Socian Technologies

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Introduction

Project Overview:

- Goal: As a team, we are working on a map interface for future integration with Socian Technologies. Our project will primarily be based on the exploration of drone mapping with a focus on first responder communication, general map and data visualization, vision sensor integration, rival drone research, artificial intelligence assimilation, and analysis of stakeholders.
- For Socian Technology, our team has to design a mapping interface or aspects of drone mapping that will be used by the drone dispatcher and potentially conveyed to police officers

Deliverables:

- Project Documentation
- Low and High Fidelity Mockups
- Prototype: Mapping Interface used by 911 Dispatcher
- Slide Deck: Prepared project process deck for Presentation Day
- Recorded Presentation - A walkthrough of our project and designs!: https://youtube.com/playlist?list=PLZv2uVcI3-EvbbtQS_Te3ATIem-IhlSt7

Stakeholders:

- 911 Operators
- First Responders (Police Officers & Firefighters)
- 911 Dispatcher
- Socian's sponsors
- Pedestrians
- Criminals

User group

- Focusing on 911 dispatchers who will be interacting with the mapping interface

Introduction of Final Design

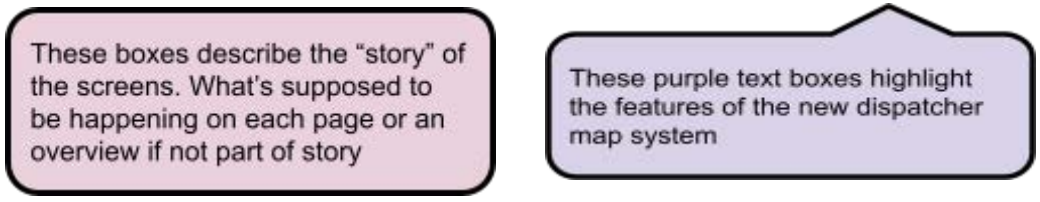
We will present our final design through a user story of a 911 dispatcher.

The screens show the different points of the reporting and responding of an incident

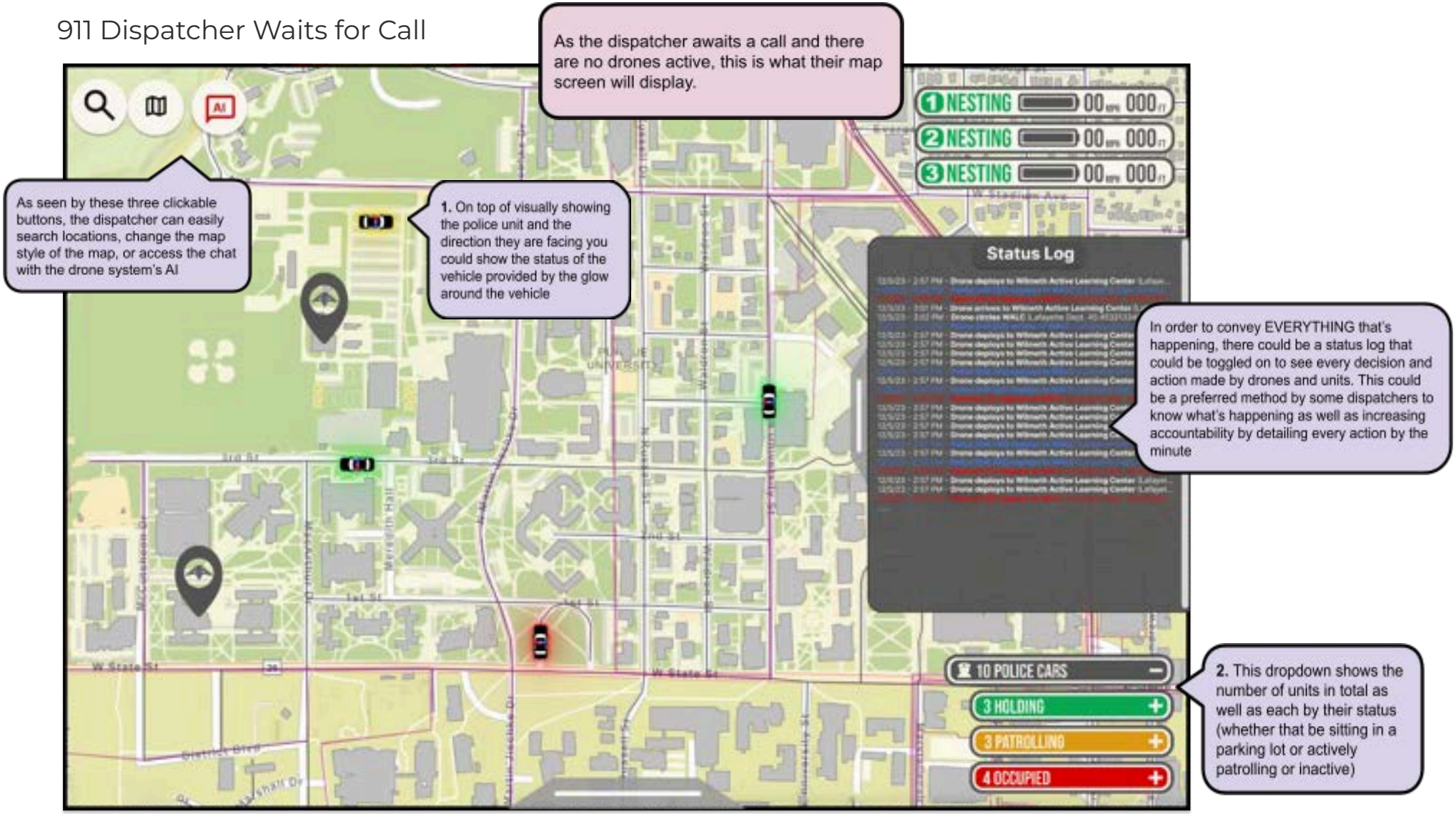
1. Dispatcher waiting for a call, just basic permanent information of drone and unit locations
2. Call being made, highlighting the drone that will respond as well as marking the exact locations of the caller and point of interest
3. Incident Report and start of incident response (by drones and units)
4. The drone searching the area
5. An ‘after-the-fact’ forensic view of the incident

Final Design Walkthrough

Key:

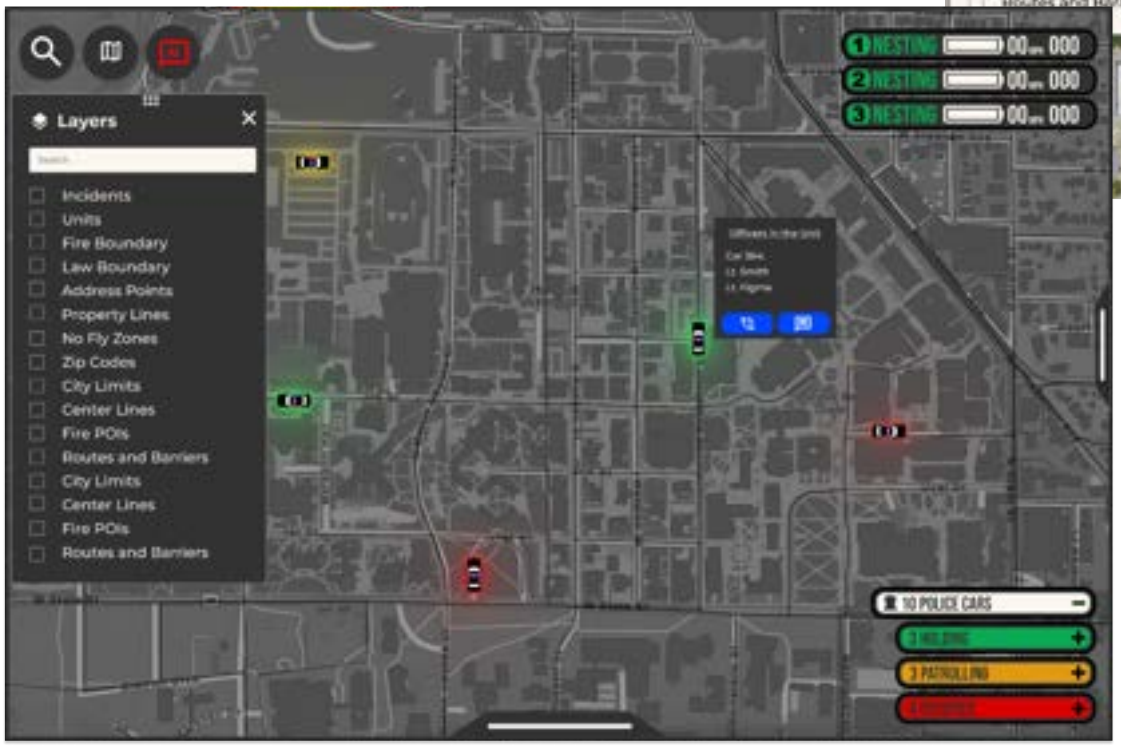


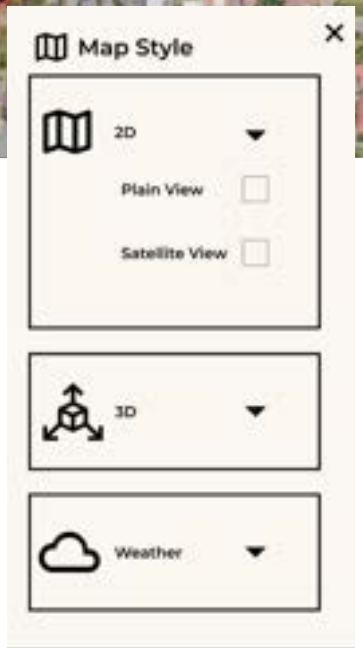
911 Dispatcher Waits for Call

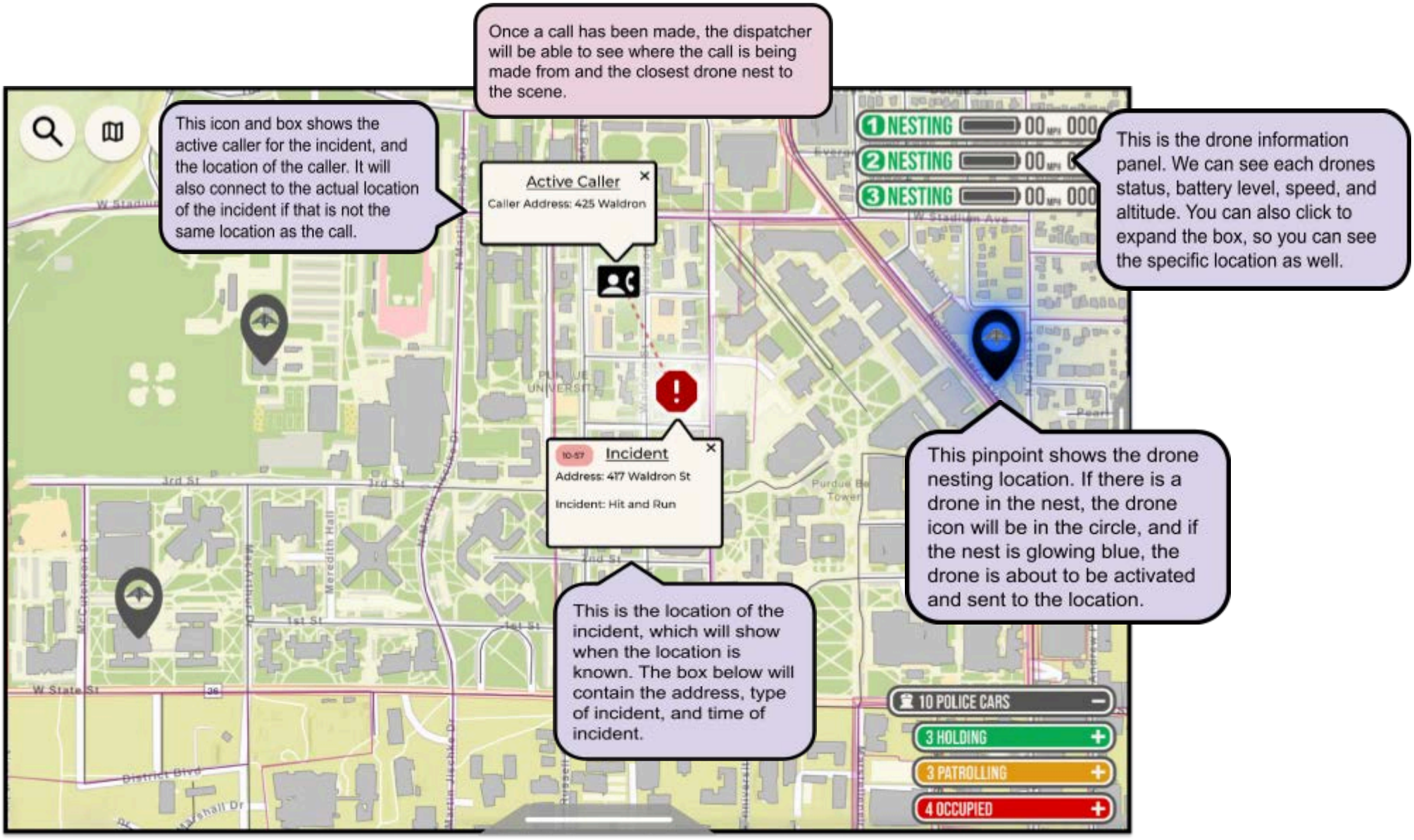


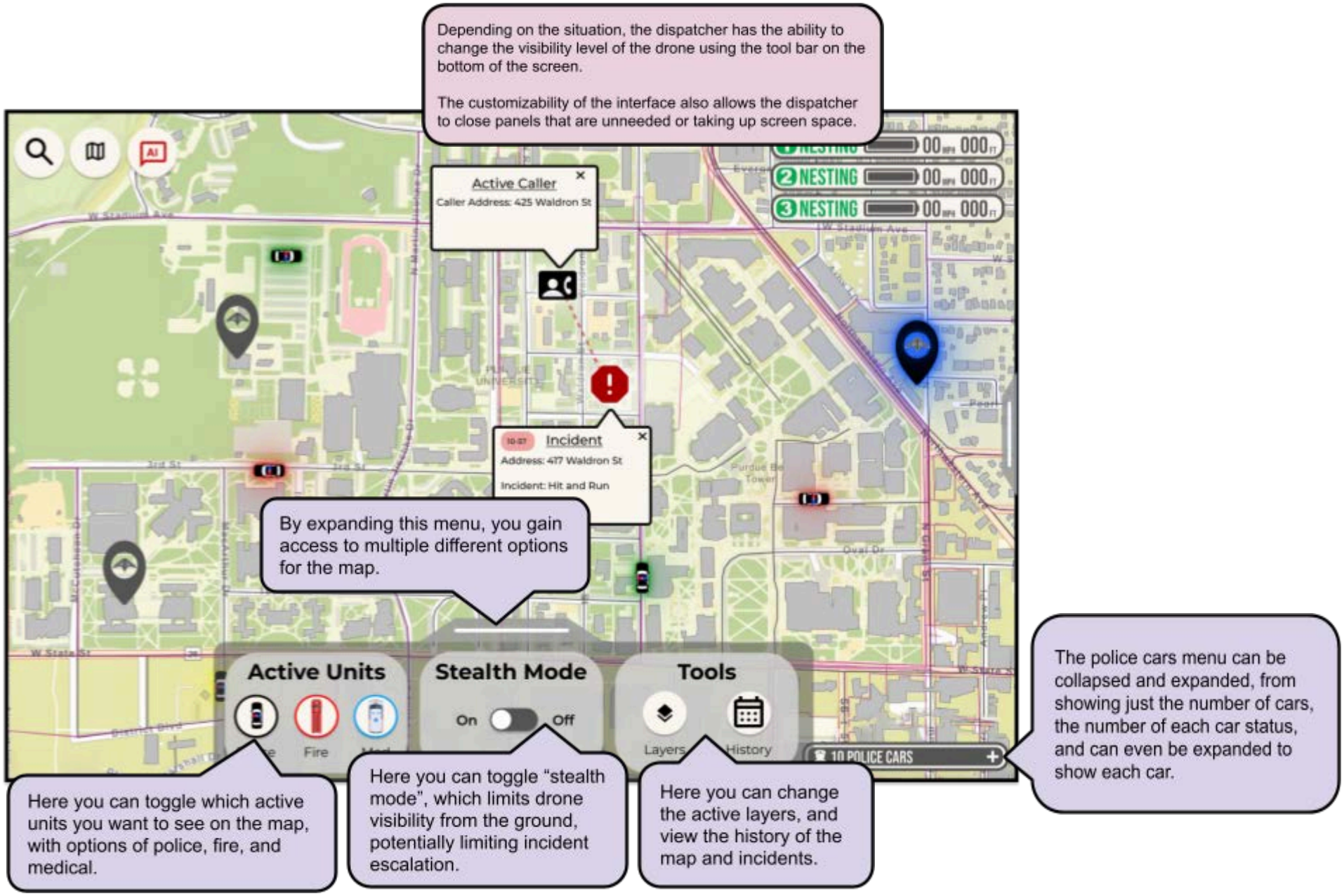
Changing Map Style

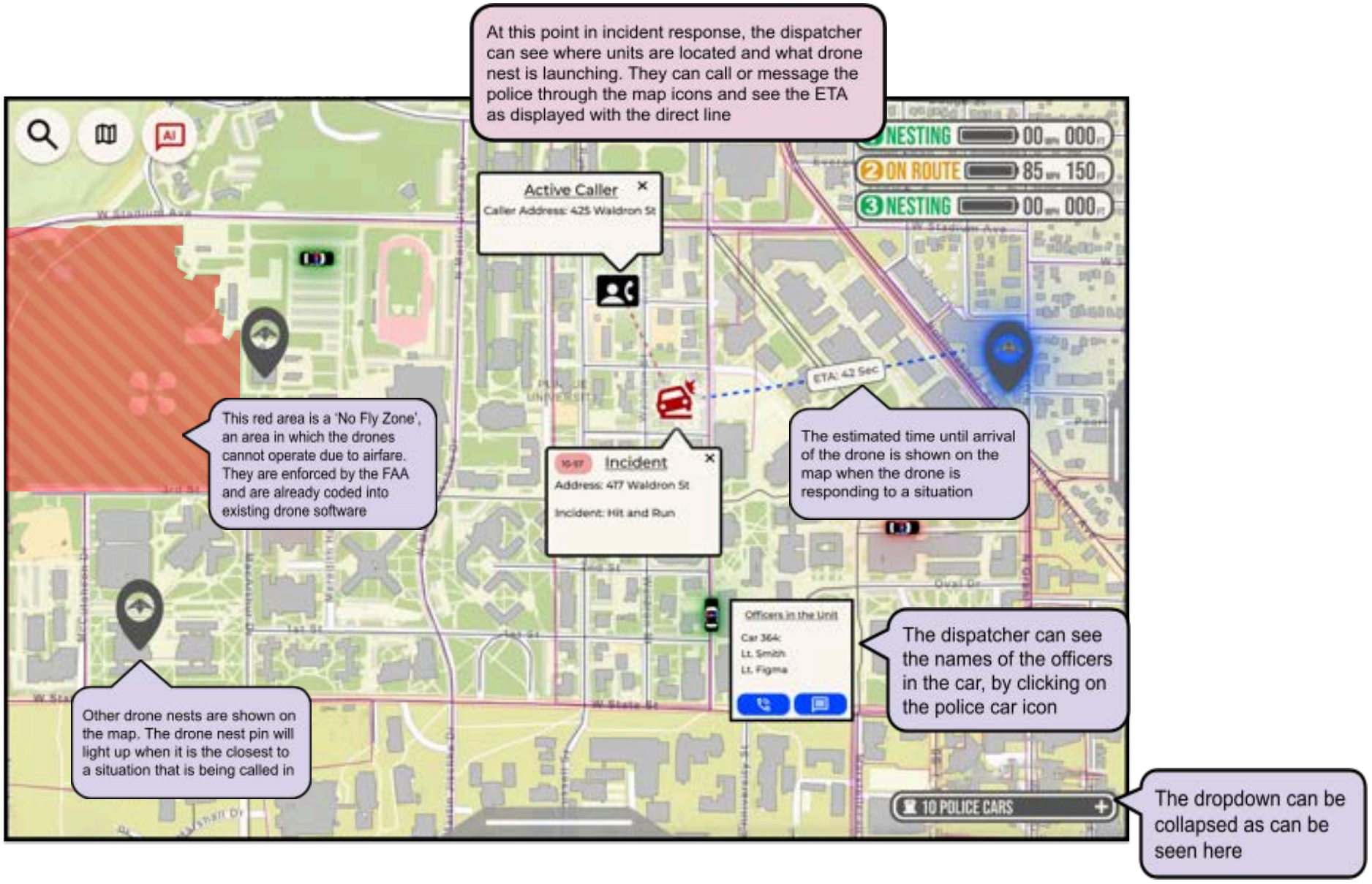
Clicking the middle of top left buttons changes the map style to the preference or need of the dispatcher. Considering the dark environment of the dispatch setting, a ‘Dark Mode’ (bottom) would put more ease on the dispatcher's eyes. The ‘Satellite’ view (right) on the other hand offers a more complex view of the area of focus and allows the dispatchers to analyze vegetation, building details and small things such as the existence of a shed or covering.

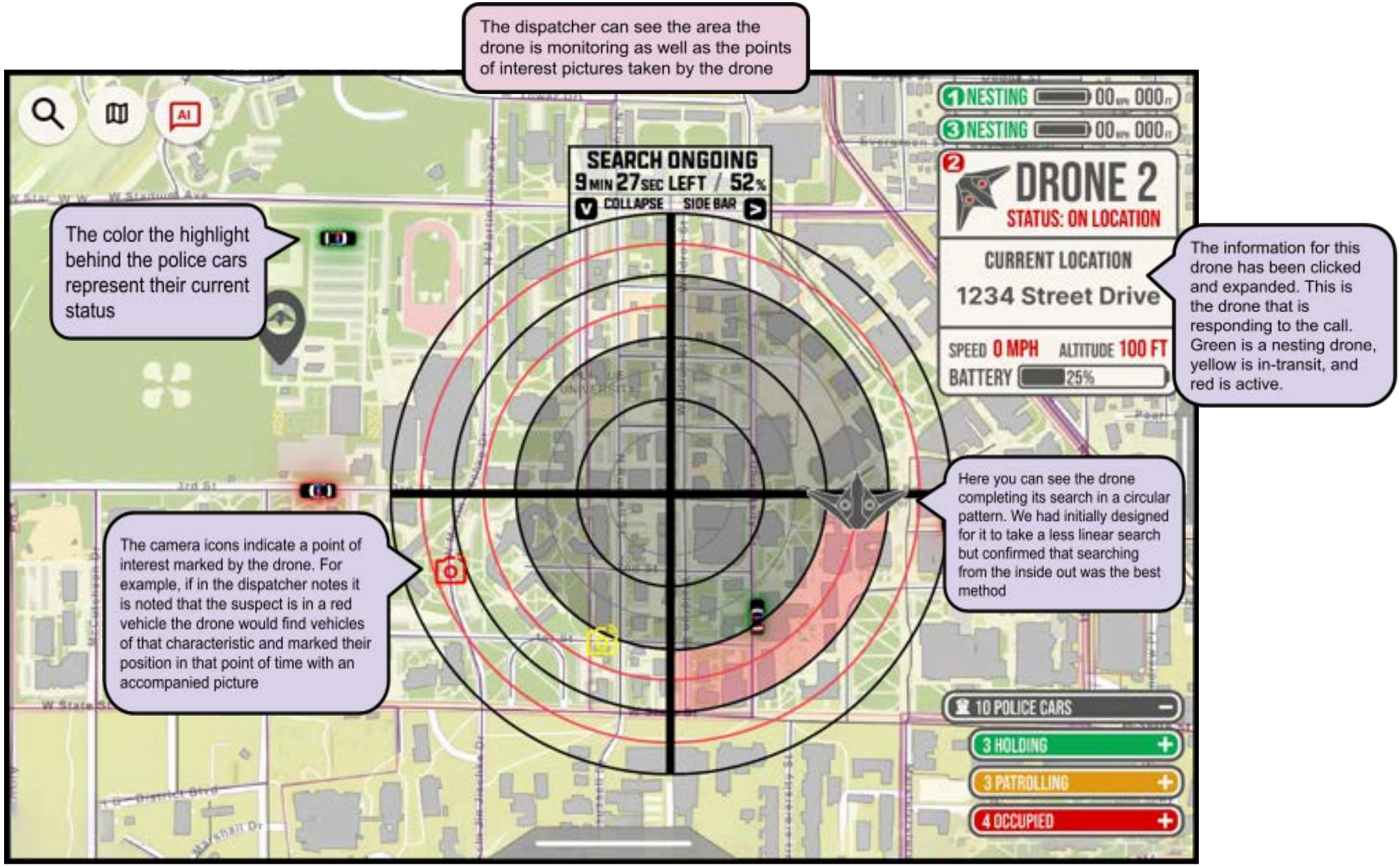


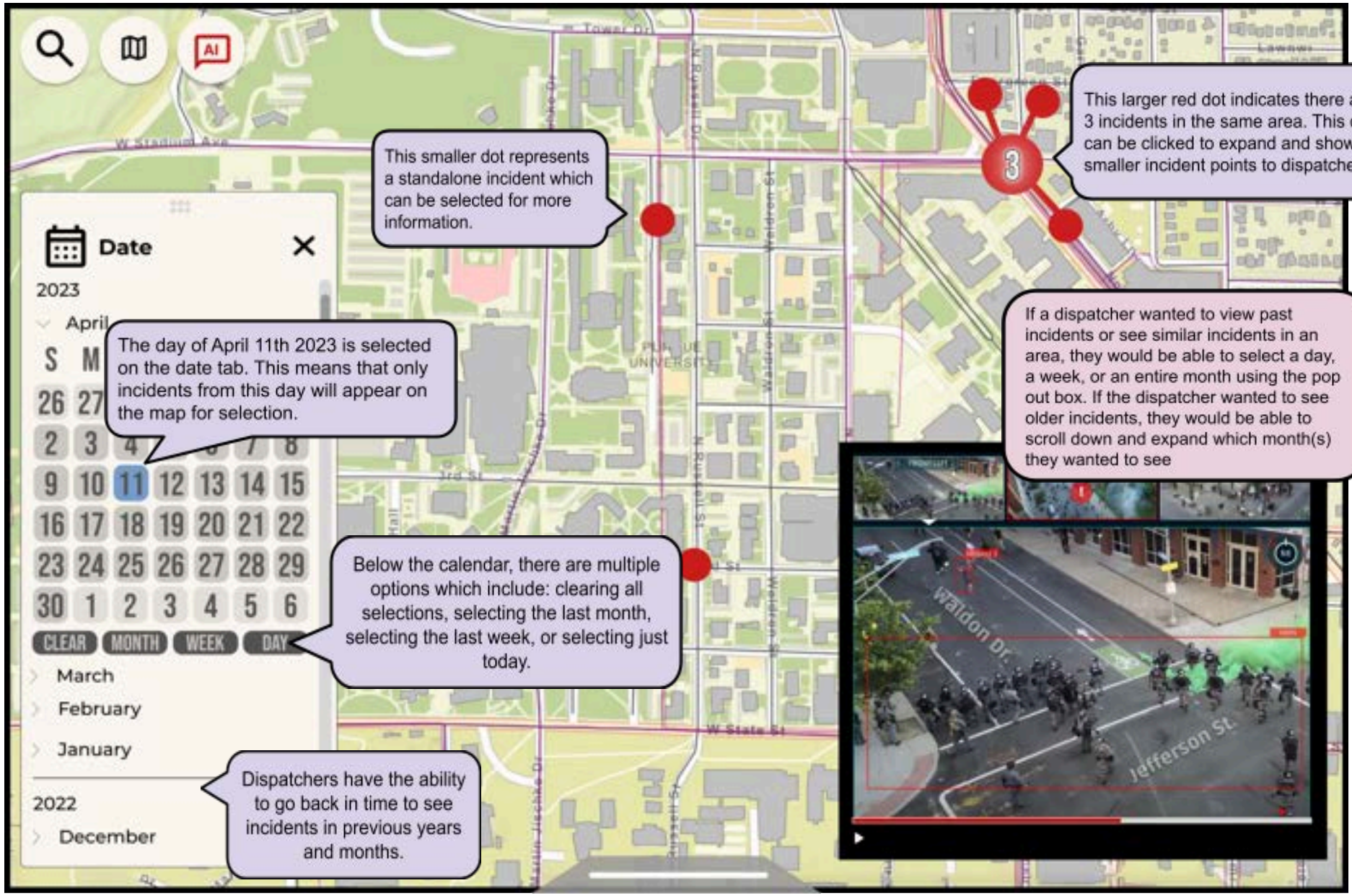


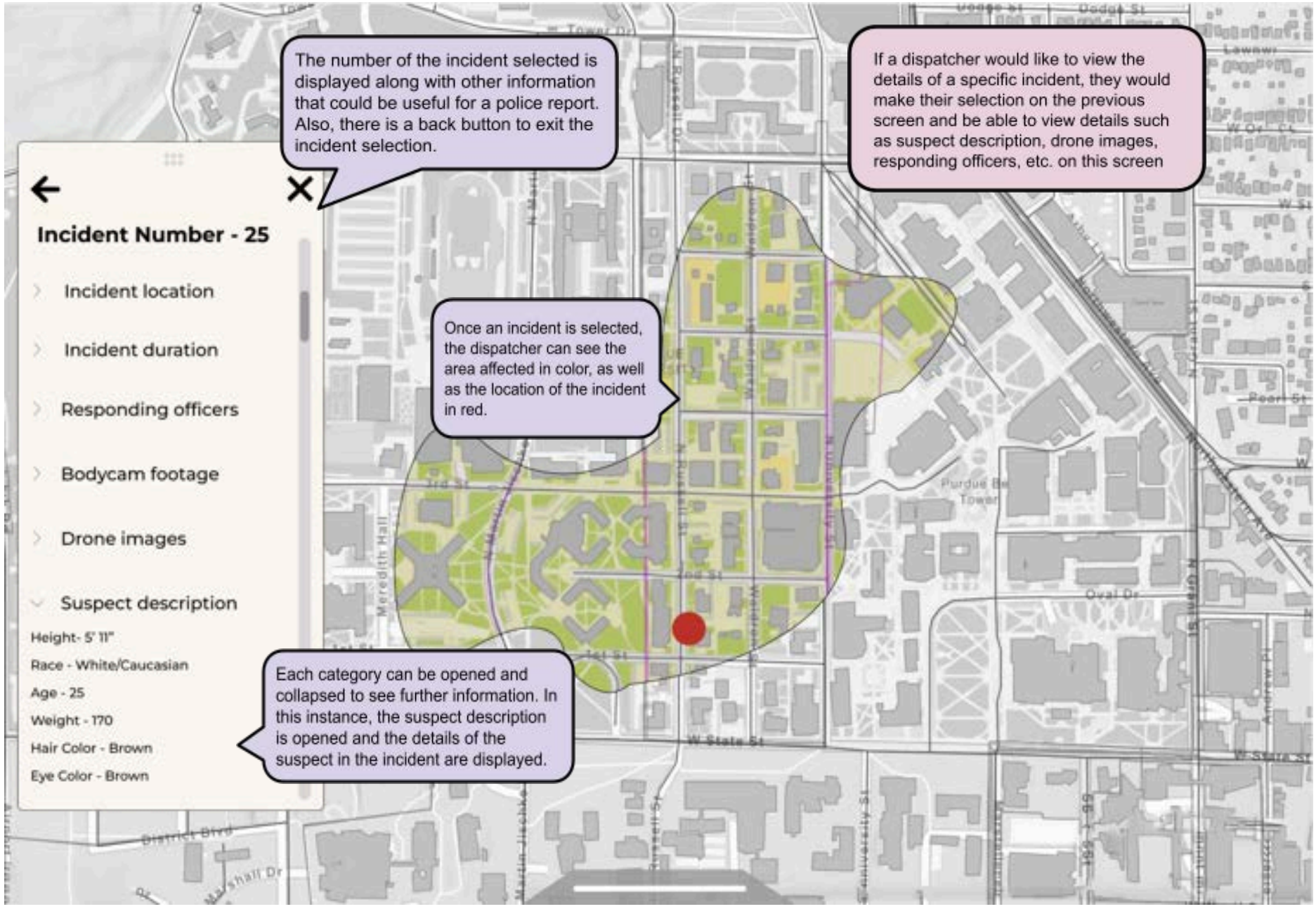

Once a call has been made, the dispatcher will be able to see where the call is being made from and the closest drone nest to the scene.
This icon and box shows the active caller for the incident, and the location of the caller. It will also connect to the actual location of the incident if that is not the same location as the call.
Active Caller
Caller Address: 425 Waldron
This is the drone information panel. We can see each drones status, battery level, speed, and altitude. You can also click to expand the box, so you can see the specific location as well.
1 NESTING
2 NESTING
3 NESTING
Incident
Address: 417 Waldron St
Incident: Hit and Run
This pinpoint shows the drone nesting location. If there is a drone in the nest, the drone icon will be in the circle, and if the nest is glowing blue, the drone is about to be activated and sent to the location.
This is the location of the incident, which will show when the location is known. The box below will contain the address, type of incident, and time of incident.
10 POLICE CARS
3 HOLDING
3 PATROLLING
4 OCCUPIED


Depending on the situation, the dispatcher has the ability to change the visibility level of the drone using the tool bar on the bottom of the screen.
The customizability of the interface also allows the dispatcher to close panels that are unneeded or taking up screen space.
Active Caller
Caller Address: 425 Waldron St
Incident
Address: 417 Waldron St
Incident: Hit and Run
By expanding this menu, you gain access to multiple different options for the map.
Active Units
Fire
Stealth Mode
On
Off
Tools
Layers
History
10 POLICE CARS
Here you can toggle which active units you want to see on the map, with options of police, fire, and medical.
Here you can toggle “stealth mode”, which limits drone visibility from the ground, potentially limiting incident escalation.
Here you can change the active layers, and view the history of the map and incidents.
The police cars menu can be collapsed and expanded, from showing just the number of cars, the number of each car status, and can even be expanded to show each car.


At this point in incident response, the dispatcher can see where units are located and what drone nest is launching. They can call or message the police through the map icons and see the ETA as displayed with the direct line
Active Caller
Caller Address: 425 Waldron St
NESTING 00 000
ON ROUTE 85 150
NESTING 00 000
ETA: 42 Sec
This red area is a 'No Fly Zone', an area in which the drones cannot operate due to airfare. They are enforced by the FAA and are already coded into existing drone software
Incident
Address: 417 Waldron St
Incident: Hit and Run
The estimated time until arrival of the drone is shown on the map when the drone is responding to a situation
Officers in the Unit
Car 364:
Lt. Smith
Lt. Figma
The dispatcher can see the names of the officers in the car, by clicking on the police car icon
Other drone nests are shown on the map. The drone nest pin will light up when it is the closest to a situation that is being called in
10 POLICE CARS
The dropdown can be collapsed as can be seen here


The dispatcher can see the area the drone is monitoring as well as the points of interest pictures taken by the drone
SEARCH ONGOING
9 MIN 27 SEC LEFT / 52%
COLLAPSE
SIDE BAR
NESTING
NESTING
DRONE 2
STATUS: ON LOCATION
CURRENT LOCATION
1234 Street Drive
SPEED 0 MPH
ALTITUDE 100 FT
BATTERY 25%
The information for this drone has been clicked and expanded. This is the drone that is responding to the call. Green is a nesting drone, yellow is in-transit, and red is active.
The color the highlight behind the police cars represent their current status
Here you can see the drone completing its search in a circular pattern. We had initially designed for it to take a less linear search but confirmed that searching from the inside out was the best method
The camera icons indicate a point of interest marked by the drone. For example, if in the dispatcher notes it is noted that the suspect is in a red vehicle the drone would find vehicles of that characteristic and marked their position in that point of time with an accompanied picture
10 POLICE CARS
3 HOLDING
3 PATROLLING
4 OCCUPIED


Date
2023
April
S M
26 27
2 3 4
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 1 2 3 4 5 6
CLEAR MONTH WEEK DAY
March
February
January
2022
December
AI
3
Waldon Dr.
Jefferson St.
This smaller dot represents a standalone incident which can be selected for more information.
This larger red dot indicates there are 3 incidents in the same area. This dot can be clicked to expand and show the smaller incident points to dispatchers.
The day of April 11th 2023 is selected on the date tab. This means that only incidents from this day will appear on the map for selection.
If a dispatcher wanted to view past incidents or see similar incidents in an area, they would be able to select a day, a week, or an entire month using the pop out box. If the dispatcher wanted to see older incidents, they would be able to scroll down and expand which month(s) they wanted to see
Below the calendar, there are multiple options which include: clearing all selections, selecting the last month, selecting the last week, or selecting just today.
Dispatchers have the ability to go back in time to see incidents in previous years and months.


The number of the incident selected is displayed along with other information that could be useful for a police report. Also, there is a back button to exit the incident selection.
If a dispatcher would like to view the details of a specific incident, they would make their selection on the previous screen and be able to view details such as suspect description, drone images, responding officers, etc. on this screen
Once an incident is selected, the dispatcher can see the area affected in color, as well as the location of the incident in red.
Each category can be opened and collapsed to see further information. In this instance, the suspect description is opened and the details of the suspect in the incident are displayed.
Incident Number - 25
Incident location
Incident duration
Responding officers
Bodycam footage
Drone images
Suspect description
Height- 5' 11"
Race - White/Caucasian
Age - 25
Weight - 170
Hair Color - Brown
Eye Color - Brown

Design “Maybes”

AI Chat with Drone System:

A flexible and iterative way a dispatcher could communicate with drones. They could type into this panel on their dispatch setup and communicate with the drone, whether that be with commands, questions, or further explanations.

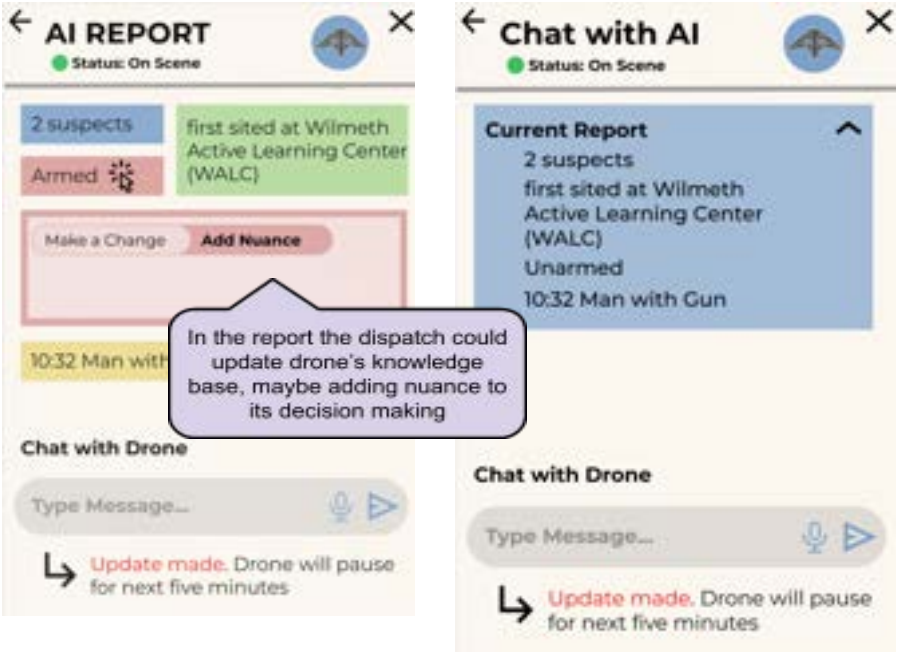
Justification for design: interview insights from our sponsor, testing with operator, and wanting to give operators the ability to question drone’s decision making. The ongoing success of CHATGPT also helped

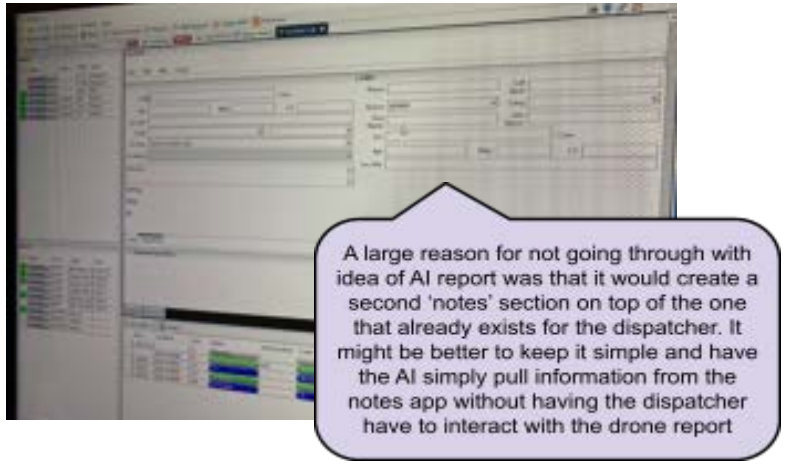
Concerns:

1) **Recognition over recall** - buttons are easier for an operator to choose, overlap with existing CAD notes
2) **Balance of control** - the drone is autonomous for a reason, giving greater control to police/dispatch might result in the same issues that spurred the creation of this drone in the first place

Based on our testing with a 911 dispatcher, we found that police notes and past information is where they gain a better understanding of the situation. Therefore, we decided to shift the AI chat to a report that combines police notes and past information and allows the dispatcher to:

- Update information that may be changing as the situation persists
- Add nuance to situation in order to give more detail to AI/drone

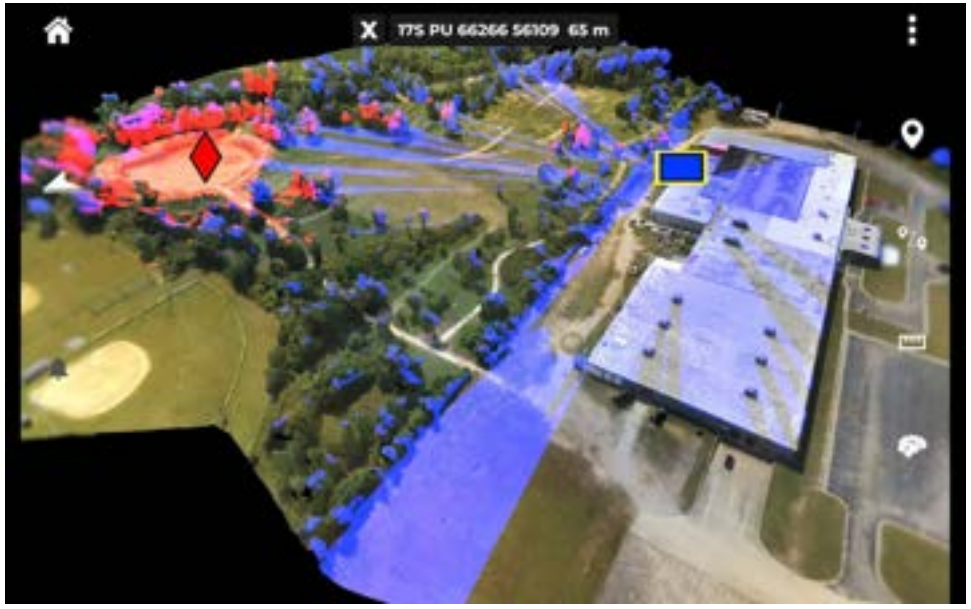


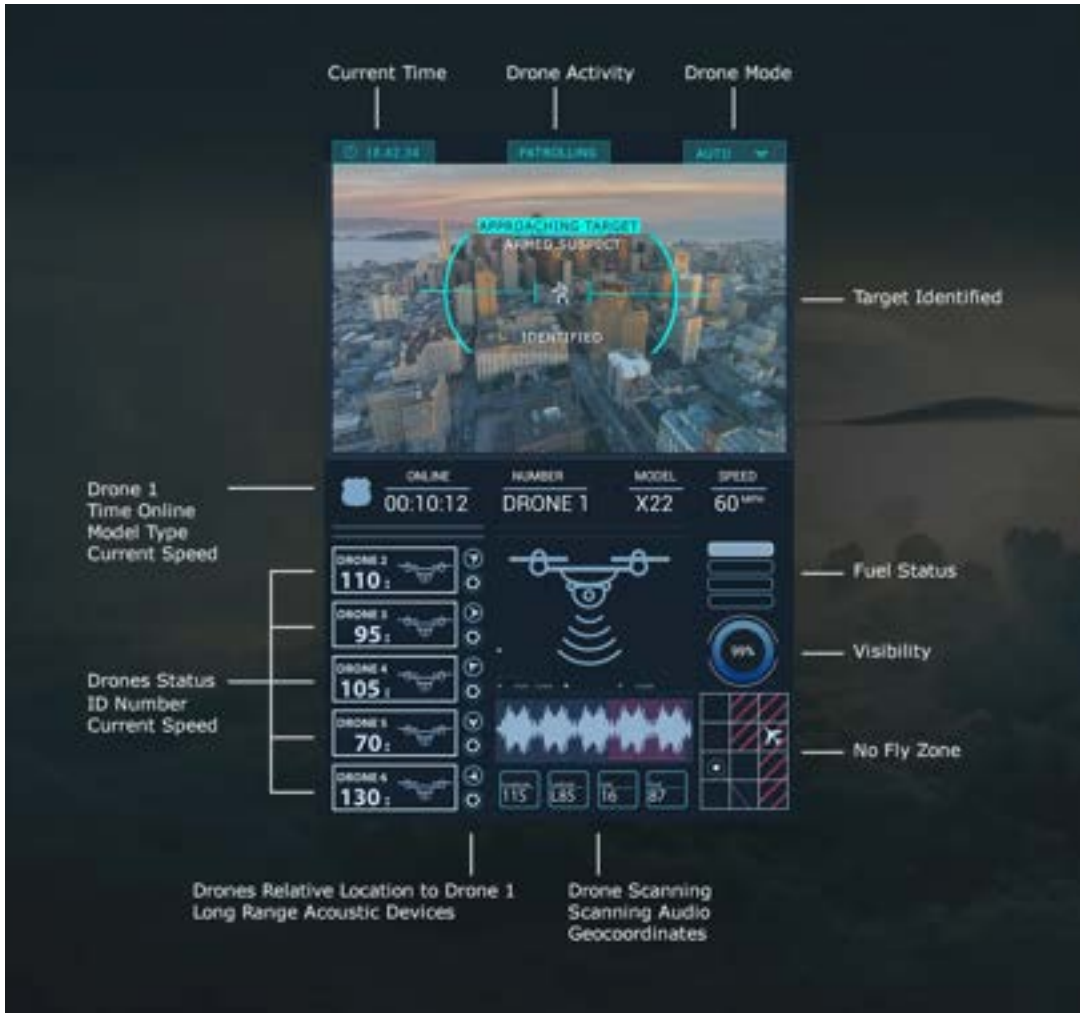


3D Maps and Camera Views

Having more complex views of a map from spatial background of buildings and artifacts could give an opportunity for dispatchers to have a more complete understanding of the incident area.

Also doing more with camera views and viewing of drone behavior could be interesting. It's obvious talking to police that they would demand that they knew what the drone was doing and have the ability to stop it in case the AI made errors or there were some other problem.





Secondary Research *much more detail can be found in appendix

Goal

Our goal was to gain more insight into our problem space and to better understand how to move forward with creating designs that would accurately fit within our scope. We first wanted to learn more about 911 dispatchers and their current set up to learn how we could integrate our solution. We also wanted to see how drone mapping is currently done for other companies. We did this to see if there were any key points that we would need to add into our designs to make them as understandable as possible.

Approach

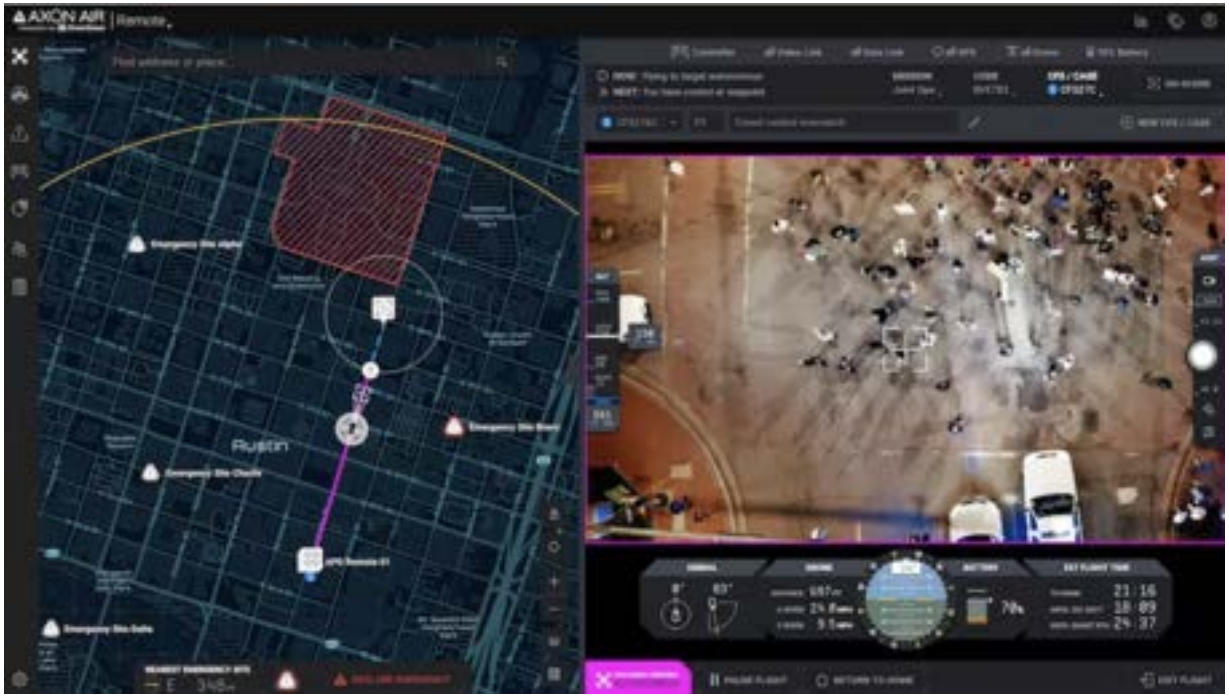
To do this, we all individually researched different topics that would aid in better understanding dispatcher terminology, their process, and Socian drones. We also conducted a comparative analysis to see what currently exists for drone interfaces. We looked at interfaces for non-autonomous drone cameras, as well as interfaces for drone mapping, that show the location and flight plan of the drone.

Insights about 911 Dispatchers

- Dispatchers currently use **Computer-Aided Dispatch (CAD)** for mapping
- **Dispatchers would be the primary user of the interface**
- Dispatchers communicate important information with officers over radio
- Dispatchers input location into CAD, so the first responders know where to go

Insights about Competitive Analysis

- Current drone interfaces are primarily for non-autonomous drones
- Interfaces contain **key information** about the drone
    - Speed, altitude, battery, etc.
- The interfaces are typically **simple**, only containing what is necessary



Axon Air Interface

References

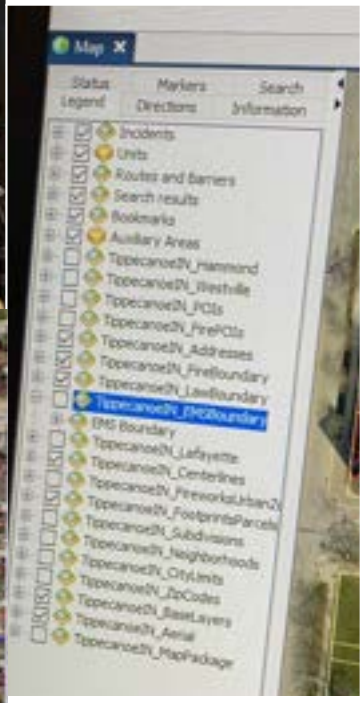
911 Dispatcher - A Day in the Life
10 Most Advanced Police Drones in the World
Remote Drone Dispatch: Law Enforcement's Future? - Police Chief Magazine
Futurism : Police Drone User Interface | by Dermot McDonagh | Medium
Axon Air

Dispatcher Tour

In order to gain a better understanding and background of our user group, 911 dispatchers, we went to West Lafayette Police Department's dispatcher center on Purdue's campus.

We interviewed a dispatch supervisor and the head of the WLPD drone department to understand:

1) Pain points operators face when using CAD and interacting with maps
2) Current implementation of police drones & situations they're used for
3) 911 dispatcher's environment and job responsibilites



Insights:

[Transcript of Tour]

Dispatcher setup consists of multiple screens where operators have the **ability to customize**:

1) **Map data layers** such as county lines, addresses, neighborhoods, units, incidents
2) **CAD screen setup** which consists of map, radio, police notes, chat with officers, and record of incidents

Jason's insight of dispatcher setup:

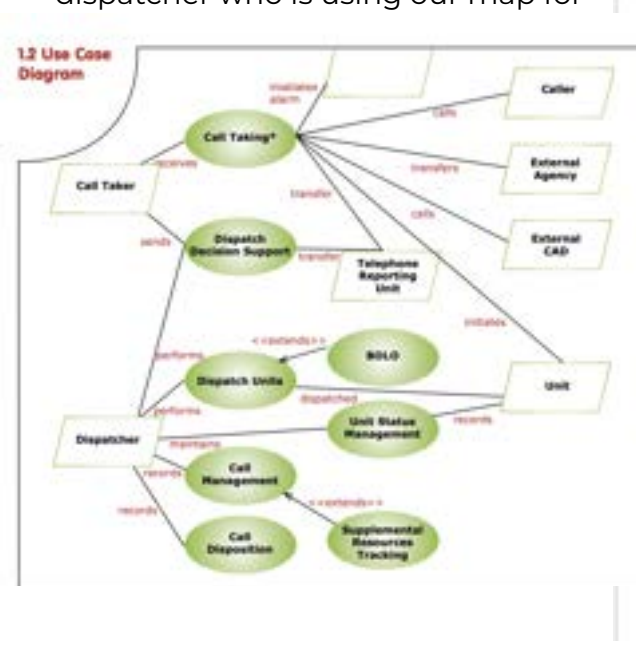
1) They see **vegetation as not-so-necessary** information in most cases.
2) **Address points are essential** to help police for identifying the jurisdiction
3) **Data layers** are usually set by dispatcher during on boarding and then **not really used**

Sargent's explanation of police drone use and surveillance:

1) Drone are mainly used for **missing persons** and for **surveying large areas of terrain**
2) Drones and surveillance cameras have the **ability to read license plates**, but do not have facial recognition
3) The live feed from the drones will be helpful in many cases as they can **lock the movement of the suspect**

Essential Information for Map Interface

Here we have combined everything from the interviews and the things that we found in our secondary research so that we can finalize on the basic structure for the map. We also tried to incorporate our ideas so that we can better address this problem space and make drone maps similar to the current CAD system that they use so there is no new learning curve for the dispatcher who is using our map for



Above left is a diagram from the “Standard Functional Specifications for.... Law Enforcement Computer Aided Dispatch (CAD) Systems” - https://bja.ojp.gov/sites/g/files/xyckuh186/files/media/document/leitsc_law_enforcement_cad_systems.pdf

Dispatcher Testing

Goal
Our goal was to test out our designs with a dispatcher, to see how effective they were. We also wanted to test how easily understandable the designs would be for a 911 dispatcher.

Approach
To do this, we talked to a 911 dispatcher over Zoom about our designs. We showed them to him and asked for any feedback on the things he appreciated and things that could be changed about the designs.

Insights
- Their setup is already complicated and they **do not want to feel overloaded**
- **Police codes** are important to add, but not the full address
- Wanted to be able to **add nuance** to the drone's knowledge
- Likes being able to change the visibility of the drone to help with **not escalating the issue**
- Enjoy features like **color coded units** to know what police on duty are doing
- Wants **layers to be less visible** because they are not used often

Conclusion
Our goal was to test out our designs with a dispatcher, to see how effective they were. We also wanted to test how easily understandable the designs would be for a dispatcher. During our interview with Jason Timmons (a West Lafayette dispatcher), we got the needed feedback to make some final changes to our design.

What Could Be Done in Future

Conclusion

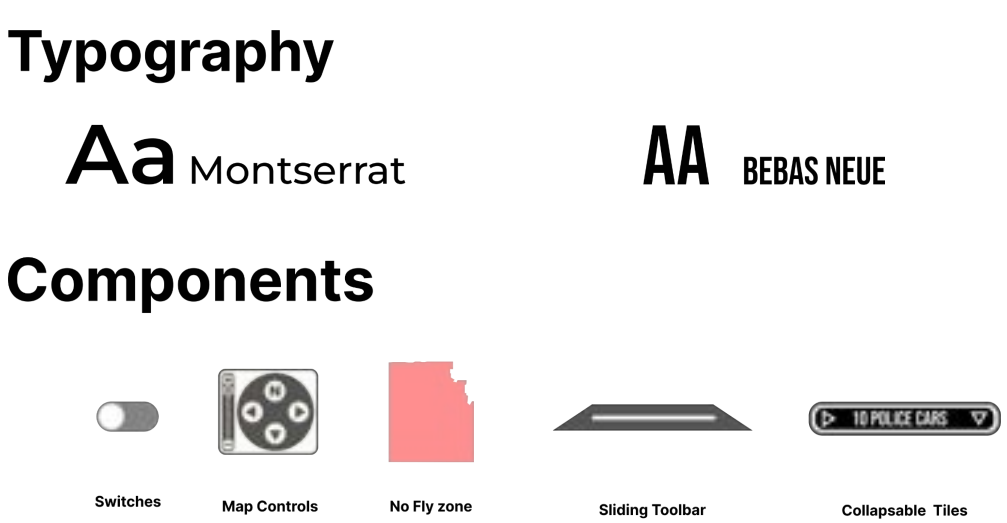
To reflect back on our semester, as a team we were effectively able to communicate and deliver ideas in order to reach our goal. From starting with secondary research and competitive analysis, to really understanding our design space, to meeting with our sponsor to figure out the specifications of the drone and the current company's vision, to designing our final prototype solution for the end of the semester presentation. We were able to grow as a team not only in our UX design skills, but in our soft skills as well. We did hit a good amount of roadblocks along the way, however, overcoming a challenge was just another step closer to our final solution. We had a great time working on this project with Marc.

Future Steps

- Onboarding Feature: Allowing dispatchers to choose the layout that makes them the most comfortable to work with the interface
- AI Chat: Allowing the dispatchers the ability to message the drone questions and clarifications about the incident
- More concept testing with dispatchers: Understanding what changes still need to be implemented regarding the structure, aesthetic, content, and functionality of the interface
- The use of more data from the notes tab of the CAD setup, visualizing the information shared between units on the screen of the dispatchers setup
- Pause/Stop button: An override button that the dispatcher an press to stop drone actions/movement
- Make opacity meter for user to choose between satellite and plain view, this way they could an in between of visibility of foliage and more detailed information but not a complete satellite view

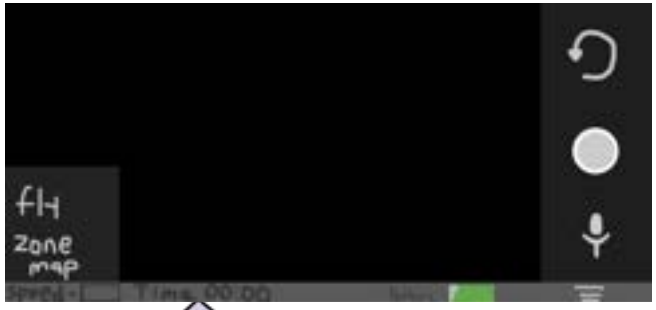
Design System

This is the set of fonts, colors, and icons we used to create designs that coalesced to look more professional



Appendix

Early Sketches



This early sketch shows what a handheld version of a map display would look like.

This is a design for a design that highlights the flight plan and location of the drone/incidents. The sidebar on the right shows would show the camera view and the layers panel.

This was an initial idea for a dashboard that shows the locations of all the drones. We used the top profile icon of the drone on later designs.

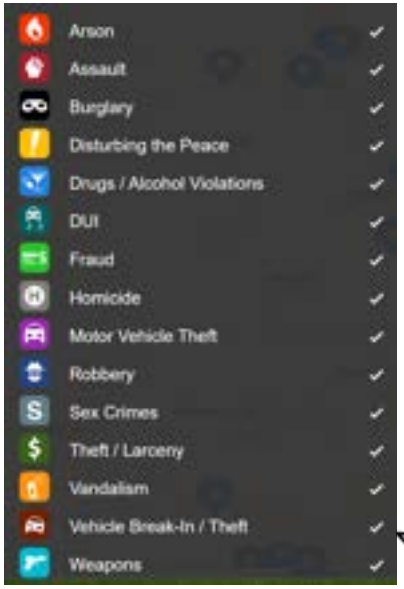
This design shows what the first version of our map would look like (some of the features that stuck include incident toggles, no fly zones, drone location, and drone path

This early sketch introduces the concept of letting dispatchers switch map views and see statistics about the drone such as battery percentage and speed.
Included in this sketch were some other unused features like the ability for dispatchers to end a drone's mission as well as the ability for a dispatcher to turn the drone's camera and rewind to see previous views from the drone
Ends the drone's mission- Drone returns to charger
Live display of drone's cameras
Drone feed goes here
Drone feed goes here
Drone feed goes here
Fly Zone Map
Plain map view/ jd map view
Plain map view/ jd map view
90%
MPH
00:00
This concept put an emphasis on the dispatcher being able to see the live feed from the drone with the map being expandable in the corner of the screen.
This (blue) button is used to switch maps
Battery percentage of the drone
How fast the drone is traveling
Time the drone has been on the mission
Menu button opens up tab with more options
Turns the drone's camera view
Rewind to a moment the drone captured

This early sketch shows an interface that highlights incidents and has a street view, similar to Google Earth. It also has information buttons to see more about the drone.

This sketch shows a drone camera view, as well as other drone information, like altitude, coordinates, etc.

All three of these images show options that we considered using for the map interface. We ultimately decided on the one in our final design.



This is a incident toggle concept that we found that we took some inspiration from.

This is a drone dashboard concept that we found that we took some inspiration from.

Primary Research

Dispatcher Tour Interview Protocol

- How do you use maps in your job?
- What programs/software do you use the most?
    - Which feature of the software do you like the most?
    - What would you like to be included?
    - What technology do you feel could be updated?
- What information is essential to have in regards to mapping?
    - What are the elements you want to see?
    - What information do you think isn't essential?
- How do you communicate with on the ground police?
- Do you use drones in this department?
    - What kind of situations would drones be used in?
- Do you collaborate with the fire department?
- Do you work with Axon and their products?
- Can you give an example of a complex or challenging drone mission you have flown, and how you handled it?
    - How does a drone help in that situation?

Dispatcher Concept Testing

To get feedback and test our concepts, we presented our interfaces to a 911 dispatcher. The screens were shown in order of how they would be presented when a dispatcher is responding to a call.

- What functionality, if any, would you want over a drone
    - drone visibility button: stealth mode?
- Do you have a search button, do you want one?
- Do you ever use a third party platform such as google to find answers? Do you prefer their interface?
- How valuable is screen space?
- In what types of incidents would call history and previous incidents be important?

- How do you currently access police notes? What are the pain points you experience when trying to access them?
- Would an AI chatbot be helpful in quickly receiving information?
- How often do you change your map settings such as layers or map style?
- Do you need the full address with the town, state, and area code?

Secondary Research

Competitive Research

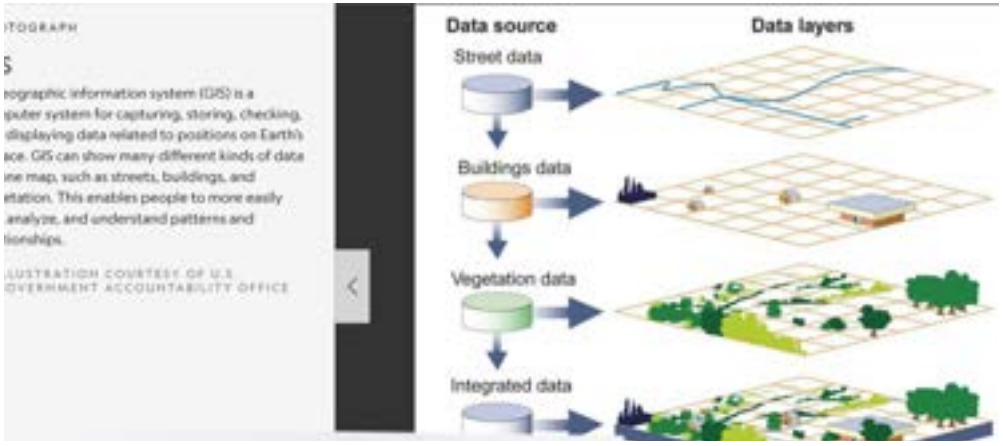
➔ Companies and projects worth to explore more
- Percepto, advanced technology “revolutionizing the way vital infrastructure and assets are inspected and monitored". LINK
- AirMap - unmanned traffic management LINK
- Diodon, rough terrain amphibious drones LINK
- Anduril, military tech examines “battle space” LINK

Police Technology

- ➔ Other drone competitors
  - Increasingly being used by police to gain aerial vantage points for crime scene work, search and rescue, accident reconstruction, and crowd monitoring.
  - Drones can be equipped with 3D mapping software to offer GPS-enhanced precisions to surveyed areas
- ➔ License Plate Recognition
  - Allows police to track a vehicle's movements over time, revealing details about an operator's whereabouts.
- ➔ Artificial Intelligence
  - Utilizing AI allows programmers to trains computers to analyze data from a vast array of sources to predict when and where crimes are likely to occur
  - AI makes it easier to share information and data between departments and agencies which allows easy cross-reference. Instead of what could take days of coordination between different police departments, AI can accomplish tasks more efficiently.

Current Computer Aided Dispatch (CAD) Map Software

- ➔ Current maps used by operators use Geographic Informaton System (GIS) data
  - GIS Displays all forms of geographically referenced information in layers
  - 911 systems use GIS to map callers' location and support dispatch functions
  - Calls are maped based on callers:
    1. Caller's address range
    2. Street name and city information
  - The caller's location is validated using the Master Street Address Guide (MSAG)



Thank you!