Emergency Management of Tomorrow Research: Emergency Operations Center of the Future Tabletop Exercise
Madison, WI Tabletop Exercise

June 2024

Science and Technology
U.S. DEPARTMENT OF HOMELAND SECURITY

Emergency Management of Tomorrow Research – Emergency Operations Center of the Future

Madison, WI Tabletop Exercise

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DISCLAIMER

Acknowledgments

Acronyms and Abbreviations

AI	Artificial Intelligence
DHS S&T	Department of Homeland Security Science and Technology Directorate
EM	Emergency Management
EMOTR	Emergency Management of Tomorrow Research
EOC	Emergency Operations Center
PNNL	Pacific Northwest National Laboratory
R&D	Research and Development
TTX	Tabletop Exercise

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Tables

1.0 Introduction and Objectives

As part of the Emergency Management (EM) of Tomorrow Research (EMOTR) program, sponsored by the Department of Homeland Security (DHS) Science and Technology (S&T) Directorate, Pacific Northwest National Laboratory (PNNL) developed concepts for the Emergency Operations Center (EOC) of the Future to provide recommendations to assist DHS S&T in future decision-making with regards to research and development (R&D) and investments toward establishing a framework for a national, coordinated approach to EM. PNNL is conducting tabletop exercises (TTXs) designed to assess the impacts and benefits of emerging technologies on EM organizations.

Table 1 summarizes the expected outcomes of each TTX.

Table 1. Exercise Objectives

Exercise Objectives
Identify technologies that could improve EOC response operations.
List efficiencies gained and performance enhancements in EOC operations through use of identified technologies.
Discuss limitations, concerns, and mitigation strategies for identified technologies.
Review how to implement identified technologies.

This report summarizes the first TTX held at the Joint Force Headquarters EOC in Madison, Wisconsin, on March 28, 2024 (Figure 1).

Figure 1. Christina Bapst-Stump, senior advisor at the DHS S&T Office of Science and Engineering, welcomes participants to the EMOTR TTX in Madison, WI.

2.0 Methodology

This section describes who participated, what was discussed, and how the TTX was executed.

2.1 Participation

Each TTX brought together emergency managers and first responders with diverse backgrounds; federal, state, and local EOC stakeholders; and academic researchers. Participants were not expected to solve the problems presented in the scenario. Instead, the exercises jump-started discussions about the technologies, data inputs, tasks, coordination,

Figure 2. EMOTR Task Lead Nick Betzsold briefs an audience at the Wisconsin TTX.

outputs, and gaps between the current and desired states. Participants were coached to keep discussions broad and focused on the impacts of technology on a given scenario.

2.2 Approach

The TTXs are designed to be sequential, spanning a variety of EM organization sizes and population densities. The first EMOTR TTX in Madison, WI focused on technologies such as artificial intelligence (AI) and the Virtual EOC concept—which relies heavily on efficient communication and distributed capabilities from county, state, and federal organizations. Against this backdrop, a futuristic severe ice storm emergency scenario and cyberattack complication were used to facilitate the TTX. For more details regarding the TTX scenario and facilitation, please see Appendix A – Situation Manual.

2.3 Format

Approximately 20 participants were invited to attend the TTX, which was executed as a half-day, café-style workshop. A high-level agenda is provided in Table 2.

Table 2. Madison, WI TTX Agenda

Time	Activity
1300	Arrival and Check-In
1330	Welcome and Opening Remarks
1340	PNNL/EMOTR Overview and Player Introductions
1400	EOC of the Future Tabletop Objectives
1410	Technology Overview
1440	Exercise Parameters
1450	Module One
1530	End Module One
1540	Module Two
1650	Closeout
1700	Adjourn

The accompanying slide deck used for facilitation can be found in Appendix B – Slides.

3.0 Key Insights

Key insights resulting from this TTX are organized into outcomes from the discussions and participant feedback.

3.1 Discussion Outcomes

Figure 3. Participants discuss research questions regarding technology solutions.

Key discussion points included the following:

- AI should help uncover the unknown information associated with an incident (e.g., anomaly detection).

- Data sources utilized by AI matter. Closed or validated sources improve trust in AI, but this must be balanced with the open or unvalidated sources that are potentially left out.

- It is necessary to understand who should receive which messages, how to tailor the messaging according to language/culture, and how messages will likely be consumed.

- Much historical data on similar events, including developed plans, goes unutilized because of the high-stress demands of an unfolding emergency. AI can help remedy this and support redundancy efforts by helping fill the institutional knowledge and situational awareness gap when EOC functions go down, particularly in a virtual or hybrid EOC environment. AI can also help de-conflict various response plans and aggregate after-action reporting into a cohesive story.

- Emerging technology has a side effect of creating demand for new skills. For example, ChatGPT and other AI tools that require prompts from humans are only as good as the prompts they receive. This is creating the need for skilled prompt engineers.

- Situational awareness is built and maintained during normal operation, not only during emergency incidents. EM personnel need tools for emergencies and non-emergencies.

- Increased reliance on technology should not have the unintended consequence of losing root-cause understanding of emergency events.

- It is not clear whether AI-generated materials (notes, emails, plans, etc.) carry the same legal weight as those created by human personnel. Ultimately these are tools, and tool operators need to be appropriately trained to take on the liability for decisions made based on tool outputs and recommendations.

Additionally, the TTX discussions evaluated the potential impacts of emerging technologies on emergency operations, summarized in Table 3. For each technology idea, the table summarizes the advantages, disadvantages, implementation considerations, and which EOC of the Future concept it addresses. For more information on EOC of the Future concepts, see the EOC of the Future Concepts and Recommendations report available by request to emotr@pnnl.gov.[1]

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[1] Betzsold, N., Barr, J., Lesperance, A., Bartholomew, R., Ortega, S., Sleiman, C., Disney, M., Tietje, G. (2024). "Emergency Management of Tomorrow Research – Emergency Operations Center of the Future Recommendations Report." Pacific Northwest National Laboratory.
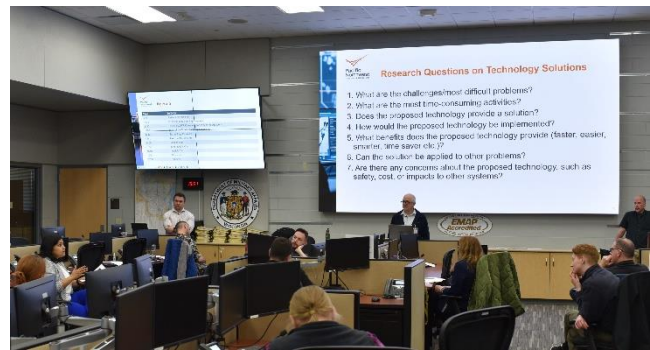
Table 3. Madison, WI TTX Outcomes

Technology Ideas	Advantage	Disadvantage	Implementation	EOC of the Future Concept(s) Addressed
AI – digital assistant	Notetaking Summarization Dissemination Curation Deconfliction	Trust Validation Ownership Sharing	Who bears responsibility? Are AI-generated notes discoverable in legal proceedings?	Continuous, real-time situational awareness AI automation and human-machine teaming
AI – predictive modeling (weather)	Micro-level forecasts Better identify the most impacted regions	Fidelity Data validation Timeliness	Feed into situational awareness reports	Continuous, real-time situational awareness AI automation and human-machine teaming
AI – resource allocation	Awareness of staffing Distribution list management Quickly and easily communicated to EOC personnel Prioritized utilization of resources		Lots of preparation needed in advance Will everyone share their information?	Continuous, real-time situational awareness
Internet of Things – wearables (e.g., glasses)	Customized to end user (preferences, job function, experience level, etc.)	Less useful in drills because the technology crutch inhibits learning		AI automation and human-machine teaming Human-centered design of workspaces

3.2 Feedback

The event was overwhelmingly deemed an effective use of time (94 percent of feedback respondents), with participants noting how eye-opening and informative it was to explore the positive side of AI and other technologies being applied to EM. This is a great sign since just over half entered the TTX without any expectations as to what it would produce. Approximately 82 percent said they would attend another PNNL-facilitated tabletop exercise.

Other feedback noted that the group should not be any bigger than what was present (20-25 participants), and a U-shaped setup would be more desirable. Some wanted to see more technology demos and involvement throughout the scenario discussions so that it felt more like an actual tabletop exercise. There were several who were interested in continued discussions and workshops.

A compiled feedback form can be found in Appendix C – Participant Feedback.

Figure 4. PNNL EMOTR Task Lead Jon Barr shares technology demonstrations with TTX participants.

4.0 Next Steps

This first TTX was a great success, but there is still ample room to improve the discussion and subsequent outcomes. In particular, changes will be made to the facilitation to promote more discussion around specific EM tasks that can be addressed by the emerging technologies. This will allow more opportunity to discuss advantages, disadvantages, and implementation.

Winter Storm 2030

Situation Manual

March 28, 2024

This Situation Manual (SitMan) provides participants with all the necessary tools for their roles in the exercise. Some material is intended for the exclusive use of exercise planners, facilitators, and evaluators, but players may view other materials that are necessary to their performance.

Table of Contents

OVERVIEW

Name	Winter Storm 2023
Dates	March 28, 2024
Scope	4 Hours at Wisconsin Emergency Management 2400Wright St. Madison, WI 53708
Mission Area(s)	Response
Objectives	See page 2
Threat or Hazard	Winter Storm and Cyberattack
Scenario	Severe ice storm and snowstorm strikes the Madison, WI region knocking out electrical power and making roads impassable. A simultaneous cyberattack interrupts some critical services.
Sponsor	Department of Homeland Security, Pacific Northwest National Laboratory, and Wisconsin Emergency Management
Participating Organizations	Players (mix of local, state, federal) representing emergency management, law enforcement, fire department, emergency medical services, utilities, transportation, communications, public health, healthcare, Federal Bureau of Investigation, cyber response, and National Guard
Point of Contact	Nick Betzsold Data Scientist Pacific Northwest National Laboratory nicholas.betzsold@pnnl.gov | (509) 375-4583

GENERAL INFORMATION

Objectives

The following objectives in Table 1 describe the expected outcomes for the exercise.

Exercise Objectives
Identify technologies that could improve EOC response operations
List efficiencies gained and performance enhancements in EOC operations through use of identified technologies
Discuss limitations, concerns, and mitigation strategies for identified technologies
Review how to implement identified technologies

Table 1. Exercise Objectives

The exercise schedule is in Appendix A.

Participant Roles and Responsibilities

The term *participant* encompasses many groups of people, not just those playing in the exercise. Groups of participants involved in the exercise (Appendix B), and their respective roles and responsibilities, are as follows:

Players- Players are personnel who have an active role in discussing or performing their regular roles and responsibilities during the exercise. Players discuss or initiate actions in response to the simulated emergency. Players will also identify and/or discuss the ways new technology could be brought to bear in their roles and what challenges they would anticipate with technology adoption.

Observers- Observers do not directly participate in the exercise. However, they may support the development of player responses to the situation during the discussion by asking relevant questions or providing subject matter expertise.

Facilitators- Facilitators provide situation updates and moderate discussions. They also provide additional information or resolve questions as required. Key Exercise Planning Team members also may assist with facilitation as subject matter experts (SMEs) during the exercise.

Structure

This exercise will be a multimedia, facilitated activity. Players will participate in the following two scenario modules:

Module 1: Storm preparation

Module 2: Response to storm and cyberattack

Each module begins with an audio update that summarizes key events occurring within that time period.

The facilitator will guide participants through a brief discussion period, developed using the scenario modules, to describe their actions, decisions, and concerns from the perspective of

personnel assigned to an emergency operations center. Players are encouraged to ask questions of other players. Throughout the discussion period, the facilitator will highlight current and possible future technologies for participants to evaluate for use in an emergency operations center during response. Players are encouraged to present other technological solutions as well as suggest ideas for future research.

Guidelines

- This exercise will be held in an open, low-stress, no-fault environment. Varying viewpoints, even disagreements, are expected.

- Respond to the scenario using your experience, knowledge of current plans and capabilities (i.e., you may use only existing assets) and insights derived from your training and experience.

- Decisions are not precedent setting and may not reflect your organization's final position on a given issue. This is an opportunity to discuss technologies that may improve EOC operations.

- Issue identification is not as valuable as player evaluations of proposed technology provided by the facilitator that could improve response efforts. Creative, and even disruptive, ideas about technology and tools should be the focus.

- Assume there will be cooperation and support from other responders and agencies.

- The basis for discussion consists of the scenario narrative and modules, your experience, your understanding of relevant plans, your intuition, and information about technology provided by the facilitators and that you bring with you to the exercise.

- Treat the scenario as if it will affect your area.

Assumptions and Artificialities

In any exercise, assumptions and artificialities may be necessary to complete play in the time allotted and/or account for logistical limitations. Participants should accept that assumptions and artificialities are inherent and should not allow these considerations to negatively impact their participation. During this exercise, the following apply:

- The activity is conducted in a no-fault learning environment wherein technological solutions to improve response will be discussed.

- The scenario is plausible, and events occur as they are presented.

- The scenario is intended to form the basis for discussions about technology, less emphasis will be placed on solving tactical problems presented in the scenario.

- All players receive the same information at the same time.

MODULE 1: STORM PREPARATION

Scenario

Sunday, March 3rd, 2030 Noon

"The jubilation felt throughout Wisconsin following the Green Bay Packers Super Bowl win has given way to growing concerns over a forecasted severe winter storm. We have a wild weather week ahead as another Arctic Blast is headed our way. The National Weather Service is predicting a series of severe storms to most of our state over the coming week.

The storm, which is expected to bring rain, ice, and snow to the region, will start at around noon this Tuesday, March 5th. Rain showers will quickly change to sleet and freezing rain with potentially heavy ice accumulations expected over the course of the afternoon and into the evening. We will transition from ice to snow during the night with accumulations anywhere from 12 to 18 inches. Tuesday's high will be 30 degrees at 11am and with temperatures dropping throughout the day to the low 20s by 8pm. Our extended forecast shows another front arriving late Tuesday bringing bitter temperatures and more snow.

Weather models vary on how much ice we might receive, with estimates ranging from ½ inch to 3 inches. Powerlines are particularly vulnerable to ice accumulation. Only a quarter of an inch of ice on a powerline can add approximately 500 pounds to a typical span between utility poles. Residents should prepare for extensive and prolonged power outages. Roadways are expected to become nearly impassable once the icing begins. Already schools in several districts have announced they will be closed on Tuesday, and area hospitals have begun cancellation of elective procedures. Managers at Dane County Airport anticipate several flight cancellations as the storm develops and recommend travelers closely monitor the status of their flight. The Wisconsin Department Emergency of Management urges everyone to take this storm seriously and prepare now.

After the commercial break, we have a developing story of a possible ransomware cyberattack on Wisconsin's natural gas utility companies. This could have a serious impact on community safety in the wake of this storm."

Key Issues

- This is a major winter storm that will exceed regional response capabilities.
- The storm response will be complicated by a simultaneous cyberattack.
- Virtual EOC operations will be highlighted during the exercise.

Questions

The following questions are provided to guide the discussion of proposed technological solutions.

1. What are the challenges/most difficult problems?

2. What are the most time-consuming activities?

3. Which of the proposed technologies provide a solution?

4. How would these proposed technologies be implemented?

5. What benefits does a given proposed technology provide (faster, easier, smarter, time saver, etc.)?

6. Can the solution be applied to other problems?

7. Are there any concerns about the proposed technology, such as safety, cost, or impacts to other systems?

MODULE 2: STORM RESPONSE

Scenario

Wednesday, March 6th, 2030, 1800 Hours

"It's a dangerous mess out there." That is how one resident of Madison described the storm. Throughout Wisconsin south of State Highway 10 and as far as northern Illinois and Indiana, winter conditions can best be described as severe and possibly record breaking. And the weather forecast doesn't look like we will get relief anytime soon. We'll have the latest forecast for you later in the broadcast. Here is what we know so far.

As expected, the storm slammed into our region around noon on Tuesday. The ice storm was worse than expected with reports of at least two inches of ice coating everything followed by heavy snow.

The Governor declared a state of emergency Monday morning and National Guard soldiers are beginning to arrive in our region.

Six deaths have been reported so far. In Madison, a poorly ventilated gas heater is to blame for the deaths of a family of four. Officials are warning everyone about the danger of Carbon Monoxide poisoning. If you are operating a generator or heater, make sure to follow the operating instructions and properly ventilate the area.

Police, fire, and EMS are asking everyone to call 911 for only life-threatening emergencies. Patrol cars, ambulances, and even fire trucks are getting stuck in the snow and ice just like everyone else. If this weren't enough, there is a 911 phone service outage affecting Columbia County. Sources tell us the cause may be a cyberattack.

Law enforcement agencies are reporting numerous accidents, some serious. Crews worked throughout Tuesday night and into Wednesday morning rescuing stranded motorists and bus riders. A State Patrol spokesperson tells us the biggest problem right now are abandoned vehicles on roadways and highways making it difficult for the snowplows. In many areas, conditions are so severe that tow trucks are getting stuck. Department of Transportation officials are focusing on the most vital roadways, such as around hospitals. Downed trees and powerlines across roadways further complicate plowing.

A power outage extends throughout most of Wisconsin. Hospitals are on emergency power with emergency departments full of patients. Many who are not sick or injured have sought shelter from the cold in area hospitals despite pleas from officials to use the shelters established by emergency management.

Currently, we have heavy snow falling with winds at 20 mph and gusting to 35 mph. Snow totals vary from 12 to 20 inches so far with more on the way. Tomorrow we will begin to feel the full effect of this polar blast as snow continues and temperatures drop throughout the day. By Thursday morning you should expect another foot of snow. Thursday's high will only reach 22 degrees before plunging to 5 degrees by this time tomorrow and a low of -10 degrees overnight. Snow will continue Friday. By then, our total snow accumulation will be in the range of two and a half feet. Clearly, this is a record-breaking storm.

Emergency management agencies in the affected areas are coordinating response efforts to ensure scarce resources are assigned to areas most in need. "Ordinarily, we rely on our neighboring jurisdictions to help

us out in an emergency. In this situation, everyone has been hard hit" said PIO Jim Evertalk at Madison Emergency Operations Center. Officials report one of their biggest concerns is staffing. Employees in critical jobs such as healthcare, first responders, and utilities have been on duty for well over 24 hours without relief because their replacements cannot get into work. Even employees at several emergency operations centers have not been able to get a break.

Longer term, emergency managers are tackling several emerging problems. Dialysis patients need to get their regular treatments, grocery stores are closed, and food warehouse and delivery employees can't get in to work. Fuel is another problem. Most gas stations do not have generators to power the gas pumps. Cell tower emergency generators have begun to run out of fuel as well.

Just in, we have confirmed a cyberattack targeting Madison Gas and Electric. Thousands of customers are without heat. This includes University Hospital that is operating with heat. The utility tells us they were forced to shut down multiple substations to contain the breach. We are told a third-party vendor responsible for control system software was compromised by a ransomware attack. The identity of the perpetrators is not known. Additionally, officials are warning the public about multiple fraudulent websites and phishing scams. Sources tell us these attacks may be related and are intended to hinder storm response operations.

Officials are also concerned about what appears to be a coordinated effort to spread misinformation. This includes fake announcements from sources claiming to be government agencies. Joint Information Centers are attempting to counter the misinformation but are overwhelmed by the sheer volume of messages on so many platforms. "By the time we identify a trending topic and craft a response, misinformation has spread far and wide and the damage is done," said one official.

Key Issues

- Power is out throughout the state south of State Highway 10.
- A thick layer of ice and snow blankets the area. More snow, falling temperatures, and wind are expected.
- Roadways are impassable in several areas due to ice and snow, trees and wires down, and abandoned vehicles. Many police, fire, EMS, and others, vehicles are getting stuck in the snow and ice.
- A cyberattack has caused a natural gas outage in some counties with thousands unable to heat their homes.

Questions

Based on the information provided, participate in the discussion concerning the scenario in Module 2. Use the critical issues, decisions, and requirements involved to assess technologies for improving response in the EOC.

The following questions are provided to guide the discussion of proposed technological solutions.

1. What are the challenges/most difficult problems?

2. What are the most time-consuming activities?

3. Which of the proposed technologies provide a solution?

4. How would these proposed technologies be implemented?

5. What benefits does a given proposed technology provide (faster, easier, smarter, time saver, etc.)?

6. Can the solution be applied to other problems?

7. Are there any concerns about the proposed technology, such as safety, cost, or impacts to other systems?

EXERCISE SCHEDULE

Note: Because this information is updated throughout the exercise planning process, appendices may be developed as stand-alone documents rather than as part of the SitMan.

Time	Activity
March 28, 2024	
1300	Arrival and Check-In
1330	Welcome and Opening Remarks – WI OEM, DHS S&T
1340	PNNL/EMOTR Overview and Player Introductions – PNNL
1400	EOC of the Future Tabletop Objectives – Nick Betzsold (PNNL)
1410	Technology Overview – Jon Barr and Nick Betzsold (PNNL)
1440	Exercise Parameters – Grant Tietje (PNNL)
1450	Module One
1530	End Module One
1540	Module Two
1650	Closeout
1700	Adjourn

ACRONYMS

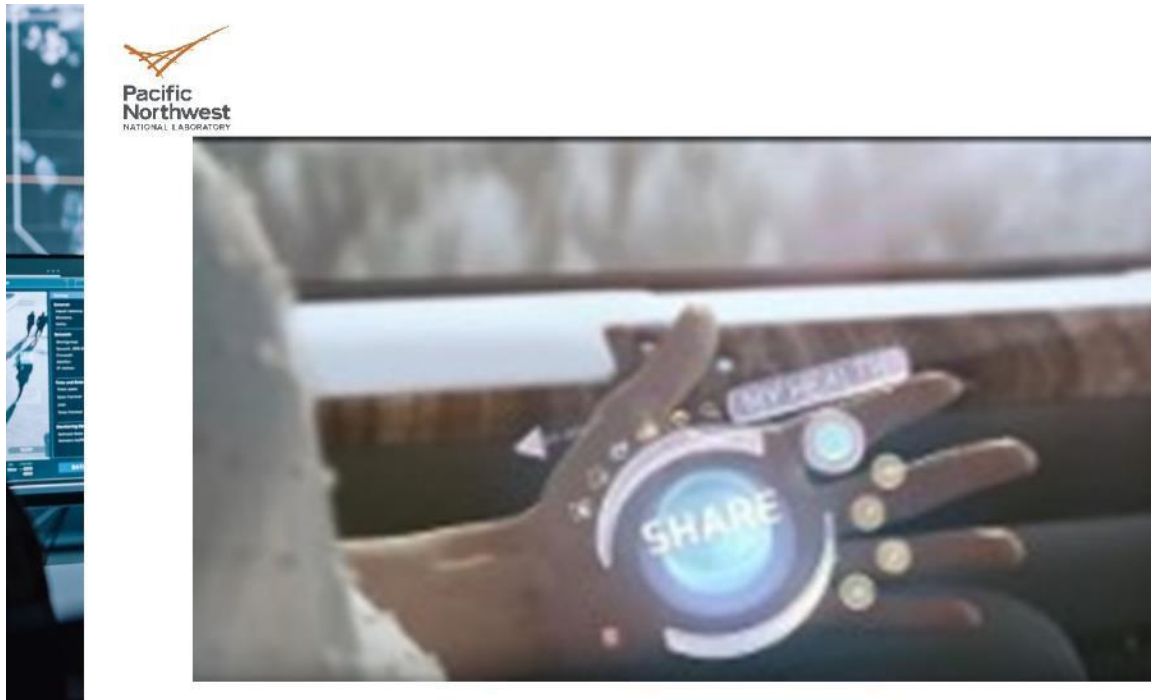| Acronym	Term
DHS	U.S. Department of Homeland Security
HSEEP	Homeland Security Exercise and Evaluation Program
SitMan	Situation Manual
SME	Subject Matter Expert
TTX	Tabletop Exercise
PNNL	Pacific Northwest National Laboratory

Appendix B – Slides

Video: https://www.youtube.com/watch?v=T6ubRoZCeVw

Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT OF HOMELAND SECURITY **Science and Technology**

PNNL is partnering with DHS on the EMOTR program:
Connecting existing research and technology **with EM capability needs.**
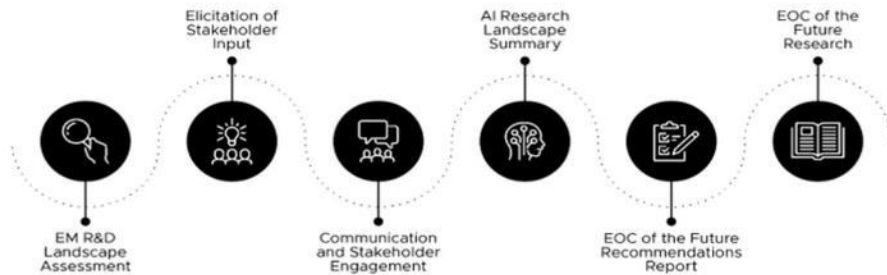
EMERGENCY OPERATIONS CENTER OF THE FUTURE

COORDINATION

FUTURE OF EMERGENCY MANAGEMENT

APPLIED RESEARCH

FUTURE THREATS RESEARCH

EM R&D Landscape Assessment

Elicitation of Stakeholder Input

Communication and Stakeholder Engagement

AI Research Landscape Summary

EOC of the Future Recommendations Report

EOC of the Future Research

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**Pacific Northwest** NATIONAL LABORATORY

Welcome and Introductions

Pacific Northwest National Laboratory is a U.S. Department of Energy national laboratory **advancing scientific frontiers** and providing solutions to critical national needs

- Established in 1965
- Managed by Battelle Memorial Institute
- 6,100+ staff across the nation
- PNNL also supports the Department of Homeland Security

Sustainable Energy

National Security

Scientific Discovery
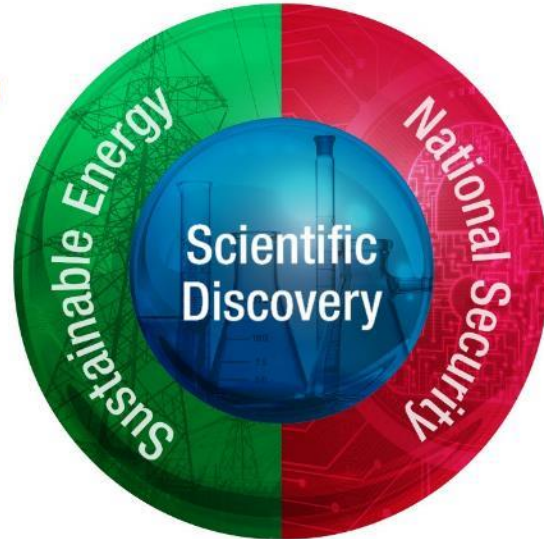
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Agenda

- Participant Introductions (Ice Breaker)
- Exercise Objectives + Research Questions
- Technology Overview
- *Module 1*
- Break
- *Module 2*
- Closing Statements and Next Steps

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Participant Introductions

What is your *favorite tool* to use in emergency response?

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Exercise Objectives

Scope:
- Evaluate potential impacts of new technologies on emergency operations, exploring the Virtual Emergency Operations Center (EOC) concept and how technology and automation can support emergency management personnel.

Objectives:
- Identify technologies that could improve EOC response operations
- List efficiencies gained and performance enhancements in EOC operations through use of identified technologies
- Discuss limitations, concerns, and mitigation strategies for identified technologies
- Review how to implement identified technologies
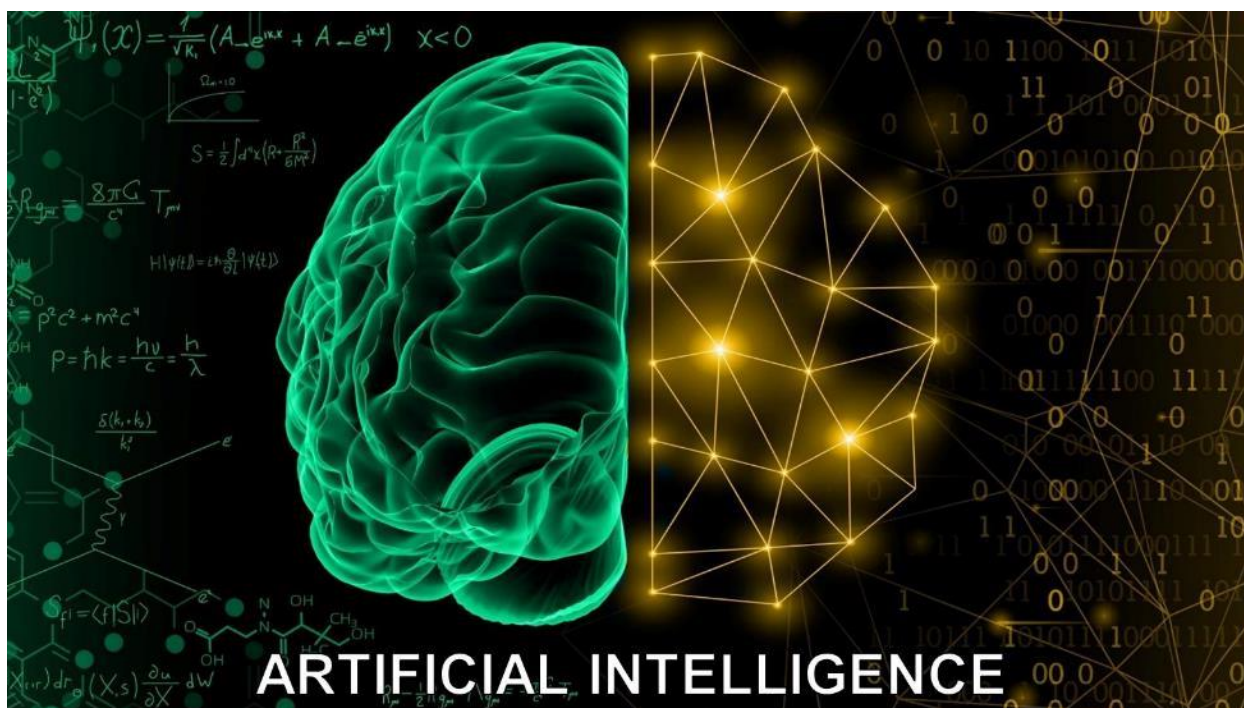
Ground Rules:

Solving scenario issues is not an objective.

Focus discussion on technology rather than working through procedural actions

We are not evaluating emergency plans

Assume cooperation from responders and agencies

CLOUD, FOG, AND EDGE COMPUTING
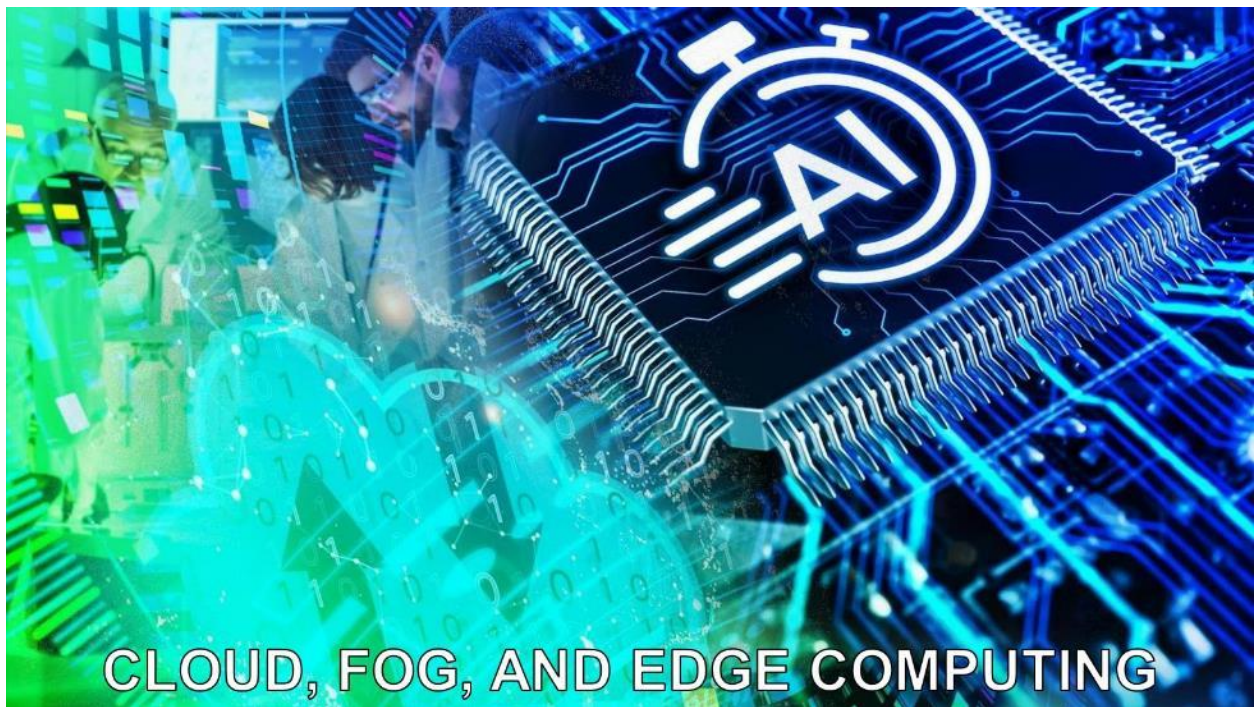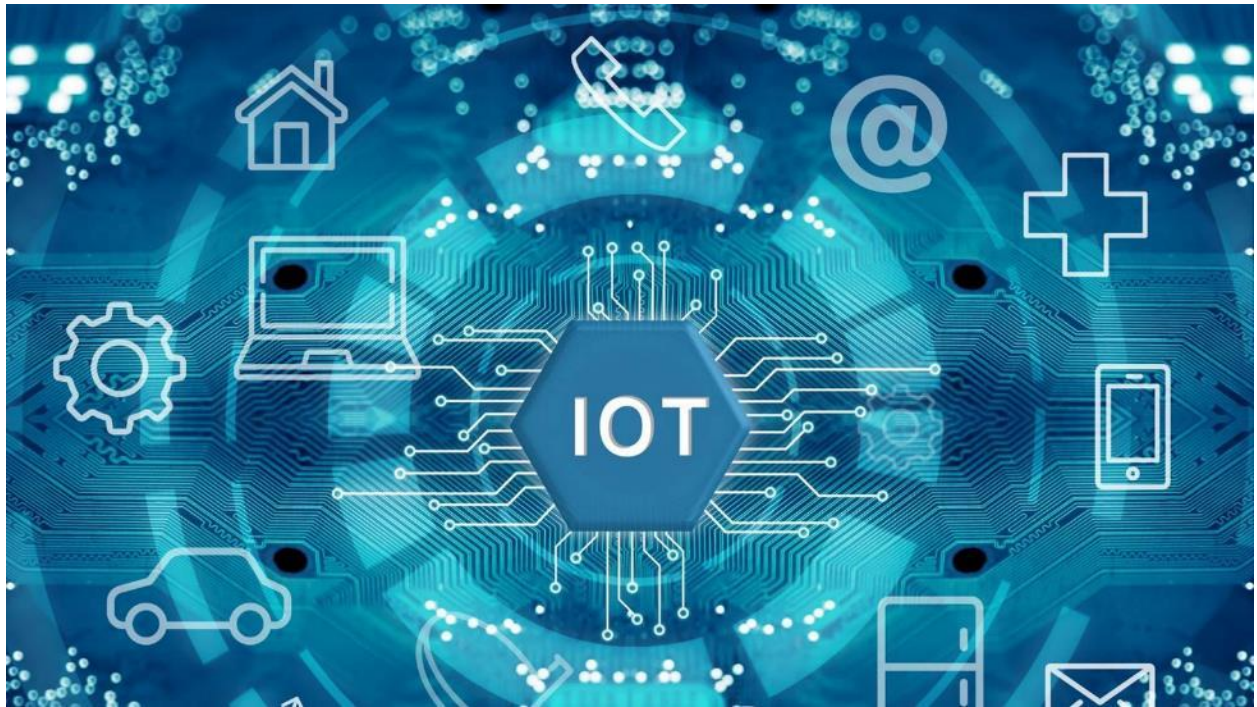
DATA FABRIC AND DATA MESH

ROBOTICS AND AUTONOMY

SITUATIONAL AWARENESS TOOLS

DIGITAL TWINS

GEOSPATIAL ANALYTICS

SOCIAL MEDIA ANALYTICS

ADVANCED WIRELESS COMMUNICATIONS

CYBERSECURITY TECHNOLOGIES
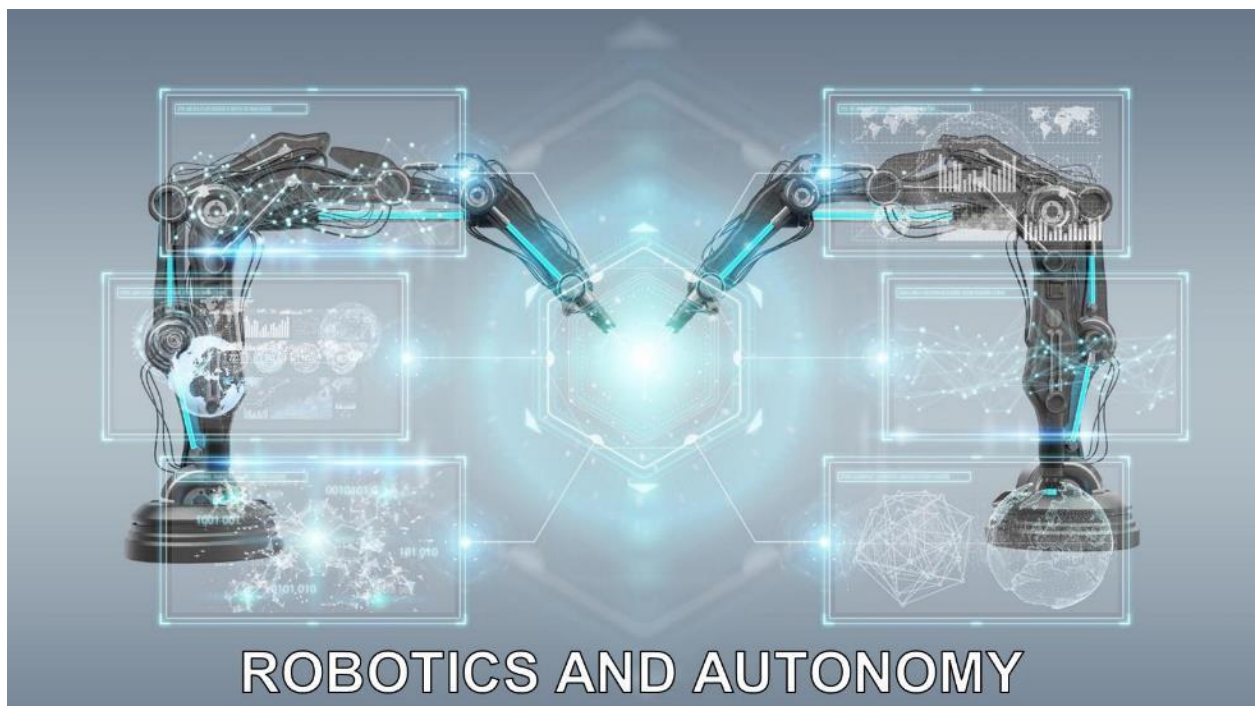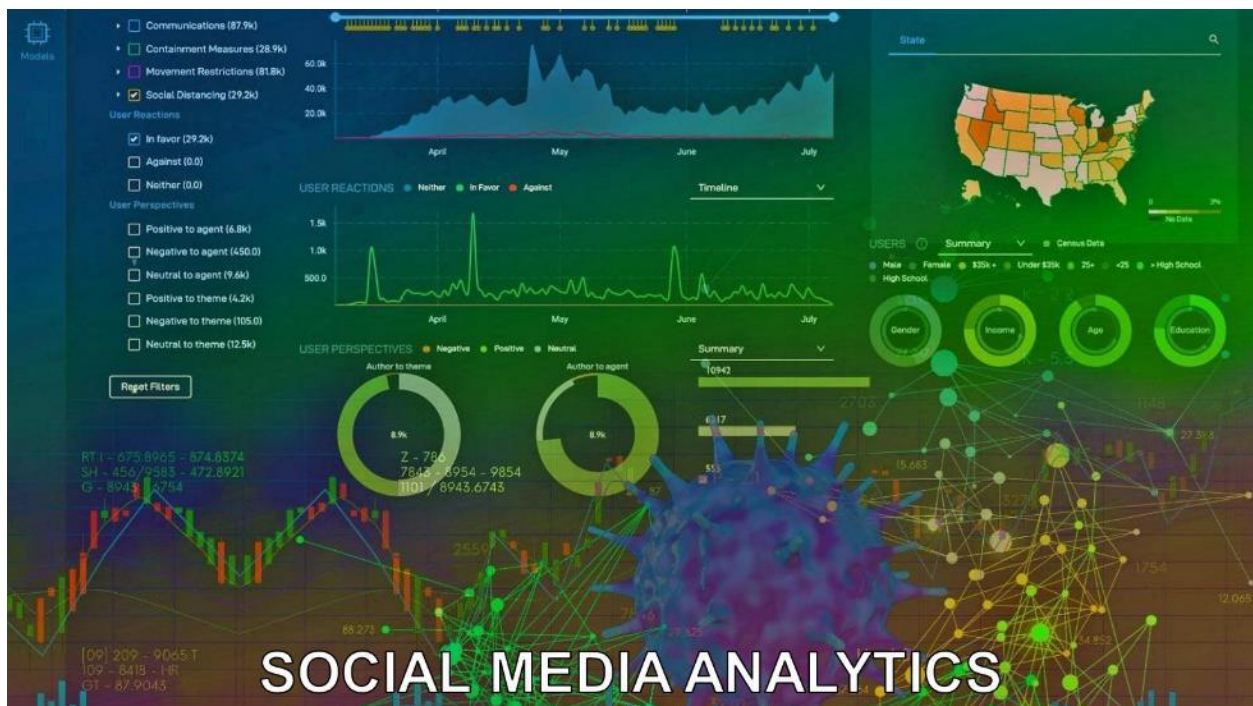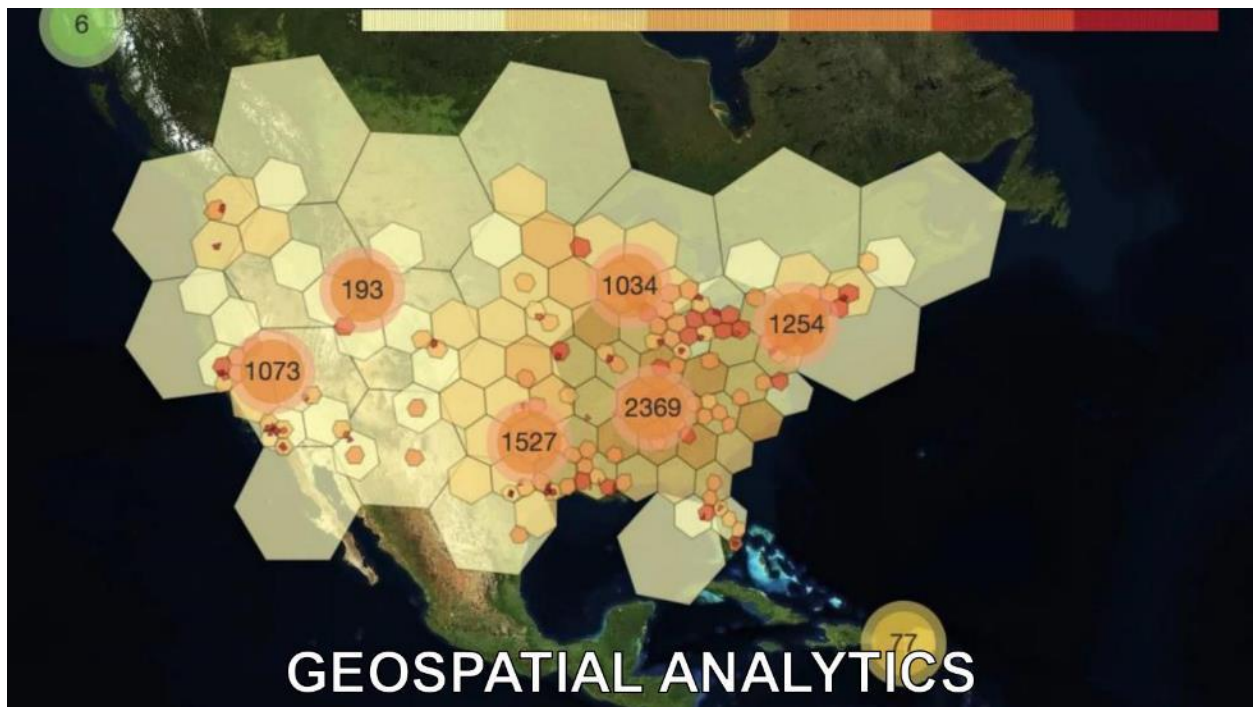
Exercise Parameters

- Formatted to address research questions.
- Injects and questions focused on technology.
- Emphasis on creative, unconventional thinking in the present and 5-10 years in the future.
- Be concise in your comments so that as many as possible can participate.
- Expect a rapid pace and a fun exercise.

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Module 1 – Storm Preparation

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Storm Preparations

Expected Weather Conditions:
- Severe winter storm – starting March 5
- Expected rain, ice, snow (8–12 inches)
- 30° to 20° by 2000
- Wind from west at 15–20 mph, gusts to 35 mph
- Ice accumulation ranging from ½ inches to 3 inches

Expected Impacts:
- Exceed regional response capabilities
- Extensive and prolonged power outages
- Roadway closures and overall unsafe travel conditions
- School closure and flight cancellations

Research Questions on Technology Solutions

1. What are the challenges/most difficult problems?
2. What are the most time-consuming activities?
3. Does the proposed technology provide a solution?
4. How would the proposed technology be implemented?
5. What benefits does the proposed technology provide (faster, easier, smarter, time saver etc.)?
6. Can the solution be applied to other problems?
7. Are there any concerns about the proposed technology, such as safety, cost, or impacts to other systems?

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Module 2 – Response to Storm + Cyber Attack

Storm Response

Weather Conditions:
- Ice storm worse than predicted – minimum of 2 inches
- Governor declared state of emergency
- Heavy snow fall continuing with 35 mph wind gusts
- Expecting low temperatures and more snow for several days

Storm Impacts:
- Deaths caused by improper use of generators and heaters
- Vehicular accidents and abandoned vehicles on roadway
- Downed power lines across roadways, power outages
- Staffing concerns

Cyber Attack Impacts:
- 9-1-1 phone service outage in Columbia County
- Attack on Madison Gas and Electric shuts down heat in some communities
- Social media misinformation

Research Questions on Technology Solutions

1. What are the challenges/most difficult problems?
2. What are the most time-consuming activities?
3. Does the proposed technology provide a solution?
4. How would the proposed technology be implemented?
5. What benefits does the proposed technology provide (faster, easier, smarter, time saver etc.)?
6. Can the solution be applied to other problems?
7. Are there any concerns about the proposed technology, such as safety, cost, or impacts to other systems?

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Thank you

Image from The Christian Science Monitor: https://www.csmonitor.com/USA/Latest-News-Wires/2015/0118/NFC-Championship-Seahawks-overtake-Packers-in-OT-28-22

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Appendix C – Participant Feedback

The following is a summary of participant feedback from the TTX. Names and identifying information have been removed.

1. Was the engagement an effective use of your time?
- Very much so – 16 (94%)
- Somewhat
- Not so much – 1 (6%)
- Not at all

2. Did the activity deliver the outcomes that you were expecting?
- Yes – 8 (47%)
- No
- I had no expectations – 9 (53%)

3. Would you attend another PNNL-facilitated tabletop exercise?
- Yes – 14 (82%)
- No – 1 (6%)
- Not Sure – 2 (depends on venue/date/time, didn't know much about the topic) (12%)

4. How did you find the format of the exercise presentation? Was it effective?
- Good balance of info and discussion
- Interesting/opens mind to other technologies; Eye-opening
- Great—could also break down into groups
- Found the questions provocative
- Would not make the group any larger for best conversation/facilitation
- Liked how AI was integrated into the presentation and exercise
- May be beneficial to follow [Homeland Security Exercise and Evaluation Program] format and consider moving from tabletop to seminar or workshop

5. What were your top key takeaways from the exercise?
- AI is a tool—learn when/how to use it and when not to use it
- Awareness of technology advancements
- Interesting to look down the road at things that will change (quickly)
- Appreciated the review of different types of tech
- No governing bodies; AI needs it
- Many in EM aren't tapped into other tools available beyond what is trendy (e.g., ChatGPT)
- Digital Twins concept
- This went a long way towards helping my comfort level around tech in EM
- Where AI could assist in EOC support functions
- Products AI can generate

- AI/tech advancements could greatly benefit EM professionals and their stakeholders
- AI is here to stay and we either have to get on board or be left behind
- EMs need more education on this

6. Please provide any other feedback you have about the exercise (e.g., what worked well, suggestions to make it better, additional information needed prior to the TTX).
- Use more actual tools during TTX
- Open conversation from attendees encouraged and tolerated
- Make everything relative to time we are playing (e.g., weather modeling in 2030 would be crazy accurate)
- Attendees were too primed with AI without specifics to their work
- There are several ancillary topics (e.g., governance, open record) critical to developing a comprehensive path forward
- Facilitators did a great job on class engagement
- Water/snacks appreciated
- Facilitators/materials were well prepared and handled the discussions well
- Exercises were realistic to our area
- Informative group discussions
- Appreciated another outlet to share info since I'm averse to speaking out in groups
- Hold in a room where microphones aren't needed and participants can see each other
- More time (6 hours instead of 4)

7. Please provide input on any other scenarios, technologies, and other subject areas that should be topics for consideration/require deeper exploration in future tabletop exercises.
- Open records, HIPAA/AI interaction
- More on mal/dis/misinformation
- Personnel safety
- Training with [augmented reality and virtual reality]
- Using AI to fuse disparate data to find patterns, areas of triangulation, and assisting with course of action development
- Automation in [Integrated Public Alert and Warning System] messages
- Best practices documents for AI implementation (when practical)
- Industrial accidents
- Civil unrest/disturbances
- Pop-up storms/tornadoes
- Still a substantial amount of concern and mistrust with AI services
- GIS in AI
- Long-term power outage

8. If you would like to be engaged in any additional workshops or discussions regarding EM or first responders, please provide your name and email. [removed]

Notecards:
- Distro list management and contact resources (potential function of AI)
- Metrics giving "so what" and automated outputs
- Warfighting functions
  - Logistics (at echelon, e.g., on hand #'s, maint status) ←→ Operations (e.g., consumption rates per dist traveled)

Military decision-making process:
1. Receive the mission
2. Mission analysis
3. COA development
4. COA analysis
5. COA decision
6. Orders production
7. Rapid decision-making sync process

AI support ideas:
- Alerts, sitreps, muster
- Threat capability and environment/societal effects
- Meet the need (branch plans), prioritization of resources
- Action and reaction and counteraction
- What Ifs, risks
- Weighted factors – calculated best COA
- Messaging filtered by capability and priority
- Heuristics based quick shift decision/plan

AI/tech could be useful for sorting/organizing information received during emergency
- Calls come in requiring resources
- AI make sure all correct info is gathered
- AI could streamline operations/prevent duplication
- AI could suggest resources that are/will be needed and who to go for them
- Track in a database

Example: AI sees an image/reads situation report of flooding/people swimming and determines we need 3 boats and medical equipment for swimmers/others that need rescuing

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