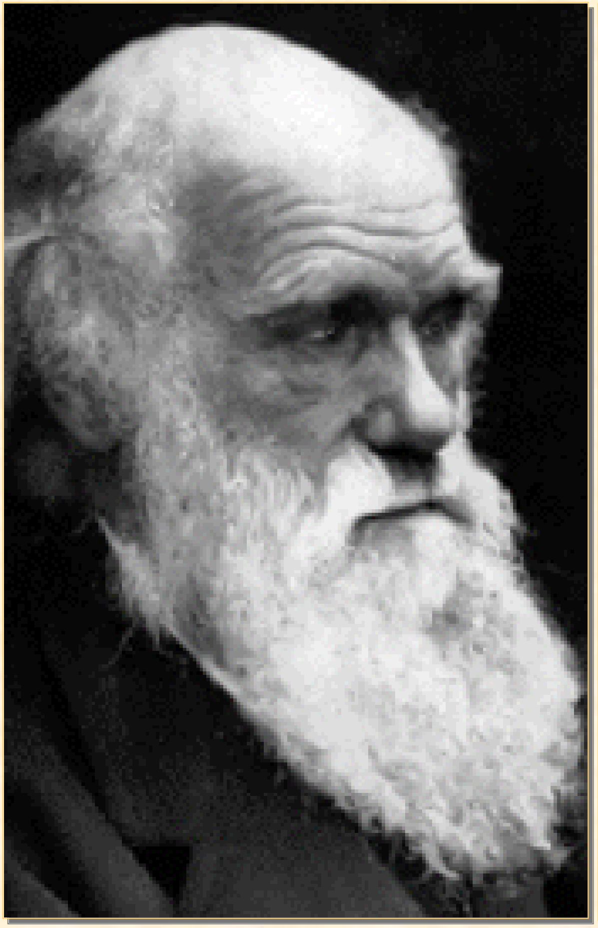


Carbon foam



AquaSentinel

Oak Ridge National Laboratory:
Ready for the next generation of great science



"It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change."

– Charles Darwin

PharmAthene

Dedicated to a safer world

USSOCOM Chemical, Biological, Radiological & Nuclear Conference & Exhibition

December 8, 2005

Use of Recombinant Butyrylcholinesterase in Responding to Chemical Weapon Attack

Gary D. Dorough, Ph.D., DABT
Director of Research
PharmAthene

Confidential

PharmAthene

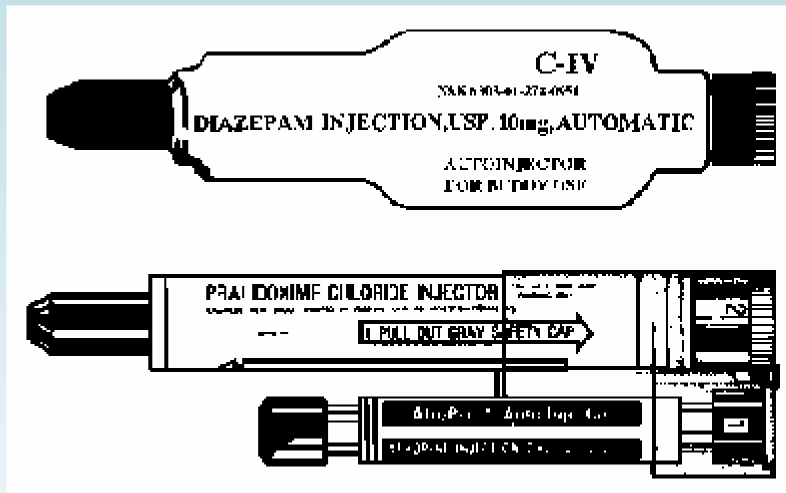
PHARMATHENE, INC.

- PharmAthene's primary objective is the development of effective countermeasures to biological and chemical weapons

- PharmAthene has two lead compounds:
  - A recombinant protein, Butyrylcholinesterase (BChE), for both pre-exposure prophylaxis and post-exposure therapy of nerve agent exposure.
  - A fully human antibody designed to protect against inhalation anthrax, the most lethal form of illness in humans caused by the *Bacillus anthracis* bacterium

PHARMATHENE, INC.

Current Response Mark I and CANA



The future of rapid response to a CW threat will be greatly enhanced by development of compounds such as Protexia

PHARMATHENE, INC.

Anticipates that the needs of SOCOM may not always be identical to that of big-DOD/Army

Coordination between Industry and SOCOM early in a project may lead to SOCOM specific products

For example, SOCOM may have needs for different drug-formulations, delivery systems, or routes of administration

Scenario 3: Chemical Agent Attack

USSOCOM

Scenario 3: Chemical Agent Attack

- Simultaneous Nerve Agent attack at three geographic locations
- 35,000 to 100,00 civilians in vicinity
- Initial explosions kill or maim a number of passers by
- What follows is a progressively acrid smell and onset of nerve agent symptoms

USSOCOM

Scenario 3: Chemical Agent Attack

- First responders don their Self-Contained Breathing Apparatus.
- Panic sets in to most of the crowded venues

WHY IS THIS SCENARIO ALARMING?

US: the panicked evacuation of Capitol Hill

By Bill Van Auken
13 May 2005

"Panic seized the US capital Wednesday and was transmitted in amplified form to the entire country via the broadcast airwaves. The cause was a light plane flown by two hapless pilots from rural Pennsylvania, who mistakenly strayed into the restricted airspace surrounding Washington DC."

In the midst of the tumultuous evacuation of more than **35,000** people onto the streets of Washington,

WHAT IF THIS HAD BEEN THE PRELUDE TO A CHEMICAL ATTACK?

PREPARATION
OR
PANIC

PANIC: The Destructive Aspect of a Terrorist Attack

- In a crowd, "people behaved differently depending on who they were told the people around them were."*

- "more mutual helping and a calmer response will result when people feel part of a group." *

* 27 June 2005 Press Release, University of Sussex

PREPARATION OR PANIC

- PharmAthene proposes to mitigate panic by:
  - Supporting multifunction Ready-Response teams
  - Providing prophylactic and therapeutic treatment for nerve agents (Protexia)
    - Increase first responder functionality
    - Decrease crowd anxiety by having first responders appear less alarming

PharmAthene

"DOTLMPF"

Doctrine:
Organization:
Training:
Leadership:
Material:
Personnel:
Facilities:

Why Change Doctrine

"Mayors Recommend Greater Role for Military in Emergency Response"

October 24, 2005

- **Recommendations:**
- Enhance Military Involvement in Response
  - Allowing for greater military involvement in immediate response
  - Creating a mechanism for direct military assets during a terrorist attack
- Creating a Better Distribution System
  - Distribution of federal first responder assets directly to local areas

PharmAthene

Doctrine

- Standing-up, and strategically staging prophylactically-protected, multi-purpose, CONUS “ready-teams”
- Emphasis is on targeting panic and site control

Organization/Personnel

- Stand-by teams consisting of experts in security, psychological operations, crowd control, local government affairs, medical counter measures, patient treatment, and science and technology

- Personnel protected enroute with nerve agent Bioscavenger Protexia

Leadership

- On-site temporary authority (over both Federal and State assets) to coordinate first responders and other assets
- Requires significant change in current local policy and doctrine
- Could avoid scenarios such as an apparent slow response to the Katrina Disaster in New Orleans

Training

- Response times within a few hours of an event
- Site control and containment
- Establishing command centers
- Coordinating Federal and State responders (i.e., local security, medical, and decontamination)

Training

- Use of Protexia by first responders
- Triage those in need of Protexia
- Distribution of strategically stockpiled Protexia to local medical facilities
- Educating local medical personnel in the use of Protexia

WHY PROTEXIA

In animal studies sponsored by the US Army

Protexia pre-treatment (18 hr) prior to **5.5 x** LD50 Soman or VX

- 100% survivability
- no signs of toxicity
- no weight loss and no impairment of motor coordination

Conventional therapy following **1.5 x** LD50 Soman or VX

- 50% survivability of Soman and 100% of VX
- Severe toxic signs (transient)
- weight loss and impairment of motor coordination

EFFICACY OF PROTEXIA

As you heard yesterday, in order to get a product fielded for use, we are required to do animal studies.

For nerve agent pre-treatments we use Guinea Pigs to test efficacy of compounds

The very short (very fast) movie clip attached shows an untreated/unexposed guinea pig walking a balance beam to test neurologic function;

The color lines you see allow us to use computers to monitor and compare neurologic function

PharmAthene

EFFICACY OF PROTEXIA

The following clip shows a guinea pig that was pretreated with Protexia and then 18 hrs later exposed to 5.5 x LD50 of Soman

We treated more than 24 animals with different V or G series nerve agents and 100% of the animals pretreated with Protexia survived with no signs of poisoning.

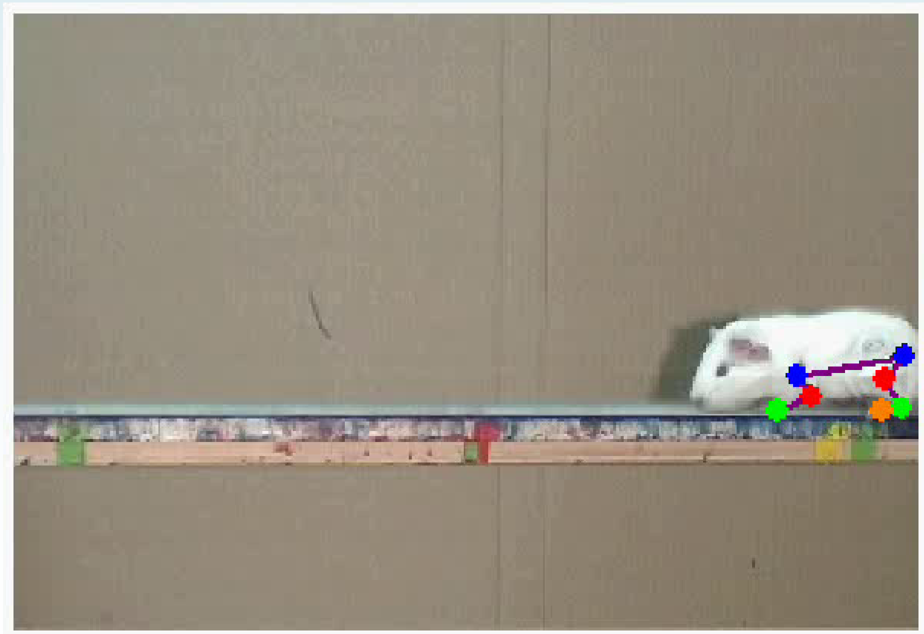
What you will see is a perfectly normal guinea pig which would have no impact in a functional field setting

PharmAthene

EFFICACY OF PROTEXIA

The next clip shows an animal that was exposed to only 1.5 x LD50 of Soman and immediately given the conventional treatment of atropine/2-PAM/Diazapam

And Yes, We do employ Model: (1) Guinea-Pig Emergency Capture/Safety Device



PharmAthene

WHY PROTEXIA

- BChE testing has been conducted in collaboration with US and Canadian Defense Departments
- Efficacy studies indicate that prophylactic Protexia can protect animals against the toxicity of multiple lethal dosages (LD_{50}s) of VX and soman
- Protexia administered up to 1 hour post nerve agent exposure in animal models can rescue up to 90% of guinea pigs from an otherwise lethal exposure to VX

PharmAthene

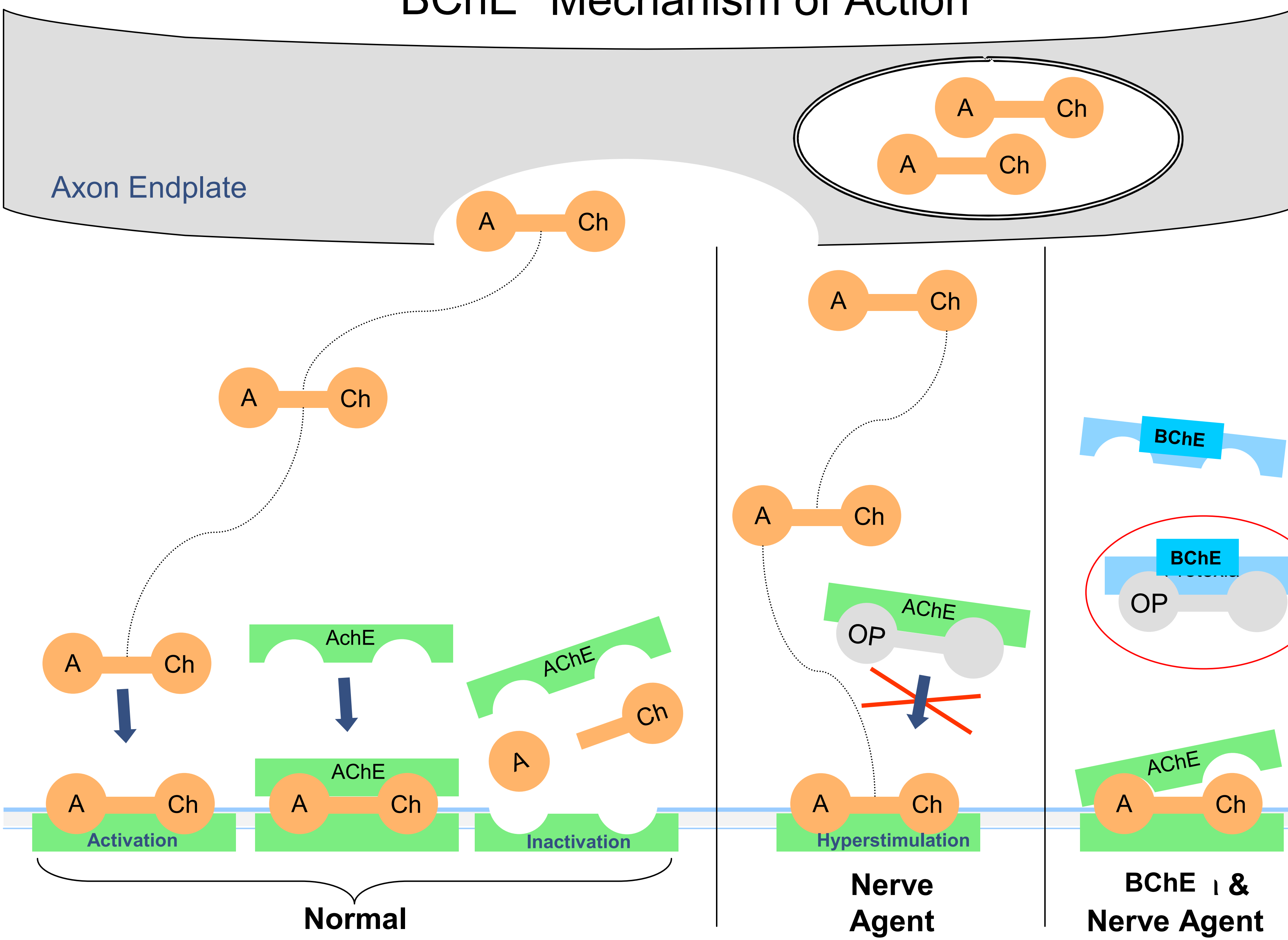
PROTEXIA: Why Does it Work

- Butyrylcholinesterase (BChE) is a naturally occurring protein found in extremely small quantities in blood.

- PharmAthene has developed a technology to produce large amounts of BChE/Protexia in the milk of Goats

- BChE functions as a natural bioscavenger, like a sponge, to absorb and degrade nerve agents before they cause neurological damage.

BChE Mechanism of Action



Protexia May Provide:

- Prophylactic protection from large doses of nerve agent
- Ease of administration for first responders
- Comfort of knowing protection is “on board”
- Increased ability to operate freely in contaminated areas
- Decreased levels of PPE/MOPP gear

Material

- Rapid air and ground transportation
- Less restrictive Personal Protective Equipment
- Protexia
  - Available to First Responders
  - Stockpiled for distribution to Aid Stations
  - Distributed to local hospitals for potential use as therapy

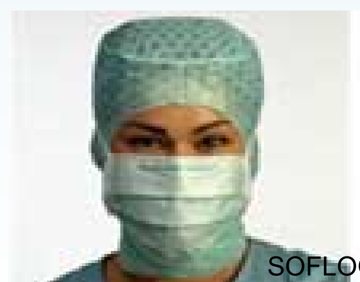
Current Response Personal Protective Equipment

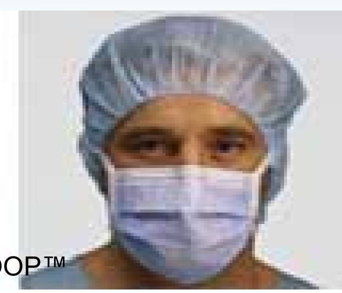
Possible Post-Prophylaxis Personal Protective Equipment?

DuPont Tychem®

Photos by Karen Fleming-Michael

Nitrile Flock-Lined





SOFLOOP™

Confidential

Facilities

SIMULATED EAST COAST CONUS

RESPONSE TEAM STAGING LOCATIONS

1: MacDill AFB
2: Bolling AFB
3: Hanscom AFB
4: Fort Bragg
5: Rickenbacker AFB
6: Robins AFB
7: Gunter AFB
8: Fort Knox
9: Kellogg AGS
10: Fort McCoy
11: Glenview NAS
12: Des Moines AGS
13: Fort Leonard Wood
14: Little Rock AFB
15: Fitzsimmons AMC

Conclusion

- It is anticipated that data to be collected will support the use of Protexia as a nerve agent countermeasure in the future
  - Anticipated filing of IND in 2007
  - Anticipated filing of BLA in 2012
- Our intent is to demonstrate that anticipating future technology, such as Protexia, can play a role in future doctrine/policy

- QUESTIONS?

Contact:
Gary Dorough
doroughg@pharmathene.com
410-571-8420

CB Defense Science and Technology Innovation for the Future

Dr. Charles R. Gallaway
Defense Science and Technology Office
Chemical and Biological Defense Program
DTRA/CB

6 December 2005

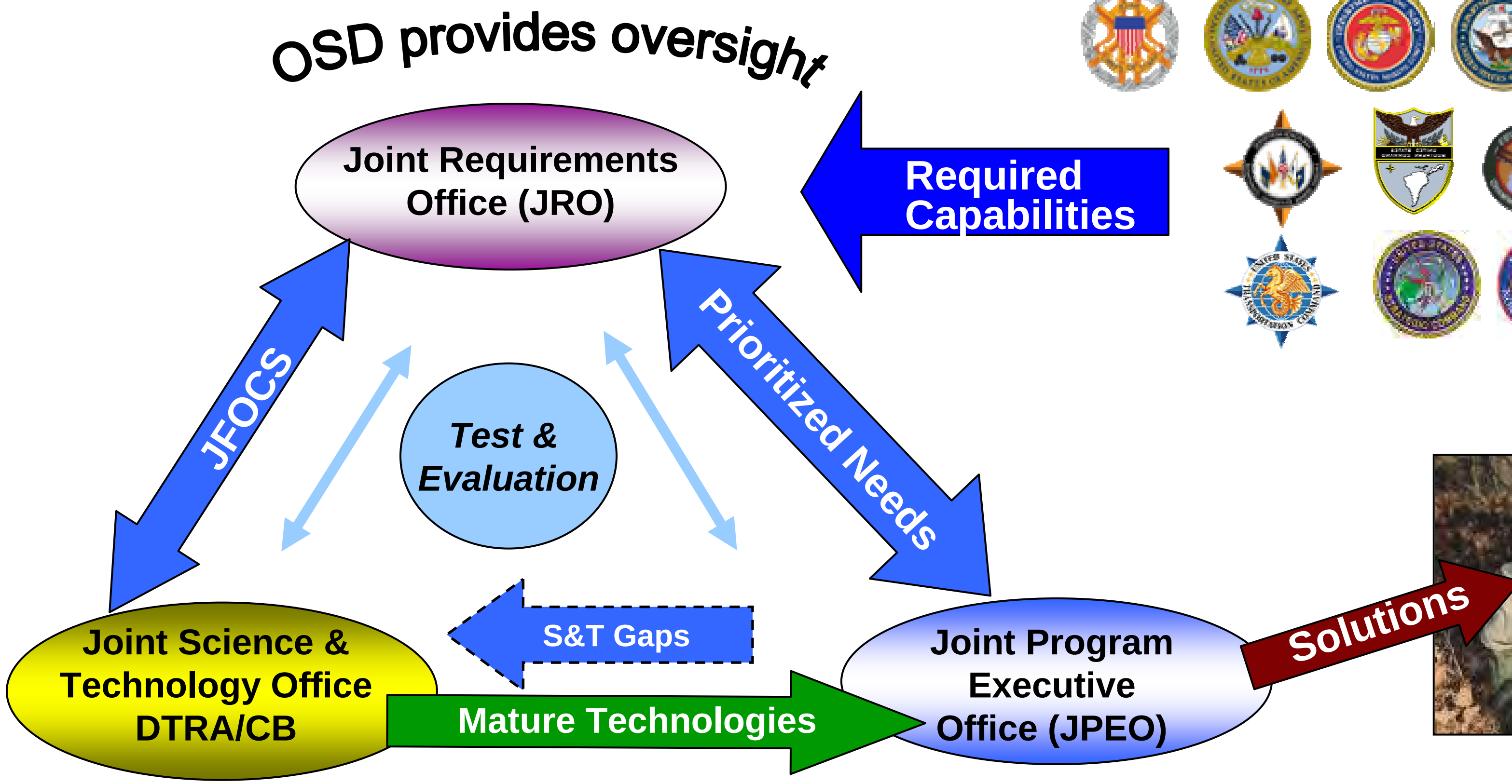
Making the World Safer

Overview

- **The Chemical and Biological Defense Program (CBDP)**
- **S&T Major Thrusts**
- **Advanced Concept Technology Demonstrations**

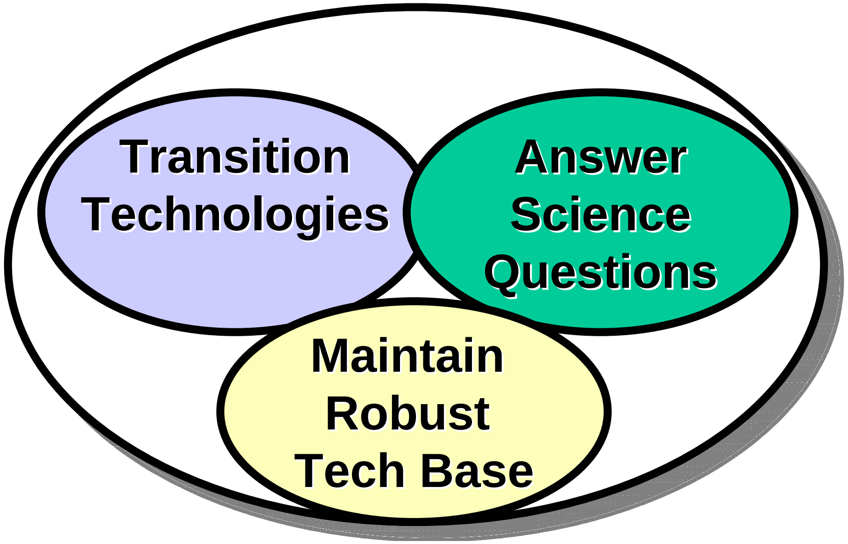
Chemical and Biological Defense Program Team

- Combatant Commanders
- Services



Science and Technology Mission

Develop and sustain a robust, agile, and flexible science and technology program to support chemical and biological defense capability needs

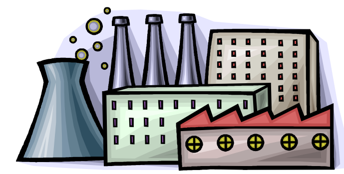


Mission Space

- *Maneuvering warfighters*
- *Installation protection*
- *Homeland defense*
- *Global war on terrorism*

We reach out to the best-in-class performers

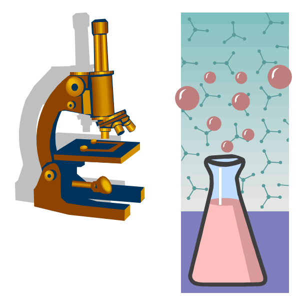
Academia

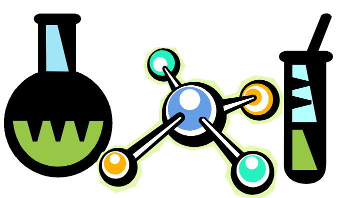


Industry

Service Labs/Agencies

FFRDCs





National Labs

Plain-English summary of our major thrusts…

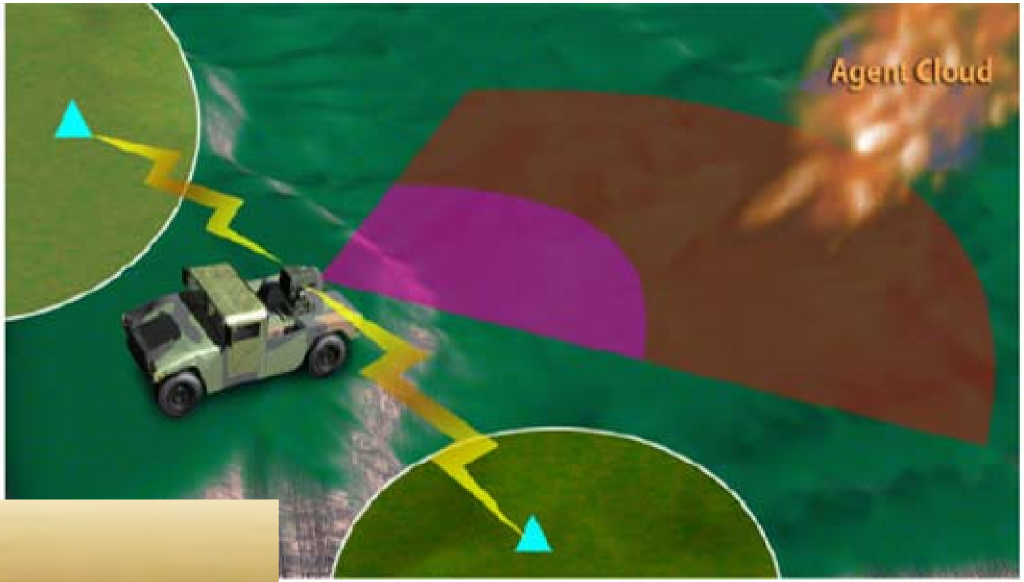
- **Earliest warning**
  - **Detection**
  - **Medical diagnostics**
  - **Information dissemination**

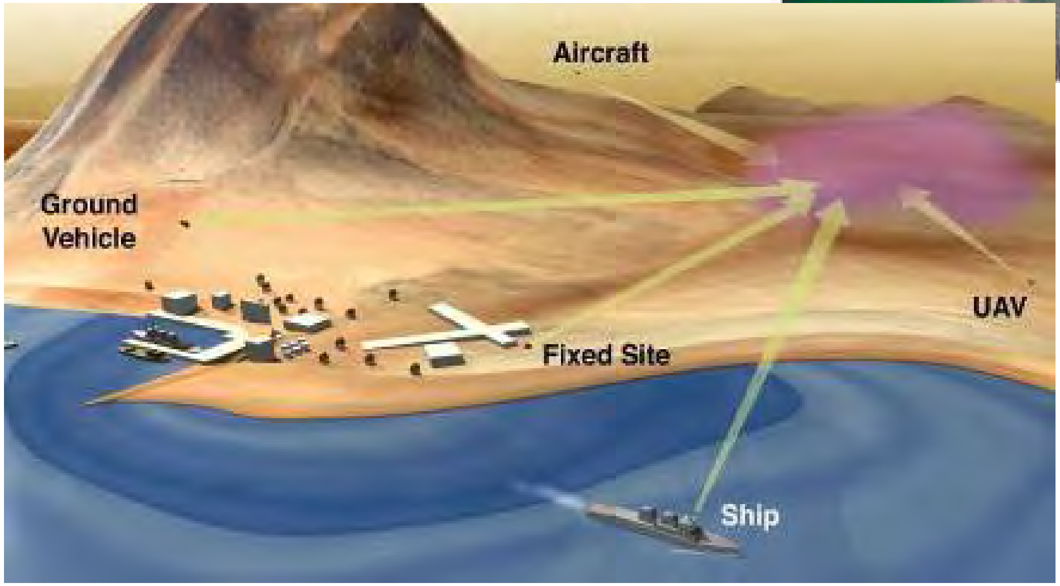
- **Broad spectrum medical countermeasures**
  - **Pretreatment**
  - **Therapeutics**

- **“How clean is safe?”**
  - **Decontamination**
  - **Low-Level toxicology**
  - **Environmental fate of agent**

Detection

- **Capability Needed**
  - Detect and identify biological threats at stand-off distances
  - Integrated Chem/Bio Detection

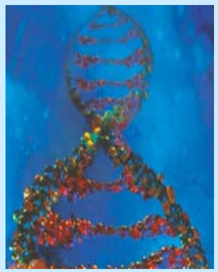




- **Current Efforts**
  - Explore terahertz spectroscopy for detection
  - Investigate laser-induced millimeter wave fluorescence for better bio-discrimination

Diagnostics

Automated DNA Extraction **Rapid Diagnostics**



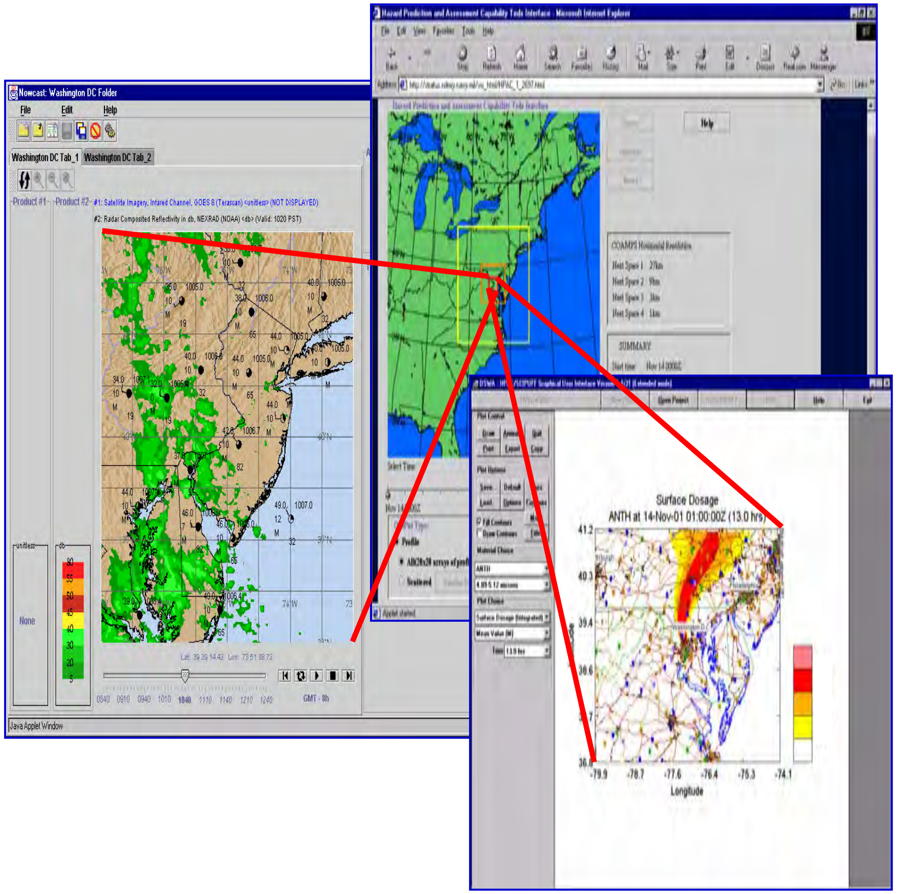
Joint Biological Agent Identification and Detection System - Block I

- **Capability Needed**
  - **Hand-held diagnostic capability, easy to operate, and with minimal logistical requirements**

Integrated Hand-held Platform

- **Current Efforts**
  - **Developing nucleic acid and antigen detection assays and reagents**
  - **Establishing standards for DoD developed nucleic acid and immunodiagnostic assays**
  - **Assessing resequencing technology for rapid identification of emergent/genetically engineered bio-agents**

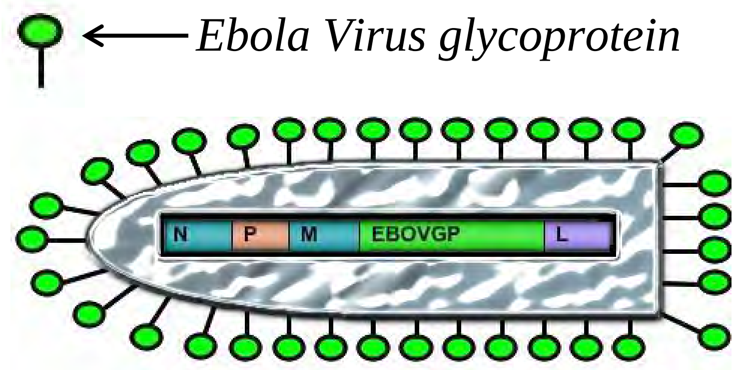
Battlespace Awareness



- **Capabilities Needed**
  - **Reliable, automated warning to allow unaffected personnel to remain in a lower protection state**
  - **Common Operating Picture of CBRN analysis and collaboration across the theater**
- **Current Efforts**
  - **Developing computational fluid dynamic (CFD) libraries for a particle transport model to provide rapid and high resolution analysis around buildings and ships**
  - **Developing techniques to use high-resolution radar data to improve wind fields for models**
  - **Providing automatic source term estimation using data from either sensors or observations**

Pretreatments

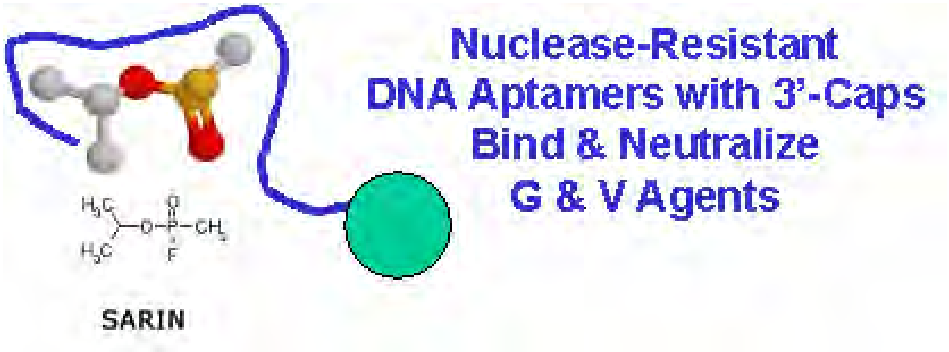
- **Capabilities Needed**
  - **Single vaccines that protect against multiple biological agents, administered via needle-free delivery systems**
  - **Rapid drug development against emerging threats**
  - **Prophylaxis for chemical warfare nerve agents**
- **Current Efforts**
  - **Evaluating select target antigens in various vaccine platforms for immunogenicity, safety, efficacy, and minimal dosing**
  - **Combining current products into one formulation for a straight recombinant protein vaccine (multi-agent vaccines)**
  - **Evaluating molecular/genetic platforms**



Silver Bullet: Negative-strand RNA based vaccine expression system

Therapeutics

- **Capabilities Needed**
  - **Effective countermeasures against viruses and toxins**
  - **Broad spectrum (multi-agent) therapeutic technologies**
- **Current Efforts**
  - **Identifying intersecting targets for intervention including common mechanisms of pathogenesis, common host responses, common housekeeping functions**
  - **Identifying and characterizing a candidate broad-spectrum nerve agent reactivator to replace the current reactivator (oxime) in nerve agent therapy**



Decontamination

- **Capabilities Needed**
  - **Non-corrosive decontaminants that are effective against a broad spectrum of agents**
  - **Effective and safe decontamination for sensitive equipment and vehicle and building interiors**

- **Current Efforts**
  - **Modeling quantum-chemical agent/adsorbent Interactions**
  - **Studying surface chemistry of vaporous H_2O_2 and ClO_2**
  - **Developing solvent soluble decontaminating enzymes**
  - **Aerosolizing activated H_2O_2 for decontamination of aircraft interiors**

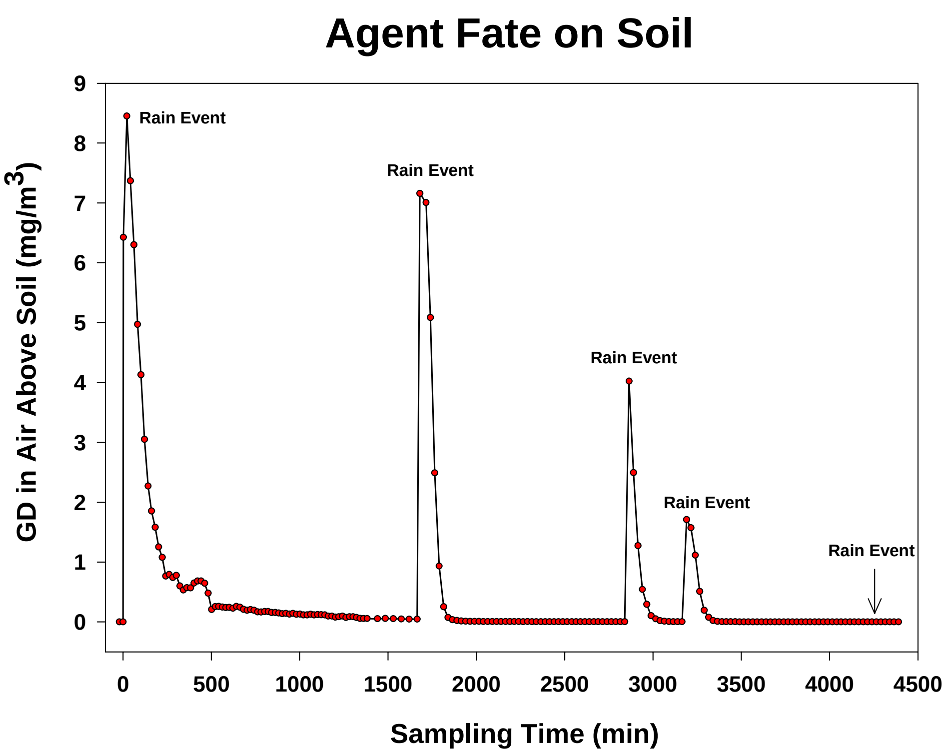
Protection

- **Capabilities Needed**
  - Comprehensive protection against broad spectrum chemical/biological/radiological agents and toxic industrial chemicals
  - Individual and collective protection systems that impose less logistical and physical burden on the warfighter
- **Current Efforts**
  - Developing end-of-service-life indicator for a wide range of chemical agents
  - Developing selective and responsive nanopore-filled membranes as breathable barriers

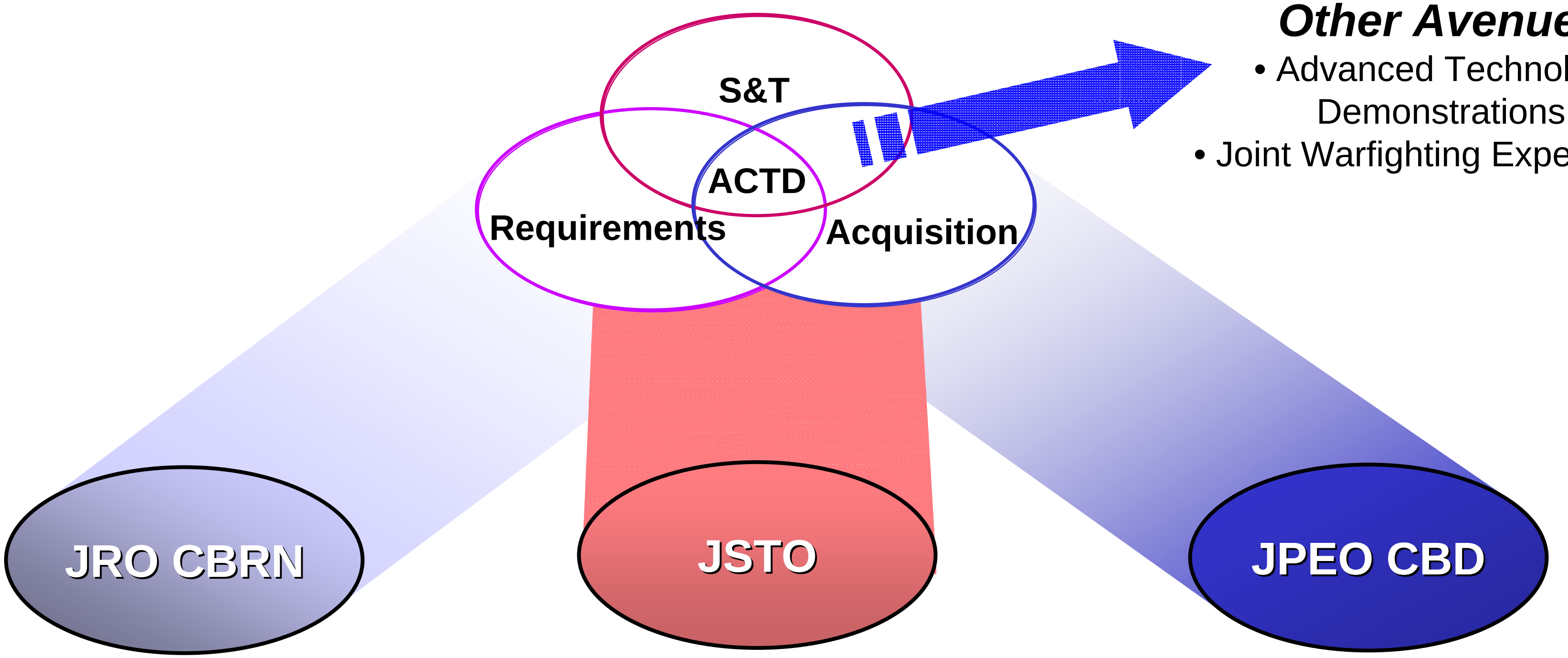
XM50 JSGPM

Threat Agent Science

- **Capabilities Needed**
  - **Improved CONOPS based on better understanding of science**
- **Current Efforts**
  - **Studying toxicological effects for low-levels of exposure to agents**
  - **Researching environmental fate of agent**



ACTDs are one of our transition tools



Other Avenues
- Advanced Technology Demonstrations
- Joint Warfighting Experiments

CBRN Unmanned Ground Reconnaissance (CUGR) ACTD

- **Raman surface contamination detection in manned recon vehicles**
  - **TICs/TIMs**
  - **Non-Traditional Agents (NTA) along with traditional Chemical Warfare Agents**
  - **Integrate on-the move radiological and biological sampling and detection: reduce human error**
  - **Recon routes at the speed of the maneuver force, independent of terrain**
- **Unmanned CBRN detection capabilities**
  - **Recon urban terrain remotely**
  - **Keep crew out of contamination and of direct fire**
  - **Keep contamination out of the Recon Vehicle**

Chemical Biological Defense S&T …A New Approach

- ***Warfighter requirements from the JRO***

    - ***Innovative technology from the JSTO***

        - ***Technology solutions transitioned to the JPEO***

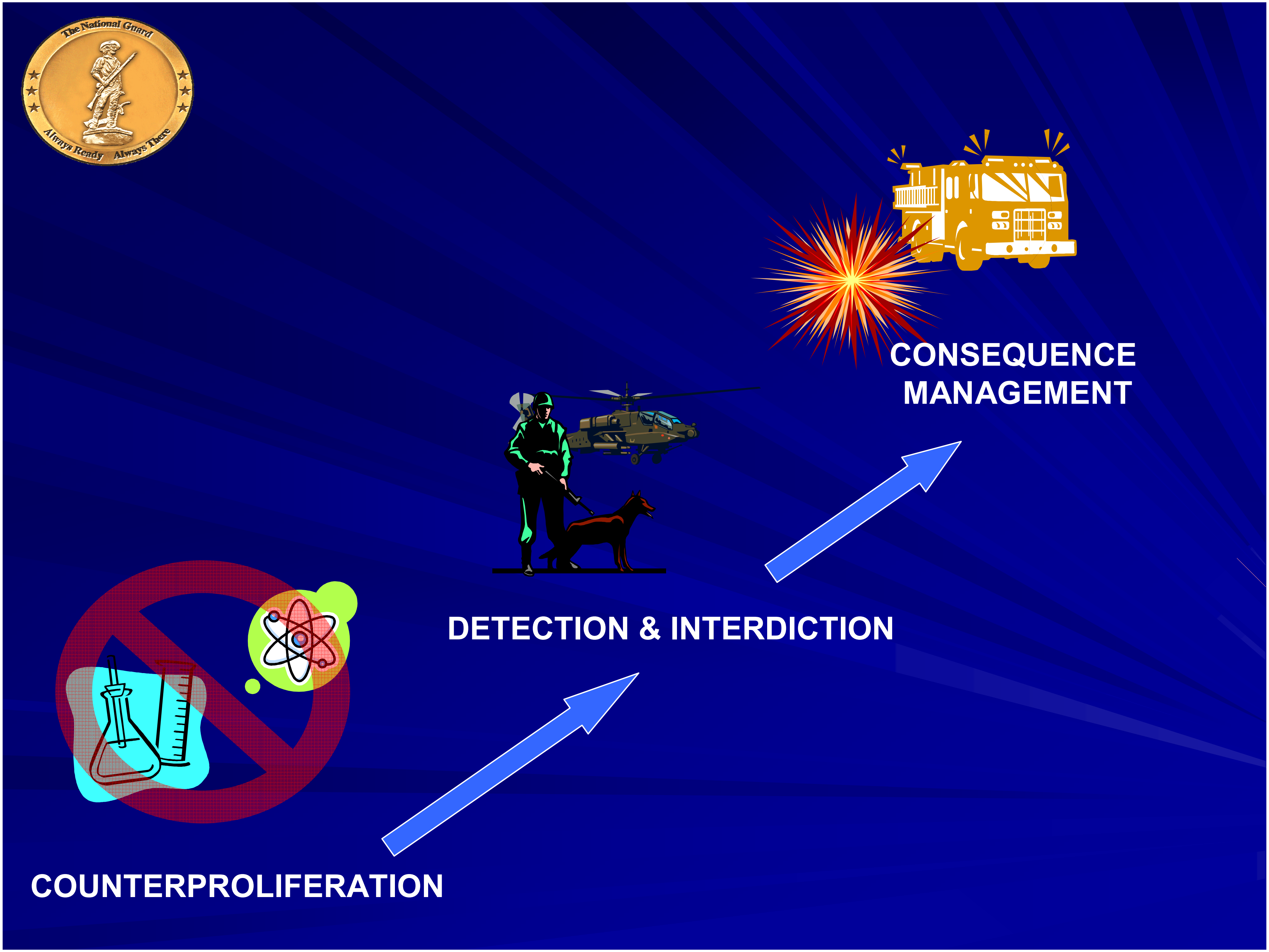
Technology for the warfighter!

National Guard CBRN Response – Achieving Unity of Effort at the Seams Between Local, State, and Federal Response

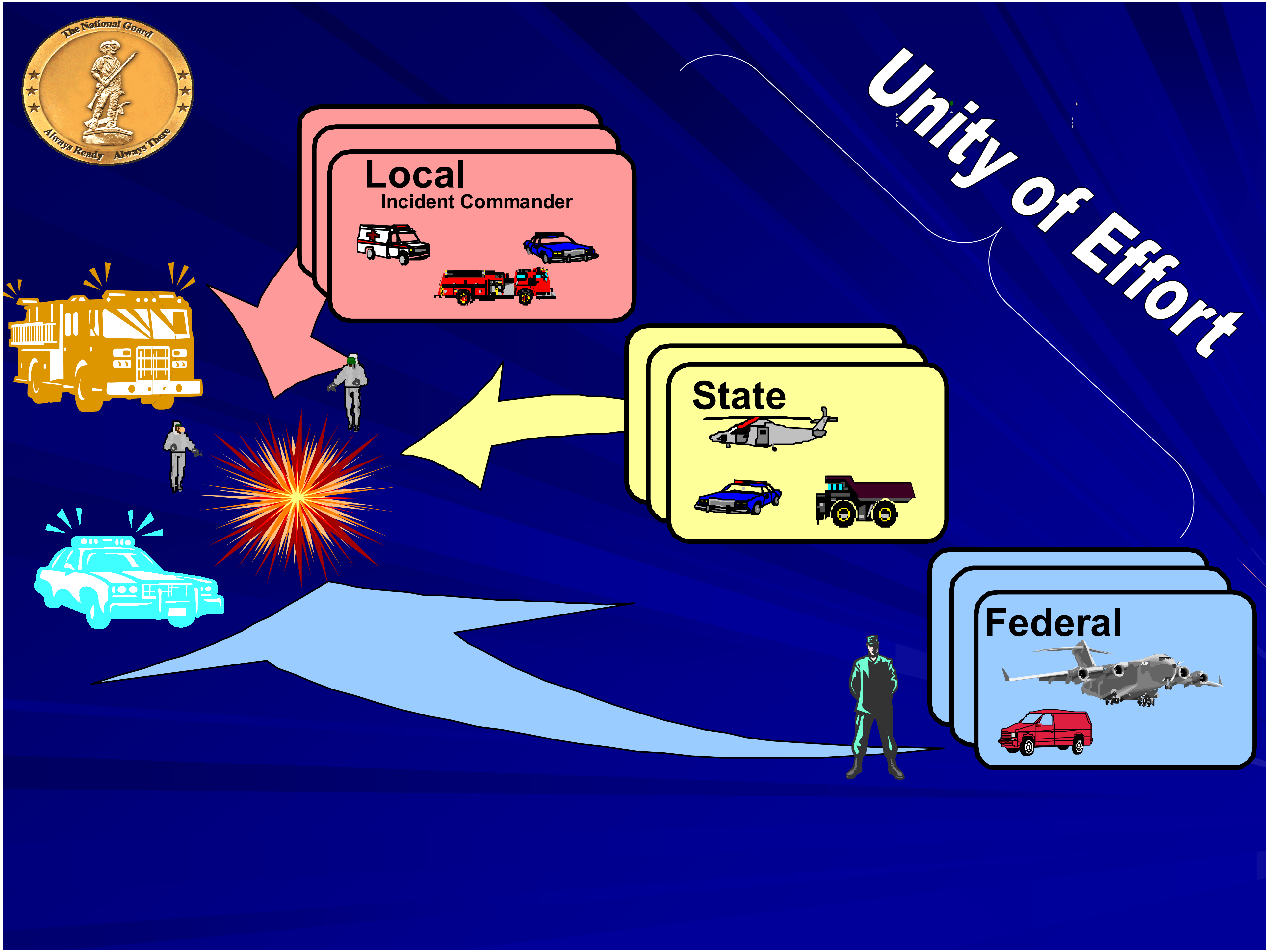
Colonel Thomas Hook

National Guard Bureau

(Source: Baltimore Sun, 16 Jul 2005)

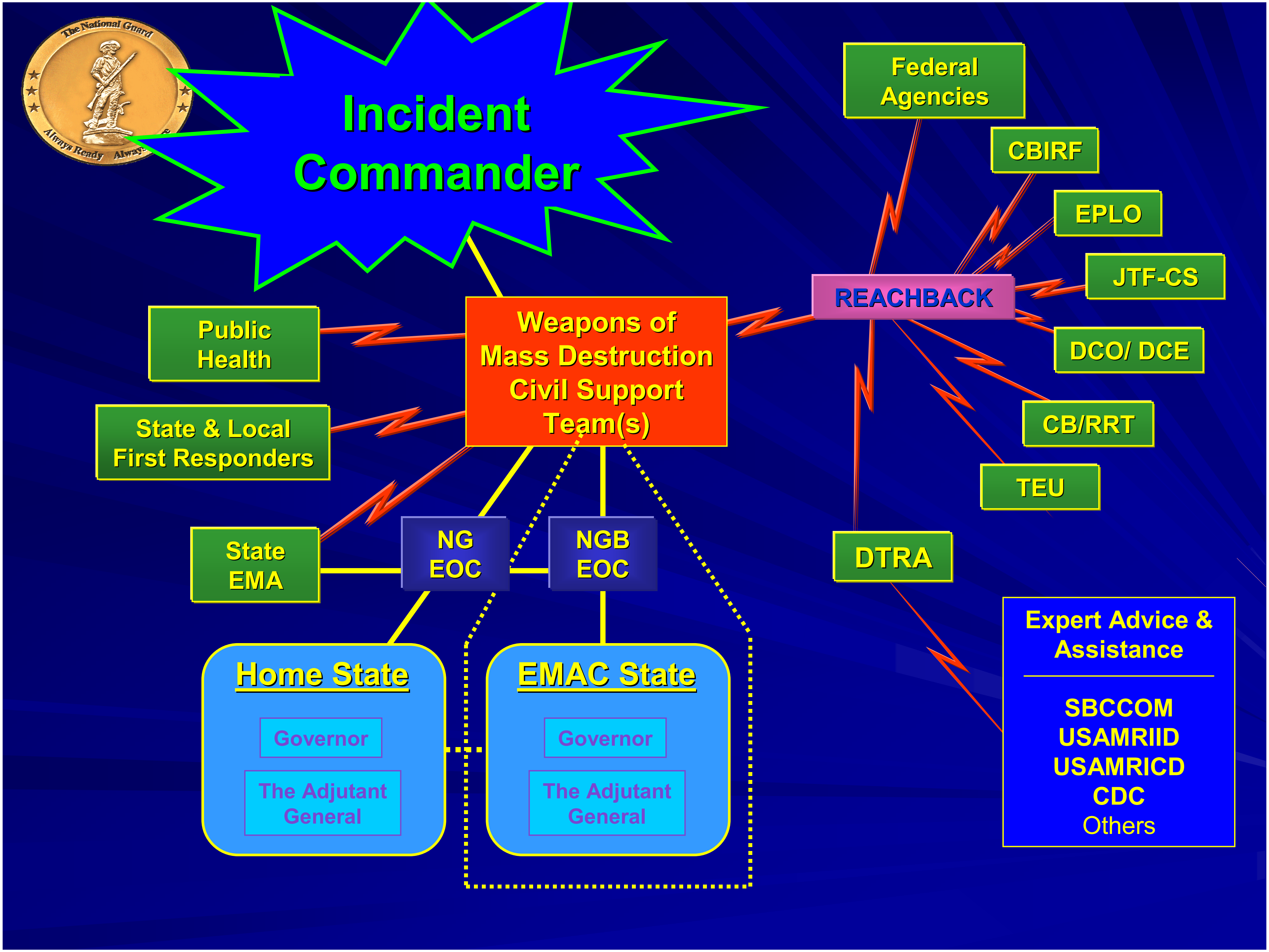


The National Guard
Always Ready Always There
CONSEQUENCE
MANAGEMENT
DETECTION & INTERDICTION
COUNTERPROLIFERATION


Unity of Effort
The National Guard
Always Ready Always There
Local
Incident Commander
State
Federal

Rapid Damage Assessment

Accurate Situational Awareness


The National Guard
Always Ready Always There
Incident Commander
Weapons of Mass Destruction Civil Support Team(s)
Public Health
State & Local First Responders
State EMA
NG EOC
NGB EOC
Home State
Governor
The Adjutant General
EMAC State
Governor
The Adjutant General
REACHBACK
Federal Agencies
CBIRF
EPLO
JTF-CS
DCO/ DCE
CB/RRT
TEU
DTRA
Expert Advice & Assistance
SBCCOM
USAMRIID
USAMRICD
CDC
Others

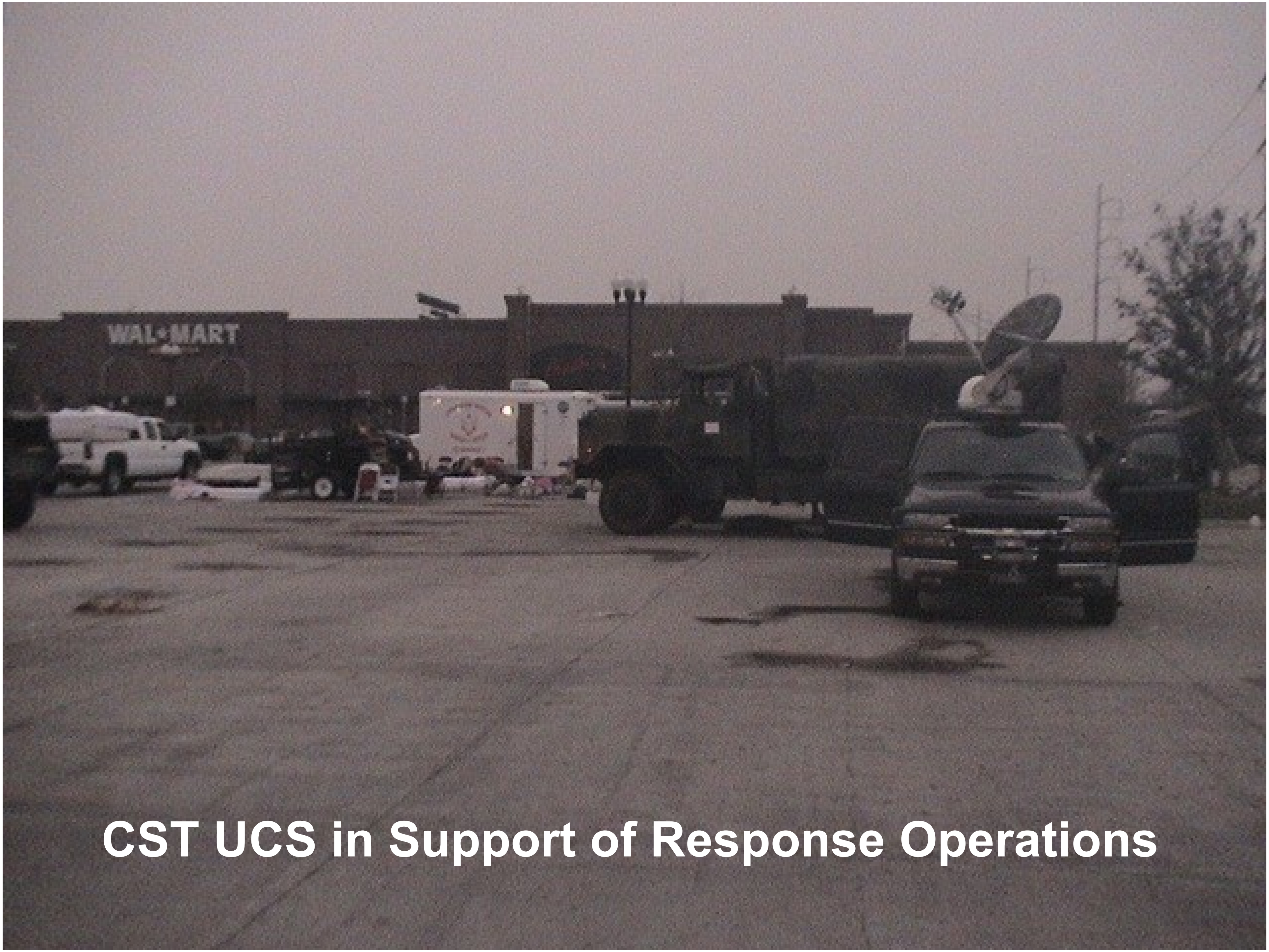
Civil Support Team
Unified Command Suite (UCS)

Radios
- UHF/VHF
- SATCOM
- INMARSAT

Phones
- DSN/Commercial

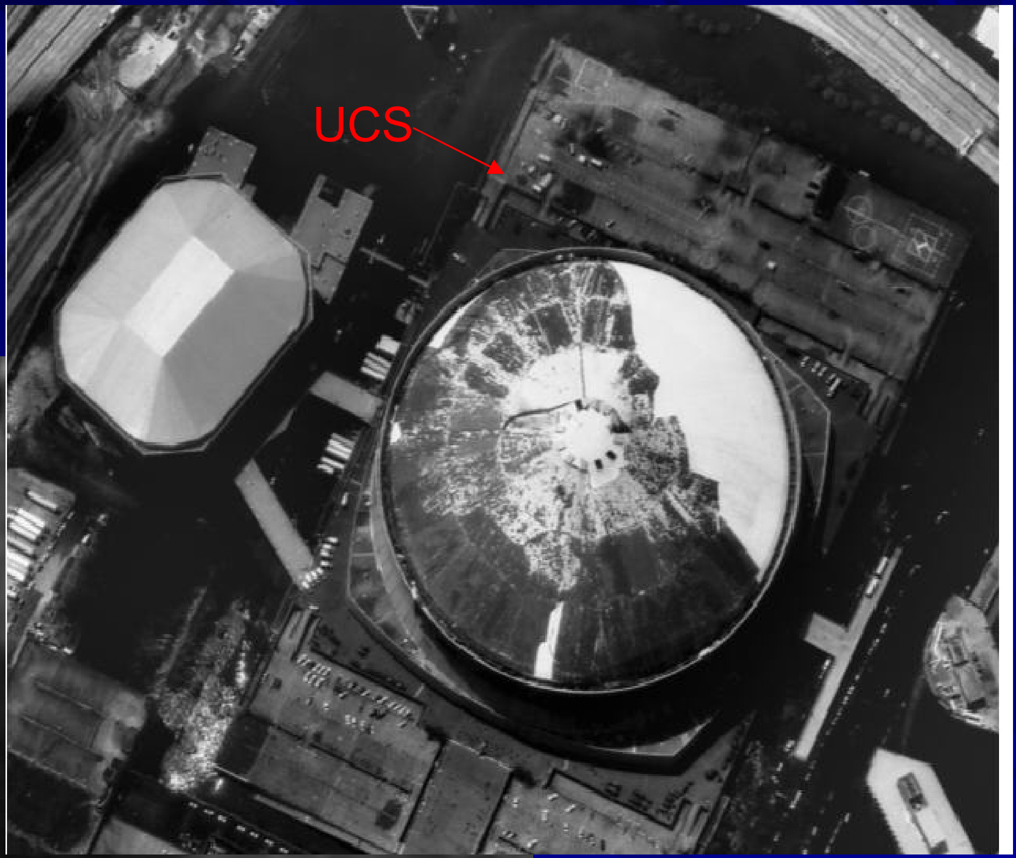
Data
- NIPRNET
- SIPRNET

Video
- Collaborative Video Conferencing Tools



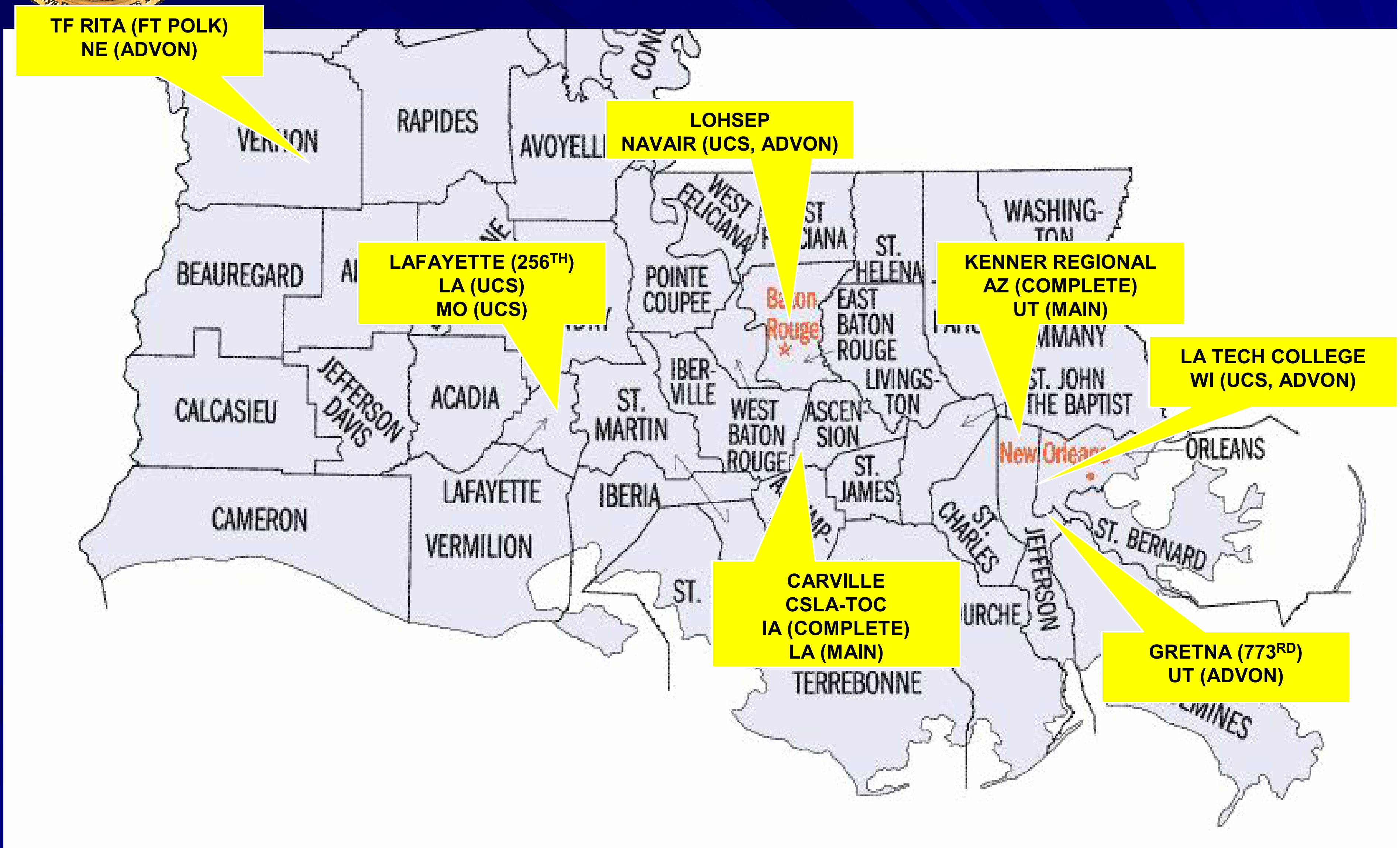
CST UCS in Support of Response Operations

NGB Float and 72nd CST ADVONs at Belle Chase NAS



62nd CST UCS at the Super Dome on 30 Aug 2005

CST Communications Support in LA on 23 Sept 05

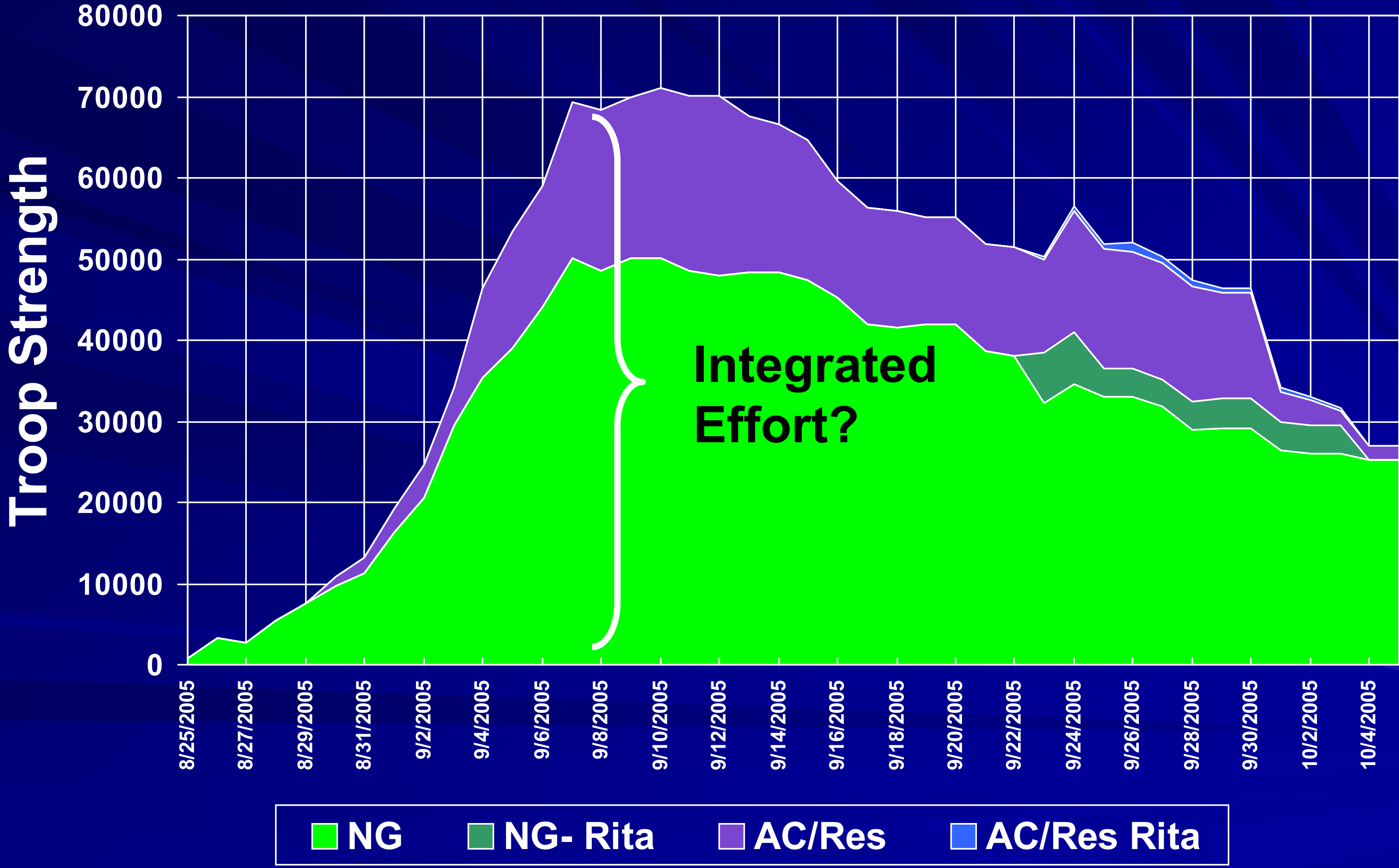


ANG aircraft at Belle Chase NAS, New Orleans

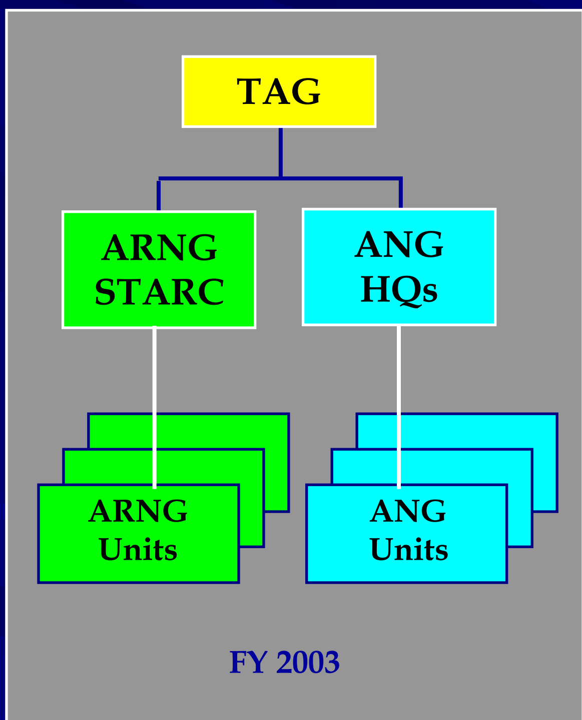
NG CD aircraft with sensor package

Hurricane Katrina/Rita Military Response

(Source: Hurricane Katrina/Rita Comprehensive Timeline, 17 Oct 05, OASD (HD))

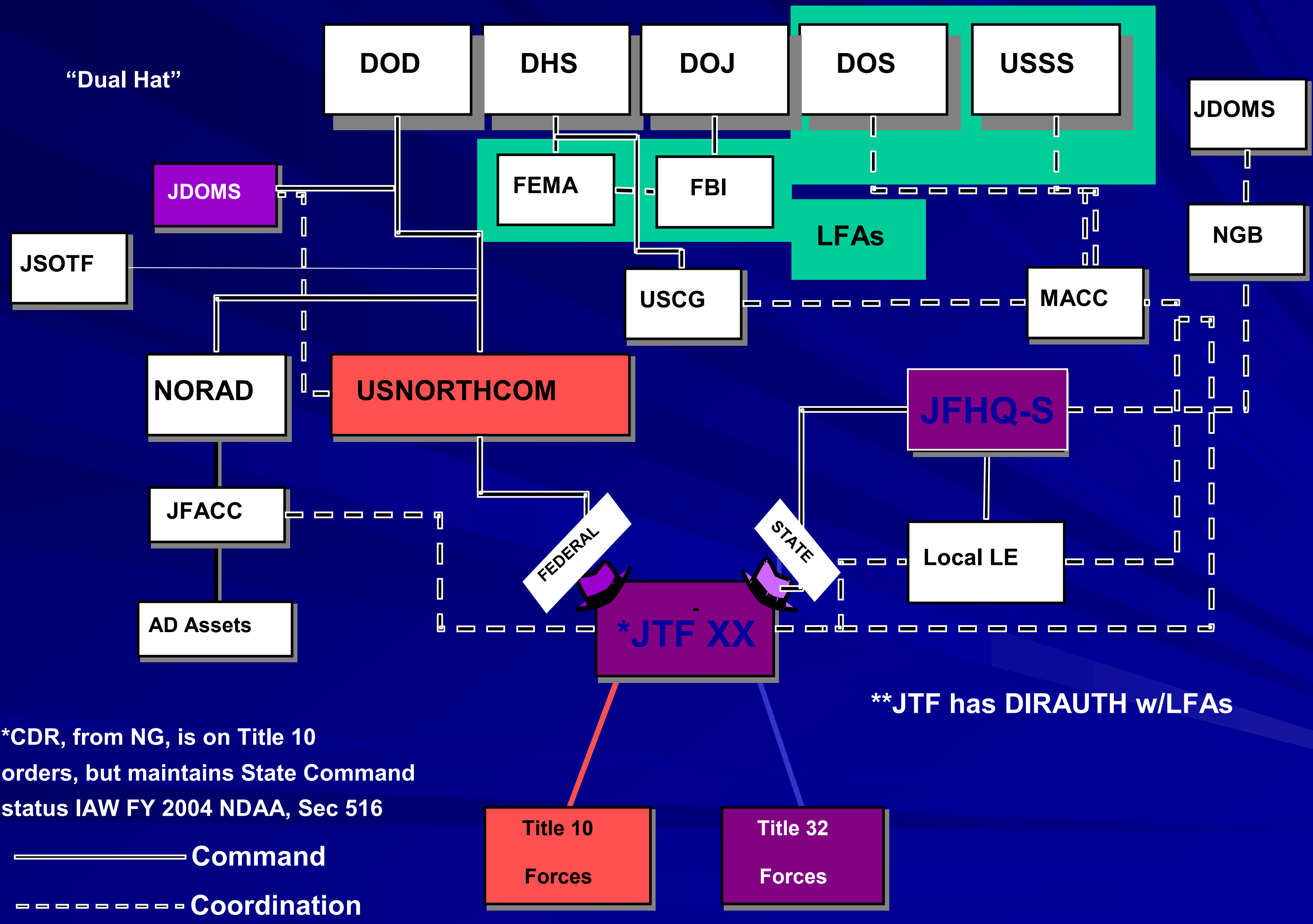


Joint Force HQs (State)

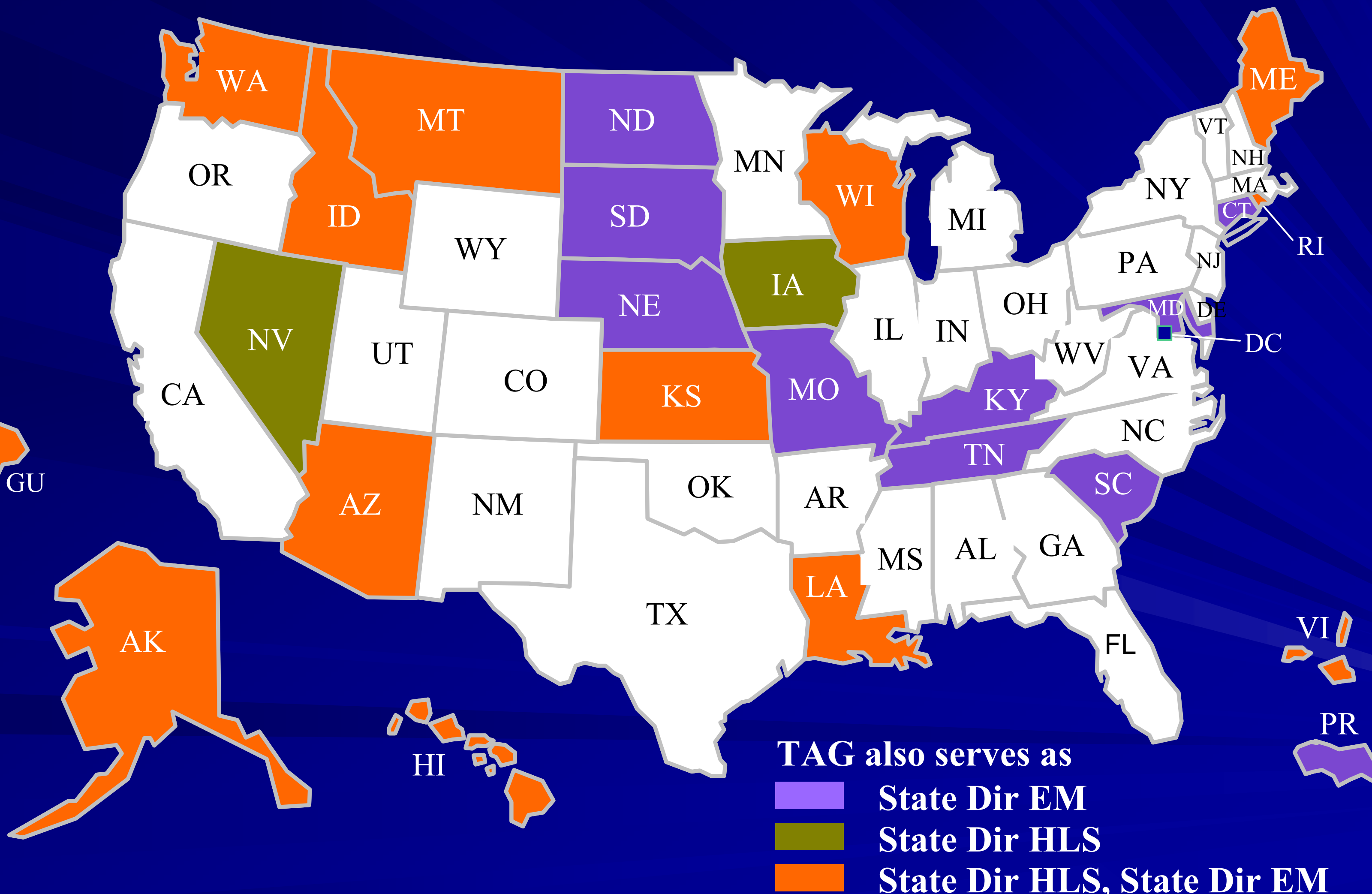


- Personal Staff
- Special Staff
- J-Staff 1 to 8
- Interagency
- Intergovernmental

Dual Hat C2 Model



TAG Roles


WA
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WV
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CO
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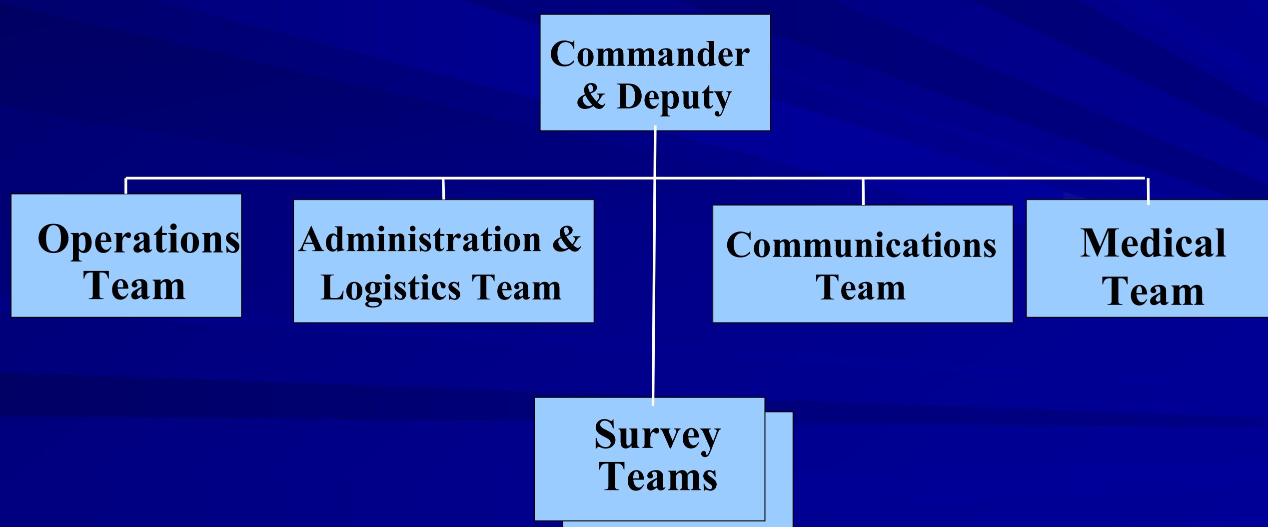
MO
KY
CA
NC
TN
GU
SC
OK
AR
AZ
NM
MS
AL
GA
LA
TX
AK
FL
VI
PR
HI
TAG also serves as
State Dir EM
State Dir HLS
State Dir HLS, State Dir EM

- CBRN Detection
- Technical Search and Extraction
- Decontamination
- Medical Treatment

Weapons of Mass Destruction Civil Support Team

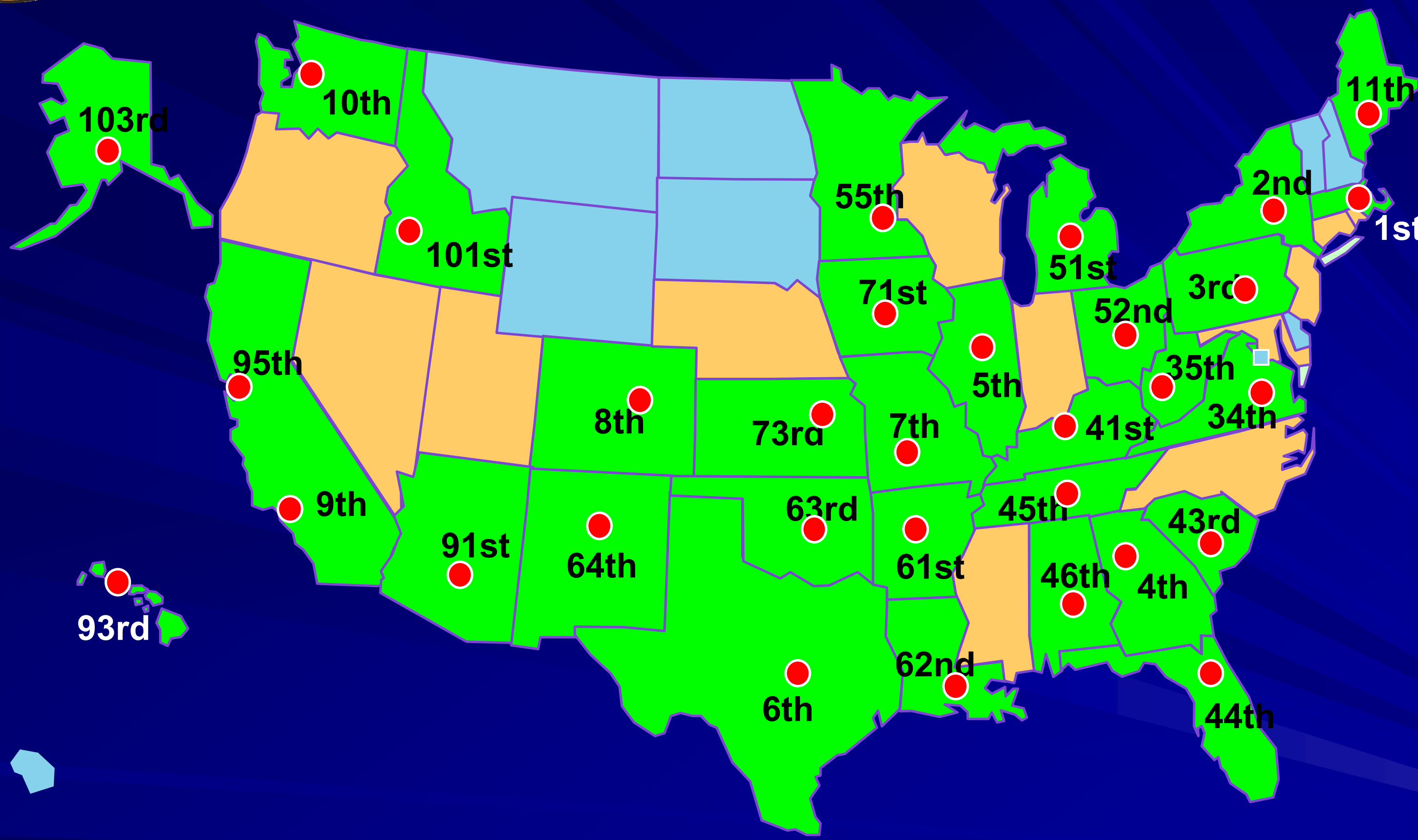
MISSION: **Support civil authorities at a domestic chemical, biological, radiological, nuclear, and high-explosive (CBRNE) incident site by <u>identifying</u> CBRNE agents/substances, <u>assessing</u> current and projected consequences, <u>advising</u> on response measures, and <u>assisting</u> with appropriate requests for state support.**



Interior of Analytical Laboratory System →

← Portable Gas Chromatograph/Mass Spectrometer

WMD-CST Locations



New FY04 Teams

New FY05 Teams

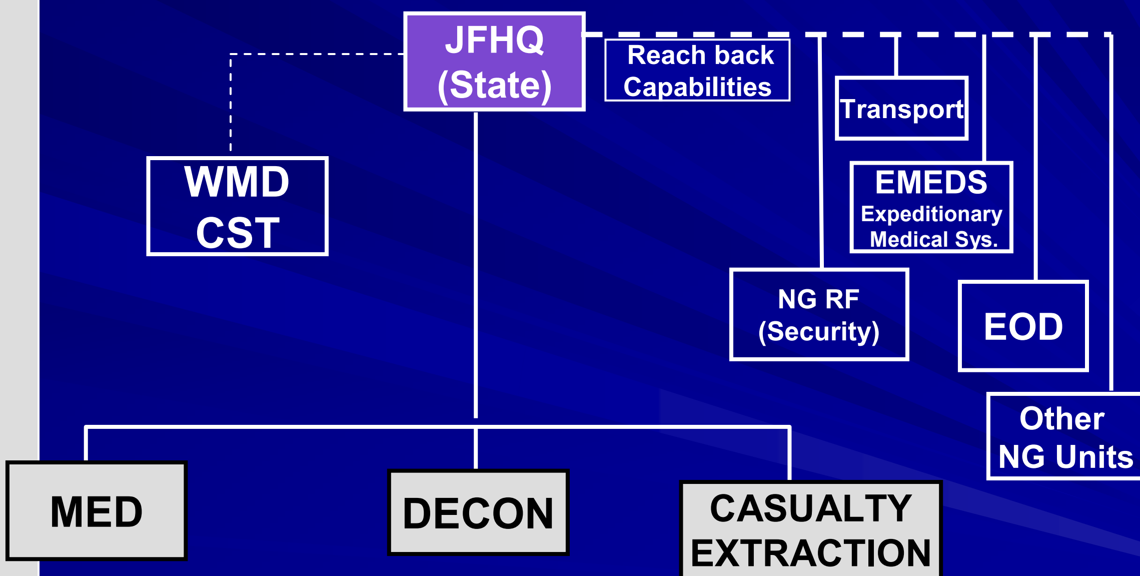
CBRNE Enhanced Response Force Package

CJCSI 3125.01: Chief, National Guard Bureau (NGB), will:

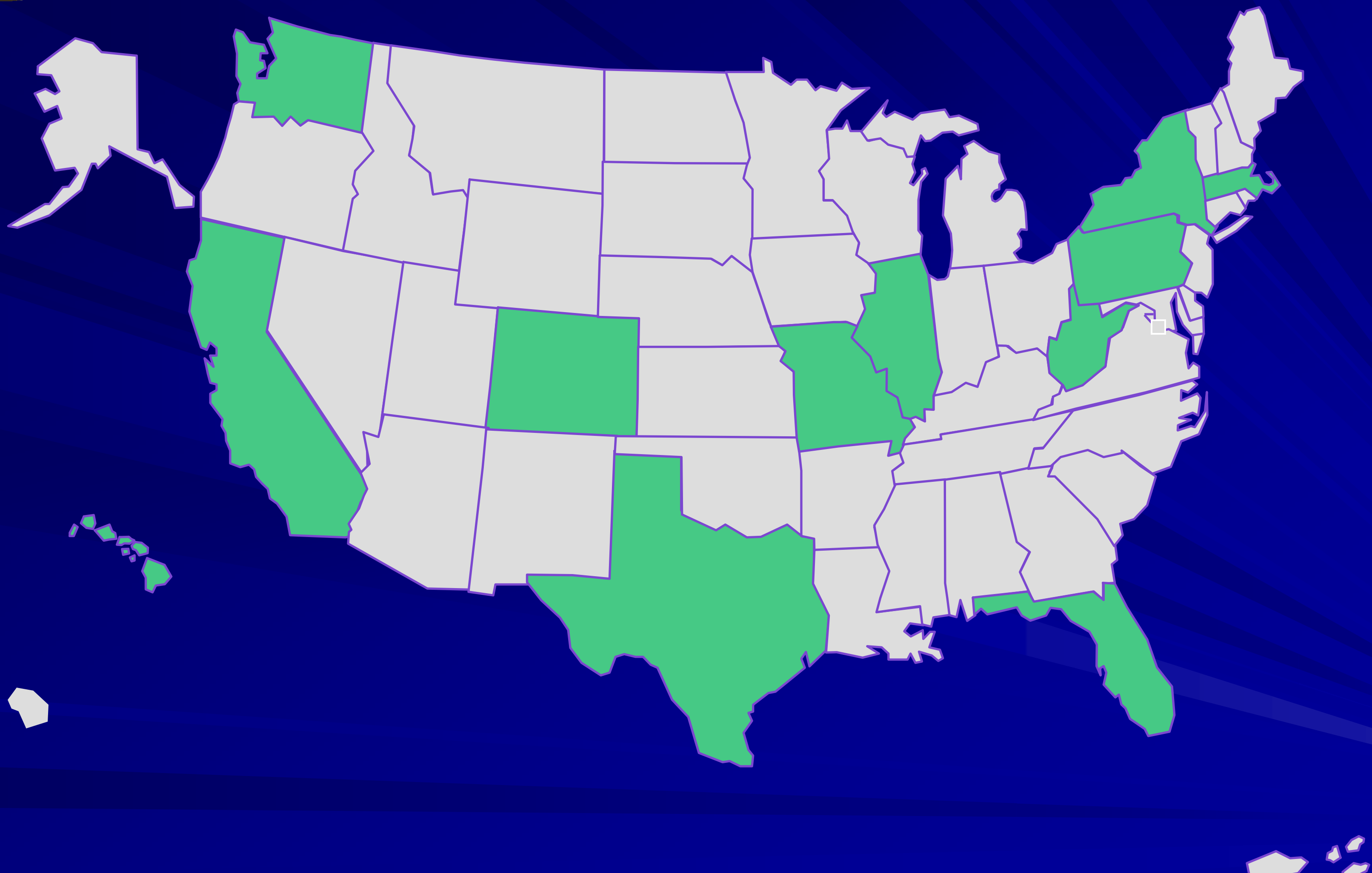
Monitor and assist the Adjutants General and the State National Guard in providing well-trained and well-equipped Army and Air National Guard forces and resources to provide military support to domestic CM operations in response to a CBRNE situation.

MISSION

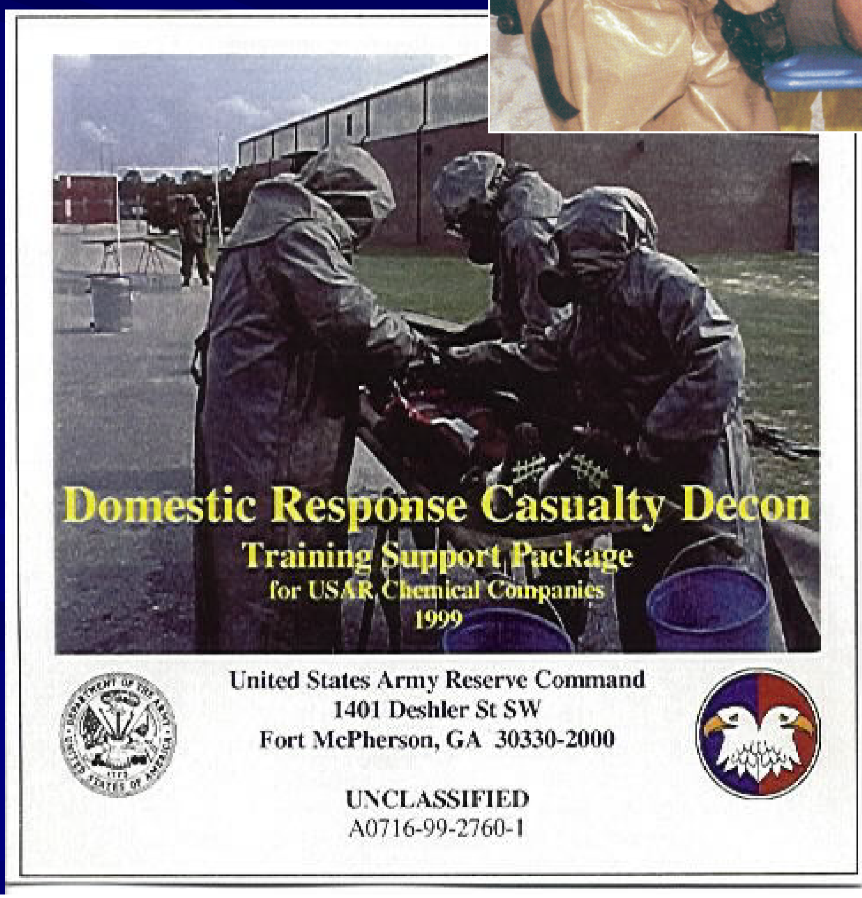
On order, respond to a Chemical, Biological, Radiological, Nuclear, or High Yield Explosive (CBRNE) incident and assist local, state, and federal agencies in conducting consequence management by providing capabilities to conduct **personnel decontamination**, **emergency medical services**, and **casualty search and extraction**.



CERFP Locations



Personnel Decontamination



Domestic Response Casualty Decon

Training Support Package

for USAR Chemical Companies

1999

United States Army Reserve Command

1401 Deshler St SW

Fort McPherson, GA 30330-2000

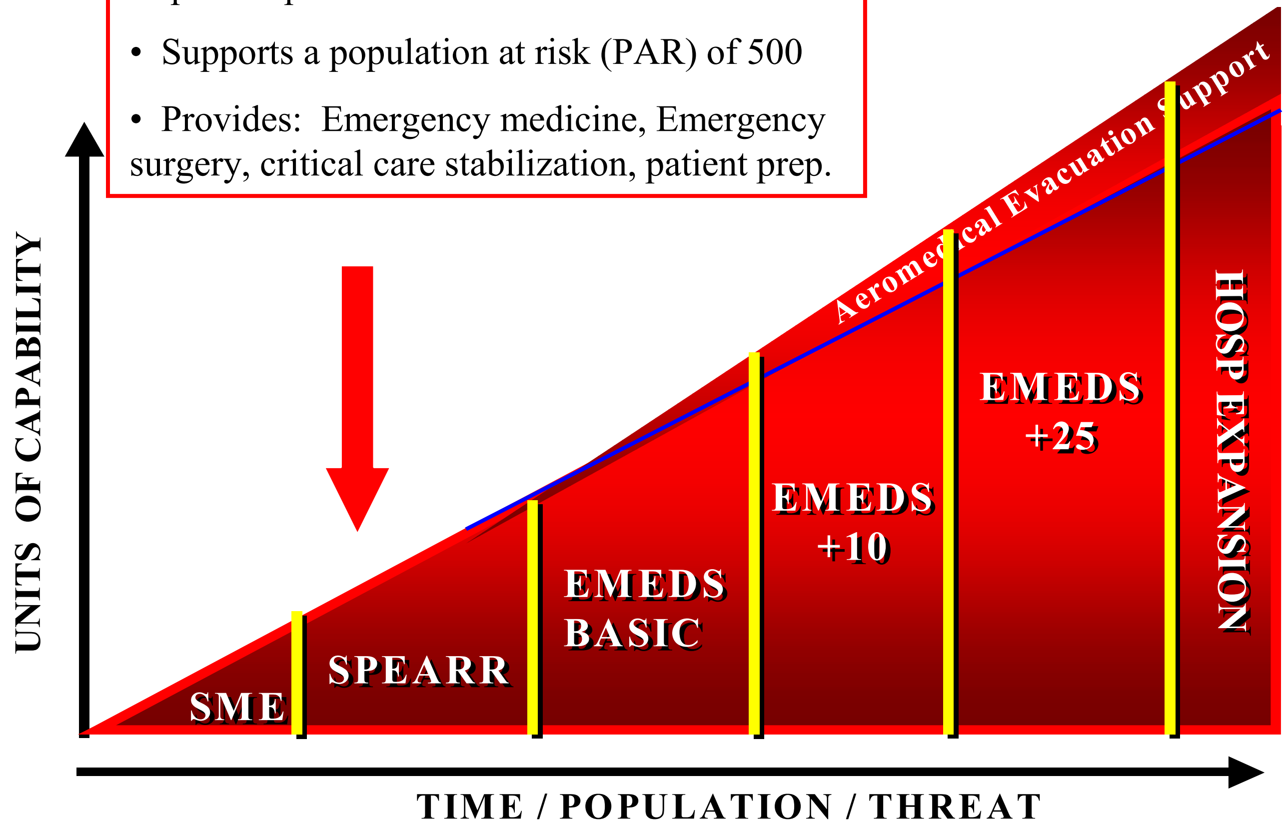
UNCLASSIFIED

A0716-99-2760-1

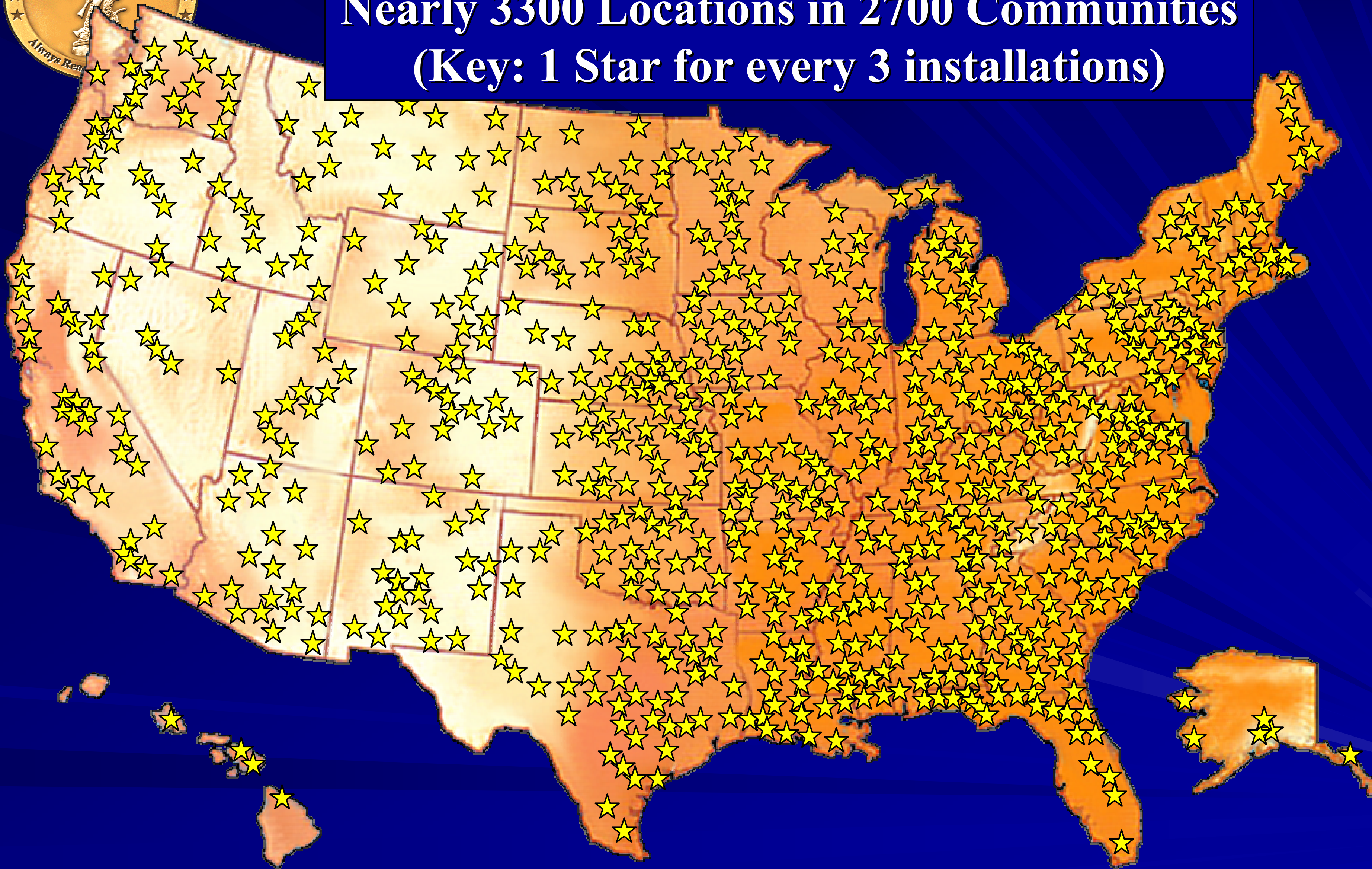
Mass patient decontamination

Emergency Medical Treatment: SPEARR

- Small-Portable-Expeditionary-Aeromedical-Rapid Response
- Supports a population at risk (PAR) of 500
- Provides: Emergency medicine, Emergency surgery, critical care stabilization, patient prep.



Army & Air National Guard Installations
Nearly 3300 Locations in 2700 Communities
(Key: 1 Star for every 3 installations)



"Joint Forces on call for State and Combatant Commander Missions"

COL Thomas Hook
National Guard Advisor
JFHQ-NCR

(202) 685-2056
thomas.hook@fmmc.army.mil

DOE/NV/11718—1107

Radiological Emergency Response from the U.S. Department of Energy National Nuclear Security Administration

Rhonda Hopkins

Senior Scientist, Bechtel Nevada

Bechtel Nevada

Strengthening national security through engineering and operational excellence

National Nuclear Security Administration

NNSA

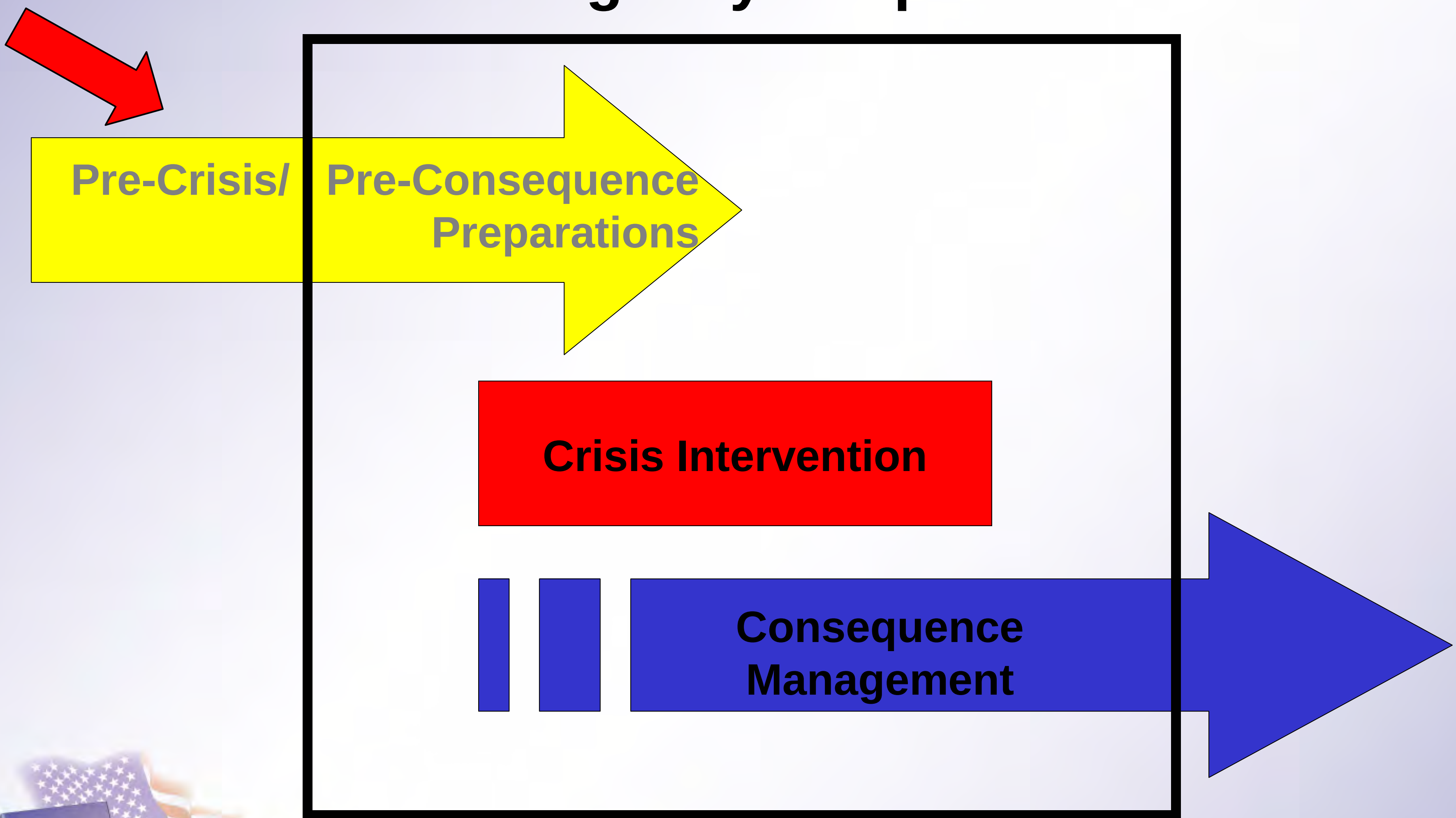
- Unique scientific and technical expertise capable of dealing with nuclear/radioactive events and materials.

- Trained, exercised, specially-equipped teams with pre-packaged equipment to conduct search, render safe, recovery and consequence management operations.

Bechtel Nevada
Strengthening national security through engineering and operational excellence

NNSA
National Nuclear Security Administration

Emergency Response



Pre-Crisis/Pre-CM Phase

- Baseline radiological measurements of at-risk facilities.
- Baseline measurements of New York City completed.

Bechtel Nevada

Strengthening national security through engineering a

National Nuclear Security Administration

Pre-Crisis / Pre-CM Phase

- Intelligence
- Readiness preparations
  - Training
  - Deployment status
  - Equipment maintenance and packaging
  - Established Plans & Procedures
  - Local coordination

Flow of Nuclear Counter-Terrorist Activities

Securing of Sources In Foreign Countries → Portals In Foreign Port Facilities → Portals in US Ports and on Border Crossings (Detection/Survey) → Distributed Detectors (Detection/Survey)

→ Checkpoint / Way station Detectors (Detection/Survey) → **Search**
RAP
SRT
Triage
→ **Render Safe – Technical Analysis**
LGAT
JTOT
→ **Render Safe Operations**
JTOT
LGAT

→ **Render Safe – Device Disassembly And Disposition**
JTOT
Disposition
→ **Attribution** of Device to Responsible Parties

failure → **Consequence Management**
FRMAC
AMS
REAC/TS
NARAC

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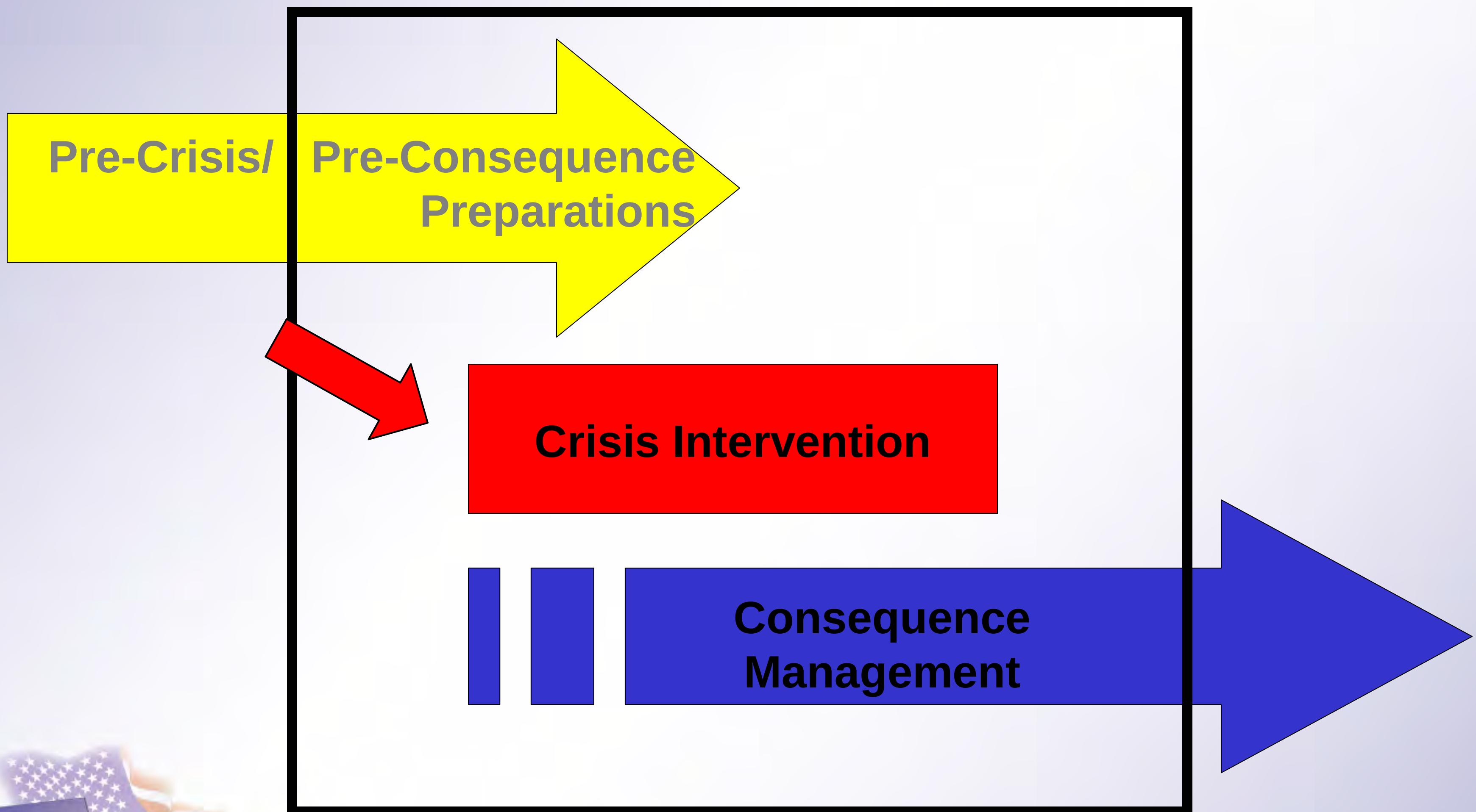
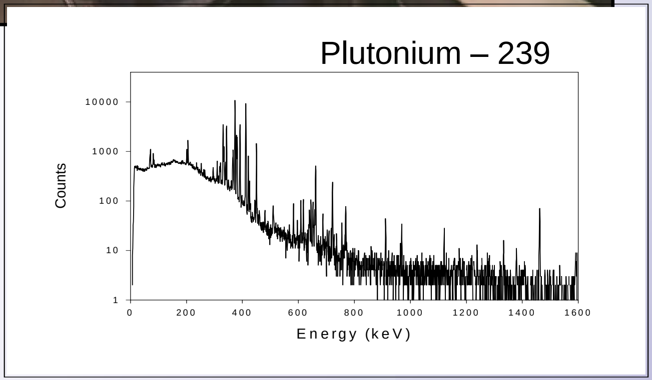
NNSA
National Nuclear Security Administration

Emergency Response



Crisis

- First Responders
  - Police, Hazardous Material Units, Coast Guard, Customs
- State and Regional Teams (Suspicious Package)
- Radiological Assistance Program (RAP) Teams
- National Search Teams
- Home Teams



Crisis Intervention

- National Search Team

  Locate and Identify Nuclear and Radiological Materials in Support of the designated Coordinating Agency
- Utilize low-profile techniques to locate
  - Nuclear or radiological materials
  - Dispersal Devices
  - Nuclear Weapons
- Different platforms
  - Hand held
  - Vehicle mounted
  - Aerial
  - Marine

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NNSA

National Nuclear Security Administration

Aerial Measuring System - Search

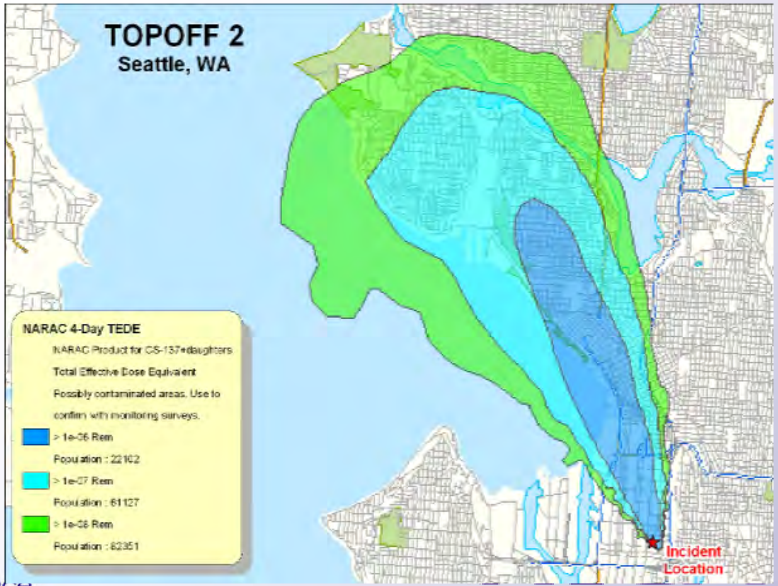
- Beechcraft B200 Fixed Wing Aircraft and Bell 412 Helicopter
- Nellis Air Force Base
- Andrews Air Force Base
- On-duty Team
  - Pilots
  - Scientist
  - Data Technician
  - Radiation Technician

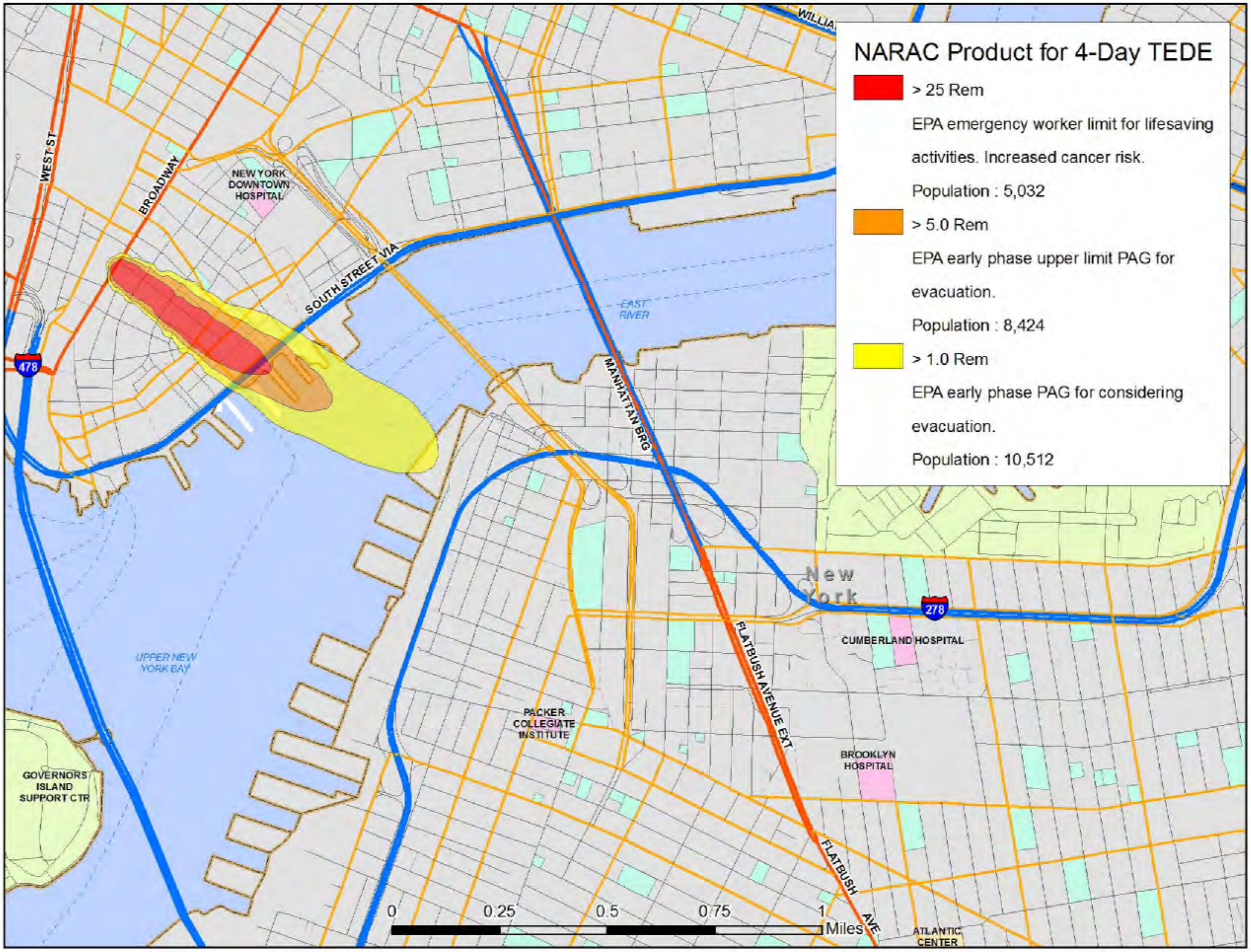
Predictive Plume Modeling

World-wide Coverage

- Terrain and land-surface
- Vector and raster maps
- Real-time weather data
- Real-time hazard advisories available within minutes
- Distributed electronically

- Natural, chemical, biological, and natural resources
- Generic and specific sources
- Advanced modeling system
- Health effects and action levels




NARAC Product for 4-Day TEDE
> 25 Rem
EPA emergency worker limit for lifesaving activities. Increased cancer risk.
Population : 5,032
> 5.0 Rem
EPA early phase upper limit PAG for evacuation.
Population : 8,424
> 1.0 Rem
EPA early phase PAG for considering evacuation.
Population : 10,512
WEST ST
BROADWAY
NEW YORK DOWNTOWN HOSPITAL
SOUTH STREET VIA
EAST RIVER
MANHATTAN BRG
478
278
New York
CUMBERLAND HOSPITAL
FLATBUSH AVENUE EXT
UPPER NEW YORK BAY
PACKER COLLEGIATE INSTITUTE
BROOKLYN HOSPITAL
GOVERNORS ISLAND SUPPORT CTR
FLATBUSH AVE
ATLANTIC CENTER
0
0.25
0.5
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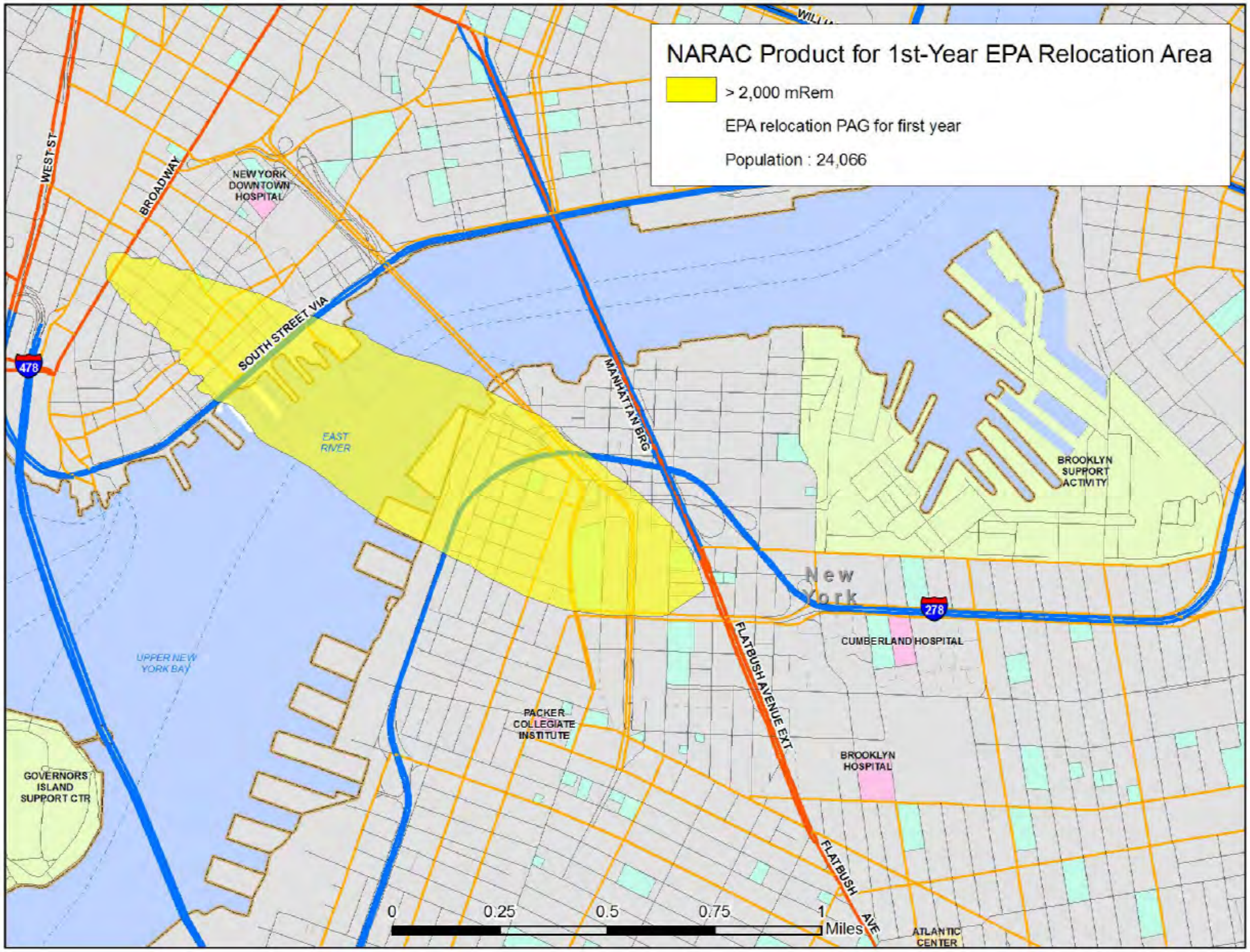
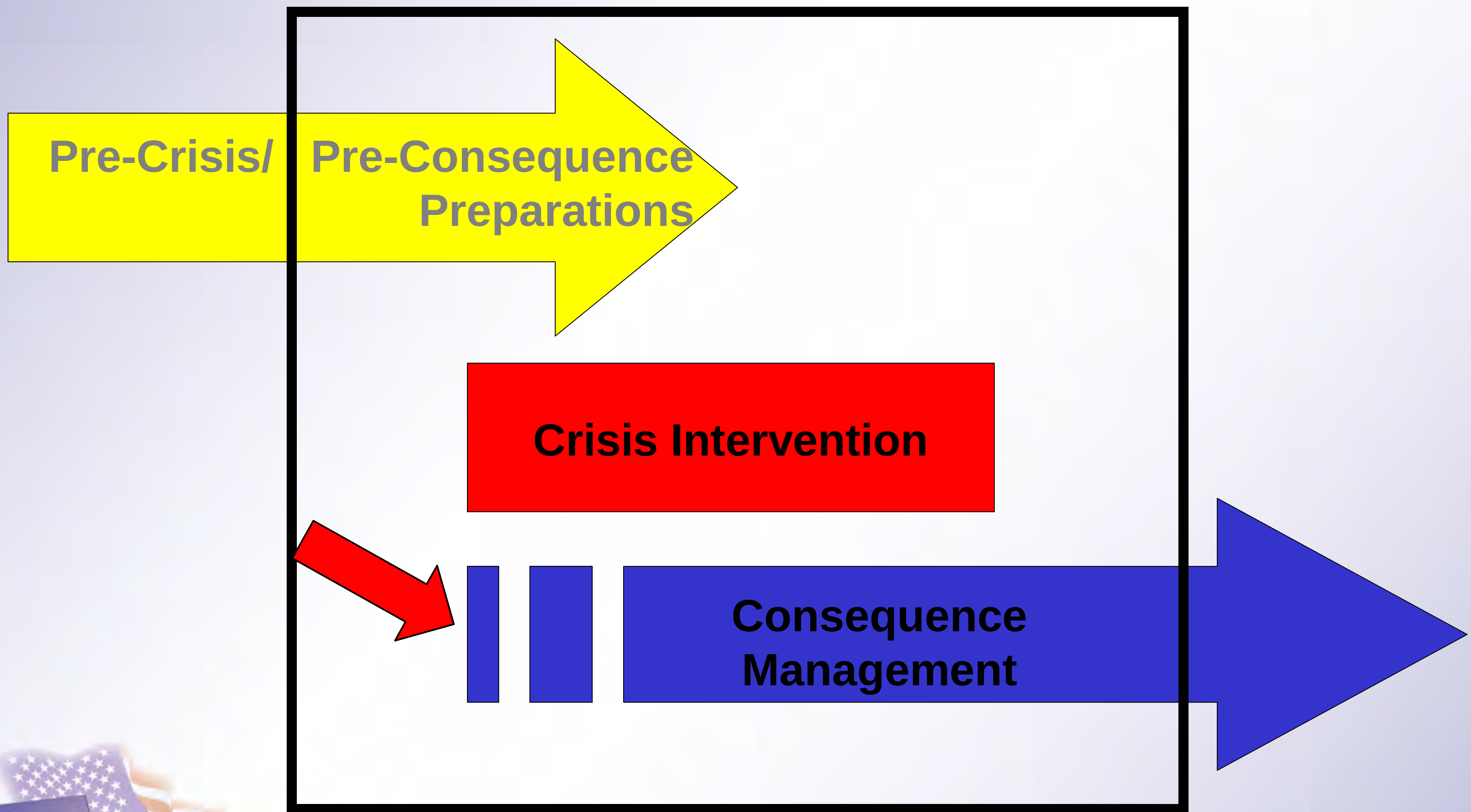
1
Miles



Exercise Data

Emergency Response



National Response Plan

- December 2004
- Nuclear / Radiological Incident Annex
- Establishes Coordinating Agency, Advisory Team, and a Federal Monitoring and Assessment Center (FRMAC).
- Assigns the coordination of the FRMAC during the initial phase to the U.S. Department of Energy (DOE) National Nuclear Security Administration.

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Consequence Management

The DOE National Nuclear Security Administration (NNSA) has the role to coordinate the FRMAC and assist the states in their mission to PROTECT THE HEALTH AND WELL BEING OF THEIR CITIZENS with:

- Verified radiation measurements
- Interpretations of radiation distributions based on EPA, FDA or local Protective Action Guidelines
- Characterizations of overall radiological conditions

CMRT Time Line

- Conduct Advance Party meeting upon arrival.
- Begin monitoring and sampling plan.
- Upload predictive models and begin assessment of first responder data.
- Ensure Health and Safety of responders
- Begin producing maps and compiling data utilizing the Geographic Information System (GIS).
- Upload GIS to FRMAC Web.
- Set up secure communications.
- Begin logistics planning for follow on response.

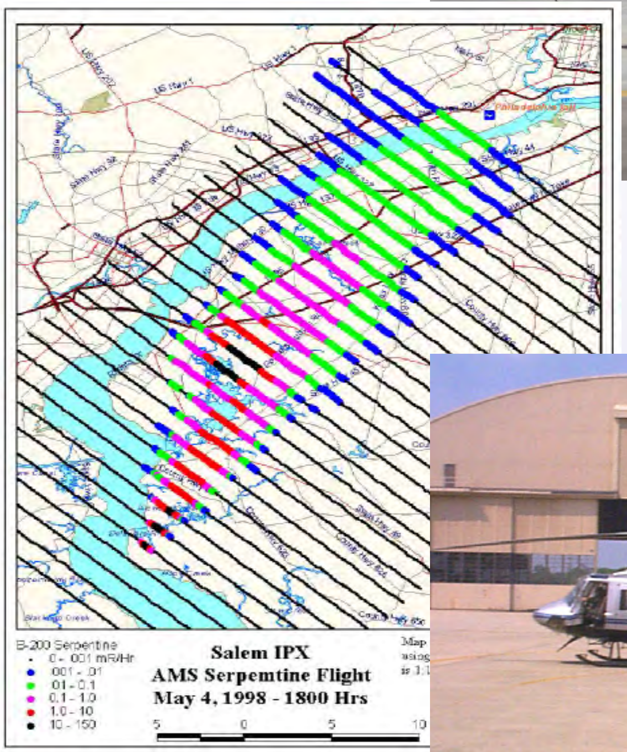
CM Products: Monitoring and Sampling Data

- Direct monitoring measurements
- Isotopic mix (*in situ* spectroscopy)
- Sampling
  - Control (hotline to lab)
  - Prep
  - Analysis
- QA & QC
- Standardized data forms

Consequence Management
Aerial Measuring System (AMS)

Mission – Provides radiological detection capability mounted on helicopters and fixed wing aircraft to measure ground disposition of radiation in radiological emergencies

- Aircraft located at Nellis and Andrews Air Force Base
- Responds in 4 to 6-hours
- 40 team members

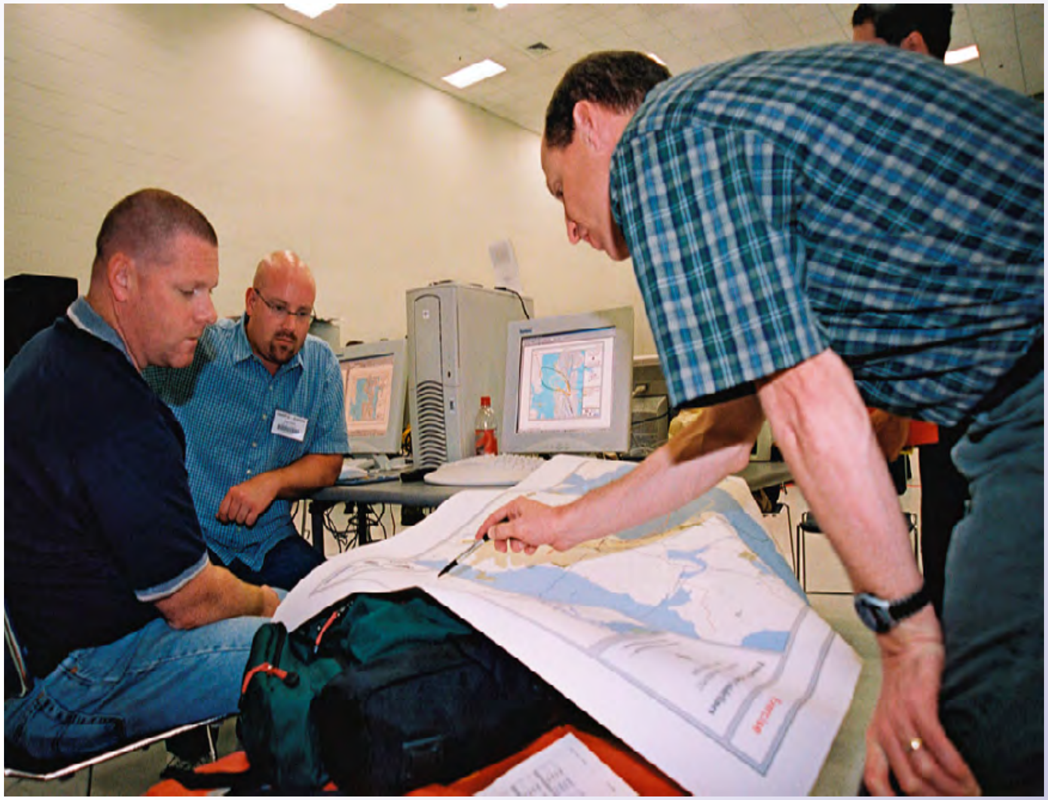


Laboratory Analysis

- Sample Hotline
- Sample Preparation
  - Documentation
  - database entry
  - chain-of-custody (sample tracking)
  - laboratory database
  - QA/QC process
- Sample Analysis
  - Laboratory Information Management System

Assessment

- Provides interpretations of radiological conditions in terms of recognized Federal or State PAGs.
- Characterizes radiological environment to address re-entry, return, and recovery issues.
- Geographic Information System (GIS)



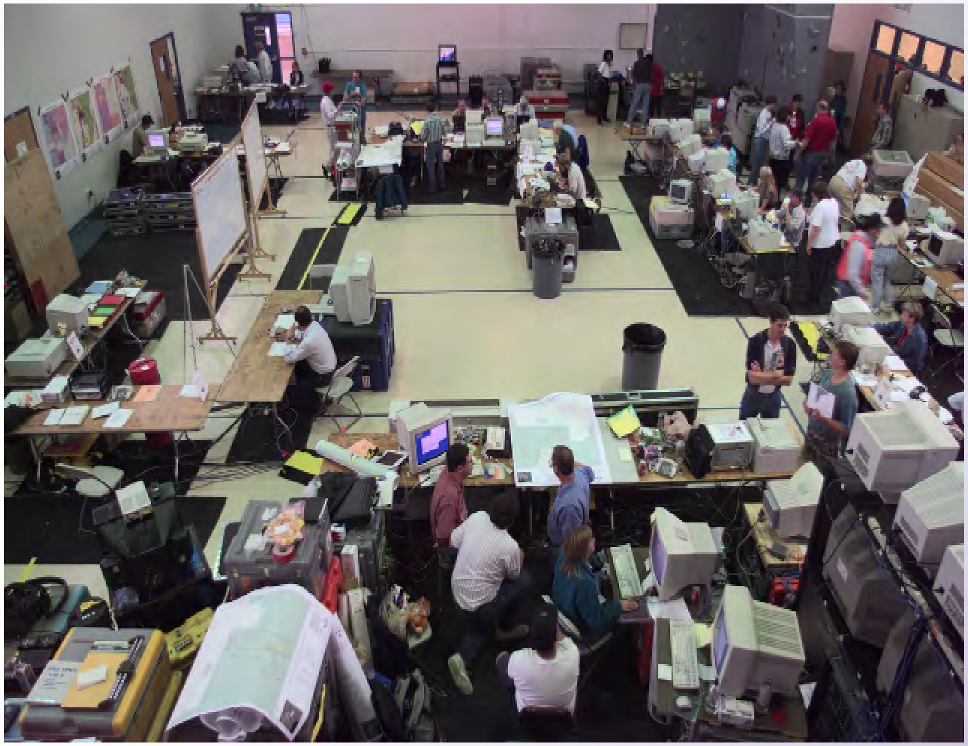
Consequence Management – Radiation Emergency Assistance Center / Training Site (REAC/TS)

Mission – Provide medical response, advice, and consultation for rapid assessment and treatment of high-dose radiation cases

- 24/7 capability
- Staffing – 14
- Assistance to Federal, state, local government governments as well as the IAEA, foreign governments and private physicians
- Provides training programs for health professionals
- Maintains "Radiation Accident Registry System"

FRMAC

- Multi-agency response.
- Large scale/long-term operations.
- Photo/video capability.
- Additional communications (voice, data, video).
- Data networks.
- Mechanical and electrical support for extended operations.
- Additional logistics and administrative support.



Digit Pace Exercise

Transfer from DOE to EPA

- At a mutually agreeable time AND after consultation with DHS and State, local, and tribal officials.
- The following conditions are to be met before transfer:
  - Immediate emergency condition is stabilized.
  - Offsite release of radioactive material has ceased.
  - Offsite radiological conditions have been characterized.
  - Initial long-range monitoring plan has been developed.
  - Other Federal agencies will commit required resources.

Questions?

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Headquarters U.S. Air Force

Integrity - Service - Excellence

Kunsan Focused Effort and the Counter-Biological Warfare Concept of Operations

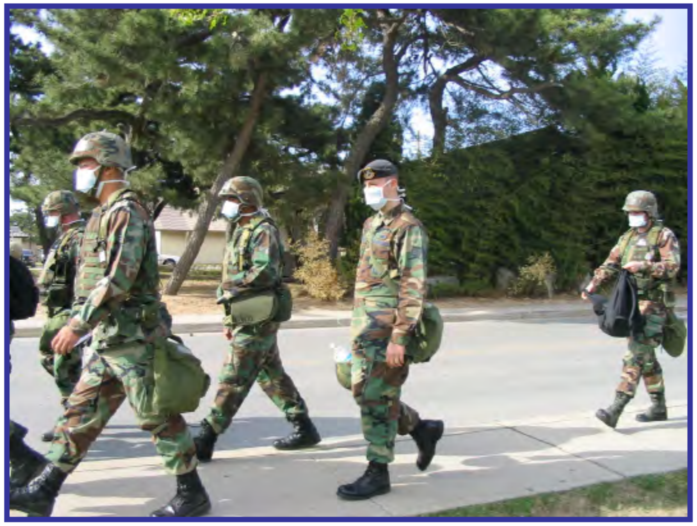
U.S. AIR FORCE

Lt Col Donna Hudson
AF/XOS-FC

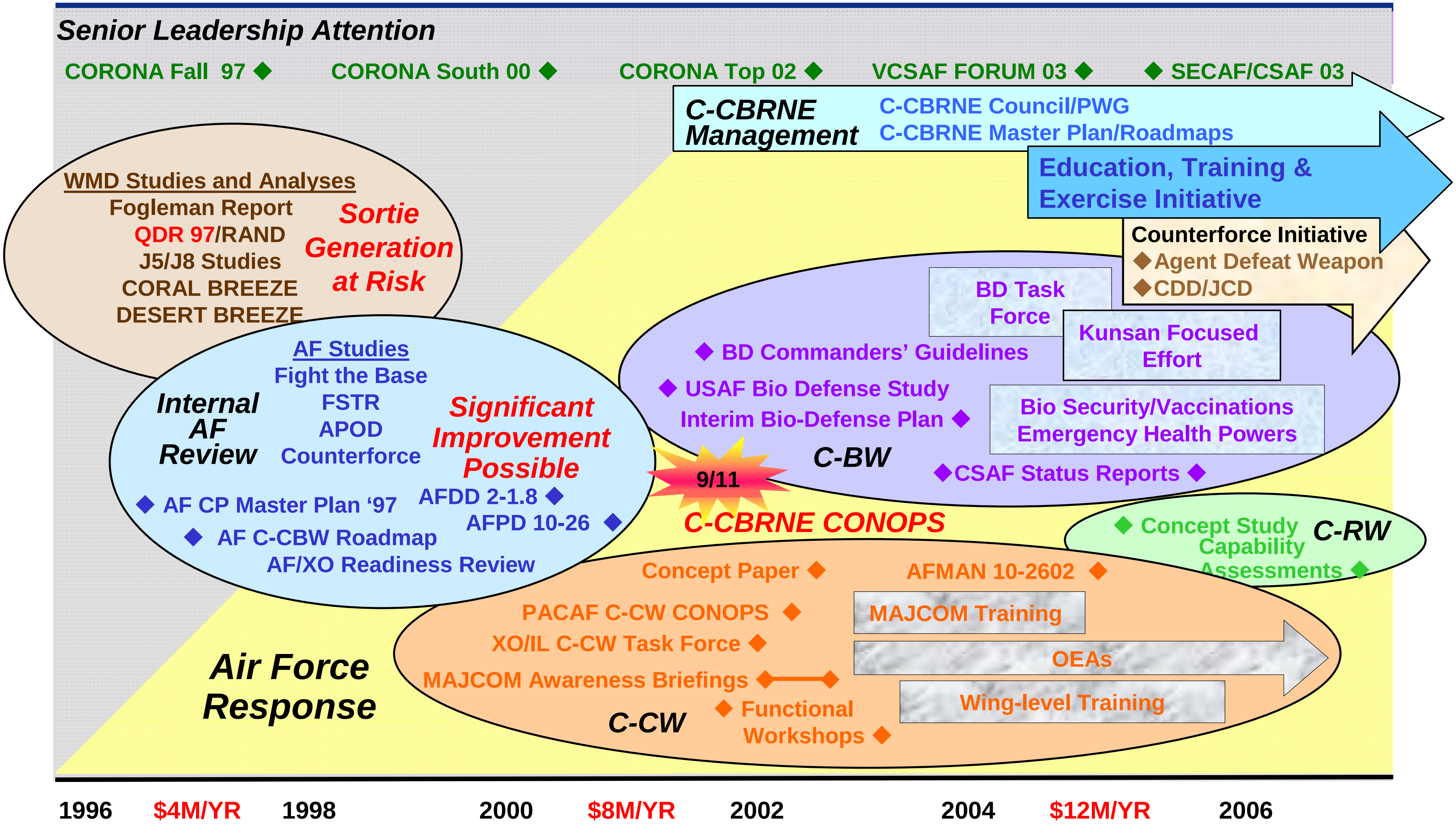
December 7, 2005

Overview

- Background
- C-BW Objectives
- Kunsan Focused Effort (KFE)
- Counter-Biological Warfare Concept of Operations (C-BW CONOPS)
  - Tenets & Approach
  - Implementation



C-CBRNE Ops Program



Integrity - Service - Excellence

KFE Objectives

- Produce operationally relevant C-BW strategies, plans, and procedures
  - Non-materiel solutions developed by functional experts and based on scientific data and ops analysis
  - Use existing wing C-BW capabilities / infrastructure
  - Complement C-CW procedures
- Provide the basis for a C-BW CONOPS and guidance for AF units to prepare, respond, operate, sustain, and recover

PREPARATION

HAZARD ASSESSMENT | INTELLIGENCE

TRAINING | METEOROLOGY | PREVENTIVE MEDICINE

SURVEILLANCE | CLINICAL DIAGNOSTICS

SAMPLING | DETECTION | IDENTIFICATION

PHYSICAL PROTECTION | WARNING

ALERT | REPORTING | NOTIFICATION

TREATMENT | CASUALTY MANAGEMENT

EVACUATION | QUARANTINE/ ISOLATION | CASUALTY REPLACEMENT

CONTAMINATION CONTROL | MORTUARY AFFAIRS

"To develop and institutionalize a comprehensive, AF-wide counter-biological warfare concept of operations for both deployed forces and homeland defense." CSAF Message July 2002

Base Selection Considerations

- High ops tempo, wartime posture, and recognized threat of BW attack
- Senior leadership buy-in and commitment
- Senior staff stability throughout study period
- C-BW materiel and non-materiel solution sets in place (e.g., C-CW CONOPS in place, updated FSTR 10-2 plans, DoD sampling kits, RAPIDS, standard laboratory capability, in-place patient decontamination, etc.)

- Aggressive exercise schedule that can be leveraged

PACAF/CC approved Kunsan AB as test-bed (KFE)

U.S. AIR FORCE

“The Wolfpack”

Kunsan Focused Effort

- Develop C-BW mitigating strategies at a fixed-site installation for mission sustainment and recovery in a wartime environment
- First USAF analytic effort that quantitatively links BW to operational capability
- Utilize existing equipment and current capabilities (not an ACTD)
- Cross-functional team
  - AF/XOS-FC, NWCA C-CBRNE Division, AF/XOS-FP, FP Battle Lab, AF/ILEX, AF/ACESA, AF/SGOP, PACAF, 7AF

Improve USAF ability to recover and sustain operations in a BW environment in a real world setting

KFE Timeline

Pre-KFE
Jan-Feb 04

KFE I
10-14 May 04

KFE II
9-13 Aug 04

KFE III
10-14 Jan 05

KFE IV
25-29 Apr 05

PACAF/ 7AF/ 8 FW Approve KFE

Baseline Kunsan's C-BW Capabilities

Develop Strategies & TTPs

Refine Strategies & TTPs (Black Wolf TTX)

Validate Strategies & TTPs (Validation FTX)

Improved Operational Capability

Baseline Assessment (May 04)

Kunsan can mitigate the effects of a BW attack, BUT…

- **Requires additional understanding of the nature of BW**
  - **C-CW TTPs well rehearsed, but often inappropriate for C-BW**
- **Must optimize use of detection devices/methods available**
  - **First detection of an attack may be casualties**
- **Need basic C-BW plans/guidelines**
  - **Preparation and prompt decision making are key to success**
  - **Not a "MDG problem" to solve; must involve entire base**
- **Personnel turnover rate impacts C-BW readiness**
  - **Need to document solutions and plans**
- **Combined / Joint operations complicate planning and response**

Key Operational Questions

- What is the BW “threat”?
  - What bio-agents can be effectively delivered by which mechanisms under what conditions and which are the most effective?
  - What will the effect on the base be?
- What is the residual hazard posed by re-aerosolization, surface contact, or person-to-person transfer?
- How much can we rely on our detectors?
  - How do we better use our detection and identification equipment based upon the character of the attack?
- What can we do about a BW attack?
  - How do vaccination, antibiotics, masking, restriction of movement, and decon impact the effects of the attack?
- What are the critical timelines for implementing responses?

KFE Lessons: The BW Threat

- Many effective BW attacks are possible with different agents and delivery means, but there are significant challenges
  - Large scale military application of BW has never been done
    - Requires the development and production of quality agents and delivery methods (large scale testing)
    - All of the pieces have been done but there is high uncertainty when linking them all together
- Combat capability may be affected by BW attack
  - Limited operational flexibility with large casualties particularly within key AFSCs
  - Mission degradation varies by agent (disease) type

KFE Lessons: BW Residual Hazard

- Large area decon may not significantly reduce outdoor residual hazard
  - Difficult to determine where to decon and to verify effectiveness
- Most BW agents are not persistent
  - Time and sunlight reduce most agent levels significantly
  - Anthrax may reaerosolize from vehicle movement in the vicinity of agent release (high deposition)
- Other protective measures may be available (e.g., prophy, masks, etc)

Decon may not be possible or required

KFE Lessons: BW Detection and Identification

- **Timely detection of covert attacks is difficult due to agent identification technology insensitivities and operational modes**
- **Sentinel casualties are likely first indicator of many attacks**
  - **Still require diagnosis (agent identification) for best treatment and hazard management**

Focus on medical surveillance and education to more quickly recognize and isolate infected personnel

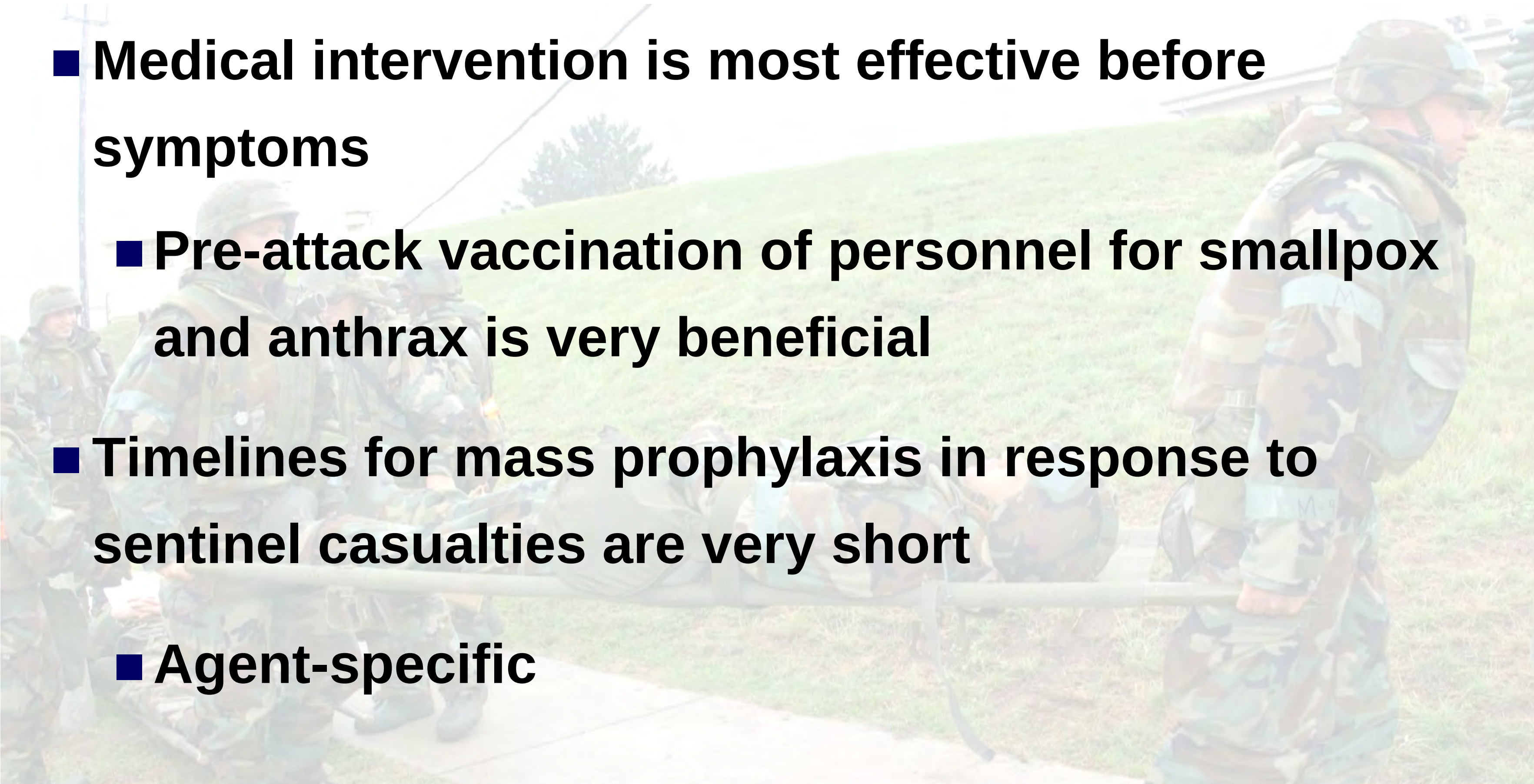
KFE Lessons: C-BW Responses

- **MCU-2 mask provides good protection, but must be worn during the attack – detection limitations make this unlikely**
- **Vaccine and/or prophylaxis treatment is highly effective for some BW agents**

- **Additional disease containment measures are important for contagious diseases**
  - **Social distancing, personal hygiene, restriction of movement and quarantine measures can significantly reduce casualties**
  - **Surgical masks worn by infected personnel can reduce secondary infections**

The diversity of the BW threat and the limitations of current C-BW capabilities mandate a layered defense strategy

KFE Lessons: Response Timelines



- Medical intervention is most effective before symptoms
  - Pre-attack vaccination of personnel for smallpox and anthrax is very beneficial
- Timelines for mass prophylaxis in response to sentinel casualties are very short
  - Agent-specific

Maximum effectiveness requires a planned and exercised response

KFE Lessons: Managed Risk Strategy

- Use new procedures to compensate for equipment shortfalls
- Layered response actions required – no “silver bullet” technology
- Involve entire base population
- Organize responses around “trigger” events:
  - Intelligence Warning
  - Weapon Event
  - Detector Alarm
  - Sentinel Casualty
- With few exceptions the responses are additive, BUT…
  - The risk/benefit calculation to implement a specific action changes based upon the trigger

Risk management requires a sophisticated understanding of the biological hazard environment

KFE Lessons: Layered BW Defense

C-BW Responses By Trigger Event

Intelligence Warning:

- Initiate vaccination
- Distribute/ initiate prophylaxis
- Elevate detector status
  - 24/7 & smart mode
- Restrict movement
  - Minimize contacts, close facilities, cancel events
- Implement collective protection
- Increase MOPP
- Increase FPCON
- Increase surveillance
  - Med, air, food, and water

Weapon Event:

- Take shelter
- Run detectors in manual mode
- Restrict assess to impact areas
- Conduct environmental bio sampling

Detector System Alarm:

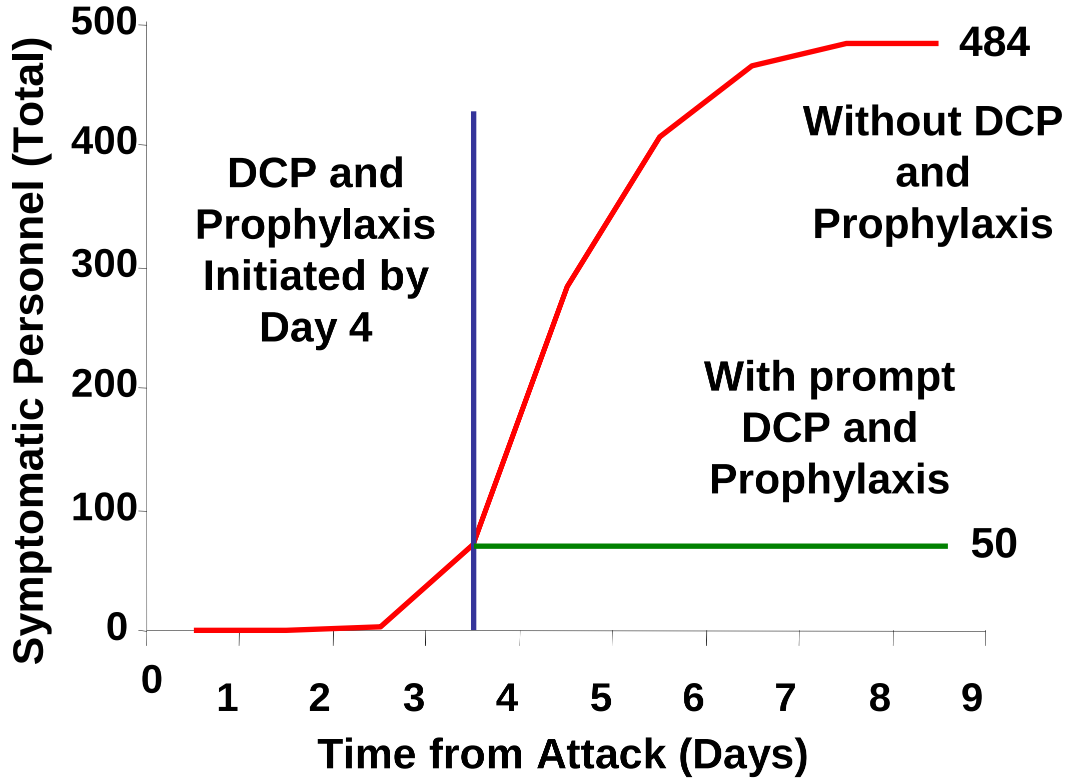
- Don military mask / increase MOPP
- Implement contamination avoidance
  - Personal hygiene and decon
- Conduct forensic sampling
- Confirm detection via RAPIDS or ECL

Sentinel Casualties:

- Clinical diagnosis and treatment
- Quarantine and isolate personnel
- Don surgical masks (if contagious)
- Casualty management planning and preparation
- Personnel management decisions

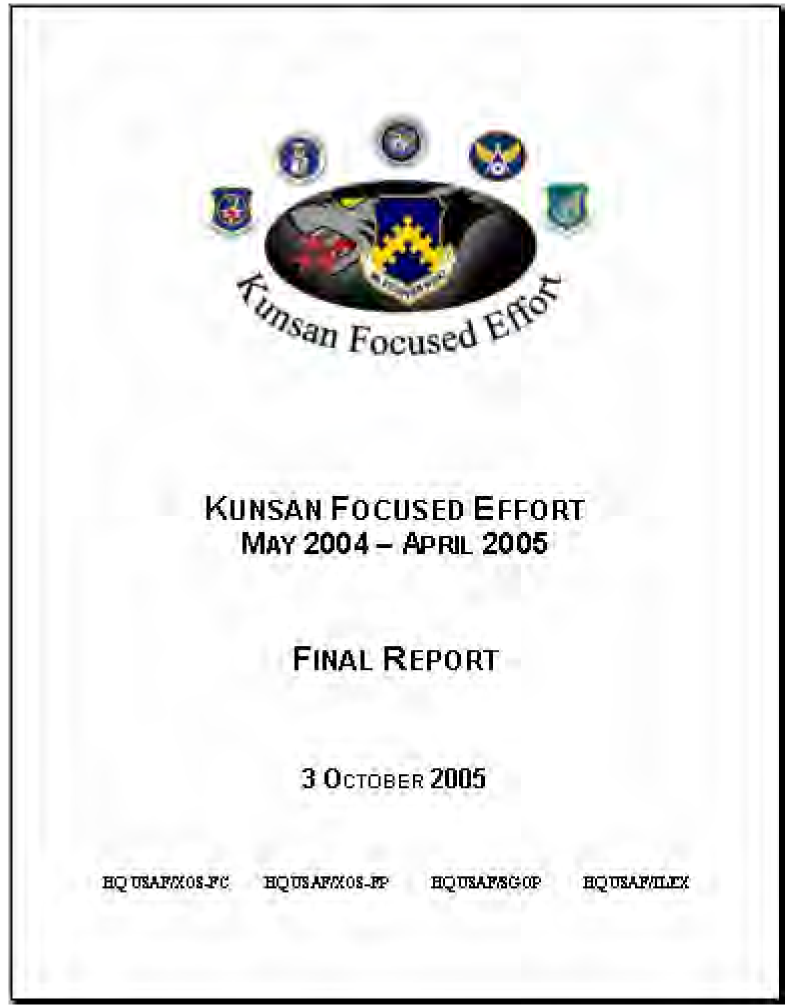
Validation FTX (Apr 05)

- Three-day wing-wide exercise to validate strategies and TTPs
  - Initial response through sustainment and recovery
  - Mission requirements consistent with wartime taskings
- Quick recognition and execution of DCP was key to effective response
- Pre-distribution of prophylaxis reduced casualties and prevented deaths
  - Reduced direct casualties by ≈ 90%



KFE Final Report

- Entered coordination on 3 Oct 05
- Findings and recommendations:
  - Threat & Hazard Environment
  - Detection & Identification
  - Protection & Decontamination
  - Disease Containment
  - Operations
- Working towards:
  - CSAF approval
  - Final out-briefs to 8 FW, 7 AF, USFK, PACAF, PACOM


Kunsan Focused Effort

KUNSAN FOCUSED EFFORT
MAY 2004 – APRIL 2005

FINAL REPORT

3 OCTOBER 2005

HQ USAF/XOS-FC HQ USAF/XOS-FP HQ USAF/SGOP HQ USAF/ILEX

KFE Products & Tools

Education & Training

- BW Threat Intel Brief
- BW Threat Analysis & Briefing
- Bio Agent Smart Cards
- BW Knowledge Survey
- Operational Impact Analysis & Briefings

Sampling, Detection, & ID

- Biological Agent Testing Guidance
- Equipment Optimization Analysis

Decontamination

- Residual Hazard Database
- Decontamination Matrix

Disease Containment

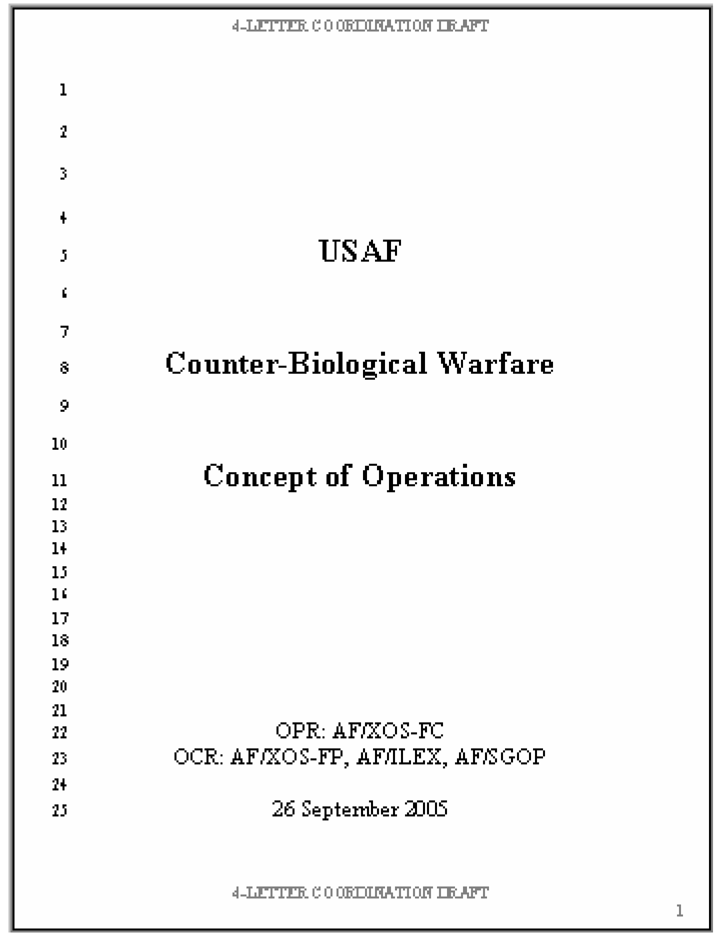
- Disease Containment Plan
- Medical Treatment Protocols Guidelines

Decision Support / Wing Commander & Staff Tools

- Commander's Decision Tool
- Threat Working Group Charter
- Public Affairs Toolbox
- Legal Review and Analysis
- Force Protection Measures
- Mask/De-Mask Matrix
- AF Procedures for Investigating a Bio Event

C-BW CONOPS

- High-level concepts for how to work through a biological event
  - Addresses planning, response, and mission sustainment and recovery
  - Focuses on base-level actions
  - Based on KFE findings
- Entered coordination on 26 Sep 05
- Working towards:
  - CSAF signature by Dec 05
  - AF-wide implementation complete by Apr 07



4-LETTER COORDINATION DRAFT

USAF

Counter-Biological Warfare

Concept of Operations

OPR: AF/XOS-FC
OCR: AF/XOS-FP, AF/ILEX, AF/SGOP

26 September 2005

4-LETTER COORDINATION DRAFT

1

Tenets of C-BW CONOPS (1 of 2)

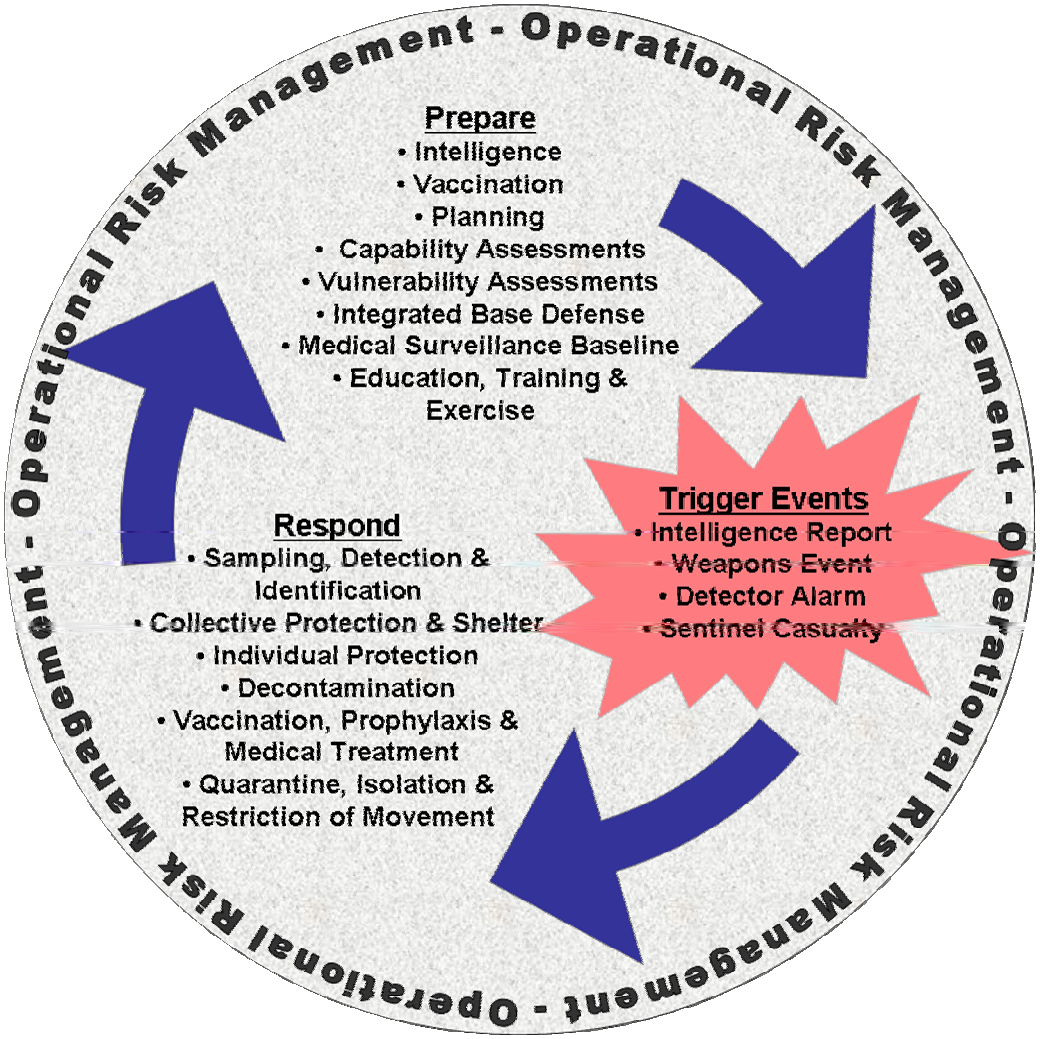
- CONOPS applies to all biological events
  - Biological warfare
  - Biological terrorism
  - Naturally occurring disease outbreaks
- Commanders decision making abilities may be hampered
  - Information will be limited
  - Timeline for actions will be compressed
  - Requires balancing mission criticality and risk to personnel
- CONOPS is based on Trigger Event Concept
  - The trigger event will determine the appropriate responses to the BW event

Tenets of C-BW CONOPS (2 of 2)

- **Preparation will determine the response options available**
- **Measures to maintain operations:**
  - **Minimize casualties through layered defenses**
    - **Avoid exposure**
    - **Mitigate impacts of exposure**
  - **Risk Management Strategy**
    - **Understanding the hazard and operational implications is essential to implementing risk management strategy**
    - **Requires education and training (ETE Initiative)**

C-BW CONOPS Approach

- Prevent or minimize personnel exposure
- Mitigate the impact of exposure
- Balance protection of personnel with need to sustaining operations
  - Apply ORM principles, techniques, and decision tools
  - Make best use of layered defense strategy
- Implementation requires guidance and training not new equipment



C-BW CONOPS Way Ahead

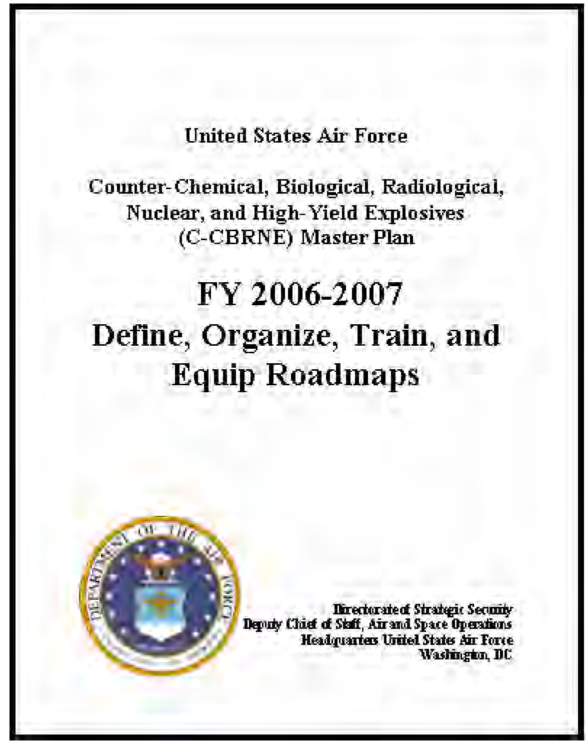
- Implement C-BW CONOPS at other constructs (i.e., different missions, populations, and operational imperatives)
- Publish C-BW policy, guidance, and TTPs
- Education, train, and exercise AF personnel
- Expand scientific and technical analysis

KFE Products

KFE Final Report

C-BW CONOPS

C-BW CONOPS Implementation Working Group (Air Staff & MAJCOMs)


United States Air Force

Counter-Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives (C-CBRNE) Master Plan

FY 2006-2007

Define, Organize, Train, and Equip Roadmaps

Directorate of Strategic Security
Deputy Chief of Staff, Air and Space Operations
Headquarters United States Air Force
Washington, DC

Implementation activities tracked through C-CBRNE Roadmaps

QUESTIONS?

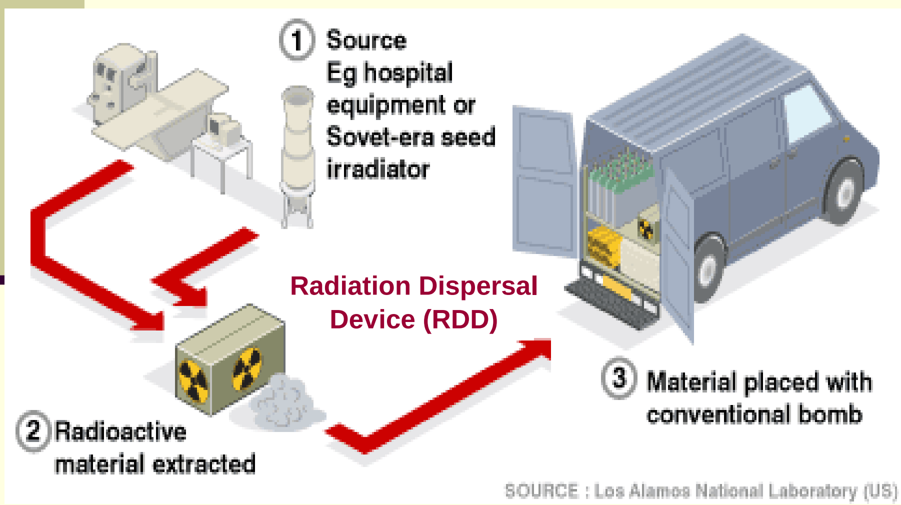
https://www.xo.hq.af.mil/xos/xosf/xosfc/c-cbrne_resources/index.shtml (UNCLASSIFIED)
http://chembio.xo.af.pentagon.smil.mil/bio-smallpox.shtml (CLASSIFIED)

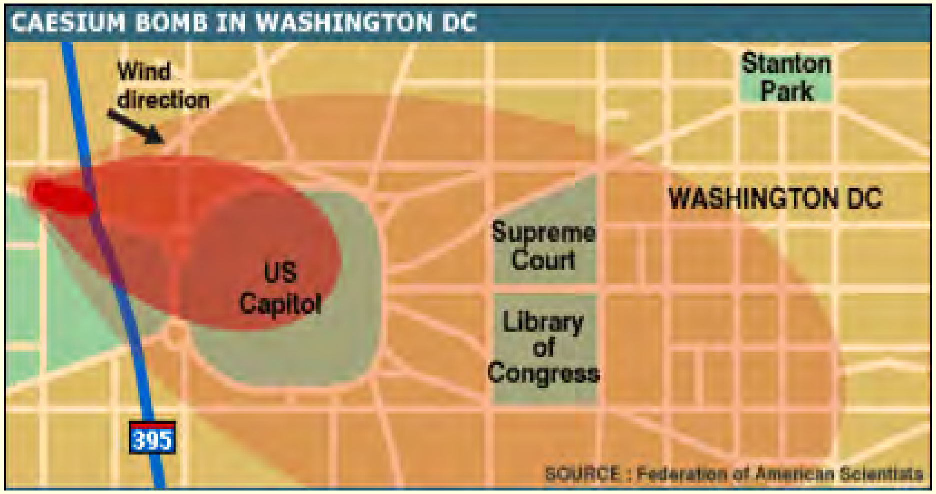
Using Smart Threads to Interdict Radioactive Materials

C. D. Hull[1], R. Seymour[1], S. Pauly[1], A. Proctor[1], LTC M. Johns[2], MAJ S. Frederiksen[2], J. Tumminello[1], L. Sideropoulos[1]

[1] Nucsafe Inc., 765 Emory Valley Road, Oak Ridge, Tennessee 37830

[2] DTRA, Nuclear Technologies Division, 8725 John J. Kingman Road, Stop 6201, Ft. Belvoir, VA 22060





Nucsafe

Presentation Overview

- Definitions & Goals
- Smart Threads Components – Platform Architecture
- Smart Threads Integrated Radiation Sensors (STIRS)
- Components and Examples of ‘Scale-ability’
- Communications and Reach-back
- Synopsis
- Questions & Discussion

Uranium Yellowcake

Nucsafe

Definitions & Goals

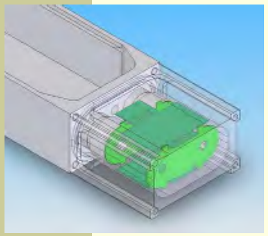
Definitions

- Smart Threads is a modular architecture for Chemical, Biological, Radiological, and Nuclear (CBRN) detectors
- Smart Threads is a dynamic, easily expandable, self-configuring platform
- Smart Threads Integrated Radiation Sensors (STIRS) used for radiation measurements are described

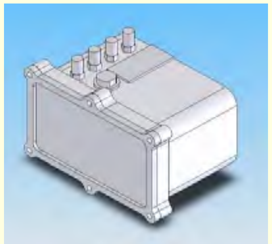
Goals – Goals of the STIRS platform are to enhance both deterrent and inconspicuous detection capabilities for SNM and radiological materials.

Smart Threads Components

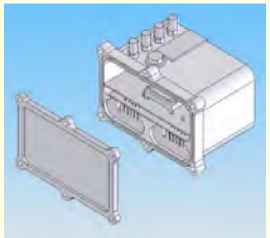
- **Hardware** – Two main hardware components
  - Smart Sensors. Each Smart Sensor contains:



    - Radiation detector – gamma-ray, neutron, *etc.*
    - HV supply, signal processing electronics, microprocessor
  - Smart Sensor Aggregator (SSA)
    - Aggregates Smart Sensor data – RS485 bus polls sensors
    - Microprocessor – Evaluates alarm conditions
    - Transmits data *via* Ethernet or wireless protocols



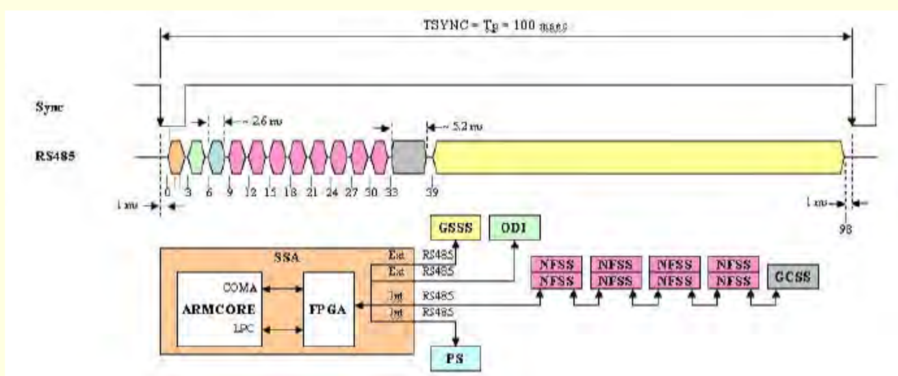
    - Includes GPS, Bluetooth, and 802.11b wireless communications modules
    - Other components as needed



Nucsafe

Smart Threads Components *(cont'd.)*

- **Firmware:**
  - Common protocol and interconnection concept
  - Modular platform for all types of CBRN detectors
  - Data processing within each Smart Sensor
    - Radiation Smart Sensors report 'counts' *per* time
    - Perform statistical calculations
    - Processing sets the bandwidth on the RS485 comm bus
    - Sensor 'State-of-Health' parameters tracked



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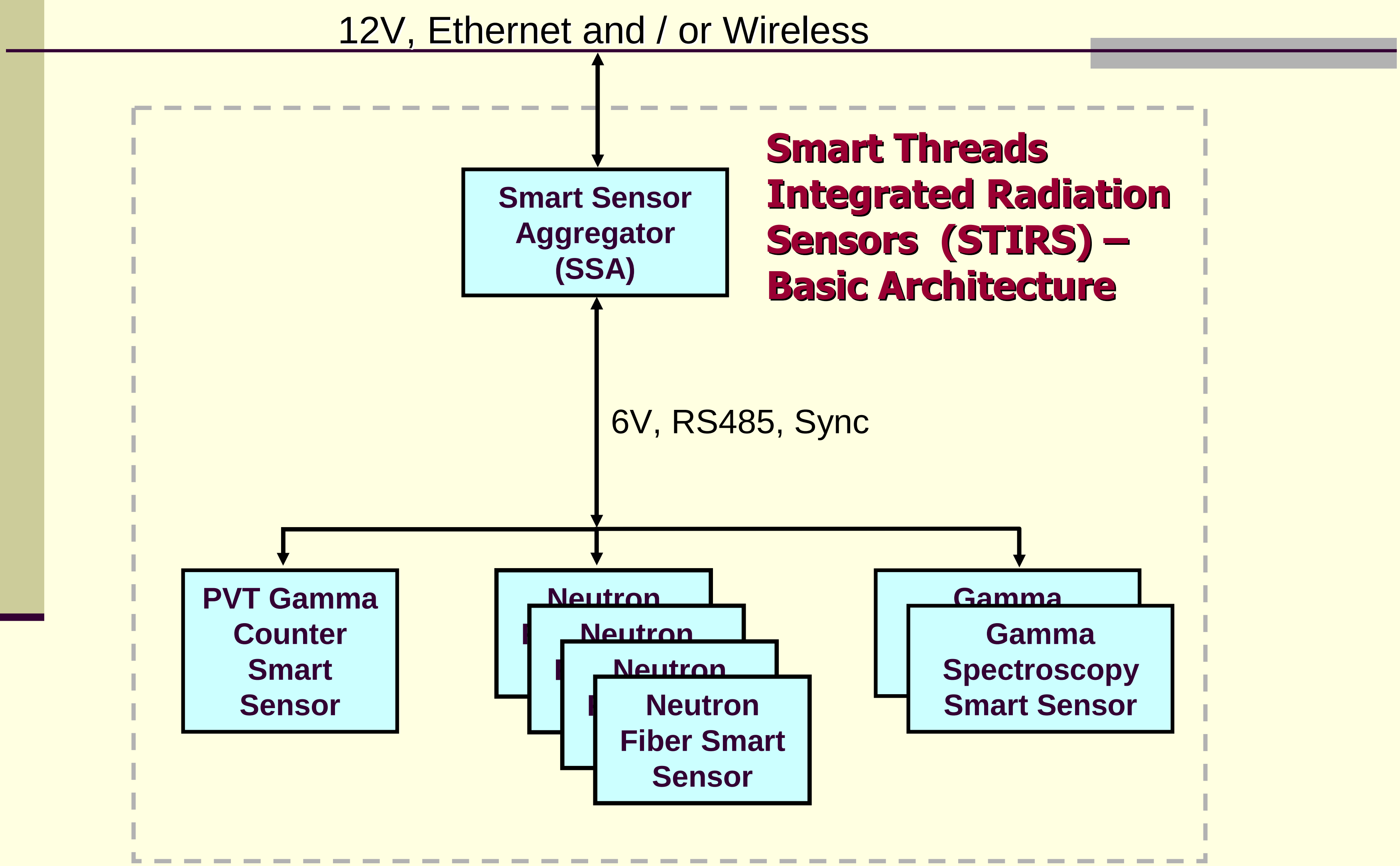
STIRS – Basic Platform Architecture



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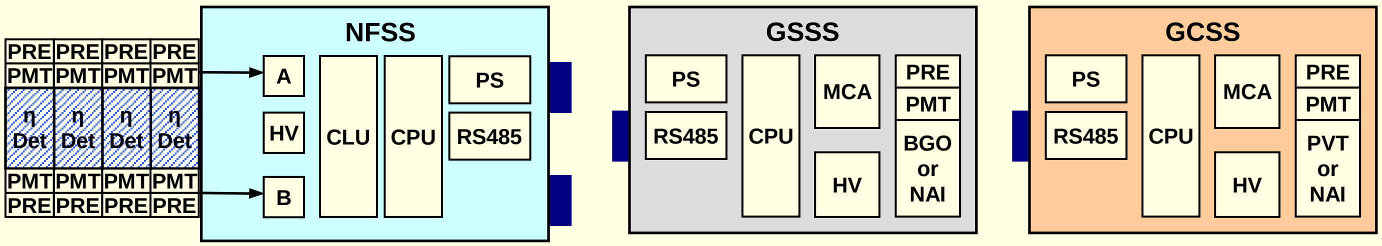
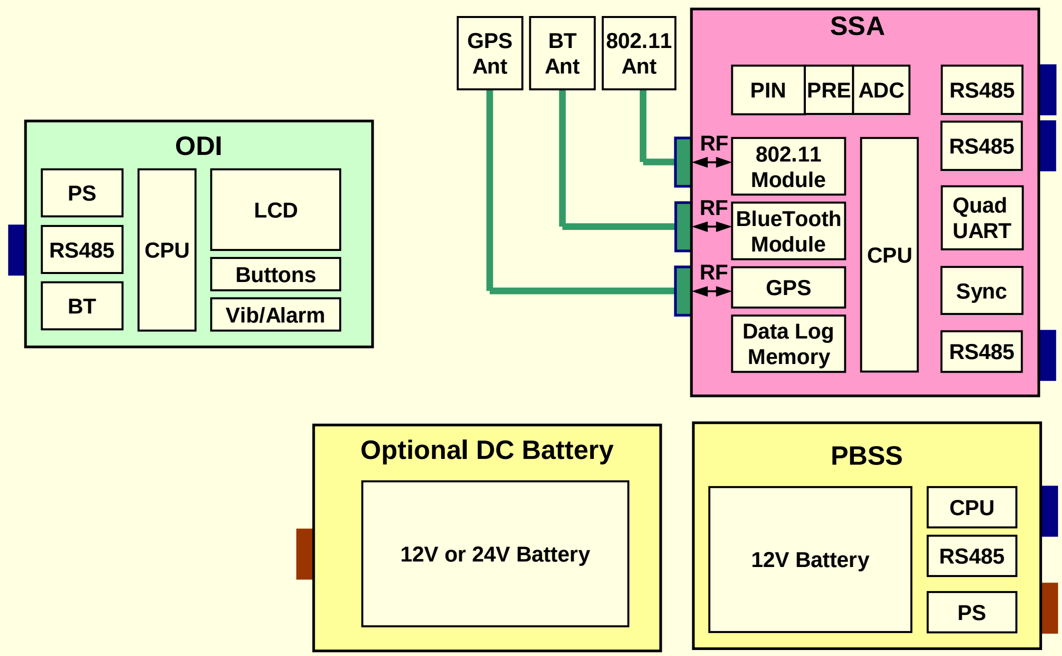
STIRS Platform Architecture

Modular Configurations for Specific Missions



Smart Sensors

- A modular architecture for portable, transportable, and large STIRS systems.
- Utilize ‘standard’ building blocks; *e.g.,*
  - Power – Line or Battery
  - HV Supply
- Communications protocols are standardized
  - Ethernet
  - Wireless protocols



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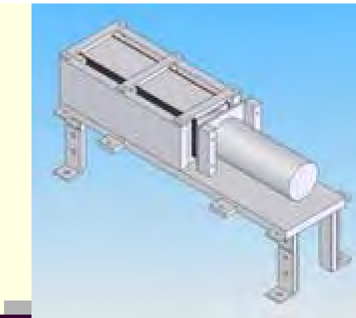
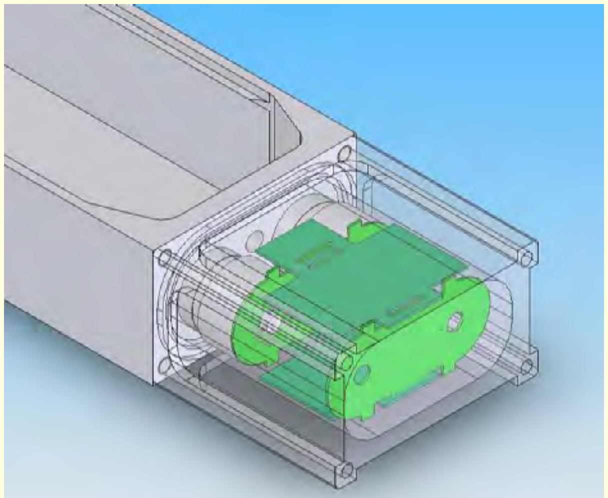
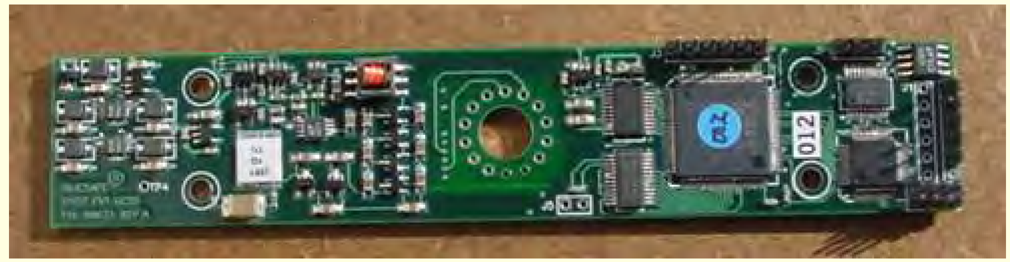
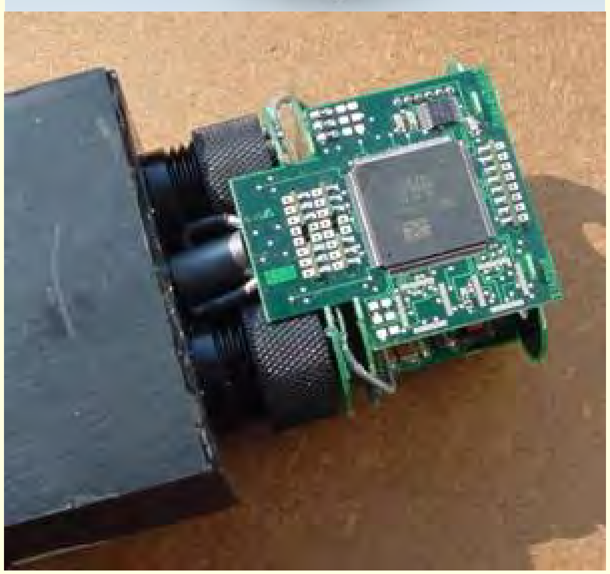
Hardware
STIRS Smart Sensors







Each STIRS Smart Sensor contains a radiation detector, HV supply, signal processing electronics, and microprocessor(s)



^{6}Li Silicate Fiber Neutron Smart Sensor

PVT Gamma Ray Smart Sensor

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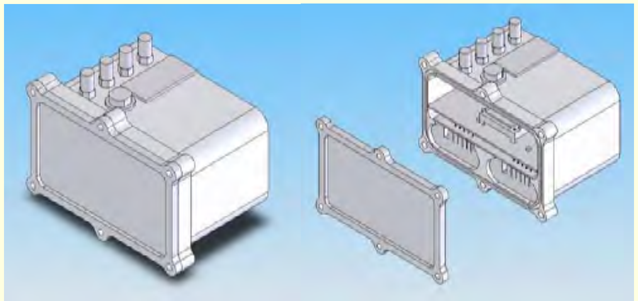
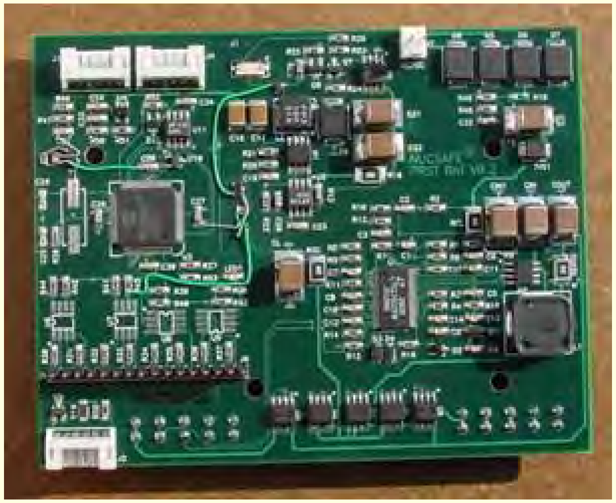
Hardware

Smart Sensor Aggregator (SSA)



- SSA and Power Supply Module
  - Collects data packets from sensors
  - Calculates alarm information
  - Drives packets to the Operator Display
  - Integrates GPS, BlueTooth, 802.11b modules
  - Power Supply reports status of batteries to SSA
  - Power Supply recharges batteries

Smart Sensor Aggregator (SSA) Board



Power Supply and Power Conditioning Board

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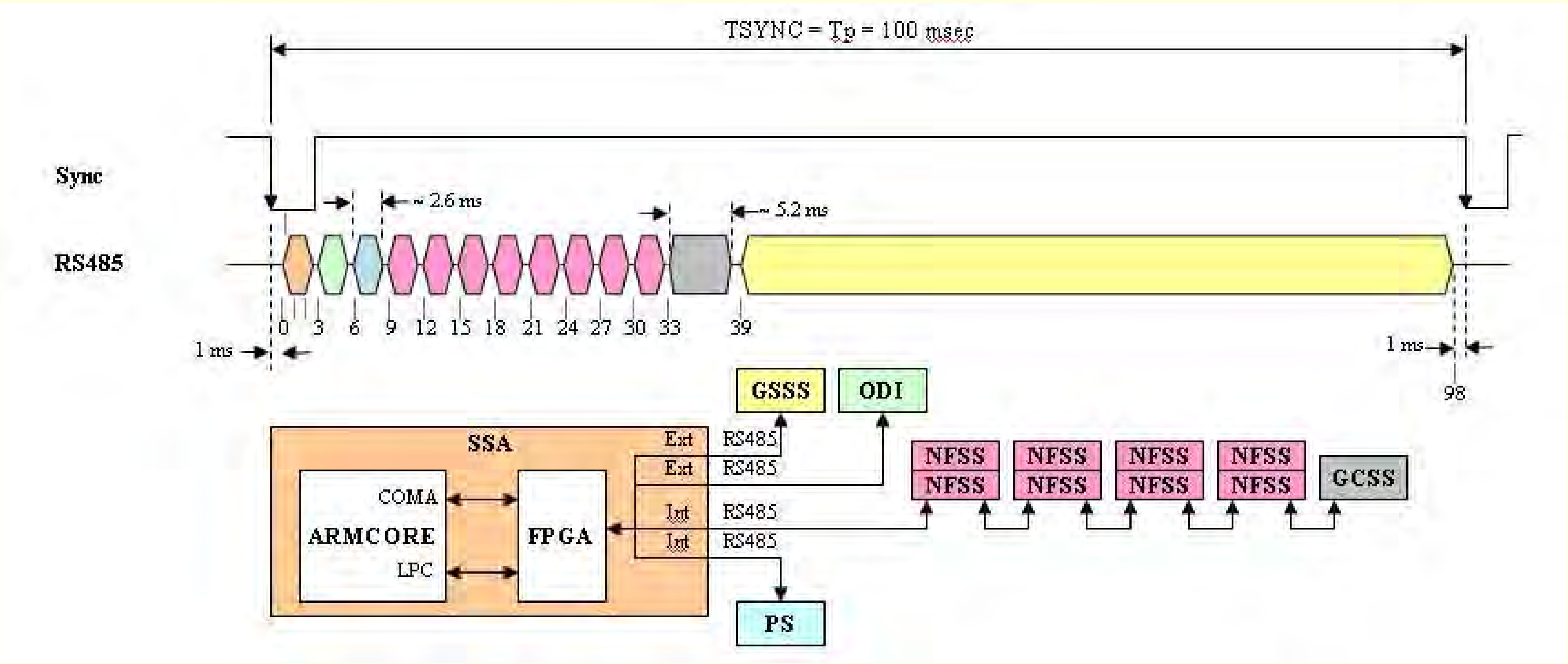
Hardware / Firmware
STIRS Smart Sensors – RS485 System Bus

Smart Sensor RS485 Communications and Data Packet Concept



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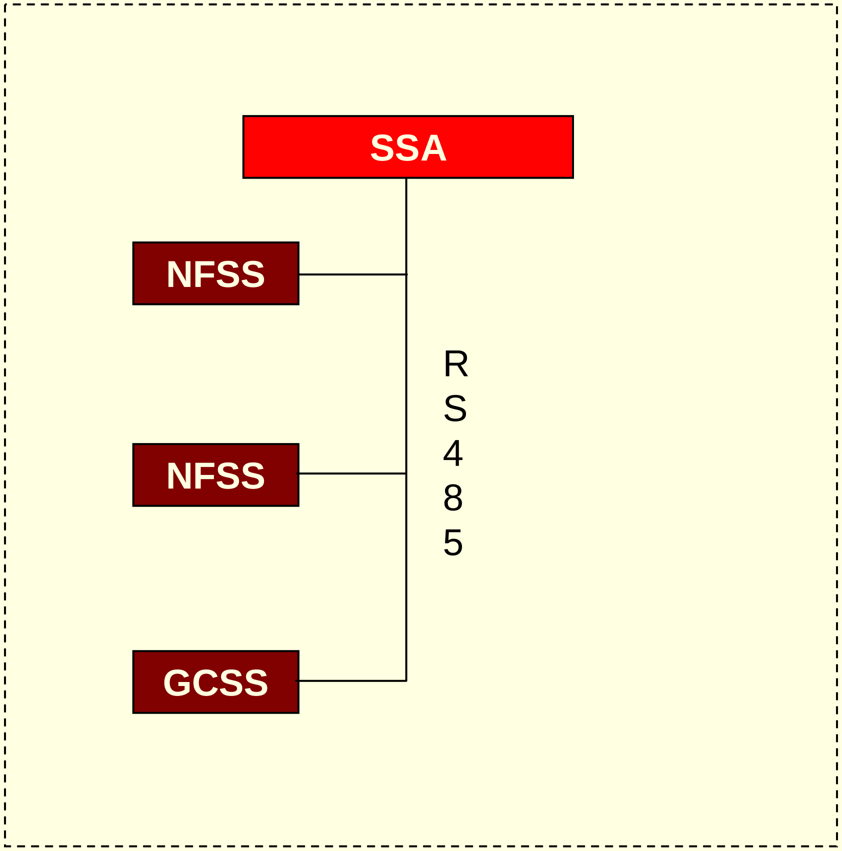
STIRS - Example 1
Portable Radiation Search Tools (PRST)

- Using any permutation of Smart Sensors, connected to a Smart Sensor Aggregator (SSA), any STIRS system can be easily configured.
- Example – Portable Radiation Search Tools (PRST)



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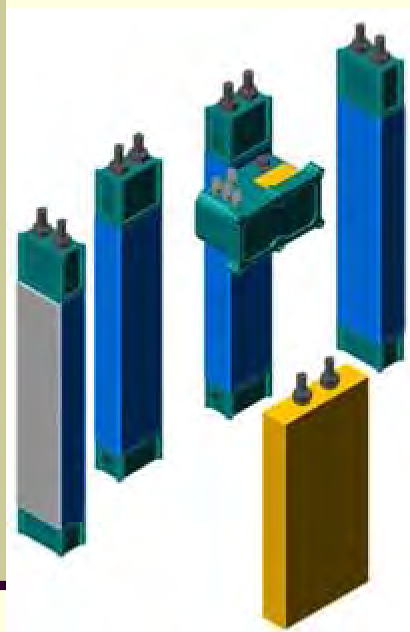
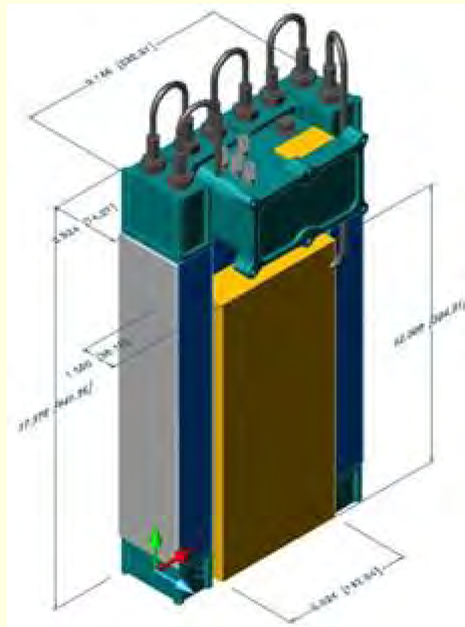
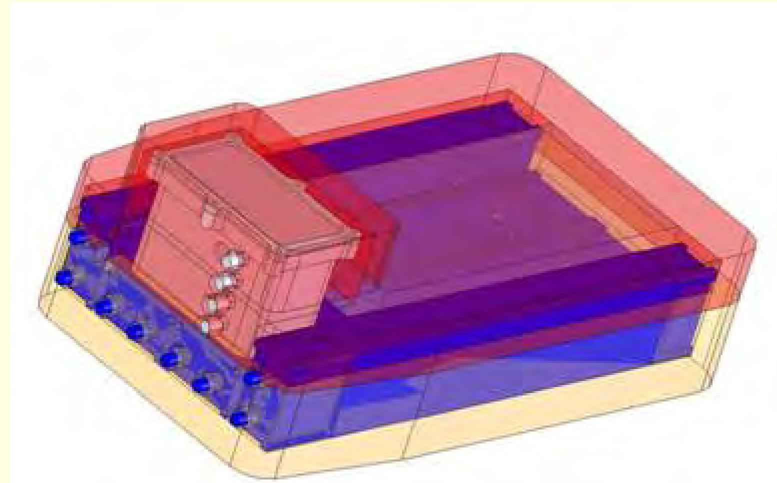
PRST Systems
Backpacks, Vests, Briefcases

- NucSafe PRST Models







Orthographic Projection – DTRA 3G PRST

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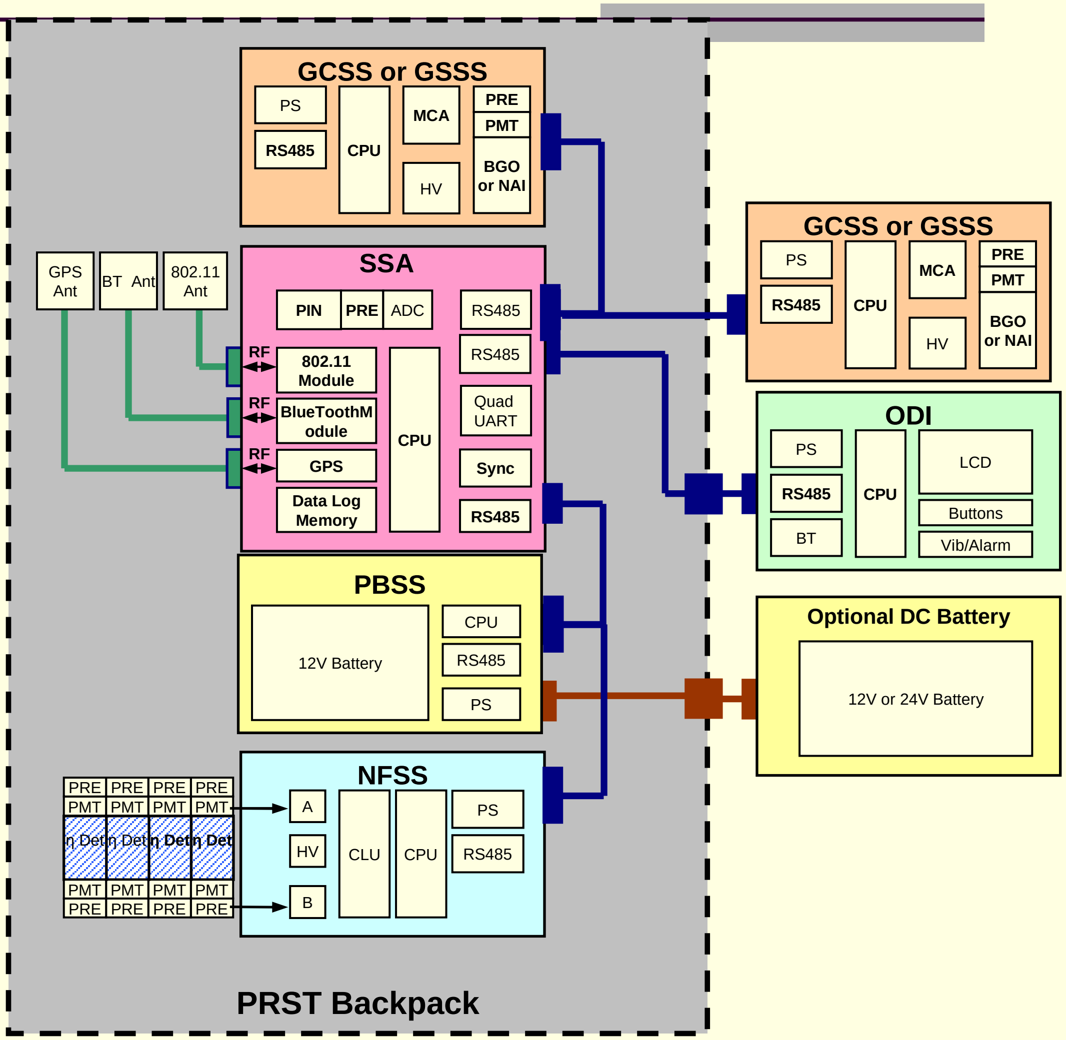
Example of 'Build Your Own' PRST
(Portable Radiation Search Tool)

- Radiation Threat – Need a mission specific Portable Radiation Search Tool
  - Select STIRS Smart Sensors for mission
  - Connect to Smart Sensor Aggregator (SSA)
  - Configure for Deployment
  - Architecture allows:
    - Choice of CBRN Detectors
    - Operator Display
    - Add-on functions
    - Multiple Wireless Protocols
    - External battery



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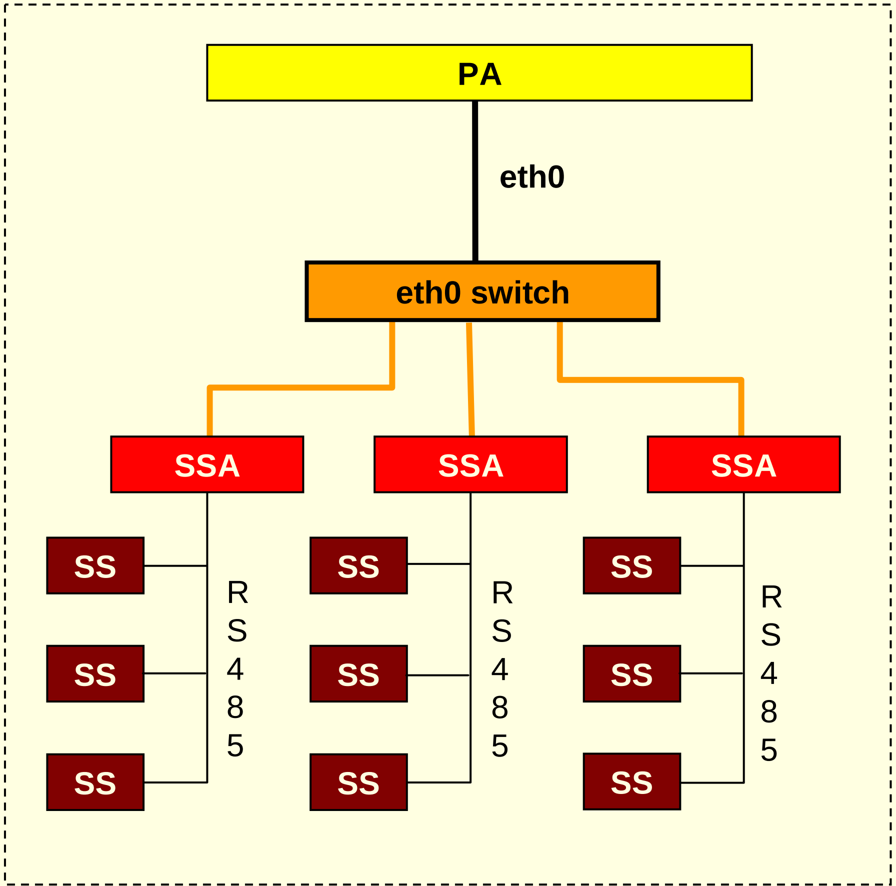
STIRS Example 2
Mobile System Schematic

- Larger and/or more numerous STIRS Smart Sensor components can be easily configured
- By use of an Ethernet switch, systems like SPARTAN can be configured.



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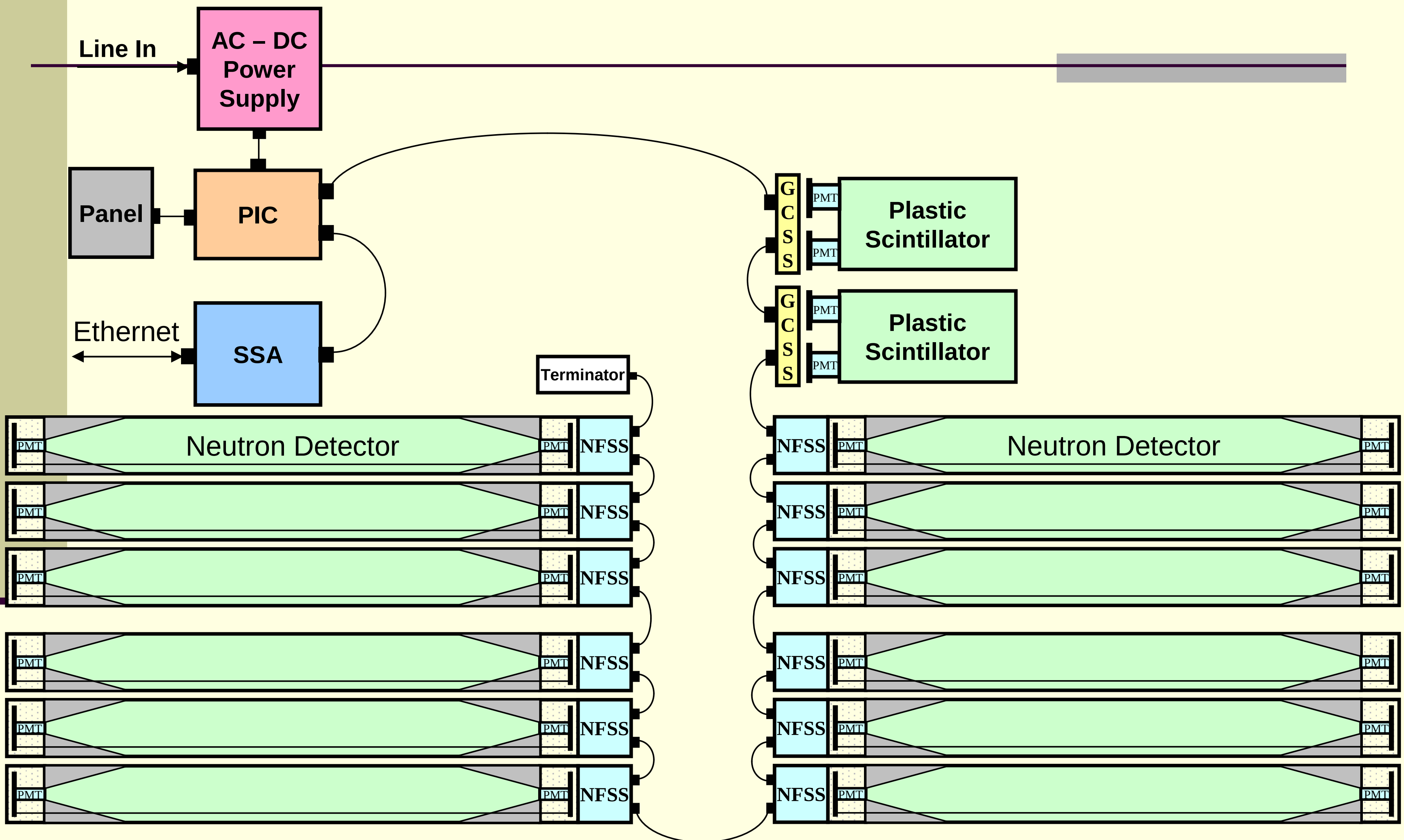
Mobile STIRS Example – SPARTAN USV



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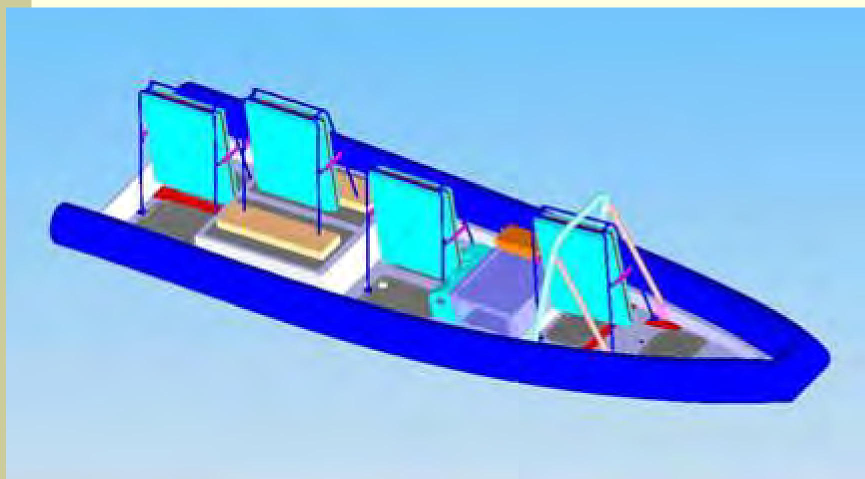
SPARTAN Mobile System - USV



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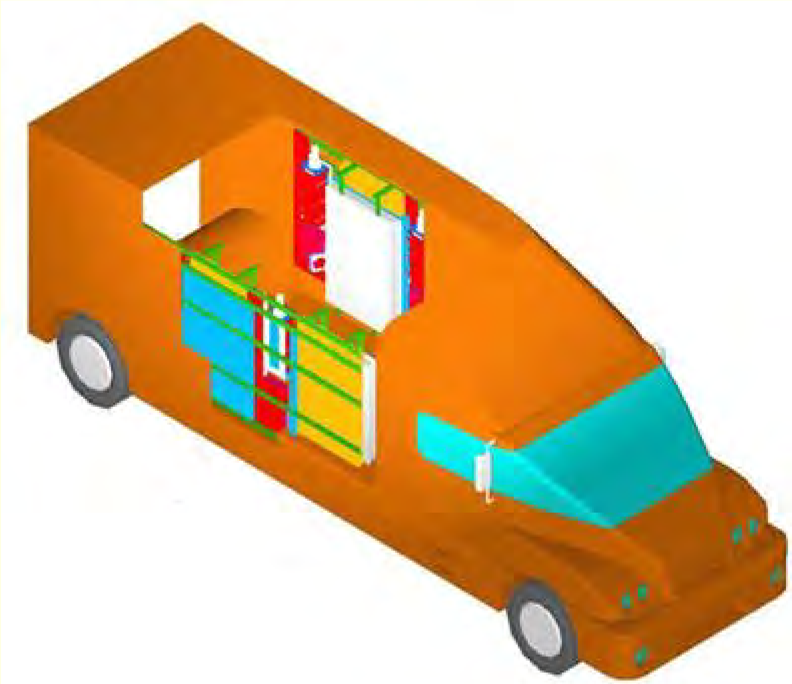
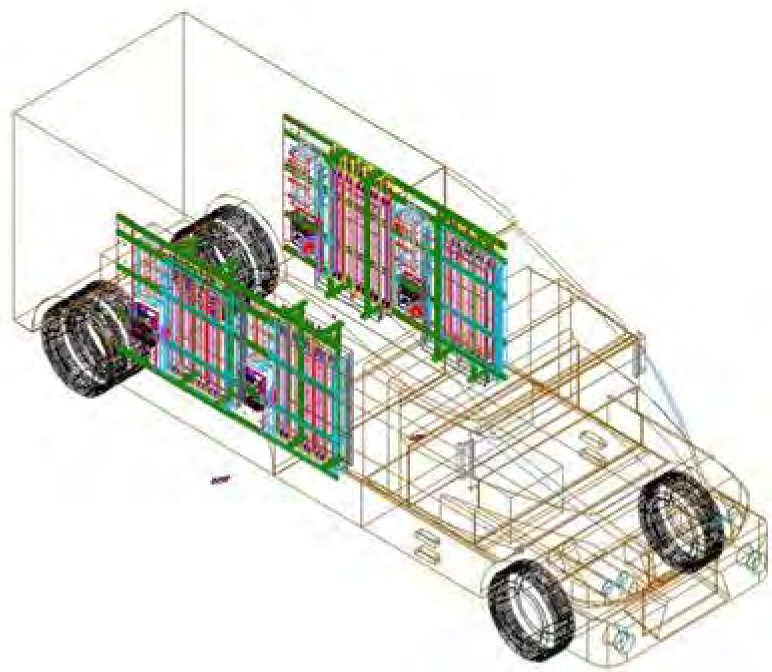
Van Mounted Mobile STIRS System





Van, SUV, and Patrol Cruiser
Mobile Systems

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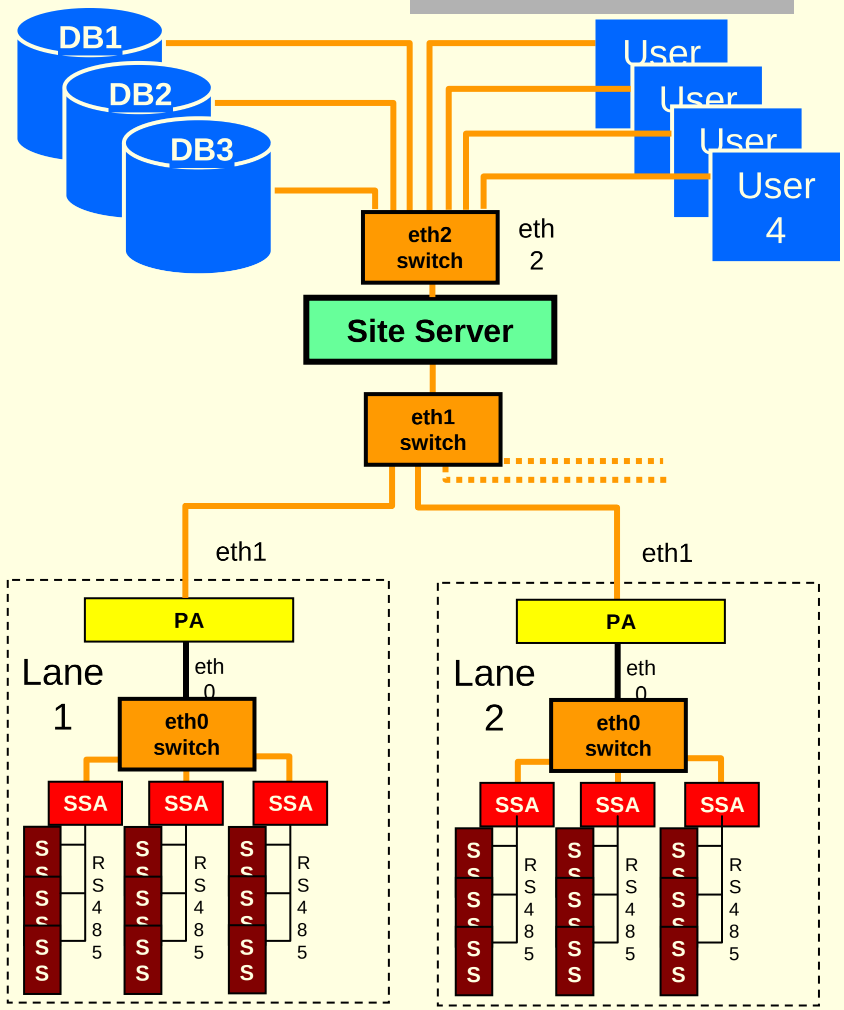
STIRS Example 3

Multi-lane Vehicle Portal Radiation Monitors

- More complex systems are assembled by connecting groups of STIRS ‘panels’
- Panels are connected to a ‘Panel Aggregator’ computer that monitors a fully integrated STIRS system.
- Multiple STIRS systems may be linked *via* Site Servers – data is made available to multiple users and stored to databases as desired.



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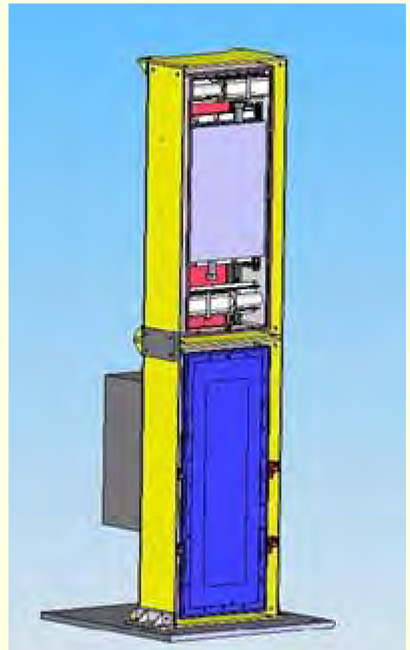
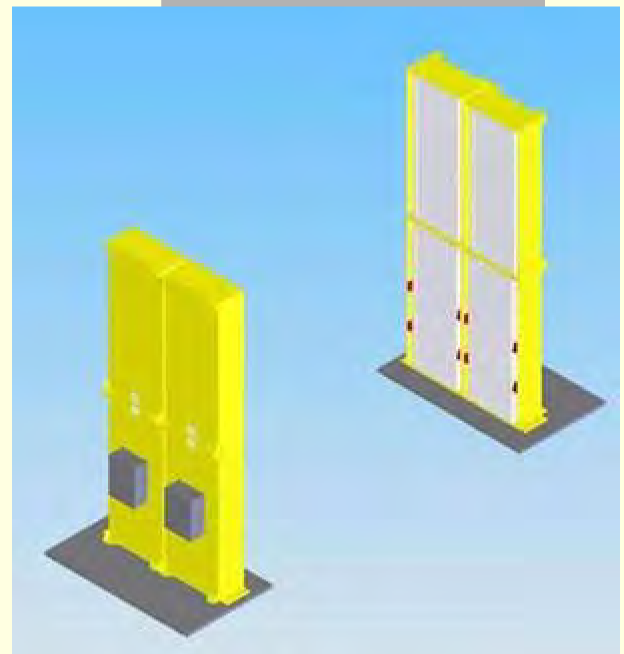
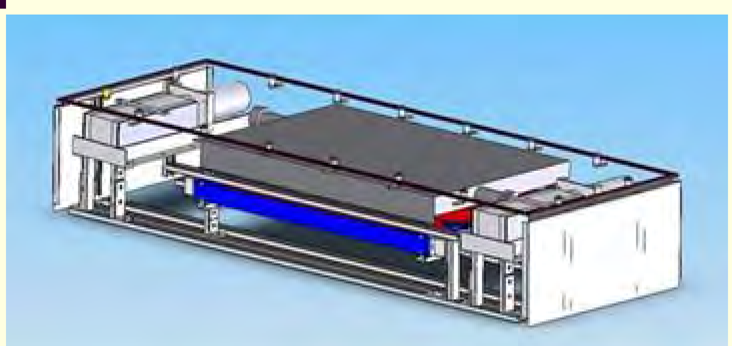
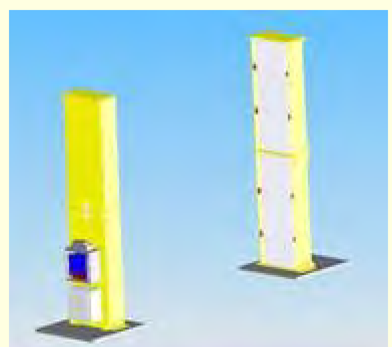
Radiation Portal Monitoring Systems









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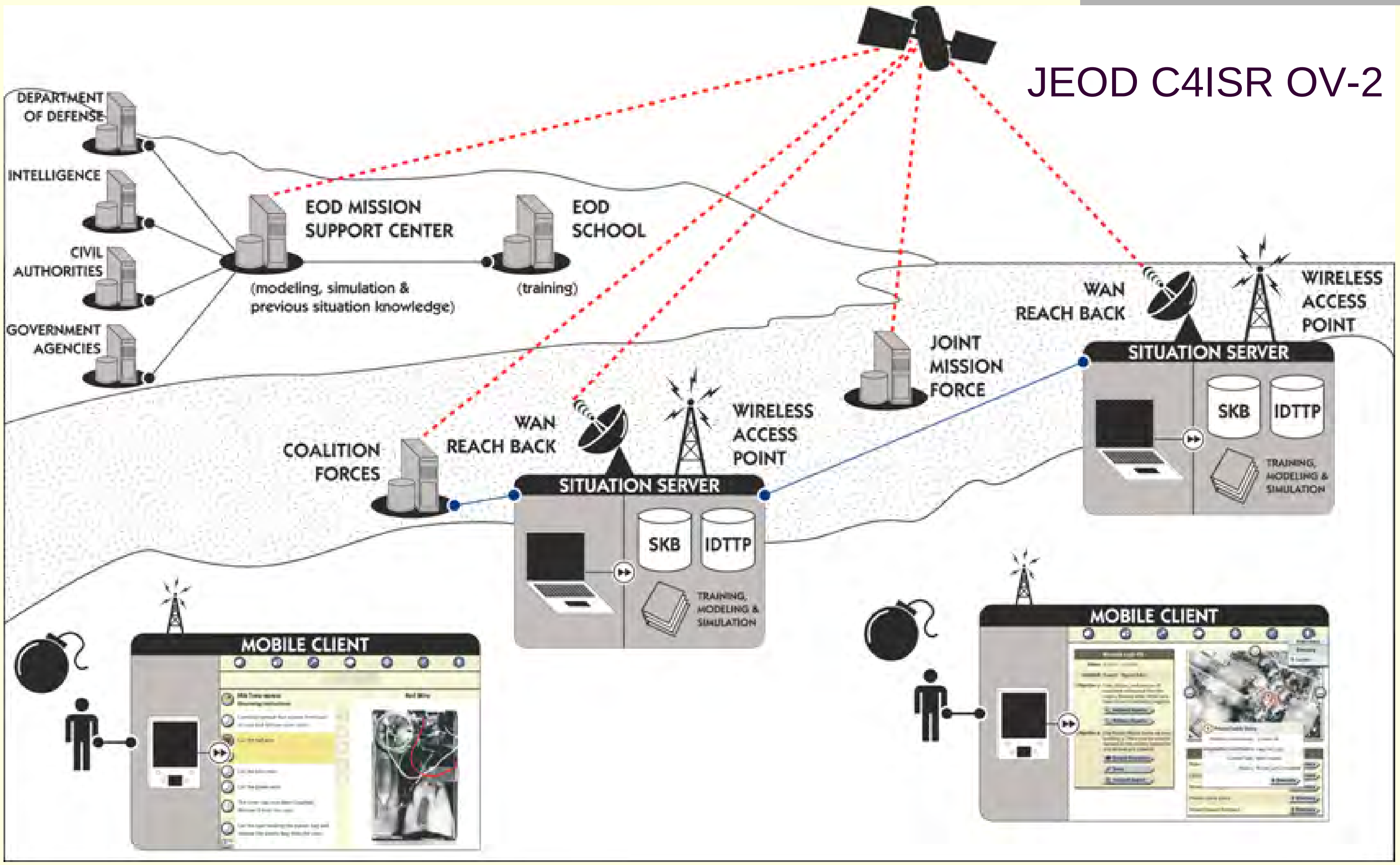
Communications and Reach-back



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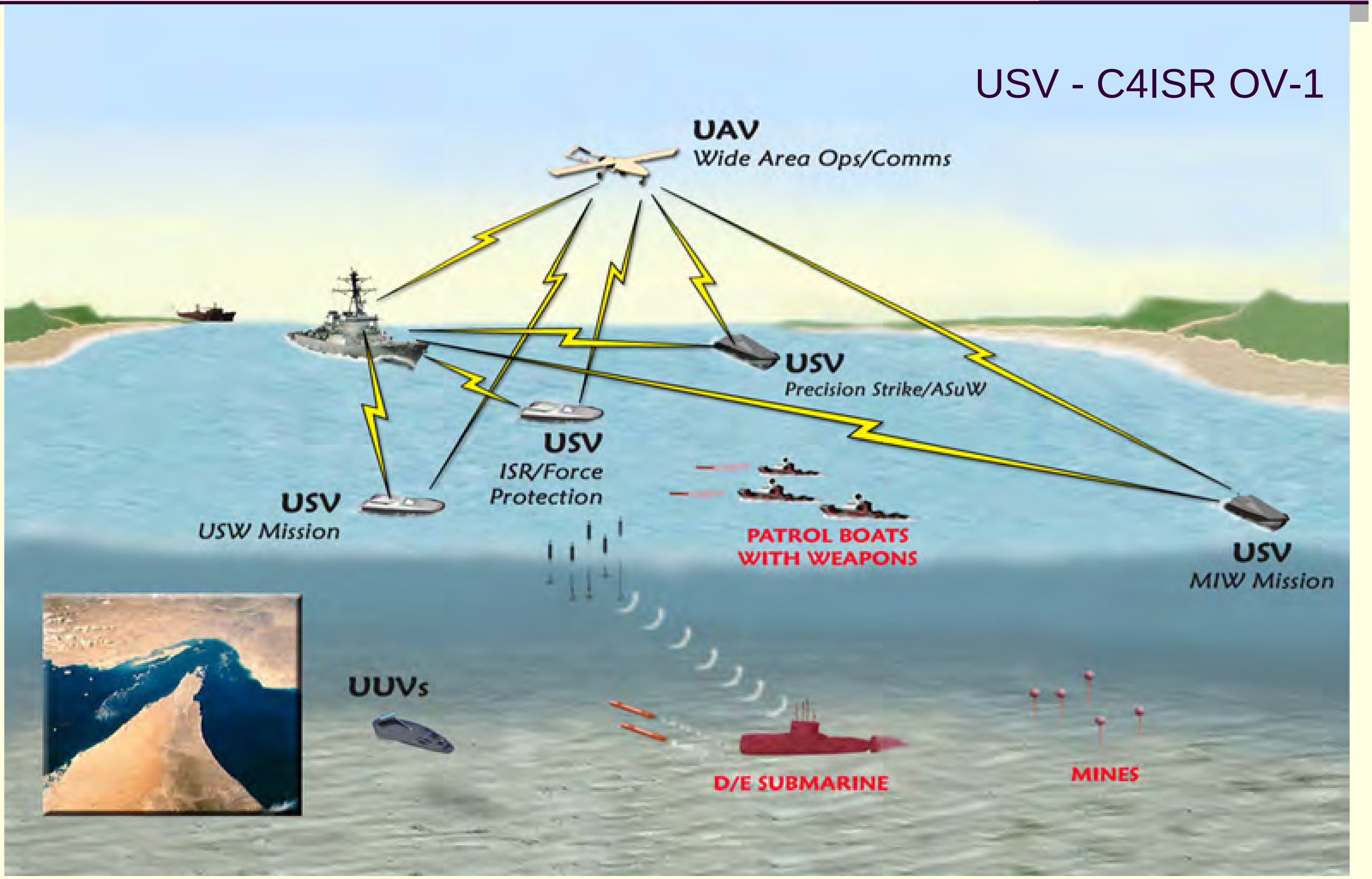
Communications and Reach-back



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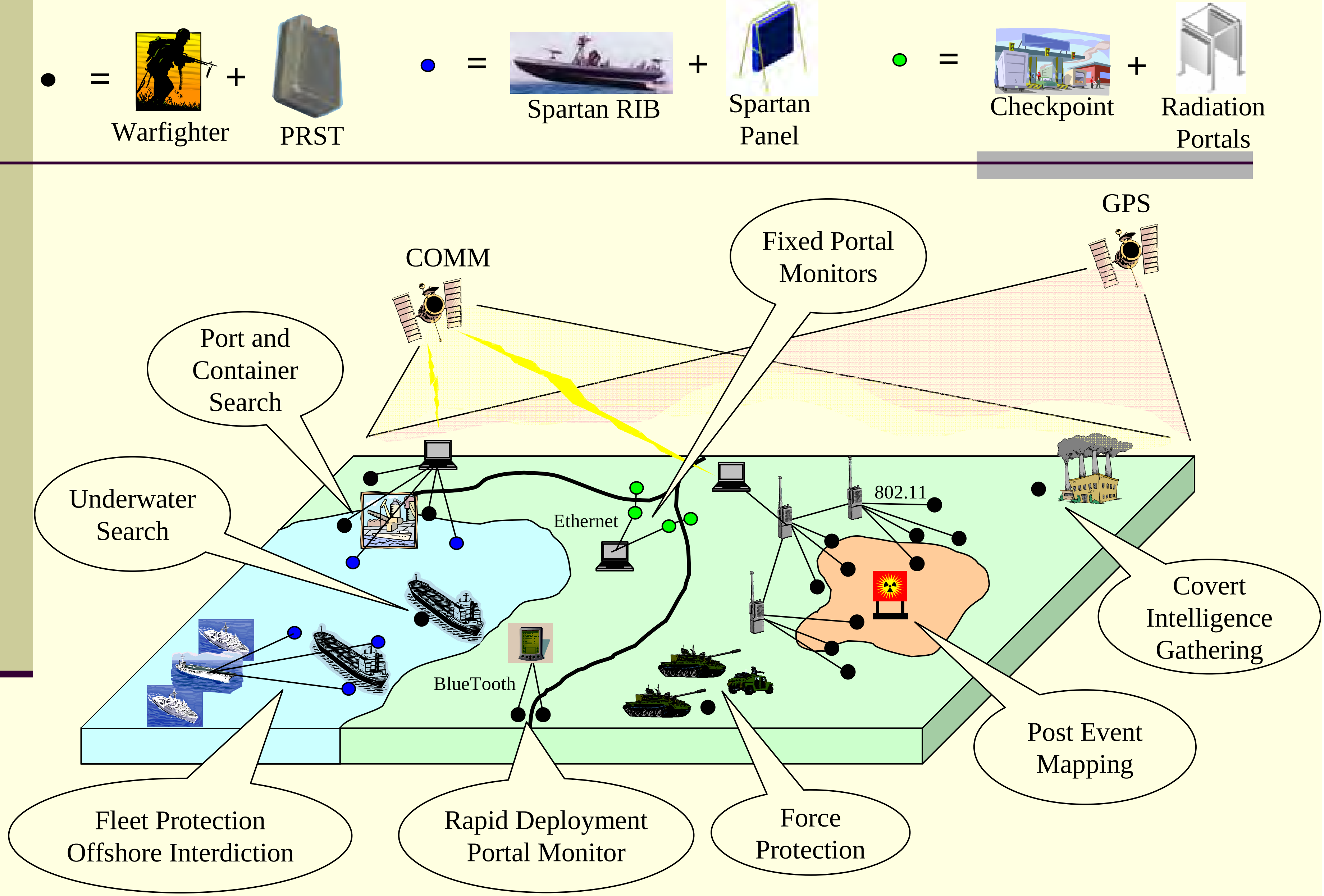
Operational View C4ISR OV-1 - Nucsafe STIRS



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Synopsis

- Smart Threads is a modular architecture for CBRN detector systems
  - Self-configuring platform
  - Dynamic
  - Easily expandable
  - ‘Scaleable’ – Portable to Very Large Systems
- Smart Threads Integrated Radiation Sensors (STIRS) were discussed in this presentation
- Smart Threads can include numerous CBRN sensor systems

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Questions & Discussion, Acknowledgments

NTS April 1953
'Badger'
300 Foot Tower
23 Kilotons

Threat Analog:
IND on Elevated
Floor of High Rise

Funding for the majority of this research has been provided by the U. S. Defense Threat Reduction Agency (DTRA), DoD, Contracts HDTRA01-04-C-0008 and HDTRA-05-D-0004.

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Terrorist Motivations to Employ Chemical, Biological, Radiological, and Nuclear Weapons

Robert C. Neumann

Program Manager

Special Operations Forces CBRN Support

The opinions expressed in this present
author's and do not represent EAI n

CBRN Terrorism

- "Its not a matter of if, but of when"
- If so, why do most terrorist groups not pursue the acquisition of CBRN?
  - Lack of technical ability
  - Lack of resources (funds, materials)
  - Not motivated to pursue – "what they are doing is good enough"
  - Fear of repercussion from target / public outcry
- But why do some terrorist groups ignore the challenges and attempt to acquire and more importantly employ CBRN weapons

Terrorism

- DOD Definition of Terrorism: the calculated use of violence or threat of violence to inculcate fear; intended to coerce or try to intimidate governments or societies in the pursuit of goals that are generally political, religious or ideological. (Source Joint Pub 3-07.2)

- An act or threat of **violence** against **noncombatants** to intimidate or influence an audience, with **political** change as the **objective**.

Typology of Terrorism

Ideological Categories	A More Narrow View
Nationalist-separatist	Practical
Social revolutionary	Practical
Religious fundamentalist	Apocalyptic - Practical
Non-traditional religious (closed cults)	Apocalyptic - Practical
Right-wing terrorism	Practical
Lone Wolves Right-Wing Religious Fundamentalist	Practical - Apocalyptic

Types of Terrorist Groups

- Today, terrorist groups can be categorized into two broad groups:
  - Practical
  - Apocalyptic

Practical terrorist groups use violence as a tactic to achieve their strategic goal.

Apocalyptic terrorist groups use religion as their ideology and typically dismiss all other forms of religion other than their own as false.

Practical Terrorist Groups

- Will commit atrocious acts
  - setting off car bombs in public places
  - kidnapping the innocent relations of his chosen enemies
  - committing assassinations
  - conducting suicide attacks

- May resort to mass casualty attacks if the group is weak and isolated.

- End states
  - Freedom
  - New society
  - New economic system
  - Autonomy
  - Reassignment of territory

"scale of actions is usually limited, despite the attendant drama"

- May use toxic chemicals or poisons if the circumstances warrant and the effects are focused

Apocalyptic Terrorist Groups

- Religiously motivated
  - Islamic
  - Christian
  - Jewish
  - Hindu
  - Others

- Retribution against unbelievers, heretics, and those with lesser commitment
- Willing to commit spectacular, extremely violent acts
- Willing to give their life in the attainment of their goals
- Unconstrained violence

- End states
  - New society

- All methods are open

Historical Constraints

- Technically & resource intensive
- Conventional tactics work
- Backlash

Bottom Line
Conventional means have proven effective

Constraints On Violence

- Unnecessary to convey a message to target audience
- Loss of approval and support of the group that the terrorists claimed to represent
- Backlash from target nation or international community

"Terrorists want a lot of people watching, not a lot of people dead"

Lack of Constraint

<u>Aum Shinrikiyo</u>

- Circa 1990-1995
- Launched a number of attacks using *botulinum* toxin, *Bacillus anthracis,* sarin, VX, and hydrogen cyanide
- Had near and far term motivations; eliminate threats, proof of prophecy, instigate a war, & survive the apocalypse

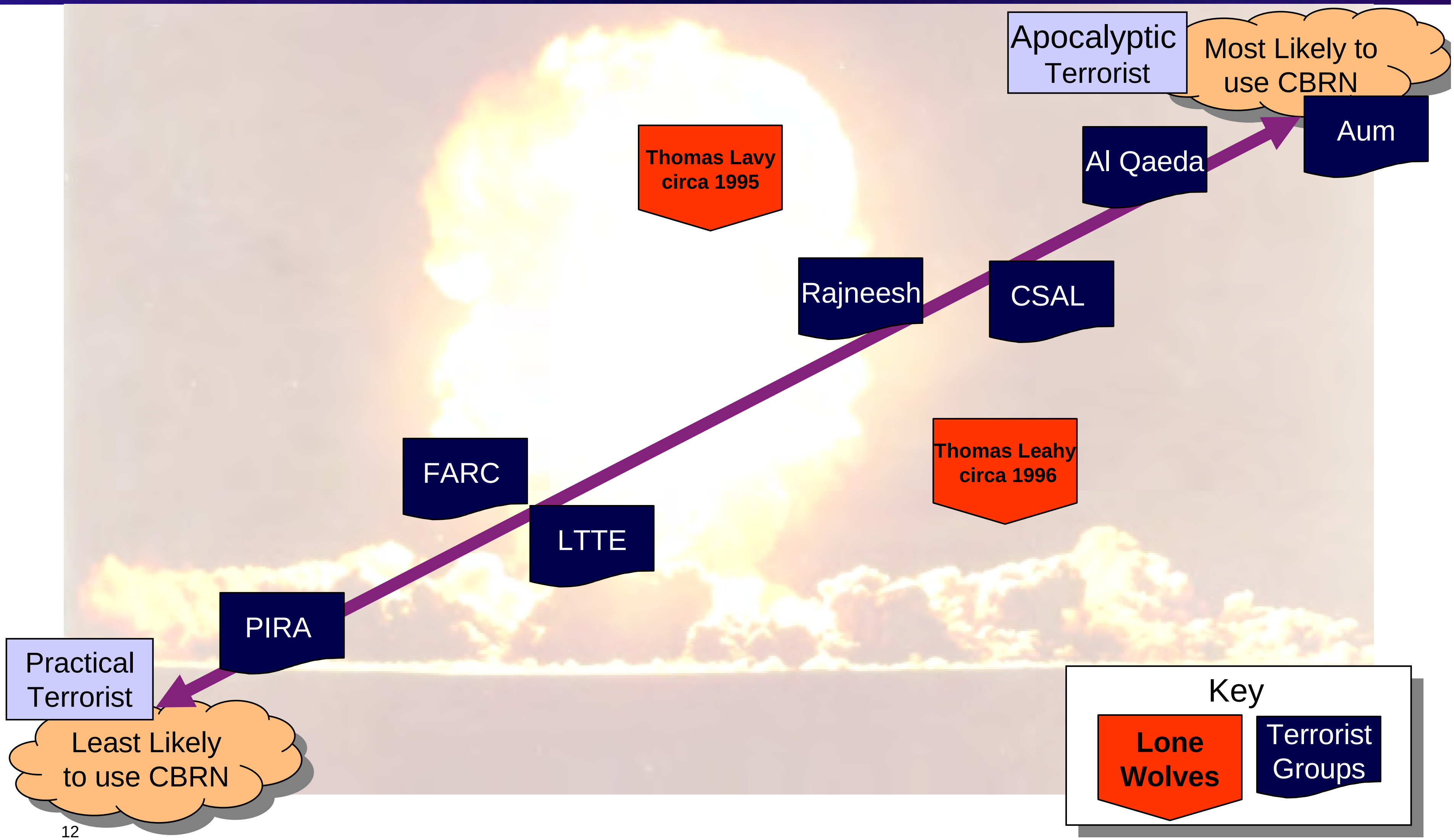
<u>Al Qaeda</u>

- 1993 – present
- Attempted to develop / acquire chemical, biological, radiological, & nuclear weapons
- Biological warfare laboratory was under construction near Tarnak Farms, Afghanistan
- Worked with poisons & toxins

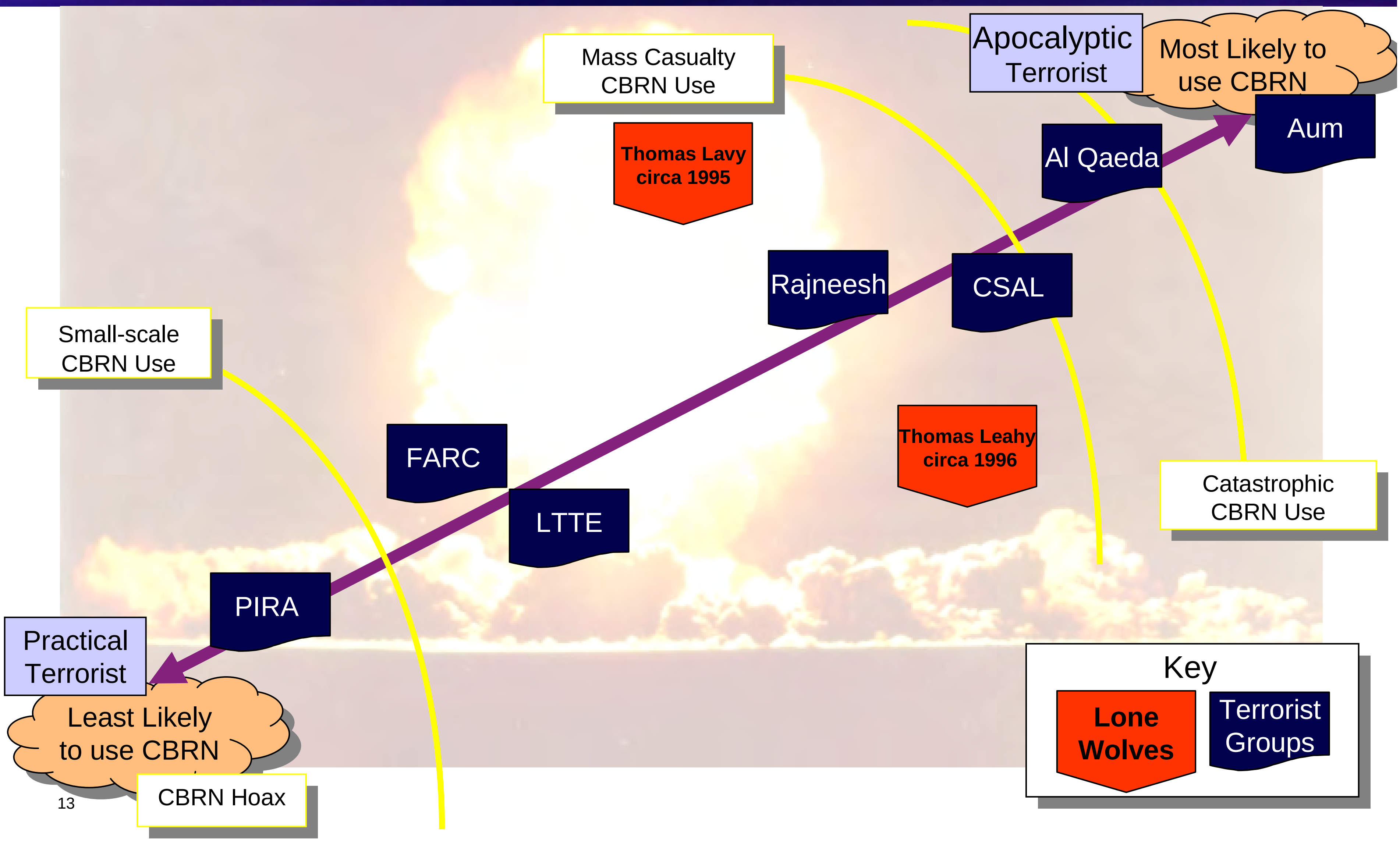
Performance Violence

- Spectacular violent acts with the intent of having the violence witnessed by the greatest number of people with little direct political impact.
- Killing the few does not suit the purpose of the apocalyptic groups. They are engaged in a cosmic war and the more horrific the act the better.
- The use of weapons of mass destruction – chemical, biological, radiological, and nuclear – are weapons that would achieve them to achieve the desired effects.

Along the Spectrum of Use



Along the Spectrum of Use



Revolutionary Armed Forces of Colombia

- Cyanide
  - Home made hand-grenades, composed of explosives and a cyanide compound inside a plastic container
  - Cyanide tipped bullets
- Parathion
  - Added to water tanks supplying drinking water
  - FARC declared the water pipeline a a "military target"
- Biological Weapon
  - Cylinder bomb charged with 5 kilos of homemade explosive R1, potassium chlorate, aluminum powder, sawdust, scraps of iron and "a mix of clay with human feces"

WMD? Not really

Rajneesh Religious Sect

- Biological attack, circa 1984
  - Salmonella bacteria
  - Placed bacteria in eight local restaurants' salad bars
  - 751 affected
  - Two members pleaded guilty to salmonella poisoning charges & received four-year prison term
- Test run for a planned biological attack
  - Target was the town's water supply before the November election
  - Cult decided to abandon the idea

Religious Cult
Not Apocalyptic

Does Al Qaeda Have WMD?

"It presupposes that I do possess such weapons, and goes on to ask about the way in which we will use them. In answer, I would say that acquiring weapons for the defense of Muslims is a religious duty. To seek to possess the weapons that could counter those of the infidels is a religious duty. If I have indeed acquired these weapons, then this is an obligation I carried out and I thank God for enabling us to do that. And if I seek to acquire these weapons I am carrying out a duty. It would be a sin for Muslims not to try to possess the weapons that would prevent the infidels from inflecting harm on Muslims. But how we could use these weapons if we possess them is up to us."

Usama bin Laden

Al Qaeda– Striving for Better Weapons

- "Encyclopedia of Jihad", one entire volume is devoted to explaining how to construct CBW
- Attempted to construct a biological laboratory to develop a biological weapon using *Bacillus anthracis*
- Repeated attempts by cells and associates to use cyanide compounds & other toxic materials
- Interest expressed in nuclear and radiological weapons

- **However, conventional attacks have proven successful**

Conclusions

- Most terrorist groups will not employ CBRN weapons
- Practical terrorist groups will use them on occasion to enhance conventional weapons or for a very specific purpose
- Practical terrorist groups will not seek massive casualties
- Apocalyptic terrorist groups will seek CBRN weapons
- Most apocalyptic terrorist groups will fail to overcome the technical challenges to produce mass casualty devices
- **An effective CBRN device, in the hands of an apocalyptic terrorist, will be employed in a spectacular manner against a symbolic target to achieve massive casualties**

Networked Application of Chemical, Biological, Radiological and Nuclear Detectors for Early Detection and Warning of CBRN Events in Transit Environments

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Prepared For:
NDIA Conference
December 5-8, 2005
Tampa, Florida
USSOCOM

Terrorist Attacks on Transit Systems

- **The Tokyo Subway Attack – March 20, 1995**
- **The Madrid Bombing – March 11, 2004**
- **The London Metro Bombing – July 7, 2005**

<u>What's Next?</u>

Sample Scenario 1: Radiological Dispersal Device (RDD)

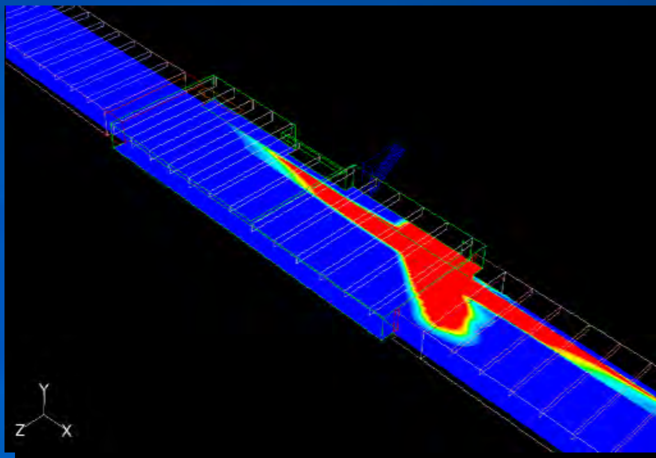
Spent nuclear fuel rods are supplied by Iran and shipped in a cargo container to Colombia then flown to Mexico and loaded on human mules used to smuggle drugs across the border. They are met in Arizona by sleeper cell agents who take the fuel rods by car toward its final destination. Three men get off subway cars at three different locations in downtown New York and head toward the New York Stock Exchange. ……..

The Unique Challenges of the Transit Environment

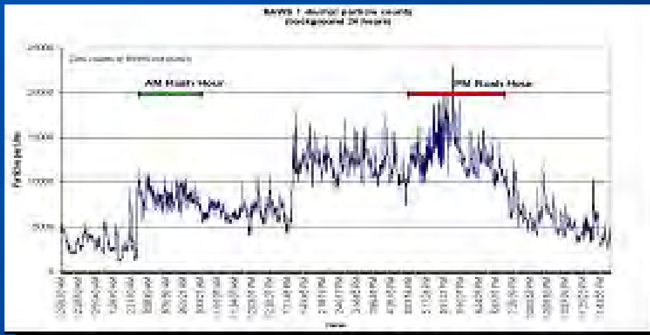
- Biological sensing problems
  - High particulate counts
    - Platform counts 100 X outside counts (PPLA)
  - Interferants
    - Diesel trains, vacuum trains mimic ‘Releases’
    - Skin cells, pollen mimic the biological signature
- Chemical sensing problems
  - Interferants
    - Pesticides and rodenticides
    - Cleaning agents, perfumes and deodorants
- Radiological sensing problems
  - Infrastructure provides many heavy steel obstructions conducive to shielding low level sources

The Unique Challenges of the Transit Environment

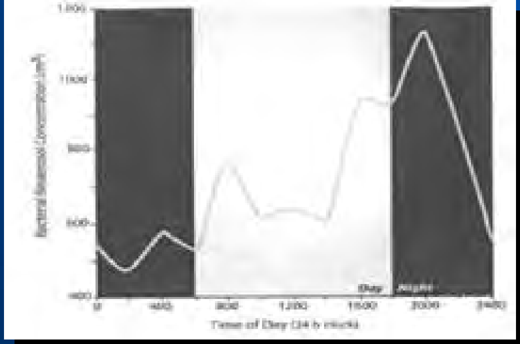
- Unusual ambient air currents



- Train operations
  - Piston effects
- Diurnal effects
  - Bimodal distributions due to AM/PM rush hours



- Seasonal effects
  - Pollen/spore count variations[1]
  - Temperature
  - Humidity
- EMI / RFI



Reference 1: "An Introduction to Biological Agent Detection Equipment for Emergency First Responders", National Institute of Justice, NIJ Guide 101-00, December 2001 Page 14.

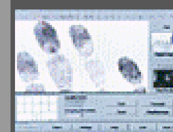
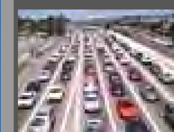
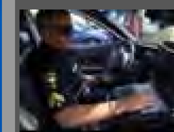
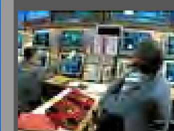
LOCKHEED MARTIN

Transit MetroGuard™ System

Mission: Protect Riders & Their Infrastructure

Transit Protection Systems

- Complex Integration
- Systems of Systems
- Disciplined Approach
- Process-Driven

Defense	Intelligence	Homeland Security	Public Safety
			
			

Bringing Domain Expertise to a New Critical Mission

Detailed Management of Requirements

- High reliability in extremely harsh environment
- Closely tailored to unique transit requirements
- Aggressive leveraging of COTS sensors & communications

Increase

System Reliability

Probability of Detection

Upgradeability

Expandability

Mean Time Between Failures

Calibration Interval

Internal Testing

False Alarms

Airborne Interference

Response Time

Maintenance Cycle & Cost

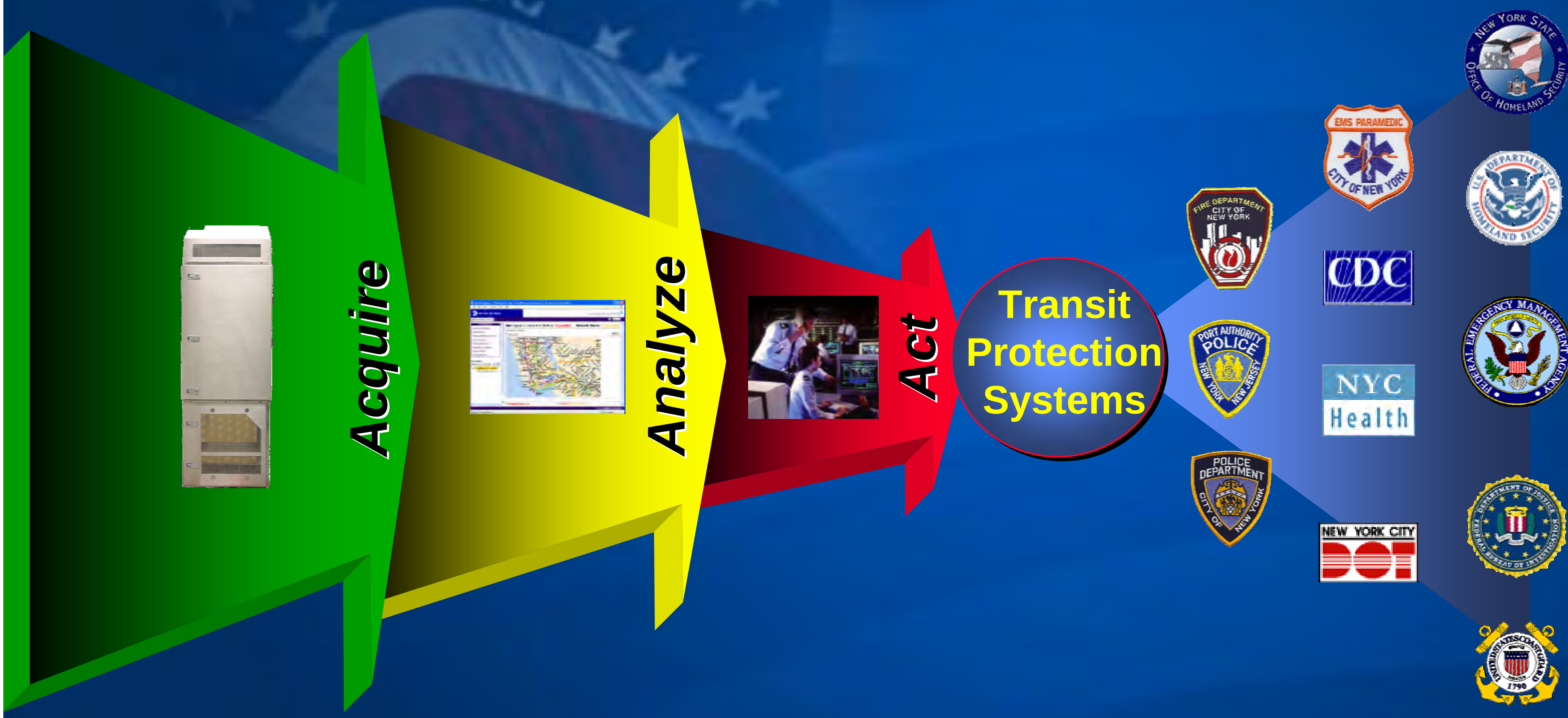
Acquisition Cost

Mean Time To Repair

Technology Risk

Decrease

Goal: Provide Actionable Intelligence



Turning Data into Knowledge . . . and Knowledge into Action

Acquire: Sensor Suite

Air Particle Counter
UV-LIF
Wet Sample Collector

Chemical	Radiological

Controller
Power / Communications

Driving Detector Requirements

- *Operation in a Harsh Environment*
- *Probability of Detection*
- *Probability of False Alarms*
- *Scheduled Maintenance Interval*
- *Calibration Interval*
- *High MTBF, Low MTTR*

Remote Detector Unit (RDU)

Analyze: The Advantages of a Networked Approach

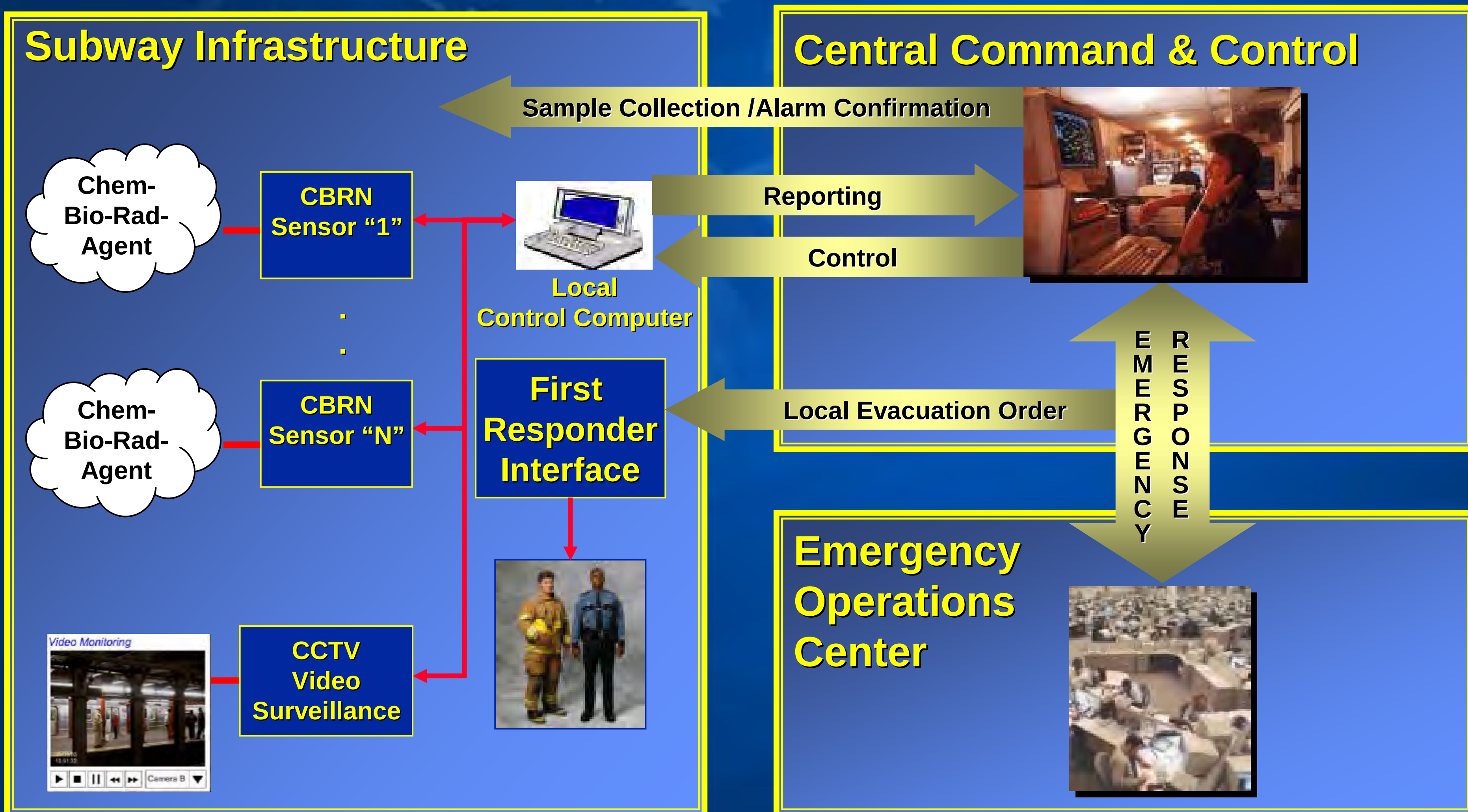
- **The basic premise of the networked approach is that a distributed array of detectors can utilize temporal and spatial characteristics of releases to increase the Probability of Detection (PoD) and reduce the Probability of False Alarms (PFA), versus use of single point detectors by**
  - **Spotting trends**
  - **Negating single detector failures**
  - **Requiring fewer detectors to establish coverage**

Analyze: The Advantages of a Networked Approach

- **Increases Probability of Detection**
  - Enables multi-sensor temporal and spatial correlation
    - Lower thresholds for Alerts correlated in time to allow detections that would otherwise go unnoticed
    - Lower thresholds for Alerts correlated in space (e.g., Waterfall Alerts)

- **Decreases Probability of False Alarms**
  - High threshold single detector alarms
    - Increases single detector signal to noise requirement
  - Correlation between independent detectors
    - Reduces single detector failure alarms

Act: Coordinated CONOPs



*Metro*Guard™ Application to Scenario 1: RDD

Spent nuclear fuel rods are supplied by Iran and shipped in a cargo container to Colombia then flown to Mexico and loaded on human mules used to smuggle drugs across the border. They are met in Arizona by sleeper cell agents who take the fuel rods by car toward its final destination. Three men get off subway cars at three different locations in downtown New York and head toward the New York Stock Exchange. ……..

Understanding the Source of the Radiation: Nuclear Fuel Rods

- There are about 557 nuclear power reactors in the world; about 440 are currently in operation
- Most nuclear reactors are powered by fuel rods that contain two types of uranium ^{235}U (2-3%) and ^{238}U (97-98%)
- Fuel that is burned in a nuclear reactor undergoes controlled fission, releasing neutrons, other radioactive elements and plutonium (^{239}Pu)

Understanding the Source of the Radiation: Nuclear Fuel Rods

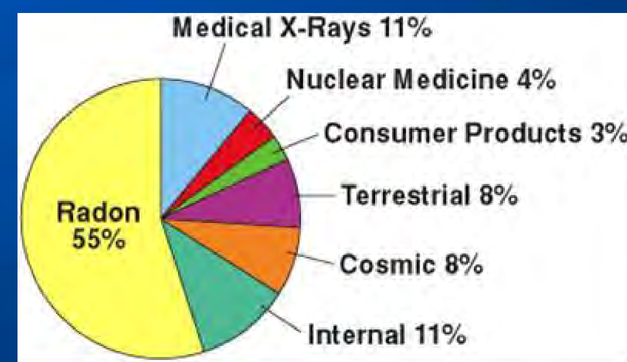
- The Fissioning process results in extremely hot and radioactive spent fuel

- After 3 years in a reactor, 1,000 lbs. of 3.3 percent enriched uranium (967 lbs. ^{238}U and 33 lbs. ^{235}U) contains[1]:
  - 8 lbs. of ^{235}U (alpha, gamma emitter)
  - 8.9 lbs. of plutonium isotopes (alpha, beta, gamma emitter)
  - 943 lbs. of ^{238}U and assorted fission products

Reference 1: http://www.chemcases.com/2003version/nuclear/nc-13.htm

Determining a Reasonable Radiation Threshold

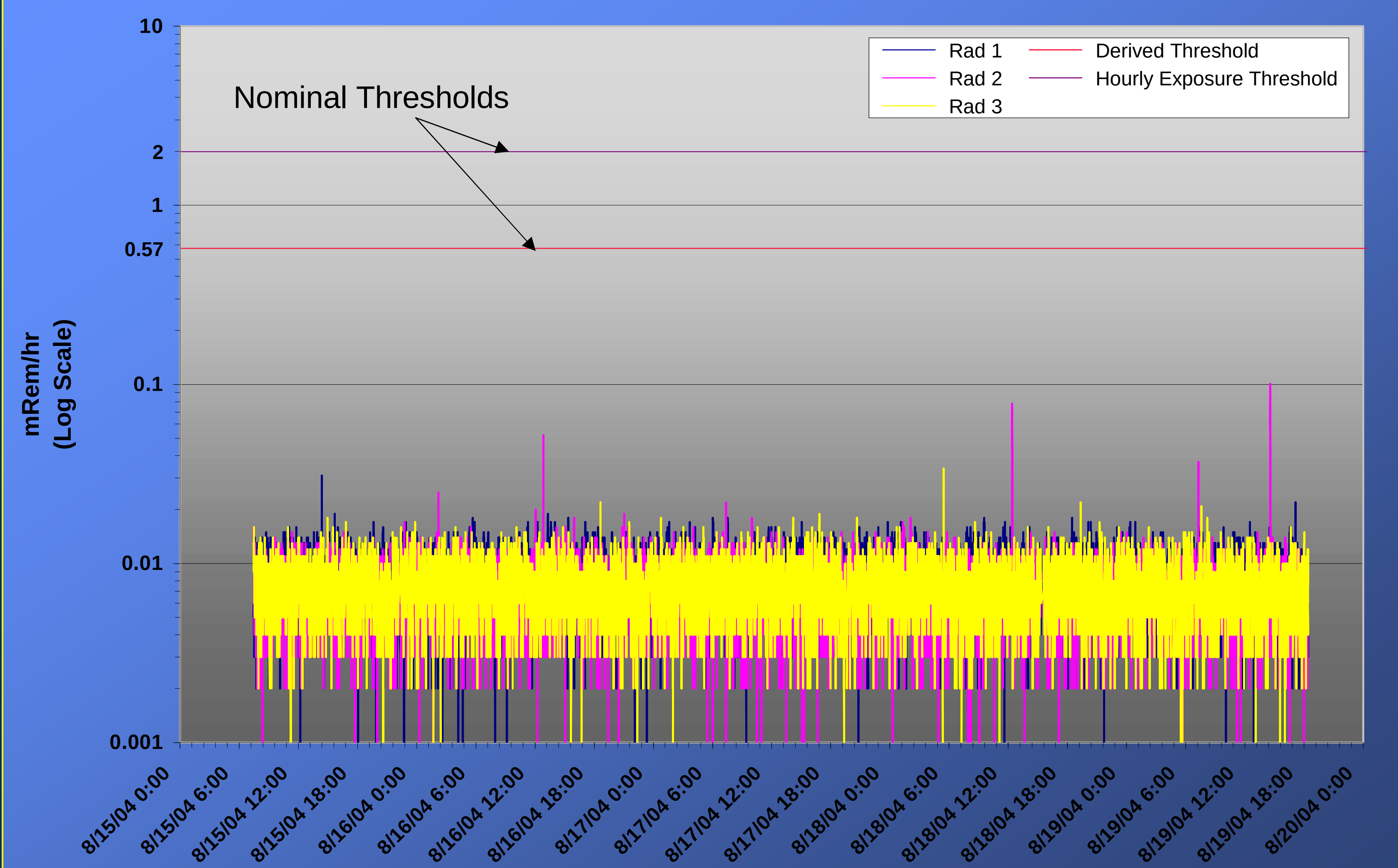
- **OSHA standard of 5000 mRem/year for whole body radiation[1] exposure yields 0.57 mRem/hr**
- **Subpart D- Radiation dose limits for individual members of the public[2]**
  - **"The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with (35.75), does not exceed 0.002 rem in any one hour"**



References:

1. http://www.nih.gov/od/ors/ds/rsb/exposure.html
2. 56 FR 23398 May 21, 1991 20.1301: http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1301.html

Radiation Data in a Transit Environment



Radiation Data in a Transit Environment

- The station operational cycles are not evident in the bulk of the data
- The handful of outliers (0.08 and 0.1 mem/hr) occurred during normal station busy periods
  - No direct cause identified for any outlier
- 108 hrs of data
- Background radiological readings typically below 0.02 mRem/hr.
- Possible causes of outliers due to:
  - Presence of passengers treated medically with radioactive injections or implants
  - Granite emissions

Sensor Alarm to Video Association

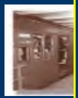
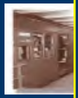
Threat Detection

Video Monitoring / Association

Surveillance / Identification

Sensor Alarm to Video Association

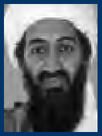
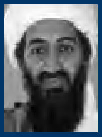
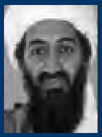
Wall Street

RDU NO.	Time	Gamma Level	Video Frame	No.	FBI DB: Suspect ID
RDU 3	T1	Background		T1	
	T2	Background		T2	
	T3	Alert			
	T4	Background			
	T5	Background			
	T6	Background			
	T7	Background			
RDU 4	T1	Background			
	T2	Background			
	T3	Background			
	T4	Alert			
	T5	Background			
	T6	Background			
	T7	Background			
RDU 5	T1	Background			
	T2	Background			
	T3	Background			
	T4	Background			
	T5	Alert			
	T6	Background			
	T7	Background			

Penn Station

RDU NO.	Time	Gamma Level	Video Frame	No.	FBI DB: Suspect ID
RDU 6	T11	Background		T11	
	T12	Background		T12	
				T13	GODWIN, T. 
				T14	
				T15	
				T16	
				T17	
				T11	
				T12	
				T13	
				T14	GODWIN, T. 
				T15	
				T16	
				T17	
				T11	
				T12	
				T13	
				T14	
				T15	GODWIN, T. 
				T16	
				T17	

Grand Central Station

RDU NO.	Time	Gamma Level	Video Frame	No.	FBI DB: Suspect ID
RDU 11	T24	Background		T24	
	T25	Background		T25	
	T26	Alert		T26	LADIN, B
	T28	Background		T27	
	T29	Background		T28	
	T30	Background		T29	
				T30	
RDU 12	T24	Background		T24	
	T25	Background		T25	
	T26	Background		T26	
	T27	Alert		T27	LADIN, B.
	T28	Background		T28	
	T29	Background		T29	
	T30	Background		T30	
RDU 13	T24	Background		T24	
	T25	Background		T25	
	T26	Background		T26	
	T27	Background		T27	
	T28	Alert		T28	LADIN, B.
	T29	Background		T29	
	T30	Background		T30	

	T28	Alert		T28	LADIN, B. 
	T29	Background		T29	
	T30	Background		T30	

Summary

- **Transit environments challenge detector system performance**
- **Networked application of CBRN detectors can provide early detection and warning**
- **Networked corroboration increases probability of detection and reduces probability of false alarms**
- **Analysis of the specific background, the expected propagation of agent material, and interferants is critical to system performance**

Thank You

Joint Program Executive Office for Chemical and Biological Defense

"Meeting Special Operations Forces' Chemical and Biological Defensive Needs"

PRESENTED TO:
USSOCOM CBRN Conference
Tampa, Florida
December 6, 2005
Open Session

STEPHEN V. REEVES
Brigadier General, USA
Joint Program Executive Officer
for Chemical and Biological Defense
(703) 681-9600

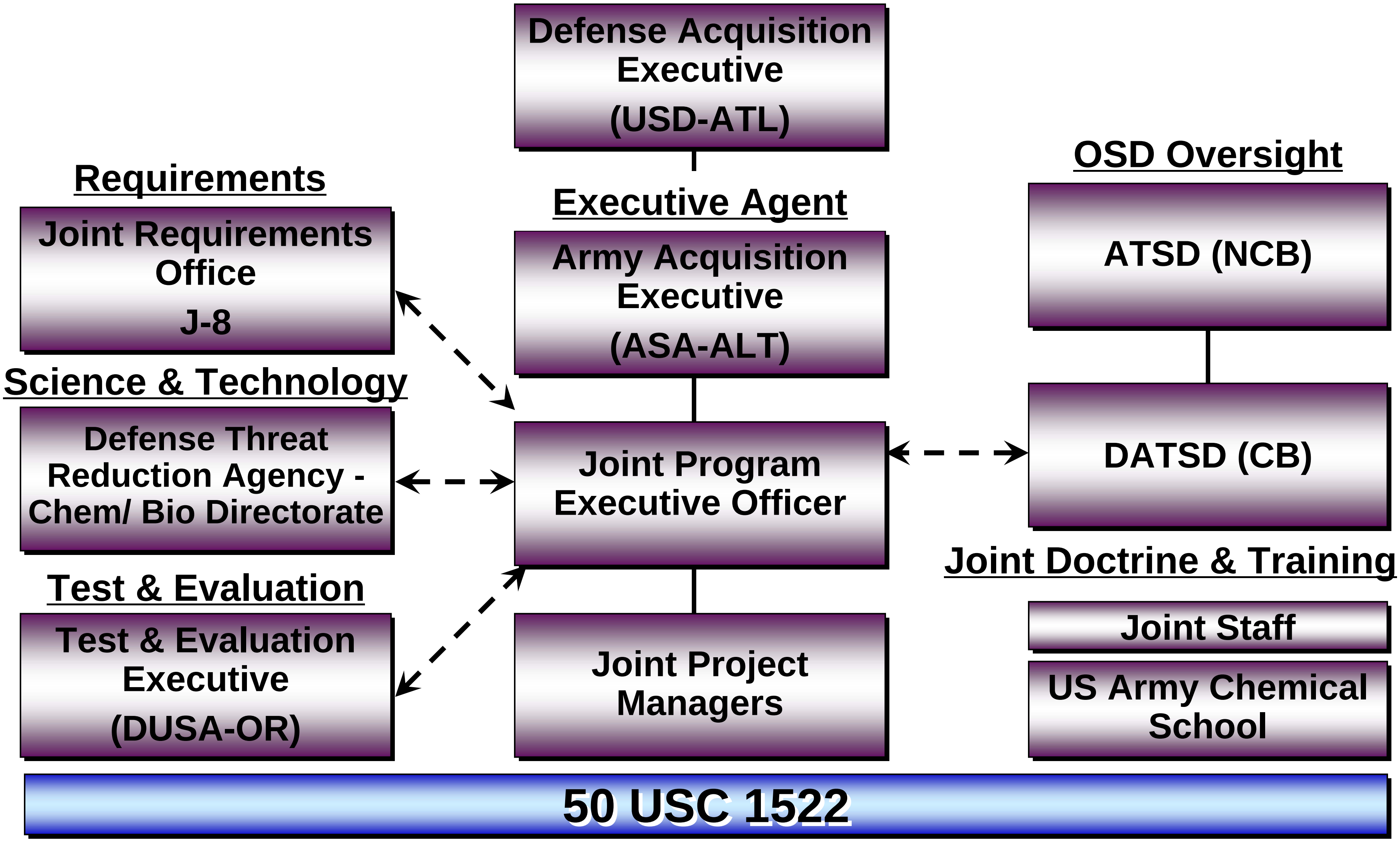
Overview

- Who We Are
- What We Do
- Joint Warfighting Capabilities

Joint Service Chemical and Biological Defense Program

Delivering Joint Warfighting Capabilities

Chem/ Bio Defense Program Acquisition Organizations



Establishment of the Chemical and Biological Defense Program

- **50 USC 1522**
  - Creates Assistant to Secretary of Defense for NCB to "Coordinate and Integrate Overall Program"
  - Assigns Army as Executive Agent to "Coordinate and Integrate RDA Programs of all Services"
  - Assigns Army Chemical School as Training Base
  - Directs all Funding be Through a Separate DoD Account
  - Prohibits Services from Budgeting for NBC
  - Requires Annual Report to Congress

Supplemented by OSD Implementation Plan Creating Joint Requirements, Acquisition, Testing and Training Organizations

Joint Program Executive Office for Chemical and Biological Defense

Mission

The Joint Program Executive Office for Chemical and Biological Defense is Responsible for Research, Development, Acquisition, Fielding, and Life-cycle Support of Chemical, Biological, Radiological, and Nuclear (CBRN) Defense Equipment, Medical Countermeasures, and Installation and Force Protection Supporting the National Military Strategy

Joint Program Executive Office
Areas of Responsibility

Vaccines

Treatments

Diagnostics

Chemical & Biological Agent Detection

Individual Protection

Collective Protection

Decontamination

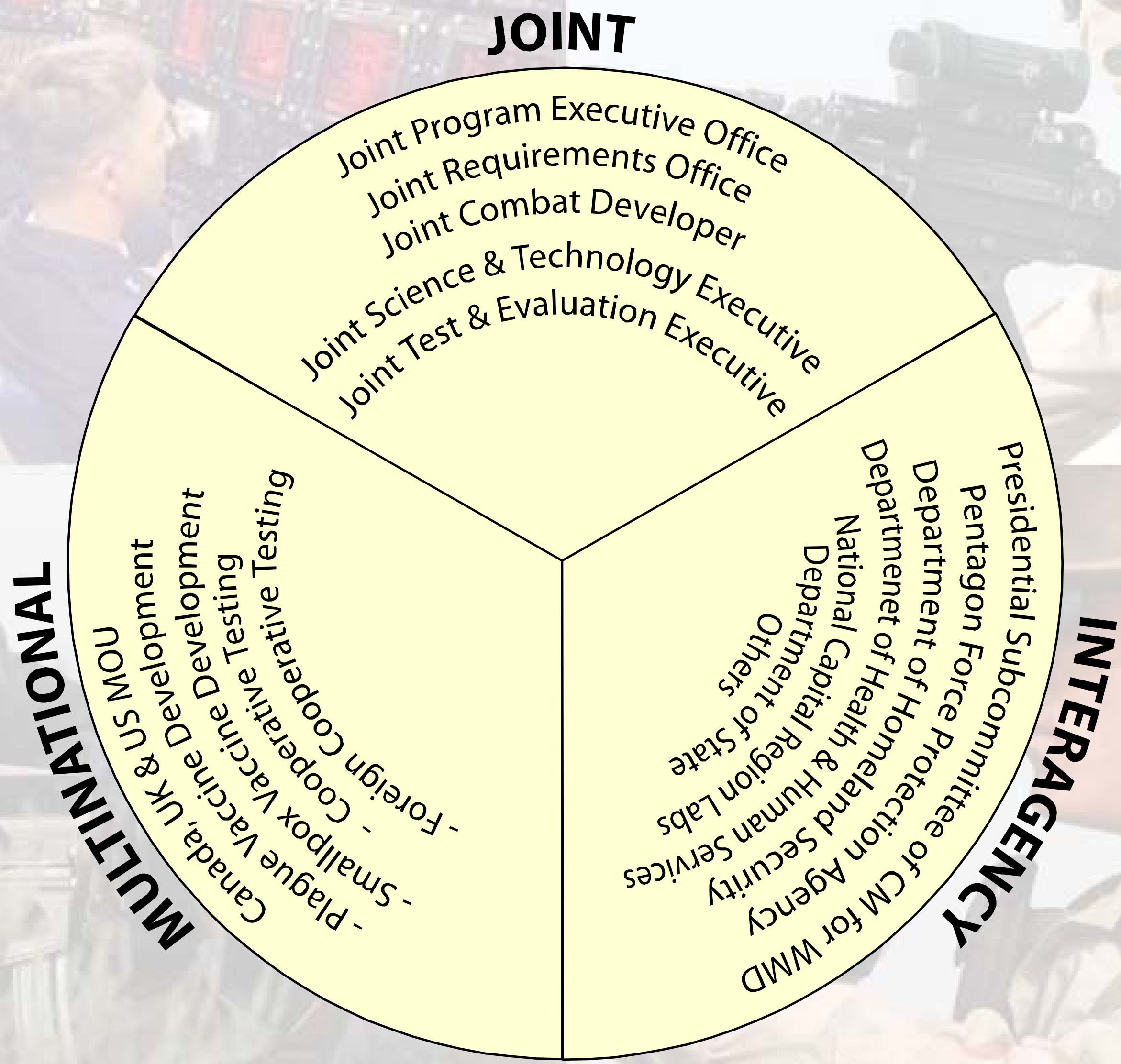
Weapons of Mass Destruction – Civil Support

Installation/ Force Protection

Information Systems

Total Life Cycle Management

Joint – Interagency – Multinational Responsibilities



Biological Defense
Edgewood, MD
Col DANIEL BERRY (USAF)
NBC Contamination Avoidance
Edgewood, MD
COL DON BURNETT (ARMY)
Chemical Biological Medical Systems
Frederick, MD
COL STEPHEN BERTÉ (ARMY)
Information Systems
San Diego, CA
CAPT TOM O'KEEFE (NAVY)
JOINT PROGRAM EXECUTIVE OFFICER
BG Stephen V. Reeves
Chemical and Biological Defense
Collective Protection
Washington, DC
MR STAN ENATSKY (NAVY)
Individual Protection
Quantico, VA
MR JIM NELSON (USMC)
JPMs Leverage Service/Installation Matrix Support
Guardian
Falls Church, VA
COL CAMILLE NICHOLS (ARMY)
Decon
Quantico, VA
Lt Col DALE TAKENAKA (USAF)
JPEO-CBD JOINT PROJECT MANAGERS

Where We Are Going

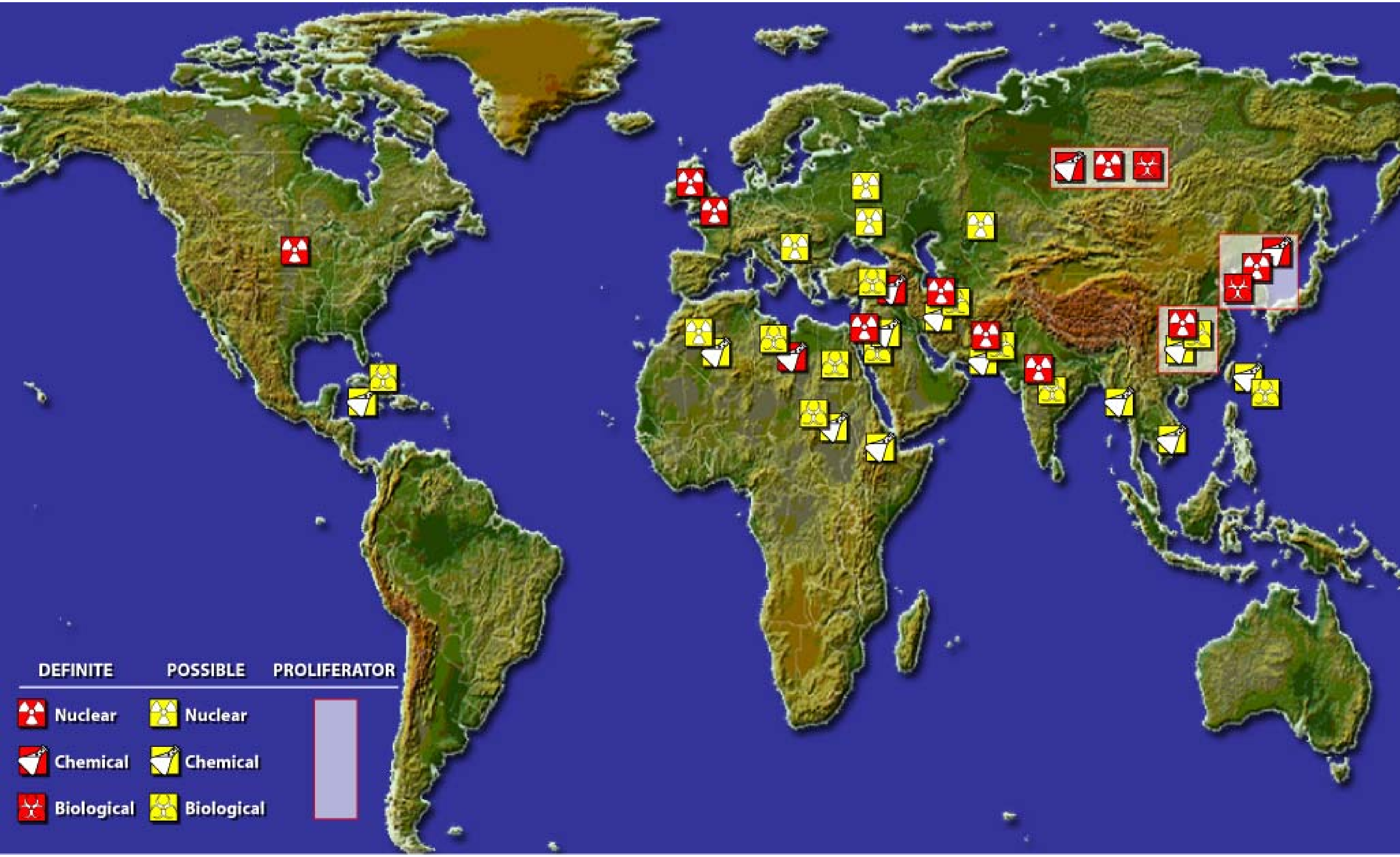
Radical Islamists On Using CBRN

- **"use of nuclear, dirty bombs, chemical and biological weapons by martyrs is justified as part of holy war strategy" (al-Qaeda message board, 11 Aug 05)**

- **"Attacking Washington Metro with chemical weapons to achieve amazing results" (al-Qaeda message board, 11 Aug 05)**

- **"The nuclear war is the solution for destruction of the United States." (Radical Islamist website, 26 Dec 02)**

State Actors

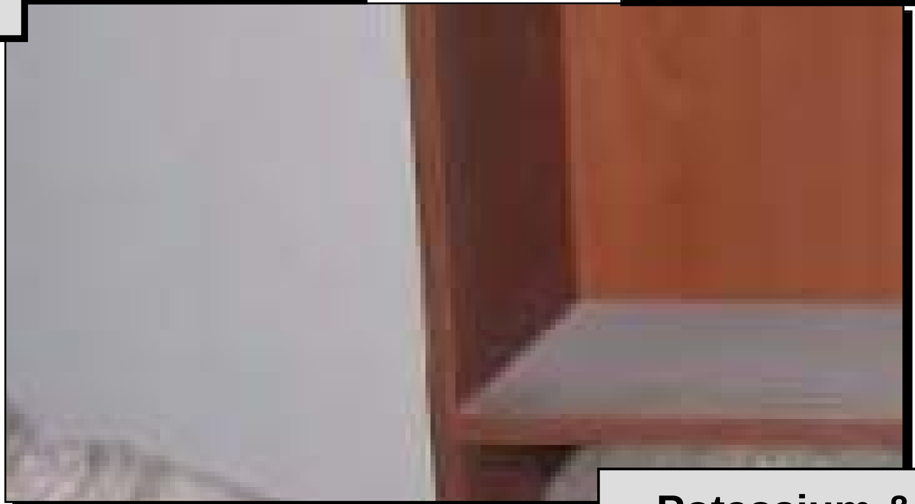


So What?

Fallujah 2004

Chemical Bottles

Potassium Cyanide



Potassium & Sodium Cyanide

DoD Chemical and Biological Defense

Expanding Roles and Missions

Infrastructure | Power Projection | Battle Space

"Threats"

"Classic" CBW

Bio-Engineered And "Non-Traditional" Threats

Environmental Threats- TICs/TIMs

Environmental/ Medical Surveillance Infectious Diseases

Expanded Capabilities Required!

System of Systems Approach to Counter the Threat

Sustained Combat Power

CB Threats & Hazards

Agent Delivery

Doses on Target

Downwind Dispersal

Doses Absorbed

Symptoms

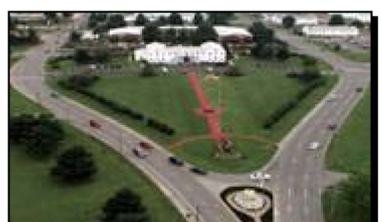
Medical Pretreatment

Individual & Collective Protection

Medical Treatment

Information Systems

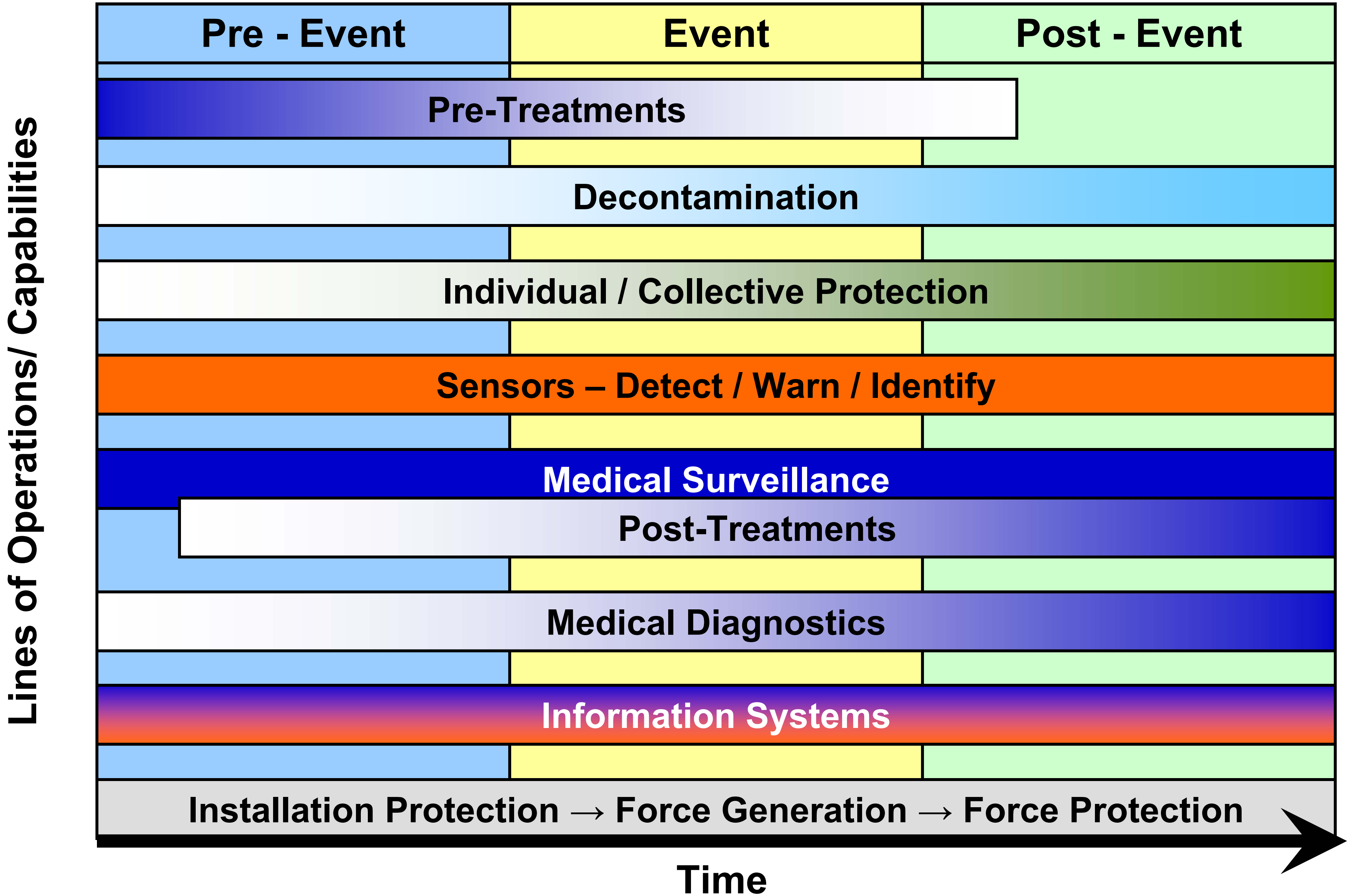
Contamination Avoidance and NBC Battle Management (Detection, Identification, Reconnaissance & Warning)



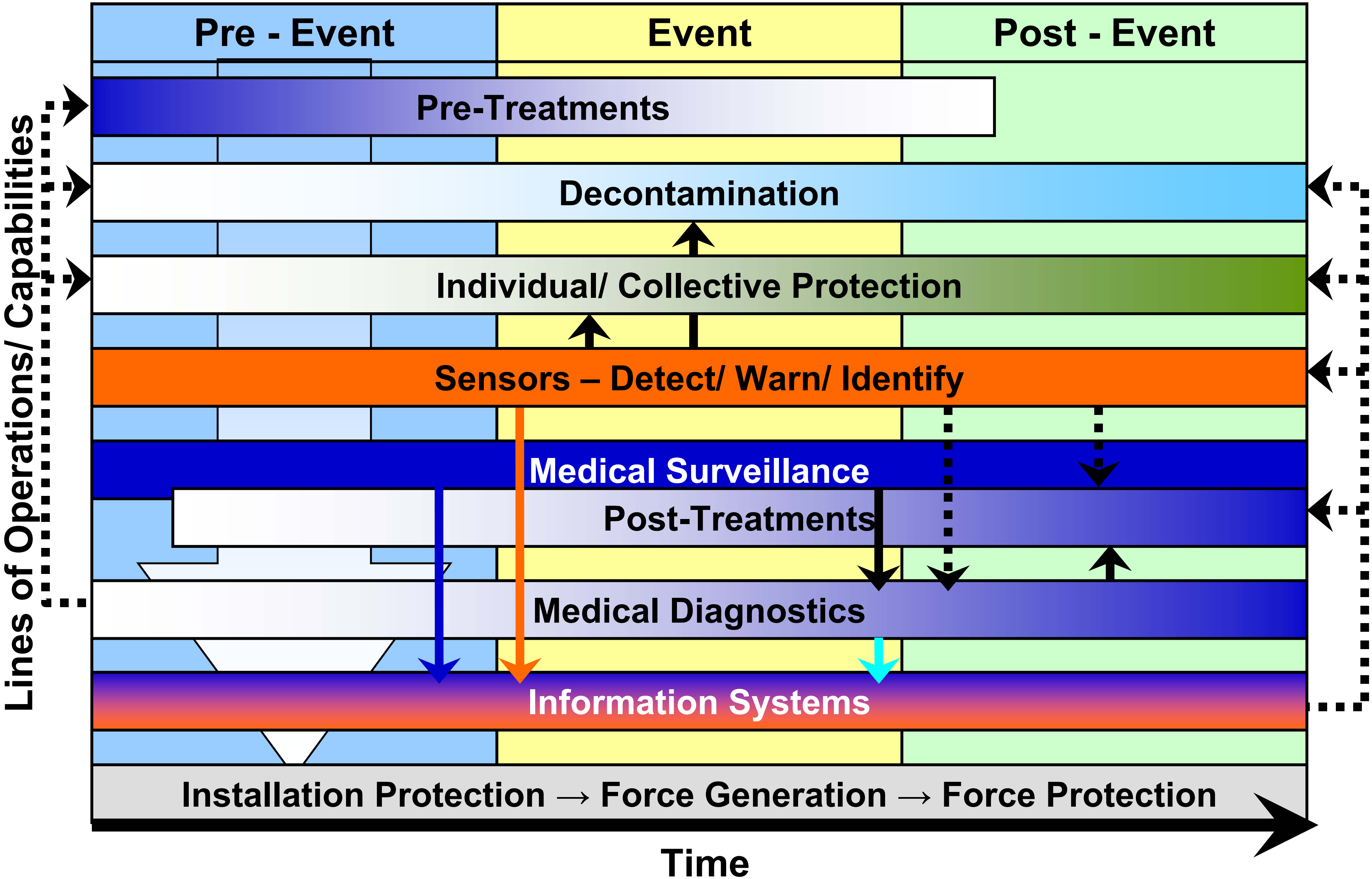
Installation Force Protection

Decontamination, Restoration

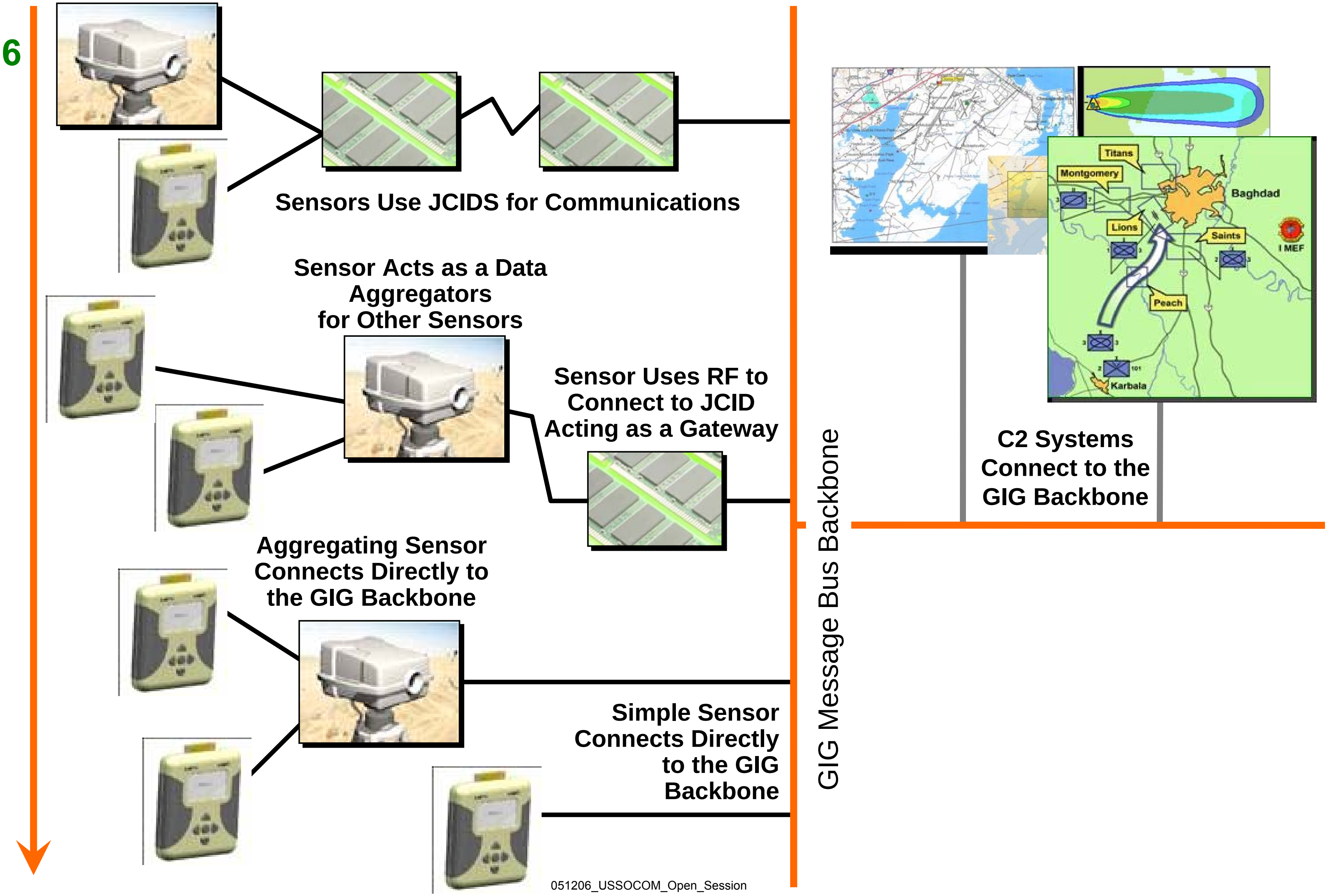
Systems Solutions



Systems Solutions



Migrating the Interface
Data Aggregation and Network Connectivity



Modularity Vision – A Plug & Play CB System

Notional Modular Chem Bio Interface Unit

Detector Component In Removable Cartridge

Two Key Parts:

- Multipurpose Interchangeable Detectors
- Common Interface and Communication System
  - Common Mechanical I/F
  - Common Signal I/F
  - Common Power I/F
  - Common Comms Protocols

Where We're Going

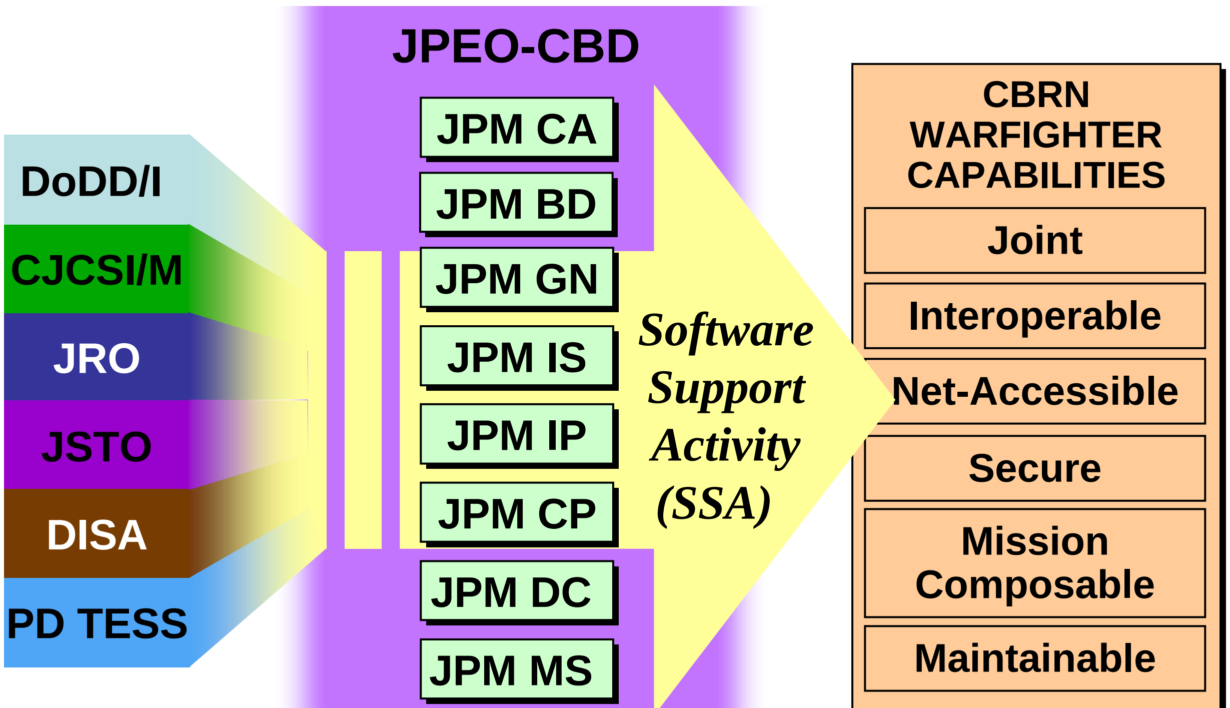
- Start with Net Centricity In Mind
- Start with Accredited Information Assurance Solutions
- Common Infrastructure for CBRN Sensors
  - Bus/ Services Architecture
  - CBRN Modules

"Systems" From Modules

Making It Happen Software Support Activity

Born August 2004

CBRN-SSA VISION



- Architecture and Data Products/ Models
- Modeling and Simulation VV&A Guidelines
- Help Desk
- Contract Language For Data Models

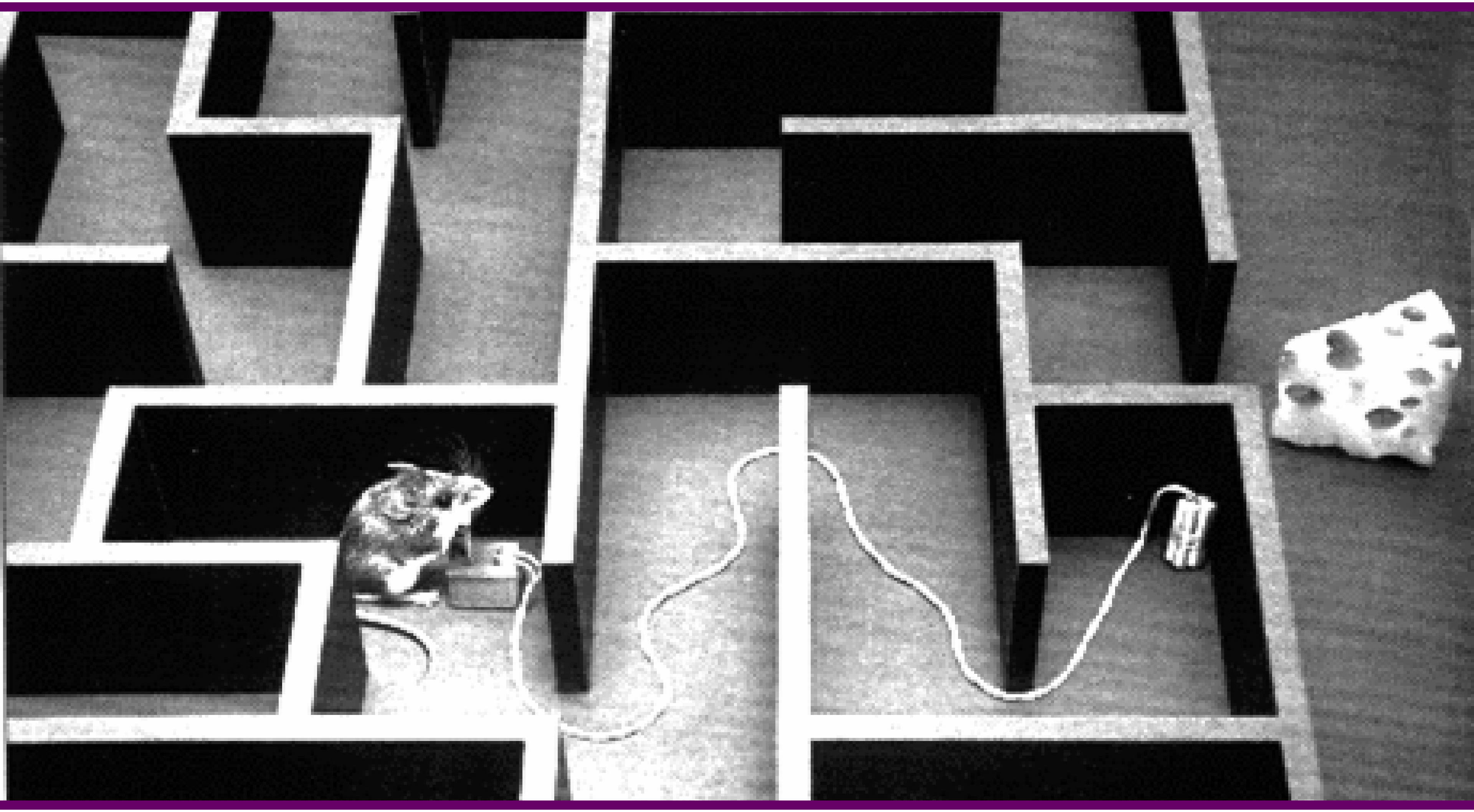
SSA WORKS TO REALIZE THE VISION OF NET-CENTRIC WARFARE - FULFILLS JPEO-CBD RESPONSIBILITIES REGARDING INFORMATION ASSURANCE, DATA MANAGEMENT, and VV&A

Collectively How We Make It Work!

- Common, Open Standards and Architectures
- Accredited, Verified and Validated Software
- Technology Transition Agreements Between S&T and Advanced Development
- Lifecycle Modeling and Simulation Strategies
- Information Assurance In All Activities

What This Means to Delivering SOCOM Capabilities

Leaders Who Can Work the Process



… and Field Systems

Examples of SOF Leveraging Joint Efforts

- M53 Chemical Biological Protective Mask
- Joint Service Chemical Environment Survival Mask
- Joint Service General Purpose Mask
- Joint Service Aircrew Mask
- Joint Protective Aircrew Ensemble
- Joint Block 2 Glove Upgrade
- Chemical Protective Overboot
- Joint Service Transportable Decontamination System
- Joint Service Sensitive Equipment Decontamination System
- Joint Platform Interior Decontamination

JPEO-CBD Equipment Used/ in Development for SOCOM

Inner Barrier Material

JSLIST Type VII

JS LIST Block 2 Gove Upgrade (JB2GU)

Joint Service Mask Leakage Tester (JSMLT)

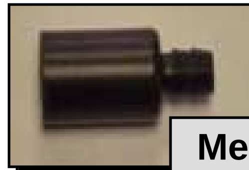
Alternative Footwear System (AFS)

Integrated Footwear System (IFS)

All Purpose Personal Protective Ensemble (AP-PPE)

JPEO-CBD Equipment Used/ in Development for SOCOM

Joint Service Chemical Environment Survivability Mask (JCESM)

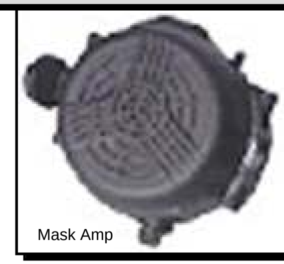


Medical Oxygen Adapter

M45 Mask

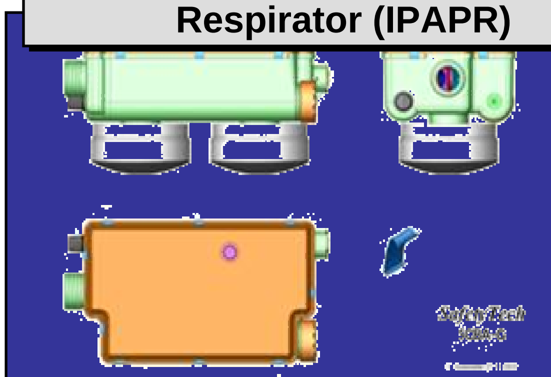
M53 Chemical-Biological Protective Mask

Voice Amplifier



Joint Service General Purpose Mask (JSGPM)

Improved Powered Air Purifying Respirator (IPAPR)



Joint Service Aircrew Mask (JSAM)

JPEO-CBD Equipment Used/ in Development for SOCOM

Draeger TIC Detection Kits

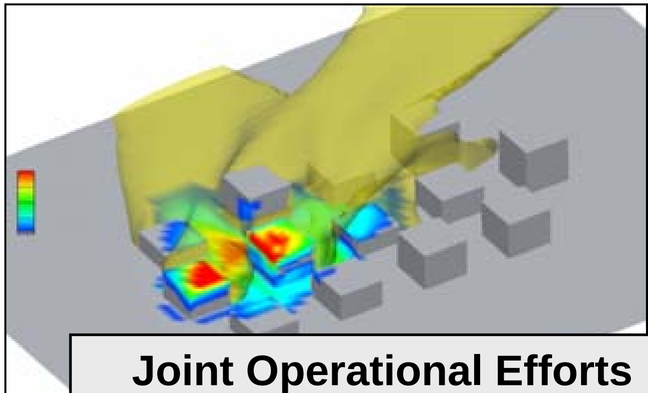
Modified Automatic Chemical Agent Alarm (ACADA)

Joint Chemical Agent Detector (JCAD)

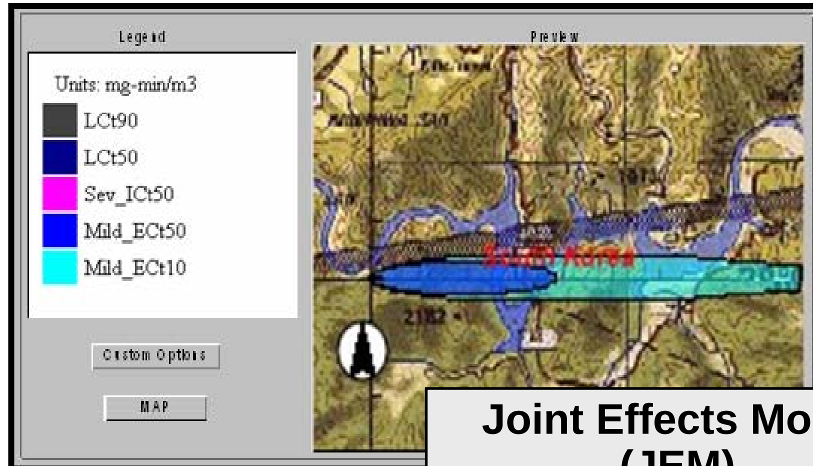
AN/VDR-2 Radiac

Improved Chemical Agent Monitor (ICAM)

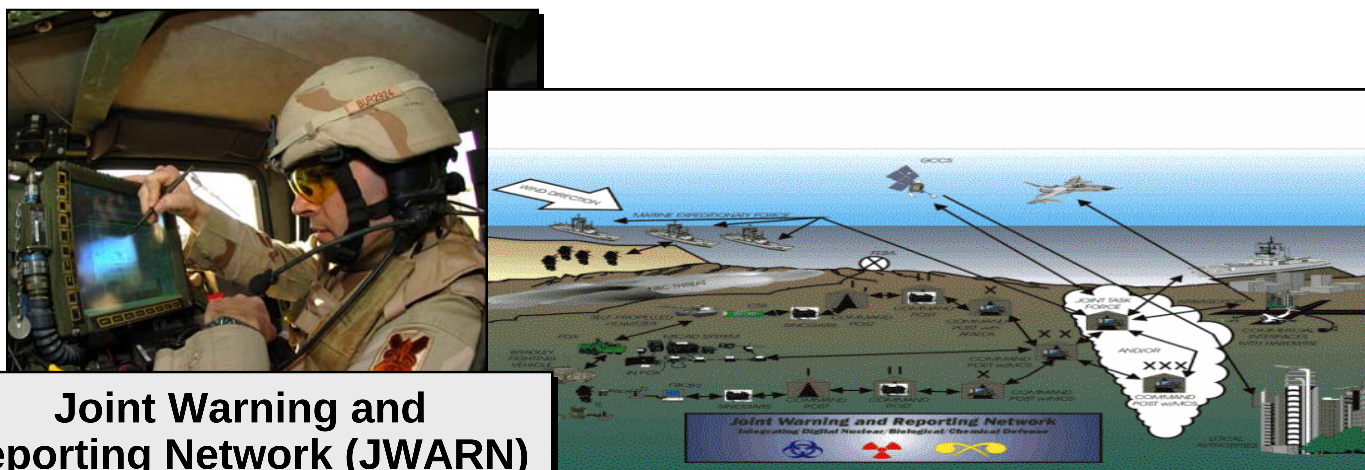
JPEO-CBD Equipment Used/ in Development for SOCOM



Joint Operational Efforts Federation (JOEF)



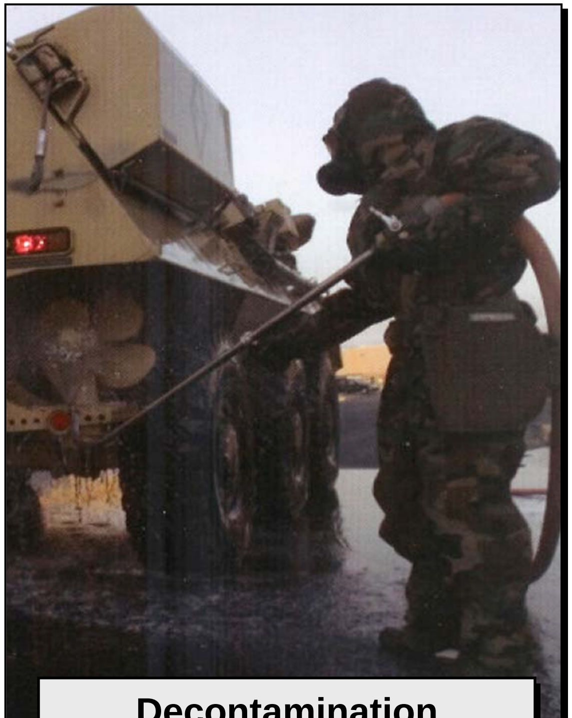
Joint Effects Model (JEM)



Joint Warning and Reporting Network (JWARN)

JPEO-CBD Equipment Used/ in Development for SOCOM

Joint Service Transportable Decon System-Small Scale (JSTDS-SS)

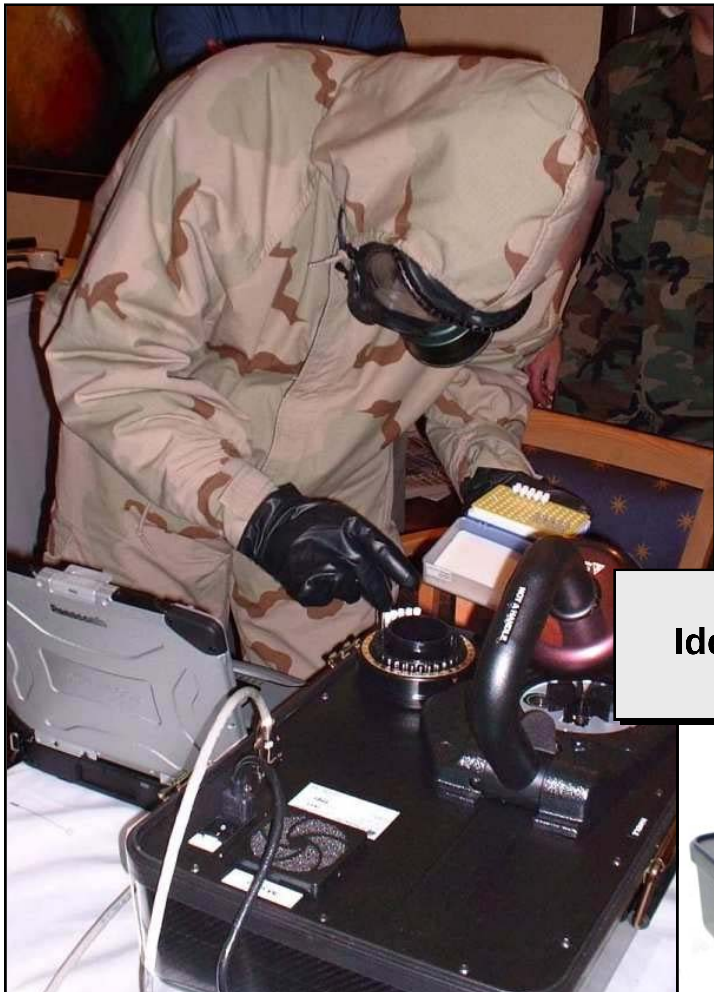


Decontamination Formulation 200 (DF200)

M100 Sorbent Decon Systems

Joint Service Personnel Decontamination System RSDL (JSPDS)

JPEO-CBD Equipment Used/ in Development for SOCOM

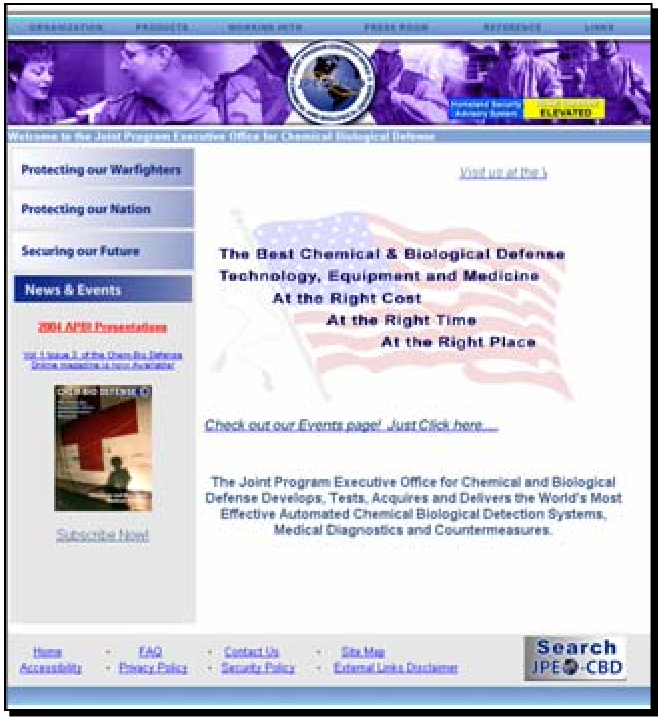


Skin Exposure Reduction Paste Against Chemical Warfare Agents (SERPACWA)

Joint Biological Agent Identification & Diagnostics System (JBAIDS)

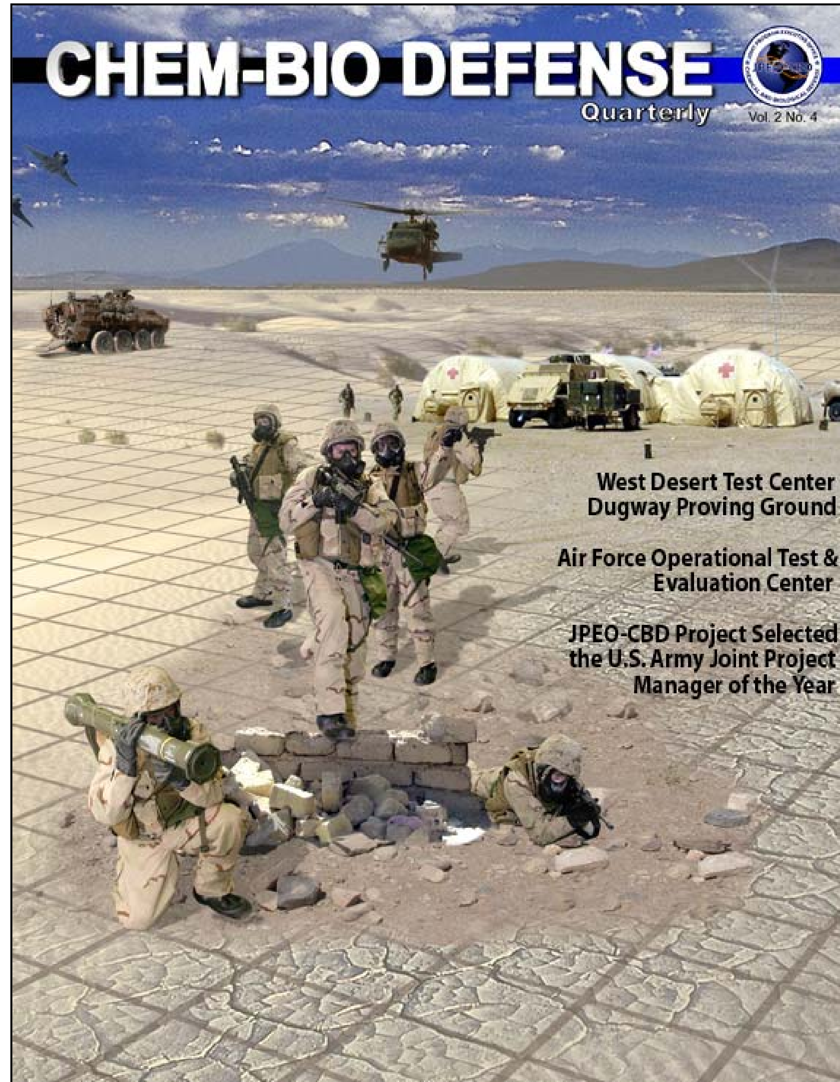
“Shameless Advertising”

www.jpeocbd.osd.mil



- News
- Business Opportunities
- JPEO Information
- Links
- New Equipment Training
- Feedback

Quarterly Magazine



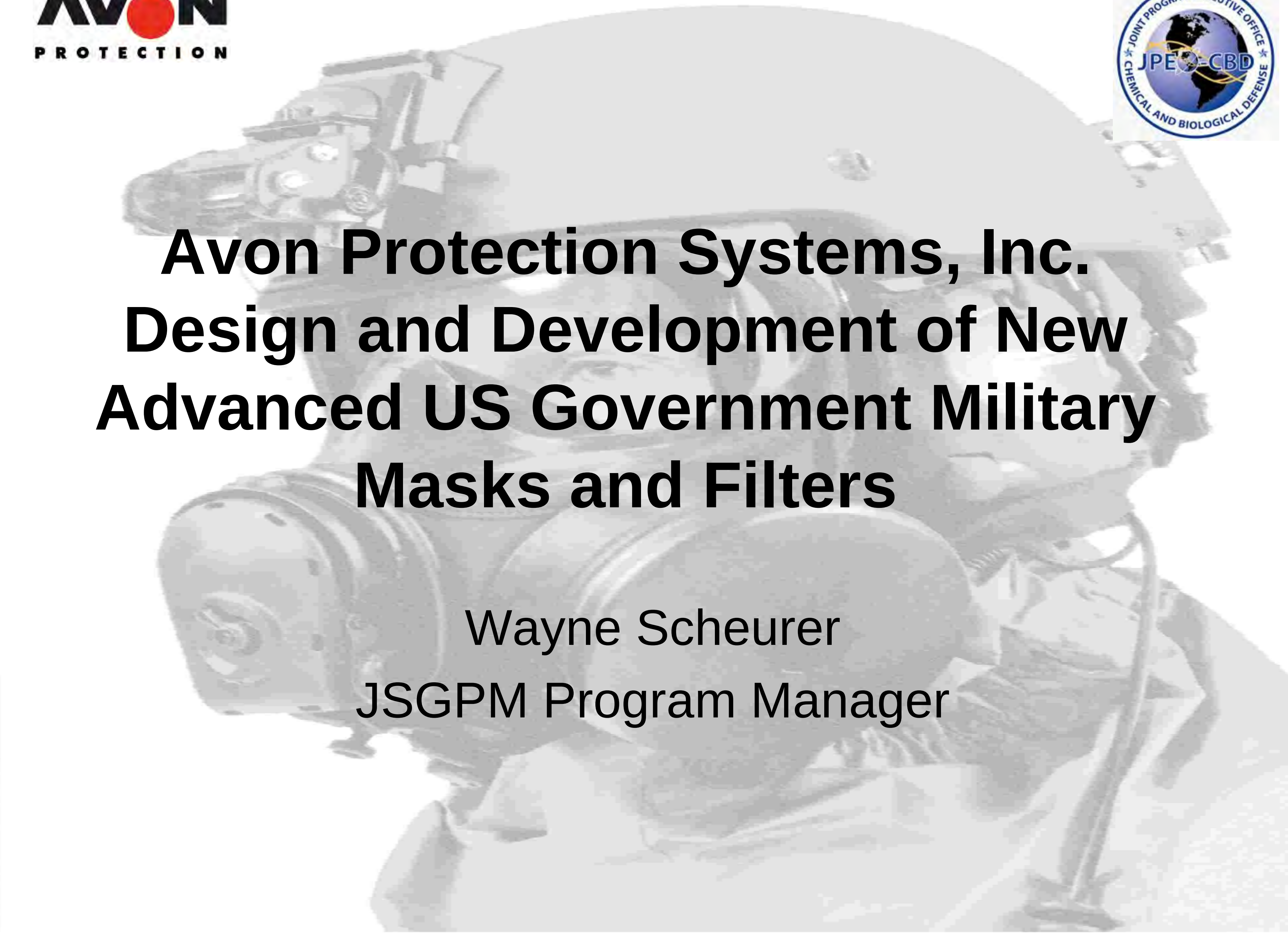
Summary

- Supporting SOCOM Through Direct-support Relationship and On-site Representation
- Framework and Process for Collaboration and Cooperation Supporting SOF CBD Materiel Development Efforts
- Leveraging Joint Services R&D for the SOF Warfighter

Meeting SOF’s Chemical – Biological Defense Needs

Joint Program Executive Office

Chemical and Biological Defense



Avon Protection Systems, Inc. Design and Development of New Advanced US Government Military Masks and Filters

Wayne Scheurer

JSGPM Program Manager

Joint Service General Purpose Protective Mask (JSGPM) XM50/51

The JSGPM is the next generation ground/ship, and combat vehicle chemical and biological protective mask replacing the USAF and USN MCU2P series protective mask and the USMC and USA M-40 series protective mask.

USSOCOM M53

The USSOCOM M53 Mask System will replace the M45

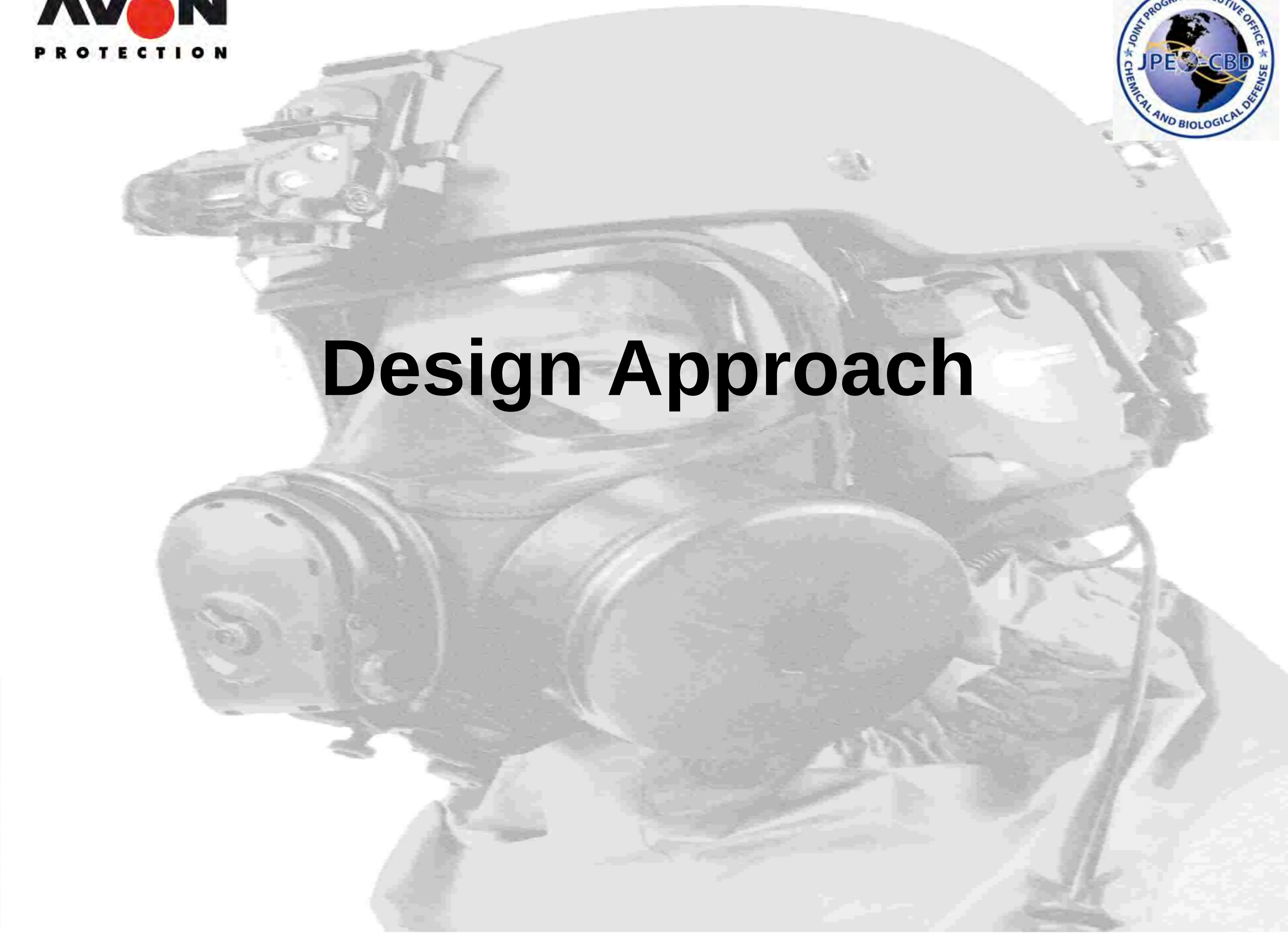
USSOCOM Drives the Design

- Tremendous emphasis on weapons and sighting systems interface
- Fit all intended users
- Enhanced comfort for prolonged missions
- Amplified voice and radio communications
- Integrate with SCBA, PAPR and CCBA systems

M53 Key Performance Parameters

- Provide the wearer facial, ocular, and respiratory tract protection from CB agents, radioactive fallout particles, and TIC/TIMs.
- Provide equal to or better protection, when compared to the C2A1 filter
- Permit unobstructed and undistorted forward vision.
- The mask shall provide a durable drinking capability.
- Be compatible with current and co-developmental SOF CB garments.
- Mask will be able to use an external voice amplification device and an internal microphone.

Design Approach



AVON PROTECTION

JPEO-CBD JOINT PROGRAM EXECUTIVE OFFICE CHEMICAL AND BIOLOGICAL DEFENSE

MILESTONE	ACTIVITY
Post Award Conference PAC October 2002	•Outline program •Review specification •View list of critical equipment
Early User Assessment (EUA) April 2003	•Produce mask prototypes •Conduct user trials •Risk Matrix
Critical Design Review (CDR) August 2003	•EUA complete •Engineering baseline approved •Draft repair level analysis
Transition to Production Readiness Review (TPRR) Feb 2004	•Draft FMECA •Draft Safety and Health Hazard Analysis
System Delivery April 2004	•Tooling manufactured •Operation Trials and Evaluation specification prepared •Production processes planned •Draft manual and training material complete
System Design and Development SDD complete March 2005 Milestone C (Government approval for production)	•Tooling and assembly and test equipment approved •400 Mask systems assembled and delivered •Training complete •Draft OEM Manual complete

Post Award Conference /Early User Assessment

Post Award Conference – Objectives:

- To establish and agree a common understanding regarding the requirements of the Statement of Work and Product Description.
- To review critical equipment item list
- The key performance characteristics along with System Description and General Tasks defined in the Product Description would form the design strategies for the program

System Description & General Tasks (EUA)

System Description:

- The NBC IPM is a lightweight, positive-pressure capable, protective mask incorporating state-of-the-art technology improvements for use in direct action missions. Specifically, it provides improved protective capability against emerging CBR threats, better visual field-of-view, closer shooter cheek-to-stock weld compatibility, and a more comfortable fit for longer duration wearing.

System Description & General Tasks (EUA)

General Tasks

The contractor shall design, develop, fabricate, test, and demonstrate a production-representative JSGPM SOF Variant in accordance with this SOW and the Product Description. The System consists of: a face piece having an integral single-piece lens, head harness, a single General Purpose filter together with a Particulate filter that address a variety of threats, a voice-amplified electronic communications device, a variable exhalation resistance valve, nose cups, eye lens outserts, optical correction capability, a drinking device coupler, a protective hood, and a water-resistant carrier. The contractor shall maximize the use of JSGPM design features, materials, manufacturing processes, and sustainment concepts in the system to optimize program cost efficiency, and effectiveness. The contractor shall exercise total system performance responsibility (TSPR).

Joint Services General Purpose Mask XM50/51

- The JSGPM program will provide an overall 50% improvement against the current equipment capability and cost including:
- Improved performance against CB agents, Toxic Industrial Materials and radioactive particulate
- Improved field of view
- Improved compatibility with interfacing equipment
- Reduced weight and bulk
- Significantly reduced breathing resistance
- Reduced in life cost

JSGPM Design Concepts

JSGPM Visor

Sight correction

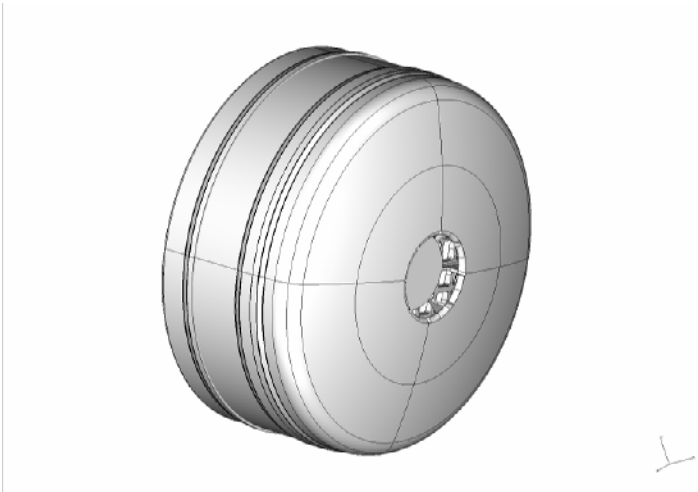
Weapon sighting

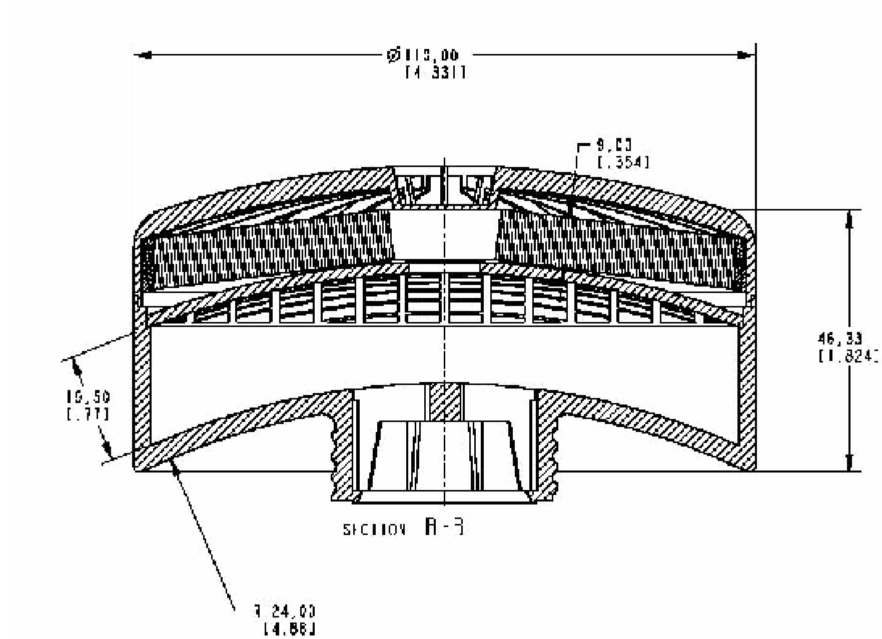
Visor Outserts

JSGPM Conformal Filters

- Supplementary additional TIC'S and TIM'S
- Enhanced compatibility with personal equipment

M53 Filter Concept



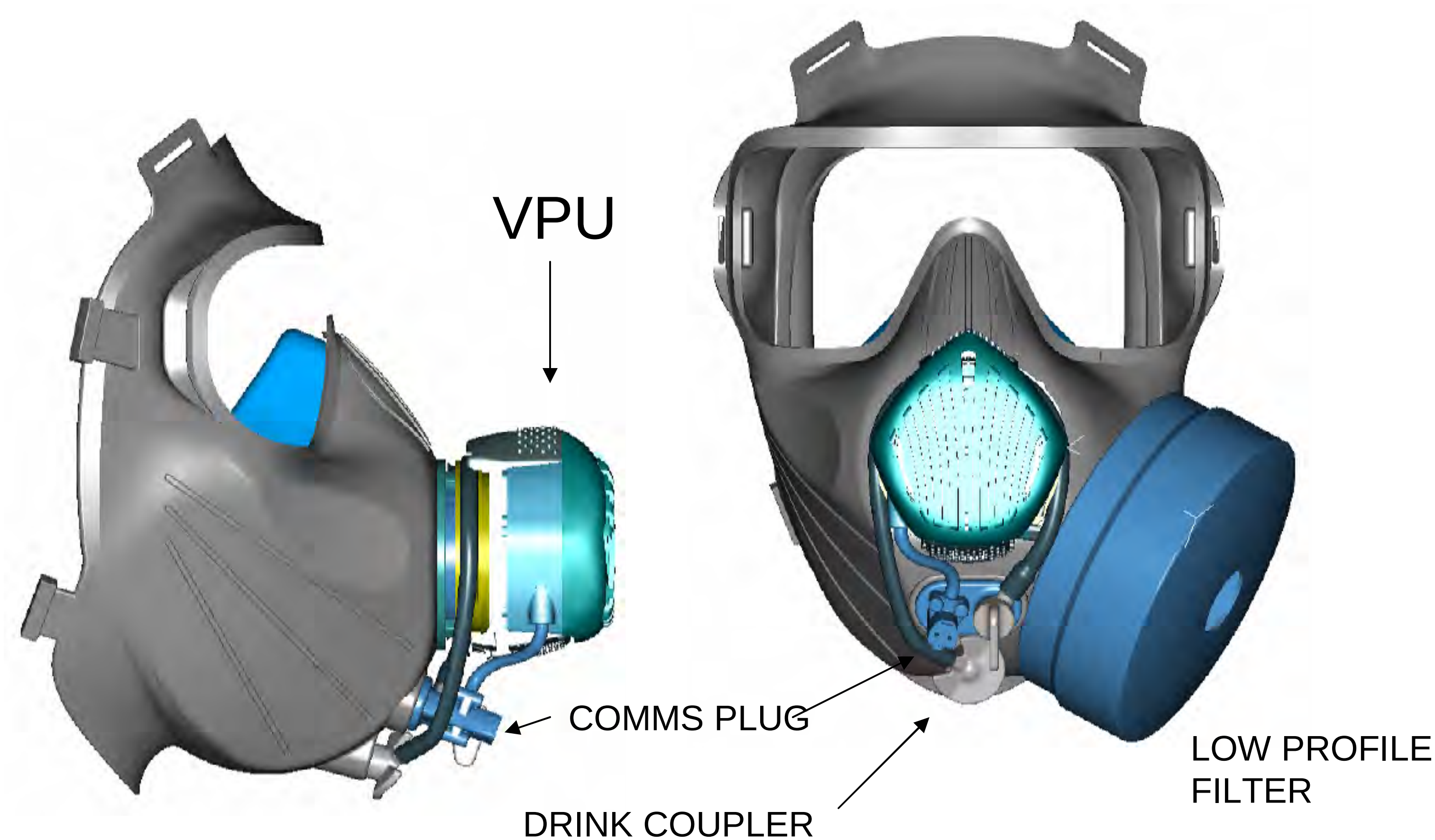


Conformal filter design developed for JSGPM

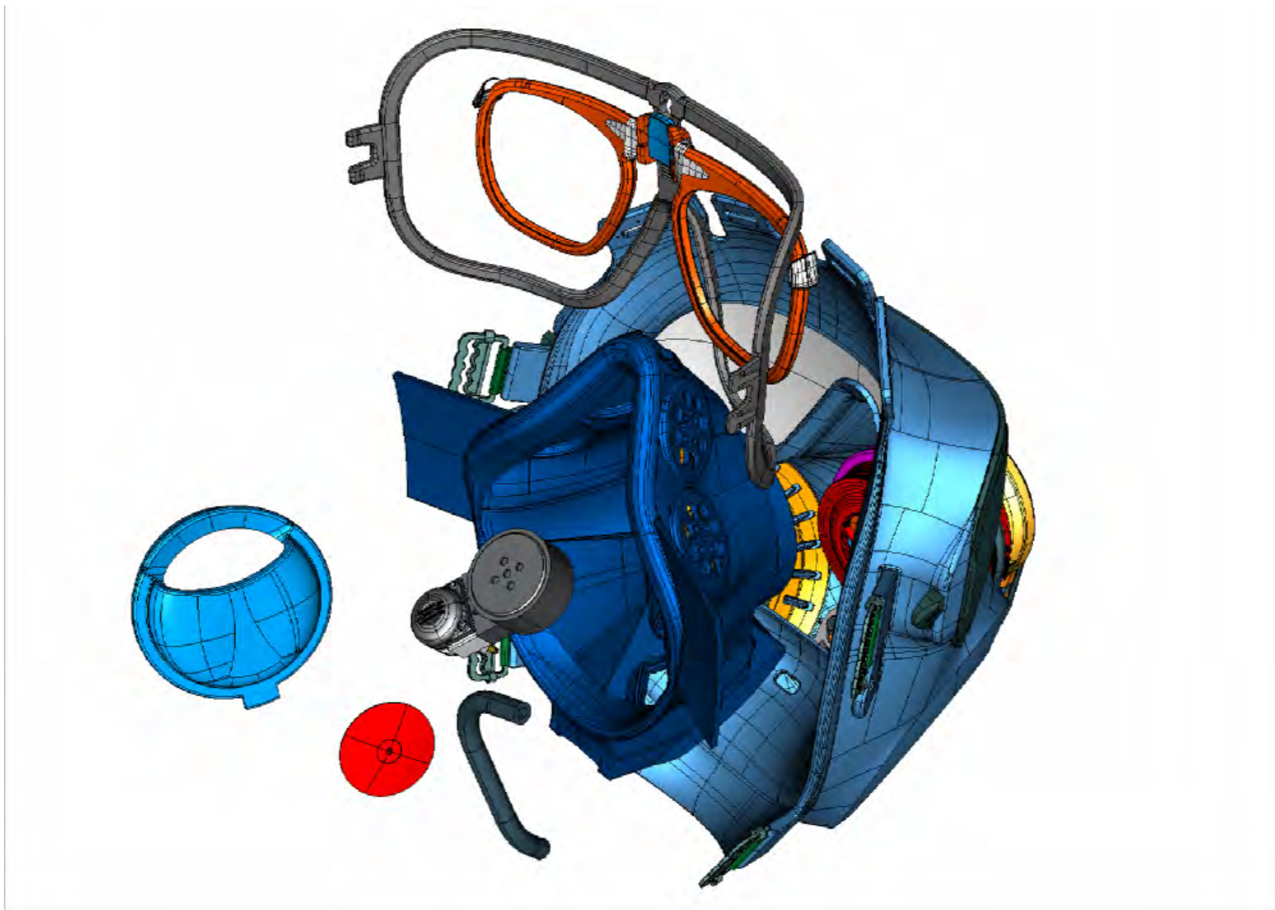
M53 Specific Requirements

- Single sided filter with left and right capability
- Be compatible with SCBA, PAPR and CCBA
- Provide voice amplification
- Available in 4 sizes with interchangeable nosecups
- Provide a protective hood for head and neck protection

M53 Prototype



M53 Prototype



Initial Testing Phase

Early User Assessment (EUA)

Early User Assessment (EUA)

- High Quality Hand Built Prototypes to demonstrate the design concept
- USSOCOM War Fighters Operationally tested the mask to validate the design
- Five days of intense testing encompassing as many operational scenarios as possible
- Avon was a present at the testing to investigate the issues as they happened

AVON PROTECTION

JPEO-CBD JOINT PROGRAM EXECUTIVE OFFICE CHEMICAL AND BIOLOGICAL DEFENSE

EUA Test Protocol

- Introduction
- New Equipment training (NET)
- Full ensemble, Primary and Secondary Fire in Negative Pressure Mode
- Full ensemble, Primary and Secondary Fire in Blower Mode
- Full ensemble, Primary and Secondary Fire in SCBA Mode
- Evaluate Drinking System
- Communication and Voice Projection Unit (VPU)
- Long-Range Fire
- Activities were conducted during day and night
- Interface with as much co-developmental equipment as possible
- Final Assessment

Early User Assessment Results

- Test participants expressed positive feedback of the XM53 prototype.
  - Excellent Field of View
  - Comfort
  - Compatibility with weapons systems

- Negative Feedback included:
  - Eyelens fogging
  - Protruding Voice Projection Unit
  - Close proximity of communication port and drink tube connections
  - VREU Design

Early User Assessment Post Test

- All data collected was jointly reviewed
- Avon prepares for the next phase of the development

Critical Design Review

Critical Design Review

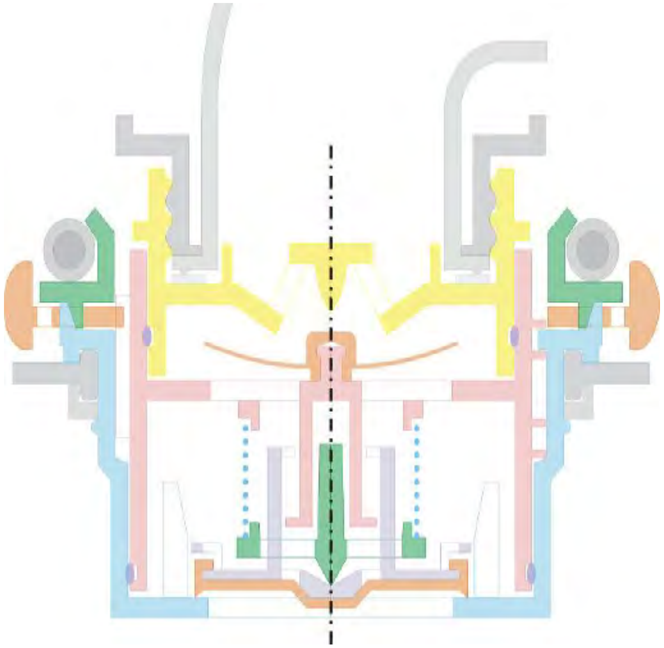
- Variable Resistance Exhalation Unit (VREU)
- Voice Projection Unit (VPU)
- Mask Configuration
- Nosecup Design
- Hood Design

Variable Resistance Exhalation Unit (VREU)

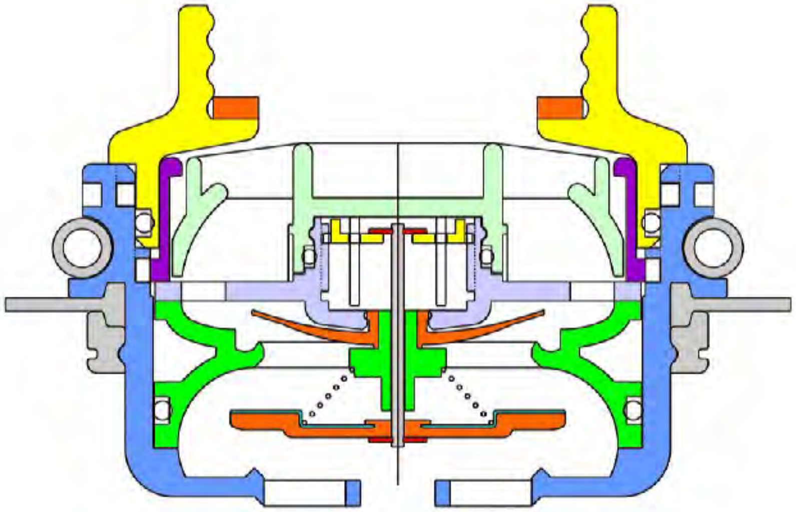
- Robustness
- Simplification of design
- Reduce profile

VREU Modification

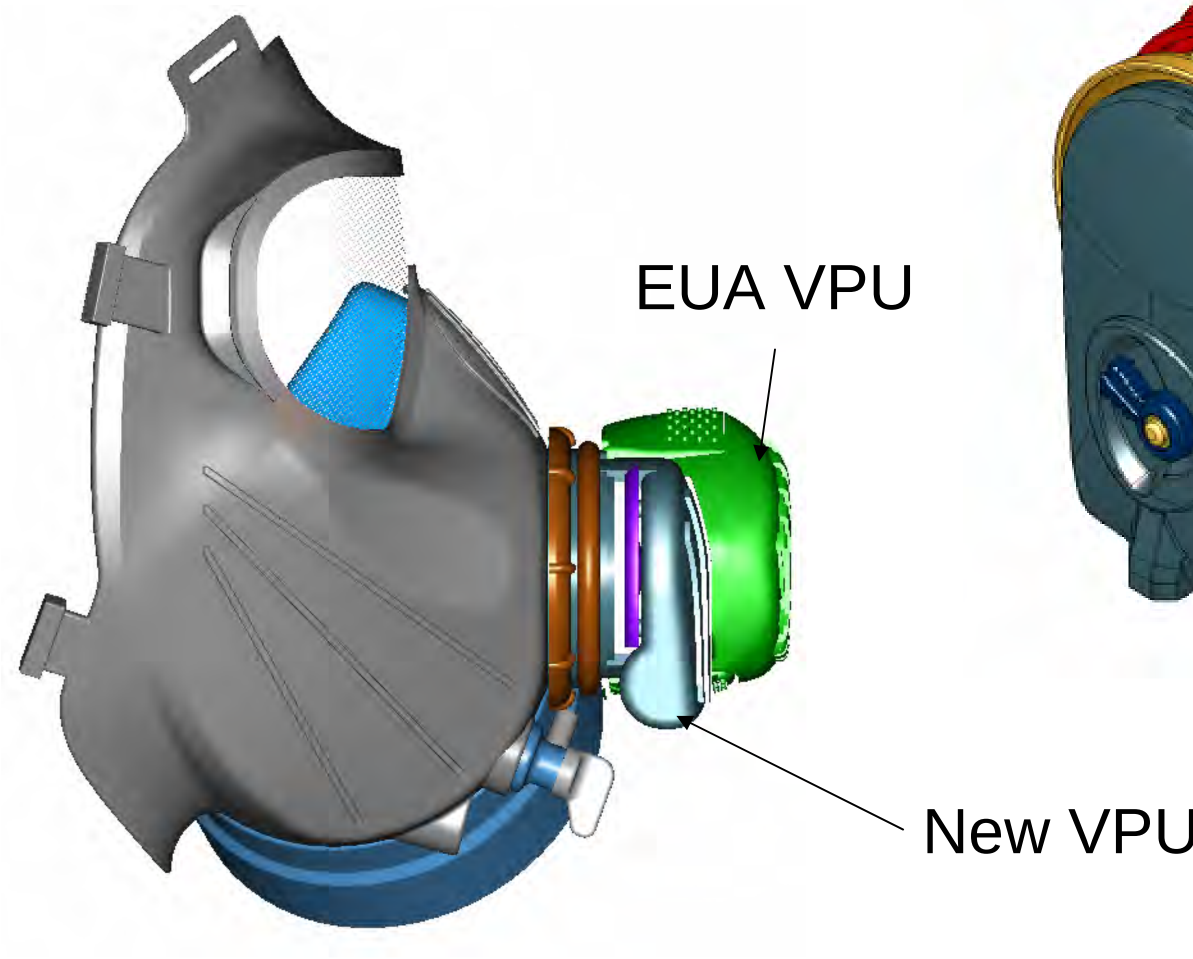
EUA Design

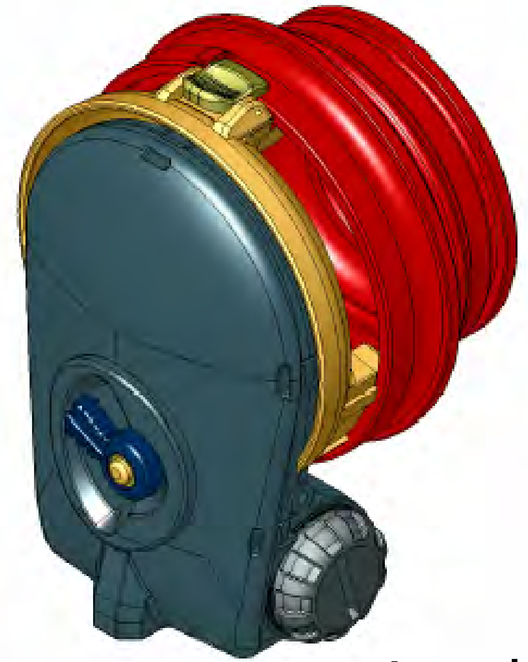


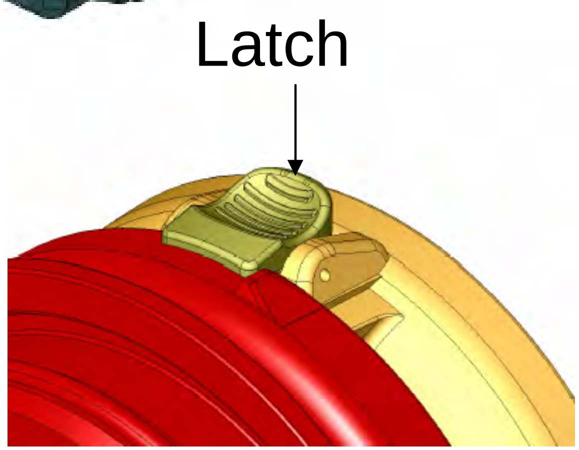
New Design



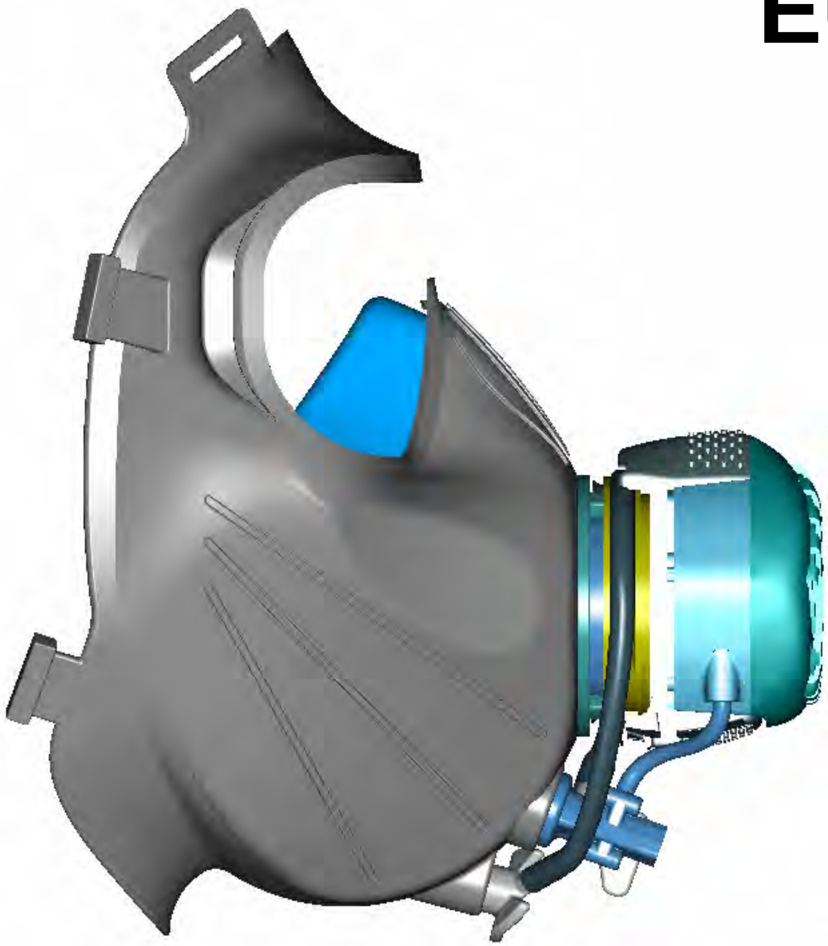
Voice Projection Unit (VPU)







Mask Configuration
EUA

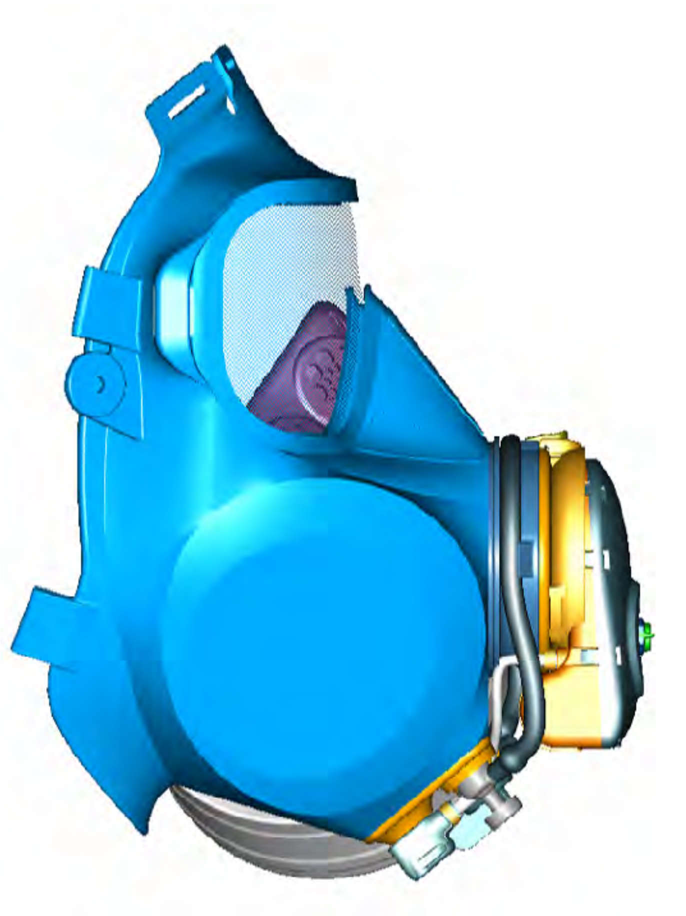


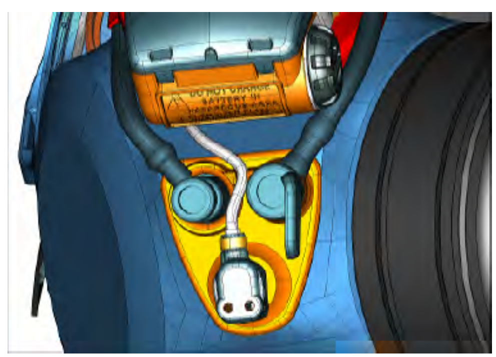
Mask Configuration Rejected Proposal

EUA

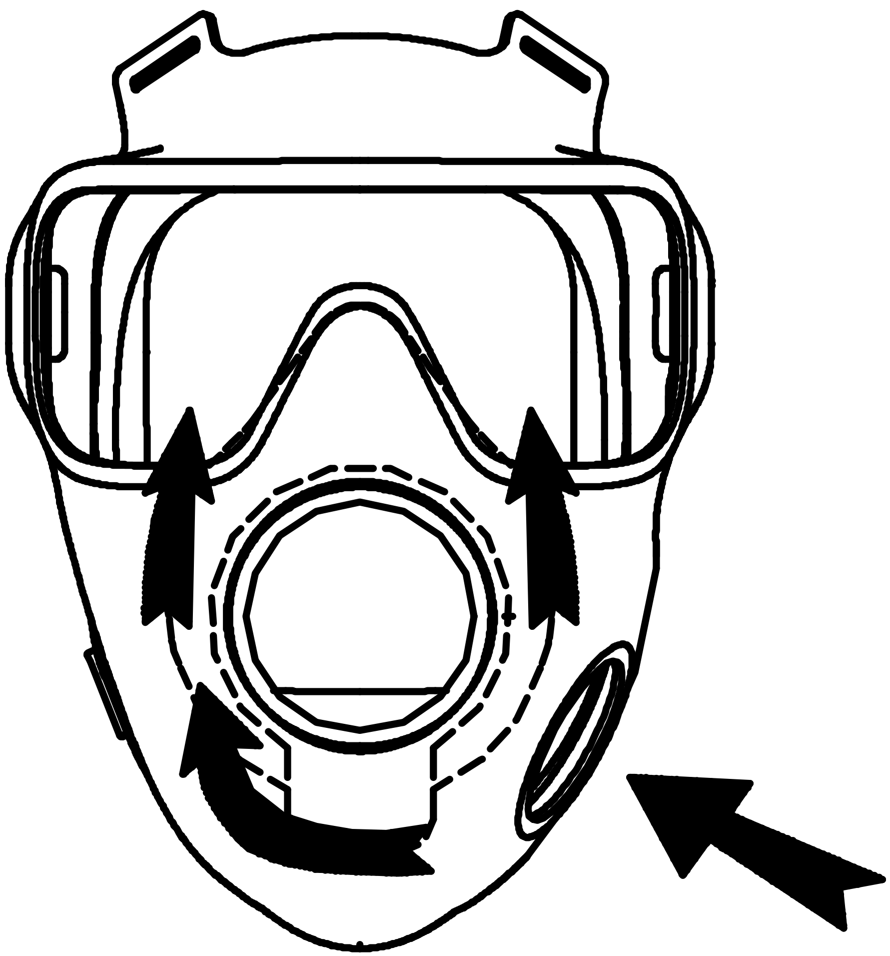
Proposal

Mask Configuration Approved Design



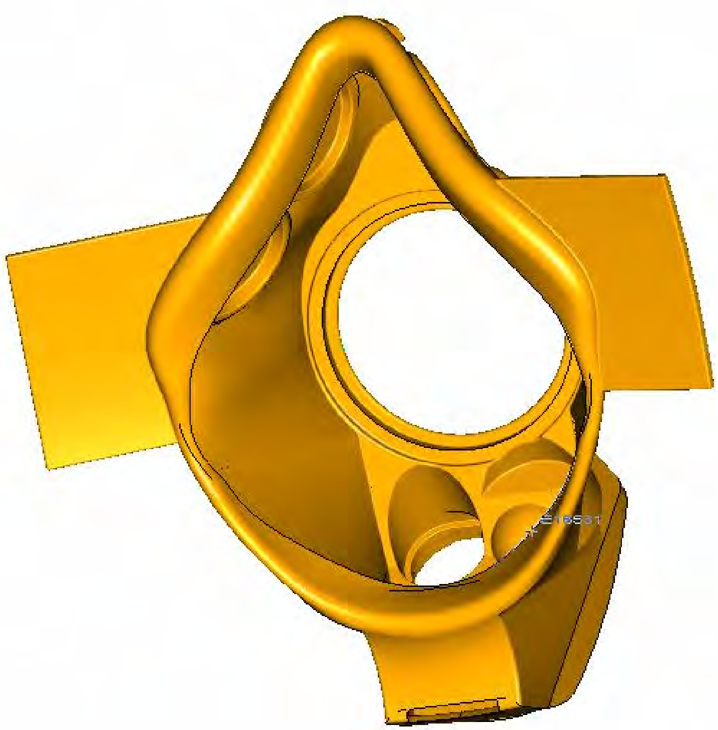


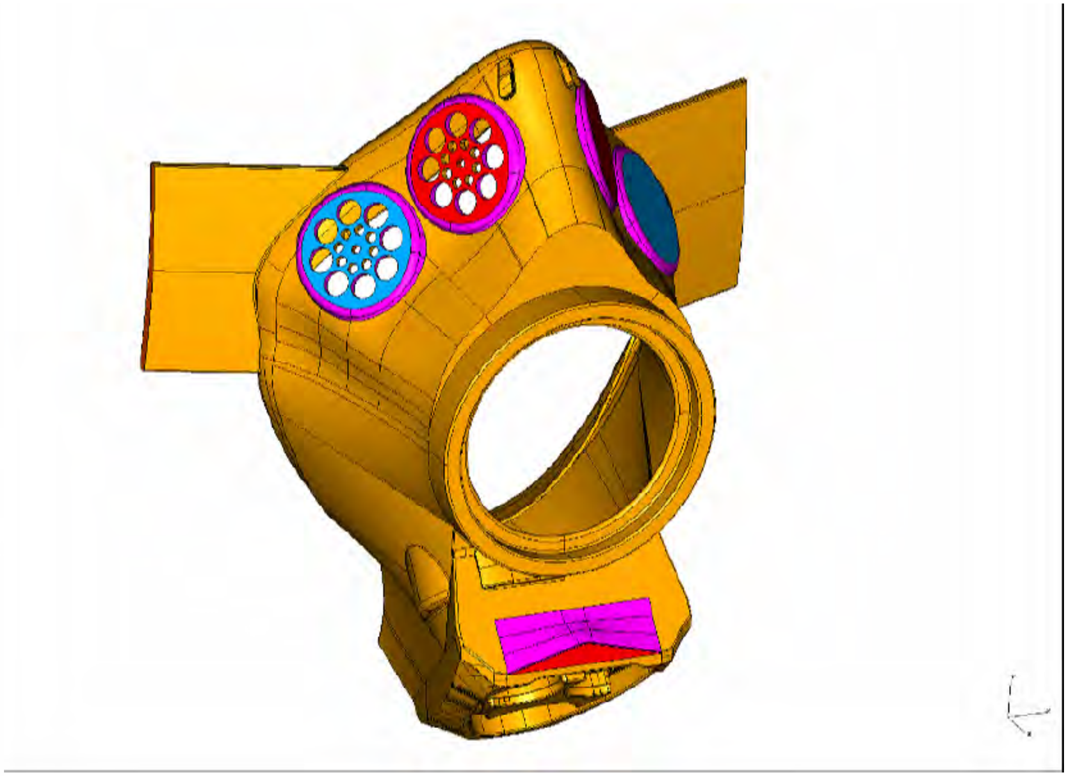
Nosecup Design



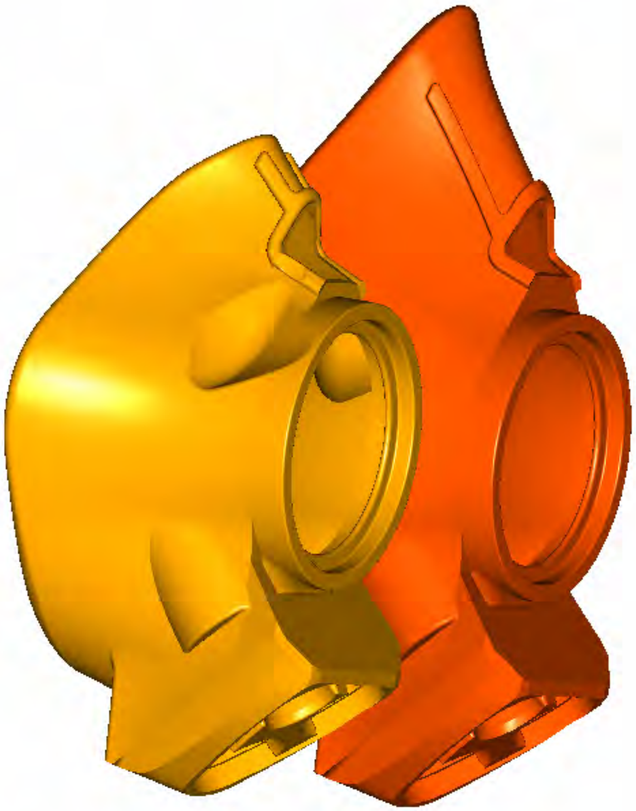
Inhaled air directed over visor

Nosecup CDR evaluation

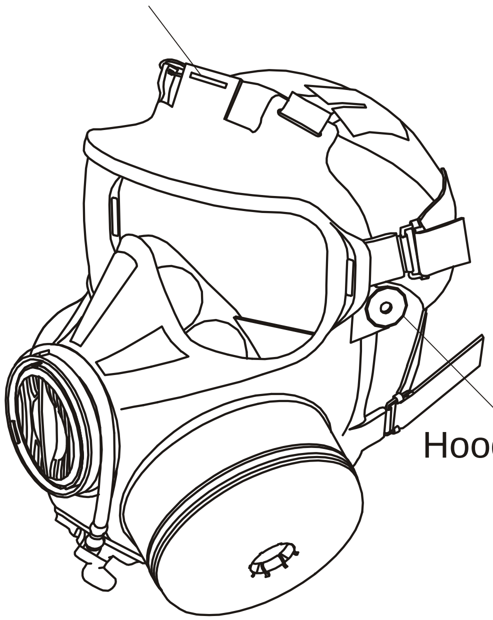




Nosecup final configuration



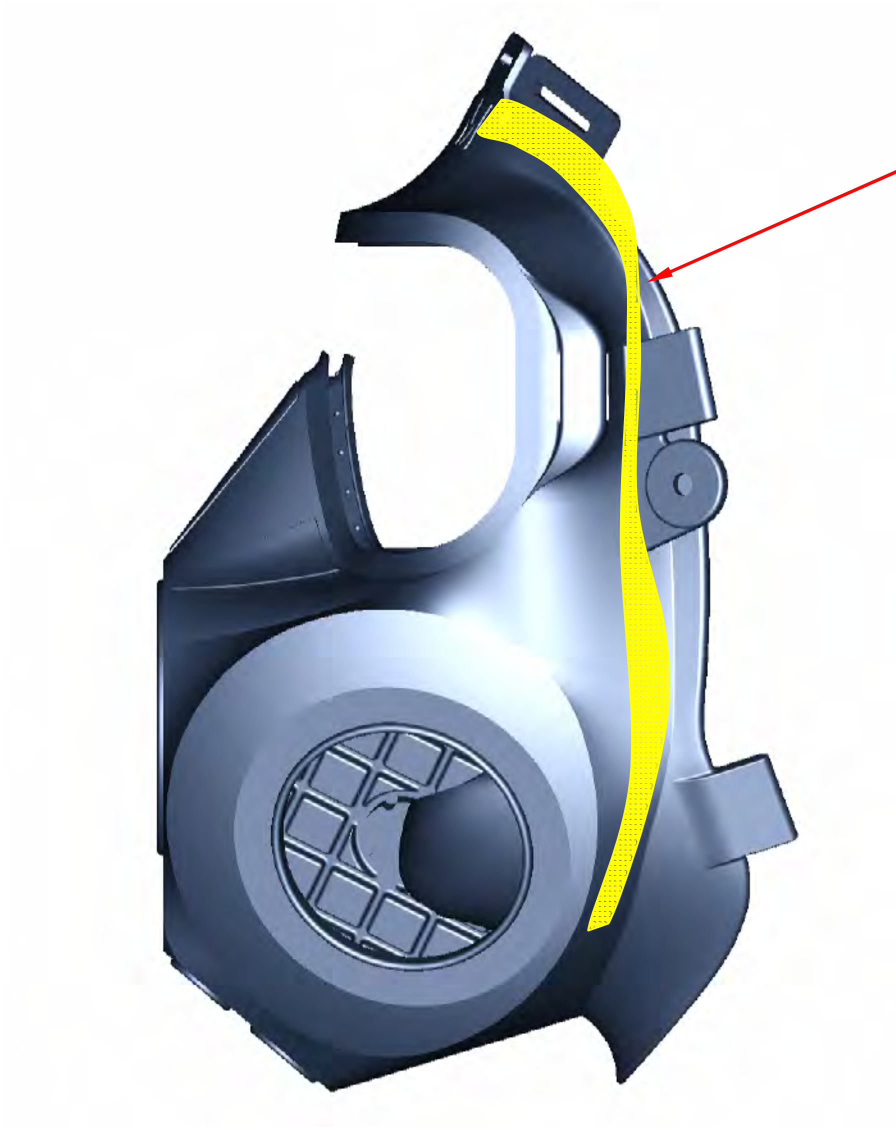
Hood Design



Hood Design Consideration

- 24 Hour protection
- Light weight
- Easily donned
- Detachable

Hood Design

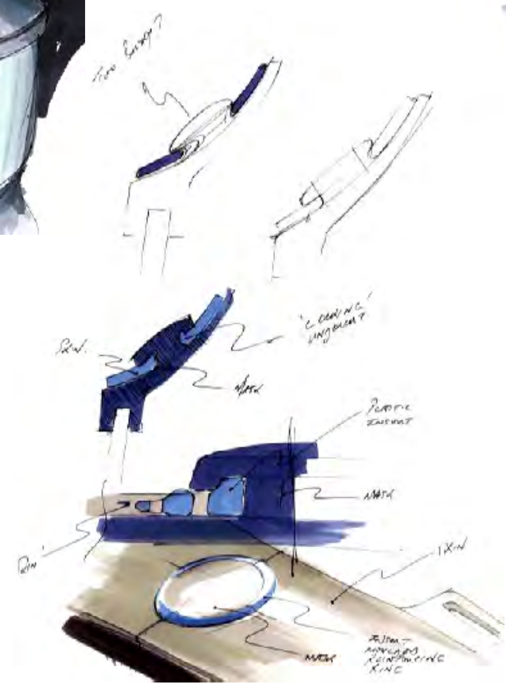


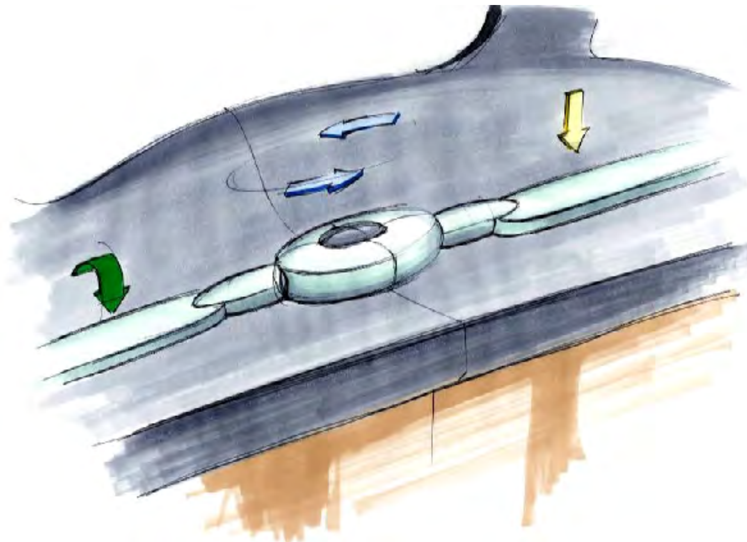
Sealing Zone

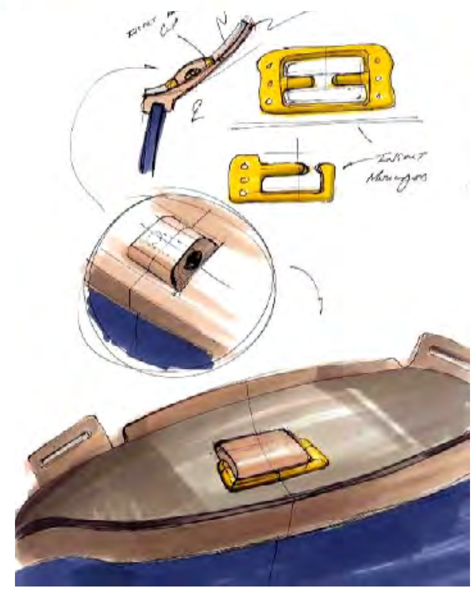
The yellow band indicates the tight contact area between second skin and mask to provide a liquid resistant seal (established by prototyping)

AVON PROTECTION

JOINT PROGRAM EXECUTIVE OFFICE
JPEO-CBD
CHEMICAL AND BIOLOGICAL DEFENSE







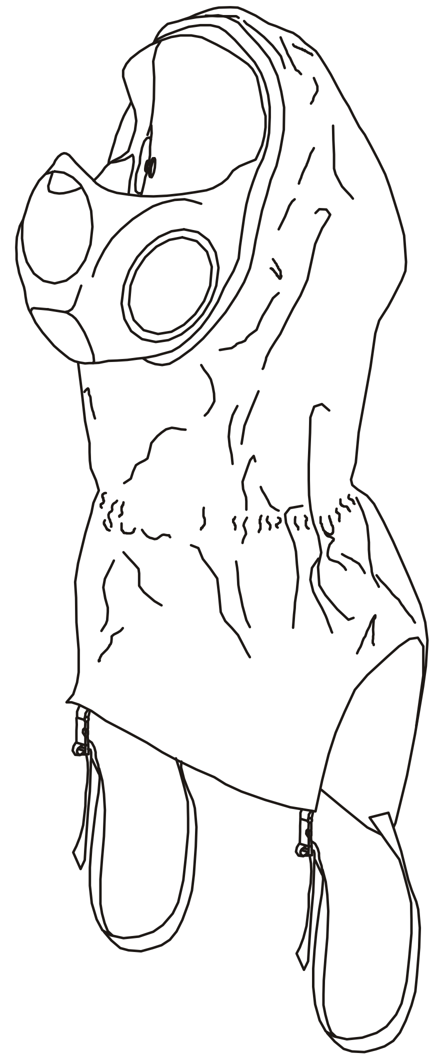
AVON PROTECTION

JOINT PROGRAM EXECUTIVE OFFICE CHEMICAL AND BIOLOGICAL DEFENSE JPEO-CBD

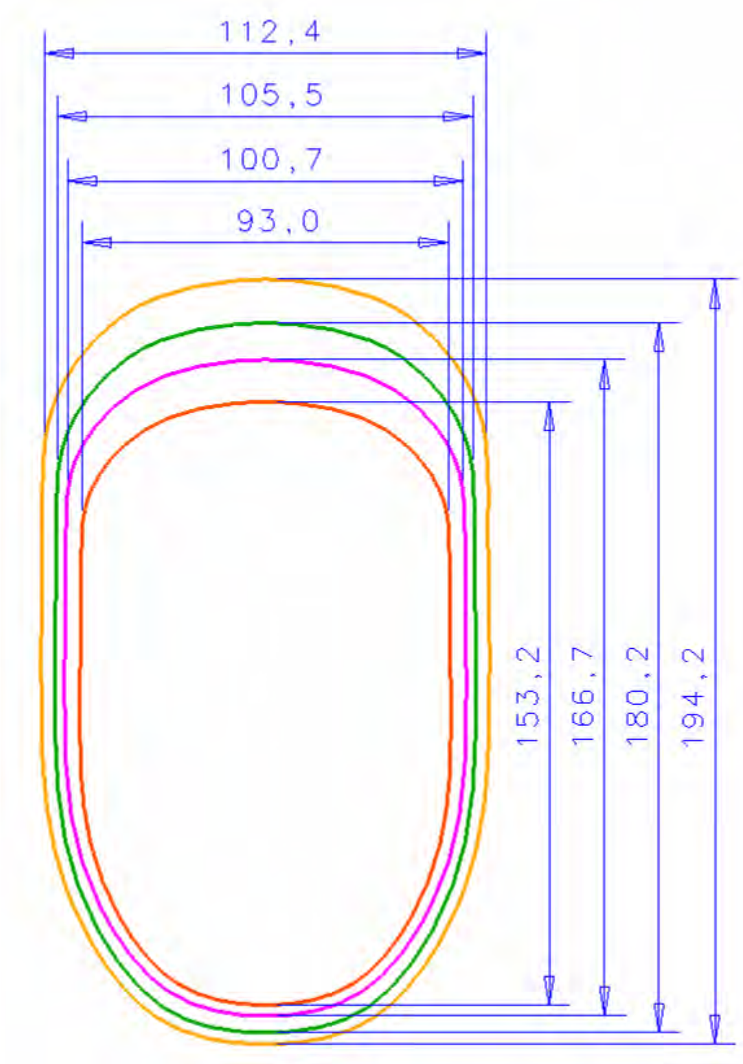
Hood Design

Hood Design

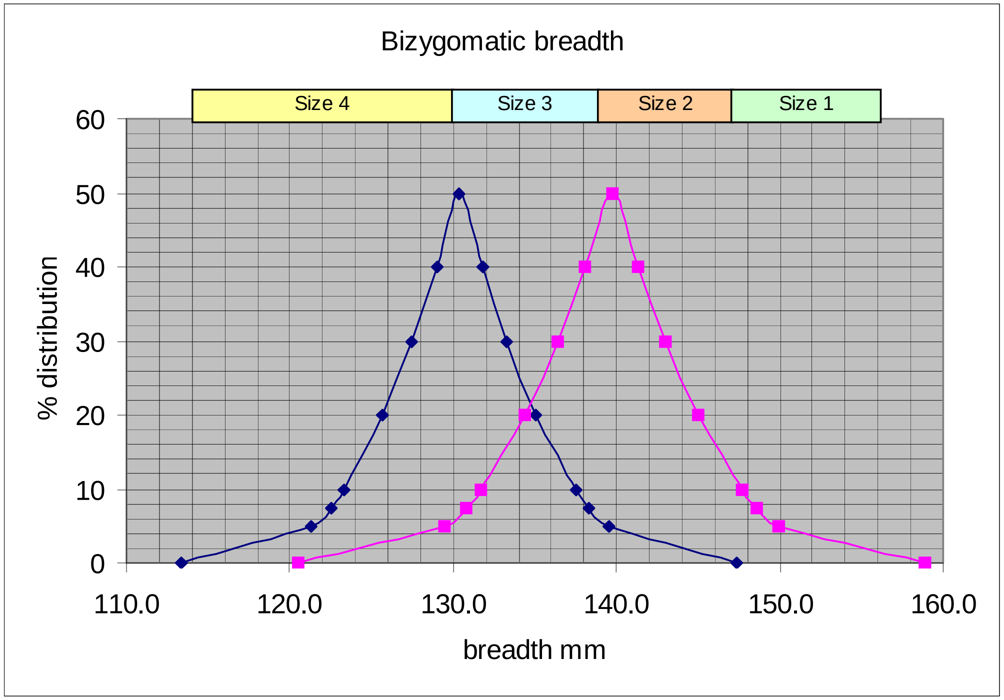
Second Skin



M53 Sizes

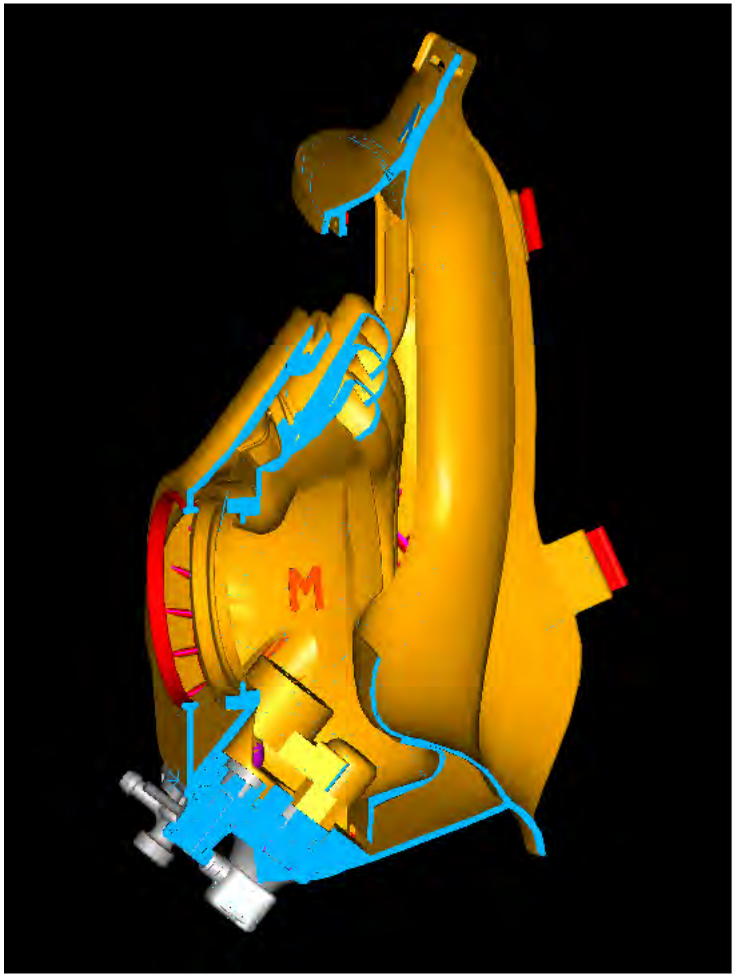


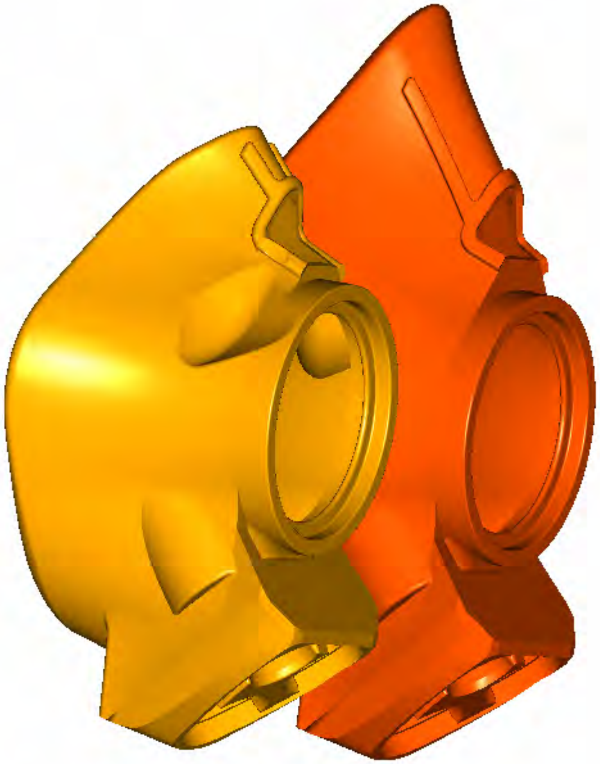
112,4
105,5
100,7
93,0
153,2
166,7
180,2
194,2



Bizygomatic breadth
Size 4
Size 3
Size 2
Size 1
% distribution
0
10
20
30
40
50
60
110.0
120.0
130.0
140.0
150.0
160.0
breadth mm

Interchangeable Nosecup





Product Qualification

- In April 2004, 400 medium size right-hand M53 masks were delivered to the DoD for evaluation.

Final Test Phase

Production Qualification Testing (PQT)
and
Operational Test (OT)

PQT/OT PLAN for SDD Masks

- PQT deals only with Developmental Tests
- OTassesses equipment compatibility, drinking and the ability to complete mission tasks
- Data is leveraged from previous JSGPM testing of common components and features
- Labs use previously written JSGPM test plans as a guideline for writing the M53 detailed test plans

Operational Test Exercises

- Field Exercises
- Maritime Scenarios
- Weapons Systems Firing
- Medical Skills
- Vehicle Driving
- Close Quarter Battle
- SOF Mission Needs

Operational Test

- **Equipment Compatibility**
  - **Radio Equipment**
  - **SCBA Compatibility**
  - **Helmet & NVG**

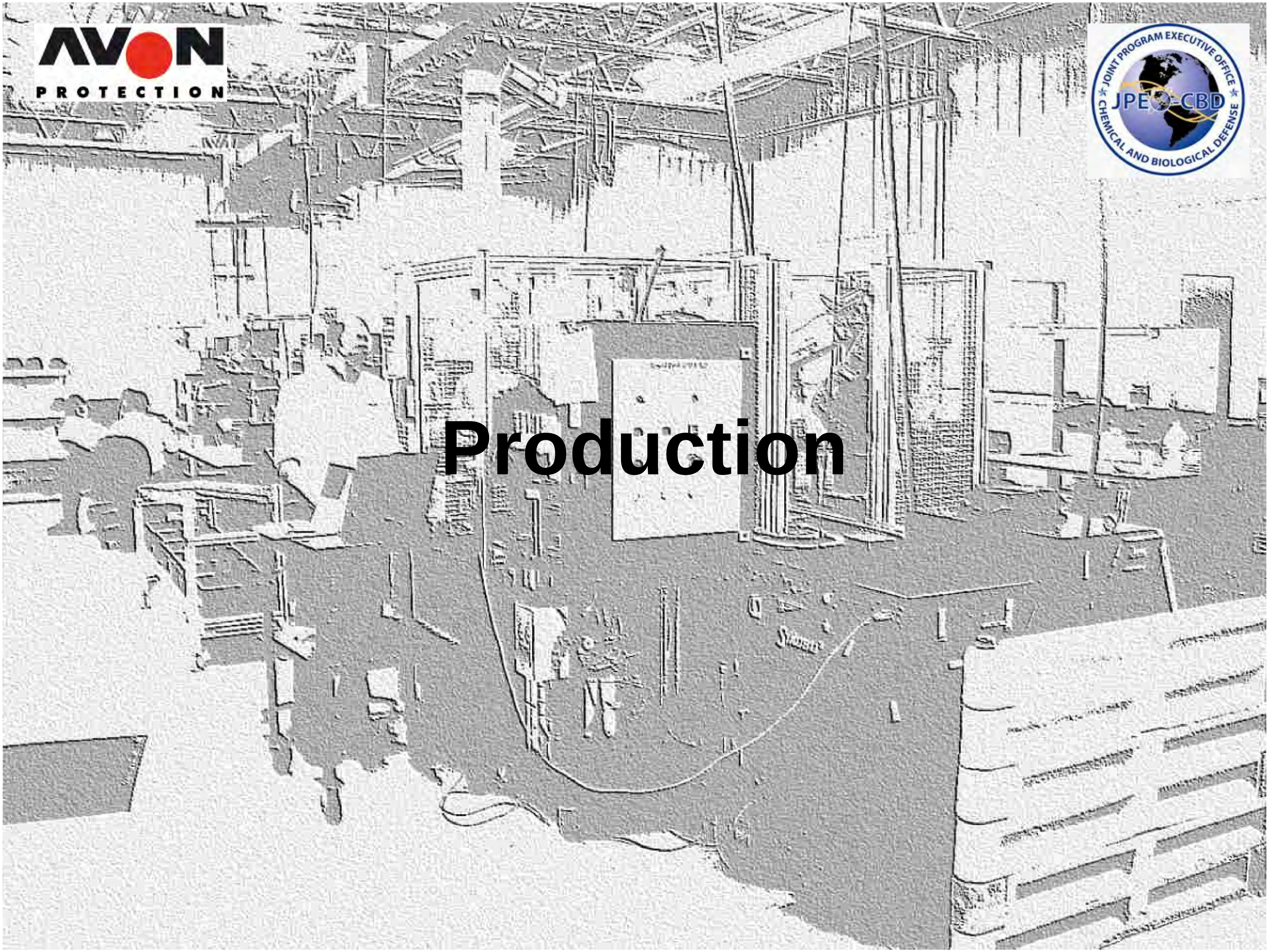
- **Human Factors**
  - **Vision and Field of View**
  - **Overall Comfort**
  - **Breathing Resistance**
  - **Cheek to Stock Weld**

AVON PROTECTION

Product Approval

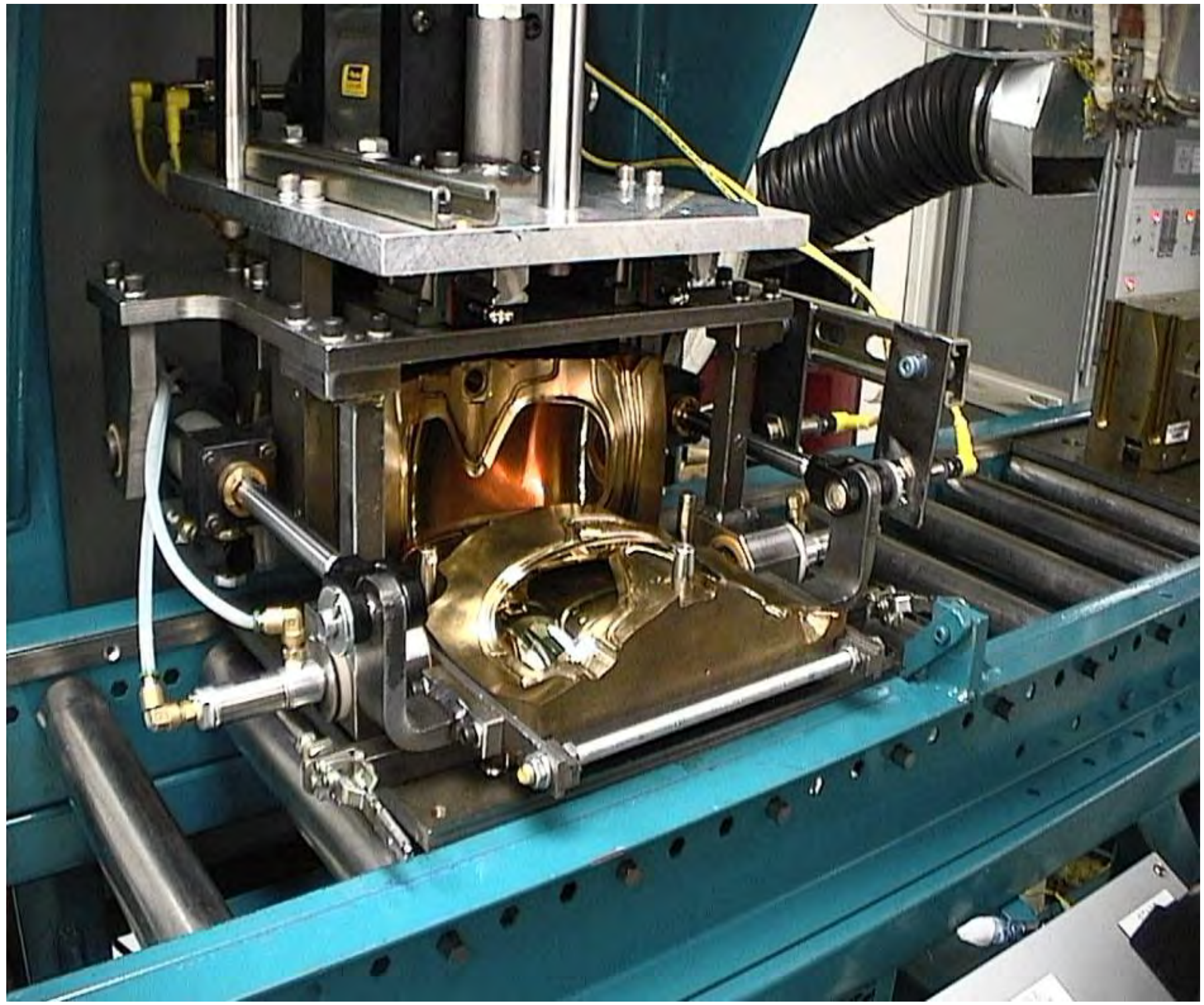
- Production Verification Testing
- All design and testing was completed to support the war fighters needs and program milestone
- The program was approved to enter the production phase
- M53 mask development, design and test in 2.25 years
- A True Team was formed that successfully executed the development and has remained intact to execute the mask production.

Production



AVON PROTECTION

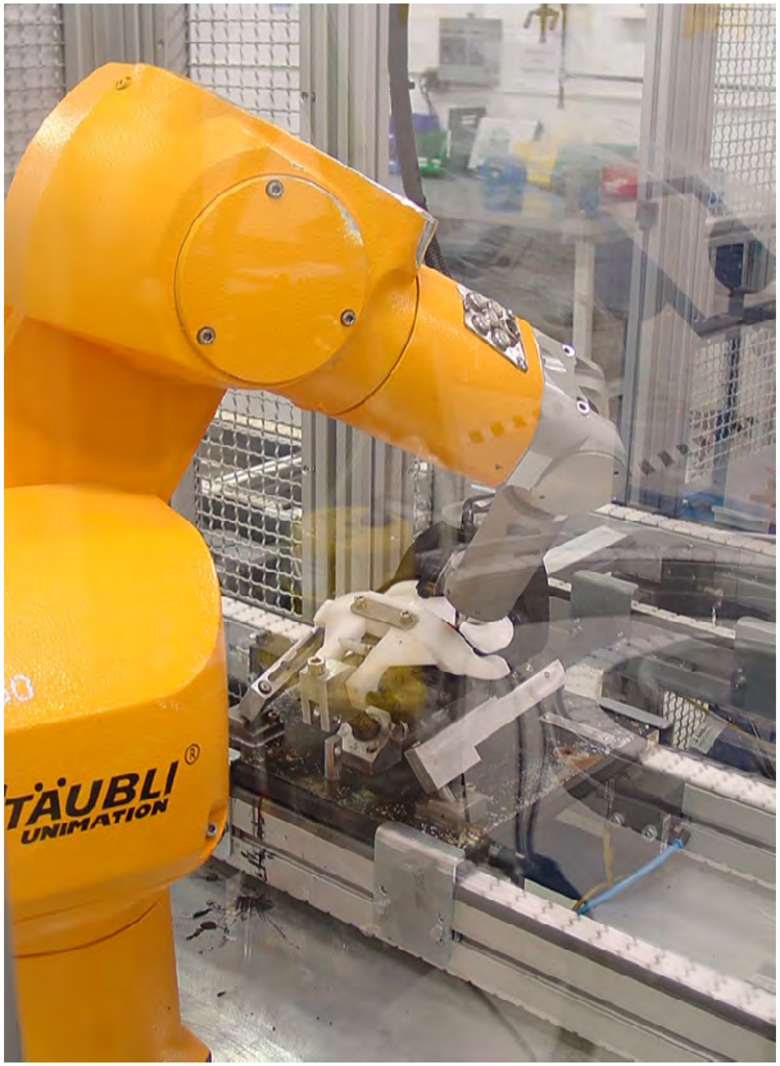
Eyelens Manufacturing



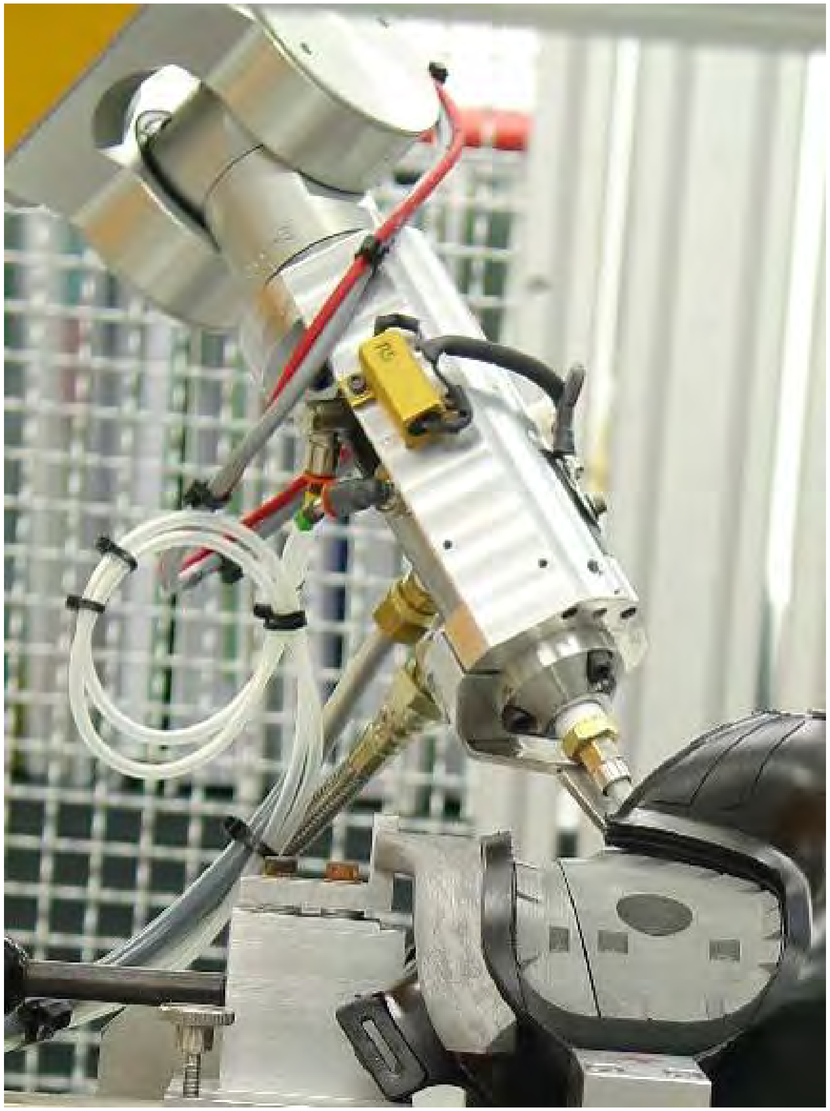
Bonding

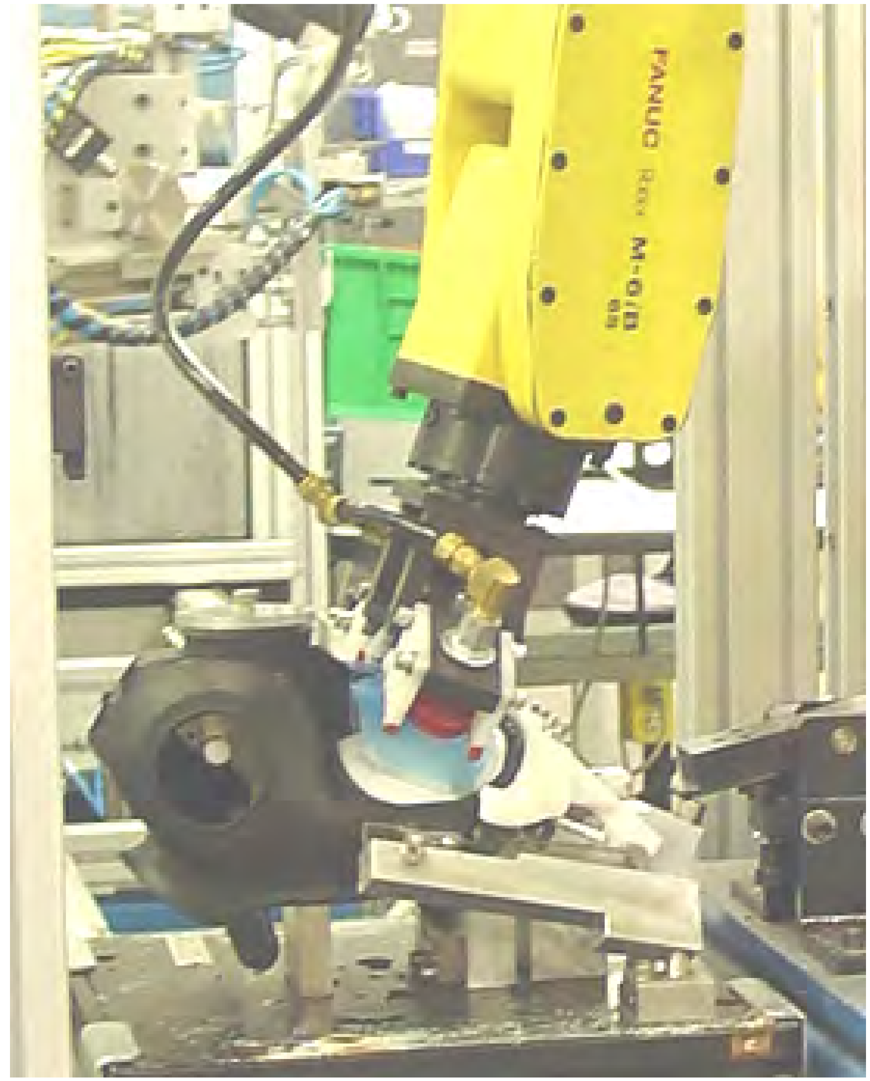
Bonding


CARE POINT
TITLE:MISSING INSERTS
STATION 1 DATE/TIME STAMP


UNIMATION

Bonding





Assembly Line

Testing

AVON PROTECTION

Fielding Plan April 2006


Questions?

USSOCOM Conference
December 6-8, 2005

Polymer Technologies for the Lockdown and Removal of Radioactive Contamination

Jayne Shelton

Isotron Corporation

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Seattle, WA 98103
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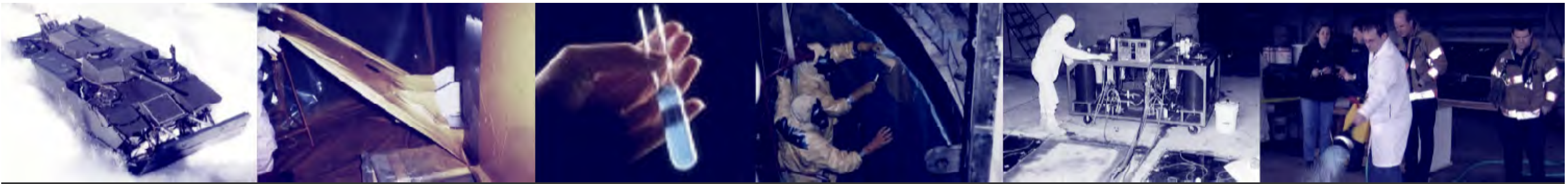
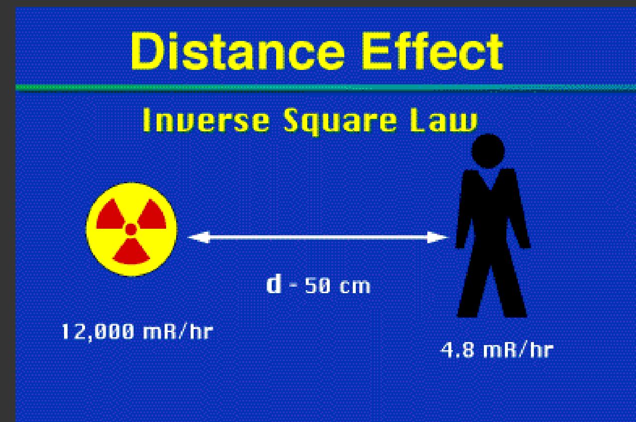
Fax: (206) 260-7014
http://www.isotron.net



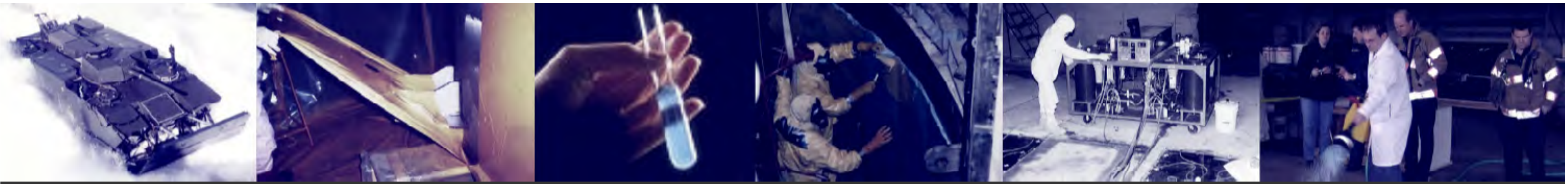
Contamination vs. Radiation

Contamination	Radiation
• Mobile ▪ Watersoluble ions ▪ Windborne dust • Intimate contact (d=0) • Ingestible radiation	• Ionizing radiation damage to cells • Intensity drops with inverse square • Acute or chronic doses



Source: Univ. of Penn.

Contamination must be suppressed immediately, whereas radiation can be dealt with in a longer timeframe.



Radiation Shielding & PPE

Jayne working in hot hood at INL.

Nuclide	Type
Cs-137	beta/gamma
Sr-90	beta
Co-60	beta/gamma
Ru-106	beta
Pu-239	alpha

Possible spent fuel rod inventory.

Jayne training in rad PPE.

Personnel distance and contact time can be controlled.

Isotron Strippable Coating ConOps

EVENT

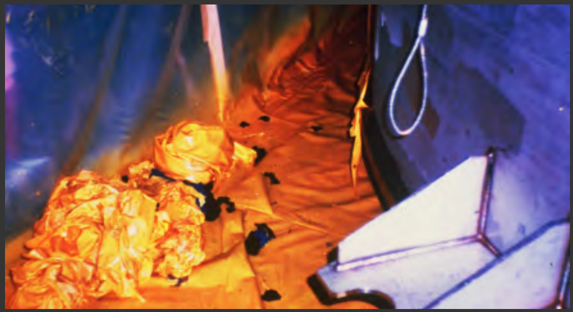
Immediate Response
Contaminant Lockdown

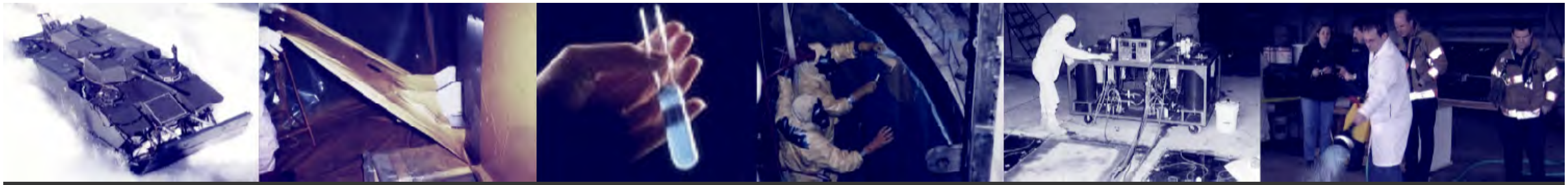
Personnel Protection

Personnel Decon

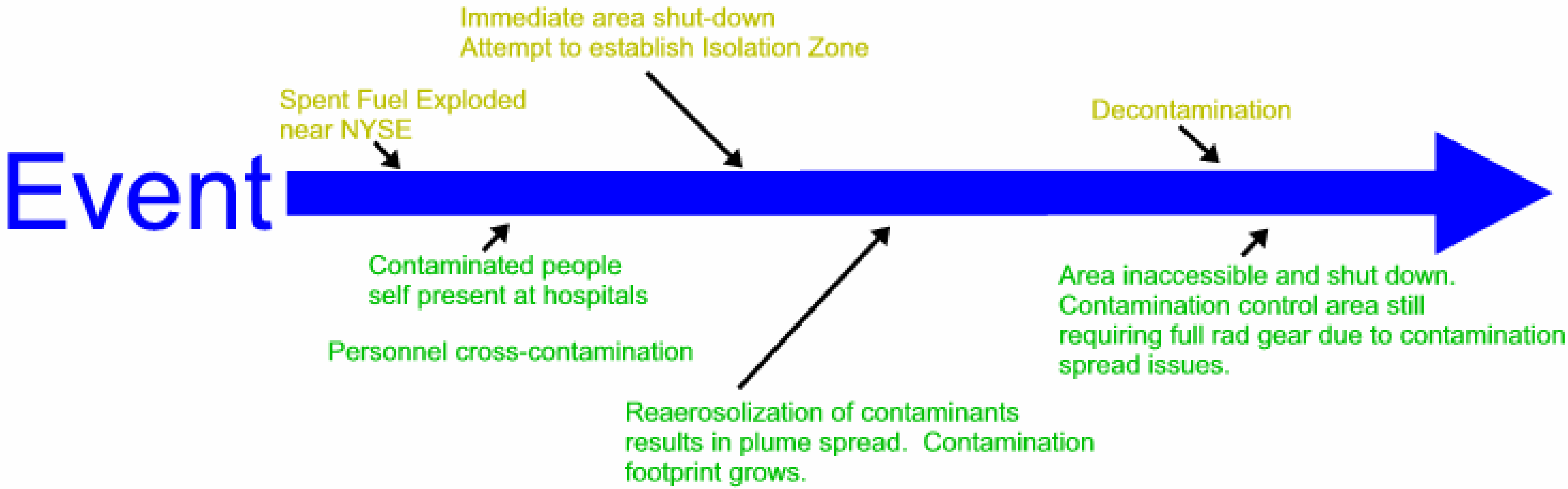
Decontamination

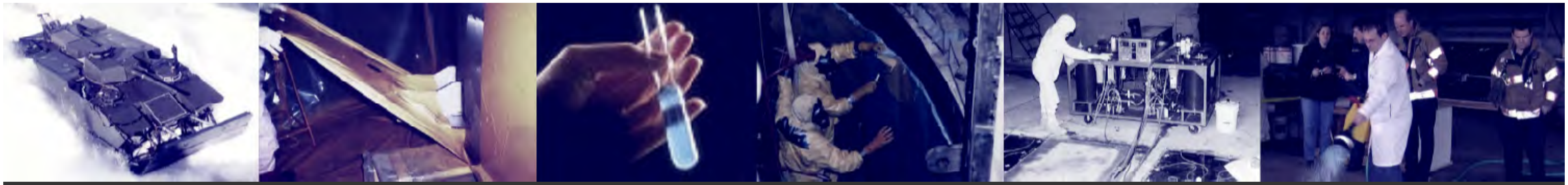
Disposal





ConOps Vision Timeline - Before





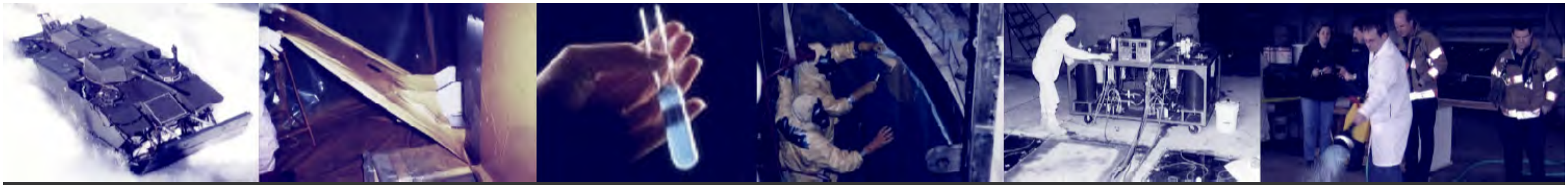
Importance of Plume Mitigation

TOPOFF 2 Terrorism Response Exercise May 2003 in Seattle, WA

Mock contamination from dirty bomb detected within c. 4 hours at San Juan Islands

Foot long stick of Co exploded at Manhattan would contaminate 1,000 sq. km, three states (NY Times, 2004)

Satellite image of Puget Sound.



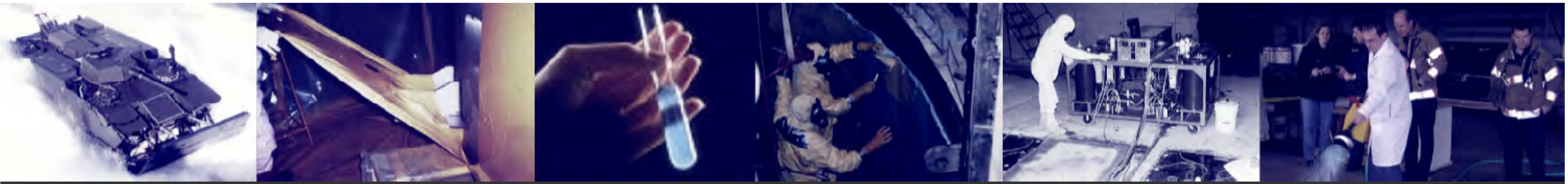
ConOps: Immediate Post-Event Activity

Wide area application of IsoFIX lockdown polymer

- Particulate lockdown
- Application from a distance

Isotron lockdown application with hydroseeder prevents personnel contact.

Pilot-scale testing in Seattle.

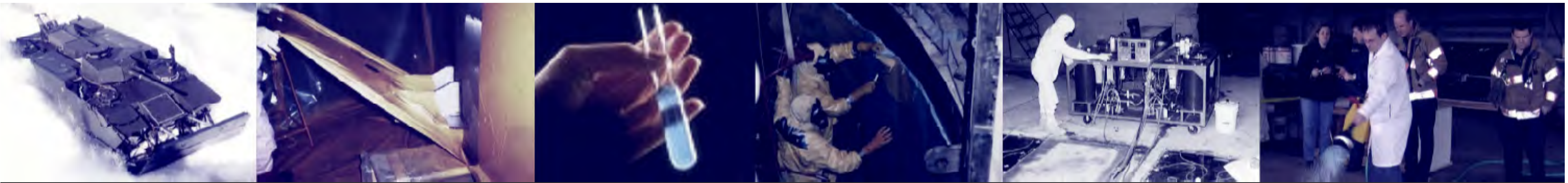


IsoFIX Lockdown Polymer Key Features

- Sprayable, elastomeric, removable polymer media
- Prevents transport by rain, wind, traffic

Once applied, the coating is easily and quickly peeled.

Pilot-scale demonstration of IsoFIX with SFD.



IsoFIX Lockdown Polymer Dust Suppression

Helipad dust suppression in Richland, WA.

Airborne lockdown immediate, full polymer properties within 13h

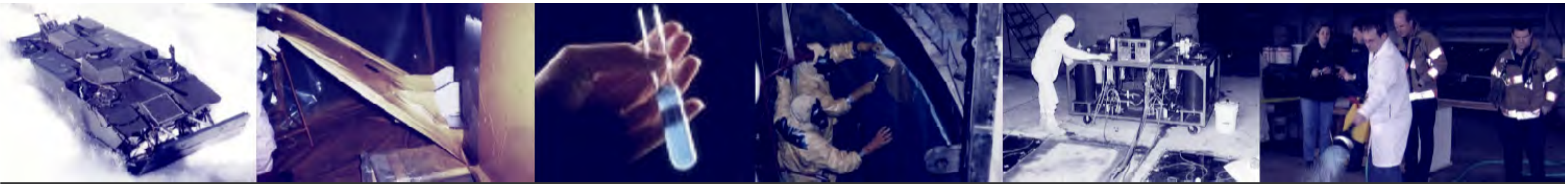
Helicopter dust suspensions cause personnel contamination (Chernobyl)

IsoFIX dust suppression trials in Richland, WA (2005)

56,000 lb. brush truck

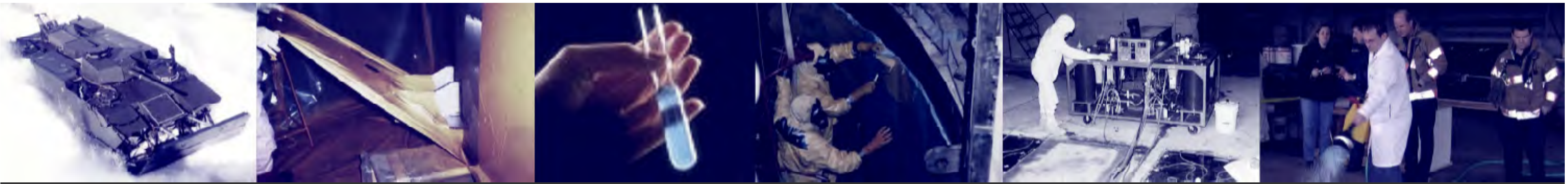
IsoFIX withstands foot traffic, emergency ground vehicles

Treated section of ground did not break or lose integrity after brush truck test.



Advantages of IsoFIX Lockdown

- Contamination footprint contained
- Cross-contamination eliminated
- Critical operations may resume (NYSE)
- Personnel contamination is reduced
- Removable media to facilitate downstream decontamination



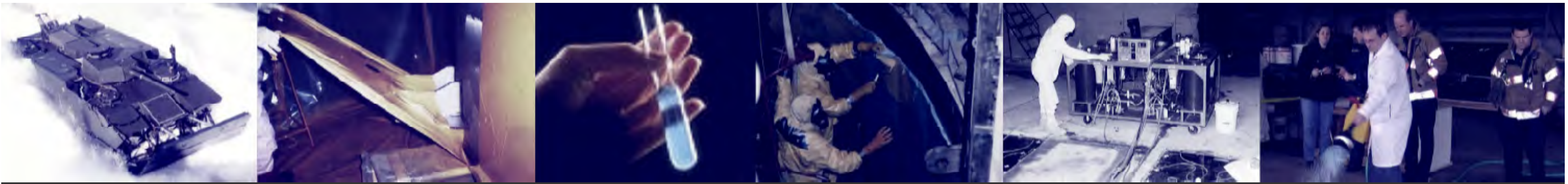
ConOps: Recovery & Reoccupation

Source: JZPhotos.com

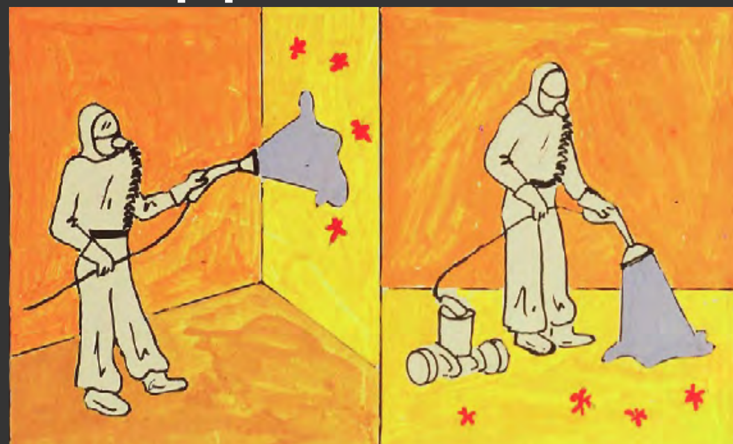
How clean is clean?

DARPA SPO Radiation Decontamination Program, in collaboration with DHS, set performance criterion at 1 mSv/yr at 1m (near background)

Attain level at over variety of surfaces, materials



ConOps: Strippable Decon Coatings

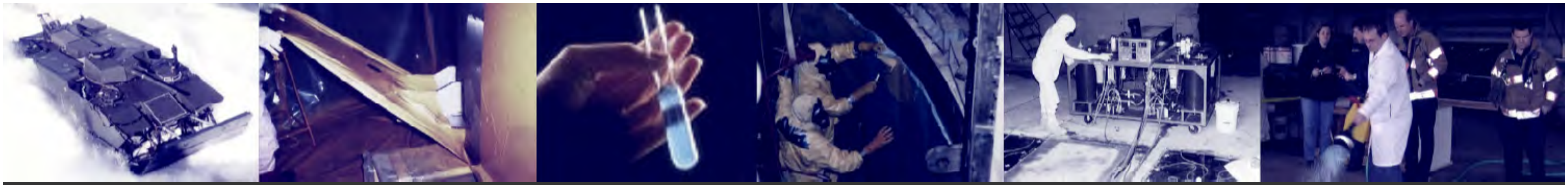


Step 1. Survey suspected areas and determine decon needs

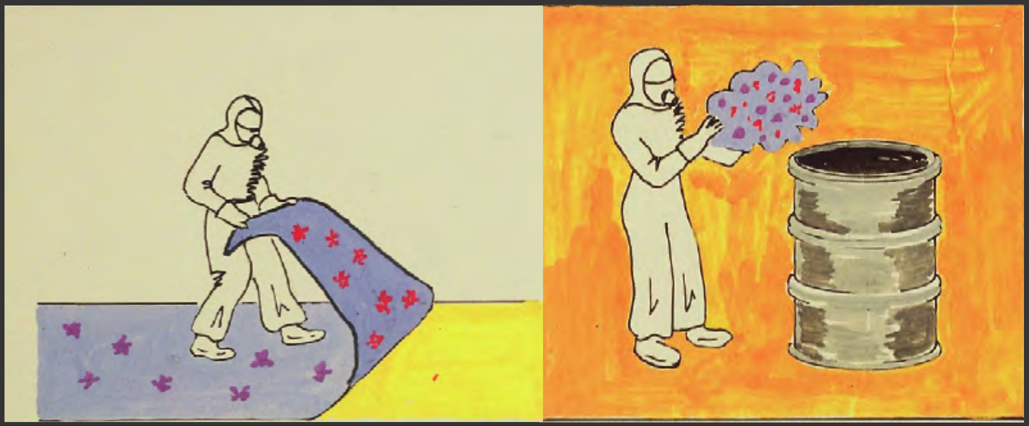
Step 2. Remove IsoFIX lockdown coating

Step 3. Apply optimal decon coating

- conventional spray equipment
- 3 m^2 coverage per gallon
- 400 m^2/hr per spray pump



Strippable Decon Coatings (cont'd)

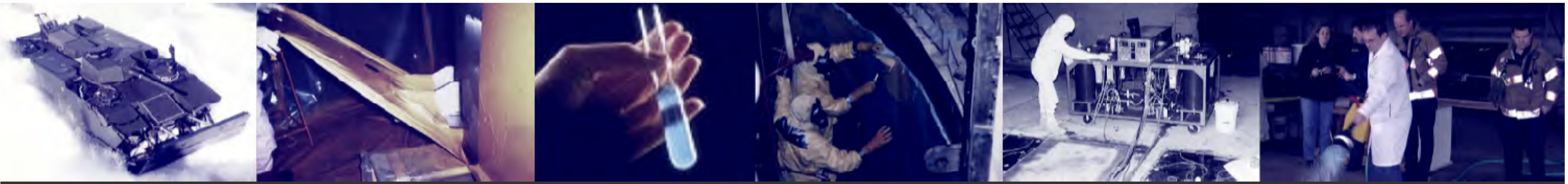


Step 4. Remove decon coating

- Peelable, no equipment necessary
- 150 m^2 per man-hr

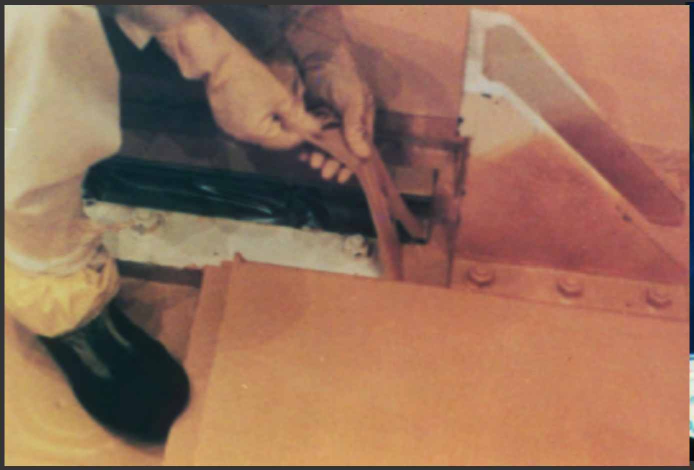
Step 5. Transport to appropriate waste facility

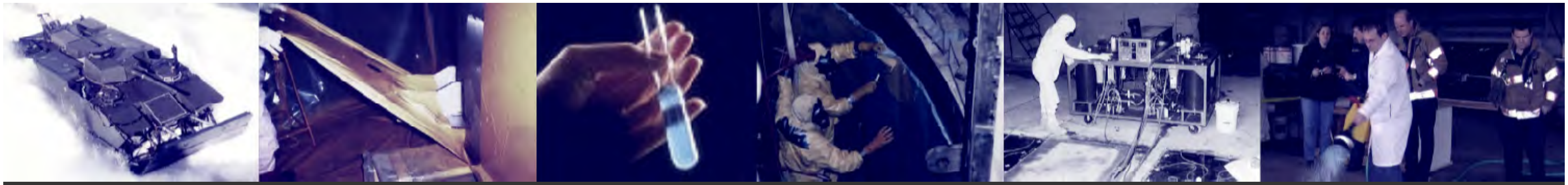
- Solid waste disposal
- Compression ratio of waste on order of 50% (worst case scenario)



Real World Performance of Strippable Decon Coatings

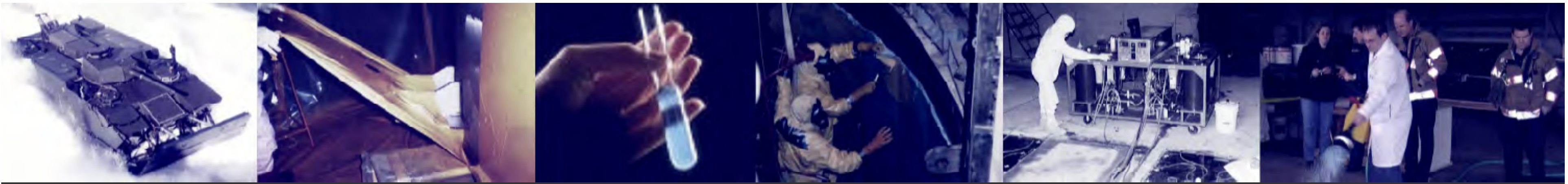
- Low man hours (Nine Mile NPP)
- Quick return to operations (3 Mile Island)
- Removable from complex surfaces
- Simultaneous locks down and decons (as opposed to scabbling)



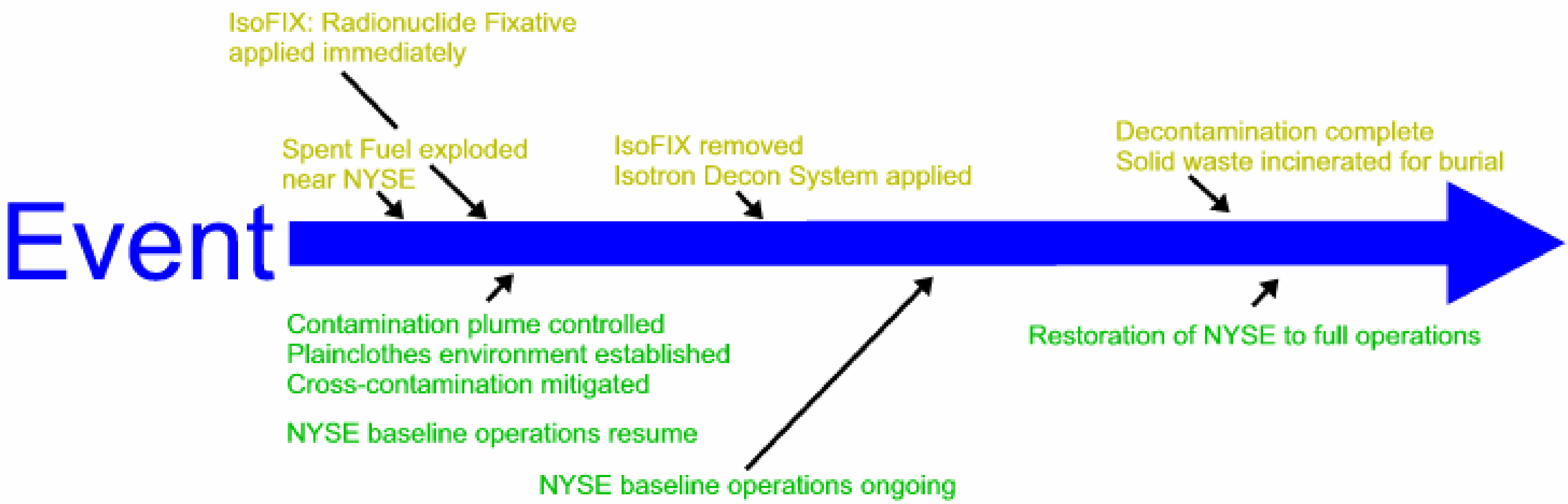


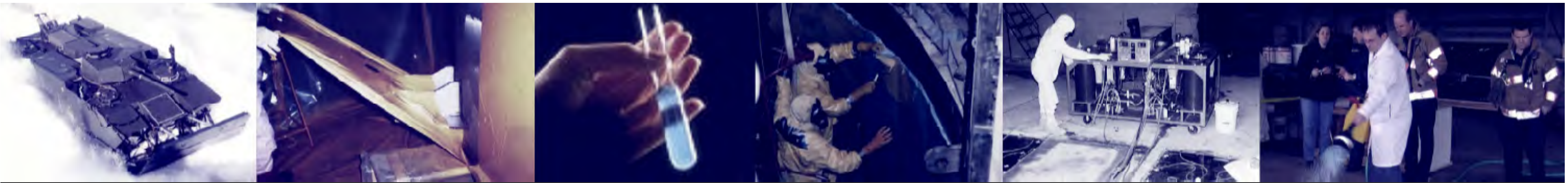
Highlights of ConOps Vision via Strippable Lockdown & Decon

- Expedient deployment to reduce personnel radiation exposure
- Cross-contamination avoidance
- Facile removal w/o resuspension risk
- Solid waste disposal (low-risk/low-cost)



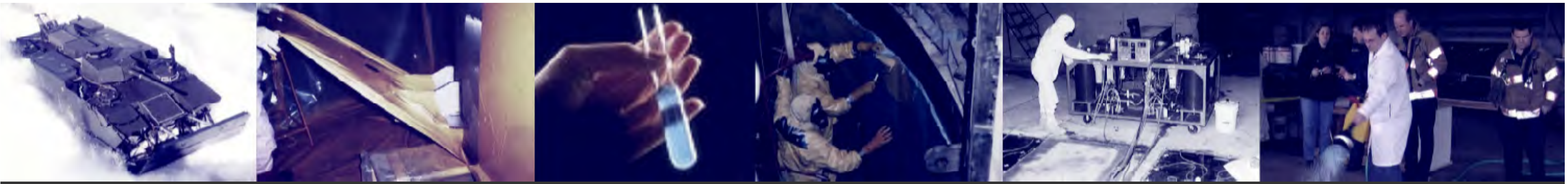
ConOps Vision Timeline - After





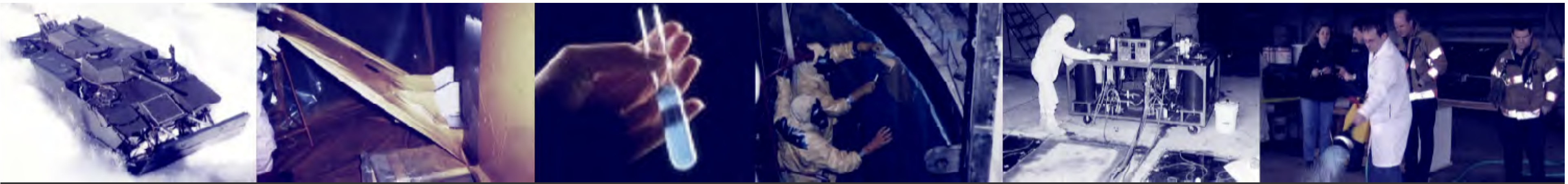
Strippable Coating Products & Experience

- **Isolock-300**
  - Anti-contamination and surface decontamination for reactor cavity
  - Designed for immersion service
  - Deployed at: Houston Power and Light, Nine Mile, Oyster Creek
- **Isolock-HP**
  - Designed for high cross-section “hot” particle capture
  - Deployed at Arizona NPP
- Isolock-VB (HSARPA)
  - Vapor barrier portion of 2-step TIC Neutralization and Removal System
  - Wide area application system
- IsoDEF™ (CB Barrier System)
  - The first expedient shelter coating designed for barrier protection from chemical, biological and radiological contaminants
  - Demonstrated in live chemical agent trials in Czech Republic (HD Threat)
  - Currently in TRE Evaluation by JPEO ColPRO



Acknowledgements

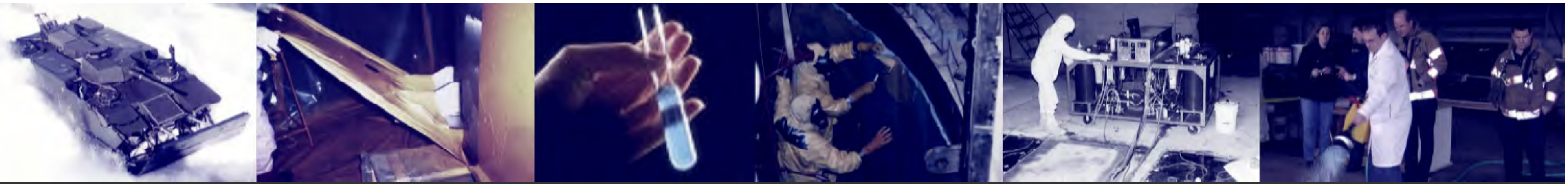
- Radionuclide Fixative Technology development is sponsored by the Technical Support Working Group under contract W91CRB-04-C-0021
- Radionuclide Decontamination Program is Sponsored jointly by DARPA and DHS under contract HR0011-04-C-0050



Isotron®

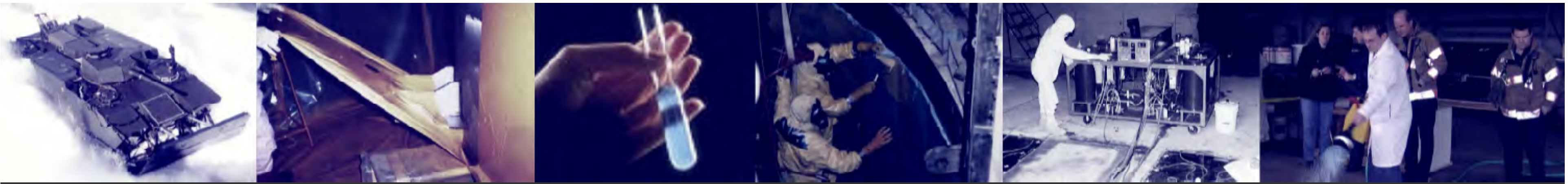
Advanced Polymer Composites

http://www.isotron.net



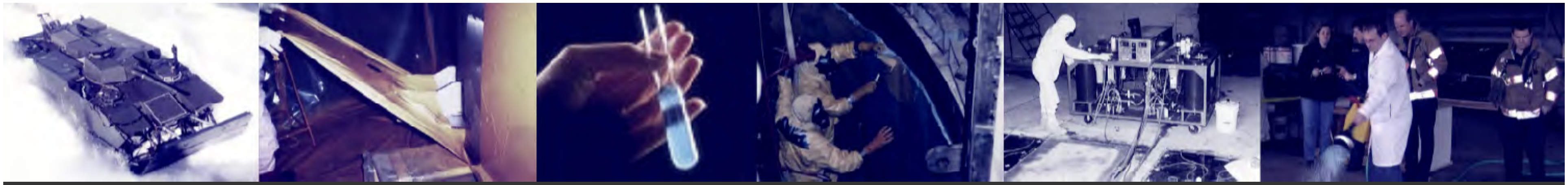
Safety &Toxicity of IsoFIX System

- Water-based Coating System
  - Non-flammable solution
  - Pre-mixed solution poses low health risk during application; mitigated by donning proper PPE
- Overall Environmental Impact
  - IsoFIX is waterborne and low VOC
  - No residue is left behind after removal



Safety &Toxicity of Decon Coating System

- Water-based HASPs
  - Non-flammable solution
  - Pre-mixed solution poses minuscule health risk during application; mitigated by proper PPE
- Solvent-based DTS
  - Flammable solution - proper ventilation needed to reduce flammability limit of air
  - PPE should include solvent respirators
- Overall Environmental Impact
  - Solvent-based DTS is based on VOC-exempt solvent (acetone)
  - HASP is waterborne and contains no VOC
  - No residue is left behind after removal of the strippable film



Strippable Coating Products & Experience

- Isolock-300
  - Anti-contamination and surface decontamination for reactor cavity
  - Designed for immersion service
  - Deployed at: Houston Power and Light, Nine Mile, Oyster Creek
- Isolock-HP
  - Designed for high cross-section “hot” particle capture
  - Deployed at Arizona NPP
- **IsoFIX / HeloTRON (Technical Support Working Group)**
  - Radionuclide and particle contaminant countermeasures
  - Designed for emergency service to “lock down” contaminants during S&R activities
  - Dual use as dust palliative for temporary helicopter landing sites
  - Removable on demand via peeling OR dissolution
  - System was deployed at field scale with TSWG, Seattle Fire Department and US Marine Corps oversight on May 13, 2005
- “Orion” System (DARPA Radiation Decontamination Program)
  - Deals with decontamination of dirty-bomb materials from common building surfaces
  - Complete decontamination system leverages strippable coatings to facilitate removal and transport of contaminants
  - Phase I demonstration completed April, 2005
- Isolock-VB (HSARPA)
  - Vapor barrier portion of 2-step TIC Neutralization and Removal System
  - Demonstrated for use on: NOx, HSO4, Cyanide, Ammonia, Ethylene Oxide and Cyclohexane remediation
  - Phase I effort will be complete June, 2005
- **IsoDEF™**
  - The first expedient shelter coating designed for barrier protection from chemical, biological and radiological contaminants
  - Demonstrated in live chemical agent trials in Czech Republic (HD Threat)
- Other systems developed by Isotron Team:
  - SprayPoly*: Asbestos control system
  - ALARA-1146*: First-generation radionuclide decon coating designed immediately following Three Mile Island accident.

USSOCOM

Chemical, Biological, Radiological & Nuclear Conference & Exhibition

Responding to the Terrorist CBRN Threat: "Preparation or Panic"

December 6-8, 2005

Chemical Homeland Security System

C-HoSS

Chemical Compliance Systems, Inc.

706 Route 15 South, Suite 207 • Lake Hopatcong, NJ 07849

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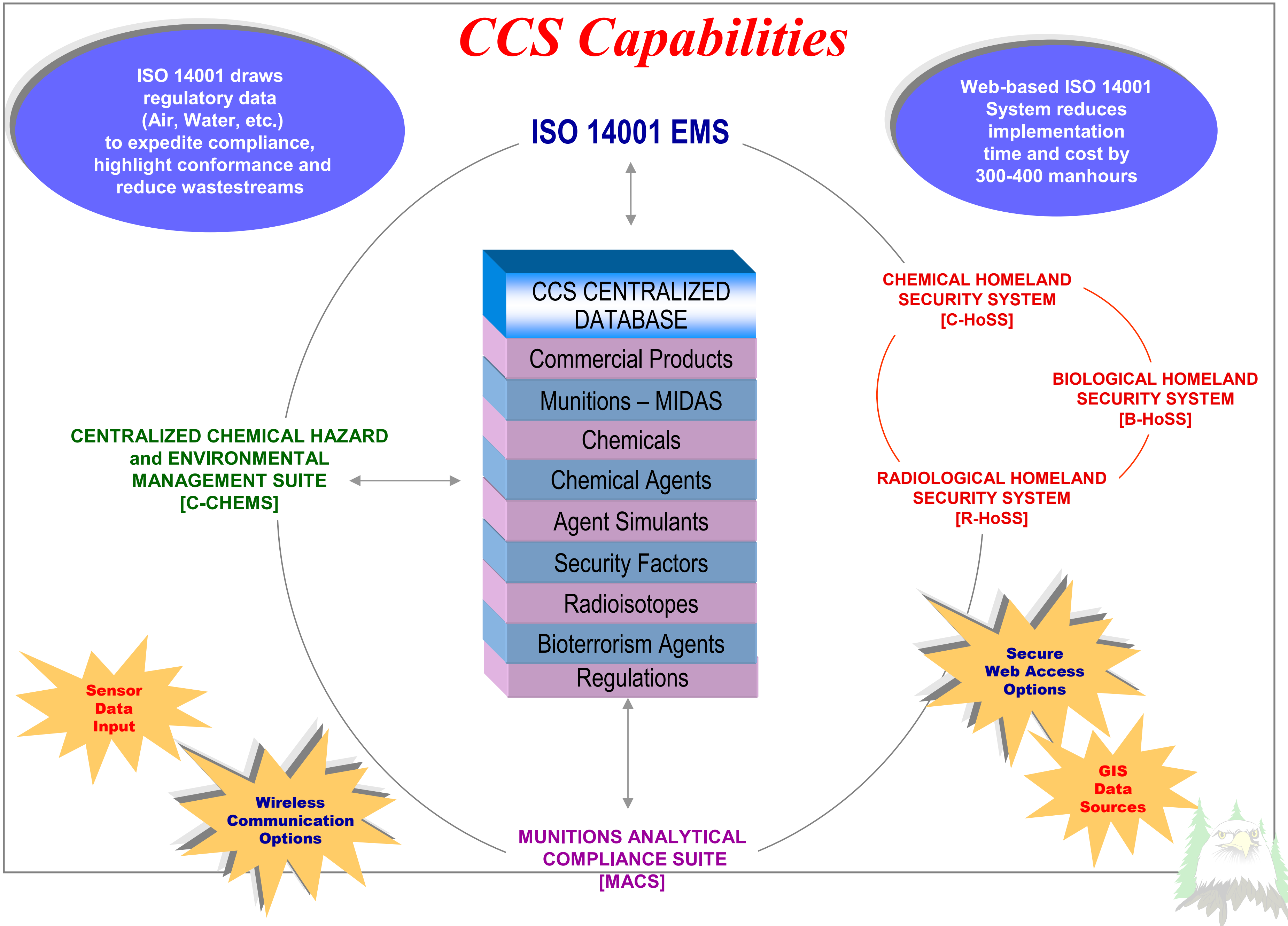
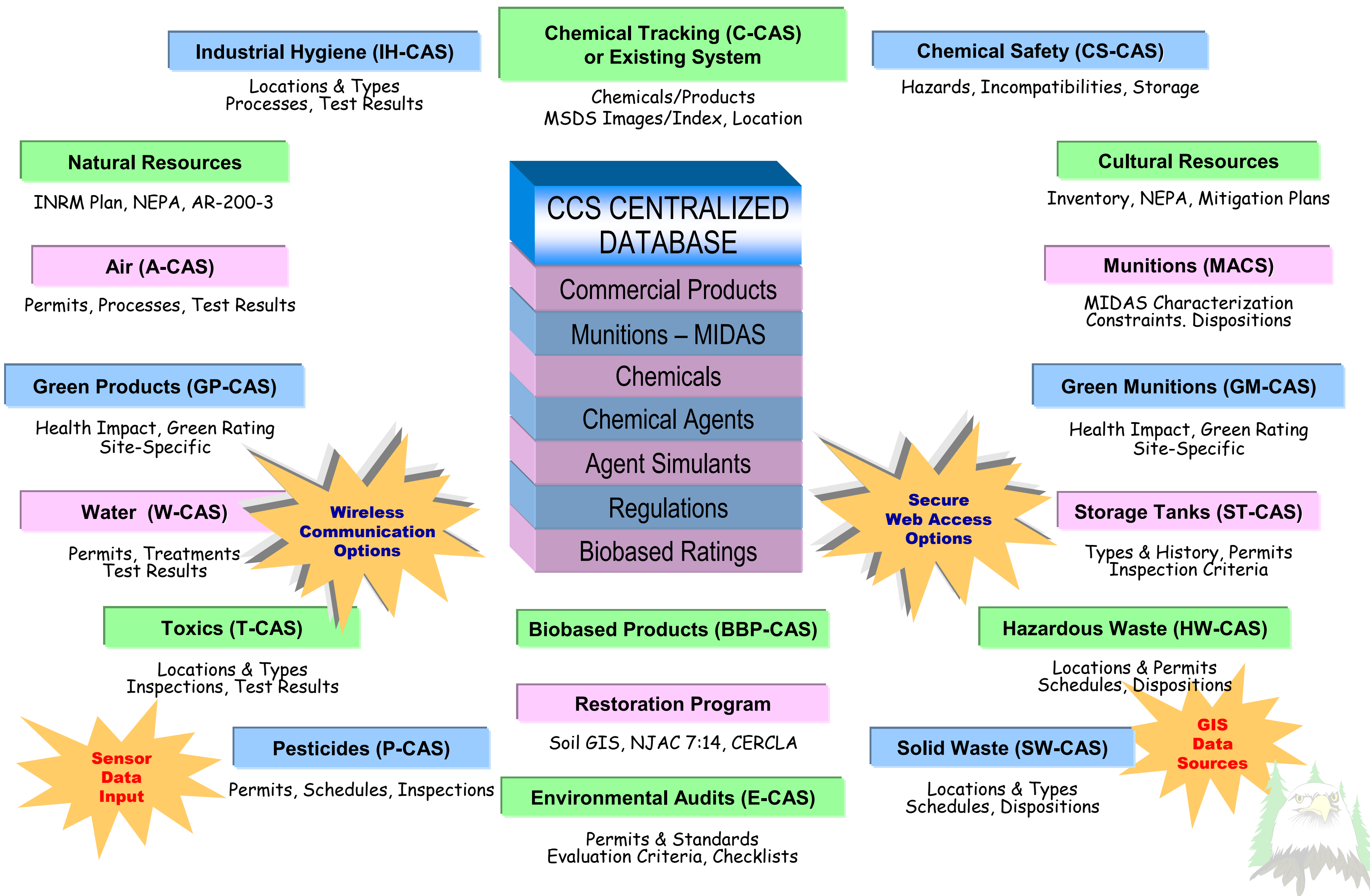
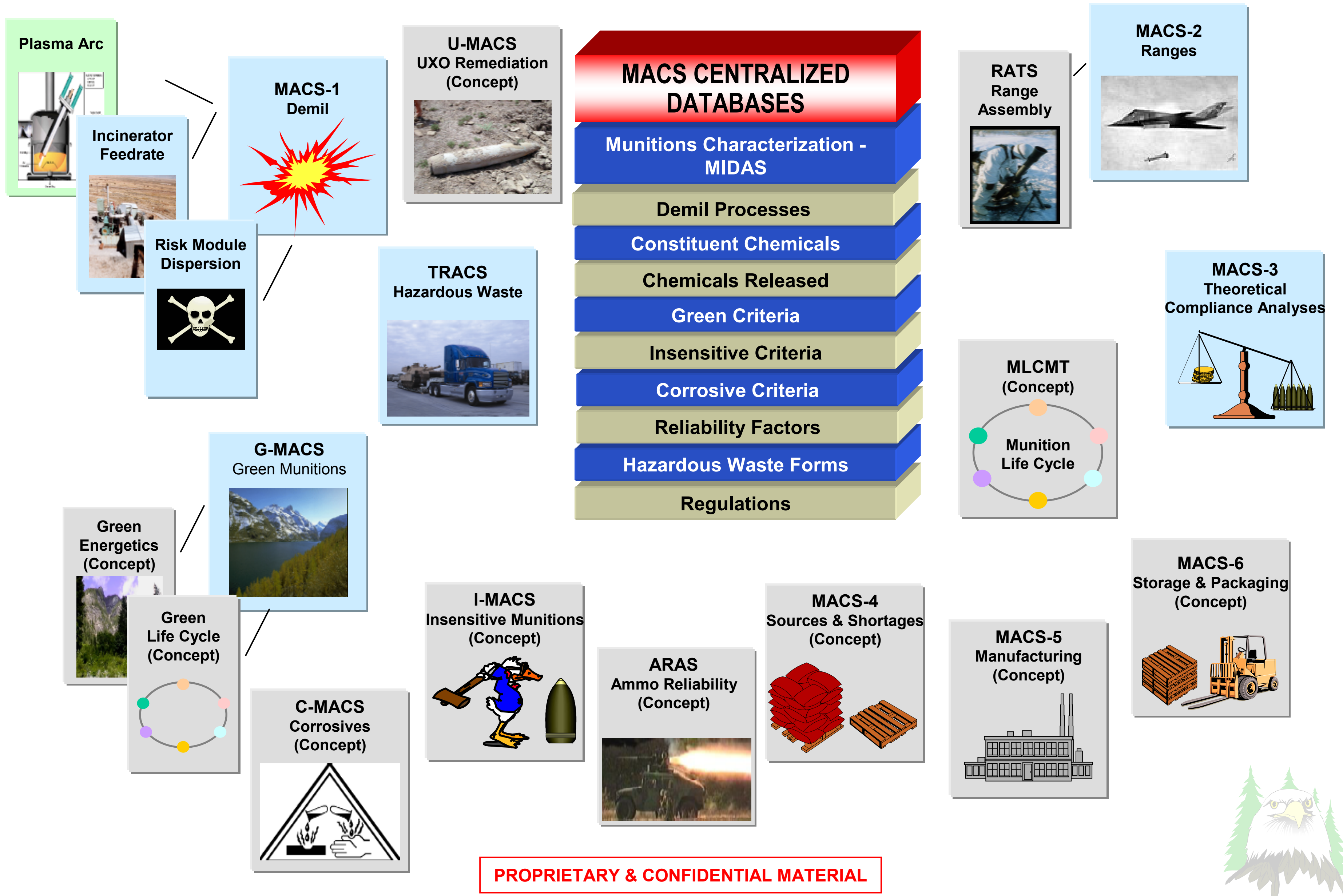

CCS Capabilities
ISO 14001 draws regulatory data (Air, Water, etc.) to expedite compliance, highlight conformance and reduce wastestreams
Web-based ISO 14001 System reduces implementation time and cost by 300-400 manhours
ISO 14001 EMS
CCS CENTRALIZED DATABASE
Commercial Products
Munitions – MIDAS
Chemicals
Chemical Agents
Agent Simulants
Security Factors
Radioisotopes
Bioterrorism Agents
Regulations
CENTRALIZED CHEMICAL HAZARD and ENVIRONMENTAL MANAGEMENT SUITE [C-CHEMS]
CHEMICAL HOMELAND SECURITY SYSTEM [C-HoSS]
BIOLOGICAL HOMELAND SECURITY SYSTEM [B-HoSS]
RADIOLOGICAL HOMELAND SECURITY SYSTEM [R-HoSS]
MUNITIONS ANALYTICAL COMPLIANCE SUITE [MACS]
Sensor Data Input
Wireless Communication Options
Secure Web Access Options
GIS Data Sources

Centralized Chemical Hazard and Environmental Management Suite (C-CHEMS)

Centralized and Relational Databases



Munitions Analytical Compliance Suite (MACS)



Scenario #4

Sleeper Cell Agents Employed As

- Chemical research laboratory technician—Columbia University, NYC
- Large high school custodian—downtown LA
- Supply clerk—Aberdeen Proving Ground, north of Baltimore
- Warehouse manager—large chemical manufacturer, near Chicago

Their Objectives

- Identify internal supply of readily accessible, incompatible chemicals
- Create a massive explosion
- Release substantial quantities of toxic air pollutants (CBR)

Simultaneous Explosions

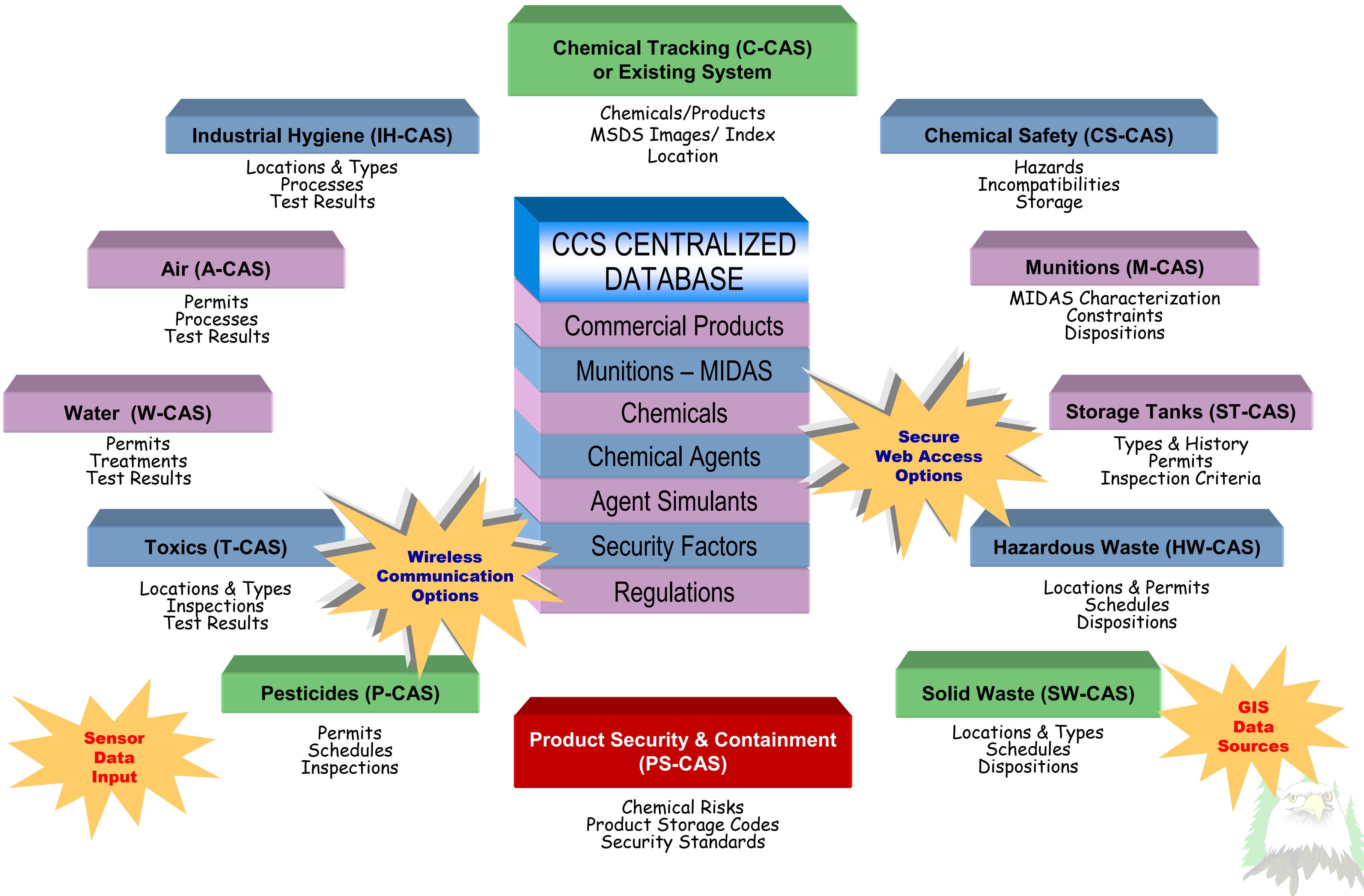
- Same day—in/near 4 major U.S. cities
- Major local panic ➠ national fear
- Substantial loss of life—each site
- Serious long-term health & environmental effects
- Tremendous loss of confidence in homeland security

Perpetrators Continue Their Employment

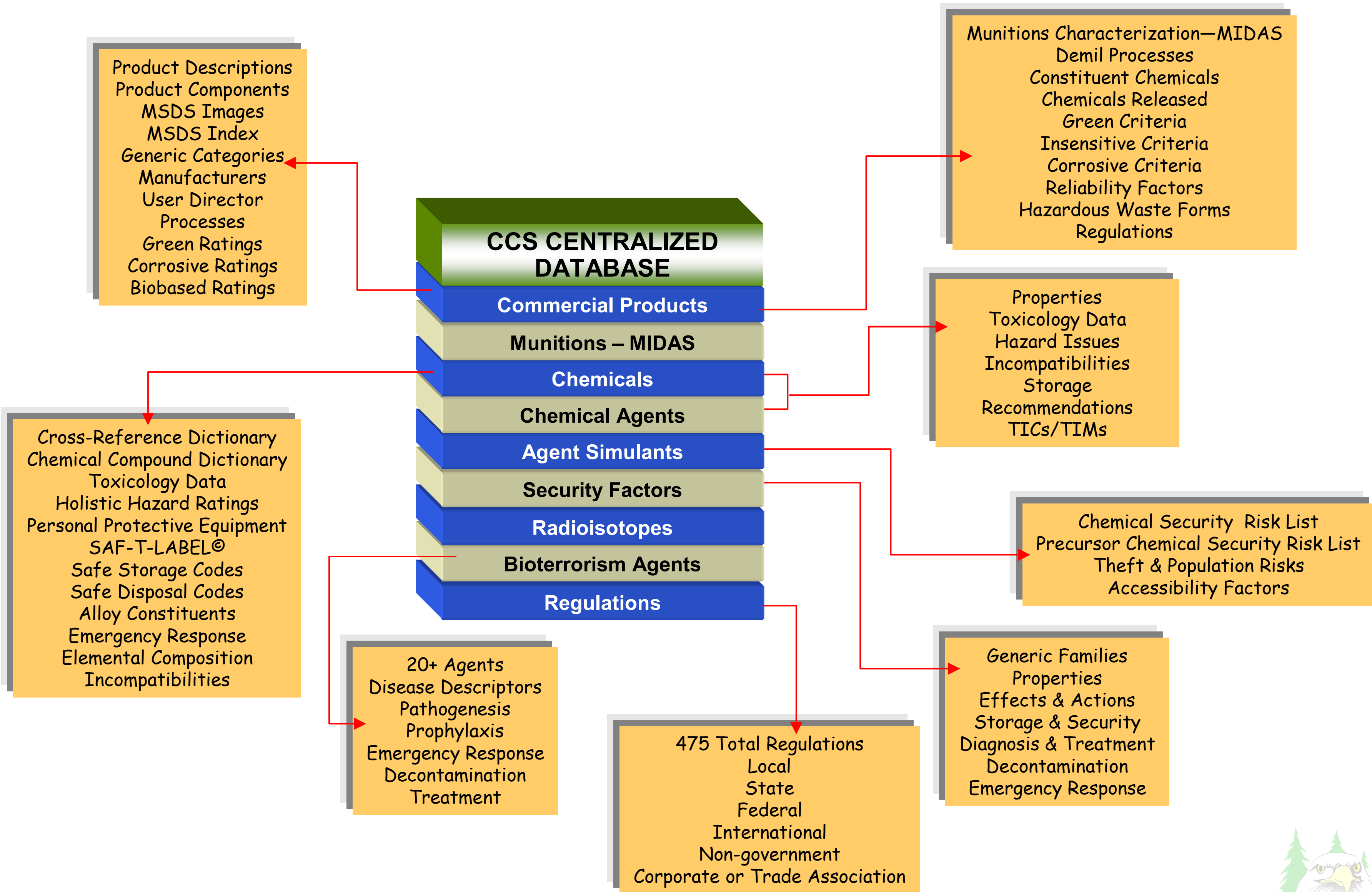
- 1–3 years, then resign
- Seek new employment
- Next targeted institution & city

Chemical Homeland Security System (C-HoSS)

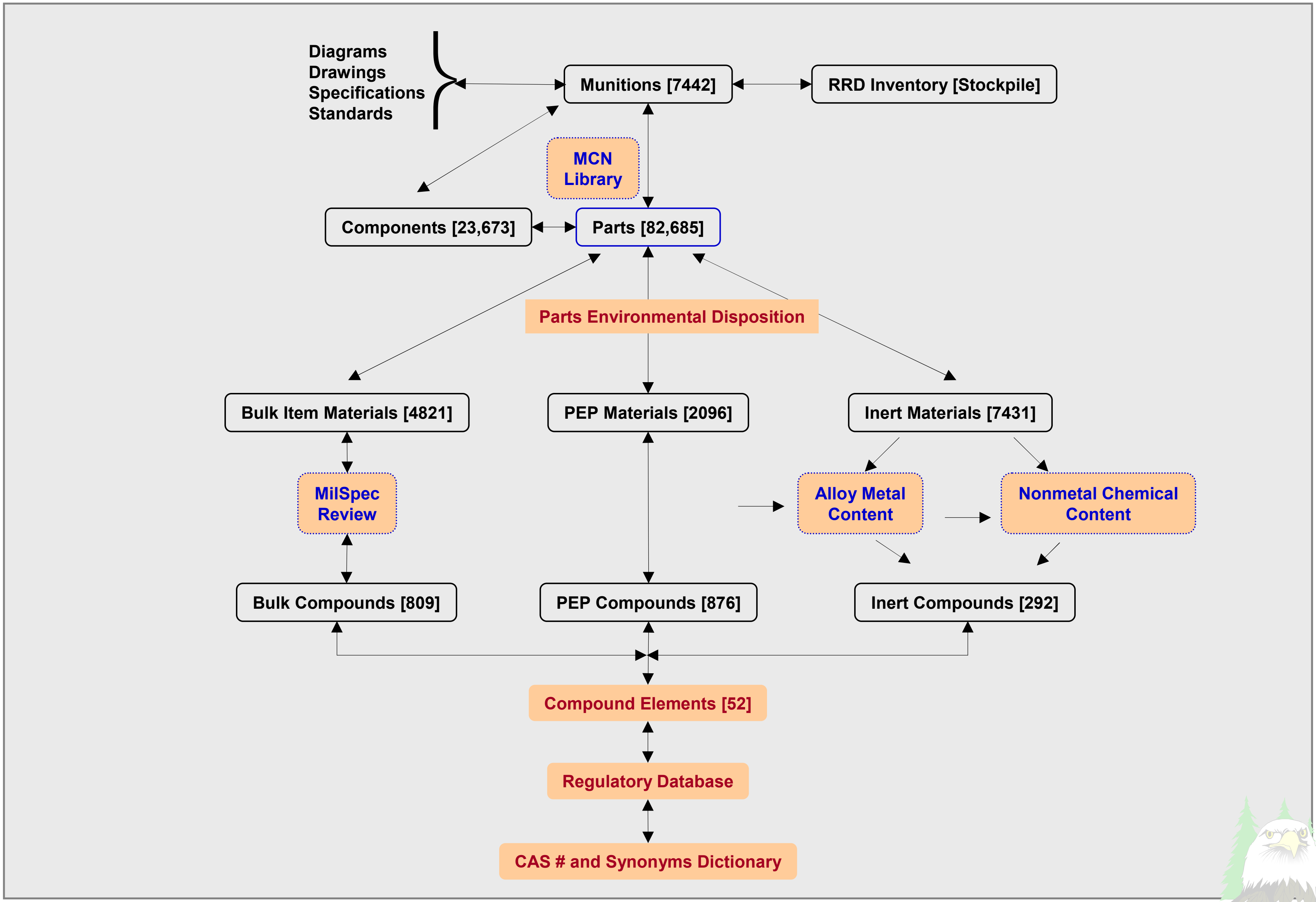
Centralized and Relational Databases



The CCS Relational Chemical and Product Database (R-CPD)



Enhanced MIDAS Database Library



Regulated Hazardous Chemicals

Acute Hazard Orientation

Chemical Agents
Neurotoxins
Extreme
Toxins
Radioactives
Explosives
Shock Sensitives
Corrosives
Flammable
Oxidizers
Hazardous Air Pollutants
Persistent Bioaccumulative Toxins
Priority Pollutants

Chemical Security Risks List

ACGIH
DEA
DOT
EPA
OSHA
California
Iowa
Maryland
Nevada
New Jersey
European Community

CPSC Specialty Regulated Substances

Canada Export Control Lists

DEA Essential Chemicals

DEA Precursor Chemicals

DOC Export Restrictions

EU Black/Gray Lists

IATA Air Transport Forbidden

IATA Passenger Transport Forbidden

IATA Regulated Substances

UK The Red List (Water)

UN/FAO Prior Informed Consent

Precursor Chemical Security Risks List

Chemical Agents and Simulants

Properties

—Structure
—Chemical
—Physical

Toxicology Data

—Human
—Animal
—In Vitro

Hazards

—Protection
—Decontamination
—Persistence
—Use

Incompatibilities

—Chemical
—Conditions
—Containers

Storage Recommendations

—Container
—Conditions
—Distances
—HSAS[a] Variables

---

[a] HSAS = Homeland Security Advisory System

Toxic Industrial Chemicals/Toxic Industrial Materials (TICs/TIMs)

Selected Examples

Industrial Feedstocks:	**Acrylamide, Chlorine, Hydrogen Chloride, Phosgene**
Carbamate Insecticides:	**Baygon, Mobam, Temik, Zectran**
Organochlorine Insecticides:	**Aldrin, Dieldrin, Endrin, Lindane, Heptachlor**
Organophosphate Insecticides:	**Disulfotan, Mevnphos, Parathion, Methylparathion**
Insecticide Synergists:	**Piperonyl Butoxide**
Fungicides:	**Pentachlorophenol, Hexachlorobenzene, Maneb, Naban, Zineb**
Fumigants:	**Calcium Cyanide, Methyl Bromide, Phosphine**
Seed Disinfectants:	**Methylmercury Acetate, Methylmercury Cyanide**

GOALS: [1] Identify all chemicals with severe to extreme acute toxicity
[2] Identify all chemicals in product classes with similar mechanisms of action

Incompatible Chemical Database

(Published Book)

Chemical Class	Chemical	Incompatible Chemical	I.C. Class	Interaction Hazard
Corrosives	Acetic Acid Nitric Acid Chlorine	Hydrogen Peroxide Acetylene Aluminum Powder	Oxidizer Flammable Metal	Explosion Explosion Spontaneous Fire
Flammables	Acetone Benzene Carbon Disulfide	Chloroform Chlorine Potassium	Carcinogen Corrosive Flammable	Explosion Explosion Violent Explosion
Reactives	Nitrotoluene Nitroethane Acrylonitrile	Sulfuric Acid Hydrocarbons Bromine	Corrosive Combustible Corrosive	Explosion Explosion Explosion
Products	Toilet Bowl Cleaner Bleach Paint Solvent	Metal Powders Ammonia Chloroform	Metals Product Carcinogen	Explosion Poisonous Gas Explosion

Safe Chemical Storage Codes

(Published Book)

Code #	Chemical
PK26	Acetaldehyde
PR29	Acetylene
PR01	Ammonia
LG22	Aniline
LG06	Arsenic
RD26	Benzene
PK26	Benzine
YL07	Bromine
LG04	Cadmium
RD27	Camphor
RD09	Carbon disulfide
LG27	Chordane
YL11	Chromic acid
LG23	Coal tar creosote
GN26	Cottonseed oil
GN01	Cupric nitrate
RD26	Cyclohexane
RD27	1,2-Dichlorobenzene
GN22	Dimethylformamide
PK21	2,6-Dinitrotoluene
RD23	Ethyl alcohol
WH20	Formic acid

Code #	Chemical
RD26	n-Hexane
YL10	Hydrogen chloride
YL07	Iodine
RD23	Isopropyl alcohol
GN04	Lead
LG24	Malathion
LG07	Mercuric chloride
YL27	Methyl chloroform
RD26	Methyl methacrylate
RD26	Naphthalene
YL12	Nitric acid
WH23	Phenol
RD06	Phosphorous (yellow)
LG03	Potassium arsenate
GN02	Potassium permanganate
GN08	Soda lime
LG02	Sodium dichromate
RD26	Styrene monomer
YL11	Sulfuric acid
RD26	Toluene
RD26	Turpentine
RD26	Xylenes

Chemical Security Procedures

Security Procedure Phases

Phase I	**Vulnerability Assessment** ***Identify chemical hazards, security risks, mortality risks***
Phase II	**Countermeasures Implementation** ***Reduce vulnerabilities***
Phase III	**Verification Audit** ***Independently confirm counter measure adequacy***
Phase IV	**Management System Integration** ***Integrate chemical security procedures into line management functions***

C-HoSS Security Criteria and Standards

- **Chemical Hazard Class Rankings (*by Hazard Class*)**
- **Chemical Hazard Grades (1-4) (*within each ranking*)**
- **Product Concentration Grades (1-4)**

Chemical Hazard Factor (CHF) = Ranking × Grade × Concentration

- **Theft Risk Grades (1-4) (*per product*)**

Chemical Security Risk Factor (CSRF) = Ranking × Grade × Concentration × Theft Risk

- **Population at Risk Grades (1-4)**

Chemical Mortality Risk Factor (CMRF) = Ranking × Grade × Concentration × Theft Risk × Population Risk

- **Accessibility Factor Levels (*Storage Constraint Levels and Descriptors*) (0.5 - 4.5)**

CMRF × Accessibility Factor (AF) = Vulnerability Factor (VF)

Chemical Security Product Storage Codes

• Based Upon CSRF	• Codes = AF Levels [a]
CSRF = 600, or CHF = 38 [b]	= AF Level 1
CSRF = 1200, or CHF = 75	= AF Level 2
CSRF = 1800, or CHF = 100	= AF Level 3
CSRF = 2400, or CHF = 150	= AF Level 4

[a] AF Levels will be calculated at 1/2 step intervals.
[b] Whichever is lower for a hazardous material.

Chemical Security Criteria and Homeland Security Advisory System (HSAS) Correlation

	HOMELAND SECURITY ADVISORY SYSTEM (HSAS)				
	SEVERE	HIGH	ELEVATED	GUARDED	LOW
	Red	Orange	Yellow	Blue	Green
If CSRF = or CHF =	> 400 or 50	> 800 or > 80	> 1600 or > 110	> 2400 or > 130	> 2800 or > 160
Then AF Increases	2 Levels	1.5 Levels	1.0 Levels	0.5 Levels	0 Levels

C-HoSS Security Risk Assessment Analytical Reports

PRODUCT & CHEMICAL ANALYSES

Inventory by Product Type [a]
Product by Location
Product by Container Size
Product by Weight
Product Hazard Classifications
Product Hazard Rankings
Product Hazard Grades
Product Hazard Factors
Product Security Risk Factors
Product Accessibility Factors
Product Accessibility Levels/Storage Codes
Chemicals by Product
Pure Chemicals by Location
Pure Chemicals by Weight

PRECURSOR CHEMICAL ANALYSES

Precursor Chemicals by Location
Precursor Chemicals by Container Size
Precursor Chemicals by Weight
Precursor Chemicals Hazard Classifications [b]
Precursor Chemicals Hazard Rankings
Precursor Chemicals Hazard Grades
Precursor Chemicals Hazard Factors
Precursor Chemicals Security Risk Factors
Precursor Chemicals Accessibility Factors
Precursor Chemicals Accessibility Levels/Storage Codes

SPECIALTY MODULE ANALYSES

Air Releases
Water Contaminants
Toxics
Pesticides
Hazardous Waste
Solid Waste
Storage Tanks
Munitions
Chemical Safety
Industrial Hygiene

INCOMPATIBILITY ANALYSES

Prioritized Incompatibility Threats by Product
Prioritized Incompatibility Threats by Room
Prioritized Incompatibility Threats by Building
Prioritized Incompatibility Threats by Facility

SECURITY ANALYSES

Inventory by CHF
Inventory by CSRF
Inventory by AF
Inventory by Storage Levels
Inventory (shift) by HSAS

---

[a] Chemical, Precursor Chemical, Munition, Chemical Agent, Simulant.
[b] Assigned by their worst classification: (1) innate classification, or (2) reaction product classification.

C-HoSS Capabilities vs. Chemical Security Procedures

Security Procedure Phases	C-HoSS Capabilities
PHASE I **Vulnerability Assessment** *Identify chemical hazards, security risks, mortality risks*	Chemical Hazard Factor Report Chemical Security Risk Factor Report Chemical Mortality Risk Factor Report Chemical Vulnerability Risk Factor Report
PHASE II **Counter Measures Implementation** *Reduce vulnerabilities*	Accessibility Factor (Storage Constraint) Report (per chemical/material)
PHASE III **Verification Audit** *Independently confirm counter measure adequacy*	Chemical Vulnerability Factor "Report Card" (to the local fire department)
PHASE IV **Management System Integration** *Integrate chemical security procedures into line management functions*	Integration of C-HoSS w/ chemical tracking system Daily C-HoSS correlation w/ Homeland Security Advisory System

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National Nuclear Security Administration
Defense Nuclear Nonproliferation

Global Threat Reduction Initiative

Reducing the Threat of Nuclear & Radiological Terrorism

Kurt Westerman

Presented at
USSOCOM CBRN Conference
December 6-8, 2005

Reducing the Threat of Nuclear or Radiological Terrorism (Scenario 1)

National Nuclear Security Administration
Defense Nuclear Nonproliferation

An Act of Nuclear or Radiological Terror has two components:

- **Enemies of the State willing to carry out such an attack**
- **The technical means to produce a weapon**
    - Purchase a weapon from an existing nuclear power
    - Develop a weapon using nuclear or radiological material

To reduce the threat of nuclear or radiological terror, we can address either or both of these components, by:

- Eliminating those enemies willing to employ these devices
- Preventing the enemy's acquisition and employment of nuclear and/or radiological weapons/materials

Preventing the Enemy from Acquiring Nuclear/Radiological Materials

The US Government has many organizations that play a key role in preventing the enemy from acquiring nuclear and/or radiological materials. Some of these major players include:

- **Department of Energy - National Nuclear Security Administration's Office of Defense Nuclear Nonproliferation**
- **Department of Defense – Defense Threat Reduction Agency, the geographical Combatant Commanders, USSOCOM**
- **Department of State – Bureau for International Security and Nonproliferation, Bureau for Verification, Compliance, and Implementation, others**
- **Department of Homeland Security – Domestic Nuclear Detection Office, Transportation Security Administration, Customs and Border Protection, Coast Guard**
- **Federal Bureau of Investigation**
- **Central Intelligence Agency**
- **Nuclear Regulatory Commission**

Preventing the Enemy from Acquiring Nuclear/Radiological Materials

NNSA
National Nuclear Security Administration
Defense Nuclear Nonproliferation

These government agencies have developed a broad range of programs to deter, detect, defeat, or respond to the nuclear/radiological threat at home and abroad. These programs focus on the full spectrum of prevention and response, including:

- **Weapons/material elimination or secure disposal**
- **Facility/Site Security (deter theft)**
- **Facility/Site Monitoring (detect theft)**
- **Local Security Response (defeat and recover)**

GTRI

- **Detect movement of weapons/material abroad**
- **Interdict shipment abroad**
- **Detect entry into US (Border/Ports)**
- **Interdict weapon prior to employment**
- **Consequence management after attack**
- **Forensic analysis & response**

Given the lack of an overall architecture to direct and coordinate these programs, it is essential to have good interagency communications to ensure that programs are complementary rather than duplicative.

GTRI Mission

Defense Nuclear Nonproliferation

The Global Threat Reduction Initiative was created in May 2004 to:

1. <u>Consolidate</u> existing DOE nuclear material removal and radiological material security efforts *into a single NNSA office* to maximize synergy of mission and effectively leverage technical expertise and resources

- **Russian Research Reactor Fuel Return Program (RRRFR)**
- **Reduced Enrichment for Research and Test Reactors Program (RERTR)**
- **Foreign Research Reactor Spent Nuclear Fuel (FRRSNF) Acceptance Program**
- **BN-350 Spent Fuel Disposition Project**
- **Radiological Threat Reduction Program**

2. <u>Accelerate</u> nuclear material removal and security timelines, in some cases by as much as 50%, identify the highest risk materials as immediate priority recoveries, and develop combined diplomatic and operational action plans to carry out these efforts

3. <u>Expand</u> existing efforts to address other nuclear and radiological materials not yet covered under existing threat reduction efforts

Global Threat Reduction Initiative (GTRI) Focus

National Nuclear Security Administration
Defense Nuclear Nonproliferation

GTRI focuses on the large quantities of nuclear and radiological materials that are not adequately secured and pose an immediate and urgent proliferation and terrorist threat

High-Risk Civilian Nuclear Materials Worldwide

- **Over 140 research reactors around the world still operating with highly enriched uranium**
- **Over 300 shut-down research reactors and associated facilities have large quantities of spent fuel**
- **Approximately 4 metric tons of Russian-origin fresh and spent fuel at more than 20 research reactors in 17 countries**
- **Approximately 20 metric tons of U.S.-origin research reactor spent fuel in more than 40 countries**

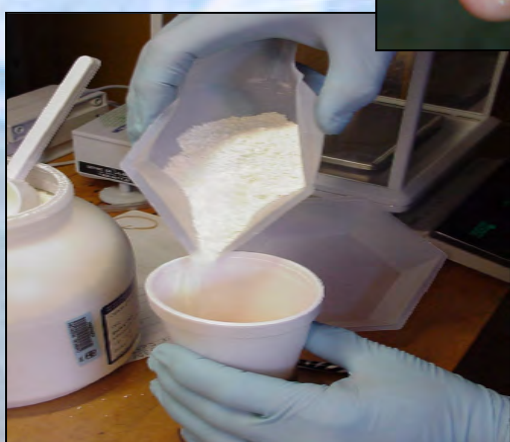
High-Risk Radiological Materials Worldwide

- **High-risk radiological materials exist in virtually every country**
- **Thousands of high-risk radiological sources exist across the U.S.**
- **Many of these sources are not longer in use, some have been abandoned**

At-Risk Materials

- The threat can come in a variety of forms and sizes, ranging from person portable (in a pocket) to truck-size









Basic Principles of Material Security (Eliminate, Detect, Delay, Respond)

National Nuclear Security Administration
Defense Nuclear Nonproliferation

- **Elimination: The less material there is, the easier/cheaper it is to secure**
  - Elimination of Weapons Grade Nuclear Material
  - Recovery and secure disposal of disused radiological sources
- **Detection: It is easier/cheaper to secure material at its source, than to re-secure it after it has gone missing**
  - Intrusion detection is relatively inexpensive
  - Detection/monitoring systems deter insider participation
- **Delay: The longer it takes to remove the material, the greater the chance of stopping the theft**
  - Locks, barriers, equipment dispersal can add to delay time
  - On-site response force provides additional delay
- **Response: The sooner we know that material has been stolen, the greater the likelihood of interdiction and recovery**
  - Real time monitoring and alarms to offsite responders
  - Dedicated off-site response force enhances effective response
  - The faster the response, the smaller the footprint of search

The Office of Global Radiological Threat Reduction

(NA-211)

U.S. Radiological Threat Reduction Program (US RTR)

National Nuclear Security Administration
Defense Nuclear Nonproliferation

Mission

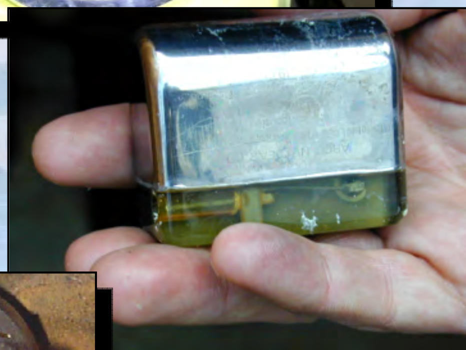
Identify, recover, secure and store on an interim basis radiological materials in the United States that could be effectively used as a radiological dispersal device (RDD) or "dirty bomb." This includes identifying, recovering, securing and storing on an interim basis Greater than Class C radiological sealed sources that are voluntarily declared unwanted and unused and other radiological materials considered at-risk.

The Threat Within the U.S. - Vulnerable Radiological Sources

- Abandoned Well-logging Sources (Americium/Beryllium and Cesium-137 sources).

- Well-logging sources declared excess and unwanted by a licensee.

The Threat Within the U.S. - Vulnerable Radiological Sources

Large and Small ^{241}AmBe Neutron Sources; Pure ^{241}Am sources; Small ^{241}Am Gauge and Calibration Sources

^{238}Pu Neutron Sources, Heat Sources and Medical Pacemakers

^{239}PuBe Neutron Sources, DOE-owned Under Old Loan-lease Programs

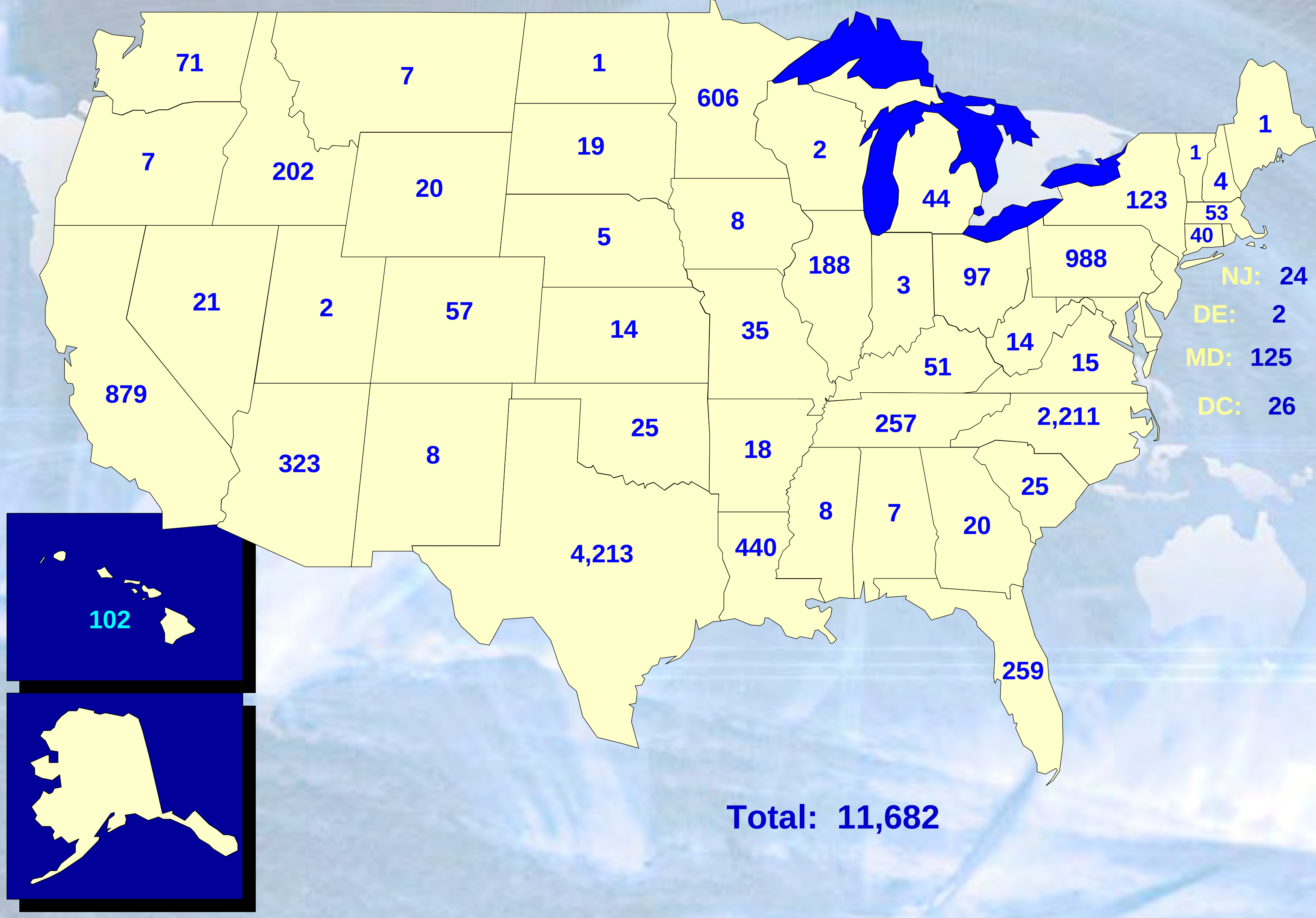
^{90}Sr Radioisotope Thermoelectric Generators

US RTR Accomplishments and Current Activities

- **More Than 11,000 Sealed Sources Recovered Since 1993 (101,180 curies)**
- **Exceeded Congressional Goal**
  - **5,529 Sources Recovered Oct. 2002 - March 2004**
- **Interagency Coordination**
  - **Recovered Orphan Sources From New York, Boston, and Houston Area Prior to National Security Events**
  - **Responded to an Emergency Request From NRC to Recover Nearly 500 Sources From a Bankrupt Licensee in Pennsylvania**
  - **Provided Technical Support to IAEA**
- **Radiological Pilot Project**
  - **Supporting DHS and Working with NRC and Others**
  - **Security Enhancement Surveys for Medical Facilities in New York**
  - **Security Training for Radiation Professionals**
  - **Radiological Security Training for Law Enforcement**

USRTR Recoveries by State

National Nuclear Security Administration
Defense Nuclear Nonproliferation



International Radiological Threat Reduction

Mission

Reduce on a global basis the threat posed by high-risk radiological materials by identifying, recovering, securing and disposing of such materials on an accelerated basis, as well as facilitating long-term sustainability that provides for effective controls.

The Threat Abroad – Industrial, Research, and Medical Radiological Sources

National Nuclear Security Administration
Defense Nuclear Nonproliferation

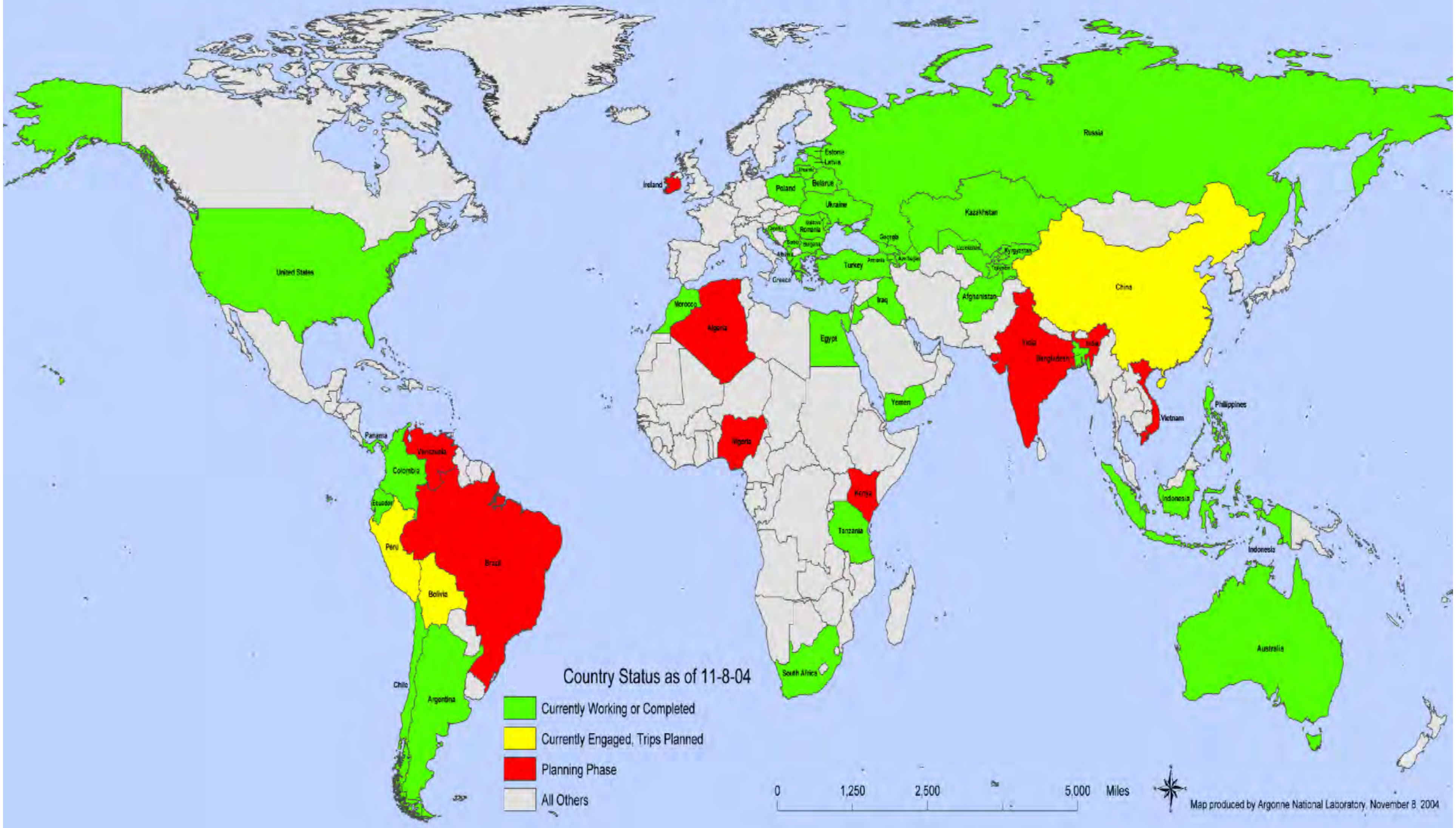
Cs-137 Seed Irradiators Stored in an Open Field.

Recovered RTGs

Abandoned Radio-isotopic Thermal-electric Generators (RTGs) in the FSU

National Nuclear Security Administration
Defense Nuclear Nonproliferation

Global RTR Efforts



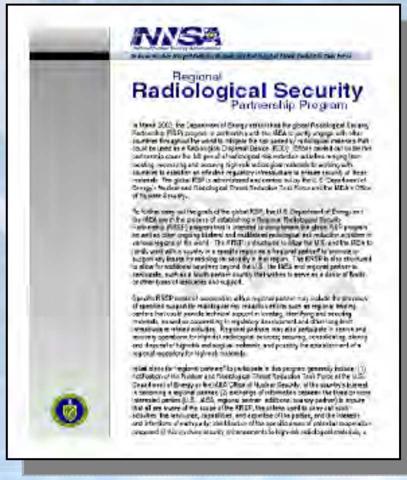
IRTR Activities & Accomplishments

Bi-lateral and multi-lateral projects in over 40 countries:

- **72 RTGs recovered**
- **7 RTG recoveries in progress**
- **Security Upgrades completed at 165 facilities/sites (as of end of FY05)**
- **Security Upgrades in progress at 234 facilities/sites (as of end of FY05)**

Partnerships and Specialized Programs

- **IAEA Cooperation**
  - **Global Radiological Security Partnership**
  - **Radiological Regional Security Partnership Program**
  - **Significant funding support to other radiological security activities via the Nuclear Security Fund (NSF), including support to IAEA radiological missions (e.g., INSServ, RaSIA), regulatory systems (RAIS), and overall support of the Code of Conduct.**



- **Radiological hand-held detection equipment and training for first-responders (CRITr)**
- **Radiological search and secure equipment and training**
- **Interpol Cooperation - Radiological hand-held detection equipment transfers and training**

Defense Nuclear Nonproliferation

Office of Global Nuclear Materials Threat Reduction

(NA-212)

Scope of the Nuclear Materials Threat

National Nuclear Security Administration
Defense Nuclear Nonproliferation

- **Over 160 research reactors around the world are still operating on highly enriched uranium – 134 of these are civilian**
- **Approximately 4,000 kilograms of Russian-origin fresh and spent HEU fuel at over 20 sites in 17 countries**
- **Approximately 20,000 kg of eligible U.S.-origin spent nuclear research reactor fuel and targets in 41 countries**

  ~5,000 kg of HEU

  ~15,000 kg of LEU
- **In addition, there are approximately 3,000 kg of high-risk, weapons-grade uranium and plutonium that are not covered under existing programs and would be candidates for securing and/or removing**

IAEA Nuclear Bomb Equivalents: 25 kg HEU / 8 kg PU

GNMTR Programs

Defense Nuclear Nonproliferation

Six programs work in concert to secure and/or eliminate high-risk, vulnerable nuclear materials at civilian nuclear facilities worldwide with the goal of preventing terrorists from acquiring weapons-usable nuclear material:

- **Reduced Enrichment for Research and Test Reactors (RERTR) -** Convert research reactors and medical isotope production processes to the use of LEU
- **Global Research Reactor Security (GRRS) –** provides security upgrades to research reactors and related sites outside of the United States and the FSU
- **Russian Research Reactor Fuel Return (RRRFR) –** repatriates fresh and irradiated Russian-origin research reactor fuel back to Russia
- **Foreign Research Reactor Spent Nuclear Fuel (FRR SNF) Acceptance –** repatriates US origin spent nuclear fuel back to the US
- **BN-350 Spent Fuel Disposition (BN-350) –** provides safe and secure long-term storage for 3000Kg of plutonium bearing spent nuclear fuel from the BN-350 fast breeder reactor in Kazakstan
- **Emerging Threats and Gap Materials (ET) –** addresses high-risk, vulnerable nuclear materials not covered in the existing programs

GNMTR Activities & Accomplishments

Global Research Reactor Security Program:

Secured approximately 13,000 kg of irradiated HEU, 2,500 kg of fresh HEU, and 3,000 kg of plutonium at 18 high-priority sites

Reduced Enrichment for Research and Test Reactors:

40 civilian research reactors converted to LEU in place of HEU

Accelerated development of new high-density LEU fuel to allow additional conversions

Russian-Origin Fuel Return Program:

122 kg of Russian-origin fresh HEU repatriated to Russia

Foreign Research Reactor Spent Nuclear Fuel Return:

Over 1,200 kg of US-origin HEU returned from 27 countries

BN-350 project:

3,000 kg of plutonium in Kazakhstan placed under IAEA safeguards

Global Threat Reduction Initiative International Partners' Conference

More than 590 representatives from 100 countries attended the Global Threat Reduction Initiative International Partners' Conference in Vienna, Austria from September 18-19, 2004

Conference Findings were adopted which included the following:

- ***Acknowledged*** **all states share the objectives of GTRI**
- ***Recognized*** **that some states may require assistance in addressing activities under GTRI**
- ***Supported*** **acceleration and expansion of current threat reduction programs**
- ***Supported*** **conversion of research reactors from highly enriched uranium (HEU) to low enriched uranium (LEU) fuel, *where feasible***
- ***Encouraged*** **all states to participate where possible**
- ***Recommended*** **all Member States work together with the IAEA to coordinate a mechanism to address opportunities for implementing GTRI projects and programs**

Conclusion

- **Significant quantities of vulnerable nuclear and radiological materials exist worldwide that pose a proliferation and terrorist threat**
- **In close cooperation with our international partners, the Global Threat Reduction Initiative is working to address these materials**
- **GTRI is an integral part of the interagency approach to reducing the threat of nuclear and radiological terrorism**
- **Interagency communication and cooperation is essential in preventing an attack by nuclear or radiological weapons in the US**