



◆ UNCOMPROMISING INTEGRITY ◆ RESPECT FOR ALL ◆ COMMITTED TO EXCELLENCE ◆ ALWAYS READY ◆



# JPEO-CBRND

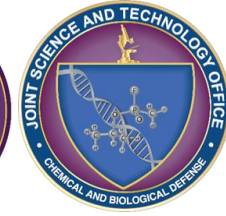
## DEVELOPING SENSORS TO ADDRESS CBRN THREATS

22 JULY 2022

Colonel Robert Carter III, Ph.D., M.P.H.  
JPM CBRN Sensors



# WHO WE ARE AND WHAT WE DO



**JPEO-CBRND**

**MISSION:** Provide integrated layered chemical, biological, radiological, and nuclear defense capabilities to the Joint Force across Combined Joint All-Domain Operations

**VISION:** A resilient Joint Force enabled to fight and win unencumbered by a chemical, biological, radiological, or nuclear environment; championed by innovative, agile, results-oriented acquisition professionals

**COVID CLAIMS OVER 5+ MILLION LIVES**

**SALISBURY NERVE AGENT POISONING**

**SYRIA SARIN ATTACK**

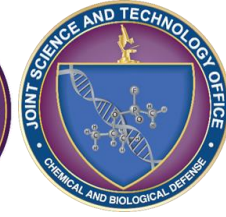
**KIM JONG-NAM ASSASSINATION**

**CBBDP**

**MISSION:** Anticipate future threats and deliver capabilities that enable the Joint Force to fight and win in CB-contested environments

**VISION:** A Joint Force ready to fight and win in CB-contested environments through a coordinated effort designed to neutralize adversarial CB threats

# JPEO-CBRND ORGANIZATION LEADERSHIP



Deputy JPEO  
**Ms. Nicole Kilgore**  
 .....  
 Executive Assistant  
 Ms. Carol Keyes



JPEO  
**Mr. Darryl Colvin**  
 .....  
 Executive Assistant  
 Ms. Heather Steinhilber



Executive Officer  
**MAJ Eric Hearn**



Chief of Staff  
**Mr. Gordon Graham**  
 .....  
 Executive Assistant  
 Ms. Stefanie Jaron



Assistant JPEO –  
 Medical  
**COL Derek Draper**



Assistant JPEO  
**Ms. Emma Wilson**

## Joint Project Managers (JPM)



JPM CBRN Protection  
**Ms. Deborah Olson**  
 .....  
 Executive Assistant  
 Ms. Brenda Lopez-Price



JPM CBRN Medical  
**COL Matt Clark**  
 .....  
 Executive Assistant  
 Ms. Jenn Scott



JPM CBRN Sensors  
**COL Robert Carter III**  
 .....  
 Executive Assistant  
 Ms. Marjorie (Margie)  
 Giles



JPM CBRN Special  
 Operations Forces  
**Mr. Michael Poe**  
 .....  
 Executive Assistant  
 Ms. Tiffany Dickinson

## Joint Project Leads (JPL)



JPL CBRND Enabling  
 Biotechnologies  
**Mr. Bruce Goodwin**  
 .....  
 Executive Assistant  
 Ms. Shelley Hilgenberg



JPL CBRN Integration  
**Mr. Paul Gietka**  
 .....  
 Executive Assistant  
 TO BE ANNOUNCED

# JPEO-CBRND

## MODERNIZATION FOCUS AREAS



### MODERNIZE BIOLOGICAL DEFENSE

- Flexible, Scalable, and Interoperable Threat Agnostic Detection
- Pre-symptomatic and Rapidly Reconfigurable Diagnostics
- Open-Architecture Diagnostic Assays and Platforms
- AI-based and Biological Models to Assess Efficacy and Safety
- Host-Response Assays



### INTEGRATED EARLY WARNING

- Threat Characterization and Hazard Modeling
- Artificial Intelligence and Machine Learning
- Wearable Sensors
- CBRN Information Nested with Joint All-Domain Command and Control (JADC2)

### UNENCUMBERING THE WARFIGHTER

- Unobtrusive Individual Protection
- Biothreat Containment and Aeromedical Evacuation to Assure Continuity of Operations
- Quick and Effective Decontamination to Contain and Neutralize Spread



# INTEGRATED LAYERED CBRN DEFENSE



SPACE

CYBER

AIR

LAND

MARITIME

## UNDERSTAND



RECONNAISSANCE



CBRN SUPPORT TO  
COMMAND AND CONTROL



DETECTION



EARLY WARNING



DIAGNOSTICS

## PROTECT



PRE-EXPOSURE PROPHYLAXIS



INDIVIDUAL



COLLECTIVE

## MITIGATE



POST-EXPOSURE PROPHYLAXIS



TREATMENTS



PERSONNEL DECON



EQUIPMENT/OBJECT DECON



AREA DECON

KEY  
■ PROTECTION ■ MEDICAL ■ SENSORS

# JPEO-CBRND

## Portfolio Overview



**92 Acquisition Efforts • FY22 CDBP Budget: \$807.6+M** (\$465.3M RDTE; \$342.2M PROC)

<b>JPL CBRN INTEGRATION</b> 	<b>JPM CBRN PROTECTION</b>			<b>JPL CBRND EB</b> 
	<b>▶ COLLECTIVE</b> 	<b>▶ INDIVIDUAL</b> 	<b>▶ DECONTAMINATION</b> 	
	<b>JPM CBRN MEDICAL</b>			
	<b>▶ PROPHYLAXIS</b> 	<b>▶ DIAGNOSTICS</b> 	<b>▶ THERAPEUTICS</b> 	
<b>JPM CBRN SENSORS</b>	<b>JPM CBRN SPECIAL OPERATIONS FORCES</b>			
	<b>▶ POINT/STANDOFF DETECTION</b> 	<b>▶ RECONNAISSANCE</b> 	<b>▶ AUTONOMOUS</b> 	
	<b>▶ PROTECTION</b> 	<b>▶ MEDICAL</b> 	<b>▶ SENSORS</b> 	



## **BLUF:**

### **What is ideal CBRN Sensor for the Complex Operational Environment?**

- Is an inexpensive, portable, foolproof device that responds with perfect and instantaneous selectivity to a particular target toxin, biologic or chemical substance, in any operationally relevant environment.

CBRN sensors are complex devices, and are generally optimized for a particular application.

Overarching Mission: Provide key enablers that provide situational awareness and decision support to Commanders as they project combat power and evaluate risk in all phases of Multi-Domain Operations

# **CBRN SENSOR LIMITATIONS IMPACT PRODUCT DEVELOPMENT AND DELAYED DELIVERY OF CAPABILITIES**

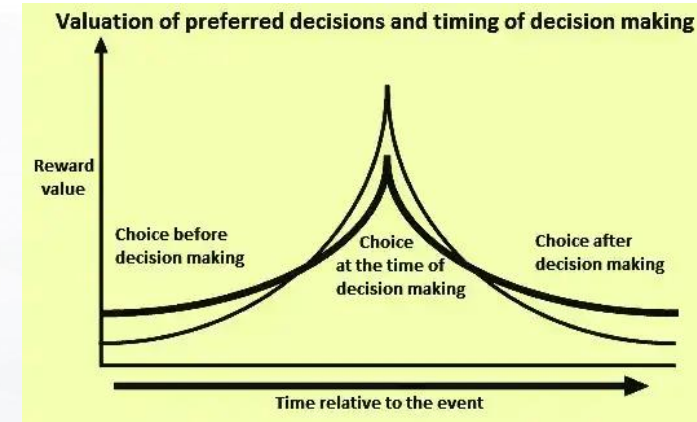
- ❖ **CBRN Threat:** Growing threat in the modern world and brought to light by recent high-profile incidents
  - ❖ Leaks from the Fukushima Daiichi Nuclear Plant + Earthquake spread irradiated seawater into the pacific (World Nuclear Association 2020)
  - ❖ Release of the Novichok nerve agent in Salisbury (Carlsen 2018)
  - ❖ Chemical weapons are confirmed to have been used in Syria (Wojtas and European Commission DG Home Affairs 2018)
- ❖ **Threat Detection, Response & Material Solution:** Limitations of the CBRN capabilities (sensor) become apparent in the late stages of development and/or limited available sensor solutions to address emerging threats



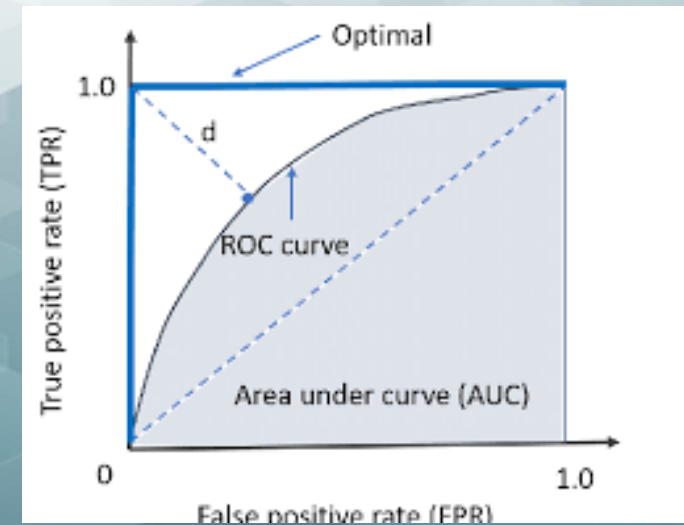
# CBRN SENSOR HISTORICAL R&D CHALLENGES

- ❖ **Selectivity:** Discriminating Chemical and Biological agents in different states of matter (aerosol, vapor, etc.)
- ❖ **Sensitivity:** Detecting sub-threshold and low concentrations of Chemical and Biological agents
- ❖ **Stability:** Difficulty in detecting agents of interest across changes in ambient conditions relevant to Multi-domain operations
- ❖ **Response time:** Typically on the order of tens of seconds to minutes to hours (require operationally relevant response times)
- ❖ **Reproducibility:** Inconsistent responses to the same agent over time
- ❖ **Sensor-Level Performance (ROC Curve):** True positive, true negative, false positive and false negative and measure detection results against the knowns (systematic biases like overconfidence )

## Response Time



## Confidence in Data



# **GRAND CHALLENGES**

## **HOW CAN HELP INDUSTRY US “STRIDE” INTO THE FUTURE?**

- ❖ **Sensitive/Selective Strategy:** More S/S detection strategies and measuring principles and new analytical methodologies to develop modern sensing devices and instruments (Go/No Go)
- ❖ **Technological:** Challenges of sensor devices which as Size, Weight and Power + Cost/Sustainability
- ❖ **Reliable Integration (Sensor Level):** Often disregarded and underestimated, reliable integration of novel materials and structures into sensor devices
- ❖ **Integrated Layered Sensor Approach (Systems Level):** Combination of nanomaterials at a sensor device scale, allowing their full exploitation at the systems level. Common Architecture.
- ❖ **Data:** Critical for integrated layered defense and early warning, sensed data needs to be analyzed and transformed to provide the final feedback to the end user in real-time
- ❖ **Enhanced** using artificial intelligence, deep learning, or other techniques to manage “big data” and development smarter sensors. Managing these increasingly large data sets streaming from highly distributed and heterogeneous sources is a rapidly growing challenge for the Warfighter (Go/No Go)

# CONTACT

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