

Introductions

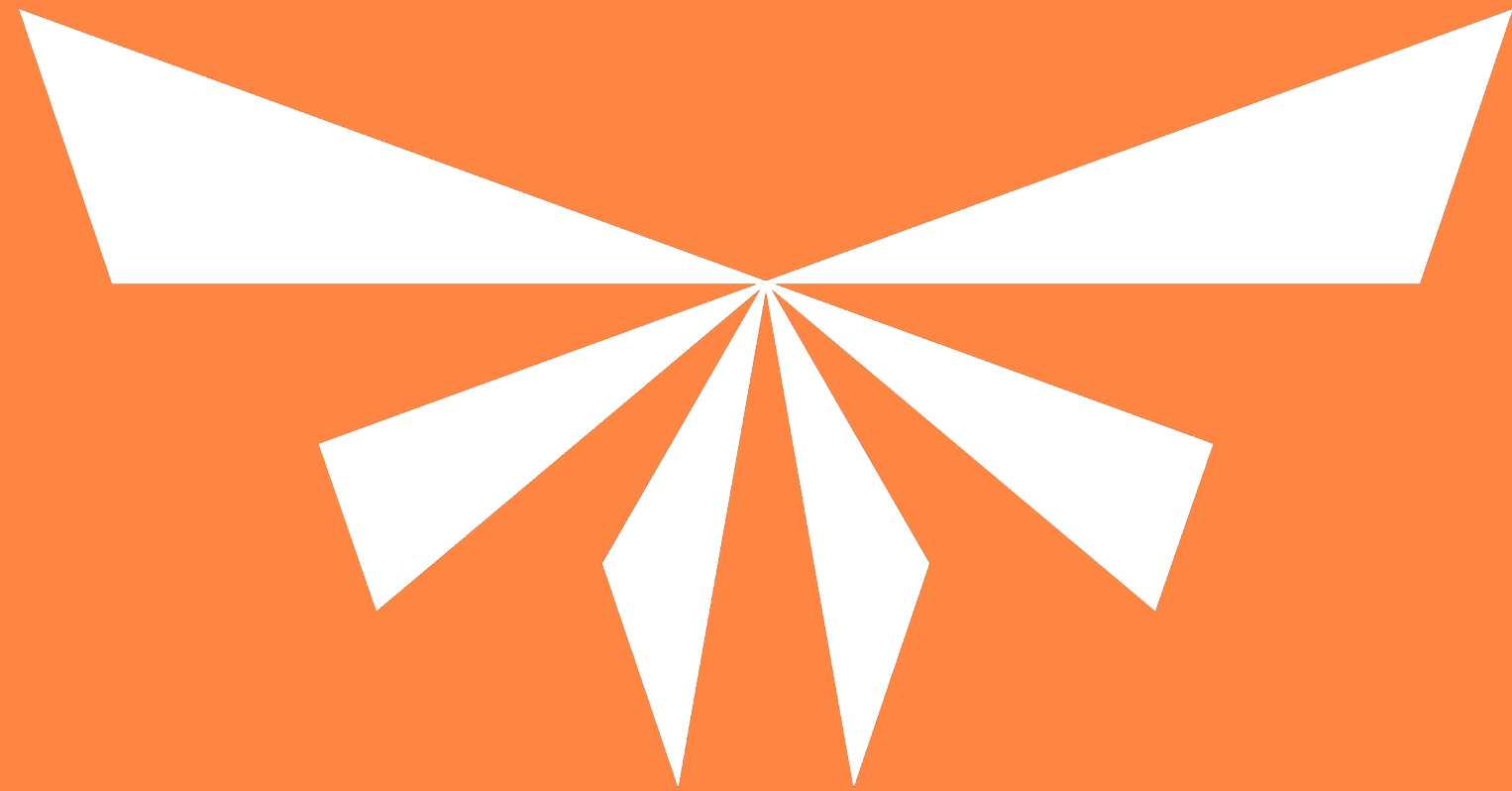
Seth Christensen, Team Advisor

Garrett Johns, Team Lead

Claire McGregor

Jackson Ringger

Adam Shumway



Project MOA

(Not Military Operated Airspace)

1. Replace old “extinct” systems
2. Keep flights in the air to maximize efficiency
3. Help managers keep flocks of planes where they need to be.

Project Aims

1. Leverage modern interface design to increase approachability
2. Consolidate disparate applications and features
3. Improve user flow with just-in-time information
4. Reduce distracting elements from interface

Understanding the Problem

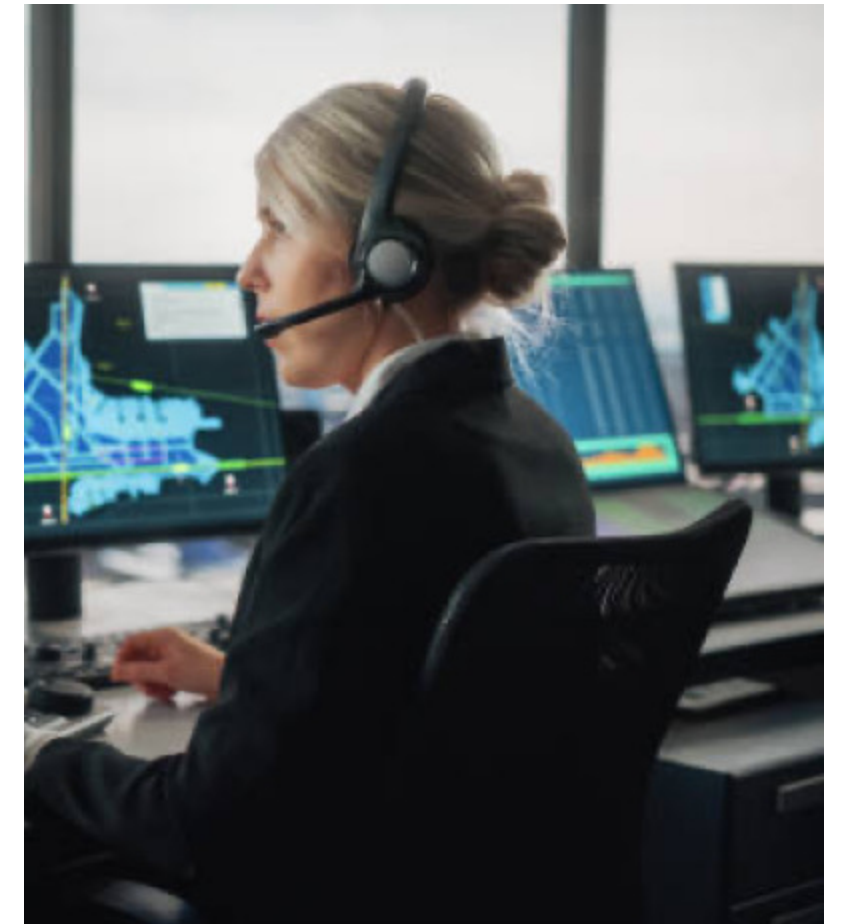
- Documentation
- Met with 10 individuals
 - TRACON managers, dispatchers, and traffic management coordinators
- Visited 3 facilities
 - Provo Airport ATCT, Salt Lake TRACON, ZLC Center

Interviewing

- Focused on 3 main questions
 - What would you improve about the current system?
 - How does communication function?
 - What causes stress in the day-to-day functions?

Jean

- Has worked at the Command Center in Washington DC for over 10 years
- Has years of experience with TFMS but many frustrations:
 - Wants more workspace customization functionalities
 - Wants more system support tools to help her make better decisions
 - Wants the flexibility to fit all her work on one monitor and not have to jump between programs



Lack of Communication Integration

- NTML is slow and disorganized
- Requires manual input to send messages
- Resorts to phone calls for smaller matters

The screenshot shows the NTML interface for ZDC 01 on 10 Jan 2008 at 1915. The interface includes a menu bar (Options, Edit, View, Tools, Information, Print, Reports, Link, Search, Help) and a sidebar with navigation options (Misc, RSTN, MRSTN, Delay, RWY, Sum, EQ, Log, MyEntry, SISO, ICE, SWAP, Count, PIREP, MA, Telcon, INFO, SUA, Pending). The main area displays a table of flight messages with columns for Approval (Aprvl), Time, Type, Facility (Fac), Message, and Status. A context menu is open over the message at 1914, showing options: Print, Copy, and Force Accept. At the bottom, there are summary statistics: Requests Awaiting Approval: 0 and Proposed RSTNs on me: 2. A status bar at the very bottom shows TPCOPS and Pending: 11 / 2.

Aprvl	Time	Type	Fac	Message	Status
	1849	RWY	ZKC	EWR VMC ARR:22R AAR(Strat/Dyn):34/34 (updated at 1849 by ZKC)	
	1907	PROP	ZAU	DCA Arvl via WHITE 30 Mit 1900-2330, WX:Thunderstorms ZAU:ZDC, RSTN: REQ	ZDC: I
	1907	DELAY	ZAU	BWI D/D, +30/1908 WX:Thunderstorms	
	1911	PROP	ZAU	MDW Dept via COATE 20 Mit JETS 2000-2030, WX:Thunderstorms ZAU:ZDC, RSTN: REQ	ZDC: I
	1912	RSTN	DCC	ORD Dept via WHITE 30 Mit JETS 2000-2100, WX:Thunderstorms ZAU:ZDC, RSTN: APVD 1912/DCC:99/PH	ZDC: Y
	1913	RWY	ZAU	BWI VMC ARR:33L- SINGLE RWY DEP:15R AAR(Strat/Dyn):36/0 ADJ:Braking Action ADR:36 (updated at 1913 by ZLC)	
	1914	RSTN	ZDC	Arvl MOONY 2130-2200, ZDC:BWI, R	BWI: ?
	1914	RSTN	DCC	DISAPPROV MOONY 35 Mit JETS 2130-2200, WX:Low Ceilings ZDC:ZAU, RSTN: 1914/DCC:99/PH	ZAU: Y
	1914	ICE	ZKC	EWR in deicing at 1849	
	1914	SWAP	ZKC	ZLA Entered SWAP at 11 05 2008 1849	

Requests Awaiting Approval: 0 Proposed RSTNs on me: 2

Log Passbk Accept Conf Open Refresh Remove

TPCOPS Pending: 11 / 2

Home Screen

Home + Account Settings

Notifications

Messages Advisories Alerts

Unread

- Request from SLC Airport 20 mins ago
- Inclement weather in ZDC 30 mins ago
- New advisory posted 34 mins ago

Past alerts

- Monitor alert in ZCA 40 mins ago
- Request sent to ZDC 55 mins ago
- Message from ZJX 1 hour ago
- Message from ZLC 1 hour ago
- New advisory posted 1 hour ago
- New advisory posted 2 hours ago
- New advisory posted 2 hours ago

Action Lists

June 05, 2023

- Inclement Weather ZJX at 0300Z
- Excess Demand SLC Airport at 0450Z
- Special Activity Airspace ZMA at 1600Z
- Thunderstorms ZLA at 2130Z

June 04, 2023 6 events

June 03, 2023 7 events

June 02, 2023 12 events

June 01, 2023 14 events

Open PERTI Plan

Advisories

Updated 1820Z

Operations Plan

LAS - Airport Closure Active 0:48:02

Harry Reid International is closed TO NON SKED TRANSIENT GA ACFT EXC PPR 702-261-7775

Arrival Runway	Depart Runway	Arrival Rate
26L/19L	26R/19L	48

Ground Stop Active 0:24:57

Ground Stop Active 0:48:02

Views

Seattle International Created 24 days ago

Major Airports Bar Graphs Created 2 months ago

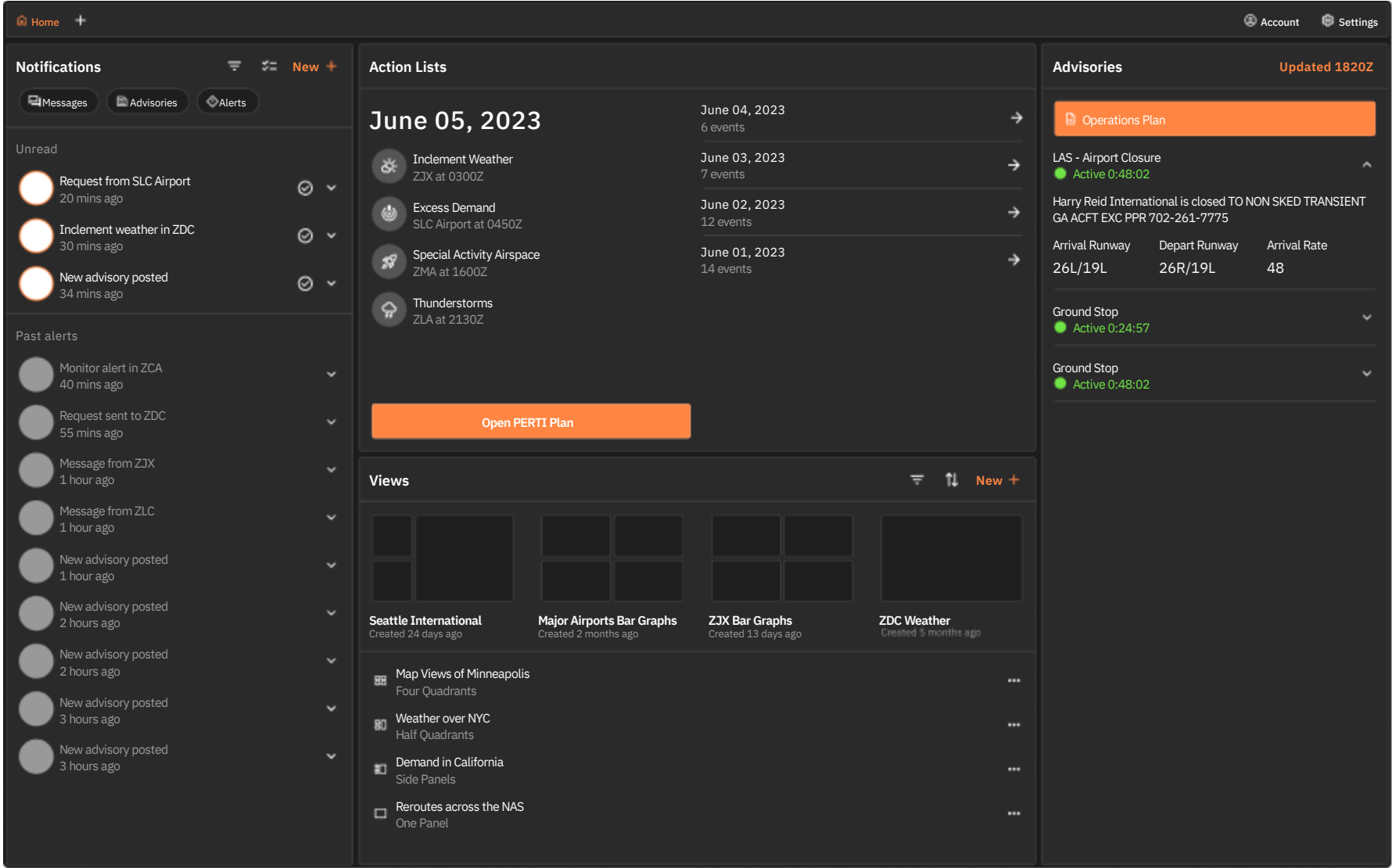
ZJX Bar Graphs Created 13 days ago

ZDC Weather Created 5 months ago

Map Views of Minneapolis Four Quadrants

Home Screen

- Centralized inbox for communication and alerts
- Action lists for daily tasks
- Posted active advisories from the Command Center



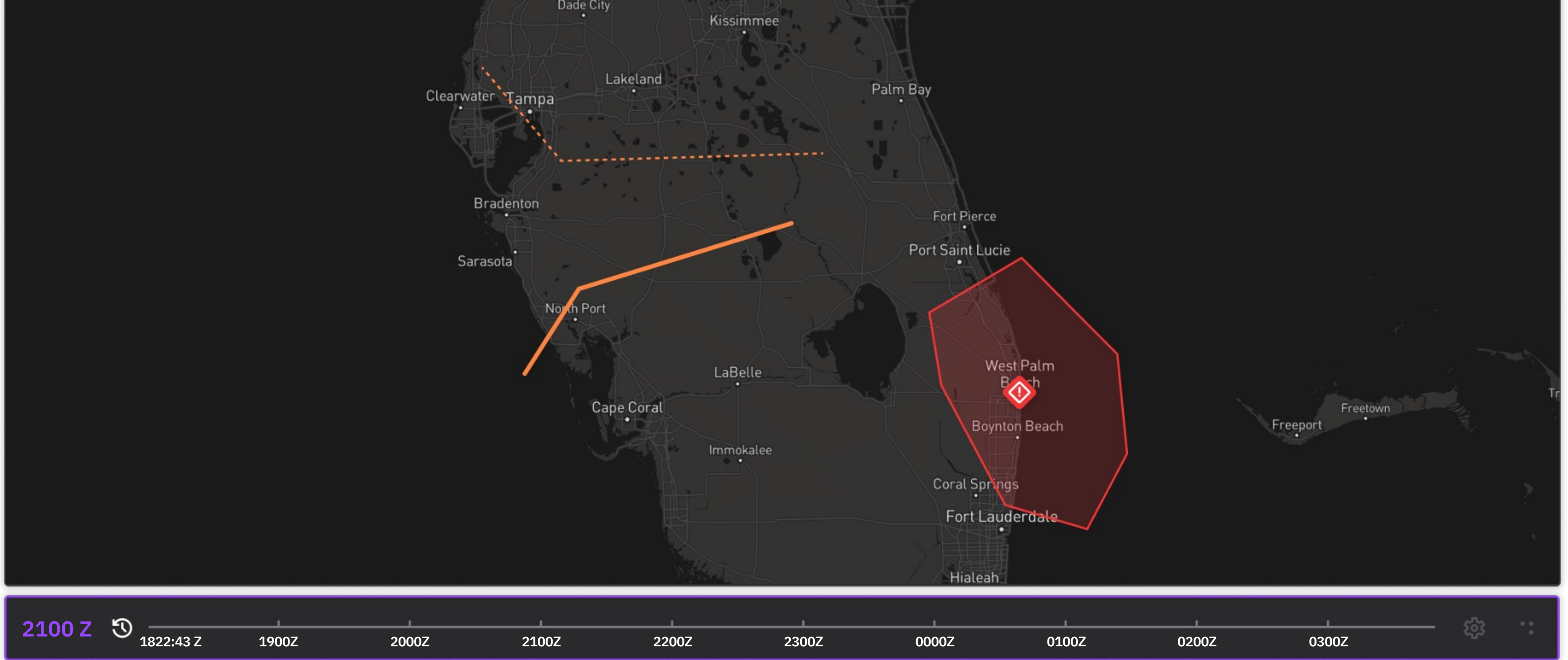
Few Decision Support Tools

- Current system supplies tools but doesn't aid user in making actions
- Relevant data is not emphasized

The screenshot shows the 'GDT Setup: BOS 2014/Jun/20 1820 GDT' window. The interface includes a menu bar (File, View, Help) and a toolbar with buttons for 'GDT Map', 'Reload', 'Model', 'Run Proposed', 'Run Actual', 'SUB OFF', and 'Reset Parameters'. The 'Program Type' is set to 'GDP - DAS' and 'SUBS: ALL ON'.

The main configuration area is divided into several sections:

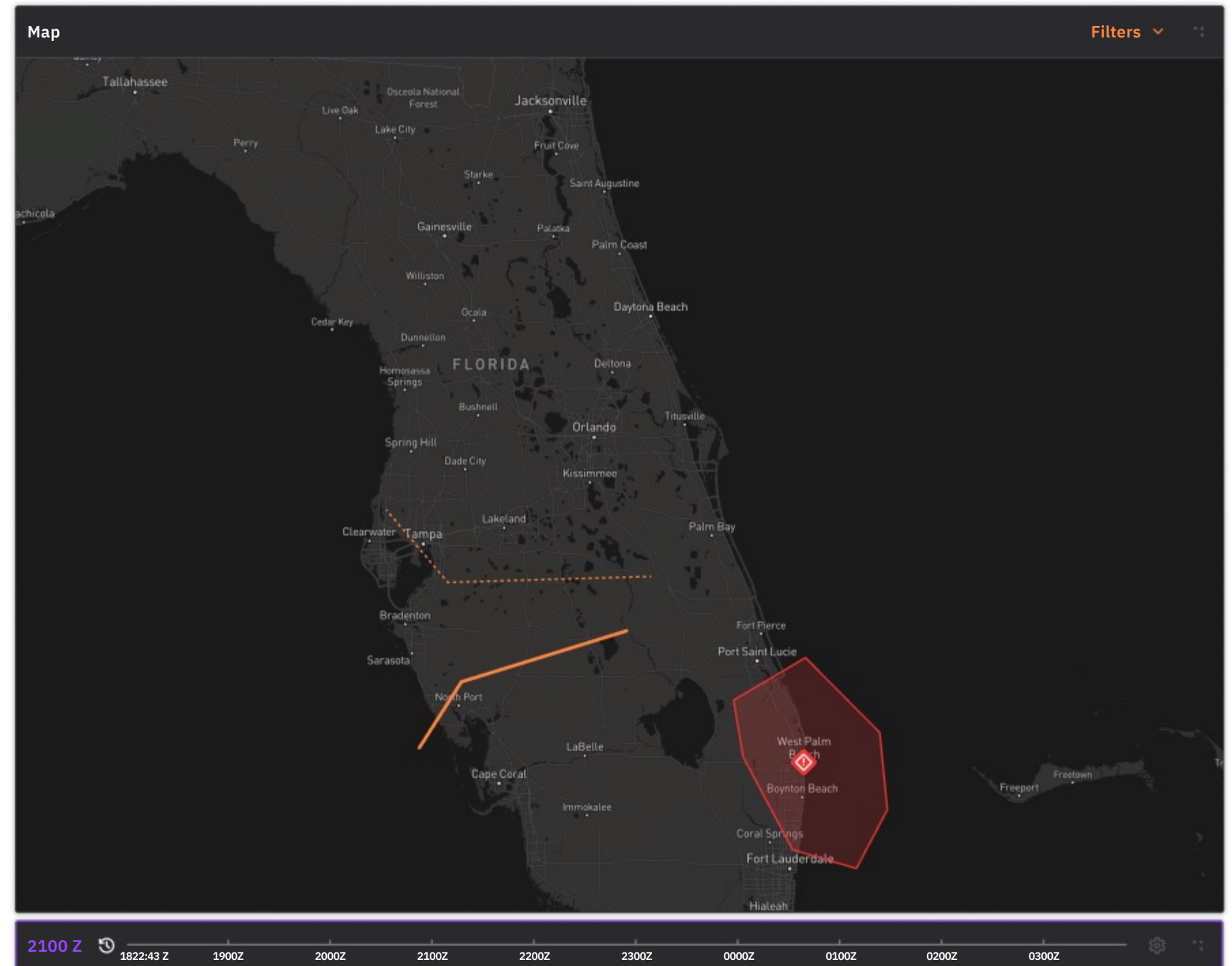
- Parameters**: Includes 'Program Time Options' with 'Start' (201820) and 'End' (210259) fields and a timeline. Below are checkboxes for 'Purge Flights' (Before Revision Start, After Revision End) and a checked box for 'Compress to Last CTA'. 'Data Time' is set to 201820.
- Program Rate (Applicable Only to Included Flights)**: Features buttons for 'Load Times', 'Load ADL AAR', and 'Historical Pop-Ups...'. A 'Fill' section shows 'Program Rate' with a value of 60, 'From Hour' and 'Through Hour' dropdowns, and a 'Fill' button.
- Hourly Data Table**: A table showing 'PR' (Program Rate) and 'Pop-Up Reserve' values for hours 17 through 08. All PR values are 60, and all Pop-Up Reserve values are 0.
- AAR**: Radio buttons for 'Set AAR to Program Rate' (selected) and 'Retain Current ADL AAR'. An 'Edit 15 ...' button is present.
- General Options**: Includes 'Delay Limit (Minutes)' (180), 'Target Delay (Multiplier) DAS Delay x' (1.0), 'Earliest R-Slot (Minutes) Program Start +' (0), 'Adjust Delay (Minutes)' (20), and 'Purge Notification (Minutes) Taxied' (20), 'GS' (20), 'GDP/AFP' (45). There is also an 'AFP Override' checkbox (disabled).
- Slot Hold Override**: Three rows for 'Slot Hold Override', 'Exempt AFPs', and 'Exempt CTOPs', each with a 'Select ...' and 'Clear' button.
- Include Only Options**: Includes 'Arrival Fix' (ALL), 'Aircraft Type' (ALL), and 'Carrier (Major)' (ALL), each with a 'Default' button.



Modeled Time and Intuitive Maps

Modeled Time and Intuitive Maps

- Alerts and issues shown on the map
- Time can be scrubbed forward or backward modeling flights
- Purple border indicates modeling not in the present



- Bar Graph
- NAS Monitor
- Playbook
- TMI Drafts

TMI Drafts
Swap out panel below

Search panels

- Map
- Bar Graph
- NAS Monitor
- Playbook

Map
Swap out panel below

Search panels

- Bar Graph
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- TMI Drafts

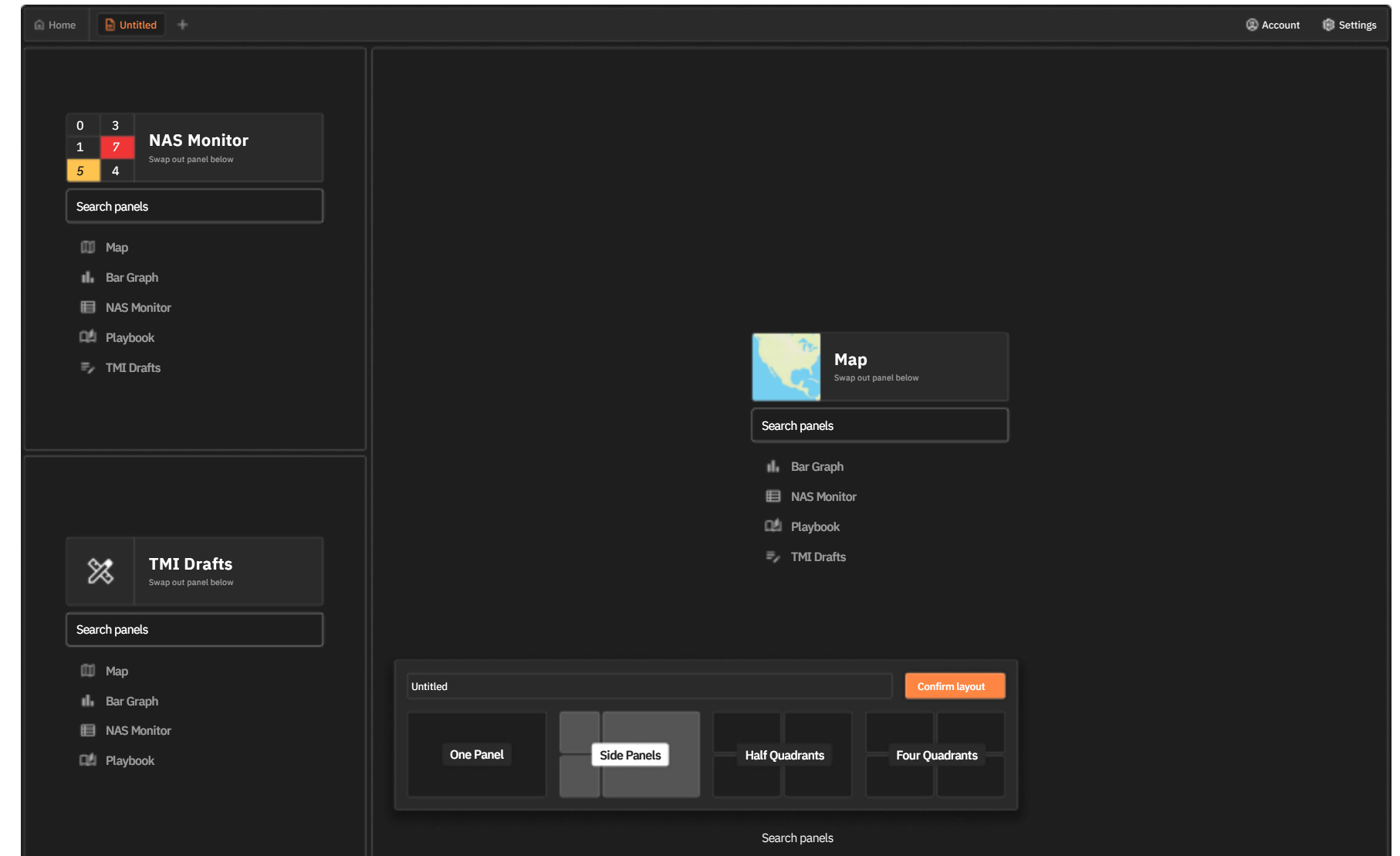
Untitled Confirm layout

One Panel Side Panels Half Quadrants Four Quadrants

Space Creation

Space Creation

- Customizable panel layouts show up to four panels of data (Bar Graph, NAS Monitor, Map Views, Playbook)
- Spaces can be pinned and used as a reference



Lack of Consistency/Unity

- A traffic manager has to use different windows across different platforms in order to get their job done
- The playbook is organized as a PDF
- To see an organized look of advisories, a traffic manager must browse the internet

The screenshot shows the Federal Aviation Administration's National Airspace System Status page. It features a navigation bar with categories like Advisories, Airport Demand, EDCT, NOTAMS, Reroutes, Restrictions, RVR, and Weather. Below the navigation, there's a 'Thank you for visiting our site.' message and view options (List View, Tile View, Map View). The main content area is titled 'Active Airport Events' and displays three event cards:

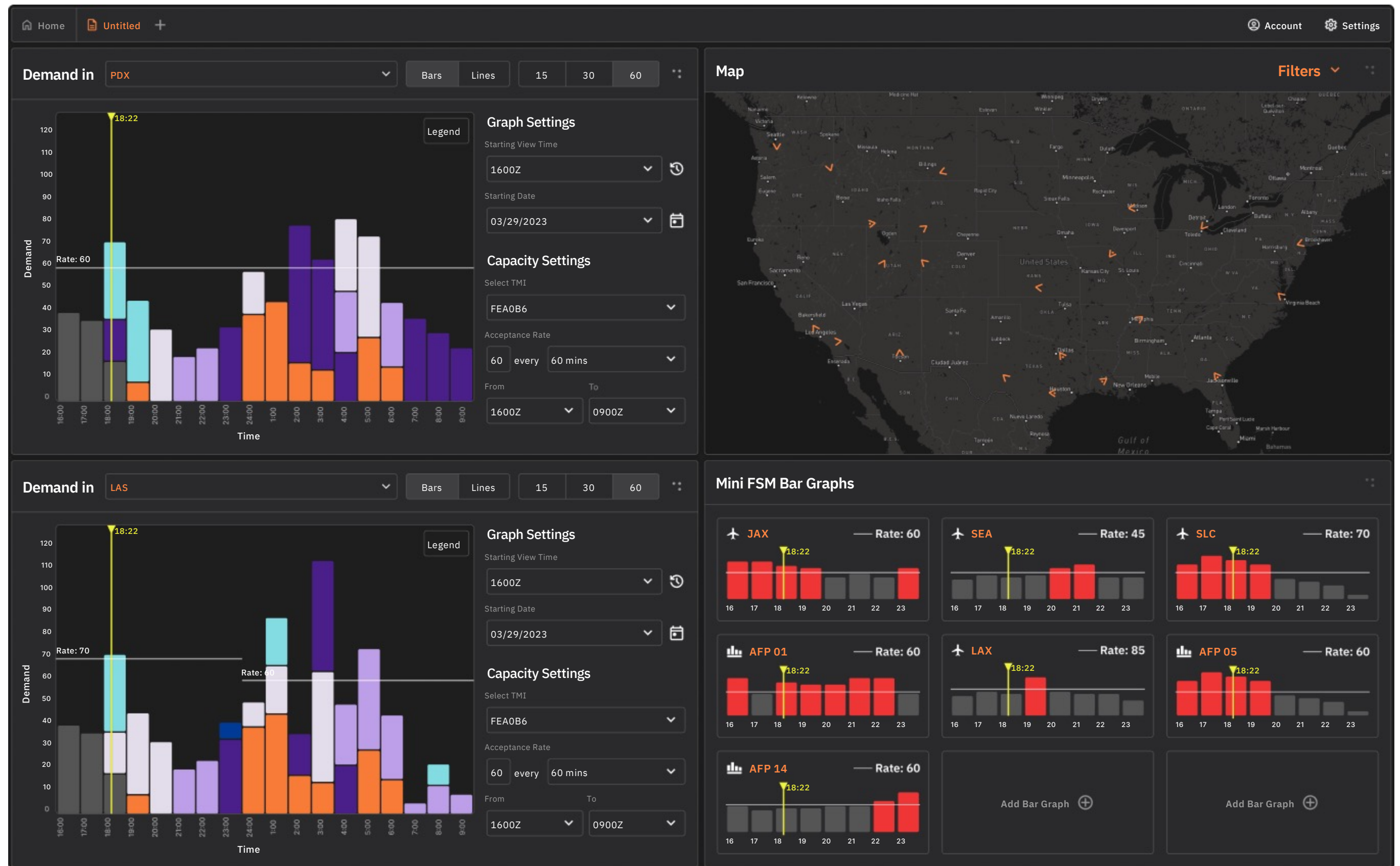
- DCA:** Departure Delay, Updated 5:00 PM MDT, Avg. 90 mins. (and decreasing) due to tm initiatives:swap:wx.
- DFW:** Departure Delay, Updated 5:32 PM MDT, Avg. 45 mins. (and decreasing) due to wx:thunderstorms.
- JFK:** Ground Stop, 23/6:00 PM MDT–23/7:30 PM MDT, Due to other. Also shows a Departure Delay, Updated 4:12 PM MDT, Avg. 90 mins. (and increasing) due to tm initiatives:swap:wx.

The image shows the cover of a PDF titled 'Play Book Air Traffic Control System Command Center'. Below the title is a photograph of a lightning bolt striking a dark landscape. At the bottom of the cover, it says 'National Severe Weather Playbook' and 'Effective Jun'. The page number 'Page 1' is visible at the bottom.

The image shows a screenshot of an ATCSCC Advisory text document. The header reads 'ATCSCC ADVZY 129 DCC 06/23/2023 OPERATIONS PLAN'. The main text includes:

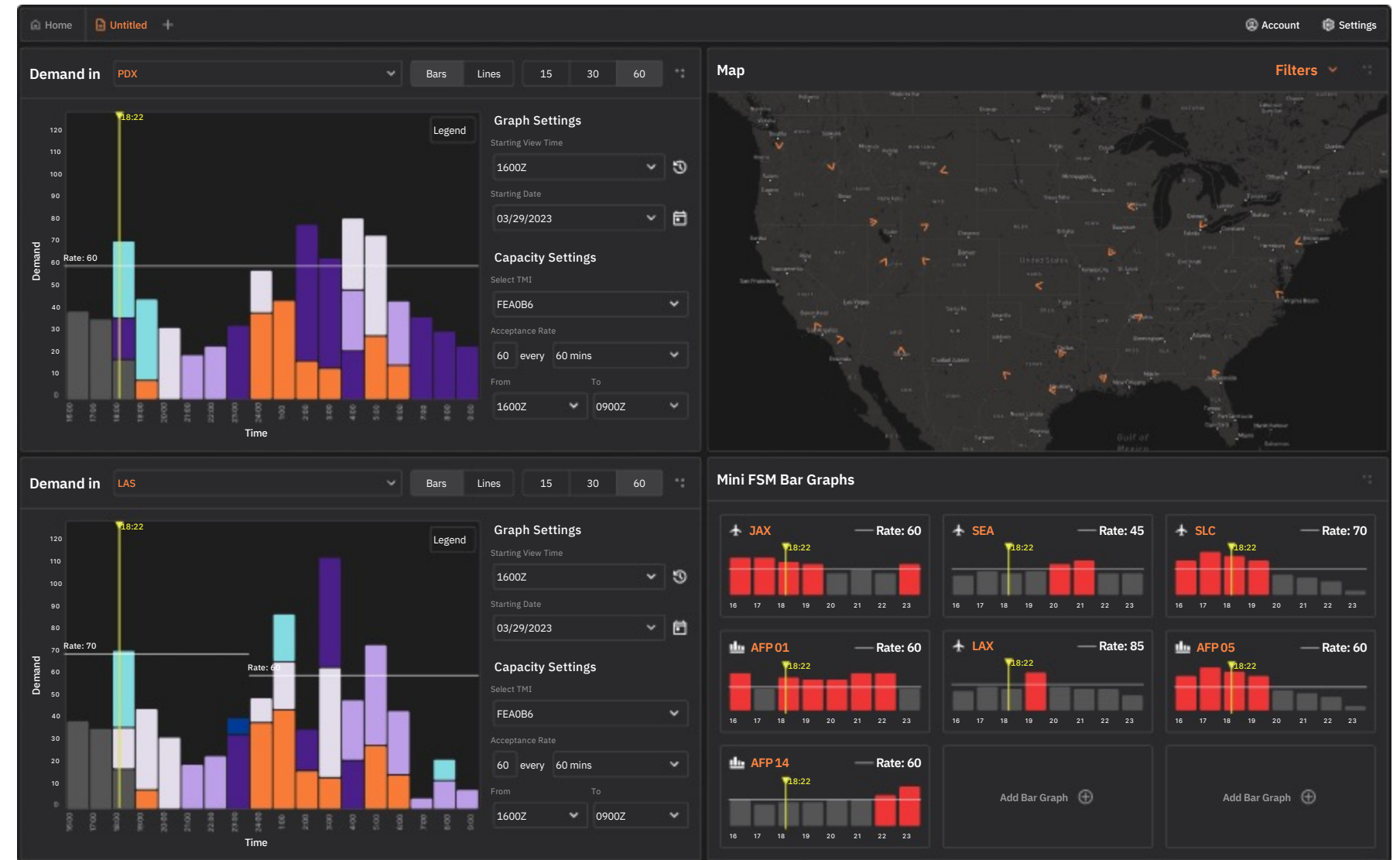
- RAW TEXT:** EVENT TIME: 24/0000 – AND LATER
- MULTIPLE CONSTRAINTS AND PLANNED INITIATIVES REMOVED FROM PLAN AS CONVECTIVE ACTIVITY HAS DIMINISHED RAPIDLY. BOS AAR INCREASED TO 61. N90 ADVISED ROUTES ARE BEGINNING TO OPEN. PATHFINDERS BEING UTILIZED IN AN EFFORT TO REOPEN DEPARTURE ROUTES WITH A FOCUS ON JFK DEPARTURES.**
- STAFFING TRIGGERS:**
 - ZLA AREA E UNTIL 0500Z
 - BIS TOWER UNTIL 0400Z
 - L30 UNTIL 0400Z
 - SCT EMPIRE UNTIL 0400Z
 - SCT COASTAL UNTIL 0430Z
 - SCT SAN UNTIL 0500Z
 - SFO UNTIL 0500Z
- TERMINAL CONSTRAINT(S):**
 - SFO – LOW CEILINGS
 - CENTRAL/SOUTH FLORIDA/D10– THUNDERSTORMS
- TERMINAL ACTIVE:**
 - UNTIL 0159 –EWR GROUND DELAY PROGRAM
 - UNTIL 0159 –LGA GROUND DELAY PROGRAM
- TERMINAL PLANNED:** NONE
- ENROUTE CONSTRAINT(S):**
 - ZDC/ZJX/ZMA/ZHU/ZFW/ZKC/ZMP/ZDV/ZLC/ZDV – THUNDERSTORMS
 - ZNY – ARB/L452/Y493/Y494 OCEANIC ROUTE CLOSURES UPDATE BY 0300Z
- ENROUTE ACTIVE:**
 - UNTIL 0200 –PHLYER_SOUTH_2
 - UNTIL 0200 –PHLYER_NORTH
 - UNTIL 0200 –PHLYER_WEST
- ENROUTE PLANNED:**
 - UNTIL 0200 –DEN CDRS/SWAP/ARRIVAL ROUTES POSSIBLE
- CDR/SWAP ADVISORIES:**
 - UNTIL 0200 –ZFW SWAP IMPLEMENTATION PLAN_FYI
 - UNTIL 0200 –ZDV SWAP IMPLEMENTATION PLAN_FYI
- RUNWAY/EQUIPMENT/SYSTEM IMPACT REPORTS (SIR):**

Unified Style and Theme



Unified Style and Theme

- Simplified colors
- Light and Dark Mode
- Features and panels follow the same structure



Signal-to-Noise Ratio

- Clutter and unnecessary visual elements in the current system get in the way of completing a task as efficiently as possible

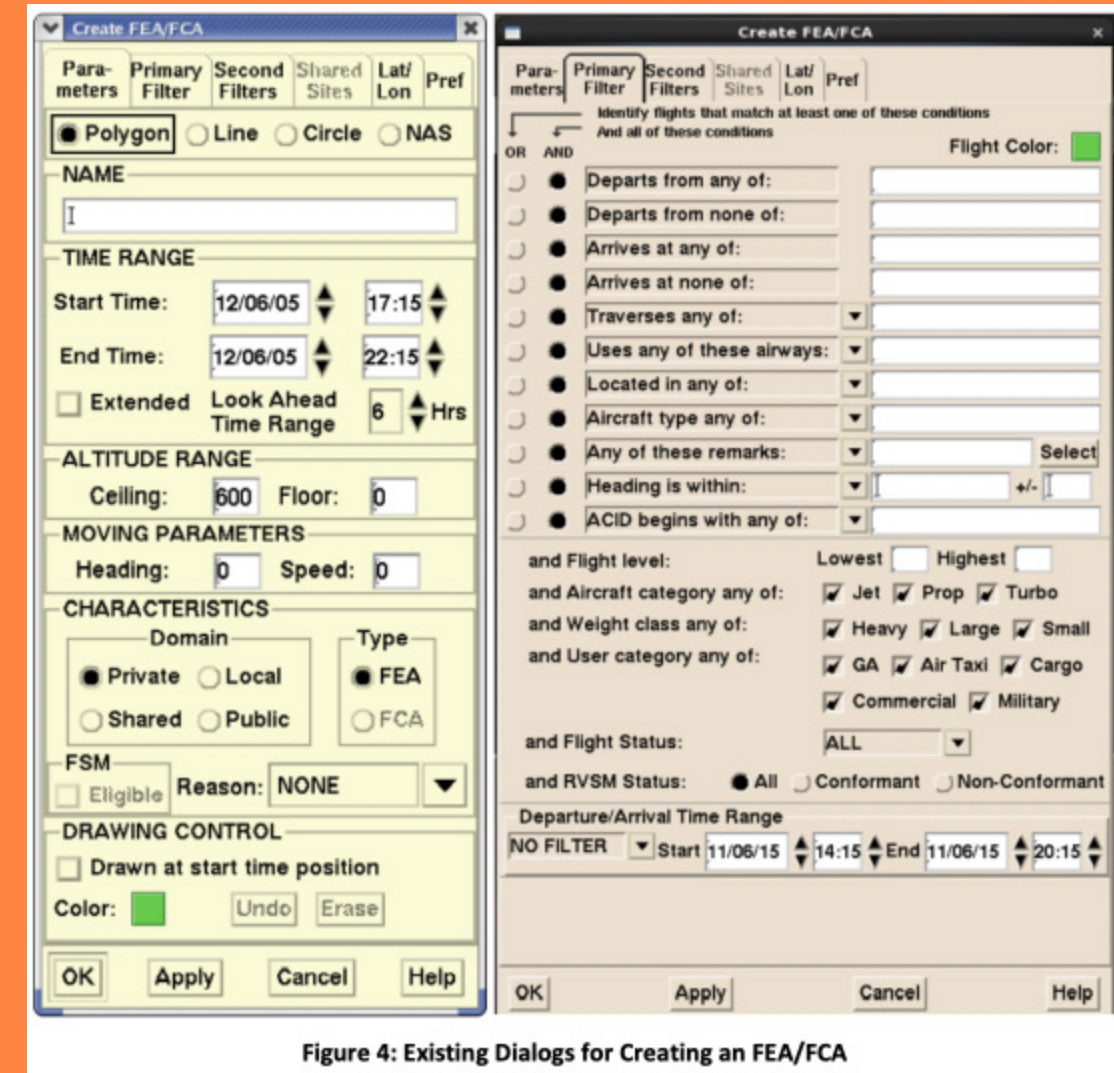


Figure 4: Existing Dialogs for Creating an FEA/FCA

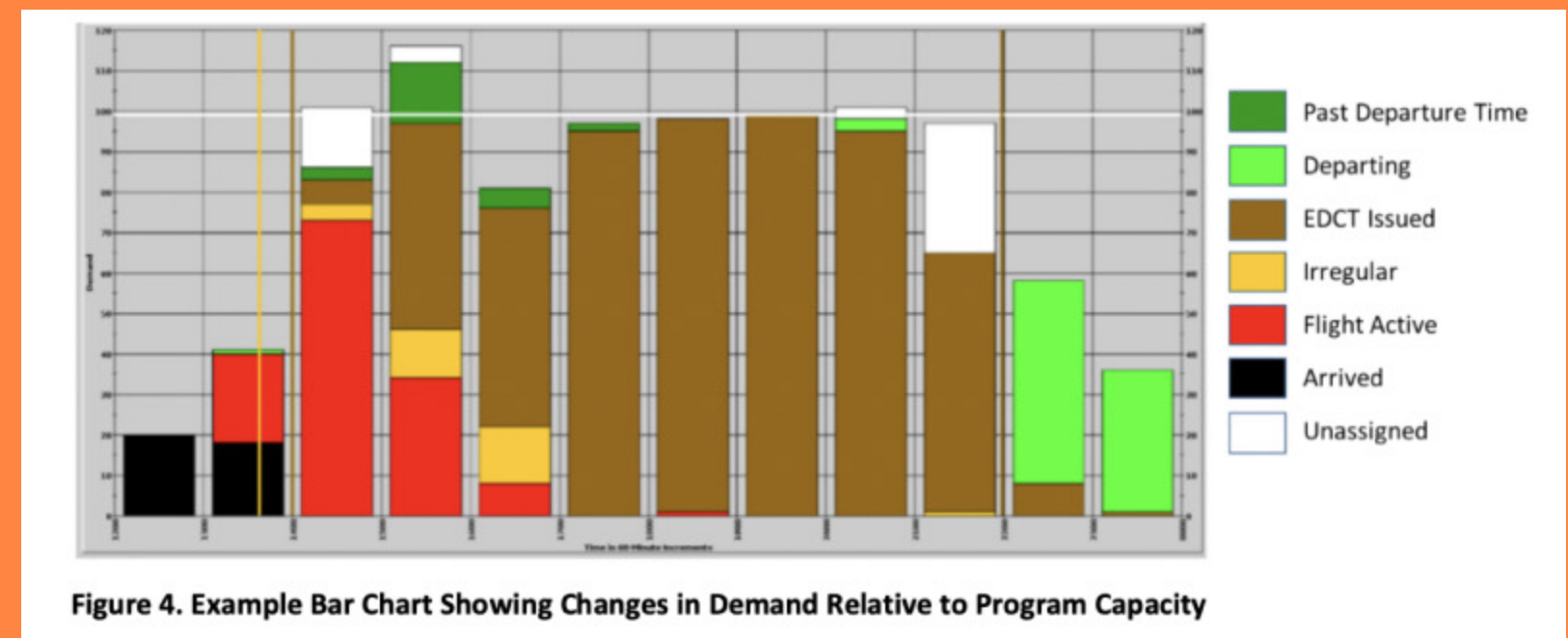
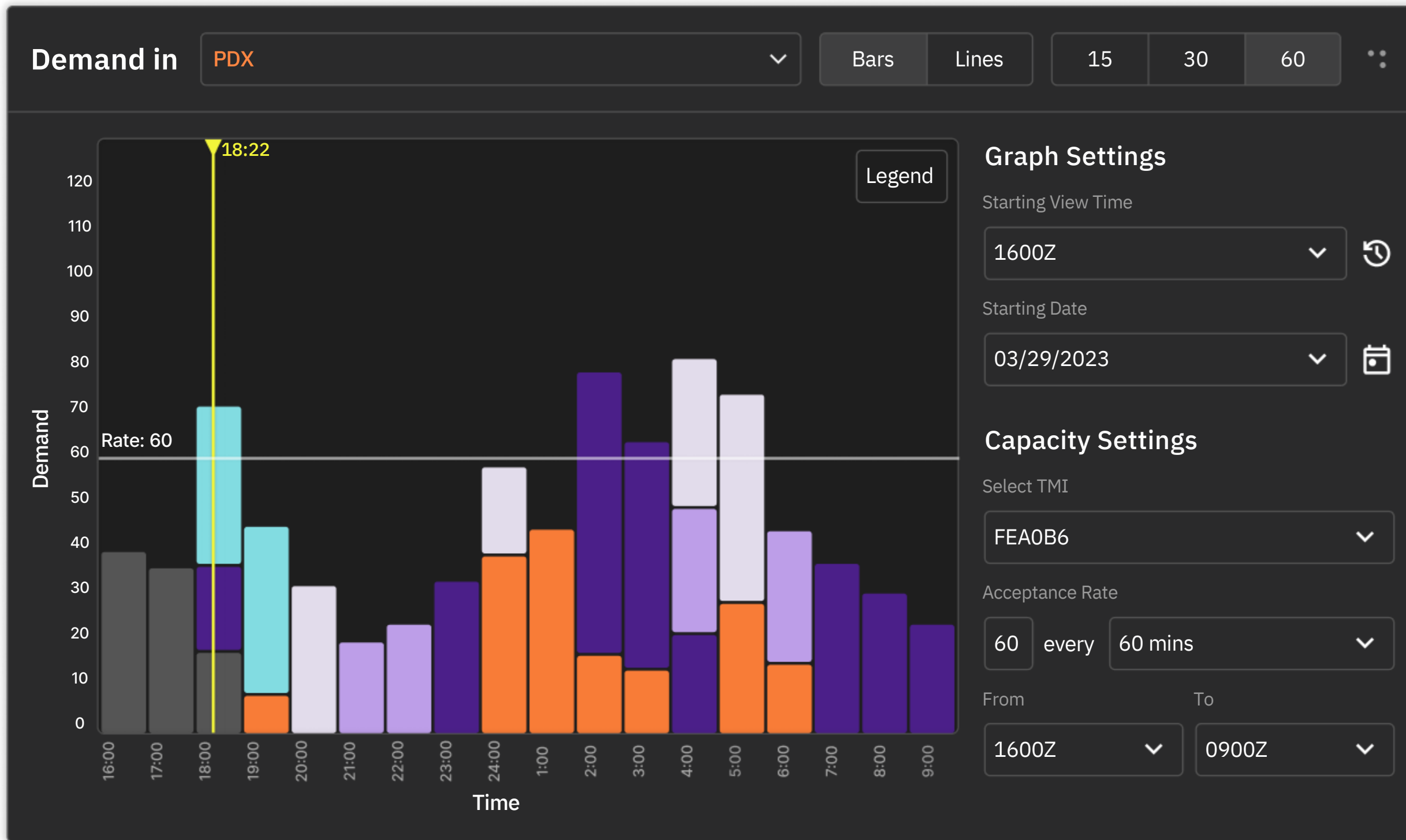


Figure 4. Example Bar Chart Showing Changes in Demand Relative to Program Capacity

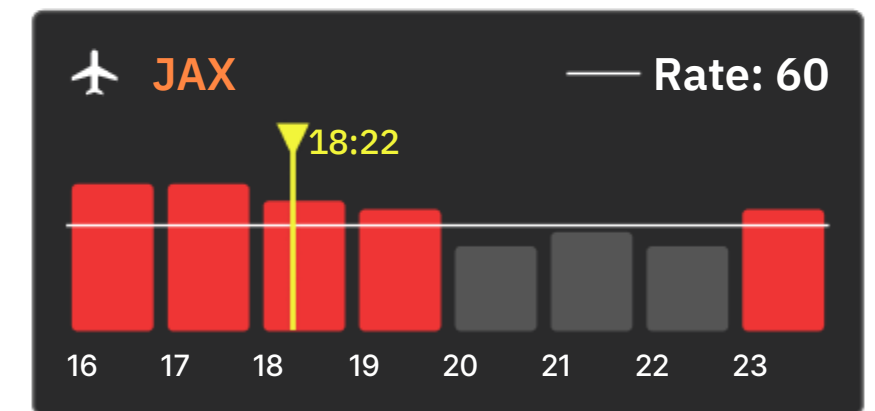


NAS Monitor Updated 1820Z

Select Airport or Region: [Dropdown]

15 mins 30 mins 1 hour

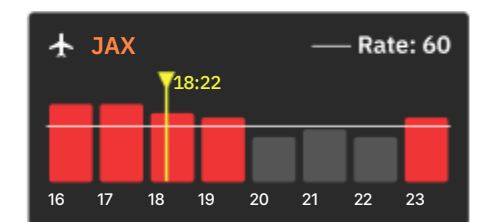
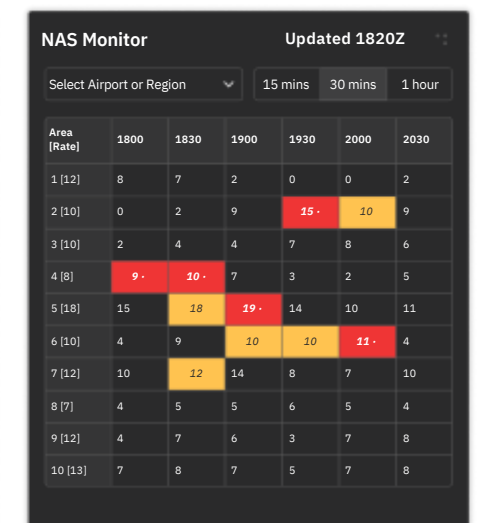
Area [Rate]	1800	1830	1900	1930	2000	2030
1 [12]	8	7	2	0	0	2
2 [10]	0	2	9	15	10	9
3 [10]	2	4	4	7	8	6
4 [8]	9	10	7	3	2	5
5 [18]	15	18	19	14	10	11
6 [10]	4	9	10	10	11	4
7 [12]	10	12	14	8	7	10
8 [7]	4	5	5	6	5	4
9 [12]	4	7	6	3	7	8
10 [13]	7	8	7	5	7	8




Purposeful Use of Color

Purposeful Use of Color

- Inactive or unimportant elements are grayed out.
- Purple is used to represent modeling on the map and timeline
- Red indicates needed attention.
 - On the Bar Graph and NAS Monitor, only over capacity values are highlighted




 **Map**
Swap out panel below

Search panels

 Bar Graph

 NAS Monitor

 Playbook

 TMI Drafts

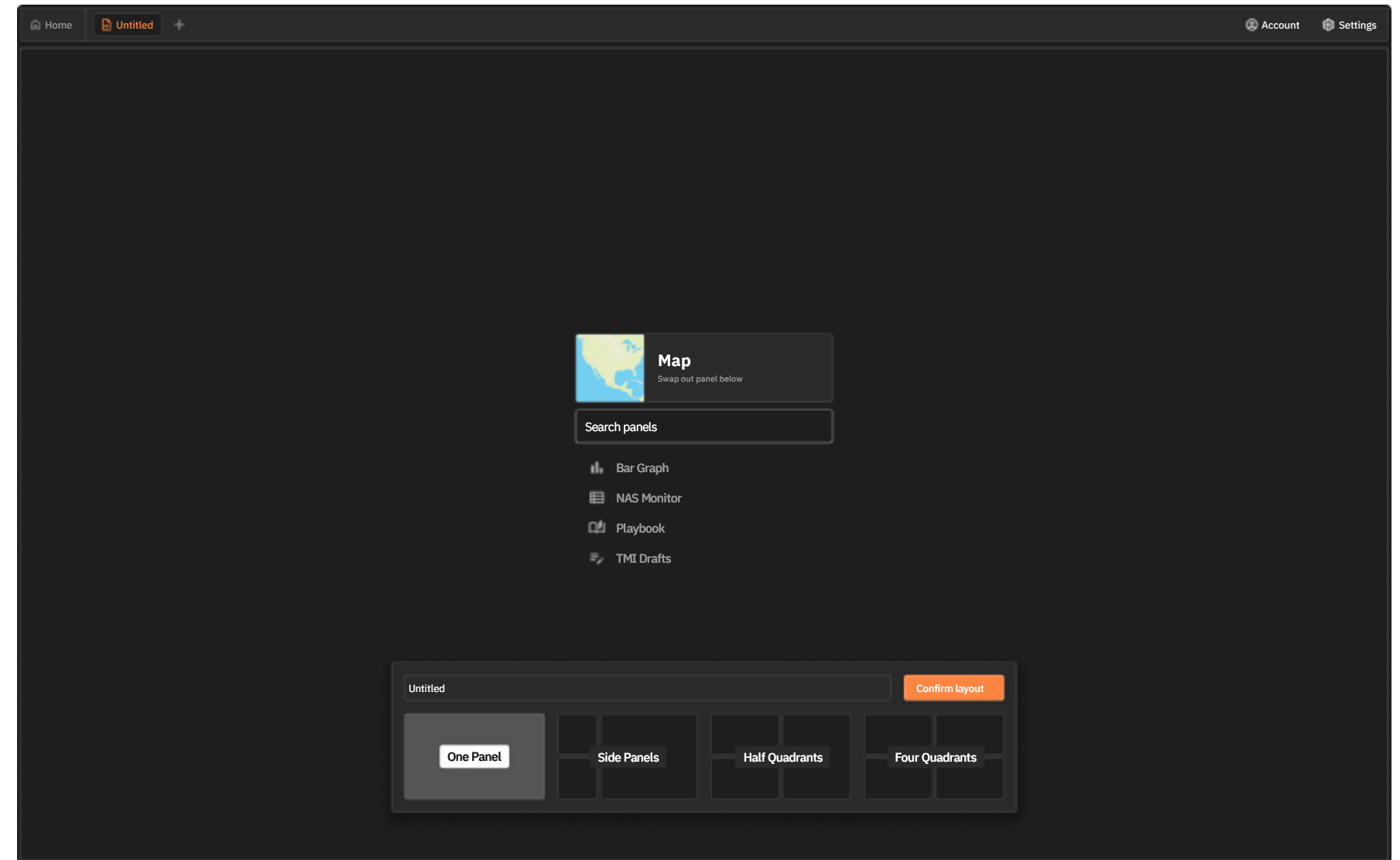
Untitled Confirm layout

One Panel Side Panels Half Quadrants Four Quadrants

Focused Spaces

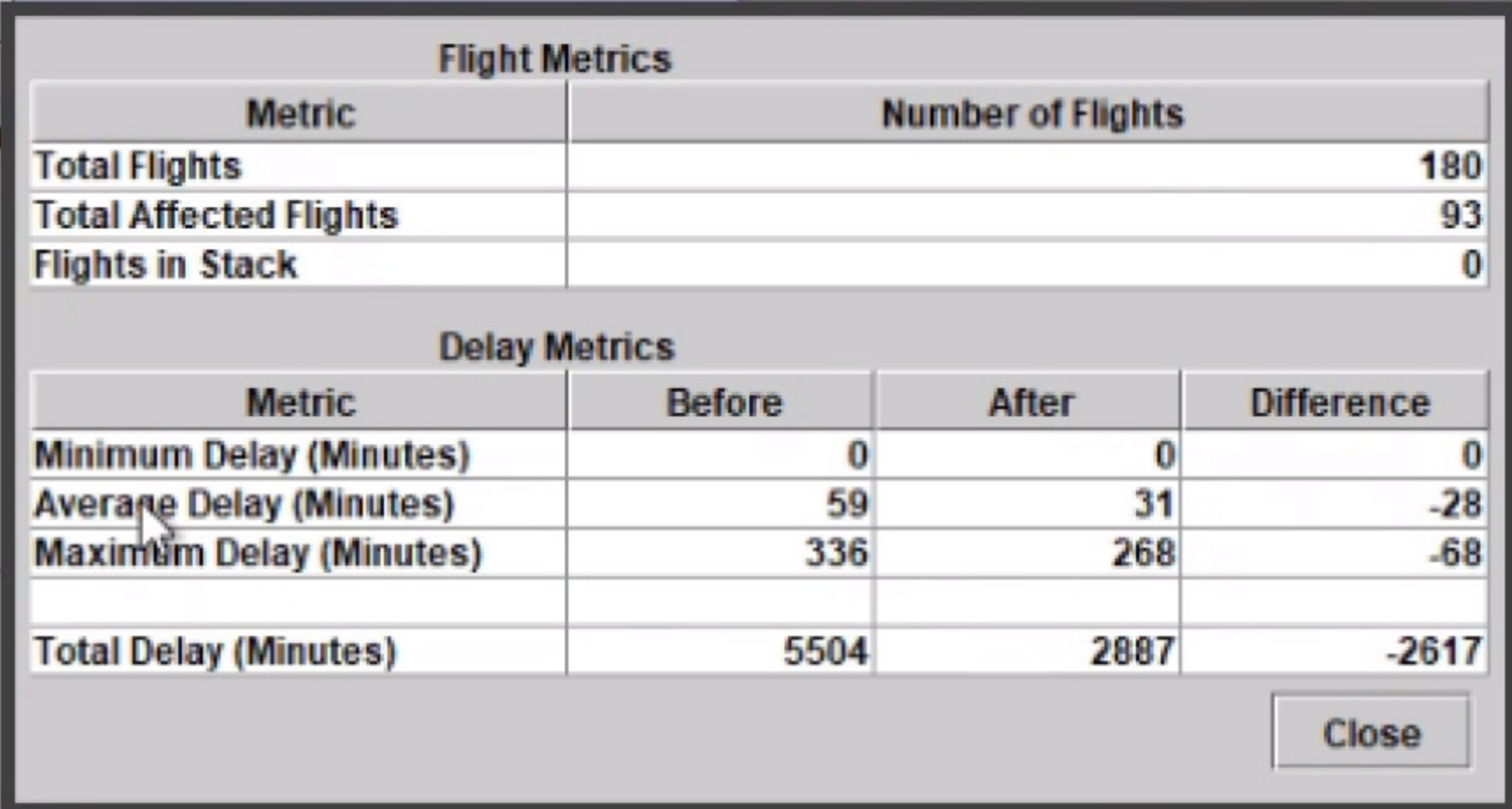
Focused Spaces

- Allows an organized view of situations in the NAS
- Provides flexibility for different traffic manager views and preferences



Lack of Automation

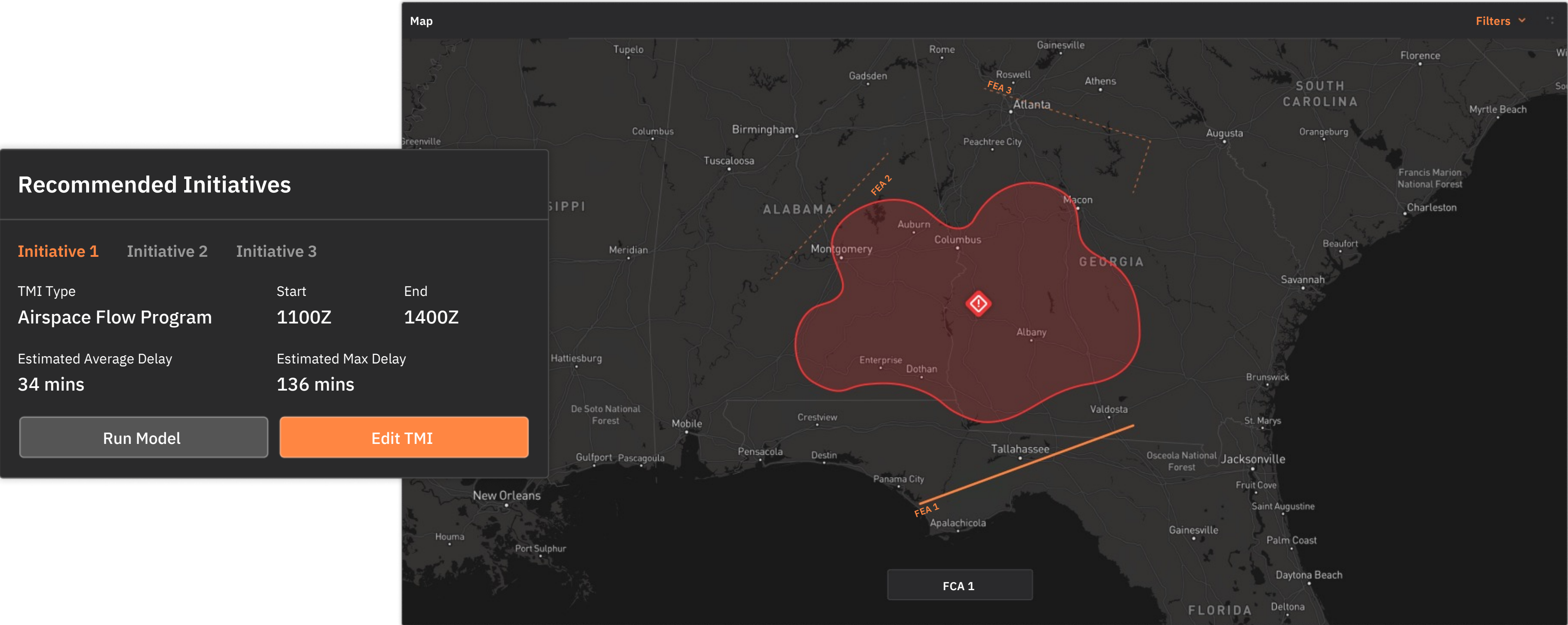
- Data must be individually inputted to generate results
- User is not directly notified of any communication updates
- User is not automatically alerted via notification or able to visually see problem spots on the map



Flight Metrics			
Metric	Number of Flights		
Total Flights	180		
Total Affected Flights	93		
Flights in Stack	0		

Delay Metrics			
Metric	Before	After	Difference
Minimum Delay (Minutes)	0	0	0
Average Delay (Minutes)	59	31	-28
Maximum Delay (Minutes)	336	268	-68
Total Delay (Minutes)	5504	2887	-2617

Close



Recommended Initiatives and FCAs

Recommended Initiatives and FCAs

- Best possible initiatives are provided on situational basis
- Reduces chance of human error
- Streamlines workflow by surfacing Playbook routes

Recommended Initiatives

Initiative 1	Initiative 2	Initiative 3
TMI Type	Start	End
Airspace Flow Program	1100Z	1400Z
Estimated Average Delay	Estimated Max Delay	
34 mins	136 mins	

[Run Model](#) [Edit TMI](#)

Smart Messages

- Traffic Management Initiatives are automatically shared to relevant facilities
- Relevant data is surfaced when viewing requests

Request from SLC Airport

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Requested Initiative

TMI Type	Start	End
Ground Stop	2330Z	0400Z
Estimated Average Delay	Estimated Max Delay	
34 mins	136 mins	

Edit TMI

Comments and Questions

Request Call

Approve

- Inclement Weather
ZJX at 0300Z
- Excess Demand
SLC Airport at 0450Z
- Special Activity Airspace
ZMA at 2100Z
- Thunderstorms
ZLA at 2130Z

Comments and Questions

Save PERTI Plan
Implement Selected TMIs

1822:43Z

1822:43 Z 1900Z 2000Z 2100Z 2200Z 2300Z 0000Z 0100Z 0200Z 0300Z

Automated PERTI Plan

Automated PERTI Plan

- Traffic Manager can instantly view potential alerts automatically generated within their upcoming PERTI plans
- Reduces time spent needing to research and develop a plan

The screenshot displays a dark-themed interface titled "Action Lists". It features a list of alerts for "June 05, 2023" on the left and a summary of event counts for previous days on the right. At the bottom, there is an orange button labeled "Open PERTI Plan".

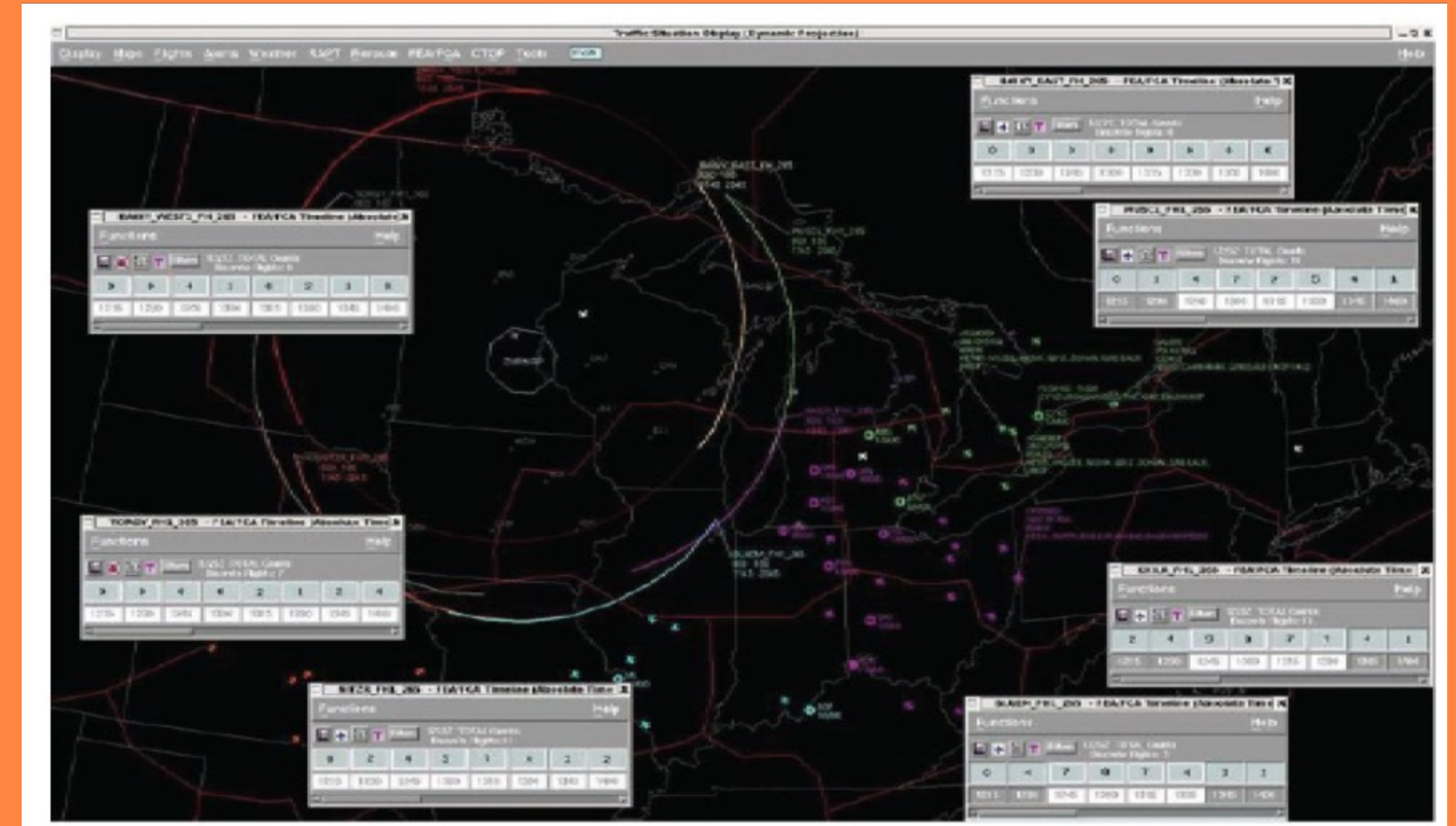
Alert Category	Location	Time
Inclement Weather	ZJX	at 0300Z
Excess Demand	SLC Airport	at 0450Z
Special Activity Airspace	ZMA	at 1600Z
Thunderstorms	ZLA	at 2130Z

Date	Event Count
June 04, 2023	6 events
June 03, 2023	7 events
June 02, 2023	12 events
June 01, 2023	14 events

Open PERTI Plan

Breaks Modern UI Conventions

- Doesn't provide adequate just-in-time feedback (alerts, notifications, and warnings)
- Lack of strong information hierarchy and architecture
- Too much information is shown all at once, overwhelming the user



FCA ZJX-017
▼

Program
Scope

Time	PR	Pop-Up	Resend
1100	30		
1200	30		
1300	30		
1400	30		

Cancel
Run Model

The map displays the states of Georgia and Florida. A large, irregular red shaded area covers a significant portion of both states, with a red diamond icon containing an exclamation mark located within it. An orange line, labeled 'FCA ZJX-017', runs diagonally across the southern part of the map, primarily over Florida. Major cities like Macon, Albany, Tallahassee, Jacksonville, and Orlando are visible. The interface is dark-themed.

0300 Z
↺
1822:43 Z
1900Z
2000Z
2100Z
2200Z
2300Z
0000Z
0100Z
0200Z
0300Z
⚙️
⋮

TMI Editor

TMI Editor

- After viewing recommended models, if unsatisfied, the traffic manager can customize the initiative to their liking
- Buttons, menus and flows follow expected convention

Inclement Weather

← TMI Editor

TMI Type Start End

Airspace Flow Program 1100Z 1400Z

Attached FCA

FCA ZJX-017

Program Scope

Time	PR	Pop-Up	Resend
1100	30		
1200	30		
1300	30		
1400	30		

Cancel Run Model



Notifications Panel

Notifications


☰ ☑= New +

🗉 Messages 📄 Advisories ⚠ Alerts

Unread

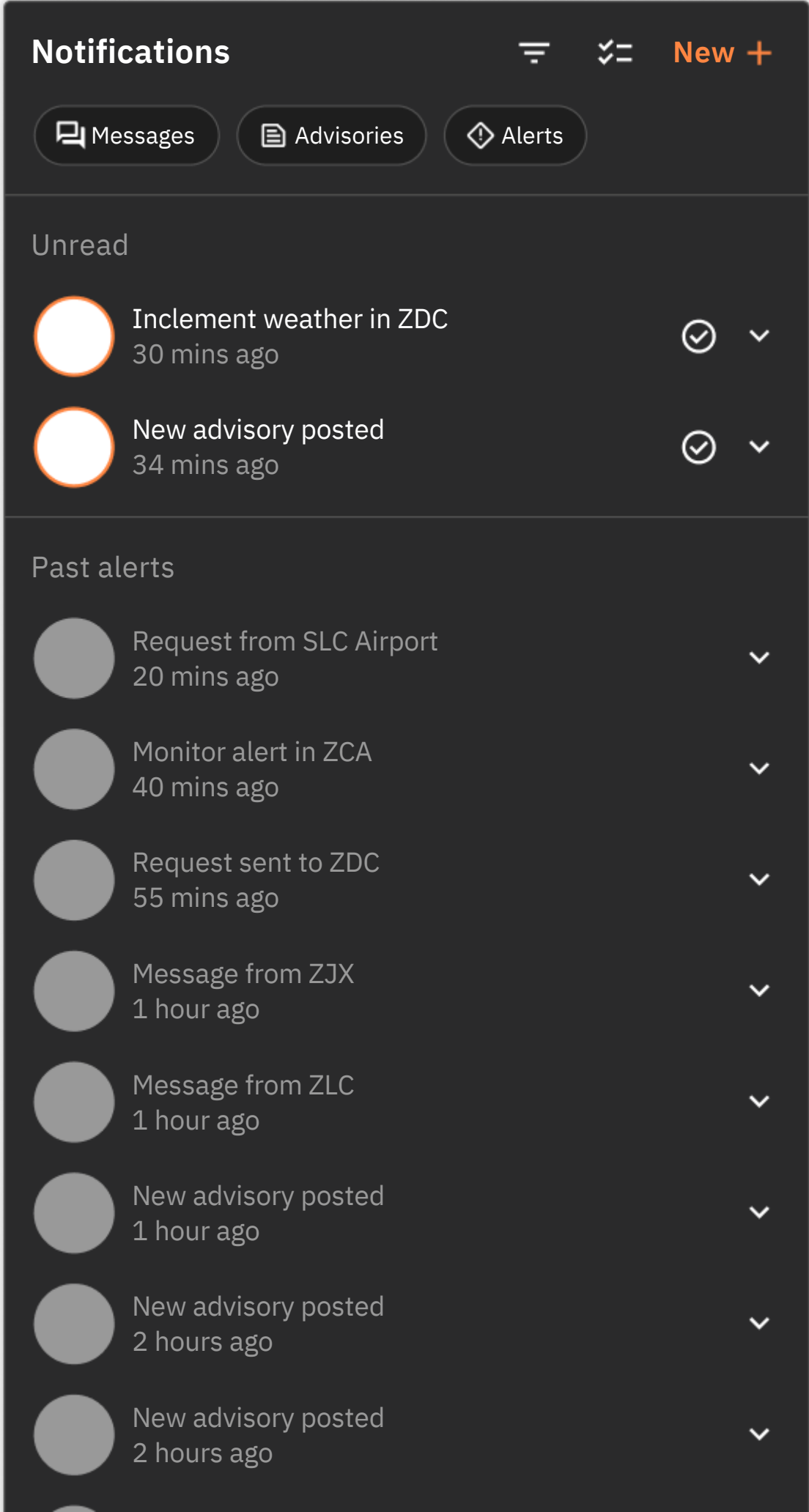
-  Inclement weather in ZDC
30 mins ago ✓ ∨
-  New advisory posted
34 mins ago ✓ ∨

Past alerts

-  Request from SLC Airport
20 mins ago ∨

Notifications Panel

- Provides just-in-time feedback.
- The user is immediately aware of the current status of the NAS when logging on first thing in the morning



Demo

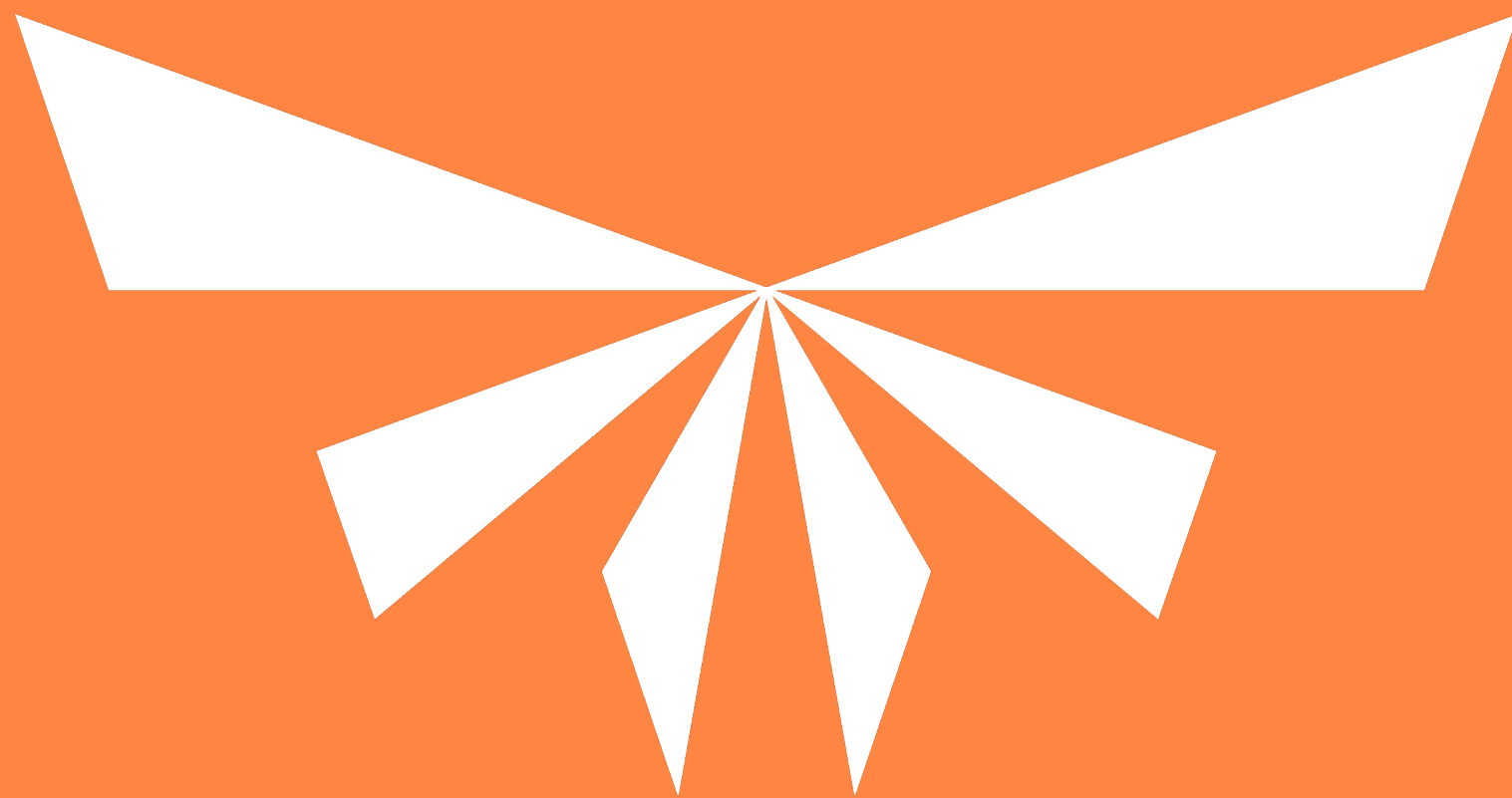
Run through a scenario:

1. Check on updated advisories
2. Organize a space to monitor demand
3. Compare playbook routes in the PERTI Plan
4. Implement a PERTI Plan and send it to relevant facilities
5. Return to monitoring windows to see progress



Aims

1. Leverage modern interface design to increase approachability
2. Consolidate disparate applications and features
3. Improve user flow with just-in-time information
4. Reduce distracting elements from interface



Thank you.



TFM-AID

TRAFFIC FLOW MANAGEMENT -
APPLICATION INTEGRATION DESIGN CHALLENGE

2023 Challenge Forum

June 28-29, 2023 | McLean, Virginia