



2025 AI in Fire Engineering Summit
May 28-30, 2025
Berkeley, California, USA



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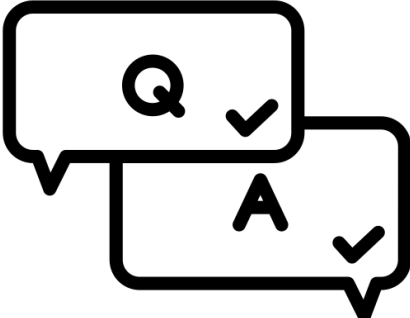
SFPE Foundation Live Webinar: 2025 AI in Fire Engineering Summit Recap

Leslie Marshall, PhD, SFPE Foundation
Amanda Tarbet, MSLS, SFPE Foundation

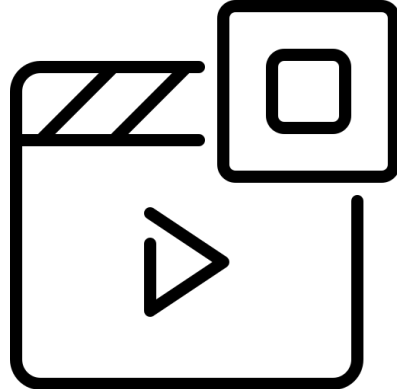
July 3, 2025



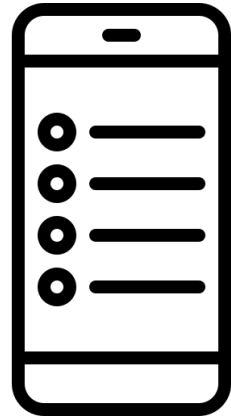
Webinar Housekeeping



Please use the Q&A feature to submit your questions.



This webinar is being recorded.



Take the webinar evaluation survey to share your thoughts.



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Event Overview



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View the Program



2025 AI Summit Program Committee

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(Co-Chair) Michael Gollner, University of California, Berkeley

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Ankit Sharma, Case Western Reserve University

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Brent Wunderlich, FM

Brian Metzger, United States Fire Administration

Bryan Hoskins, Oklahoma State University

Charley Fleischmann, University of Canterbury

Christopher Wieczorek, FM

Corey Kinsman, Performance Based Fire Protection Engineering

David Icove, University of Tennessee

David Jacoby, Simpson Gumpertz & Heger

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Guillermo Rein, Imperial College

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John LeBlanc, FM

Jonathan Hodges, Jensen Hughes

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M. Hamed Mozaffari, National Research Council Canada

M.Z. Naser, Clemson University

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Will Higgins, Fisher Engineering, a BOWMAN company

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SFPE Foundation Grand Challenges Initiative (GCI)

MOTIVATION:

- Rapidly changing world; new technologies and applications, widening inequalities, systemic challenges
- Fire engineers have critical skills and expertise to offer, but gaps persist

APPROACH:

- Convening industry, academic, government, non-profit partners in the interest of strategic cooperation in research, education, and outreach over the next 10 years

FOUR TOPIC AREAS:

1. Energy & Infrastructure
2. Resilience & Sustainability
3. Climate Change
4. Digitalization, AI, & Cybersecurity

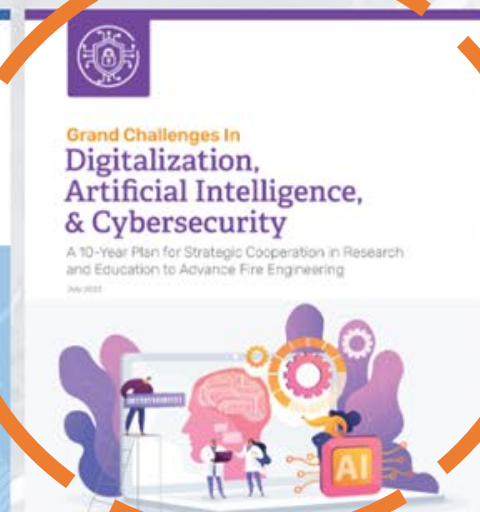
GCI White Papers = 10-Year Timeline for Strategic Cooperation



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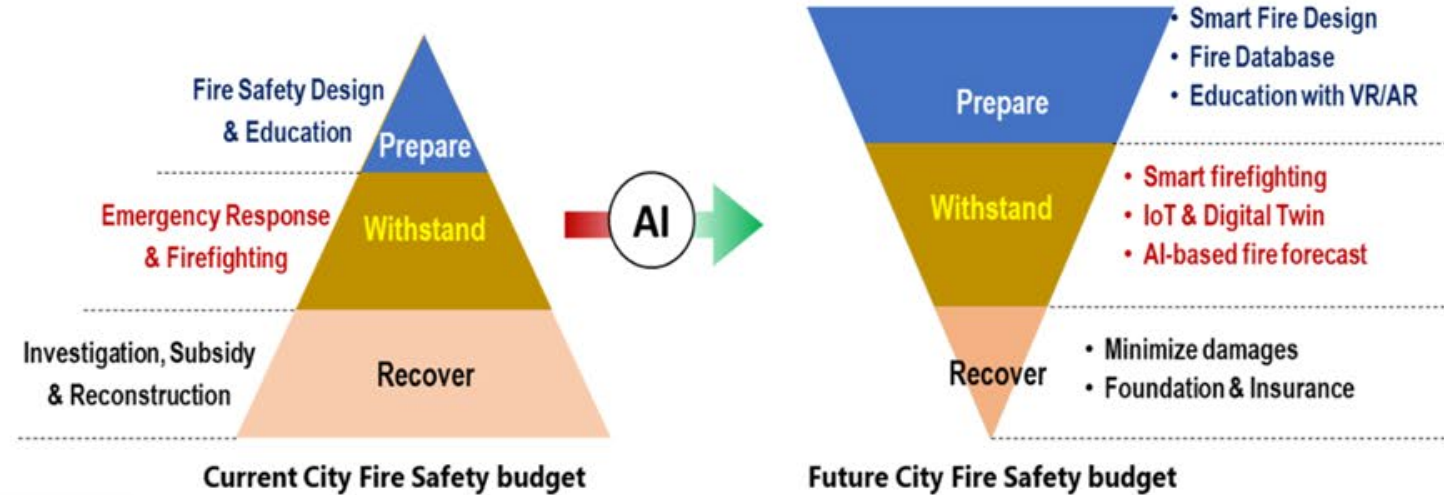


How is AI shaping fire protection engineering?

Grand Challenges In Digitalization, Artificial Intelligence, & Cybersecurity

A 10-Year Plan for Strategic Cooperation in Research and Education to Advance Fire Engineering

July 2023



1. Data Management & Analysis for Risk Assessment
2. Smart Fire Modeling
3. Digitalized Design, Operation, Inspection, & Maintenance of Fire Protection Systems
4. Digitalized Firefighting & Evacuation



Where should we focus our collective efforts?

Goals for the AI Summit:

- Showcase existing/future AI applications to fire engineering, for practitioners and researchers
- Highlight gaps, opportunities
- Identify areas of greatest impact AND partners to act

Workshop: crowdsourcing research, education, outreach, policy priorities



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Program Summary & Main Takeaways

Program Day 1 - Part 0

Part 0: Situating AI within Fire Engineering	
1:20 – 2:20	Opening Plenary Session
1:20 – 1:50	Demystifying AI for Fire Science and Management <i>Ilkay Altintas, Ph.D., University of California, San Diego</i>
1:50 – 2:20	Artificial Intelligence as an Agent to Suppress Fires: How Can ML Address Challenges in Wildfire Management? <i>Matthias Ihme, Ph.D., Stanford University</i>
2:20 – 3:15	Panel Presentation and Discussion What is AI, and where is it heading? <ul style="list-style-type: none">• What digitalization means, and how AI fits in – <i>Yoon Ko, Ph.D., National Research Council Canada</i>• AI and the role of the fire protection engineer – <i>Jonathan Hodges, Ph.D., Jensen Hughes</i>• Integrating AI into curriculum – <i>Milosh Puchovsky, P.E., Worcester Polytechnic Institute</i>• What [explainable] AI is, and how it relates to fire engineering and ethics – <i>MZ Naser, Ph.D., Clemson University</i>• Why we need to establish a trustworthy AI research and education framework – <i>Xilei Zhao, Ph.D., University of Florida</i>



Part 0 - Situating AI within Fire Engineering - Takeaways

Rethinking Fire Protection Engineering in the Age of AI

AI brings transformative potential—but realizing that potential requires a thoughtful, user-centered approach.

A Different Approach Is Needed

"Solution Innovation Approach"

AI integration demands more than just adopting new tech—it requires solving real problems for real users.

Stay Grounded in Real-World Needs

- Design with **end users** in mind
- Keep focus on **measurable objectives**, not just the technology

Big Opportunities in Fire Safety

- Many **digitalization opportunities** remain untapped
- AI can enhance detection, prevention, response, and analysis

Part 0 - Situating AI within Fire Engineering - Takeaways Continued

Start Early: AI in Education

- Integrate AI into the **education curriculum**
- Begin as early as **elementary school** to build future-ready engineers

The Evolving Role of FPEs

The **impact of AI on Fire Protection Engineering** depends on how FPEs adapt. Professionals must evolve from traditional roles to include **AI oversight and integration**

Trustworthy AI Is Essential

We must build and use AI that is **transparent, ethical, and accountable**. Engineers play a key role in **ensuring AI integrity**

AI Is a Tool—Use It Wisely

- Treat AI like any other engineering tool: with **discipline, context, and responsibility**
- It's not a replacement for expertise, but a **complement** to it

Program Day 1 - Part 1

Part 1: Data Management & Analysis for Risk Assessment	
3:45 – 4:10	AI for Resiliency & Fire Protection <i>Jaap de Vries, Ph.D., FM</i>
4:10 – 4:35	Curating Synthetic & High-Resolution Observational Data for Wildfire Studies (Modeling and Validation) <i>Ali Tohidi, Ph.D., University of Maryland</i>
4:35 – 5:00	Automated Fire Pattern Recognition via Shape Metrics and Spatial Localization <i>Shuna Ni, Ph.D., University of Maryland</i>
5:00 – 5:15	Audience Questions & Discussion with Part 1 Speakers
5:15 – 6:00	Panel Discussion Challenges and needs for shared data/databases for use with AI models and tools <ul style="list-style-type: none">• <i>Seth Sienkiewicz, P.E., FM - Facilitator</i>• <i>David Saah, Ph.D., Spatial Informatics Group</i>• <i>Nalini Venkatasubramanian, Ph.D., University of California, Irvine</i>• <i>Jason Webb, Potter Electric Signal</i>• <i>Ruchira Datta, Ph.D., Firescore.ai</i>

This panel supported by:

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Part 1 - Data Management and Analysis for Risk Assessment - Takeaways

Flattening the AI Hype Cycle

1

Keep Objectives at the Core

Focus analysis on real-world problems and outcomes — not hype.

2

AI ≠ Autopilot

Expert judgment remains critical. AI should augment, not replace.

3

Data Is Essential and Needs to Improve

Validate foundational models, add context to FPE problems, standardize and strengthen datasets, ensure robustness.

Part 1 - Data Management and Analysis for Risk Assessment - Takeaways Continued

Turning Data into Impact

1

Data Collection Tools Exist

Buildings and wildfire systems already provide usable data — the tech is there.

2

Build the Business Case

Demonstrate clear benefits and ROI to justify collection and analysis efforts.

3

AI is a tool

its power depends on how we use it.

We must guide AI with **purpose**, **expertise**, and **ethics**

Program Day 2 - Part 2

9:00 – 9:10 am	Welcome & Day 1 Recap <i>Amanda Kimball, P.E., Executive Director, Fire Protection Research Foundation & 2025 SFPE President</i>
9:10 – 9:35	A Review of the Literature on AI in Fire Journals, with Pioneers, Trends, and Gaps <i>Guillermo Rein, Ph.D., Imperial College London</i>
Part 2: Smart Fire Modeling	
9:35 – 10:00	Isolating the Primary Drivers of Fire Risk to Structures in California <i>Michael Gollner, Ph.D., University of California, Berkeley</i>
10:00 – 10:25	Prediction of the Most Fire-Sensitive Point in Building Structures with Differentiable Agents for Thermal Simulators <i>Khalid M. Mosalam, Ph.D., University of California, Berkeley</i>
10:25 – 10:40	Break Light refreshments provided
10:40 – 11:05	AI prediction of flammability and flammable dispersion <i>Qingsheng Samuel Wang, Ph.D., Texas A&M University</i>
11:05 – 11:20	Audience Questions & Discussion with Part 2 Speakers
11:20 am – 12:15 pm	Panel Discussion Structural/wildfire modeling applications in California <ul style="list-style-type: none">• <i>Guillermo Rein, Ph.D., Imperial College London - Facilitator</i>• <i>Dave Winnacker, Retired Fire Chief, Moraga-Orinda Fire District (retired)</i>• <i>Michael Gollner, Ph.D., University of California, Berkeley</i>• <i>Mike Peterson, Ph.D., California Department of Insurance</i>• <i>Nima Masoudvaziri, Ph.D., Berkshire Hathaway Specialty Insurance</i>

Part 2 - Smart Fire Modeling - Takeaways

AI in Fire Protection – Powerful Ally, Not Master

- “AI is a good servant, but a bad master.”
- Domain knowledge is essential to review AI analysis
- Collaboration with Computer Science is a recurring theme
- Tackles hard problems (e.g., WUI)
- Machine Learning bridges micro to macro scale
- High-accuracy models support fast, scalable predictions

Part 2 - Smart Fire Modeling - Takeaways Continued

AI in Practice – Applications & Future Needs

- Supports structural and wildfire applications
- Enables future-focused, generalizable risk insights
- Helps inform broad risk mitigation strategies
- Need better metrics for measuring risk reduction
- Ground decisions in real data and science

Program Day 2 - Part 3

Part 3: Digitalized Design, Operation, Inspection, & Maintenance (DIOM) of Fire Protection (FP) Systems	
1:30 – 1:55	Speaker 1 Verification and Validation of AI Systems for Digitalized DIOM of FP Systems <i>Jonathan Hodges, Ph.D., Jensen Hughes</i>
1:55 – 2:20	Speaker 2 AI and Property Loss Control in Warehouses <i>David Flack, Cardinal Health</i>
2:20 – 2:30	Audience Questions & Discussion with Part 3 Speakers
2:30 – 3:15	Panel Discussion AI and fire protection engineering consulting: What does FPE look like in 10 years? <ul style="list-style-type: none">• <i>Peter Senez, Ph.D., Senez Co. - Facilitator</i>• <i>Derek White, P.E., Jensen Hughes</i>• <i>Corey Kinsman, P.E., Performance Based Fire Protection Engineering</i>• <i>Chris Lautenberger, P.E., Ph.D., CloudFire Inc.</i>• <i>Qianru Guo P.E., Ph.D., Simpson Gumpertz and Heger</i>• <i>Ralf Bruyninckx, FPC Risk, part of Sweco</i>
3:15 – 3:45	Keynote <i>Chief Daniel Berlant, California State Fire Marshal</i>

Part 3 - Digitalized Design, Operation, Inspection, & Maintenance (DIOM) of FP Systems - Takeaways

Smart AI in Fire Protection: Risk-Aligned QA & Applications

- Formal Verification & Validation (V&V) is costly but critical for high-risk systems
- Different applications require different quality levels — tailor to risk and autonomy
- QA depends on the level of system autonomy and potential failure impact
- Example uses: Records & learning management, warehouse fire detection, fire service tools
- AI can support continuous risk monitoring and proactive system improvement

Part 3 - Digitalized Design, Operation, Inspection, & Maintenance (DIOM) of FP Systems - Takeaways Continued

FPE in 10 Years: Ethics, Adaptability & the AI Advantage

- FPEs must anticipate client and market needs to stay relevant
- Ethical use of AI requires knowing the limits of each tool
- Specialized tools for FPE are in demand — flexibility is key
- Education and lifelong learning are essential for evolving practice
- AI frees up time for higher-value, strategic decision-making

Program Day 2 - Part 4

Part 4: Digitalized Firefighting and Evacuation

4:15 – 4:40	Perspective on Technology and Evacuations <i>Chris Bachman, Assistant Chief / Fire Marshal, Contra Costa County Fire Protection District</i>
4:40 – 5:05	AI Applications in Smart Firefighting <i>Xinyan Huang, Ph.D., The Hong Kong Polytechnic University</i>
5:05 – 5:30	Application of AI and Computer Vision in Assisting Firefighting: Flashover Detection and Prediction <i>M. Hamed Mozaffari, P.E., Ph.D., National Research Council Canada</i>
5:30 – 5:45	Audience Questions & Discussion with Part 4 Speakers
5:45 – 6:30	Panel Discussion Is it possible to overcome trust issues with AI? <ul style="list-style-type: none">• <i>Xinyan Huang, Ph.D., The Hong Kong Polytechnic University - Facilitator</i>• <i>Robin Zevotek, P.E., NFPA, Principal Engineer</i>• <i>Ben Rogers, CalFire Chief Technology Officer</i>• <i>Kevin Sehlmeier, Retired Michigan State Fire Marshal</i>

Part 4 - Digitalized Firefighting and Evacuation - Takeaways

Where AI Is Being Used

California fire service is exploring AI — especially for **wildfire applications**. There is potential to enhance **mitigation, forest health, and response strategies**

What AI Could Enable

Support more **effective community-level risk mitigation**

Tools to **augment decisions**, not replace expertise

Leverage **real-world firefighter input** to shape useful tools

What's Still Needed

Real-time information is critical and current systems fall short

Clear communication with the fire service to identify practical needs

Find the **right level** of information and avoid overload

Build trust with tools: **“CFD as ground truth”**

Know what's happening in the AI “black box”

Call to Action: Involve the Experts

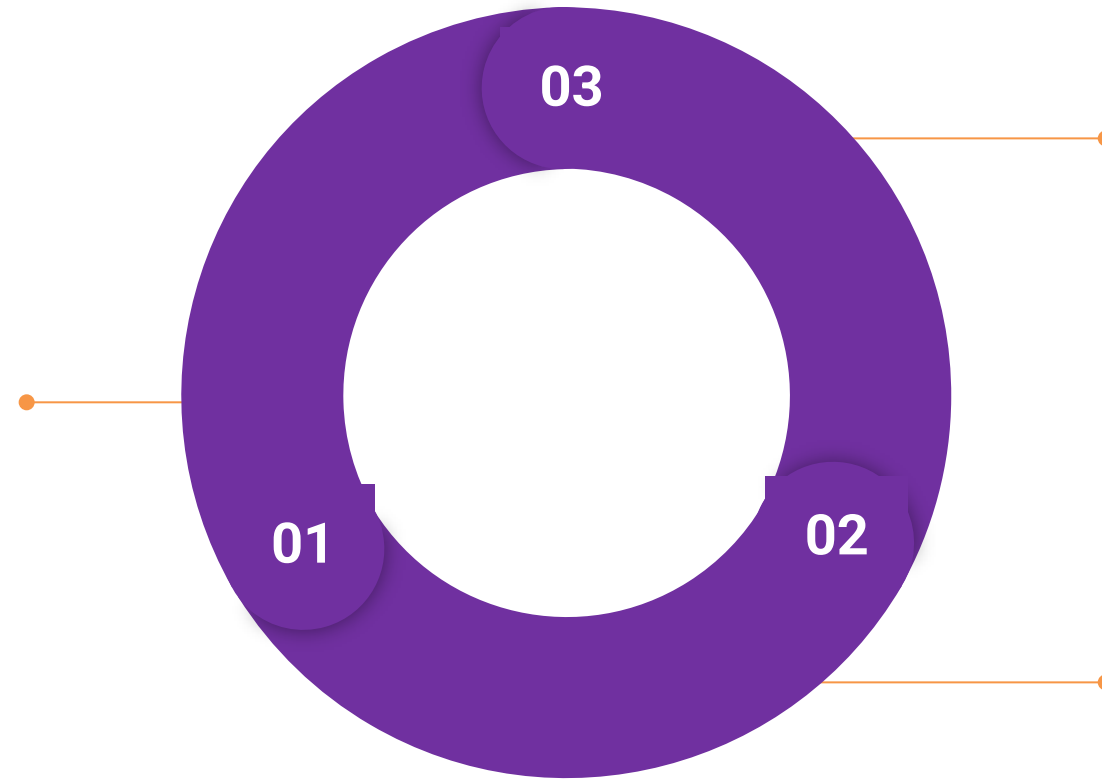
Firefighters and FPEs must be **actively involved in tech development**

Ongoing **education and collaboration** are essential

Build tools **with**, not just **for**, the fire service

Day 3 - Workshop Goals

Identify top
research
needs/projects



Identify top
educational/out
reach priorities

Committing to
collaboration and
building progress
hubs through GCI
Working Groups

Day 3 - Workshop Goals

Break out group Questions

- What presentation/topic most stood out to you from the last day and a half?
- Given the work that you do, when you think about what you need most urgently, what does it look like? Is it guidance? Is it education?
- As a group, star 2-3 things that you want to share with the rest of the group (for each subtopic):
 - Group them by education/outreach and research
 - 2-3 research needs
 - 2-3 education/outreach needs



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Breakout Group Reports

Group 1: Data Management & Analysis for Risk Assessment

Led by: Michael Gollner & Maryam Zamanialaei

TOP RESEARCH NEEDS:

- 1. Data Accessibility, Standardization, and Utilization:** Accessing, processing, and accurately utilizing data is more important than just having the data. Advanced technologies are necessary for better data utilization in decision-making.
- 2. Need for Risk Assessments and Science Based Data:** Comprehensive risk assessments, including statistical analysis, are crucial for informed decision-making, particularly in wildfire management and evacuation planning.

Group 1: Data Management & Analysis for Risk Assessment

Led by: Michael Gollner & Maryam Zamanialaei

TOP EDUCATION/OUTREACH NEEDS:

- 1. Cross-Disciplinary Learning and Data Management:** Learning from other scientific fields and ensuring proper metadata collection can help improve the accuracy and usefulness of data, while also minimizing legal and technical limitations.
- 2. Training Firefighters and Educating the Public:** There is a need for continuous education for both firefighters and the public, focusing on firefighter safety, technology use (such as LiDAR), and the role of AI in improving firefighting tools. The emphasis should be on creating accessible, ready-to-use tools for firefighters.

Group 2: Smart Fire Modeling

Led by: Jonathan Hodges & Wuquan Cui

TOP RESEARCH NEEDS:

1. Developing robust AI-driven probabilistic **methods for risk scenario selection** and prioritization.
2. Creating **authoritative AI model standards** with emphasis on reproducibility, uncertainty management, and quality assurance.
3. **Enhancing AI capabilities for pattern recognition and statistical analysis** to capture hidden dynamics in fire phenomena.

Group 2: Smart Fire Modeling

Led by: Jonathan Hodges & Wuquan Cui

TOP EDUCATION/OUTREACH NEEDS:

1. **Training programs** integrating AI early in fire safety design.
2. Educational materials and **curricula leveraging AI (LLMs)** for improved QA/QC practices and staff training.
3. Workshops and seminars emphasizing **dynamic simulation techniques** and personalized **AI-driven support tools**.

Group 3: Digitalized Design, Operation, Inspection, & Maintenance (DIOM) of Fire Protection (FP) Systems

Led by: Yoon Ko & Emily Kalil

TOP RESEARCH NEEDS:

1. We need the minimum required data to start- What are we setting as the **bare minimum data requirements** that are going to support our activities as FPEs - Design, Inspection, Operation and Maintenance of Fire protection systems.
2. Potential research / study for how we can all **play in the sandbox together**- Data sets from each section of the FPE and releasing the death grip on what data we share to benefit all FPEs.

Group 3: Digitalized Design, Operation, Inspection, & Maintenance (DIOM) of Fire Protection (FP) Systems

Led by: Yoon Ko & Emily Kalil

TOP EDUCATION/OUTREACH NEEDS:

1. Helping people understand why they should be motivated to **share info / data**. By listing out potential benefits
2. This study will shed light on the possibility of having a future **best practice guide**, which could serve as educational material not only for the FPE, but also the end users and the people that we support (manufacturers, insurance companies / building owners / regulators, etc.)
3. **ADDED 6/5/25 (not part of orig. vote): performance-based standards for AI applications** in fire engineering.

Group 4: Digitalized Firefighting and Evacuation

Led by: Amanda Kimball & Jesse Roman

TOP RESEARCH NEEDS:

1. **Trusted resiliency scoring for buildings**
2. Improving the process of **building design using AI.**
3. **Data standardization** – quantity and quality
4. Work on how to package **work for the fire service**; involving them throughout the dev and implementation process
5. Create a **standard for quality assurance** – V&V

Group 4: Digitalized Firefighting and Evacuation

Led by: Amanda Kimball & Jesse Roman

TOP EDUCATION/OUTREACH NEEDS:

1. **Continued convo** between experts, FPEs, academia, educators, fire service. Fire protection is often an afterthought and it shouldn't be.
2. Considering the **needs of the fire service as products are developed** and put to market; giving fire service a full polished product that's useful for how they operate.



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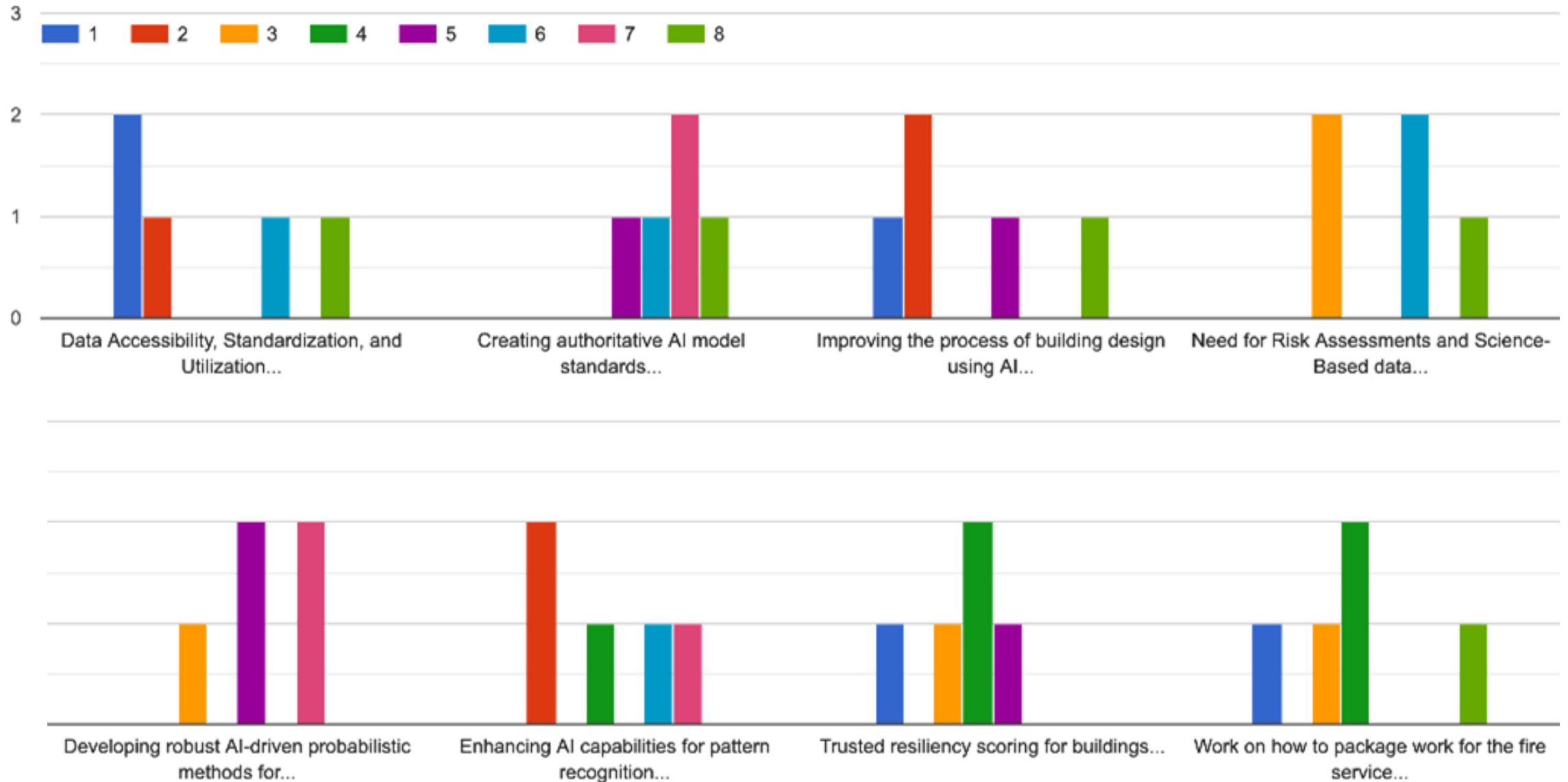
Prioritization Exercise

Revised to Combine Similar Items & Ordered by Vote Count

TOP RESEARCH PRIORITIES (ALL GROUPS)

1. Data Accessibility, Standardization, and Utilization (20) + Potential study of how we can all play in the sandbox together with datasets from each section of FPE and looking at how to release the “death grip” on what data we share to benefit all FPEs (8) + Define the bare minimum required data needed to support our activities as FPEs, focused especially on Design, Inspection, Operation, and Maintenance of fire protection systems (13) (42/45)
2. Creating authoritative AI model standards with emphasis on reproducibility, uncertainty management, and quality assurance (12) + Create a standard for quality assurance (V&V) (6) (18/45)
3. Improving the process of building design using AI. (15/45)
4. Need for Risk Assessments and Science-Based Data (15/45)
5. Developing robust AI-driven probabilistic methods for risk scenario selection and prioritization. (10/45)
6. Enhancing AI capabilities for pattern recognition and statistical analysis to capture hidden dynamics in fire phenomena. (9/45)
7. Trusted resiliency scoring for buildings (6/45)
8. Work on how to package work for the fire service; involving throughout the dev & implementation process (3/45)

Survey of Research Priorities (Vote Today!)



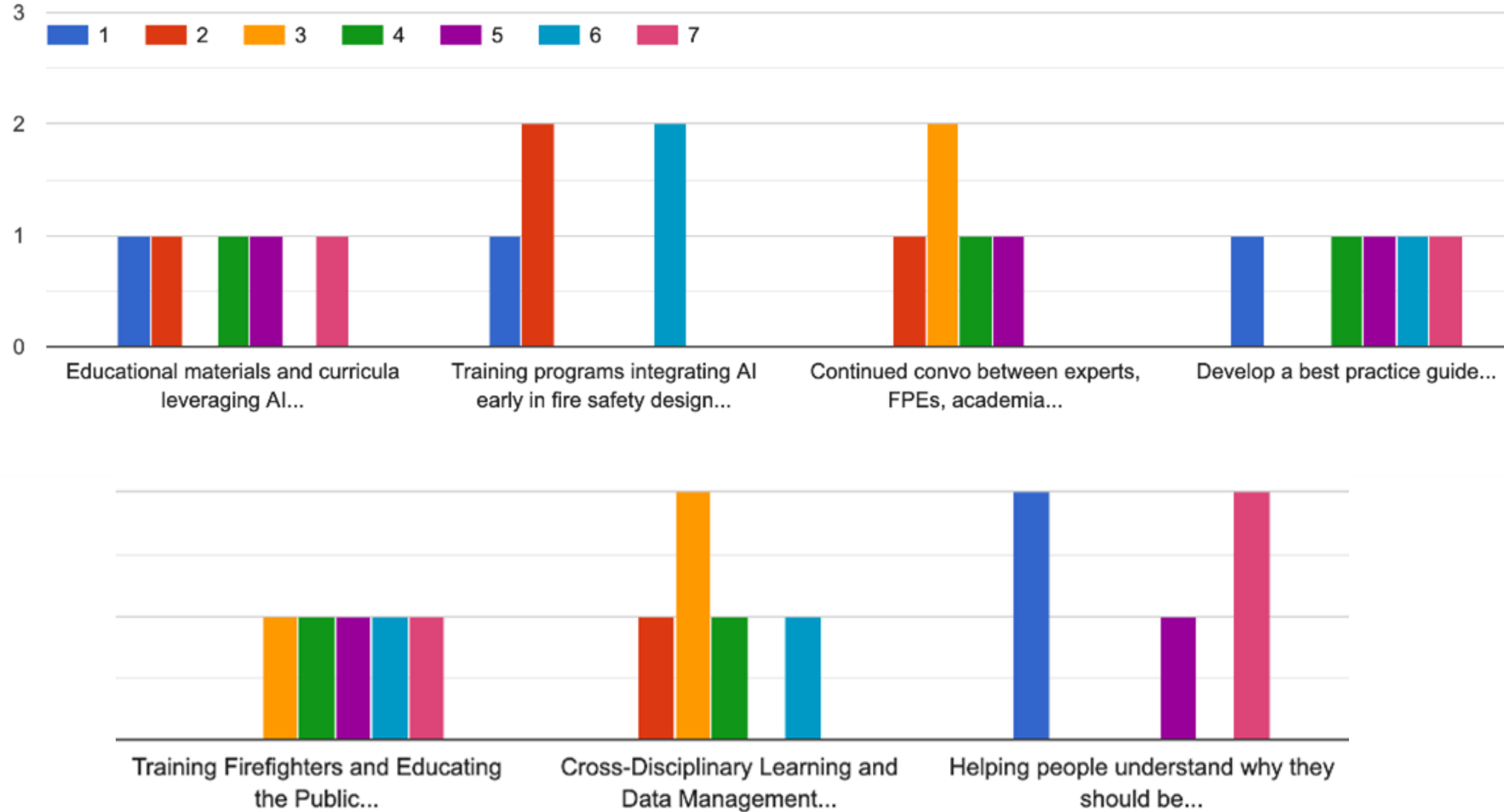
Revised to Combine Similar Items & Ordered by Vote Count

TOP EDUCATION PRIORITIES (ALL GROUPS)

1. Educational materials and curricula leveraging AI (LLMs) for improved QA/QC practices and staff training. (19) + Workshops and seminars emphasizing dynamic simulation techniques and personalized AI-driven support tools. (8) (27/45)
2. Training programs integrating AI early in fire safety design. (23/45)
3. Continued convo between experts, FPEs, academia, educators, and fire service. Fire protection is often an afterthought, but it shouldn't be + AI Task Group with GCI DAIC group (19/45)
4. Develop a best practice guide that could serve as educational material not only for the FPE, but also end-users and the people that we support (manufacturers, insurance companies, building owners, regulators, etc.) (16/45)
5. Training Firefighters and Educating the Public (3) + Considering the needs of the fire service as products are developed and put to market; giving fire service a fully developed and polished product that's useful for how they operate. (9) (12/45)
6. Cross-Disciplinary Learning and Data Management (8/45)
7. Helping people understand why they should be motivated to share information/data, e.g., by listing out potential benefits. (7/45)



Survey of Education/Outreach Priorities (Vote Today!)

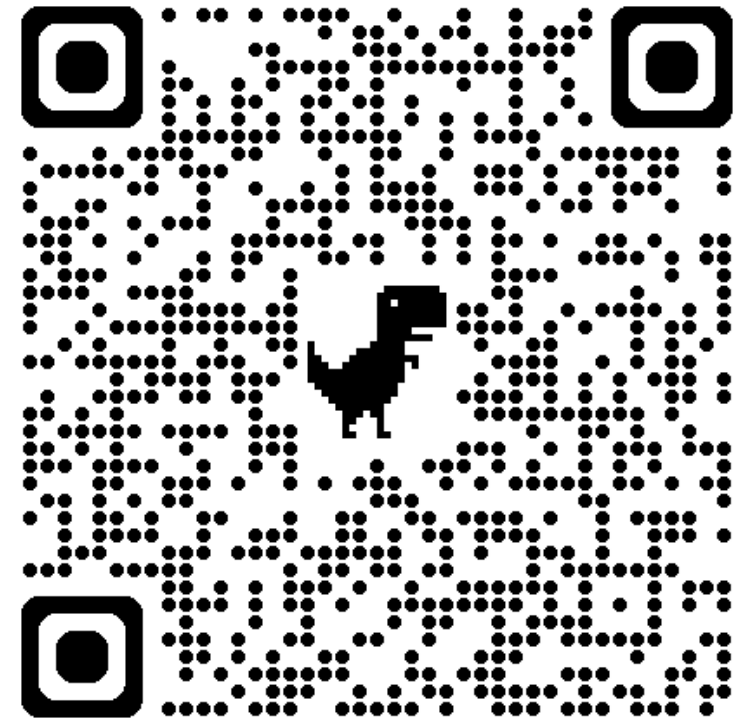




Help Determine Our Priorities for AI in FE!

Scan the QR code to take the survey,
or follow this URL:

<https://forms.gle/jWEVSDAv6owNQZpx9>





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Next Steps


Next Steps

- Committed to funding project(s) emerging from this Summit – **Vote!**
 - Acting on these priorities through the GCI Digitalization, AI, & Cybersecurity (DAIC) Working Group
 - AI in FE Task Force within the GCI DAIC Working Group to continue discussions, collaboration, future meetings, and projects
 - Join the SFPE Foundation's **Grand Challenges Initiative** to get involved today!
- Visit the GCI website at:
<https://www.sfpe.org/gci>
- Or email:
foundation@sfpe.org



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 Do you have questions or comments about this webinar?

 Amanda Tarbet
Senior Program Manager
atarbet@sfpefoundation.org

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