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Airport Risk Assessment Model Stakeholder Symposium

July 2021

Robert Brigantic
Nick Betzsold
Bayasa Batsaikhan
Atithi Bharth
Maren Disney

Fatima Gowher
Ann Lesperance
Jonathan Mills
Samuel Ortega
Roxanna Rodriguez

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Event Report

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Maren Disney
Fatima Gowher

Ann Lesperance
Jonathan Mills
Samuel Ortega
Roxanna Rodriguez

Pacific Northwest National Laboratory
Richland, Washington 99354

Abstract

On June 22–23, 2021, the Pacific Northwest National Laboratory hosted a two-day virtual stakeholder symposium to share how the Airport Risk Assessment Model (ARAM) is putting security resource allocation planning into the hands of our airport's front lines of defense. ARAM is an advanced risk modeling and assessment tool that helps airport security stakeholders prioritize the use of their resources based on evolving threats.

Participants were invited to watch a demonstration of the tool, explore the ARAM methodology and mathematics, and brainstorm how ARAM could be enhanced or used in conjunction with other technology to make it even more powerful in reducing risk. The event featured the sponsor for ARAM, Dr. John Fortune, Department of Homeland Security Science and Technology Director, and key operator Jeff Holmgren, Transportation Security Administration Federal Security Director State of Washington.

This report highlights the key takeaways from the discussions, including:

- Define new and additional use case scenarios that could be modeled in ARAM.
- Provide greater clarity around scoring and processes used for setting model parameters at airports.
- Allow for integration across facilities, devices, and agencies, thus enabling a holistic approach to airport security.
- Expand the threat base to include natural or biological hazards like COVID-19.

As pilot efforts with the tool continue at several U.S. international airports, feedback from the symposium will be used to drive future improvements in the technology.

Acknowledgments

Acronyms and Abbreviations

|	
ARAM	Airport Risk Assessment Model
PNNL	Pacific Northwest National Laboratory
DOE	U.S. Department of Energy
DHS	Department of Homeland Security
S&T	Science and Technology Directorate
TSA	Transportation Security Administration

Contents

1.0   Introduction

On June 22–23, 2021, Pacific Northwest National Laboratory (PNNL) hosted a two-day virtual stakeholder symposium to share how the Airport Risk Assessment Model (ARAM) is putting security resource allocation planning into the hands of our airport's front lines of defense.

After introductions, welcoming remarks, and an ARAM overview video, participants were invited to individual breakout sessions to either (1) watch a demonstration of the tool, (2) explore the ARAM methodology and mathematics, or (3) brainstorm how ARAM could be enhanced or used in conjunction with other technology to make it even more powerful in reducing risk. The event featured the Screening at Speed Program Director and ARAM sponsor Dr. John Fortune, Department of Homeland Security Science and Technology Directorate, and key operator Jeff Holmgren, Transportation Security Administration (TSA) Federal Security Director State of Washington.

This report highlights the key takeaways from the discussions. As pilots with the tool continue at several U.S. international airports, feedback from the symposium will be used to drive future improvements in the technology.
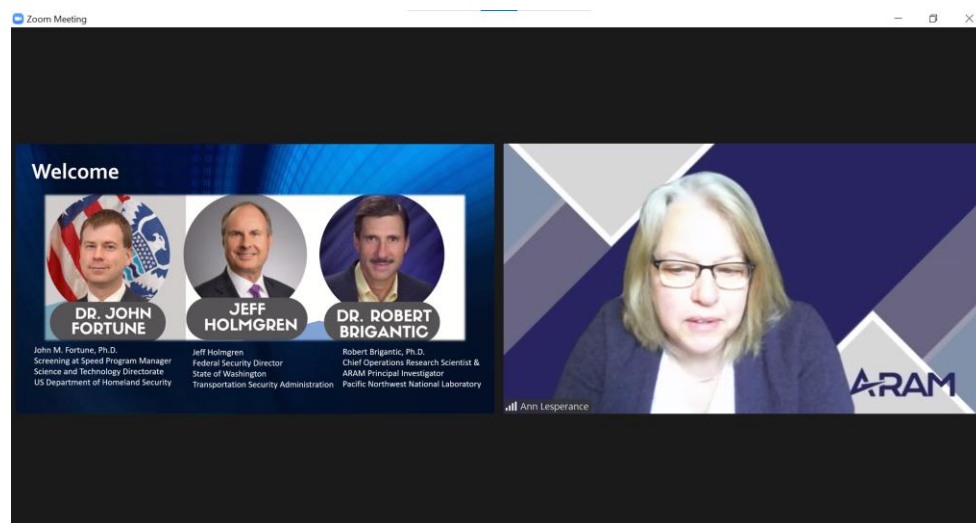
Ann Lesperance, PNNL, introduces speakers for the ARAM Stakeholder Symposium.

1.1   About ARAM

ARAM is an advanced risk modeling and assessment tool that helps airport security stakeholders prioritize the use of their resources based on evolving threats. Risk is quantified as a function of threat, vulnerability, and consequence at each area of a given airport—overall airport risk is the sum of the risk at all these areas. From this, total risk can be calculated for the airport each hour and for the whole day. ARAM uses this risk assessment to dynamically recommend assignments for security countermeasures during the day and makes the information accessible to security practitioners via a user-friendly, web-based app.

"ARAM gives the ability to deploy scarce resources beyond the checkpoint in a way that you can get a sense of reducing future risk. That becomes a guiding light that we are continuously improving our risk reduction."

– Jeff Holmgren, Transportation Security Administration

1.2 Objectives

The ARAM symposium invited participants to achieve the following objectives:

- Observe and learn more about the ARAM tool.
- Understand how ARAM is used in an operational setting.
- Recognize the value ARAM provides to users and security operations.
- Explore potential extensions to other domains.

1.3 Symposium Logistics

The symposium comprised repeated virtual sessions conducted four times over two days to allow stakeholders to attend at a time most convenient to them. Each main session included more detailed breakout sessions on the following topics:

- **Breakout Session 1 – ARAM Demonstration and Deep Dive**: Participants observed a live demonstration of ARAM and suggested inputs about its operations.

- **Breakout Session 2 – Risk Methodology and Background**: Participants learned more about the underlying methodology and mathematics of the ARAM risk engine and how the ARAM methodology could be employed in other venues.

- **Breakout Session 3 – Open Forum/Discussion**: Participants discussed the potential to leverage new technologies for increased situational awareness and brainstormed how ARAM could be combined with additional technologies to make it even more powerful in reducing risk.

1.4 Participants

The symposium invited representatives from a wide range of ARAM stakeholders and potential users, including:

- Calhoun Port Authority
- Customs and Border Protection
- Dallas Fort Worth International Airport
- Department of State
- Delta Airlines
- Department of Homeland Security

- New York Port Authority
- Port of Portland
- Port of San Diego
- Port of Seattle
- South Carolina Ports

- TSA
- U.S. Coast Guard
- U.S. Secret Service
- Washington State Patrol

2.0 Breakout Session 1 – Demonstration and Deep Dive

Discussions focused around the operations, configurations, and risk mathematics of the tool. Key focus areas are outlined below:

- **Configuration** – As the process of using the tool begins, users set up the tool to meet their needs including areas, vulnerability nodes, countermeasures, threats, and a randomness factor. Vulnerability nodes are the specific locations within areas where risks will be assessed and where countermeasure teams will be assigned based on defined access. Occasionally, vulnerability nodes provide attack types with access points to multiple areas throughout the airport. Countermeasure schedules are input into the tool throughout the day, integrating both fixed and optimized countermeasures.

- **Dashboard** – The ARAM dashboard displays several different analytic views of risk, both spatially and temporally. One view is the overall risk score for the day. Risk starts at 100%, and ARAM works throughout the day to bring that down through the assignment of countermeasures. Risk is also broken down by area and tracked via heat map. As the tool is used over time, historic trends can be observed.

- **Risk scoring** – Risk scores show the likelihood of the threat types, assessed consequences, and vulnerabilities of the risk. It also contains countermeasure effectiveness. More information regarding term definitions and scoring criteria can be found with the help buttons on each page/tab. If the risk scores and countermeasure schedules do not change much over time, and if assignments were always optimal, the resulting schedule would become predictable, which is why the randomness factor exists in configuration. Risk scores are aggregated by threat type. Countermeasure effectiveness scores are delineated by detection and prevention (responding and mitigating a threat/attack in motion) and deterrence (mitigating a threat/attack before it happens).

- **Scheduling** – The ARAM schedule option helps place various countermeasures to certain areas at certain times and creates a schedule for each team. Individual members can place themselves or managers can create schedules for their team. A list of countermeasures (teams) with their work shifts is entered to the tool, which outputs a schedule of individual teams with their assignments. This is saved in the ARAM database. Users can view the schedule in different ways and observe the risk buydown.

- **Heat map** – Within the map, users can click on vulnerability nodes and get an output of risk score along with their countermeasure unit.

- **Questions**
  - How does this populate for flight schedules and passenger load?
    - These are automatically forecasted within ARAM for the top 100 airports for the next five years.

– Is there an area where countermeasures are defined in the system or a fixed point where countermeasures cannot exceed or move from areas?

o These type of constraints can be defined by the users of the tool when they configure the model for their airport.

– Can nodes be an entire baggage claim?

o Yes, as defined and desired by the user.

– Can you further explain the vulnerability nodes and what they encompass?

o The easiest way to think about vulnerability nodes is as sub-areas where countermeasures are specifically deployed by the model.

– What are potential extensions with wearable technology using the ARAM tool?

o This could affect (i.e., improve) the subcomponents of risk (e.g., organic security vulnerability).

3.0 Breakout Session 2 – Risk Methodology and Background

In an in-depth discussion of the ARAM risk methodology, participants focused on the intricacies of the tool's mathematical risk reduction approach. Key discussion points included:

- **Risk, threat, consequence, and vulnerability** – Each are unique such that any single component does not dominate resource deployment. They are required to get a risk measure for the day to work for the risk buydown.

- **Scoring** – The scoring granularity, how it applies versus cost, and how future drilling into artificial intelligence could make scores more dynamic.

- **Possible inputs** – Threats (active shooter) and countermeasures (airport security). For each threat type, target parties get scores to determine how likely an injury is to occur.

- **Countermeasures** – Taking the product of consequence, vulnerability, and threat likelihood, the tool is trying to determine which countermeasure is best used at which location to reduce risk. As more countermeasures are added, given what is already assigned, there is a 24-hour plot risk comparison that includes:

  – Risk with no countermeasures; each hour of the day risk increases during busy times at the airport.

  – Risk with countermeasure ad hoc; provides benefit of lowered risk.

  – Risk with countermeasures assigned to minimize risk, based on effective and mathematical matching, reducing risk as low as possible.

- **Threats** – Designers should consider additional threats that are more naturally focused, such as the spread of COVID-19. Further, countermeasures do not have to be personal; they can also be in the form of technology.

- **Questions**

  – Are threats more generic vs. specific?

  o ARAM tends to be more general, but specific threats can be added.

– Does it consider a 9-11-type event (which happens on a plane)?

  o We consider loss of aircraft.

– How do we protect the information and/or update for specific known threats that may include sensitive data?

  o ARAM has a multiuser environment with different access levels and backend formulations.

– Will the number of people dominate the threat? Does risk drive the model? What happens as other factors drop out?

  o This is related to consequence. The threat is related to the likelihood of certain threats.

– Does this factor in the potential for employees having weapons? Should we be including this in the model?

  o Insider threat is included in ARAM.

– How do we quantify consequence? Do we convert those to dollars? Is it not linear?

  o ARAM uses points. It is not linear. Further explanation is required on how the points work and Likert scoring.

– Do we consider indirect economic impact?

  o Yes, an example is in dollars but converted to 1-5 Likert.

– How do we make this much more plug and play and apply this at different locations?

  o This a focus of research for future updates (e.g., artificial intelligence to support parameter scoring).

– What is the likelihood model parameters will be static?

  o It is currently static, but these can be updated at will by the users. Eventually we would like to automate or semi-automate.

– Can we include accessibility in the model? Do we have any uncertainty in this (e.g., accessibility)?

  o Yes. We have real data to pull from to help.

– How do we calculate the relative likelihood?

  o By comparisons of one threat to another and/or Likert scores that provide a rubric in the model for relative scoring.

– Do we take into consideration the spread of resources?

  o We consider diminishing returns.

– Do we have scheduling abilities?

  o Yes.

– How does identity management play into ARAM, bio-hazard, passenger vaccination status etc.?

  o Currently, that is a level of detail that has not be explored, but if the desire was to make it more aggregate based on information in an incoming flight, the model allows users to change those parameters. For example, regarding COVID-19 exposures, a

user can put COVID-19 in as a threat and see it is a significantly reduced risk compared to the other threats.

– Is this in compliance with foreign entities?

o No export restrictions at this time.

4.0 Breakout Session 3 – Open Forum and Discussion

After the demonstration and overview discussion about the tool, the third breakout session encouraged participants to have an open conversation about the tool and its potential applications and opportunities for improvement. Participants demonstrated interest in the following concepts:

- **Interagency engagement** – Expand capabilities between airport police, TSA, Customs and Border Protection, and multiple teams in Seattle, and the use of ARAM will be the driver.

- **Integration between multiple facilities or devices** – Whether an ARAM-like system could be linked between multiple physical locations and agencies for a common interface, or could the tool be linked with cyber resources, drones, or transportation systems.

- **Adaptation** – Adaptation and response to real-time changes and what technologies are in use now and in the future. Use cases of knowing where to go when arriving for a shift.

- **Value add** – A robust, visual, and threat assessment program seems essential, and ARAM demonstrates good potential for risk assessment for airports everywhere. Opportunities to apply ARAM to increase capability at the airports is inherent.

- **Communications** – A participant noted their coordination center has a new Google Earth-type program and Adobe Connect allows for real-time response and sharing of multiple types of platforms. There was a general desire to better connect with all tools in use.

- **Questions**
  - Does ARAM work with single organizations or between agencies, and/or plan resources between TSA and law enforcement together?

    o Together, it combines the resources.

  - Does ARAM schedule with knowledge of personnel schedules?

    o Yes, it considers individual schedules.

  - Can it monitor office locations based on phone GPS?

    o Not at this time.

  - How do we expect it to expand?

    o There is a criterion and potential gradual roll-out to new facilities, pending feedback.

  - Are there future plans for integration of sensors, drones, etc. that can be used with ARAM?

    o Yes, real-time data, data sources, and artificial intelligence are being considered as these technologies evolve.

  - Can ARAM verify shift locations, move resources, and avoid patterns from on-site adversaries watching shifts?

o Ideally, users would have real-time flight knowledge to shift resources as multiple flights shuffle in at once, etc. Randomization is used to make very predictable patterns less predictable.

– What type of threat reduction can the tool bring?

o Threat is reduced by the countermeasures deployed to lower risk as a direct result of the prevent, detect, and deterrence values of the countermeasures assigned.

5.0 Summary

General response was positive, with participants collectively citing the value the tool brings to airport security. Across the multiple sessions, participants collectively voiced an interest in:

- New use case scenarios that could be modeled in ARAM.

- Greater clarity around scoring and processes used for setting model parameters at airports.

- Integration across facilities, devices, and agencies, thus enabling a holistic approach to airport security.

- Expanded threat base to include natural or biological hazards like COVID-19.

6.0 Next Steps

The PNNL ARAM team will explore the feasibility of incorporating the key takeaways and discussion points/questions into the current or future versions of ARAM. The team will also distribute and share this report with the symposium participants.

Appendix A – Agenda

ARAM 2021
Stakeholder Symposium
June 22–23, 2021
VIRTUAL

The following is the standard agenda for each day/session.

Introduction		
	Topic	**Speaker**
11:00 AM	Introduction/Purpose	Roxanna Rodriguez/Ann Lesperance
11:05 AM	Welcome	Dr. John Fortune/Mr. Jeff Holmgren
11:10 AM	Description and overview of ARAM	Robert Brigantic
11:13 AM	Q&A	All
11:15 AM	Transition into breakout sessions	
Breakout Sessions		
11:20 AM	Sessions Begin	
	• Deeper dive/demonstration of ARAM	**Nick Betzsold**	• *ARAM demonstration and deeper dive into the tool* ➢ *See ARAM in action and suggest your own inputs during a live demo of the tool*
	• Risk methodology and background	**Robert Brigantic**	• *Discussion on ARAM risk methodology* ➢ *Learn more about the underlying methodology and mathematics of the ARAM risk engine and how the ARAM methodology could be employed in other venues*
	• Open forum/discussion	**Atithi Bharth**	• *Leveraging new technologies for increased situational awareness* ➢ *Discuss needs and brainstorm how ARAM could be combined with additional technologies to make it even more powerful in reducing risk*
11:45 AM	Transition back to main session	
11:46 AM	Report out key takeaways from each group and next steps	Ann Lesperance
11:50 AM	Close Session	

Appendix B Participants

- Robert Brigantic, Chief Operations Research Scientist, Pacific Northwest National Laboratory
- Nick Betzsold, Data Scientist, Pacific Northwest National Laboratory
- Ann Lesperance, Director, Northwest Regional Technology Center, Pacific Northwest National Laboratory
- Dr. John Fortune, Director, Screening at Speed Program, Department of Homeland Security Science and Technology Directorate
- Jeff Holmgren, Federal Security Director, State of Washington, Transportation Security Administration
- Roxanna Rodriguez, Community Affairs Consultant, Pacific Northwest National Laboratory
- Atithi Bharth, National Security Specialist, Pacific Northwest National Laboratory

Appendix C Presentation

Introduction

o *Symposium objectives:*

- o *Observe and learn more about the ARAM tool*
- o *Understand how it is used in an operational setting*
- o *Appreciate the value it provides to users and security operations*
- o *Consider potential extensions to your domain*

Screening at Speed Overview

Project Thrust Areas

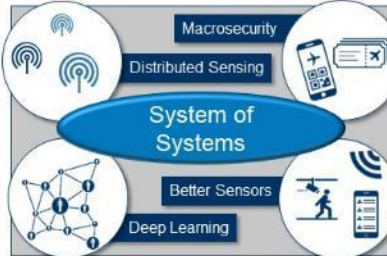| Passenger Screening	Passenger Analysis	Carry-On Screening
Overarching Architecture	Enabling Capabilities	

Screening at Speed pursues transformative R&D to increase security effectiveness from curb-to-gate while dramatically reducing wait times and improving the passenger experience.

Homeland Security
Science and Technology

DHS Science and Technology Directorate | Screening at Speed | Public Release

4

Screening at Speed Mission

What is ARAM?

Why ARAM?

o *Risk-based approach to decide on best use of discretionary resources*

o *Accounts for multiple threats*

o *Unity of effort across stakeholder organizations / reduces duplication of effort*

o *Track risk and risk reduction trends over time*

o *Easy to use*

ARAM
AIRPORT RISK ASSESSMENT MODEL
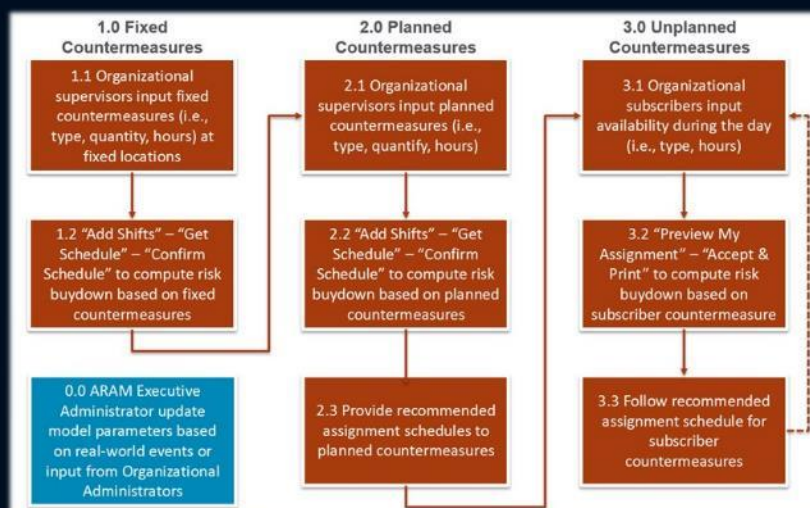
Breakout groups

o *ARAM demonstration and deeper dive on the tool*
  o *See ARAM in action and suggest your own inputs during a live demo of the tool*

o *Discussion on ARAM risk methodology*
  o *Learn more about the underlying methodology and mathematics of the ARAM risk engine and how the ARAM methodology could be employed in other venues*

o *Leveraging new technologies for increased situational awareness*
  o *Discuss needs and brainstorm how ARAM could be combined with additional technologies to make it even more powerful in reducing risk*

For more information, contact:

Dr. Robert T. Brigantic, ARAM PI
Chief Operations Research Scientist
NATIONAL SECURITY DIRECTORATE

Pacific Northwest National Laboratory
Richland, WA 99352 USA
Tel: (509) 375-3675
robert.brigantic@pnnl.gov

Nick Betzsold, ARAM Co-PI
Data Scientist
NATIONAL SECURITY DIRECTORATE

Pacific Northwest National Laboratory
Richland, WA 99352 USA
Tel: (509) 375-4583
nicholas.betzsold@pnnl.gov

ARAM
AIRPORT RISK ASSESSMENT MODEL

Breakout group 1: Nick Betzsold

○ *ARAM demonstration and deeper dive on the tool*
  ○ *See ARAM in action and suggest your own inputs during a live demo of the tool*

ARAM CONOPS

1. Stakeholders input availability of deployable countermeasures
2. Hit the "easy button" to obtain schedule of optimal assignments
3. Patrol assigned areas per defined stakeholder CONOPS
4. View risk buydown and heat maps to evaluate benefits in terms of countermeasure contributions to overall risk reduction

1.0 Fixed Countermeasures

1.1 Organizational supervisors input fixed countermeasures (i.e., type, quantity, hours) at fixed locations

1.2 "Add Shifts" – "Get Schedule" – "Confirm Schedule" to compute risk buydown based on fixed countermeasures

0.0 ARAM Executive Administrator update model parameters based on real-world events or input from Organizational Administrators

2.0 Planned Countermeasures

2.1 Organizational supervisors input planned countermeasures (i.e., type, quantify, hours)

2.2 "Add Shifts" – "Get Schedule" – "Confirm Schedule" to compute risk buydown based on planned countermeasures

2.3 Provide recommended assignment schedules to planned countermeasures

3.0 Unplanned Countermeasures

3.1 Organizational subscribers input availability during the day (i.e., type, hours)

3.2 "Preview My Assignment" – "Accept & Print" to compute risk buydown based on subscriber countermeasure

3.3 Follow recommended assignment schedule for subscriber countermeasures

Typical ARAM Operational Flow Process
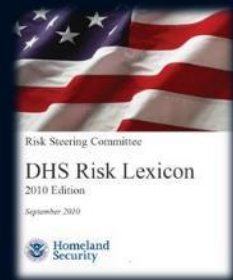
Breakout group 2: Robert Brigantic

o *Discussion on ARAM risk methodology*

o *Learn more about the underlying methodology and mathematics of the ARAM risk engine and how the ARAM methodology could be employed in other venues*
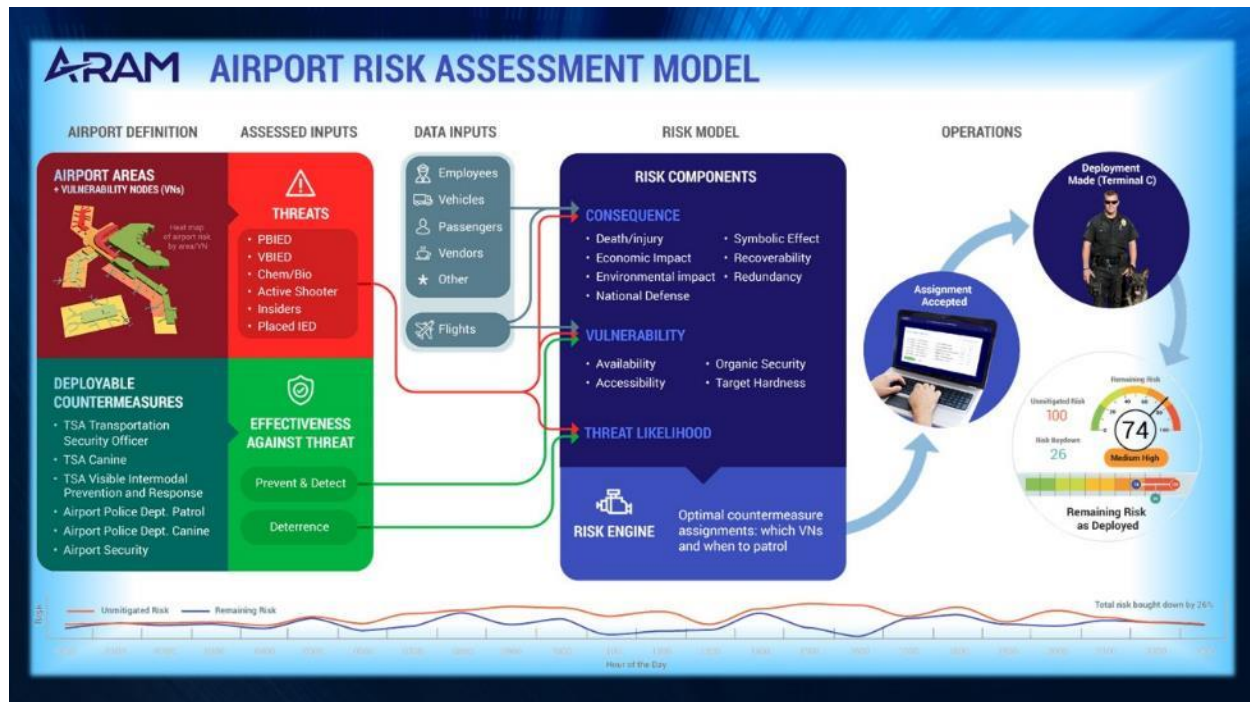
Typical Results – Risk Comparison
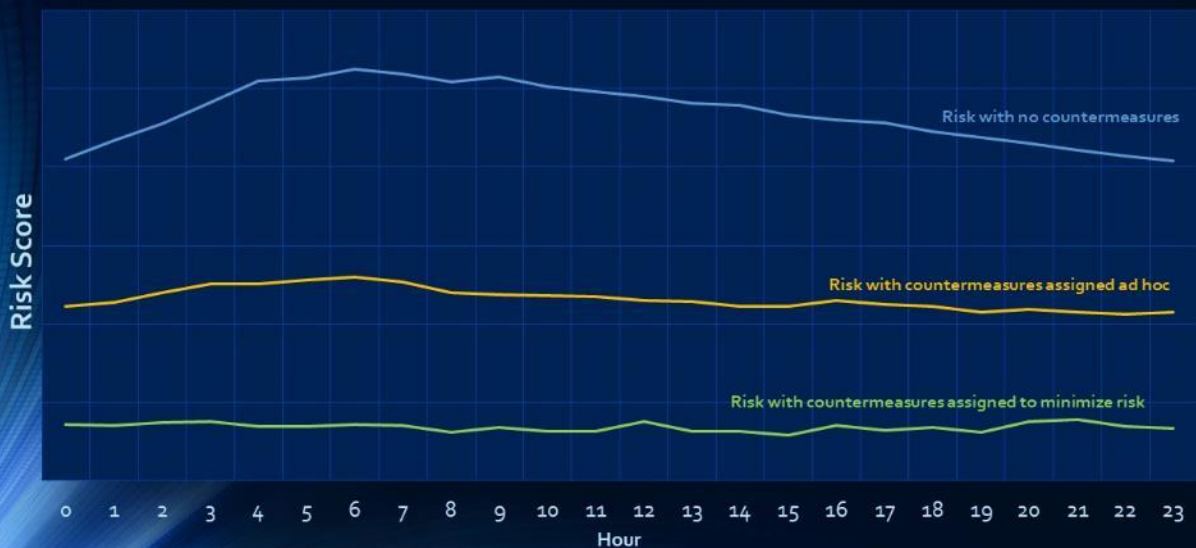
Breakout group 3: Atithi Bharth

o *Leveraging new technologies for increased situational awareness*

  o *Discuss needs and brainstorm how ARAM could be combined with additional technologies to make it even more powerful in reducing risk*

Starter questions

o *Are risk-based decision approaches for supporting resource allocation a priority?*

o *What are we missing to support your mission needs?*

o *Do you have ideas related to new and emerging technologies that could bolster real-time risk decisions when combined with ARAM?*

Appendix D Event Flyer

Pacific Northwest
National Laboratory

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99354
1-888-375-PNNL (7665)

www.pnnl.gov