aMaize – A Unified GUI for FMDS
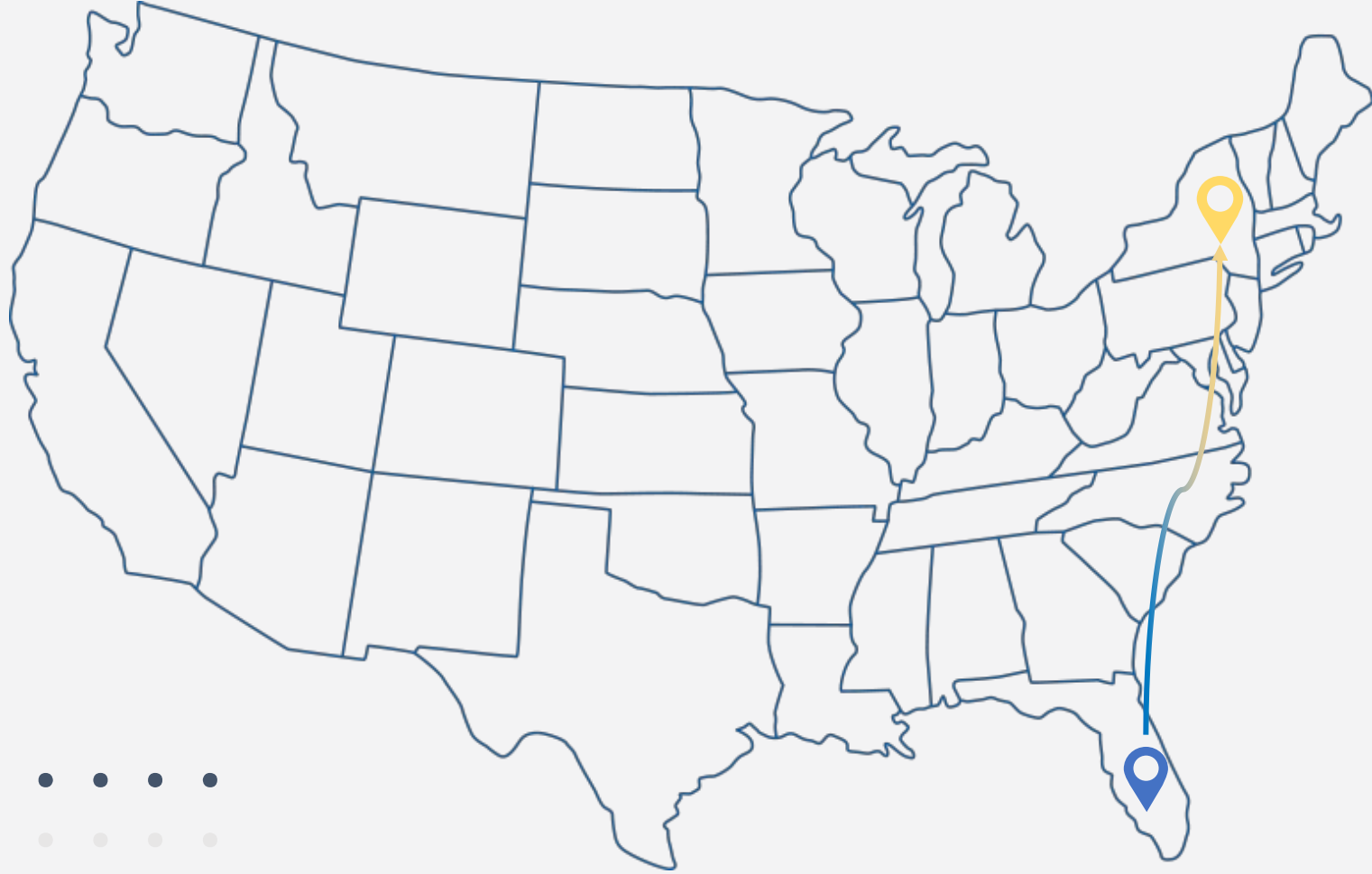
RESEARCH, DESIGN, AND PROTOTYPE DEMO

TEAM MAIZE AND BLUE:
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Tyler Carvette
Kate Shen
Dr. Max Li, Faculty Advisor

The University of Michigan, Ann Arbor
June 28, 2023

UNIVERSITY OF MICHIGAN

Let me tell you a short short story…
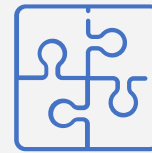
I was going from RSW to LGA

Introduction

Problem

TFMS' 20+ interfaces creates a tedious AFP workflow for NTMS, and is running on almost obsolete infrastructure [1]

Our Solution

We designed a user-centered GUI for FMDS that unifies different tools, and is backed by FAA and industry stakeholders [2]

Today's Goal

Present user research, design iterations, and interactive prototype

User Research Methods:

Interviews with FAA and Airlines to understand needs and pain points

Interviews with Stakeholders

FAA Stakeholders: Traffic Managers

Jen Ross   Former ATCSCC and current ATM at ZJX [3]

Ralph Tamburro   Former STMC at N90 [4]

Curt Kaler   TFMS Subject-Matter Expert and former ZHU and ZMP [5]
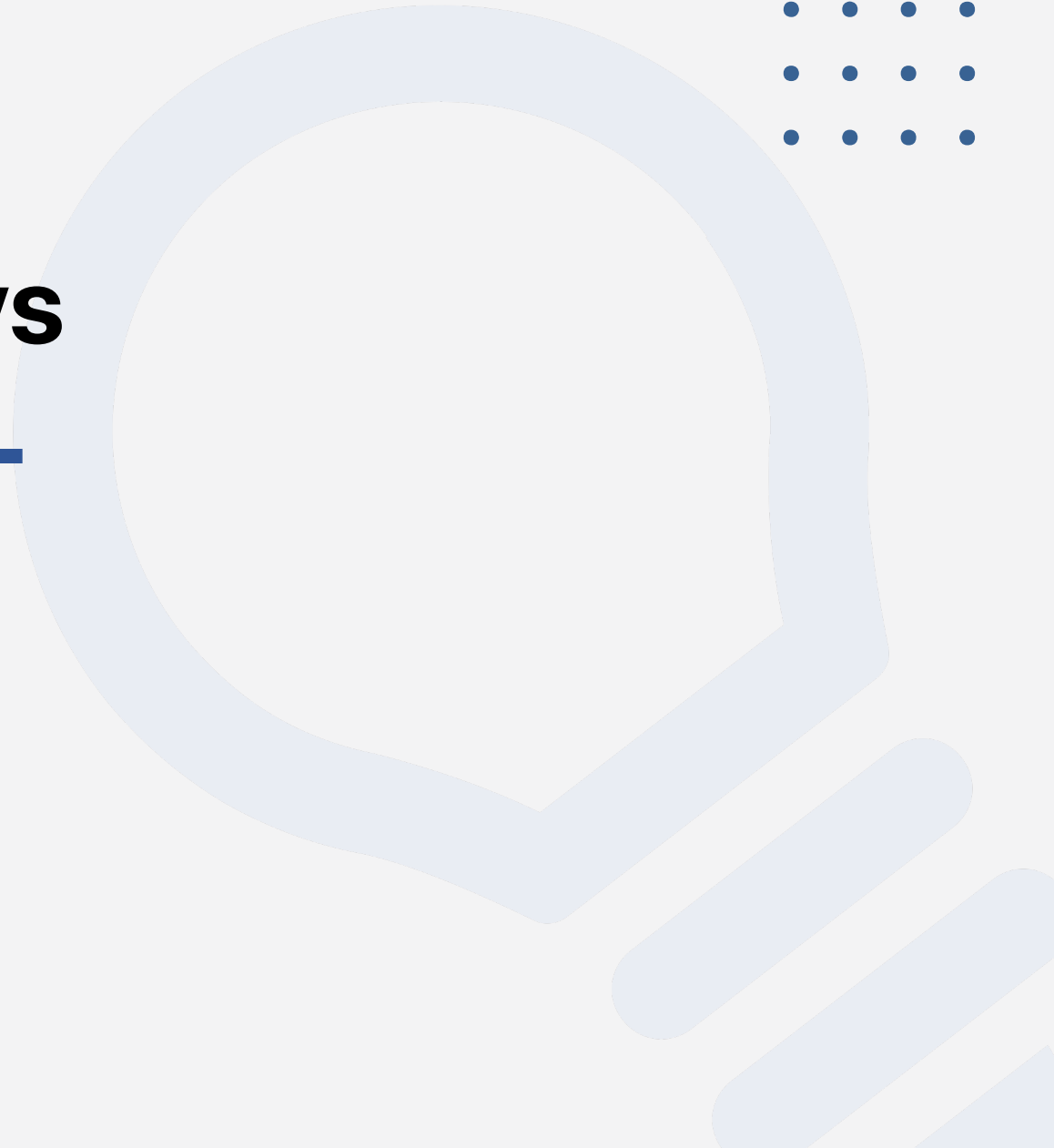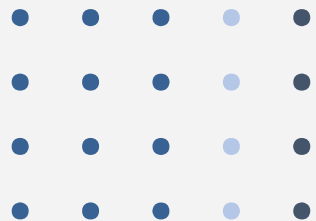
Interviewing Industry Stakeholders: Airline Operations Centers

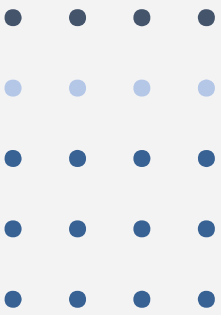**Jason Conolly**   Former Digital Technology Manager [6]

Bill Tuck   General Manager of Air Traffic Management [7]

User Research Takeaways

From our interviews with different stakeholders, we were able to learn three crucial details

Takeaway 1

Current Interface and Workflow is Disjointed, which may lead to Triaging Tasks

1. 20+ interface environment adds clutter and creates user confusion
2. NTMS may not log on NTML during peak workloads
3. The lack of a centralized communication platform makes CDM challenging

" *When you're dealing with a severe weather event, you don't have time to write a giant log entry for NTML* "

– Ralph Tamburro, former STMC at N90 [8]

Takeaway 2
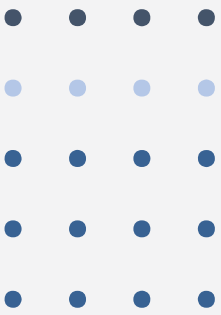
AFPs don't work in Isolation – The NAS is Interconnected

1. Weather is key in determining AFP need, along with other NAS constraints

2. AFPs work in conjunction with other Traffic Management Initiatives (TMI)

" *We start by looking at the weather [to evaluate AFP need]* "

– *Jen Ross, ZJX ATM [9]*

" If an AFP doesn't address the demand-capacity imbalance, you might pair it with another TMI "

– *Greg Juro, former FAA NTMS and NASA ATD-2 [10]*

Takeaway 3
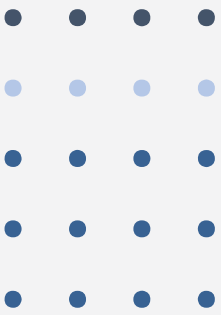
Impact Summaries are a key Decision Support Tool

1. Summarizing AFP impact (e.g. delay metrics, adherence to EDCT) helps NTMS make informed decisions quickly [11]

2. Air Traffic Control System Command Center (ATCSCC) has a higher-level view than facilities (ARTCCs), and looks at NAS-wide constraints

Problem + Solution

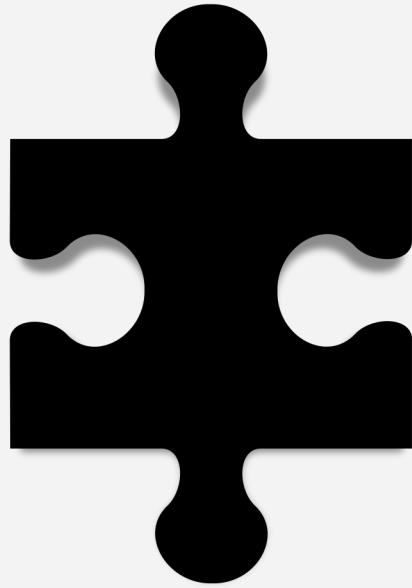We developed a problem statement and worked towards a solution
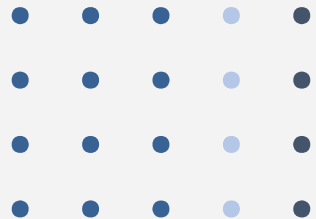
Problem Statement

TFMS' 20+ interface environment creates an inconsistent, tedious user experience for an NTMS' AFP workflow that lacks cohesiveness among the application's tools, compounded by extensive user training requirements that lack modern user experience design heuristics
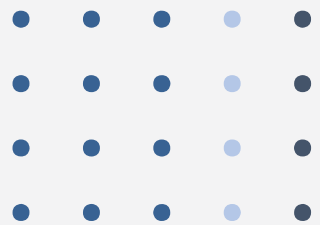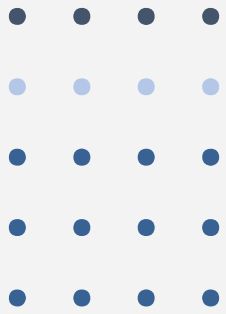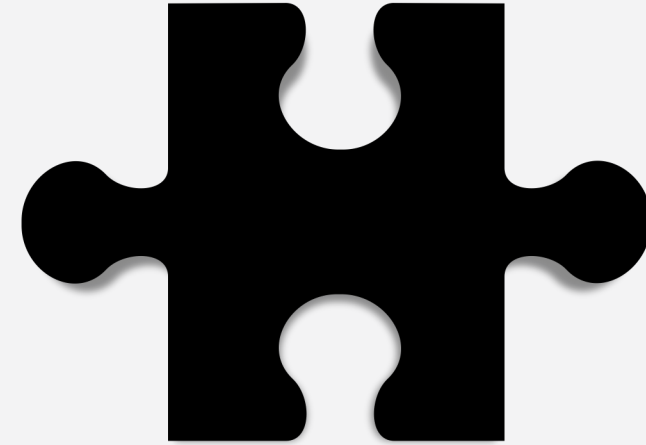
Solution

aMaize

G A P

TFMS Users Experiencing

- Overload of 20+ interfaces
- Extensive user training requirements
- Repeatedly inputting same information
- Overwhelming free-text logging for NTML
- Multiple disconnected communication channels

FMDS Users Experiencing

- 1 interface that combines several functionalities
- Easily learnable GUI for faster onboarding
- Automation-assisted NTML decreased logging burden
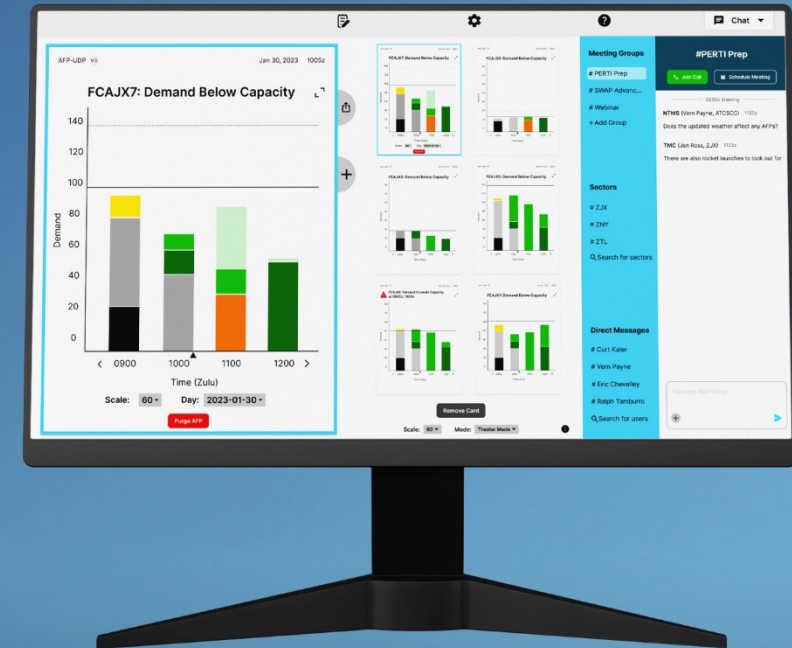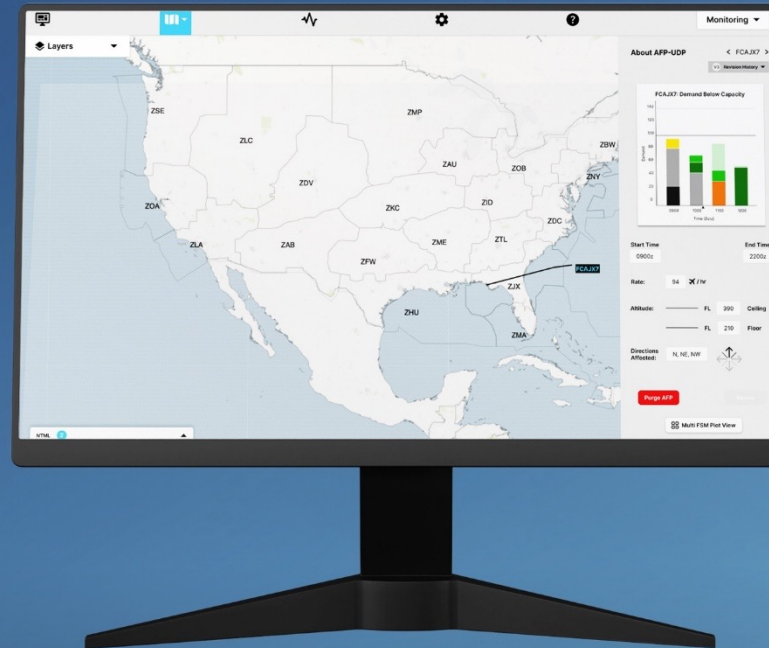- Built-in collaboration tool centralizes communication channel

aMaize

aMaize is a user-centered GUI built for FMDS that streamlines the AFP workflow for FAA NTMS.

It's designed to:

- Address pain points of Traffic Management Specialists

- Minimize user training

- Strengthen CDM

aMaize meets all TFM-AID requirements [12]

aMaize

aMaize has 3 core functionalities tailored to NTMS working with AFPs

1 **Evaluate** AFP need by viewing weather, rocket launches, and other NAS constraints

2 **Model** an AFP with sharable impact statistics and revamped FSM graphs

3 **Monitor** AFPs and other FEAs/FCAs with user-centered viewing modes

Evaluating

- Overlay NAS constraints on an expansive TSD-style map

- Assess AFP need using a Playback Feature with customizable forecast durations

- Constraint Summary to support decision-making
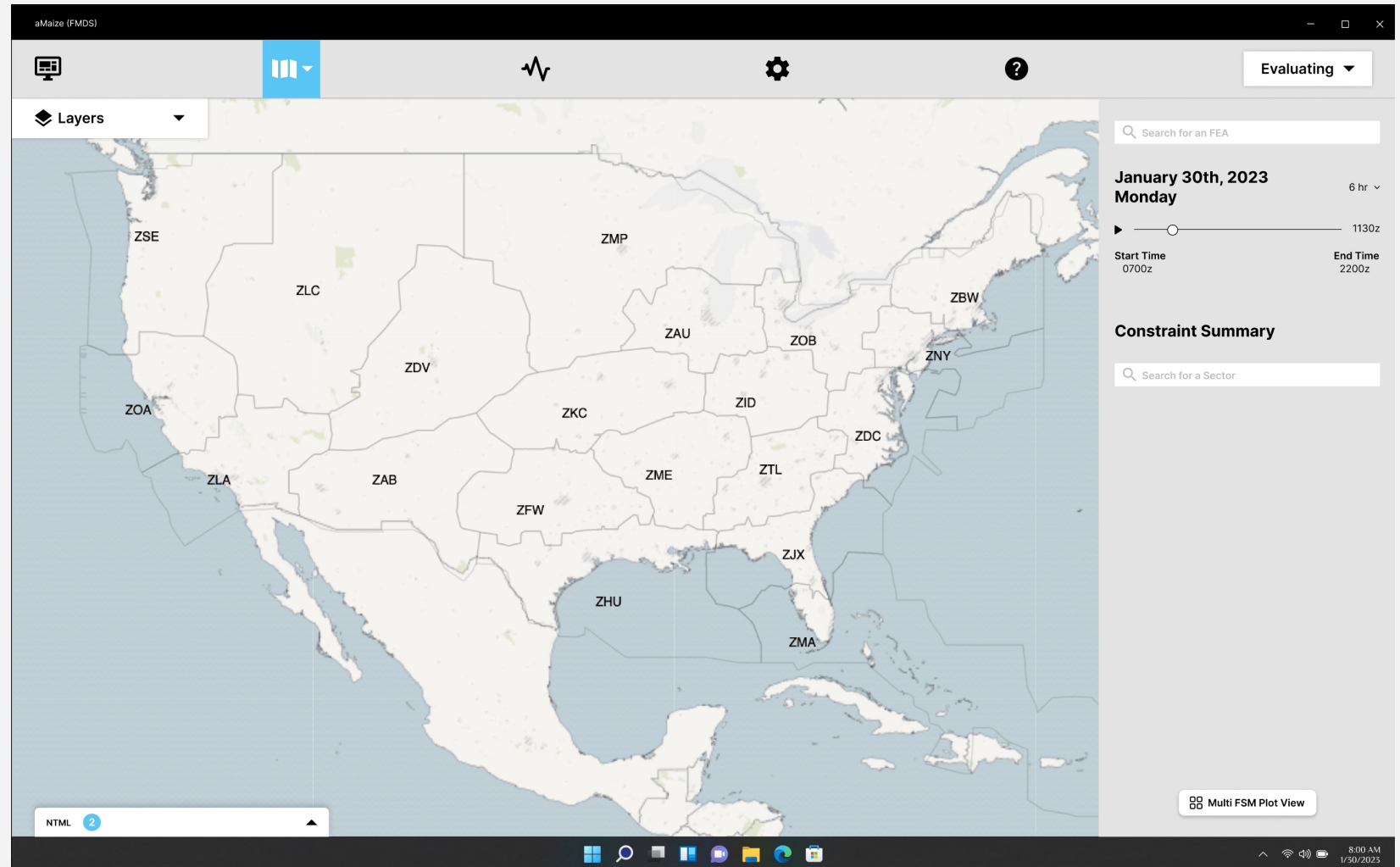
Modeling

- Mimics Command Center workflow
  - Create a Baseline Proposal
  - Tinker on Baseline to create a Revised Proposal
- Easily compare proposals side-by-side
- Add other TMIs to proposals
- Share data cards to threads
- Implement immediately or schedule implementation
- Automation-assisted NTML logging for decreased user workload
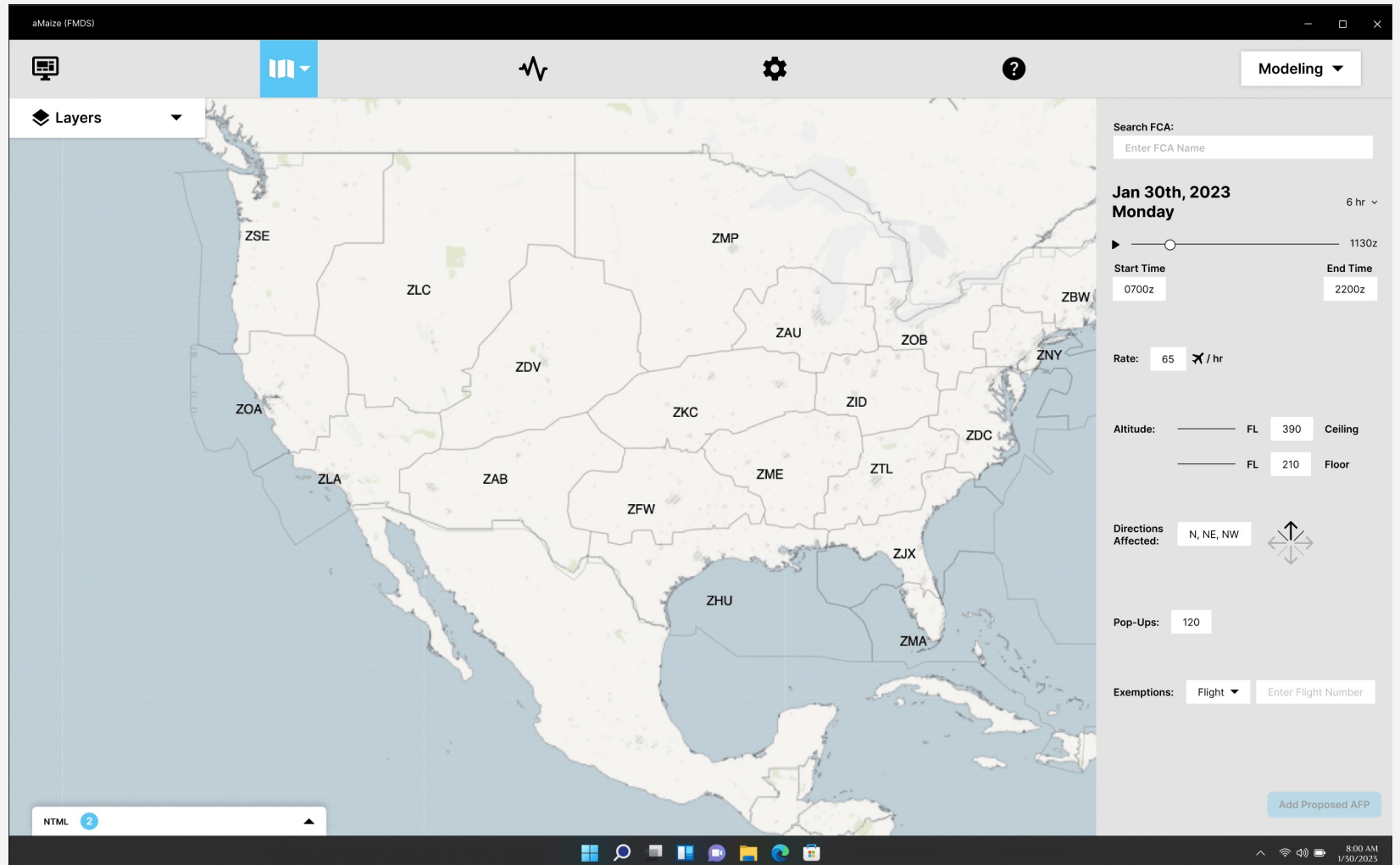
Monitoring

- Multi-FSM Plot View to quickly launch 8 FSM graphs

- Multiple viewing modes to compare FSM graphs

- AFP-specific features
  - Revision History summarizing changes to AFP since implementation
  - Purge or revise AFPs, with automated NTML logging (optional textbox for more rationale)

Feature Highlight

In addition to our three main core functionalities, aMaize has other important features

Drawing Tool

- Draw FEA/FCA line or a Segmented AFP

- Input parameters to view corresponding data card summarizing demand-capacity impact

- Functions similarly to pen tool in other applications
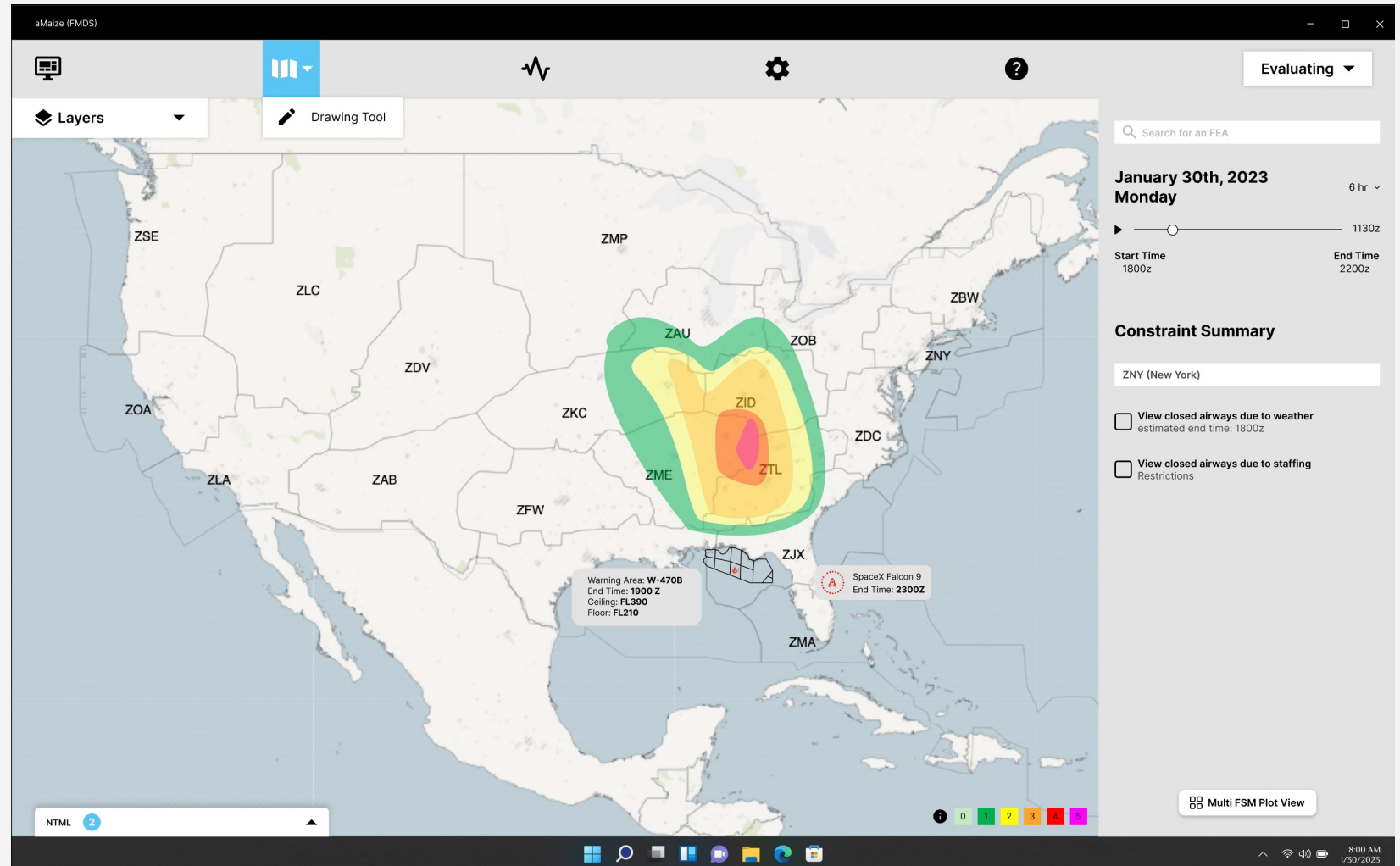
Collaboration Tool

- Share data cards to commence CDM

- Send and receive messages through threads pertaining to your workflow

- Pinned messages and alert notifications

- Join voice rooms to facilitate collaboration

Interactive Prototype Demonstration

We will now walkthrough the interface
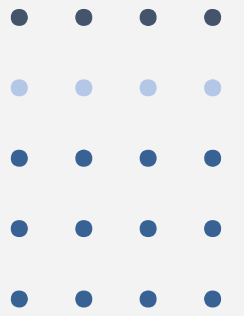
User Tests Takeaways

After completing our final interactive prototype, we tested our application design with several users
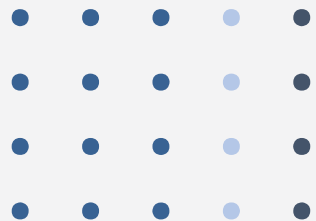
Takeaway:
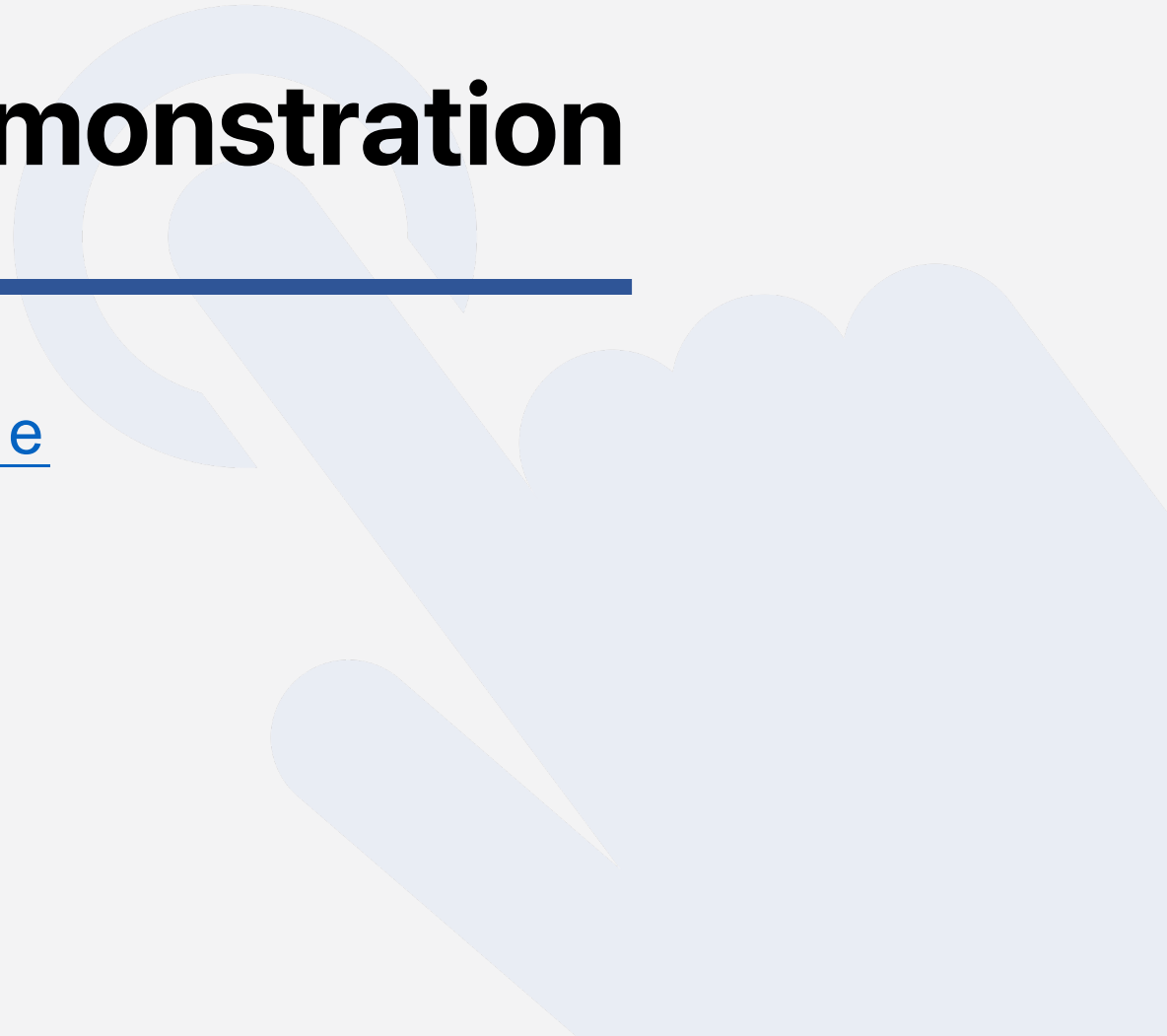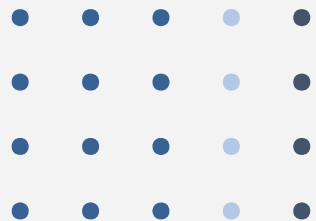# First-Time Users Find aMaize Intuitive

User test with Ralph Tamburro, Former N90 STMC [13]

- Multi-FSM Plot View is "definitely valuable, especially in the Command Center"
- Overall, "[aMaize] is much better than the current system"

User test with Bill Tuck and Jason Conolly, OCC at Delta Air Lines [14]

- Easily recognizable icons
- Quickly learnable, even without a guide
- Everything is readable on a 24-inch monitor
- Theater mode mimics what Bill does manually with FSM boards

Takeaway:
User Tests Uncovered Usability Concerns

User test with Ralph Tamburro, Former N90 STMC [15]

- Added an undo feature for the Drawing Tool

- Giving users the option to full screen from the viewing mode dropdown

User test with Bill Tuck and Jason Conolly, OCC at Delta Air Lines [16]

- Add a dismiss button for unread NTML notifications

- Make 8-12 hours viewable simultaneously on FSM graphs

Next Steps: Short-Term

1

Modifying bar width in FSM graphs to display 8-12 hours of data simultaneously (By July 10th)

2

Create On-boarding wireframes (By July 17th)

3

Airline View of aMaize (By July 31st)

4

Additional user research through user tests (Ongoing)

Next Steps: Long-Term

5

Collaboration with software developers to determine feasibility of design (By 2025)

6

Pilot test of product (By 2027)

7

FMDS Implementation (By Fall 2028) [17]

Conclusion

- aMaize – A unified GUI for FMDS addresses the many concerns that current TFMS users face
- We have conducted extensive user research to design a user-centered product
- aMaize has been designed through an iterative design process that improved upon its designs in both UX and UI
- Short-term and long-term next steps highlight future development milestones for aMaize
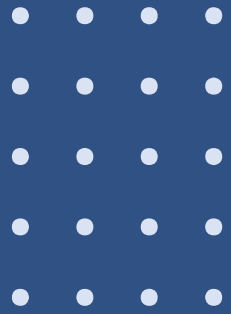
Thank You!

References

[1] FAA. "FAA TFM-AID Challenge Guidelines." FAA. Winter 2022, https://faa-tfm-aid.nianet.org/wp-content/uploads/FAA-TFM-AID-Academic-Challenge-Guidelines.pdf

[2] Tamburro, Ralph. FAA., 22 May 2023, Personal Communication [User Test]

[3] Ross, Jen. FAA., 3 Feb. 2023, Personal Communication [Zoom]

[4] Tamburro, Ralph. FAA., 22 May 2023, Personal Communication [User Test]

[5] Kaler, Curt. Mosaic., 11 May 2023, Personal Communication [Zoom]

[6] Conolly, Jason. Delta Air Lines., 19 May 2023, Personal Communication [Zoom]

[7] Tuck, Bill. Delta Air Lines., 19 May 2023, Personal Communication [Zoom]

[8] Tamburro, Ralph. FAA., 18 Apr. 2023, Personal Communication [Zoom]

[9] Ross, Jen. FAA., 3 Feb. 2023, Personal Communication [Zoom]

[10] Chevalley, Eric and Greg Juro. NASA., 4 May 2023, Personal Communication [Zoom]

[11] Ross, Jen. FAA., 3 Feb. 2023, Personal Communication [Zoom]

References

[12] FAA. "FAA TFM-AID Challenge Guidelines." FAA. Winter 2022, https://faa-tfm-aid.nianet.org/wp-content/uploads/FAA-TFM-AID-Academic-Challenge-Guidelines.pdf

[13] Tamburro, Ralph. FAA., 22 May 2023, Personal Communication [User Test]

[14] Connolly, Jason and Bill Tuck. Delta Air Lines., 6 Jun. 2023, Personal Communication [User Test]

[15] Tamburro, Ralph. FAA., 22 May 2023, Personal Communication [User Test]

[16] Connolly, Jason and Bill Tuck. Delta Air Lines., 6 Jun. 2023, Personal Communication [User Test]

[17] FAA. "Flow Management Data and Services (FMDS)". FAA. Winter 2022, https://www.faa.gov/atmm

Extra Slides

The Team

SINAN ABDULHAK

- B.S.E in Industrial Engineering
- 11-month Co-Op with Air Traffic Management (ATM) at Delta
- Current UX Design Intern at Michigan Medicine

TYLER CARVETTE

- B.S in Information Science specializing in Information Analytics
- UX Research experience with City of Ann Arbor

KATE SHEN

- B.A in Art and Design and Minor in UX Design
- Experience with UX research and UI design with startups at Desai Accelerator

User Persona for NTMS

Kristin Smith

AGE	38
STATUS	Married
OCCUPATION	National Traffic Management Specialist (NTMS)
LOCATION	Washington, DC
MAJOR	Aviation Management

> " I am used to waiting for others to get back to me so I can proceed and finish my tasks. I find myself waiting around and getting frustrated with the application because of its badly executed features.

Scenario

Kristin grew up exposed to aviation and kickstarted her career working at the local fixed-base operator (FBO). She then moved to the FAA to pursue her dream of solving aviation puzzles as a Traffic Control Specialist, and currently has spent multiple years as an NTMS in the Command Center. With the rollout of FMDS, Kristen is being onboarded into the new interface, which has challenges because of the breadth of traffic she has to manage. She is looking for something that ties her disparate tasks together into one, easy-to-navigate interface while also having the ability to communicate with her colleagues and other facilities easily.

Goals

- Be onboarded and familiarize herself with FMDS technology with ease
- To seamlessly carry out every day tasks and be able to communicate with other facility and airline personnels
- Be able to quickly learn the functionalities and have the application adapt to her workflow and preferences

Frustrations

- Ease of use: Having a hard time understanding and navigating the TFMS interface
- Can't find an easy way to communicate and coordinate with other NTMS, facilities, and customers
- Having to repeatedly make duplicate entries into separate applications
- Workflow challenges: The need to transition between between multiple application in order to complete a specific task thus decreasing decreasing work efficiency
- NTML inefficiency: Having to log all updates and reenter AFP parameters leading to lack of logging during busy hours
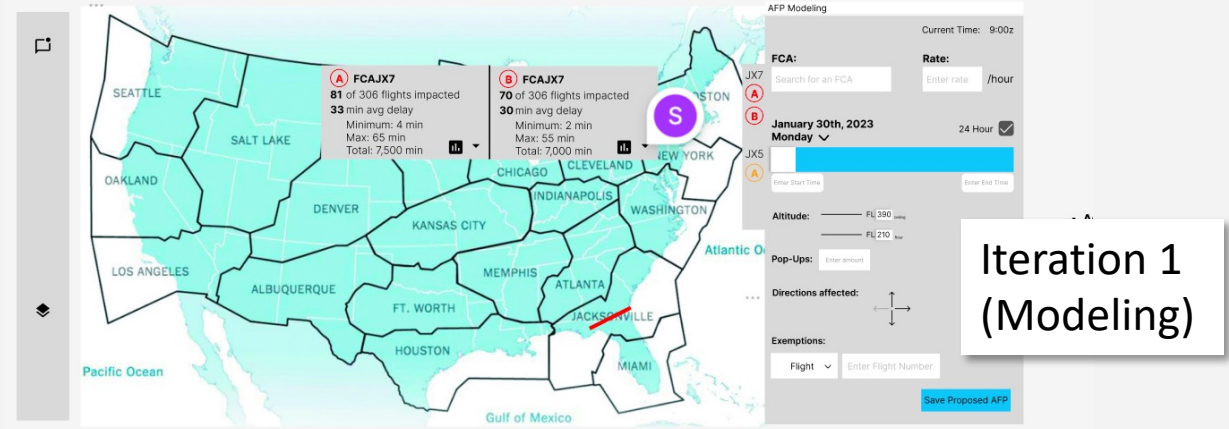
Motivations

1. Increased Efficiency in AFP Workflow
2. Interface that adapts to different roles and user needs
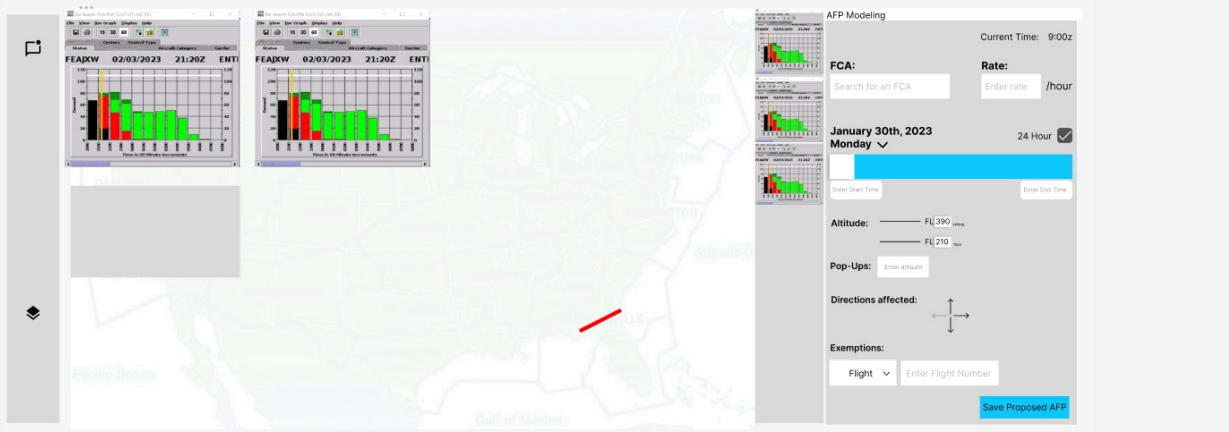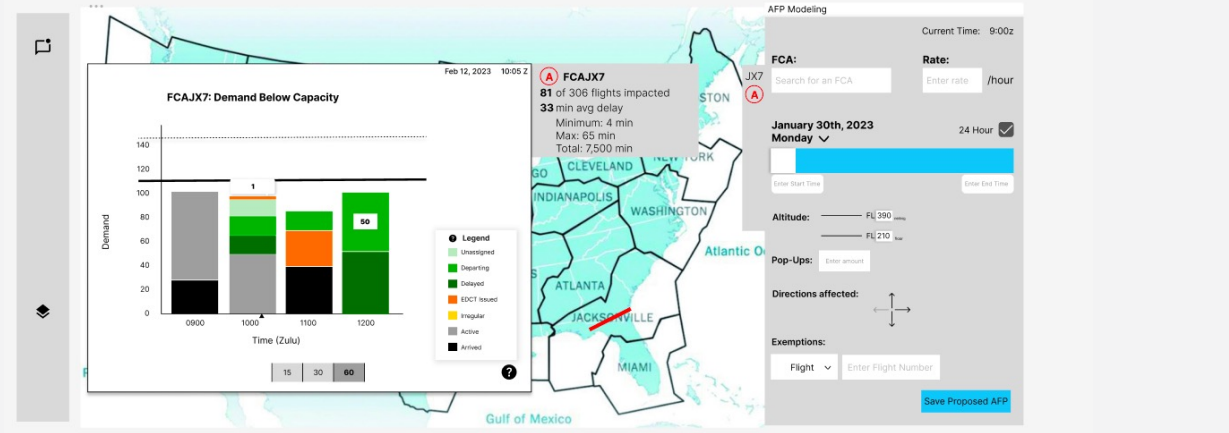3. Effortless coordination and collaboration
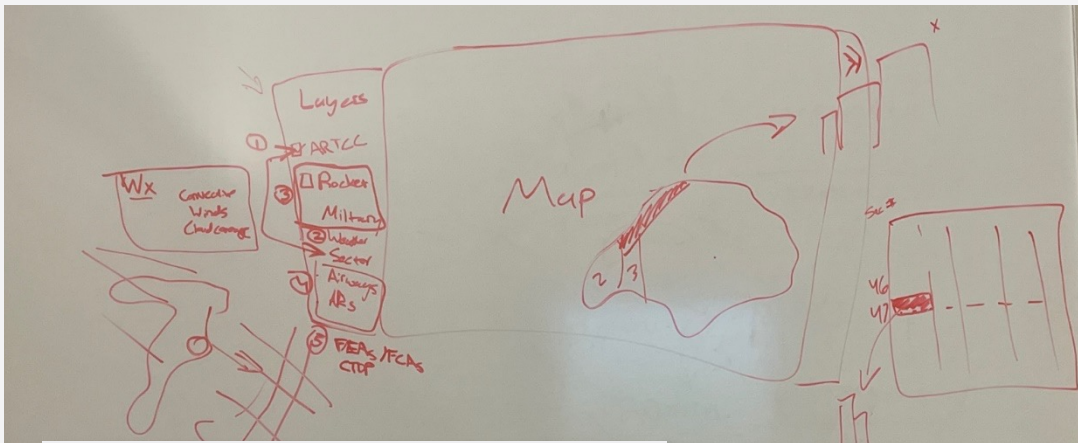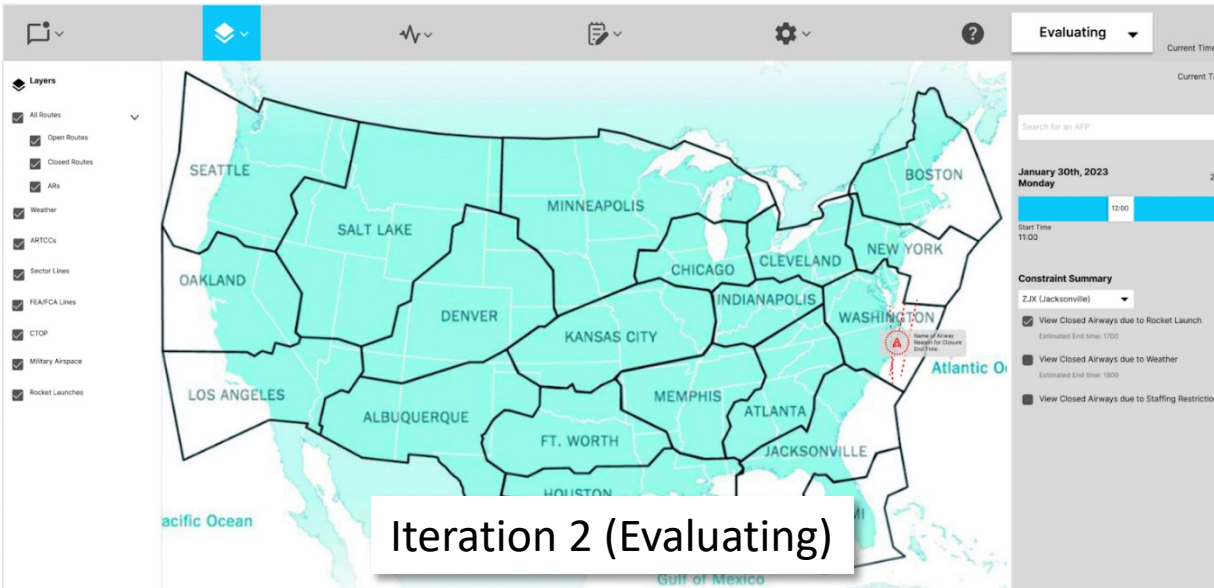
White-board sketch (ideation) for "Evaluating"
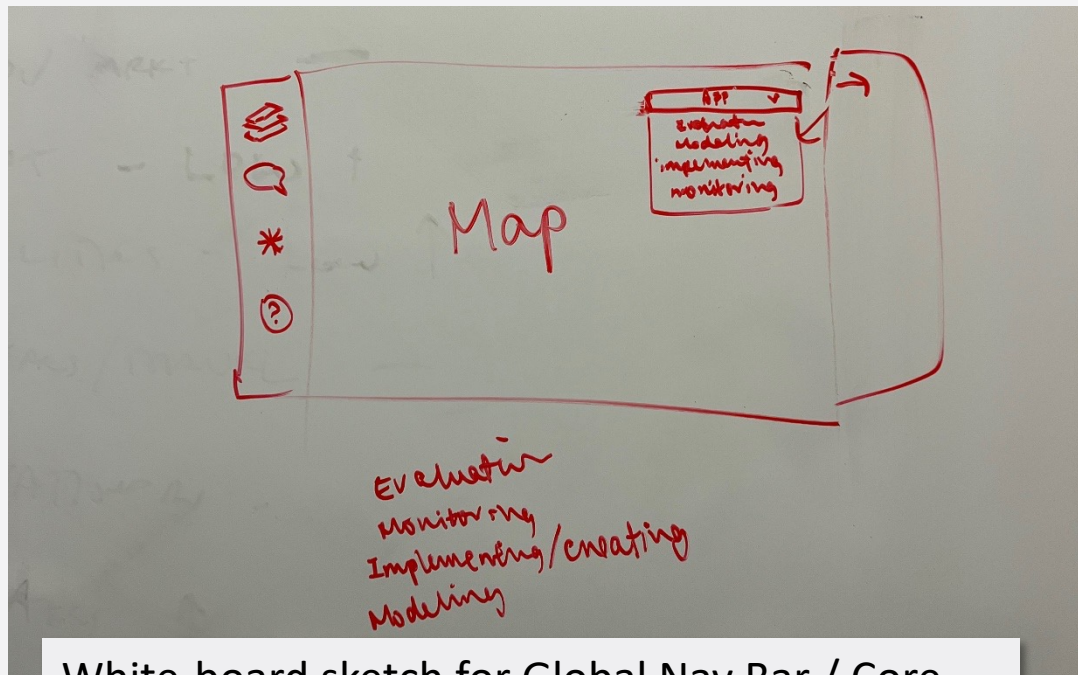
White-board sketch for Global Nav Bar / Core Functionalities
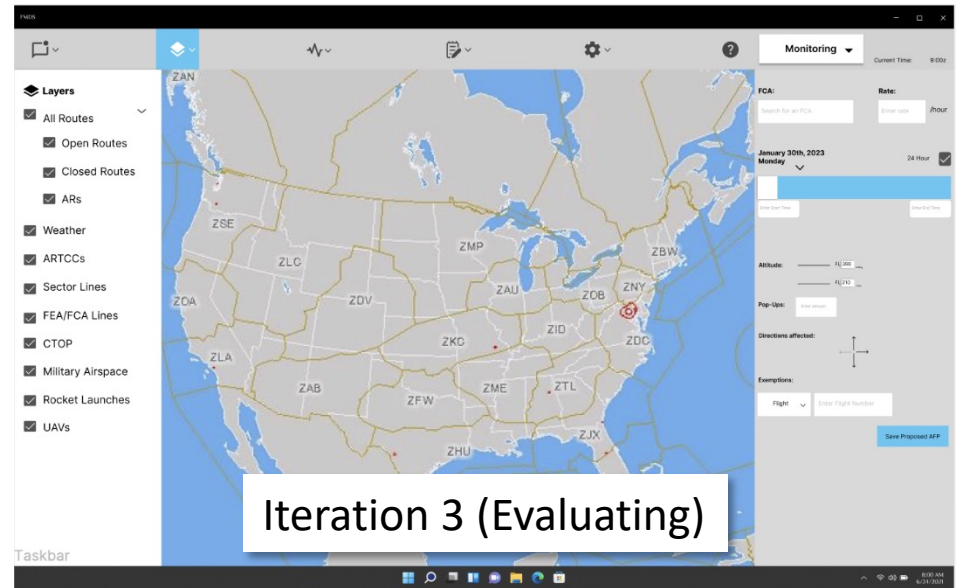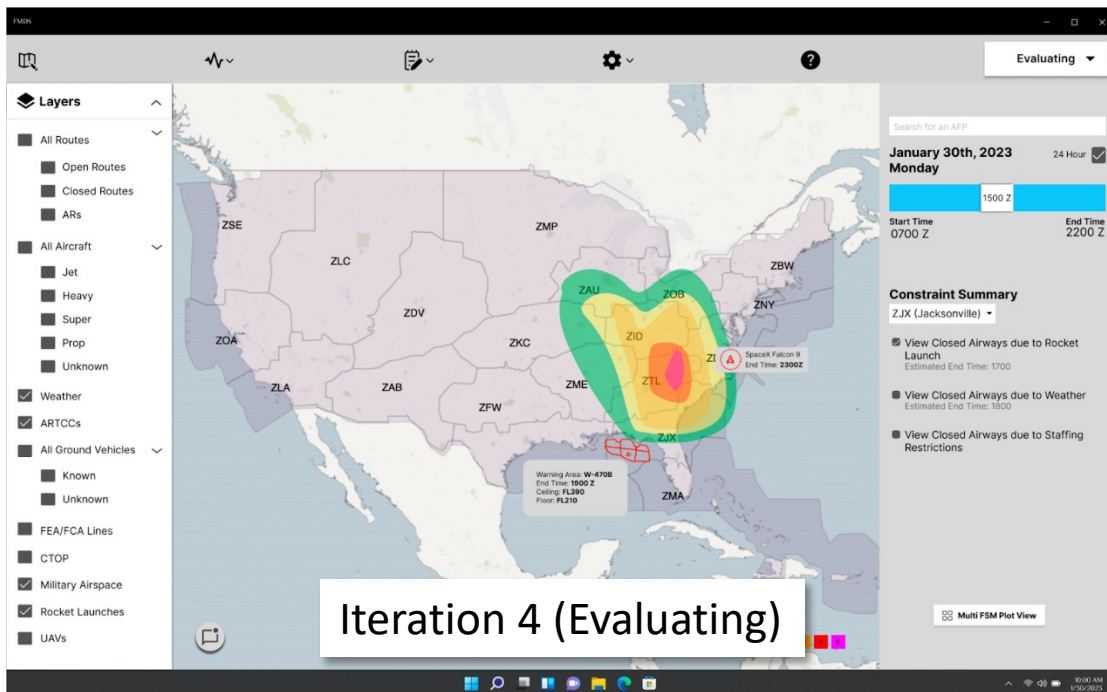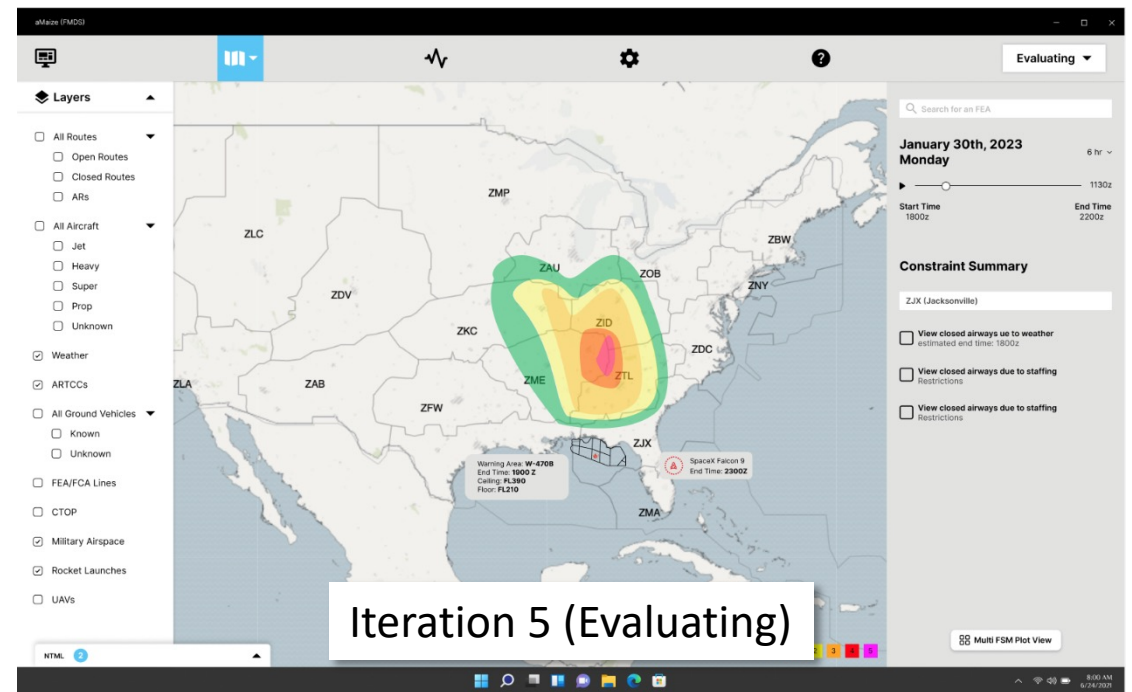
Iteration 1 (Modeling)

Iteration 2 (Evaluating)
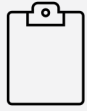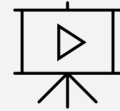
Iteration 3 (Evaluating)

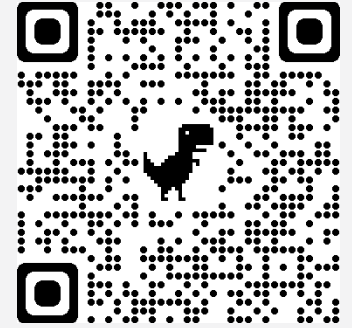Iteration 4 (Evaluating)

Iteration 5 (Evaluating)

Links to Survey, User Test, CDR Explainer Video, and Interactive Prototype

[Survey](#)

[Explainer Video](#)

[User Test](#)
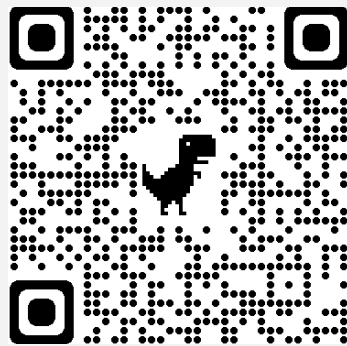
[Prototype Demo](#)
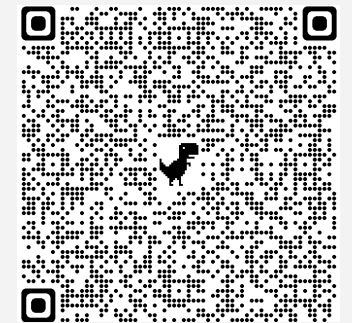
Closed Set Rationale for faster NTML Logging

Choose Rationale(s) for Telecon

- ☑ Weather _____
- ☐ Rocket Launch
- ☐ Military Restriction
- ☐ Special Event

The Ten Usability Heuristics

Visibility of system status
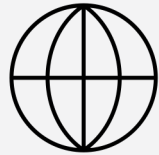
Match system and the real world
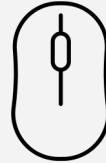
User control and freedom

Consistency and standards

Error prevention

Recognition rather than recall

Flexibility and efficiency of use

Aesthetic and minimalist design

Help users recognize, diagnose, and recover from errors

Help and documentation

Source: https://www.nngroup.com/articles/ten-usability-heuristics/
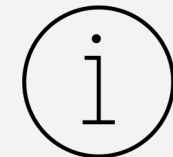
aMaize vs TFMS

aMaize is designed for efficiency: Time to complete tasks

- **TMFS**: "dependent on several variables, including an individual's experience and training, plus general/overall computer skill" – Curt Kaler

- **aMaize**: Designed so all users can quickly complete tasks
  - First-time users completed all tasks in under 20 seconds with no prior training

**aMaize is centralized:** Entering Rates for FCAs

- **TFMS**: "A rate is entered in a whole different program– much more complicated/time consuming" – Curt Kaler

- **aMaize**: Enter rate from the same menu

Acknowledgements

We would like to extend our gratitude and appreciation to the following individuals, whose help made aMaize even better and made our journey so enjoyable:

1. **Dr. Max Li**, *our advisor* who guided and connected us with resources to learn about AFPs

2. **Erin Cobbett**, *Manager of Air Traffic Management (ATM) at Delta Air Lines*, for her airline and operational perspective, and assisting us in reaching out to FAA Traffic Managers

3. **Bill Tuck**, *General Manager of ATM at Delta Air Lines*, for his operational perspective and TFM training courses

4. **Jason Conolly**, *Former OCC Digital Technology Manager at Delta Air Lines*, for his software insights on TFMS applications, how it integrates into airline workflow, and UI feedback on aMaize

5. **Jen Ross**, *Former ATCSCC and current Traffic Manager at Jacksonville ARTCC*, for the FAA's operational perspective in managing air traffic with AFPs and other TMIs

6. **Ralph Tamburro**, *Former STMC at N90*, for FAA operational perspective and immense help in understanding NTML challenges and conducting user tests for aMaize

Acknowledgements

We would like to extend our gratitude and appreciation to the following individuals, whose help made aMaize even better and made our journey so enjoyable:

7. **Eric Chevalley**, *NASA Human Factors Engineer*, for evaluating our mockups and providing a UX and data analyst perspective in his feedback

8. **Dr. Jeremy Coupe**, *NASA ATD-2 Analytics Lead and Digital Information Platform (DIP)*, for his feedback and helping us understand the workflow of AFPs in conjunction with other TMIs

9. **Greg Juro**, *Former FAA NTMS and NASA DIP,* for his feedback on our mockups and helping us understand the workflow of AFPs in conjunction with other TMIs

10. **Tony Vassiliadis**, *Dispatcher and ATM at Delta Air Lines*, for his operational perspective and Python code that mapped ARTCC lines using latitude and longitude coordinates

11. **Curt Kaler**, *TFMS SME and Mosaic ATM*, for his invaluable operational perspective and insight into how traffic managers flow through different tasks