

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

## **Interim Report #1**

**February 23rd, 2022**

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

By **Tara Hodson, Kayleigh Jones, Caleb Likens,**  
**JoAnna Muniz, Krystal Nolasco, and Julia Ottaway**



# Executive Summary

The Indiana University Crisis Technologies Innovation Lab (IUCTIL) is developing an augmented reality (AR) system to assist incident commanders and first responders in resolving emergency situations. We are aiding in that effort by discovering what data is necessary for incident commanders to see, demonstrating where AR technology can be best utilized in incident command workflows, generating user interface and experience design criteria and requirements, and recommending a standardized interface from requirements set by incident commanders and first responders.

The first several weeks of our efforts were devoted to getting acquainted with the lead sponsor, Director of User Experience, Sonny Kirkley, and learning more about the previous work completed on the project. During several information sessions, project objectives and scope were determined. The team wrote and submitted an initial draft of the Project Definition and Scope document.

The project sponsor introduced the team to an expert stakeholder, Dale Rolfson, Chief Technology Officer of the Indianapolis Fire Department. An initial interview was conducted on February 11th, 2022. This interview was a conjunctive effort including questions developed from both active augmented reality teams. This interview was recorded virtually on the Zoom platform and notes were taken.

Feedback received from the project sponsor informed significant revisions to the Project Definition and Scope Document. These revisions were guided by ongoing team research and information obtained during the interview. Specific attention was given to the development of expected project activities and deliverables.

As the second project phase begins, a follow-up interview will be conducted with Dale Rolfson on February 25th, 2022. Additional questions will be compiled and responses recorded. The focus of this interview will clarify the different types of people in his workplace who may interact with the AR technology visualized in this project. The creation of an affinity map and an empathy map will assist in the creation of viable personas. Furthermore, up to three personas will be developed and shared to enable future development teams to accommodate them.

After this interview is complete, results discussed, and project deliverables have been rendered, a second Interim Report will be written and delivered to the project client demonstrating continued progress towards project objectives. Additionally, personas documents, an empathy map, and an affinity map will be submitted as project artifacts. Upon feedback, the group will proceed with activities, as detailed in the Project Definition and Scope document.

# Overview

In this first phase of the project, we completed the following activities:

- **Initial draft of Project Definition and Scope (January 31)**
  - This was the first attempt at developing the project definition and scope. The paper received considerable constructive feedback which was applied for the next iteration
- **Completed interview with Subject Matter Expert (February 11)**
  - The interview was conducted with Battalion Chief, Dale Rolfson using the Interview 1 Protocol detailed below (Appendix A). The protocol was used as a rough guideline of points we wanted to hit, while also letting the interviewee guide the direction of the interview by giving insights we had not considered. This interview was used to gain high-level insight about what the problem space entails and help the team further clarify what is needing to be defined and scoped
- **Revised Project Definition and Scope (February 21)**
  - The revision of the project definition and scope was determined by the needs of the team in order to continue the research progress. Future deliverables and methods were changed, added, and identified to accommodate the increased understanding
- **1st Interim Report (February 23)**
  - A summary and overview was written to encompass what the team has learned and performed so far on the project.

## What Was Learned

After conducting the initial interview and upon examining the secondary research, the team realized that further exploration was needed. Specifically, the team decided that user analysis was necessary to proceed to fulfill project objectives. Furthermore, the exploration of such topics as firefighter placement, firefighter biometrics, environmental variables, and relation to structural weaknesses would help the team focus on the next steps. The team learned about the daily working life of potential users as well as the challenges they faced while on emergency calls. This helped the team determine that they needed to develop a closer affinity to real-life users, perhaps in the form of empathy and affinity mapping, to consider what strengths augmented reality could offer them during emergency incidents.

# Next Steps

Date	Action	Goals	Deliverable
<b>February 25</b>	Conduct a follow-up interview with Dale on February 25 <sup>th</sup> , 2022.	Define future persona attributes, wants, goals, and problems.	Interview notes
<b>March 4</b>	Develop an affinity map based on research and interview answers.	Brainstorm and group common ideas and concepts.	Affinity map
<b>March 11</b>	Create an empathy map based on the conducted interviews to explore their thought process.	Understand what users are saying, thinking, doing, and feeling	Empathy map
<b>March 13</b>	Develop personas based on interviews and types of users within an incident command structure.	Deciding and creating target user profiles	Persona Document
<b>March 14</b>	Write up a second interim report in order to update project definition with scope	Provide status update of project objectives	2nd Interim Report
<b>February 22 - March 15</b>	Conduct a team meeting every Wednesday or Thursday evening and every Sunday evening	To collaborate on project advancement	N/A

# Appendix A: Interview 1 Protocol

## Preliminary Steps

1. Thank the participant for agreeing to speak with us
2. State Interview Purpose – To understand the work processes of incident command and first responders in order to target pain points where Augmented Reality technology could assist them in their day to day lives
3. Ask their permission to record – if they say no take good notes
4. Let them know if they feel uncomfortable with any of the questions to let us know and we will move on
5. Ask them if they have any questions before you begin.

## Background:

1. Can you start by telling me about your current work?
2. What is your position there?
3. How long have you been working there?
4. Did you work anywhere else in this field before the job you have now?
5. How long have you been working in this field in total?

## Work Experiences:

6. Can you walk me through a recent day you've worked? What did you do and work on?
  - a. Was that a typical day for you?
  - b. If not, how was this day different from a normal day?
7. What are your responsibilities at your job?
8. How do you communicate with other people at work?
  - a. Can you give me examples of specific words or phrases you'd use?
9. Can you tell me about a time when you had difficulty communicating with someone during an emergency?

## Technology:

10. What kinds of technology do you use at work?
11. Tell me about a time when technology made your job easier.
12. Tell me about a time when technology made your job more difficult.
  - a. How would you fix that problem?

## **Decision Making: Common Mistakes**

1. What are mistakes you see in new recruits?
2. What are common mistakes you see with experienced firefighters? What are the causes of these mistakes?
3. What are common problems or concerns you see arise in first responder situations?
4. Tell me an experience where an issue arises that was difficult to handle? How did you solve the problem?

## **Situational Awareness: New environments**

1. What are situations that firefighters are trained to do but don't really encounter on a regular basis?
2. Tell me about a time where you failed to be more aware of a situation? Why?
  - a. Would you change anything about your work to prevent that situation from happening?

## **Situational Awareness: Durations**

1. How do you track the duration of an emergency?
2. What do you keep track of in an emergency?

## **Wrap Up:**

13. Is there anything I haven't asked you about that you think I'd like to know about?
14. Can I contact you in the future if I have additional questions?

***Thank the participants for their time and generosity.***



# Appendix B: Interview 1 Notes

## Time and Date:

Friday, February 11th, 2022 at 4:00 pm

## [Video Link](#)

## Participant:

Dale Rolfson - Chief Technology Officer for Indy Fire Department

Been with Indy Fire Department for 34 years, went to school for computer science. Also drove a ladder truck, did fire investigations and worked in public education

- Colors in HUD: green, amber, red
  - Red = get out
- Situational Awareness Tech
  - PASS – personal alerting system
    - Senses lack of movement, gives warning beeps
    - Longer you go without movement, louder it gets
  - RFID system
    - Wand
    - Based on the sound, closer you get the louder / faster the beeps are
    - For finding where someone is
    - Takes a lot of time
      - Rather have GPS coordinates – including Z coordinate
- Incident command doesn't have a visual of where everyone is
  - Could have 8 firefighters in a building, don't know exactly where they are
    - Assume based on smoke / fire etc.
  - Can be alleviated by using a drone (to find resources)
    - Find exposures
      - E.g. dogs, electrical wires, cars parked nearby, etc.
- Incident commanders
  - Battalion chiefs
    - Indy has 8?
    - His executive officer is a captain's rank
    - Tools:
      - Have incident command sheet
        - Could be a map of structure, etc.
      - White boards w/ wax pencil so it doesn't wash away
      - Command board for large incidents
      - Laptop / tablet in every fire truck and battalion chief vehicle
        - Show water mains and hydrants

- Important for knowing which ones to use
- Looking for a software solution for incident command
  - Offered to send us options they have looked at
  - Cons:
    - Bad weather, could damage laptops etc.
    - Using a touch screen is hard when it's wet
      - Sometimes put tablet in a freezer bag to keep the screen dry
      - Indiana task force 1 uses tablets, not fire department
      - Scott air management system – only tablets fire departments are using right now
        - Doesn't have GPS
        - Safety chief uses it
- A, B, C, D seats in all fire engines and ladders
  - A seat is passenger seat – officer (in charge)
    - Lieutenant or captain
  - B: directly behind officer – generally a “rookie”
  - C: right behind the driver – more seasoned / veteran firefighter
- Incident Command walkthrough
  - Call 911 about fire, goes through police dispatch (working on adding fire)
  - Dispatch sends to fire & ambulance
    - They have location based on where the call is placed
  - Based on given info, send appropriate apparatus
  - Fire alerting system
  - Dispatch Debbie – recorded voice like Alexa that reads the info from the computer
    - To avoid a person being overly emotional
  - First arriving apparatus will give size up report and establish command
    - They're incident commander for the time (until first arriving chief comes and takes command)
      - Generally Battalion Chief, could be safety chief
  - Shift commander shows up if it's a bigger incident
    - Highest ranking chief / firefighter on duty
  - Operations – manages the incident
  - 2 in 2 out – firefighters
- Battalion Chief tasks
  - Incidents
    - Fire
    - Vehicle accident
    - Hazmat spill
    - Rope rescue
  - Incident command system gives a chain of command
  - Time is key – better survival



- How long has the structure been burning? How much longer before firefighters need to evacuate?
    - Indy department always goes in – aggressive interior attack style fire fighting
    - Managing personnel
    - Seeing what hazards there are
    - Go on the defensive – e.g. use aerial nozzles on trucks
    - Building construction – how old is the building?
      - Drone footage helps to figure out construction
  - Communicate with a radio
    - Officer from each apparatus does radio talking
    - Try to minimize radio traffic
  - How can AR be used in incident command?
    - Similar to the death star in star wars lol
    - 3D representation of the scenario
      - Stick and ball
      - Every stick and ball is a gps location of a firefighter / emergency responder, etc
      - Select it, and it shows who it is
        - Heart rate
        - Blood pressure
        - Core temp
        - Breathing rate
        - Atmospheric conditions
          - Oxygen level
          - Explosive limits
          - Hazardous chemicals in the area
          - Be able to visualize these (red or yellow, etc)
            - Can let them know what areas to be worried about
    - Tag victims
      - Dead, walking, wounded, etc.
      - Triage
        - How many hospitals to contact
        - Which victims are priority, etc.
  - Commanders in command center
    - Could be a van, back of battalion buggy
    - Some sort of command vehicle – out of the elements
    - Portable tent
  - Would be useful to have 3D visual
    - With GPS
    - Fire apparatus all have GPS in them right now (trucks)
- Pain Points
  - “Firefighters don’t like change and they hate the way things are”
  - Older people don’t generally love the new technology
    - Younger firefighters are better with it

- Not having a visual of the scenario because you're removed from the incident
  - Don't want the incident commander to be in the middle of it (too dangerous, can't control with an air pack, etc.)
  - Lose track of resources
- Faster mitigation of incident = save more lives and property
- Want thermal imaging technology
  - Thermal imaging cameras
    - Allow firefighters to see temperatures
    - See a body through the smoke
  - Incident commander can see
- All of this helps with making tactical decisions
- Look Up:
  - FDIC – fire department instructors conference
    - Manufacturers lists for current technology
      - MSJ
      - Scott?
        - These don't let you touch their stuff
        - Possible that these would void manufacturer warranties (in case of dead firefighters, litigation etc.)
- Video games with tactical controls
  - Dragon Age
  - Mass Effect
  - Assassins Creed: Origins
  - Fire Emblem
  - Stellaris

# Appendix C: Annotated Bibliography

## 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](#)

## References

### **“PSCR 2021: Augmented-Reality (AR) Usability Evaluation Framework for PSCR”, NIST, [https://tsapps.nist.gov/publication/get\\_pdf.cfm?pub\\_id=932560](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](#)

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

## **Project Definition and Scope**

**February 23rd, 2022**

For **Indiana University Crisis Technologies Innovation Lab**  
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# Summary of Project

The Indiana University Crisis Technologies Innovation Lab (IUCTIL) is in the process of developing an augmented reality (AR) design system that assists both incident commanders and first responders in resolving emergency situations in an efficient manner. The future innovations and use of AR within heads-up displays (HUDs) have already proven to be a viable asset in many hands-on industries. Utilizing research and data from interviews, cognitive analysis, and other user experience design techniques, we are looking to uncover what most incident command operators are wanting in a futuristic environment that incorporates the use of AR. Features, workflows, client requirements, and proper contextual user-centered design will be at the forefront of recommendations to a design and development team that will create prototypes. The anticipated research and work from this project will impact the following:

- Demonstrate the value of precise location-tracking, asset management, and other necessary data within incident commander workflows
- Demonstrate the value of using AR in emergency scenarios to assist with situational awareness and decision making while saving more lives compared to conventional measures
- Generate user interface and experience design criteria and requirements for an augmented reality interface
- Recommend a standardized interface and design restraints from requirements set by incident commanders and first responders

**Incident command personnel will be the focus of this project; specifically, commanders that work directly with first responders. Understanding their workflows, problems, and goals will be paramount to our research on using augmented reality when performing duties.**



# The Project Goals

To accurately conceptualize and recognize the user experience in augmented reality for incident commanders, five (5) main goals have been defined:

## **1. Understand the current workflow of incident commanders in emergencies**

- a. The current toolsets being used, the steps taken to accomplish tasks, finding the data and information necessary to achieve goals, and other potential cognitive processes involved
- b. Understanding AR is secondary—this is not our focus when receiving user feedback
- c. Attempt to fix problems that incident commanders have when responding to emergencies and propose solutions

## **2. Learn what smart-tracking or indoor location-tracking interfaces and ideas would benefit incident commanders**

- a. Investigate the data that is useful to the incident commander and determine how detailed it needs to be
- b. Discover the usefulness of their current toolset and how future effort can iterate and improve upon the incident commander's productivity and flow
- c. Explore what information is currently available for an incident commander during an emergency and uncover any unknown data points that would be beneficial

## **3. Investigate the use of location-tracking and other techniques to assist in workflow enhancement**

- a. Demonstrate the value of highly accurate location-tracking in workflows
- b. Validate the use of AR in these settings to assist with situational awareness and decision making
- c. Research if AR can assist current incident commander workflow regarding role assignment, asset management, and resource allocation with a heavy emphasis on location-tracking

## **4. Research the benefits of augmented reality interfaces and controls when creating common operational pictures (COP)**

- a. Identify current processes, designs, and tasks that COP applications utilize
- b. Explore tools that handle COP workflows and understand why or how they deliver experiences for their users
- c. Investigate the addition of AR within these interfaces and tools to verify advantages and disadvantages
- d. Discover if modern AR concepts have enhanced experiences for their userbases, particularly for indoor location-tracking, command and control, and other similar situations, such as emergency response

**5. Gather enough ideas and concepts to easily hand-off user interface requirements to an external development team**

- a. Prepare UX design criteria with AR techniques at the forefront
- b. Create workflows for designers and developers to build and materialize
- c. Deeply understand user workflows and how AR would best fit within them
- d. Design AR specific features and functionality at a prototyping level
- e. Find the high-value tasks in incident command workflows and capture them accurately for AR experience purposes

**These outlined goals will keep our focus and priorities on client requirements while delivering detailed recommendations about our target user base.**

# Expected Activities and Deliverables

For each of our project goal's success, multiple activities and deliverables have been identified. The efforts will range from collecting various sets of data and research, conducting interviews with multiple subject matter experts, and developing documents that will help the next team understand what users will require in their workflows and tasks.

## 1. Interviews with subject matter experts

- a. Conduct five (5) interviews
- b. Initial interview will assist in further defining the scope of the project
- c. Second interview will target our users' workflows and understanding their wants, needs, and problems
- d. Third interview will help define persona attributes, needs, wants, and problems
- e. Fourth interview will be explicitly about task-analysis and investigating what works well, what doesn't work well, and what can be improved
- f. The final interview will be about reviewing all effort completed with an expert and assist with creating suitable scenarios and storyboards
- g. All interviews will attempt to help understand workflows of emergency personnel, information that is necessary or beneficial for the actual user, and conceptualize modern interfaces that can use AR to enhance experiences

## 2. Task analysis document

- a. A task analysis document will be created to understand how our users are affected by their environment and assess where their actions could be simplified.
- b. Identify areas of opportunity for AR to assist and innovate in their process
- c. Gain insightful information about tasks and outcomes currently in a user's workflow

## 3. Persona development

- a. Three (3) unique personas will be developed
- b. Each persona will be idealized as personnel on different command levels in an incident command system hierarchy
- c. These personas will help future developers understand the types of users that are envisioned to use this technology and help guide their team in the right direction

## 4. Affinity map

- a. Using an affinity map will help organize findings, ideas, and pursue concepts uncovered throughout the project
- b. The affinity map will assist in defining common themes through qualitative data gathered from the informal interviews conducted. This data will be used to help create personas that will enable designers to greater empathize with the future end users

## **5. Empathy map**

- a. An empathy map will guide us through visualizing our target users' behaviors and create a deeper understanding of their mindset
- b. An empathy map will facilitate a shared understanding of the users' needs and perspectives among the design team and client

## **6. Experience map**

- a. The experience of what the user goes through when accomplishing tasks and goals will need to be properly visualized through the use of an experience map
- b. The experience map will serve to illustrate the user's journey through an emergency scenario using AR technology. The map will be used by future designers to empathize with the users and recognize the key parts in the user's journey that are impacted by the design

## **7. Scenarios and storyboards**

- a. Scenarios will help with predictions on user behavior while delivering potential experiences and interactions
- b. To help properly explain a journey (story) the user participates in, storyboards can give a visual representation. The story boards will be used to demonstrate the value of using AR technology to enhance situational awareness

## **8. Tree-testing**

- a. A tree test will be prepared to discover any usability or findability issues within smaller pieces of an interface
- b. Evaluation of users performing tasks on mock navigations
- c. Explore different exploration outcomes that would benefit users in completing a task

## **9. Secondary literature review**

- a. Reviewing previous research will uncover solutions and problems that other research teams have encountered. Some examples of this research include:
  - A framework for AR Usability Evaluation in the public safety communication research realm ([PSCR 2021: Augmented-Reality \(AR\) Usability Evaluation Framework for PSCR](#))
  - Presents grants and funding opportunities for AR in public safety communications research, as well as descriptions of ongoing projects ([PSIAP Augmented Reality \(AR\) Funding Opportunity](#))
  - Research portfolio for User Interface / User Experience work with the public safety community ([NIST User Interface/User Experience Research Portfolio](#))
  - Description of the CHARIoT Challenge in which participants built AR interfaces or IoT data emulators for first responder communications ([2020 CHARIoT Challenge: Advancing First Responder Communications](#))
  - A roadmap for planning public safety communications research ([Public Safety User Interface R&D Roadmap](#))

## **10. Work/activity models**

- a.* Demonstrate how the system would work in real life
- b.* Help the development team clarify user requirements and define the system architecture

## **11. User Interface Requirements Document**

- a.* After analyzing tasks, feedback, and other requirements, a document will be created to help guide future development teams
- b.* Various user interface designs that are proven necessary for the user will be recommended
- c.* The document will contain research artifacts, such as the personas, empathy map, experience map, and more, to enable future designers to grasp the context for which they will be designing. In addition, the document will include an activity model to demonstrate the product's intended workflow and what features should be designed

**The expected activities and deliverables will assist in developing a better understanding and thought process for the design and development team in their effort on creating viable features and prototypes.**

# The Project Timeline

## *Four Phases, January 31 – May 2*

The expected timeline has been outlined for the next four months and broken out into individual phases. All actions and deliverables are tentative. If any changes or updates happen, the timeline will be refreshed accordingly.

<b>PHASE 1</b> <i>January 31 – February 21</i>	
<b>ACTIONS</b>	<b>DELIVERABLES</b>
<ul style="list-style-type: none"><li>• Continue reviewing secondary literature and researching applicable material</li><li>• Perform interview with subject matter expert utilizing a developed protocol in collaboration with a different team</li><li>• Update the project definition and scope from feedback given within interview and from client</li><li>• Create the first interim report on success and failures for the project</li></ul>	<ul style="list-style-type: none"><li>• January 31<ul style="list-style-type: none"><li>◦ Initial draft of Project Definition and Scope</li></ul></li><li>• February 11<ul style="list-style-type: none"><li>◦ Complete interview with Subject Matter Expert</li></ul></li><li>• February 21<ul style="list-style-type: none"><li>◦ Revised Project Definition and Scope</li></ul></li><li>• February 23<ul style="list-style-type: none"><li>◦ 1st Interim Report</li></ul></li></ul>



## PHASE 2

*February 22 – March 15*

ACTIONS	DELIVERABLES
<ul style="list-style-type: none"><li>● Pursue a second interview with a knowledgeable candidate that can help define our future persona attributes, wants, goals, and problems</li><li>● Develop an affinity map based off research and interview feedback</li><li>● Develop up to three (3) unique personas that are representations of users within an incident command structure</li><li>● Develop an empathy map for each persona that targets four main areas: what things they are saying, thinking, doing, and feeling</li><li>● Produce a second interim report and potentially update project definition and scope</li></ul>	<ul style="list-style-type: none"><li>● February 25<ul style="list-style-type: none"><li>○ Complete interview with focus on building personas</li></ul></li><li>● March 4<ul style="list-style-type: none"><li>○ Affinity Map</li></ul></li><li>● March 11<ul style="list-style-type: none"><li>○ Empathy Map</li></ul></li><li>● March 13<ul style="list-style-type: none"><li>○ Personas Document</li></ul></li><li>● March 14<ul style="list-style-type: none"><li>○ 2nd Interim Report</li></ul></li></ul>

## PHASE 3

*March 16 – April 6*

ACTIONS	DELIVERABLES
<ul style="list-style-type: none"><li>• Complete a third interview, based on questions about incident command task analysis</li><li>• Produce a diagram detailing our findings and examples when performing task analysis</li><li>• Based off the last interview and research, produce scenarios and storyboards that help conceptualize the incident command workflow in AR</li><li>• With scenarios and storyboarding in hand, develop an experience map that will assist in identifying major processes and problems that can occur during this workflow</li><li>• Produce a third interim report and potentially update project definition and scope</li></ul>	<ul style="list-style-type: none"><li>• March 18<ul style="list-style-type: none"><li>◦ Complete interview with focus on task analysis and scenarios</li></ul></li><li>• March 22<ul style="list-style-type: none"><li>◦ Task Analysis Diagram</li></ul></li><li>• March 25<ul style="list-style-type: none"><li>◦ Scenarios</li><li>◦ Storyboarding</li></ul></li><li>• March 27<ul style="list-style-type: none"><li>◦ Experience Map</li></ul></li><li>• March 28<ul style="list-style-type: none"><li>◦ 3rd Interim Report</li></ul></li></ul>

## PHASE 4

*April 7 – May 2*

ACTIONS	DELIVERABLES
<ul style="list-style-type: none"><li>• Using subject matter experts from previous interviews, complete a feedback session based on concept art and ideas produced by past groups</li><li>• With everything completed thus far, create a work/activity model document that pinpoints all the necessary flows and variables within an incident commander's workflow</li><li>• Produce our fourth and final interim report with findings and updates</li><li>• In addition to the work/activity model, perform tree testing on prototypes, sketches, or wireframes. Depending on the results, research user feedback and create a document detailing pros and cons. This will be presented to a subject matter expert for testing purposes</li><li>• Since this research is being handed off to an external team, develop user interface requirements that will explain all visual and interactive experiences necessary for the incident commander. This effort will build on previous research and create/innovate where there are gaps</li><li>• Present all the research, findings, and ideas in one final report and presentation</li></ul>	<ul style="list-style-type: none"><li>• April 8<ul style="list-style-type: none"><li>◦ Feedback session on concept art and ideas</li></ul></li><li>• April 14<ul style="list-style-type: none"><li>◦ Work/Activity Model Document</li></ul></li><li>• April 15<ul style="list-style-type: none"><li>◦ Tree-testing concepts and prototypes</li></ul></li><li>• April 25<ul style="list-style-type: none"><li>◦ 4th Interim Report</li></ul></li><li>• April 29<ul style="list-style-type: none"><li>◦ User Interface Requirements Document</li></ul></li><li>• May 2<ul style="list-style-type: none"><li>◦ Final Report and Presentation of Research</li></ul></li></ul>

# Conclusion

Our team is excited to explore the first responder's cognitive work flow during times of crisis to analyze how many enhancements can be completed regarding their situational awareness. First responders and other emergency personnel place their own lives on the line every day to assist the general public. Our belief is that augmented reality interfaces and controls can assist in streamlining their processes with innovative technology and utilizing modern concepts. We hope the future of our work results in saving the lives of many for generations to come.