

# PICARD

## Pursuing Intelligent Complex Aerosols for Rapid Detection

Sherrie Pilkington | Program Manager | 26 SEPT 2022



Intelligence Advanced Research Projects Activity

# I A R P A

Creating Advantage through Research and Technology





# Welcome to the PICARD Proposers' Day!



- Thank you for your interest in PICARD and your participation
- To ensure a clear broadcast stream, audio and visual are disabled for virtual meeting participants
  - Questions and comments can be submitted to the IARPA team via the WebEx chat tool (virtual attendees) or via index cards (in-person attendees)
  - Please direct questions to “All Panelists” in the chat (virtual attendees)
- Questions submitted to the alias ([dni-iarpa-PICARD-proposersday@iarpa.gov](mailto:dni-iarpa-PICARD-proposersday@iarpa.gov)) prior to or during this meeting, and corresponding answers, may be posted in writing online
- A recording of this Proposers' Day will be posted on the PICARD webpage after the end of the event



# Disclaimers



- This presentation is provided solely for information and planning purposes.
- Proposers' Day does not constitute a formal solicitation for proposals or proposal abstracts.
- **The Broad Agency Announcement (BAA) language supersedes anything presented or said by IARPA at Proposers' Day.**
- This meeting is being recorded for later public posting.
- For those viewing the recording, be aware that email addresses, links, and POCs may be outdated. Please refer to [IARPA.gov](http://IARPA.gov) for current information.



# Proposers' Day Goals



1. Familiarize participants with IARPA's outline of the PICARD program and solicit questions and feedback
2. Foster collaborative discussion among potential program participants, i.e., TEAMING
  - An attendance list, with contact information of participants who approved of sharing, will be distributed shortly after the event.
  - The chat feature is enabled for participants to plan future discussions associated with teaming (virtual)
  - There are two breakout rooms available for discussions throughout the day (in-person)
3. Introduce an overview of USG capabilities being utilized for the PICARD program
4. Lightning Talks will be posted publicly on the PICARD webpage until the BAA submission period closes. Additional information can be found on the PICARD webpage: <https://www.iarpa.gov/research-programs/picard>



# Teaming



- Collaboration is encouraged! PICARD is a highly interdisciplinary endeavor.
- *No Government personnel* will be in this room from 2:05 pm til 5:00 pm to allow for open dialogue between participants (lightning talks and teaming discussions).
- Lightning talks are professional material for peers to explore collaborations and resources, for forming the best proposal. The Government's evaluation resides only with the proposal.



# Questions and Feedback



## Proposers' Day Questions

- Questions may be submitted until 12:00 EDT to be considered for a response in the afternoon session.
- Presentations resume at 1:00 pm EDT, with an overview of PICARD T&E capabilities, followed by answers to selected technical questions.
- While all questions will be captured, only a selected subset will be answered in this session.
- Questions may be submitted to the IARPA team until a BAA is published.
- (Virtual attendees) Please use the chat function to submit questions.

## Technical BAA Feedback

- Please send any feedback to: [dni-iarpa-PICARD-proposersday@iarpa.gov](mailto:dni-iarpa-PICARD-proposersday@iarpa.gov)
- IARPA will not respond to feedback individually



# Agenda



Time	Topic	Speaker
10:00am-10:30am	(Attendees can log in early)	N/A
10:30am-10:40am	Welcome, Logistics, Proposers' Day Goals	<b>Sherrie Pilkington</b> Program Manager, IARPA
10:40am-10:50am	IARPA Overview	<b>Pedro Espina</b> Office Director, IARPA
10:50am-11:40am	PICARD Program Overview	<b>Sherrie Pilkington</b>
11:40am-12:00pm	Contracting Overview	<b>Frank Kennedy</b> Department of Interior
12:00pm-1:00pm	Break (Submit questions by 12:00pm)	N/A
1:00pm – 1:30pm	Test and Evaluation Overview	<b>Sherrie Pilkington</b>
1:30pm – 2:00pm	Answers to Selected Technical Questions	<b>Sherrie Pilkington</b>
2:00pm - 2:05pm	Introductions to Lightning Talks	<b>Sherrie Pilkington</b>
2:06pm - 3:11pm	Lightning Talks*	Selected Presenters
3:12pm - 5:00pm	Teaming Discussions*	In-Person Participants

*\*The Government will not attend these events*



# Lightning Talks Agenda



Time	Speaker	Institution
2:06pm – 2:11pm	Dr. Karyn Apfeldorf	Areté
2:12pm – 2:17pm	Dr. Ashish Chaudhary	Detect-Ion
2:18pm – 2:23pm	Dr. Maria Bauer*	Design West Technologies
2:24pm – 2:29pm	Dr. Masoud Agah	Virginia Tech
2:30pm – 2:35pm	Dr. Stephen Roberson	4S-Silversword
2:36pm – 2:41m	Scott Higdon	Spectral Sensor Solutions
2:42pm – 2:47pm	Dr. Aaron Zilkie	Rockley Photonics
2:48pm – 2:53pm	Elizabeth Schundler	Physical Sciences Inc.
2:54pm – 2:59pm	Dr. Anne Dowgiallo	SRI International
3:00pm – 3:05pm	Dr. Danielle Dickinson*	Signature Science
3:06pm – 3:11pm	Dr. Holger Schmidt*	University of California – Santa Cruz
3:12pm – 3:17pm	Dr. Katsuo Kurabayashi*	University of Michigan

# IARPA

## High Risk/High Payoff Research for the IC

**Pedro Espina, PhD | Director, Office of Collection | September 26, 2022**



Intelligence Advanced Research Projects Activity

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# IARPA Mission



**IARPA's mission is to invest in high-risk/high-payoff research that has the potential to provide the U.S. with an overwhelming intelligence advantage over our future adversaries**

- **Our problems are *complex and truly multidisciplinary***
- **We emphasize *Technical Excellence & Technical Truth***
  - Scientific Method
  - Peer/independent review
  - Full and open competition



# Chartered to be Different



- **About taking real risk**
  - NOT about “quick wins”, “low-hanging fruit”, “sure things”, etc.
  - Relatively small size
  - Lean, non-bureaucratic structure
- **Failure is completely acceptable as long as...**
  - It is not due to failure to maintain technical and programmatic integrity
  - Results are fully documented
- **Leverage the best and brightest**
  - Focus on potentially change-state technologies
  - Highly flexible and adaptive research program
  - Competitive awards and world-class Program Managers.
  - Every IARPA program will start with a great idea and a qualified program manager to lead it. Without both, IARPA will not start a program.
- **Maintain a cross-community focus**
  - Address cross-agency challenges
  - Leverage IC partner agency expertise (both operational and R&D)
  - Work transition strategies and plans

# Organization



**DIRECTOR**  
Catherine Marsh, Ph.D.



**DEPUTY DIRECTOR**  
GP Sandhoo, D.Sc.

## OPERATIONS

- Acquisition
- Plans, Budget & Execution
- Information Technology
- Security
  - Research & Technology Protection
- Communications/PAO

**CHIEF OF STAFF**

**TALENT MANAGEMENT**

**OFFICE OF ANALYSIS**

**DIRECTOR**  
Robert Rahmer



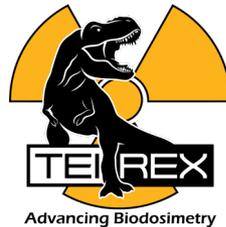
**OFFICE OF COLLECTION**

**DIRECTOR**  
Pedro Espina, Ph.D.



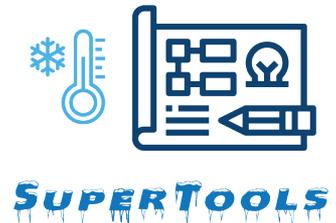


# Office of Analysis





# Office of Collection





# IARPA Summary



- **Invest in high-risk, high-payoff research to achieve an overwhelming intelligence advantage for the Nation**
- **Constantly developing new programs based on the problems and challenges facing the IC**
- **Use full and open competition, engaging the best of academia and industry, with challenging goals & rigorous, independent testing**
  - ~2,200 unique bidders to our programs
  - T&E with FFRDCs, UARCs, National Labs, Government Labs
- **3000+ journal articles published**
- **Have delivered technology to 17 IC agencies: >75% of our programs have resulted in at least one tech transition**

# IARPA Highlights



*“One of the government’s most creative agencies”*

*– David Brooks, NYTimes*

## • Process innovations:

- Security, Civil Liberty, & Privacy Protection reviews of all research
- Research & Technology Protection: Executive Branch “best practice”
- Internal R&D contracting shortening award timelines
- Proposers’ Days for industry-academia matchmaking
- Prize Challenges cost-effectively drawing solutions from untraditional innovators

## • Research breakthroughs:

- Quantum Computing: Science Breakthrough of the Year
- Privacy Assurance: MacArthur Genius Prize
- Human Judgment: world’s largest forecasting experiment
- Microelectronics supply chain: security through split manufacturing





# How to Engage with IARPA



## ENGAGE WITH US

Throughout our website you can learn more about engaging with us on our highly innovative work that is having a positive impact in the Intelligence Community and society in general.

[iarpa.gov](http://iarpa.gov) | 301-243-1995

[dni-iarpa-info@iarpa.gov](mailto:dni-iarpa-info@iarpa.gov)

- Reach out to our Program Managers.
- Schedule a visit if you are in the DC area or invite us to visit you



### Open BAAs

Broad Agency Announcements (BAAs) solicit research proposals for specific programs. Learn more about current BAA opportunities and ways to get involved...



### Requests For Information

Requests for Information (RFIs) are designed to gather more information on an idea in an area in which our program managers are not fully informed...



### Seedlings

Seedlings are typically 9 – 12 month research efforts that are less than \$1M in cost. They are intended to address highly innovative ideas and concepts within...

# PICARD Overview

Sherrie Pilkington | Program Manager | 26 SEPT 2022



Intelligence Advanced Research Projects Activity

I A R P A

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# Introduction of the PICARD Team



## **IARPA**

- Sherrie Pilkington, Program Manager
- Rebecca Levine, Science and Technology Support
- Paula Bugosh, Programmatic Support

## **Department of Interior**

- Frank Kennedy, Contracting Officer

## **Test and Evaluation**

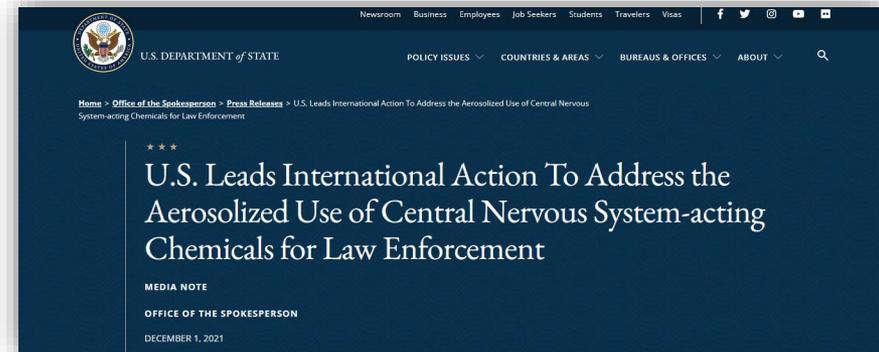
- Andrew McGill and team, Naval Research Lab (NRL)
- Matt Moorman and team, Sandia National Lab (SNL)
- Tim Johnson and team, Pacific Northwest National lab (PNNL)



# What IC Need Does PICARD Address?



- **Problem:** Many threat materials are released as aerosols. Identifying them is challenging due to high variability in physical characteristics, chemical complexity, and environmental factors.
- **Solution:** PICARD will create a fieldable sensing platform that can rapidly identify aerosol particles in plumes with non-uniform sizes, shapes, and chemical composition. PICARD will create both a point detection and standoff detection capability.

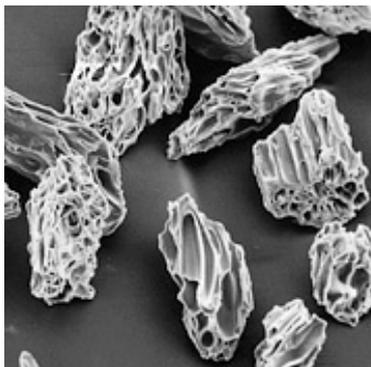




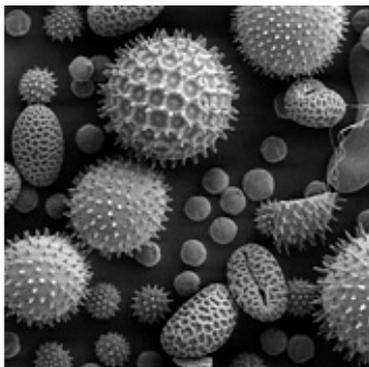
# What are Aerosols?

**Aerosols are suspensions of solid particles and/or liquid droplets in air**

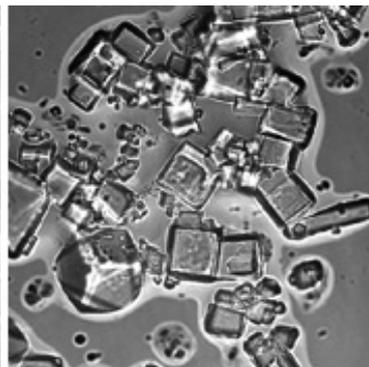
- Liquid
- Solid, crystalline
- Liquid embedded in solid carrier
- Solid embedded in liquid carrier
- Aggregated – particles/droplets that have collided/combined



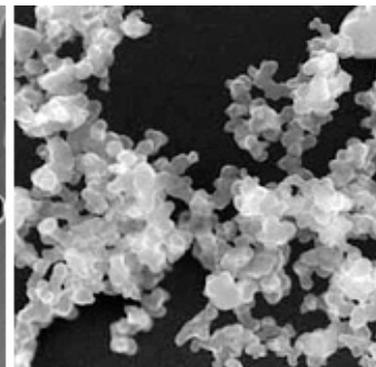
Volcanic Ash (<2mm)



Pollen (30  $\mu\text{m}$ )



Sea Salt (1-10  $\mu\text{m}$ )



Soot (20 nm)



# Why Are Aerosols Challenging?



## Chemical Characteristics

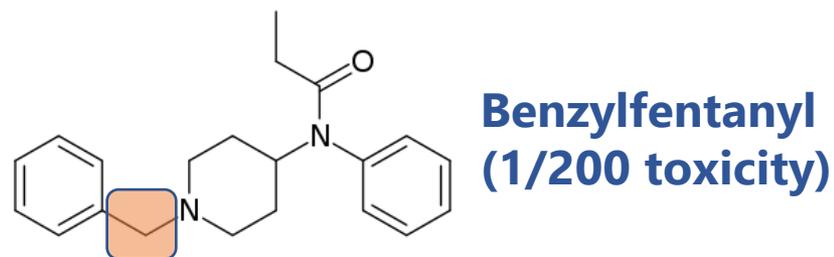
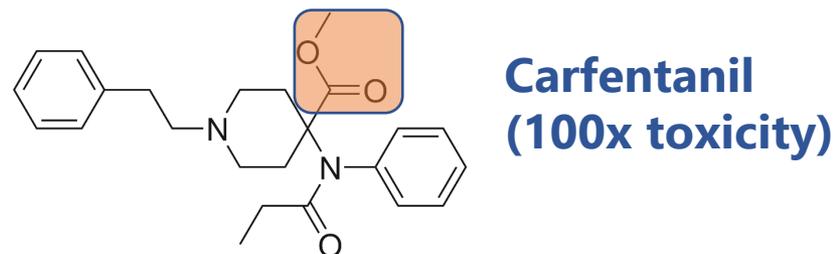
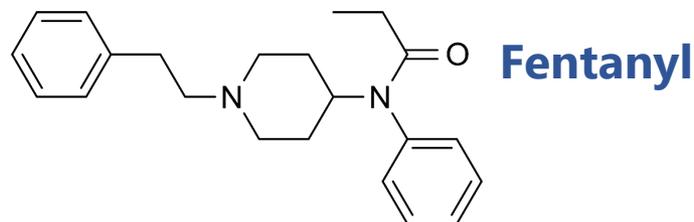
- Chemical interferences
- High specificity required
- Low concentrations

## Physical Characteristics

- Size variation of particles/droplets
- Shape variation of particles
- Aerodynamics

## Environmental Factors

- Humidity
- Temperature
- Wind
- Topography
- Background chemistry



**Fentanyl analogues  
(~1400 in lit/patents)**



# Chemical Characteristics



## Chemical Reaction Dynamics

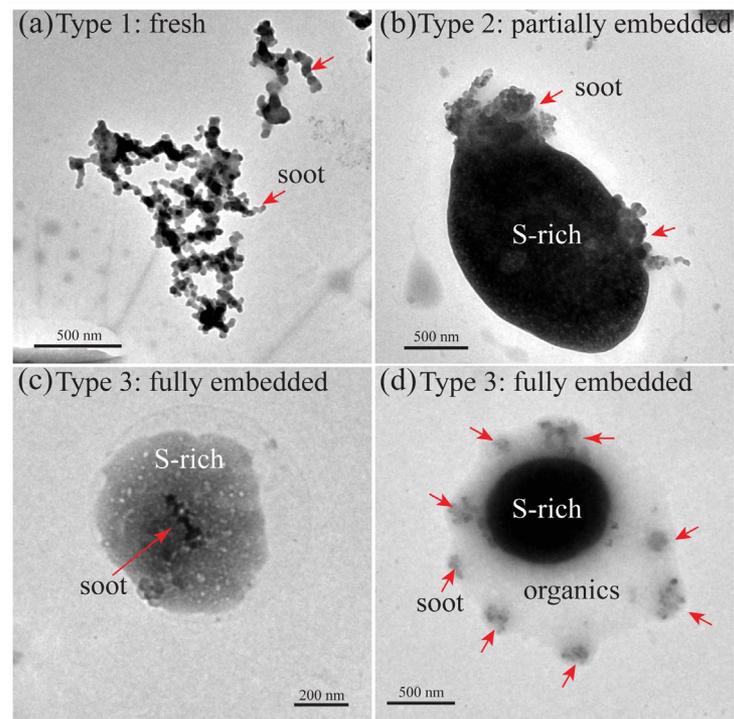
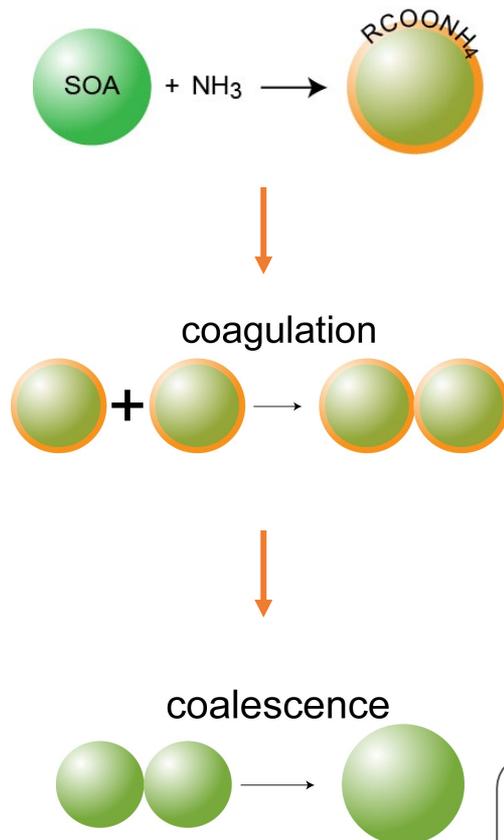
- Concentration
- Temperature
- Particle size

## Chemical Specificity

- Analogues
- Precursors
- Interferents

## Chemical Interference

- Encapsulation
- Aggregation
- Coagulation
- Coalescence



## Coexistence of three liquid phases in individual atmospheric aerosol particles

Yuanzhou Huang<sup>a,1</sup>, Fabian Mahr<sup>a,b</sup>, Shaun Xu<sup>a</sup>, Manabu Shiraiwa<sup>c</sup>, Andreas Zuend<sup>d</sup>, and Allan K. Bertram<sup>a,2</sup>

<sup>a</sup>Department of Chemistry, University of British Columbia, Vancouver, BC V6T 1Z1, Canada; <sup>b</sup>Laboratory of Environmental Chemistry, Paul Scherrer Institute, 5232 Villigen, Switzerland; <sup>c</sup>Department of Chemistry, University of California, Irvine, CA 92697-2025; and <sup>d</sup>Department of Atmospheric and Oceanic Sciences, McGill University, Montreal, QC H3A 0B9, Canada



# Physical Characteristics



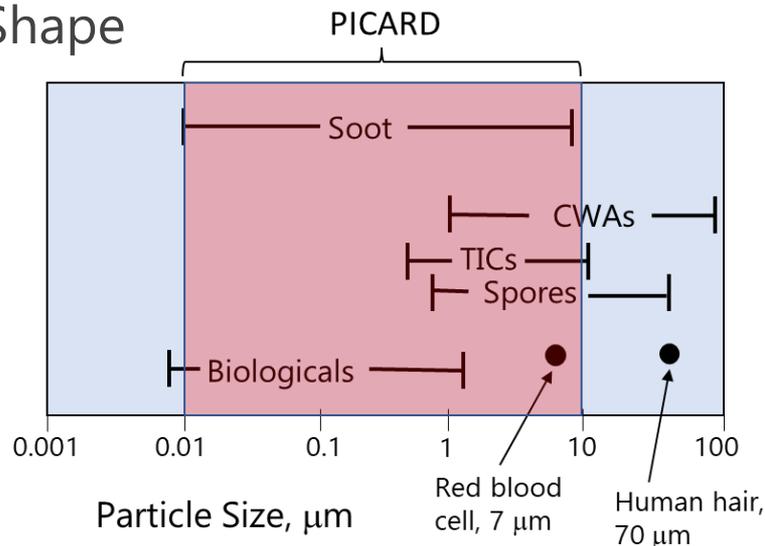
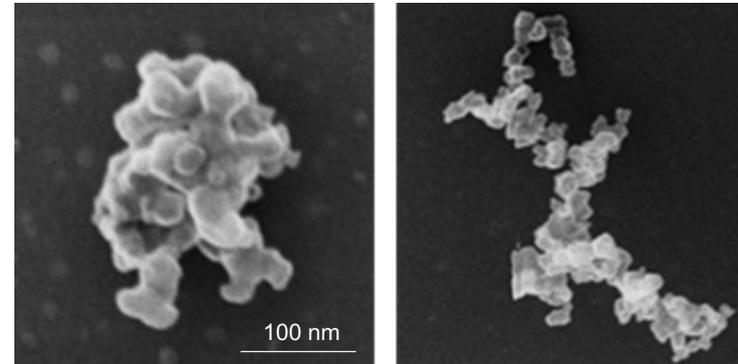
## Size ranges affected by:

- Age of particles
- Water content/humidity
- Production method

## Time in the air affected by:

- Size
- Mass
- Shape

## How is particle size determined for non-uniform shapes?



Particles < 5 mm can be inhaled into the lungs, posing the largest threat to people



# Environmental Factors



## Temperature

- Volatility of chemicals
- Equilibrium ratios

## Humidity

- Particle size
- Reaction chemistry

## Wind

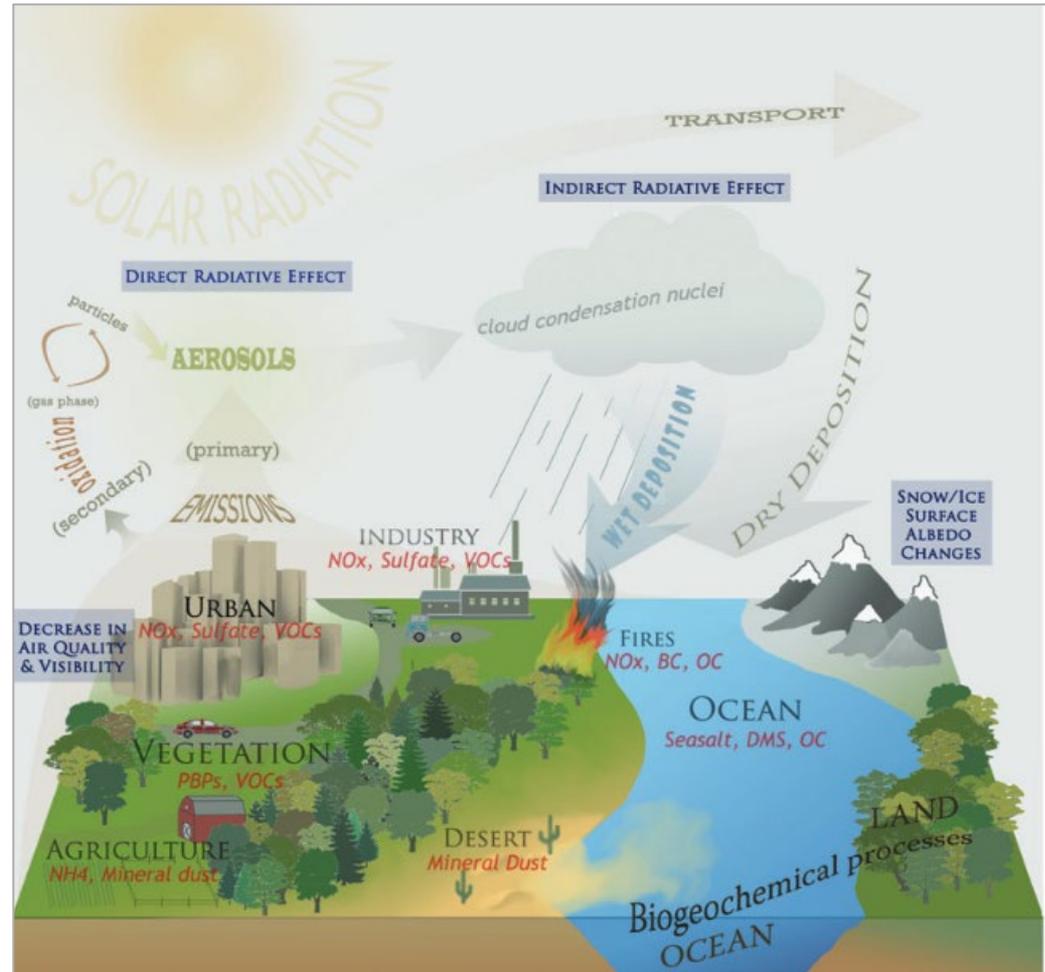
- Particle location and mixing

## Topography

- Particle location and mixing

## Background Chemistry

- Chemical reactions
- Lifetime of particles





# Current Limitations



## Current State of the Art

- Mass Spectrometry
  - Gold standard, broad use capability
  - \$350k, 350 lbs., > 1000L
- Fluorescence
- IR(Infrared) /Raman Spectroscopy
- Ion Mobility Spectrometry
- SAW (Surface Acoustic Wave Spectroscopy)
- Colorimetrics
  - Single chemical response per sampler
  - \$300, 1.2 lbs., 1.2 L (12 samplers)



## Art of the Possible

- Mass spectrometry
- Raman spectroscopy
- Photoacoustics
- Cavity Ring Down Spectroscopy
- Ion mobility spectroscopy
- Multi-modal approaches
- Standoff approaches
- Neural Networks

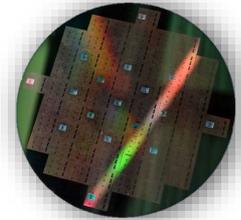


# Solutions to PICARD Challenges

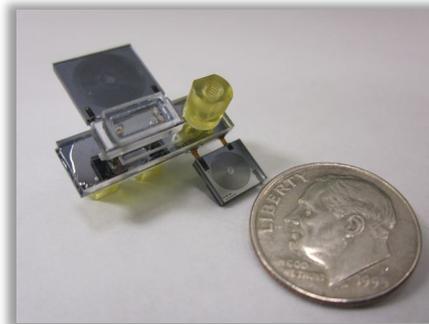


## Achievements that make PICARD possible now:

- Integrated photonics
- Machine learning
- Power systems
- Fiber lasers
- Hyper and multi-spectral technology
- Advances in vapor sensing



**SILMARILS**  
A LIGHT IN DARK PLACES...



**MAEGLIN**  
REVEALING THE UNSEEN



# PICARD Program Goals



"IARPA seeks to understand the chemistry, morphology, and dispersion characteristics of aerosol plumes. Identification of the chemicals of interest from complex environmental backgrounds would enable security and emergency services to quickly assess threats."

## Integration

### Sampling

- *In Situ* – chemical agent specificity
- Standoff – chemical class specificity
- Broad range of particles sizes/shapes
- Complex environmental conditions

### Sensing

- Rapid response time
- Encapsulated or embedded particles
- Low concentration
- Complex environmental conditions

### Analysis

- Adaptable to novel materials
- Low false alarm rate
- Automated chemical identification
- Complex environmental conditions



# PICARD Overview



Real time  
data

Standoff  
screening  
tool

Concurrent size  
and chemical  
analysis

Low false  
alarm rates

*In-Situ*  
forensic  
tool

A graphic element above the word 'PICARD' consisting of a light blue cloud shape with several dark blue dots of varying sizes and one yellow dot, resembling a molecular or particle structure.

PICARD

Agnostic to  
environmental  
interference

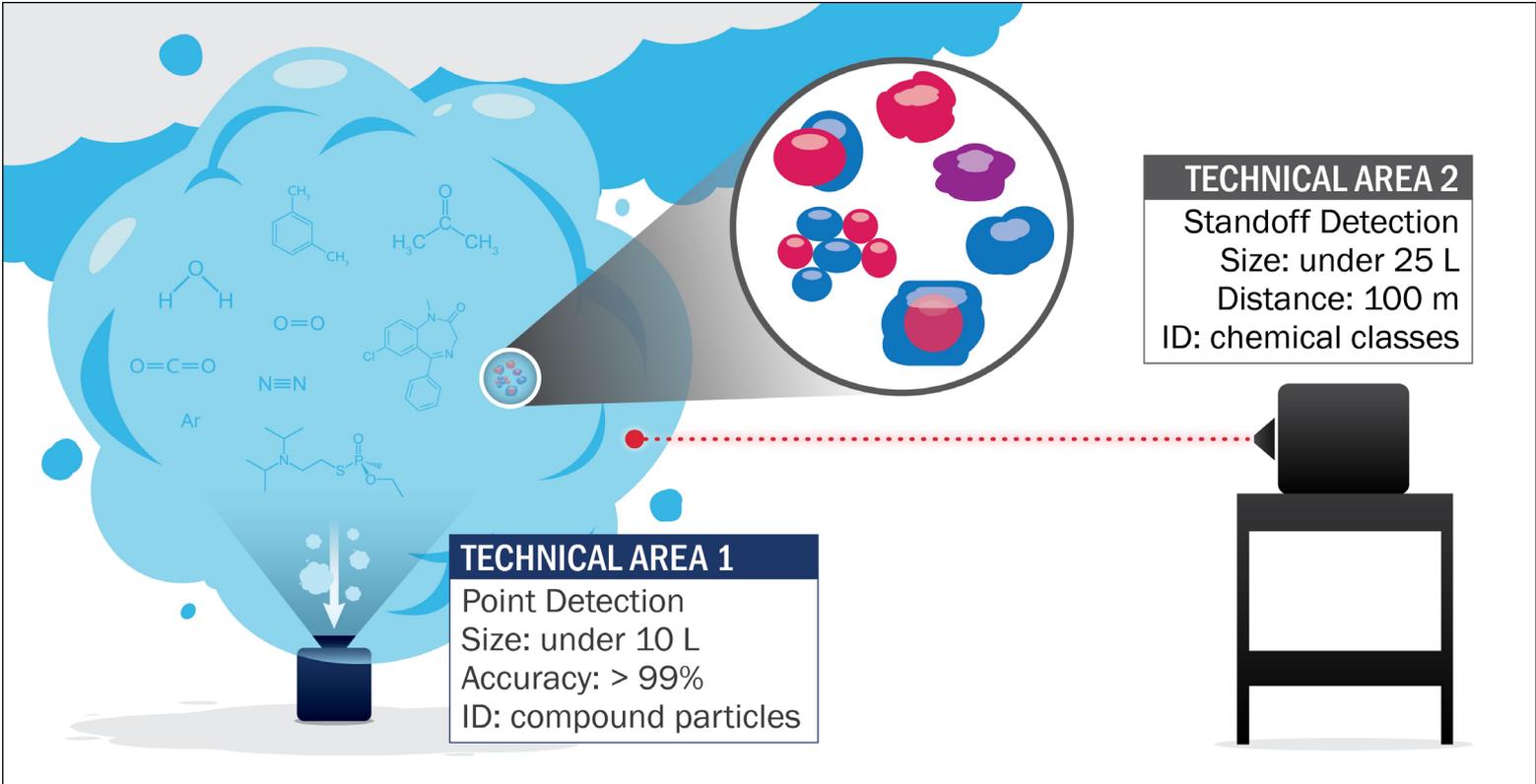
Adaptable to  
novel threats  
and obscurants



# Program Structure – Technical Areas



**PICARD aims to develop two types of sensing platforms: Point Detection and Standoff Detection**





# Technical Area 1 – Point Detection



## Capability

- Low false alarm rate in complex chemical mixtures
- ID of individual chemicals in *compound particles*
  - *aggregated* (stuck together irregularly)
  - *coalesced* (chemicals evenly mixed throughout)
  - *embedded* (target chemical partially encased by others)
  - *encapsulated* (target chemical fully encased by others)



## Form Factor

- Size: < 10 L
- Weight: <10 kg
- Power: COTS, on-board, swappable, 24 hour operation

## Components

- Sampling
  - solids, liquids, and combinations; various size distributions
- Sensing
  - *Clutter*- Particles in the air which comprise the background chemicals
- Analysis- automated identification with very low false alarm rates in complex chemical mixtures
- Integration of all components into a single device
- \*optional metric- identify particle morphology



# Technical Area 2 – Standoff Detection



## Capability

- Distance up to 100 m
- Chemical class identification (e.g Fentanyls, organophosphates)
- Low signal to noise in complex environments
- Short response time

## Form Factor

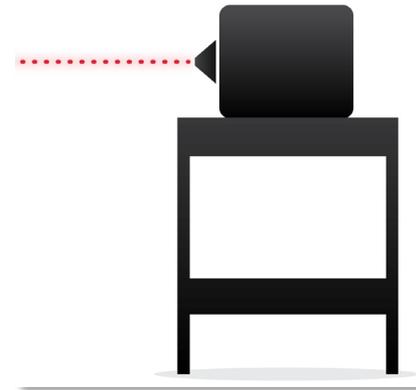
- Size: <25 L
- Weight: <30 kg
- Power: COTS, on-board, swappable, 24 hour operation

## Components

- Sensing
  - *Cloud Depth* - the total mass of particles that may be encountered over a certain volume
  - While these devices will not collect aerosols, various compound particles must still be considered
- Analysis- automated identification with high accuracy in complex environments of chemical class
- Integration of all components into a single device
- \*optional metric- identify specific chemicals of interest

### TECHNICAL AREA 2

Standoff Detection  
Size: under 25 L  
Distance: 100 m  
ID: chemical classes





# Program Structure – Phases



	Phase 1	Phase 2
Duration	18 months	24 months
Technical Area 1: Point Detection	<ul style="list-style-type: none"><li>• <b>Hardware:</b> <b>breadboard</b> traceable to all program metrics</li><li>• <b>Software:</b> demonstration of <b>manual</b> identification of chemicals (including <i>unknowns</i>)</li><li>• <b>T&amp;E:</b> quantitative chemical mixtures in <b>controlled environments</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Hardware:</b> <b>brassboard</b> traceable to all program metrics</li><li>• <b>Software:</b> demonstration of <b>automated</b> identification of chemicals (including <i>unknowns</i>)</li><li>• <b>T&amp;E:</b> <i>indoor</i> and <i>outdoor</i> testing with highly complex mixtures and environments</li></ul>
Technical Area 2: Standoff Detection	<ul style="list-style-type: none"><li>• <b>Hardware:</b> <b>breadboard</b> traceable to all program metrics</li><li>• <b>Software:</b> demonstration of <b>manual identification of chemical classes</b></li><li>• <b>T&amp;E:</b> quantitative chemical mixtures in <b>controlled environments</b> at up to <b>10 m</b> distances</li></ul>	<ul style="list-style-type: none"><li>• <b>Hardware:</b> <b>brassboard</b> traceable to all program metrics</li><li>• <b>Software:</b> demonstration of <b>automated identification of chemical classes</b></li><li>• <b>T&amp;E:</b> <i>indoor</i> and <i>outdoor</i> testing with highly complex mixtures and environments at up to <b>100 m</b> distances</li></ul>

A **breadboard** is an early prototype, with a non-optimized footprint, developed to test the combined system components in a laboratory environment.

A **brassboard** is a self-contained prototype with the functionality and approximate physical configuration of the final product intended for testing in relevant environments.



# Test & Evaluation



## How does IARPA define T&E?

- Major component of all IARPA programs (~25% of program budget)
- Creative, collaborative, and data driven

## What will PICARD T&E look like?

- 3 test events per Phase – increasing complexity over time
- Tests meant to inform, challenge, and guide technology towards transition
- Phase 2 – monthly challenges

## Collaborative environment!

- Ongoing discussions with T&E partners
- T&E teams are SMEs and resources *NOT* competitors
- We do not compare approaches – evaluation of each performer is done individually across the program metrics





# Key Metrics – Point Detection



## Sampling

Particle Type/Size

Target Chemicals

Response Time

## Sensing

Specificity

Clutter

Dynamic Range

Limit of Detection (LoD)

## Analysis

Limit of Identification (LoI)

True Positive Probability

False Positive Probability

Library

\*Optional\* Morphology

## Integration

Size

Weight

Power

Data Format

## Environment

Temperature Range

Humidity

Wind Speed

EMF



# Key Metrics – Standoff Detection



## Sampling

Particle Type/Size

Target Classes

Distance

Safety

## Sensing

Specificity

Cloud Depth

Dynamic Range

Limit of Detection (LoD)

## Analysis

Limit of Identification (LoI)

True Positive Probability

False Positive Probability

Library

**\*Optional\***  
Chemical ID

## Integration

Size

Weight

Power

Data Format

## Environment

Temperature Range

Humidity

Wind Speed

EMF



# Program Schedule



<b>Phase 1 (18 months)</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Program Kickoff	█																	
Final Waypoints Due			█															
Site Visit					█	█	█											
T&E Evaluation #1					█	█	█											
T&E Evaluation #2												█						
Design Review														█				
Government Interaction Workshop															█			
T&E Evaluation #3																█		
Phase 1 Final Report																		█

<b>Phase 2 (24 months)</b>	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Phase 2 Kickoff	█																							
Adjusted Waypoints Due			█																					
Site Visit						█																		
Monthly Challenges						█	█	█	█	█	█	█	█	█	█	█	█							
T&E Evaluation #1								█																
T&E Evaluation #2																█								
Design Review																		█						
Government Interaction Workshop																					█			
T&E Evaluation #3																							█	
Phase 1 Final Report																								█



# Program Deliverables



Phase	Months	Description	Comments
1 & 2	All	Monthly Status Report (MSR)	Due on the 15 <sup>th</sup> of each month; technical and financial
1 & 2	3 & 21	Final Milestones due	Performer defined milestones driven by approach and metrics
1 & 2	1 & 19	Kickoff Meeting Presentations	Read ahead slide packages due 5 days before meeting date; corrected slides due 15 days after meeting date
1 & 2	6 & 24	Site Visit Presentations	Read ahead slide packages due 5 days before meeting date; corrected slides due 15 days after meeting date
1 & 2	13 – 14 & 35 - 36	Design Review Packages	Draft packages due 15 days before presentation; corrected packages due 30 days after receipt of feedback
1 & 2	15 & 38	Workshop Presentations	Read ahead slide packages due 5 days before meeting date; corrected slides due 15 days after meeting date
1 & 2	18 & 42	Phase 1 and 2 Reports	Final reports for each Phase are due prior to the end of the technical Period of Performance
1	6, 12, & 16	T&E Results Report	All results, including raw data, are due to the Government team 7 days after the conclusion of the test event
2	26, 34, & 40	T&E Results Report	Quick Look results, including initial chemical identification, are due within 24 hours of the conclusion of the testing each day; a summary report, including raw data, is due 7 days after the conclusion of the test event



# Milestones and Waypoints



## Goals

- Enable records management
- Organize research activities in a reportable format
- Allow for consistent & effective communication across IARPA, PICARD T&E, USG stakeholders, and performers

## Milestones

- Program meetings
  - Kickoff Meetings
  - Progress Meetings
- T&E events
- Site Visits
- Design Reviews
- Government Interaction Workshops

## Waypoints

- Proposer defined interim “check in” performance measurements which indicate technical progress on each task
- Waypoints help the PICARD team to assess progress and provide feedback
- At a minimum, each project task should include Waypoints every 3-6 months
- They should be developed with specific project goals in mind



# In Scope



**Underlying theory- light/matter interactions, aerosol dynamics, and spectroscopy of particles**

**Research and development approach for a fully integrated system**

**Technical risks and possible mitigation strategies**

**Analysis software development- including tailored algorithms and specific background/clutter filter approaches**

**Solutions can be multidisciplinary. This requires subject matter expertise across multiple fields**

**\*Please refer to the BAA for the full broad scope**



# Out of Scope



**Bioaerosols - bioaerosols, such as viruses, bacteria, and pollen**

**Research that does not have strong theoretical and experimental foundation for the Proposer's claims.**

**Approaches that are likely to result in only incremental improvements over the state of the art.**

**Approaches with limited operation parameters that do not accommodate day/night, wind, or temperature fluctuations.**

**Development of component level technology that are not required for the Proposer's approach.**



Thank you for your interest!



# Contracting Overview

Frank Kennedy | Department of the Interior | 26 SEPT 2022



Intelligence Advanced Research Projects Activity

I A R P A

Creating Advantage through Research and Technology



# PICARD Proposer's Day

Contracting Officer for PICARD  
Frank Kennedy, DOI - CO



[DOI.GOV/IBC](https://doi.gov/IBC)

# DOI Introduction

Department of the Interior –  
Interior Business Center (DOI- IBC)

In partnership with

The Intelligence Advanced Research Projects  
Activity (IARPA)

# Precedence

- Information contained within the BAA takes precedence over what is discussed today.
- All vendors should propose only to what is discussed in the BAA and not to these slides or information conveyed today.

# Award Instruments

- Procurement Contracts, using FAR 35 – Research and Development Contracting.
- Multiple awards are anticipated.
- The PICARD program is anticipated to be a 42-month effort, comprised of two (2) Phases. Proposals shall include a solution for Phases 1 and 2, offerors may address one technical area or both. Proposals that do not include a solution for both phases will be considered non-responsive and will not be evaluated.
- The Government reserves the right to select for award all, some, one, or none of the proposals received in response to the BAA.

# General Information

- Carefully read all information in the BAA.
- Certain sections will contain formatting instructions and page limitations. Any information beyond the page limitations will not be considered.
- Be sure to include all required documents and attachments.
- Classified proposals are not anticipated for this program
- Proposal Due Date and Time - Be sure to submit early enough to avoid transmittal issues. Proposals after the due date will not be considered. It is strongly recommended to submit 48 hours before the deadline.

# Eligibility Information

- The following are generally **not** eligible to submit proposals under this BAA or participate as team members under proposals submitted by eligible entities:
  - Other Government Agencies,
  - Federally Funded Research and Development Centers (FFRDCs),
  - University Affiliated Research Centers (UARCs),
  - Any organizations that have a special relationship with the Government; e.g., that would give them
    - access to privileged and/or proprietary information,
    - access to Government equipment or real property.

## Eligibility (cont)

- Foreign entities and/or individuals may participate but only as a part of a U.S. based team. The prime contractor must be a U.S. entity. Foreign entities and individuals may participate as subcontractors or employees of a U.S. based entity; however, all foreign participation must comply with any necessary Non-Disclosure Agreements, Security Regulations, Export Control Laws, and other governing statutes applicable under the circumstances.

# BAA Release Information

- BAA will be posted to SAM.gov via Department of the Interior, Interior Business Center (DOI-IBC)
- The BAA will be released for 45 days.
- All information required for submitting a proposal will be outlined in the BAA.

# Proposal Submission Process

- Proposals must be submitted through IARPA's IDEAS system
  - Interested Offerors must register electronically IAW instructions on: <https://iarpa-ideas.gov>. (will be available after BAA is posted)
  - Interested Offerors are strongly encouraged to register in IDEAS at least one week prior to proposal "Due Date"
  - Offerors must ensure the version submitted to IDEAS is the "Final Version"
- The BAA will have instructions for how to respond if there are system problems with IDEAS

# Evaluation Process

- Each BAA will detail the method for evaluation and selection; IARPA generally follows a two-step process:
  - First step is technical evaluation and selection for negotiations. This is conducted through a scientific/peer review process after which Offerors are notified of selection
  - Second step is negotiation and contract award conducted by the Contracting Officer
- Proposals will be reviewed individually against the BAA requirements in accordance with FAR 35, Research and Development Contracting, and not against each other.

# Evaluation Process (cont)

- Preliminary review for proposal completeness, eligibility requirements, conformance with BAA requirements
- All information necessary for the review and evaluation of a proposal must be contained in the proposal itself. No other material will be provided to the panel. Proposals should contain sufficient technical detail to allow for in depth technical assessment.

# Organizational Conflicts of Interest

- IARPA follows FAR Part 9 regarding Organizational Conflicts of Interest (OCIs). The main principles being:
  - Preventing conflicting roles that might bias a contractor's judgement.
  - Preventing an unfair competitive advantage.
- The BAA will describe how offerors are to identify and disclose all facts relevant to potential OCIs for the offeror as well as any proposed team members.
- OCI disclosures may require a mitigation plan describing the actions the offeror will take or intends to take to prevent the conflict.
- IARPA generally prohibits contractors from concurrently providing System Engineering Technical Assistance (SETA) and T&E support while being a technical R&D performer due to OCI concerns. Each case will be determined individually.

# Pre-Publication Review

- IARPA encourages publication of **UNCLASSIFIED** IARPA-funded research in peer-reviewed journals, presentation at conferences and publication in conference proceedings.
- Prior to public release of any work submitted for publication, the Performer will:
  - Communicate results to be publicly released with the IARPA Program Manager to discuss any sensitivities (e.g., security, speculation on IC use cases, etc.)
  - Provide advance courtesy copies to the IARPA PM and Contracting Officer Representative (COR).

# Academic Institutional Acknowledgement

- According to Executive Order 12333, contracts or arrangements with academic institutions may be undertaken only with the consent of appropriate officials of the institution.
- An Academic Institution Acknowledgement letter is required for offerors that are academic institutions.
- A template for this letter will be included in the BAA. Each letter must be signed by a senior official of the institution ( e.g. President, Chancellor, Provost or other appropriately designated individual).
- IARPA requires this letter before entering into negotiations and/or awarding a contract. It is highly advised that it be submitted with the proposal.

# Intellectual Property

- The Government needs to be able to effectively manage the program and evaluate the output and deliverables, communicate the information across Government organizations and support further use and development of program results.
- Offerors will address their IP Rights assertions in their proposal. The Government may request additional information as may be necessary to evaluate.
- The Government will evaluate the IP rights being offered and whether they are in the Government's best interests.

# Proposal Evaluation Criteria

- Current Evaluation Factors
  - A. Overall Scientific and Technical Merit
  - B. Effectiveness of Proposed Work Plan
  - C. Contribution and Relevance to the IARPA Mission and Program Goals
  - D. Relevant Experience and Expertise
  - E. Resource Realism
- The above factors are **anticipated**, and proposers should review the BAA for the criteria as they may change when the BAA is released.
- Cost Proposal – Full cost proposals will be requested from the beginning. The BAA will provide specific instructions and a cost proposal template will be a BAA attachment.

# Communications

- All questions or discussions regarding this solicitation must be directed to the Contracting POC.
- CO: Frank Kennedy (Frank\_Kennedy@ibc.doi.gov)
- All communication throughout this process must be handled formally and through the proper channels, which means all parties must ensure a DOI Contract Specialist or Contracting Officer is present and/or engaged during any and all communication exchanges.
- Any informal communications or outside communication will delay and may also jeopardize a potential award.

# Potential Important Dates

- Proposals will be due approximately 45 days from BAA issuance. Proposals submitted after the closing date will not be considered or evaluated by the Government.
- Submit your proposal package at least 24-48 hours prior to the closing date/time.
- Full BAA Posting: ~ Late October 2022 (estimate)
- Question Period: two (2) week time period from BAA posting
- Proposals due forty-five (45) days from BAA posting VIA IDEAS
- Don't forget that the BAA may involve amendments after it is initially released – these will be posted at on SAM.gov. Proposals will be expected incorporate/ comply with all amendments.

# Questions & Answers (time permitting)

- Q&As at today's Proposers' Day reflect informal information and do not override the BAA. The BAA is the authoritative document.
- Please read entire BAA before submitting questions
- Pay attention to Proposal & Submission Information.

# Test and Evaluation

Sherrie Pilkington | Program Manager | 26 SEPT 2022



Intelligence Advanced Research Projects Activity

I A R P A

Creating Advantage through Research and Technology





## T&E Brings Together:

- Subject Matter Experts
- IC partner input
- Ground truth and baseline capabilities
- Ongoing feedback for performers
- Government furnished capabilities
- Evaluation Strategy
  - Measurable
  - Quantitative
  - Clear
  - Ambitious



# Evaluating Performer Success



## Program Metrics

- Metrics given in the BAA
- Developed by team of SMEs

## Test and Evaluation Events

- 3 events per Phase
- Increasing complexity
- Intended to inform research

## Site Visits

## GAP Meetings (Government Advisory Panel)

## Technical Reviews

- In-depth technical discussions
- Documentation of prototype design, materials, risks, costs, etc.

## Monthly Challenges (Phase 2)

- Broad range of environmental factors to be considered
- Meant to inform progress towards T&E events



# T&E Partners



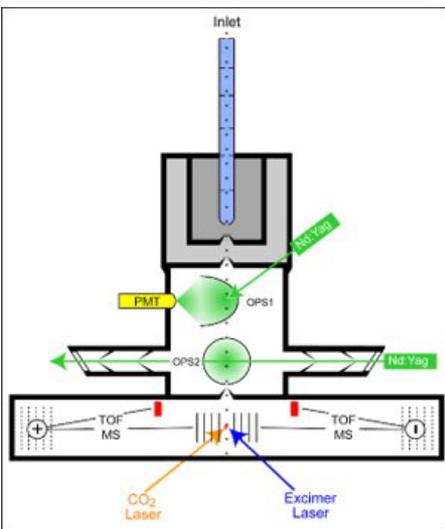
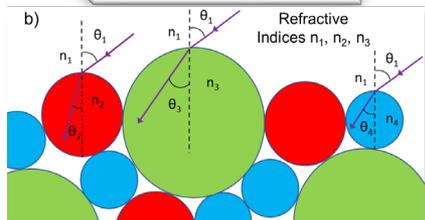
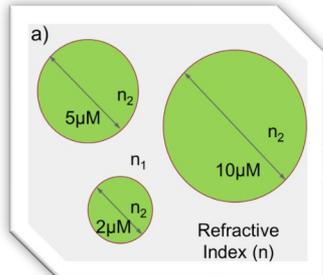
	Tasks	NRL	PNNL	SNL
<b>Sampling</b>	Environmental Evaluation (outdoor testing)	<b>Tropical, Temperate</b>		<b>Desert, Fog Tunnel</b>
	Chemical Selection	<b>CWAs, explosives</b>	<b>Pollutants</b>	<b>PBA's, metals</b>
<b>Sensing</b>	Quantitative Evaluation (indoor testing)	<b>X</b>		
<b>Analysis</b>	Modeling/Machine Learning		<b>X</b>	
<b>Integration</b>	System Design			<b>X</b>

## • Aerosol Modeling Approaches

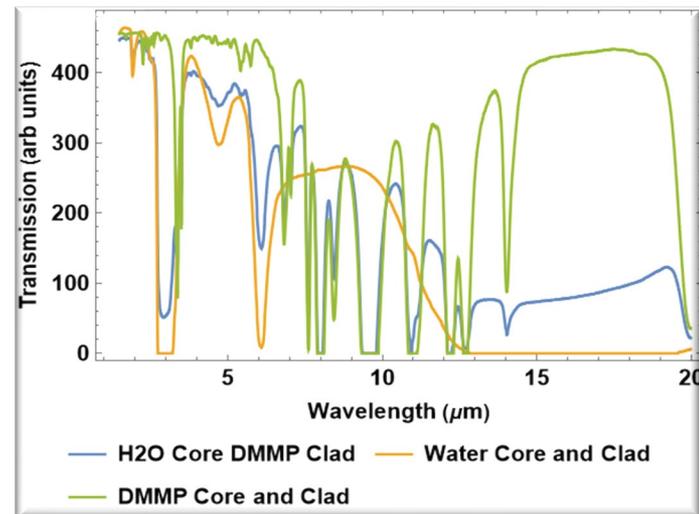
- Modeling pure/mixed chemical environments
- Light scattering impacts
- Prediction of chemical spectra
- Robust reference spectra for known threats

## • miniSPLAT (Single Particle Laser Ablation Time-of-Flight Mass Spec)

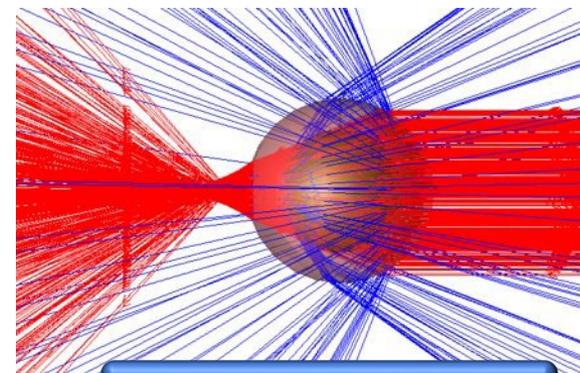
- Characterizes individual particles (50 nm - 5  $\mu\text{m}$ ) *in situ* and in real-time with ultra-high sensitivity, temporally resolve mass spectrometry
- Applicable for a wide variety of aerosols and particles collected as powders and suspensions in solvent  
Characterizes volatile and non-volatile fractions of each particle, acquiring both positive and negative ions MS with a rate of 100 p/sec
- Ground truth in complex environments



Schematic of miniSPLAT



Transmitted Light Through Clad Aerosol Particle



Core-Cladding Aerosol Model



## Aerosol Generation

- Droplets - Spray Nozzles, Atomizers, Nebulizers, Collisions, Foggers
- Dust & Other Dry Aerosol – Topas, Fluidized Bed Aerosol Generator

## Aerosol Measurements

- Size & Concentration – APS, OPCs, SMPS
- Composition – SPAMS, WIBS
- Hygroscopicity – CCN-100
- Offline Sampling – Filter Samplers, Cyclones, Cascade Impactors, Coupons, Impingers

## Material optical signature analysis tools

- Quantitative MWIR/LWIR reflectance spectrometer
- Quantitative VIS/SWIR reflectance spectrometer
- IR BRDF (developmental)

## SMEs in aerosol generation, chemistry, aerosol measurements, and various environmental chambers for to support T&E



Fog Chamber  
180' x 10' x 10';  
64 nozzles



Environmental Chamber 5 mb;  
-127°C



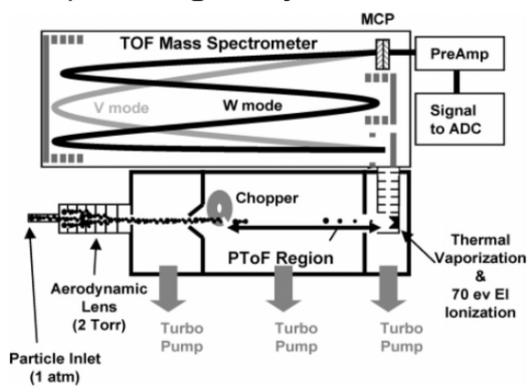
\*Generation and characterization of chemical and biological droplets and dry aerosol with diameters ranging from 10 nm to 1 mm.



# NRL Capabilities



- SMEs in optical spectroscopy, mass spectrometry, aerosol generation and detection, standoff detection, sorbents, particle studies
- **Aerosol Generation**
  - Capability to generate aerosols of mixed composition with variable size and concentration
  - Demonstrated capability coating core particle material with a secondary analyte
- **Environmental Testing facility for complex evaluations**
  - Prototyping High Bay 50 meter laser standoff for static target tests.
  - Desert High Bay dust storms, and controlled light conditions
  - Tropical High Bay 27°C >90%RH with plants for simulated rainforest



Schematic of Aerodyne High Resolution Time of Flight Aerosol MS



AATF (Ambient Air Test Facility) *In situ* introduction of Aerosol, ambient air, and detect



# Technical Area 1 Metrics (Point Detection)\*



		Phase 1 (breadboard)	Phase 2 (brassboard)
<b>Sampling</b>	<b>Particle Type</b>	Solid, liquid, and combinations	
	<b>Particle Size</b>	0.05 – 5 $\mu\text{m}$	0.01 – 10 $\mu\text{m}$
<b>Sensing</b>	<b>Response Time</b>	1 per 3 hrs	1 per hr
	<b>Clutter</b>	< 1 $\text{mg}/\text{m}^3$	< 10 $\text{mg}/\text{m}^3$
	<b>Specificity</b>	ID of individual chemicals**	
	<b>Interferents</b>	Performer defined chemicals/waypoints (in consultation w IARPA/T&E)	
	<b>Dynamic Range</b>	1000x	10,000x
<b>Analysis</b>	<b>Limit of Detection</b>	< 50 $\mu\text{g}/\text{m}^3$	< 5 $\mu\text{g}/\text{m}^3$
	<b>Limit of Identification</b>	< 1 $\text{mg}/\text{m}^3$	< 0.1 $\text{mg}/\text{m}^3$
	<b>True Positive Probability</b>	0.90	0.95
	<b>False Positive Probability</b>	0.10	0.05
<b>Integration</b>	<b>Device Size and Weight</b>	Designed to 20 L, 20 kg	Designed to 10 L, 10 kg
	<b>Power</b>	COTS, on-board, swappable, 24 hour operation	
<b>Environment</b>	<b>Temperature Range</b>	25°C range	50°C range
	<b>Humidity</b>	25-75% RH	10-90% RH
	<b>Wind Speed</b>	0-5 km/h	0-10 km/hr

\*Metrics are subject to change and are dynamic to the program

\*\*including unknowns with/without bkgd/interference



# Technical Area 2 Metrics (Standoff Detection)\*



		Phase 1 (breadboard)	Phase 2 (brassboard)
<b>Sampling</b>	<b>Particle Type</b>	Solid, liquid, and combinations	
	<b>Particle Size</b>	0.05 – 5 $\mu\text{m}$	0.01 – 10 $\mu\text{m}$
	<b>Distance</b>	< 10 m	< 100 m
<b>Sensing</b>	<b>Cloud Depth</b>	10 (mg/m <sup>3</sup> )*m	100 (mg/m <sup>3</sup> )*m
	<b>Specificity</b>	ID of chemical class	
	<b>Dynamic Range</b>	1000x	10,000x
	<b>Limit of Detection</b>	< 0.1 mg/m <sup>3</sup>	< 0.01mg/m <sup>3</sup>
<b>Analysis</b>	<b>Limit of Identification</b>	< 1 mg/m <sup>3</sup>	< 0.1 mg/m <sup>3</sup>
	<b>True Positive Probability</b>	0.90	0.95
	<b>False Positive Probability</b>	0.10	0.05
<b>Integration</b>	<b>Device Size and Weight</b>	Designed to 75 L, 50 kg	Designed to 25 L, 30 kg
	<b>Power</b>	COTS, on-board, swappable, 24 hour operation	
<b>Environment</b>	<b>Temperature Range</b>	25°C range	50°C range
	<b>Humidity</b>	25-75% RH	10-90% RH
	<b>Wind Speed</b>	0-5 km/h	0-10 km/h

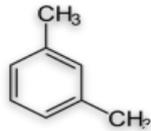
\*Metrics are subject to change and are dynamic to the program



# Government Furnished Capabilities



At Phase 1 Kickoff, the Government will provide performers with the following



Chemical list



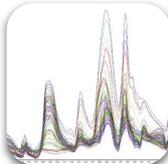
Test Plan



Aerosol Generation Protocols



Custom Sorbent Materials



Simulated Aerosol Spectra



# What to Expect...



## Proposal Evaluation Factors

- Positive Factors
  - Fully integrated system
  - In-depth knowledge of underlying theory and possible risks
  - Interdisciplinary team
- Relative Importance

*Clutter/Interferents > false alarm rate > dynamic range > response time*

## Timeline

- BAA release in 1-2 months
- 45 day submission period
- Source selection, offers, and contract negotiation
- PICARD program kickoff in FY23, Q3

## If You're Selected

- Communication and collaboration!
- We will start working towards T&E Event #1 on Day 1



Thank you for your interest!



# Selected Q&A

Sherrie Pilkington | Program Manager | 26 SEPT 2022



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# Q&A



Question	Answer
There can be substantial schedule and cost advantages to leverage existing proposer's hardware. Will the Phase 1 breadboard or Phase 2 brassboard be deliverables?	Yes.
Should proposed solutions have the data analysis performed on the instrument or is raw data transmission to an off-site computing resource permitted?	Permissible during Phase 1, but should be fully integrated by Phase 2.
How will you create and disperse aerosolized compounds of interest for T&E?	TBD. However, our plan is to have methodology in place prior to kickoff.
Can one PI or institution participate in multiple proposals (as subcontractors)?	Yes. However, no subcontractor will be paid for the same work multiple times.



# Q&A



Question	Answer
Would you consider a hybrid approach (TA1 + TA2)?	Yes, but it must be clearly stated how their solution would address both technical areas.
Are you envisioning the point detection on the mobile platforms or stationary?	Primarily stationary, but both are on the table.
In the Metrics, the Device Power "on-board", does this mean that the battery is included within the Device Size? How long does the battery need to last, giving the listed Response Time metric?	Yes. 24 hours.
Do we need to address all chemical families listed in Table 1? Or can we just focus on one family for the development and expand later on?	The table is an example of classes. It is not meant to be exhaustive. We encourage proposer's to consider a variety of chemical classes or families as opposed to just one.



# Q&A



Question	Answer
What is the expected funding level for this project?	IARPA programs are \$75 - \$100 M on average, with ~25% of the budget dedicated to Test and Evaluation.
How might stand-off detection and point detection benefit each other during the program?	Ultimately, they don't. They have different applications, metrics, and goals. Related but different goals.
What are ideal T&E scenarios and locations? How closely will point and standoff technologies work together during T&E?	Anything that covers a broad range of environmental situations. Consider the specific environmental factors defined in the BAA.
Across all performers on TA1 and TA2, will there be an effort to ensure that all aerosol clouds are generated the same way? i.e., using standardized equipment for releasing?	We will develop standard methodologies. They may differ for different clouds (sizes, chemicals), but we will inform teams when a decision is made.
How did you arrive at breadboard volume constraints (2x full system volume)?	All of our volume metrics came from partners and SMEs, however any ideas you have may be sent to the BAA email alias.



# Q&A



Question	Answer
How often can any consumables can be replaced? Is it 24 hours like the battery life?	TBD. We are continuing to develop an answer to this.
Particle sizes of interest seem more steered towards biologic vs. chemical. For example, CWAs and TICs tend to be slightly larger than the stated region of interest. Is there a reason for this? Should we exclude larger particle sizes?	The size range of interest was developed based on what could be a threat to humans (<5 $\mu\text{m}$ ) . Larger particles are still being considered because they may be broken down to smaller particles.
How many teams will likely be funded? If it's easier, how many have been funded on similar programs?	IARPA does not disclose total program budget, but it is expected that there will be multiple awards based on the diversity of innovative approaches.
Will this be a single award or multiple award contract?	We are anticipating multiple awards.
Table 1 of the draft BAA shows possible uses cases and needs. Will you say a bit about any unique aspects of the concepts of operations or users' preferences within each of the four example uses?	No.



# Q&A



Question	Answer
Will you say more about the schedule? E.g., ~1 month to final BAA; 45 days for proposal preparation/submission; ~3 months to selection; 2 months to program kickoff.	We don't have finite dates. We're hoping for end of Oct. for final BAA. Then 45 days for submission. Anticipating program kickoff in Q3 of FY23.
What is the anticipated time to detect/identify for TA1 & TA2? What factors are driving the response time metrics for TA1 (3 hours - 30 min.)? Do these times seem to slow for come CONOPS?	See BAA. Time to detect for TA2 should be approximately real-time. These times will be slow for certain CONOPS. That said, they are fast enough for others. If your technology can do faster, let us know.
The schedule shows "monthly challenges" for Phase 2, but there is no detailed description. What is the vision for monthly challenges?	In Phase 2, we will be doing increasingly complex scenarios. Monthly challenges are built in to reduce risk and inform T&E. There will be specific protocols/guidelines/measurements that we send to you for results discussion.
PICARD will be targeting particle sizes between 0.01 um to 10 um. Is it expected that the sensor covers the full range or is there a preferred range?	Full range but there can different modes of operation for different sizes.
Are there subsets of chemicals that are considered more important than others?	Yes, you will see those when we provide the chemical list at kick off.



# Q&A



Question	Answer
Will we be sent the BAA when it is released?	No, please track Sam.gov
Will performers be provided the required information to generate spectral libraries for all target chemicals?	We will be providing synthetic or measure aerosol spectra for a subset of chemicals depending on the approaches selected.
For standoff systems, do they need to be fully remote and non-contact?	No.
Is there a requirement for area coverage (and rate) for standoff detection? Or does the sensor have a defined path to monitor?	That is TBD.
Are the point and stand off sensor required to support networking to share information?	Not required.
Do we need to identify background sources or just not alarm on them?	Just not alarm on them.



# Q&A



Question	Answer
What contract vehicle(s) will be utilized for PICARD? Will OTAs be considered?	FAR-based contract. We are anticipating cost plus fixed-fee (universities reimburse the fee). OTAs – Not currently supported.
How does the IARPA SILMARILS standoff illumination program feed into PICARD if at all?	MAEGLIN and SILMARILS inform what we are doing now through lessons learned programmatically and component level technologies that can be applied to aerosols.
Is a proposal to participate in T&E design, etc. potentially responsive?	No.
Are small businesses allowed to prime?	YES. This is a full and open competition.