

Conceptualizing the Design and Use of Augmented Reality Within a Common Operating Picture for Incident Command Systems

Annotated Bibliography

May 3rd, 2022

For **Indiana University Crisis Technologies Innovation Lab**
and **Director of User Experience, Sonny Kirkley**

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Data Collected

Recorded Interview with Dale Rolfson - February 11th, 2022:

Dale Rolfson is the Chief Technology Officer for Indy Fire Department. He's been employed with the Indianapolis Fire Department for 34 years. The interview addressed his career working for the Indianapolis Fire Department and his responsibilities. Many of the questions targeted situational awareness and technology related to his day to day activities.

- [Watch on Kaltura](#)
- [Download Dale Rolfson Interview 1 - 02_11_2022.mp4](#)

Discussion with Sonny Kirkley - February 11th, 2022:

Follow-up discussion to review notes and insights obtained from the Dale Rolfson interview. Key points discussed were the project focus and the gathering of new information based on new findings.

- [Watch on Kaltura](#)
- [Download Dale Rolfson Interview 1 - Additional Discussion - 02_11_2022.mp4](#)

Recorded Interview with Dale Rolfson - February 25th, 2022:

Dale Rolfson is the Chief Technology Officer for Indy Fire Department. This interview included questions that focused on walking through incident command scenarios with Dale and attempted to capture the details of those experiences from thoughts, feelings, and motivations. This was done to assist in creating an affinity map, develop an empathy map, and ultimately, generate two unique personas that capture the necessary users. A bonus to this interview was witnessing the current software the IFD uses daily when responding to incidents.

- [Watch on Kaltura](#)
- [Download Dale Rolfson Interview 2 - 02_25_2022.mp4](#)

Recorded Interview and Tour with Dale Rolfson and Jacob Spence at Indianapolis Metro Police Department Command Center - March 2nd, 2022:

Dale Rolfson is the Chief Technology Officer for Indy Fire Department and Jacob Spence is an active Battalion Chief for the Indy Fire Department. This interview included a direct placement of researchers in the same room and seats that the users are in. Dale was also able to include Jacob Spence, an active incident commander, who provided valuable insights from his career, including recent events such as the NCAA tournament in 2021. Our researchers were able to capture critical information and take photos of the command center the incident commanders have been using when responding to larger scale emergencies and events.

- [View Images](#)
- [Download IMPD Tour and Interview - Dale Rolfson & Jacob Spence - 03_02_2022.m4a](#)

Recorded Interview with Kirk McKinzie - March 8th, 2022:

Kirk McKenzie is a retired firefighter and is currently the president of McKinzie Smart Technologies LLC. This interview was a group effort of four different teams and the time was shared between all. Kirk explained the history, issues, and concerns of firefighters in different areas. He recounted his experience as an active firefighter and expectations for the future of first responders.

- [Watch on Kaltura](#)
- [Download Kirk McKinzie Interview 1 - 03_08_2022.mp4](#)

Wide Area Search Waypoint Data Directory Documentation - March 4th, 2022

A document containing information about visual icons and universal images that is used in emergency situations. The document also contains definitions about their use and when the images are implemented. The information contained within is also used internationally with other civilian service organizations. Dale passed this documentation to us as it dealt with common visualizations that should apply to all incident commanders.

- [Download USAR Data Dictionary.pdf](#)

Indianapolis Fire Department Standard Operating Procedure Documentation - March 4th, 2022

The document contains how certain first responders are required to account for their responsibilities depending on their role. These responsibilities include addressing immediate situations and the occupancy of other people's roles. Dale Rolfson provided this document and it allowed us to accurately picture responsibilities of our users in their roles.

- [Download IFD Accountability SOP.pdf](#)

Indianapolis Fire Department Tactical Worksheet - March 4th, 2022

Provided by Dale Rolfson, this worksheet details some of the things the incident commander in an emergency situation would cover and update. The document also represents the workflows incident commanders may encounter.

- [Download Tactical Worksheet - IFD - Version 4.31.xlsx](#)

Kirk McKinzie's Next Gen Curriculum Resource - March 8th, 2022

Kirk has graciously shared this with us and it contains a plethora of resources and links to continue investigating for research and inspiration.

- [Download McKinzie's Next Gen Curriculum 2021.pdf](#)

i-Axis Best Practices Guide - March 9th, 2022

An excellent resource detailing some best practices on navigational visuals for indoor mapping and tracking.

- [Download i-Axis Best Practices Guide to Indoor Mapping, Tracking, & Navigation.pdf](#)

Augmented Reality Device for First Response Scenarios - March 16th, 2022:

This paper discusses a prototype of a wearable computer system that allows for access to location-specific information about an environment, and the capability for user tracking. Its applicability is primarily discussed for use in first response scenarios.

- [Download Augmented Reality Device for First Response Scenarios.pdf](#)

NIST Delivering Building Intelligence to First Responders - March 16th, 2022:

This paper discusses the challenges of delivering building intelligence information to firefighters. It also presents a summary of current state-of-the-art technology in this area and provides insight into how to address these challenges.

- [Download NIST Delivering Building Intelligence to First Responders.pdf](#)

HPHSCC - 2017 Active Shooter Planning and Response in a Healthcare Setting - March 16th, 2022:

This booklet discusses basic information and difficult to answer questions when it comes to safety in an active shooter situation occurring in a healthcare setting. This information is based on expert review and specifically covers patient, visitor, and personal safety, duty to act, and abandonment.

- [Download HP HSCC - 2017 Active Shooter Planning and Response in a Healthcare Setting.pdf](#)

Intelligent Dashboard for Augmented Reality Based Incident Command Response Co-ordination - March 16th, 2022:

This paper describes an Intelligent Dashboard for incident commanders that provides augmented reality benefits with minimal human communication through IoT devices. These devices include such as heads-up displays, virtual beacons, QR-code cards, and wireless mesh network elements. Usability evaluations are conducted to show the ease-of-use and effectiveness of the dashboard.

- [Download Intelligent Dashboard for Augmented Reality Based Incident Command Response Co-ordination.pdf](#)

Recorded Interview with Kirk McKinzie - March 22nd, 2022:

Kirk McKinzie provided answers as our team explored some questions detailing his experience and knowledge of any products related to incident command and control, situational awareness, and future technology adoption

- [Watch on Kaltura](#)
- [Download Kirk McKinzie Interview 2 - 03_22_2022.mp4](#)

Recorded Interview with Jacob Spence - March 25th, 2022:

Chief Spence described an incident situation in-depth that he felt was unusually complicated and overwhelming. The incident described was the Civil Unrest of 2020.

- [Watch on Kaltura](#)
- [Download Jacob Spence Interview 1 - 03_25_2022.mp4](#)

ARTAK Informational Brief - March 30th, 2022:

An informational brief on the Augmented Reality Tactical Assault Kit which helps soldiers to plan missions. The presentation shows detailed images of the process and its capabilities.

- [Download ARTAK Informational Brief.pdf](#)

Project Update and Next Steps - April 2nd, 2022:

The teams Video Presentation and Slides which served to update the class on the project scope, the steps they have completed since beginning the project and intended plans as they move forward. Includes the deliverables they have created thus far, and the key issues the team is facing.

- [Download Project Update and Next Steps - 04_02_2022.mp4](#)
- [Download Project Update and Next Steps - 04_02_2022.pdf](#)

ICS 100 - Incident Command System - USDA.gov - April 3rd, 2022:

This report serves as an overview of the Incident Command System (ICS). It details what the ICS is, its history, applications, its interdisciplinary and organizational flexibility and how it serves as the standard for emergency management across the country.

- [Download ICS 100 - Incident Command System - USDA.gov.pdf](#)

US Department of Transportation - ARC-IT Architecture Overview - April 9th, 2022:

An overview of the USDOT's ARC-IT architecture which can help influence how a public organization organizes objects and views.

- [Download US DOT - ARC-IT V8 Architecture Overview - 04_09_2022.pdf](#)

Chris K. Bailey - Finav Process Book - April 10th, 2022:

A book detailing the process that Team Ember took to accomplish objectives in creating Finav: a firefighter management system that crosses some of the same paths our research takes.

- [Download Finav Process Book - Chris K. Bailey - 04_10_2022.pdf](#)

Edgybees - GeoRegistration Checklist eBook - April 11th, 2022:

An eBook describing the benefits and requirements to find a solution to accomplish situational awareness by use of "GeoRegistration" and other related concepts.

[Download GeoRegistration Checklist eBook - Edgybees.com - 04_11_2022.pdf](#)

References

**“PSCR 2021: Augmented-Reality (AR) Usability Evaluation Framework for PSCR”,
NIST, https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=932560.**

A framework for AR Usability Evaluation in the public safety communication research realm. The document contains examples of Usability Evaluation test scripts targeting specific metrics such as behavioral and performance. Further detail includes how the framework is implemented and the measurement of task performance.

- [Direct Web Link](#)
- [Download PSCR 2021 Digital Experience.pdf](#)

**“PSIAP Augmented Reality (AR).” NIST, 21 Oct. 2021,
<https://www.nist.gov/ctl/pscr/funding-opportunities/past-funding-opportunities/psiap-augmented-reality>.**

Presents grants and funding opportunities for AR in public safety communications research, as well as descriptions of ongoing projects. The document mentions past participants who have received grants and the importance of research needed for AR technology.

- [Direct Web Link](#)
- [Download PSIAP Augmented Reality \(AR\)_NIST - 02_23_2022.pdf](#)

**“2020 Chariot Challenge: Advancing First Responder Communications.” NIST, 8 Dec. 2021,
<https://www.nist.gov/ctl/pscr/open-innovation-prize-challenges/past-prize-challenges/2020-chariot-challenge>.**

Description of the CHARIoT Challenge in which participants built AR interfaces or IoT data emulators for first responder communications. The document mentions specific rewards provided based on success of a category. The challenge is to develop solutions using the latest technology in order to help first responders effectively obtain information.

- [Direct Web Link](#)
- [Download 2020 CHARIoT Challenge_Advancing First Responder Communications_NIST - 02_23_2022.pdf](#)

**“Enhanced User Interface/User Experience Research Portfolio.” NIST, 18 Sept. 2017,
<https://www.nist.gov/ctl/pscr/research-portfolios/user-interfaceuser-experience>**

Research portfolio for User Interface / User Experience work within the public safety Community. It contains links to different resources on user experience with AR and VR interfaces.

- [Direct Web Link](#)
- [Download User Interface User Experience_NIST - 02_23_2022.pdf](#)

**Feldman, Harris, et al. "Public Safety User Interface R&D Roadmap." *National Institute of Standards and Technology*, April 2017,
<https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1961.pdf>**

A roadmap for planning public safety communications research. The report contains detailed information regarding different interface technology that can enhance a user experience. Details and explanations on current technology and possible usage is discussed. It explores how specific interfaces can enhance, evolve and expand current public safety operations and the capabilities of users.

- [Direct Web Link](#)
- [Download Public Safety User Interface R&D Roadmap.pdf](#)

**Motorola Solutions. "Consensus For Change Transforming Safety Through Technology." *n.d. Motorola Solutions*.
https://www.motorolasolutions.com/content/dam/msi/docs/dt/consensusforchange/Consensus_for_Change_Report_V13.pdf**

A document containing information on a study conducted by University of London detailing how the pandemic affected innovation and attitudes toward technology for public safety. Kirk McKinzie

- [Direct Web Link](#)
- [Download Motorola's Consensus for Change Report V13.pdf](#)

**National Institute of Standards and Technology. "NIST Special Publication 1191: Research Roadmap for Smart Fire Fighting Summary Report." *n.d.*
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1191.pdf>**

A document detailing how new technologies have allowed for the collection of large amounts of information that can be used to enhance fire fighting and aid in public safety.

- [Direct Web Link](#)
- [Download NIST Research Roadmap for Smart Fire Fighting.pdf](#)

**Federal Bureau of Investigation. "Improving Our View of the World: Police and Augmented Reality Technology." *n.d.*
<https://www.fbi.gov/file-repository/stats-services-publications-police-augmented-reality-technology-pdf/view>**

This report serves as an introductory document on Augmented Reality to the policing profession. It discusses principles and components of the technology as well as its newest developments. It also covers potential applications for future use of this technology.

- [Direct Web Link](#)
- [Download FBI.gov - Police and Augmented Reality Technology.pdf](#)

US Fire Administration. "Incident Command System and Resource Management for the Fire Service" n.d.

<https://apps.usfa.fema.gov/nfacourses/catalog/details/10557>

This report serves as a tool to teach about the Incident Command System (ICS) and Resource Management for the Fire Service and their application in both emergency and nonemergency situations. It covers the need for an ICS, an overview of the structure and flexibility of ICS, and an understanding of the command skills necessary to function effectively in an ICS structure and the need to effectively manage your resources.

- [Direct Web Link](#)
- [Download National Fire Academy - Incident Command System and Resource Management for the Fire Service.pdf](#)

California's All Hazards. "Situation Awareness and Collaboration Tool Concept of Operations." n.d.

<https://www.caloes.ca.gov/Cal-OES-Divisions/Regional-Operations/Situation-Awareness-and-Collaboration-Tool>

SCOUT is a web-based tactical and operational response platform that assists in communication, coordination, and collaboration within incident management for all hazards, whether natural or human-made. It was made for the California first responder community and supporting agencies. Authorized users can view, search and add relevant tactical incident information for a variety of incident types, including wildland fires, floods, search & rescue missions, special events, earthquakes, and homeland security incidents.

- [Direct Web Link](#)
- [Download Situation Awareness and Collaboration Tool \(SCOUT\).pdf](#)

NAPSG Foundation. "Symbol Library" n.d.

<https://www.napsgfoundation.org/all-resources/symbology-library/>

The NAPSG Foundation has been working with the Department of Homeland Security to develop a consistent incident symbology framework. These symbols have helped us add commonly accepted and standard iconography for various incidents within the dynamic prototype. This library is a representation of in-use and current symbology that incident commanders should be familiar with and covers a vast range of incident, hazard, and resource iconography.

- [Direct Web Link](#)
- [Download NAPSG Foundation - Symbol Library.pdf](#)
- [Download NAPSG Foundation - Symbol Library.zip](#)

Chris K. Bailey. "Finav: Firefighter Management System." n.d.

<https://www.chriskbailey.com/finav>

Bailey developed a Fire Management System (Finav). The page has a vision video for how this technology is used and provided great reference material for the team's prototype.

- [Direct Web Link](#)

Edgybees. “Public Safety & Government - Edgybees.” n.d.

<https://edgybees.com/who-we-serve/public-safety-government/>

Geospatial intelligence for aerial and satellite videos and images. This portion of the site details its use for public safety purposes. EdgyBees augments roads, landmarks, and other mission-critical data on top of live video feeds to provide visibility in complex and opaque disaster scenes.

- [Direct Web Link](#)

D4H. “Incident Management Software - D4H.” n.d.

<https://d4h.com/incident-management>

D4H is a cloud platform for emergency response. The site details the importance of the 3 R’s (Readiness, Response and Re-evaluation) as they relate to D4H as well as the full capabilities of the software.

- [Direct Web Link](#)

Adashi. “Adashi C&C Incident Command Software.” n.d.

<https://www.adashi.com/incident-command-software/>

Adashi C&C is an incident management platform currently being used around the world which is designed to help commanders handle everyday incidents and large-scale disasters. It provides fire and police commanders with enhanced situational awareness, improved interoperability, and detailed accountability tracking to manage incidents effectively and prevent line of duty deaths. The product helps commanders with real-time collaboration, tactical planning, resource management, and incident reporting.

- [Direct Web Link](#)

UX Matters. “How to Create Better Alerts and Symbols in Your Designs.” April 6, 2020.

<https://www.uxmatters.com/mt/archives/2020/04/how-to-create-better-alerts-and-symbols-in-your-designs.php>

UX Matters covers standard uses for alerts in symbols in current technology. It discusses the several different types of alerts and how they are typically designed. It also discusses industry standard symbols and how they are interpreted.

- [Direct Web Link](#)

OnPage. “OnPage.com Homepage.” n.d.

<https://www.onpage.com/>

OnPage is an incident alert management system that enables response teams to get the most out of their digital technology investments. Physicians and IT teams use OnPage’s rock-solid escalation features, on-call capabilities and persistent notifications to ensure that critical alerts are never missed. Whether to minimize IT infrastructure downtime, or to reduce incident response time for healthcare providers, organizations trust OnPage for all their critical notification needs.

- [Direct Web Link](#)