



Tactical Surface Metering Procedures for Charlotte Douglas International Airport

AHFE

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- Motivation
- Objective
- Surface metering Tool
- Metering Procedures
- Analyses & Feedback
- Summary



- Airport congestion leads to delays and loss in predictability
- NASA is testing tools to address the problem
 - Spot and Runway Departure Advisor (SARDA) (Jung, Malik, Gupta & Hayashi, 2014)
 - Gate hold times and runway queues were explored in a Human-In-The-Loop (HITL) (Verma et al., 2017)
- NASA deployed ATD-2 tools that included a Tactical Surface metering Tool at Charlotte Douglas International Airport (CLT) in Sept 2017
- The surface metering procedures were required for deployment of the tool

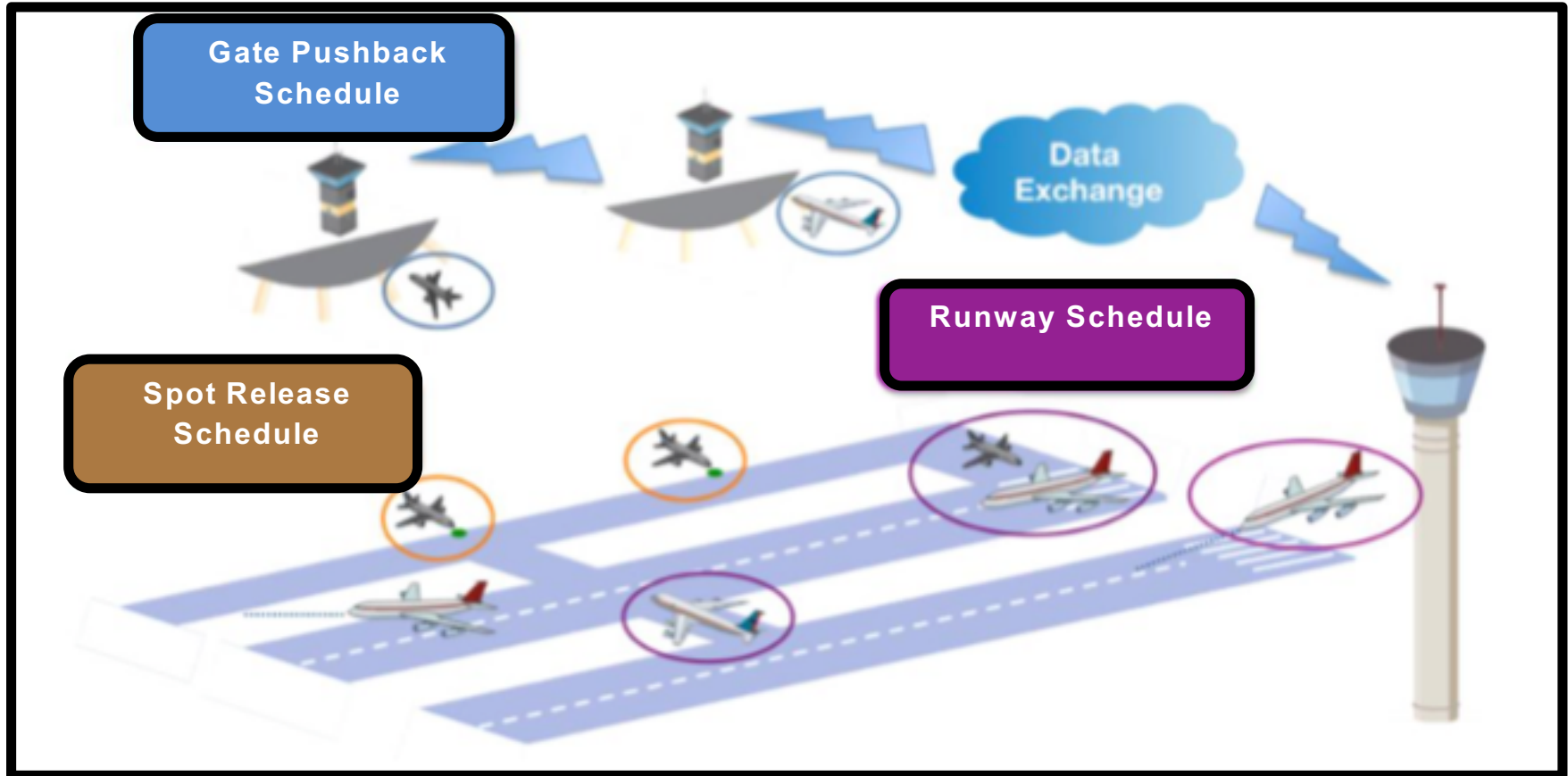
ATD-2 = Airspace Technology Demonstration-2

Objective



- Define metering procedures for deployment of surface metering at Charlotte Douglas International Airport (CLT)
- Obtain user feedback and perform initial analysis to improve the metering tool and procedures

Surface Metering Tool at CLT



Surface Metering Tool

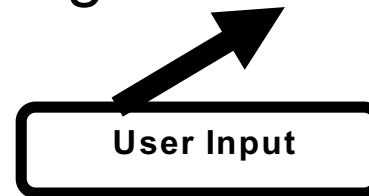


- Surface metering is analogous to ramp metering at freeways
- Recommends gate hold times based on pushback advisories
- Calculates pushback advisories or Target pushback times as follows;



Source**

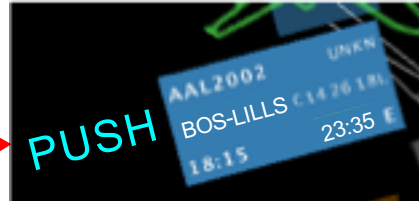
Target Pushback Time = max [Ready Time, Target Take Off Time – Unimpeded time – TargetExcessQueueTime]



Metering Advisories on Ramp Controller Tool

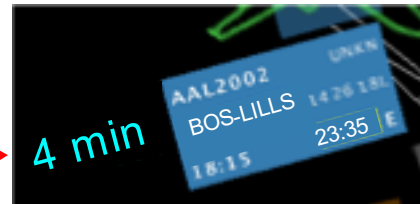


- Push Advisory



Ready Time < 10 min

- Gate Hold Advisory



Ready Time < 10 min

- Hashtag: Click here to get an advisory



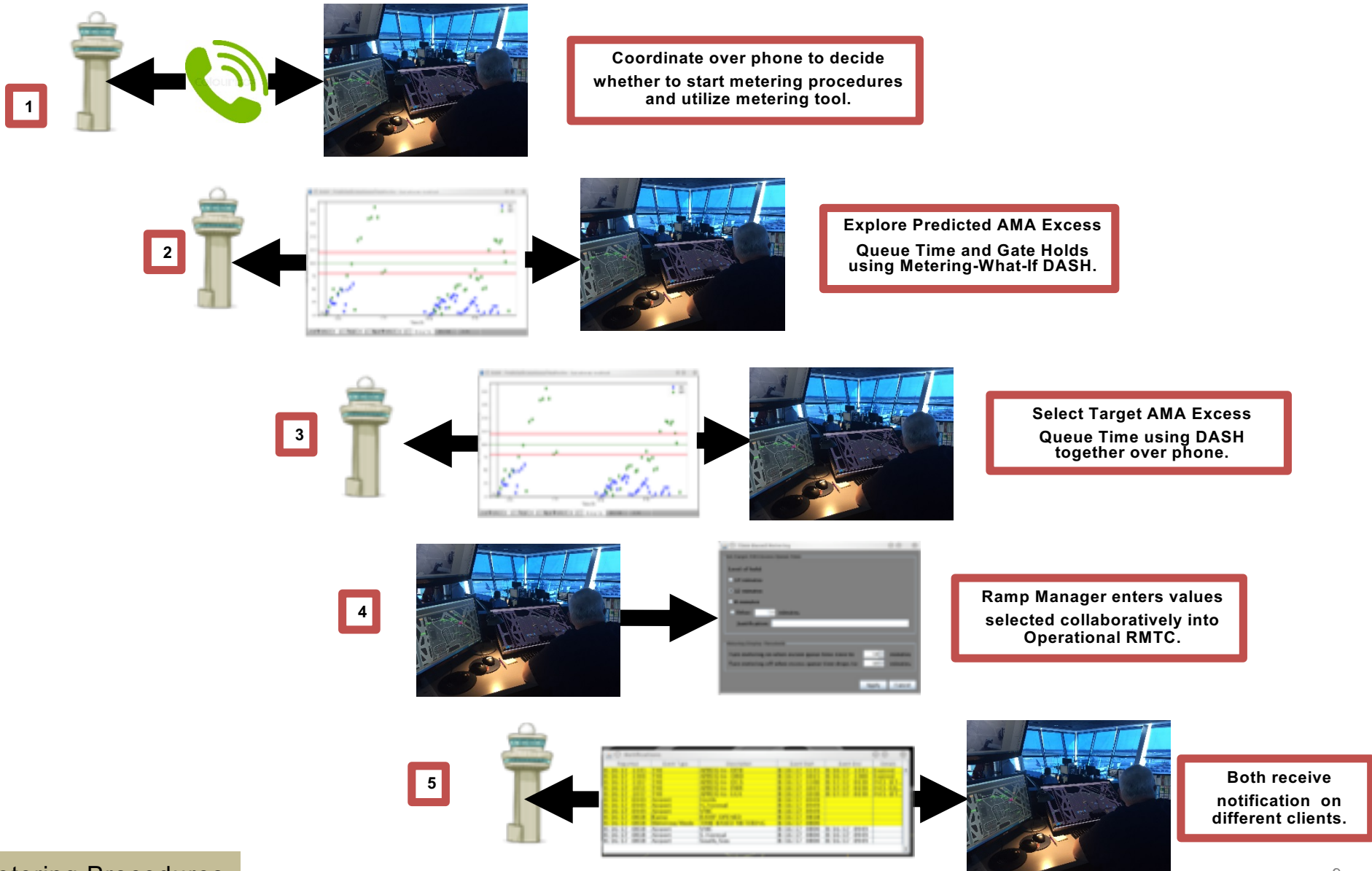
Ready Time > 10 min

Metering Procedures



- Surface metering procedure at CLT is a collaborative function shared by ATC-T Traffic Management Coordinator (TMC) and Ramp Manager
- Coordination was required for decisions that included
 - Turning metering on and off
 - Setting parameters
 - Target excess queue time/ gate holds
 - Thresholds for displaying advisories

Metering Procedures



Metering Procedures



1

Coordinate over phone to decide whether to start metering procedures and utilize metering tool.



ATC Tower



Airline Ramp Tower**

Metering Procedures



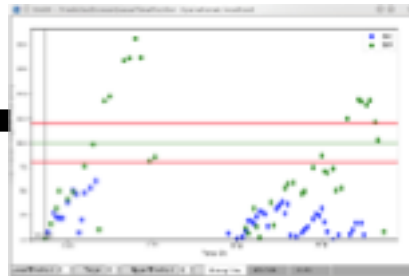
2

Explore Predicted Excess Queue Time in the Airport Movement Area (AMA) and Gate Holds using What-If DASH.



ATC Tower

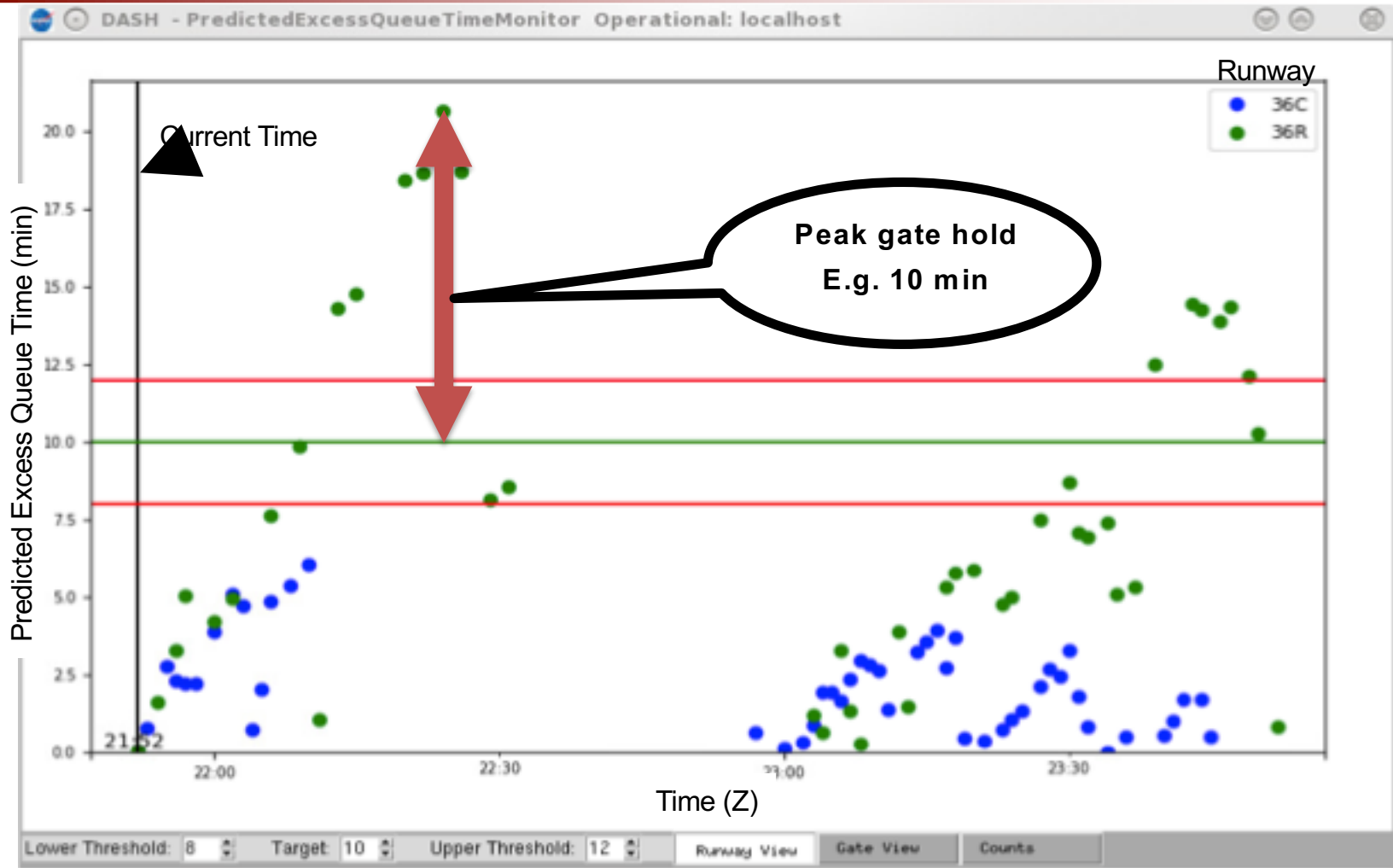
DASH



Airline Ramp Tower

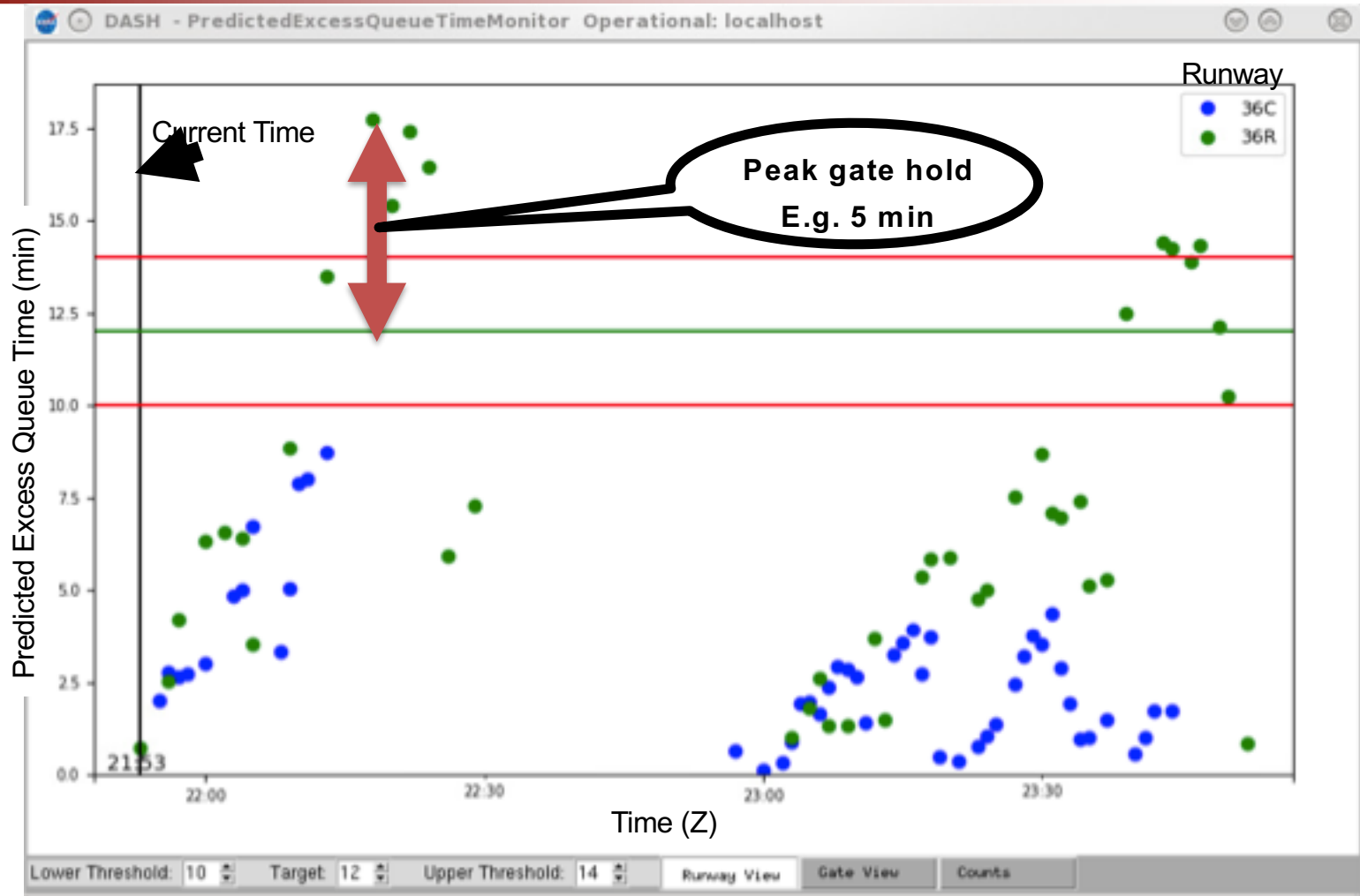
DASH=Data Analysis System Health

Data Analysis and System Health (DASH) Target = 10

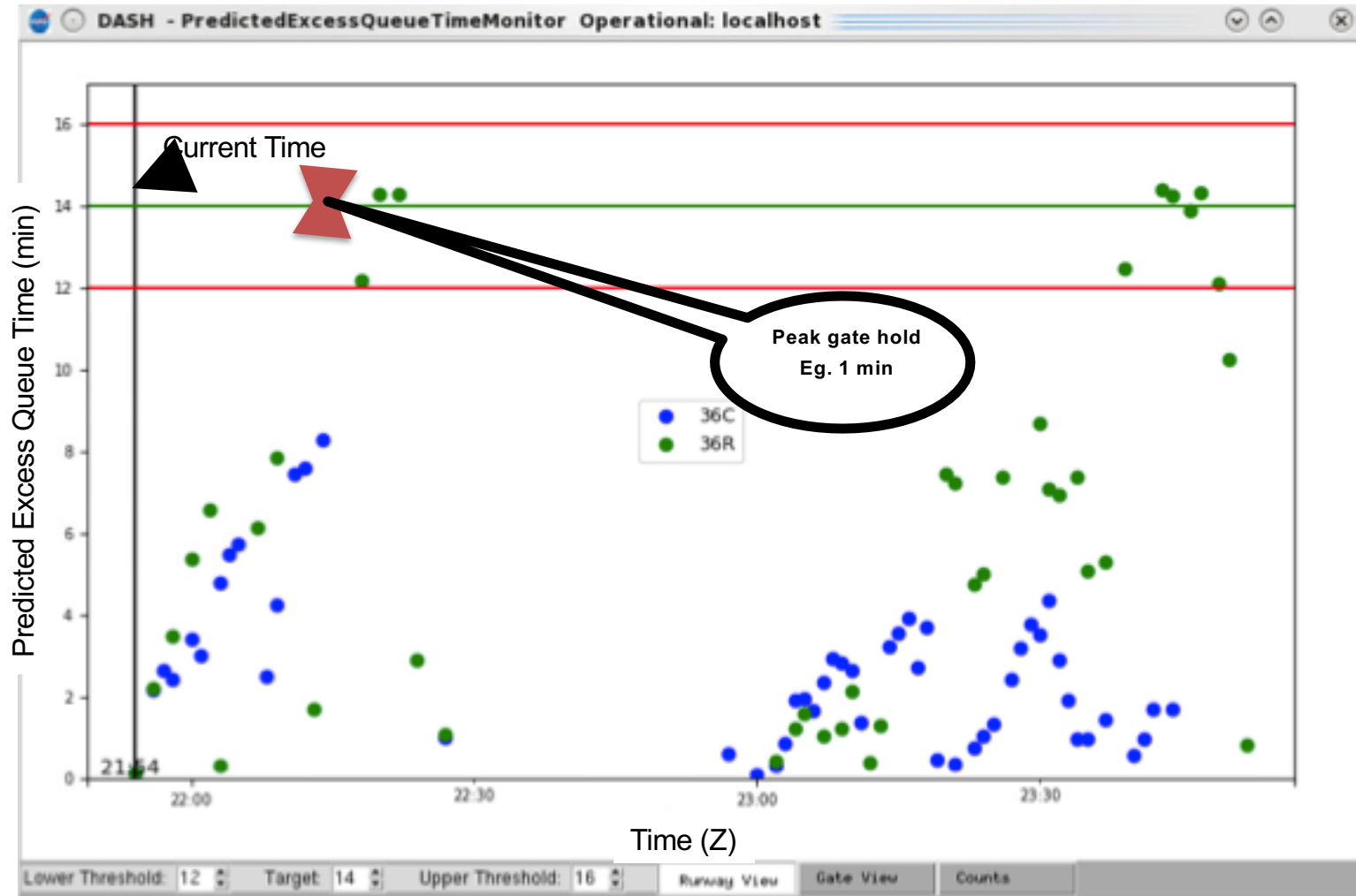


Users explored different targets and thresholds and when metering will get triggered

Data Analysis and System Health (DASH) Target = 12



Runway View - Target as 14



No advisories will be displayed here because the peak is below the upper threshold

Metering Procedures

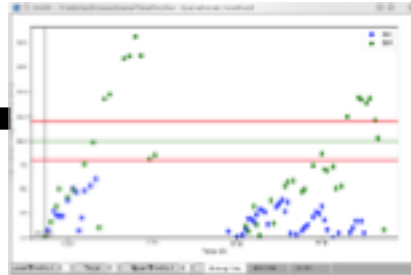


3

Select Target Excess Queue Time using DASH together over phone.



ATC Tower



Airline Ramp Tower

Metering Procedures

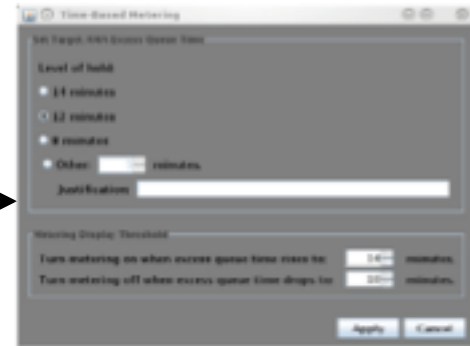


4

Ramp Manager enters values selected collaboratively into Operational Ramp Manager's Traffic Console.



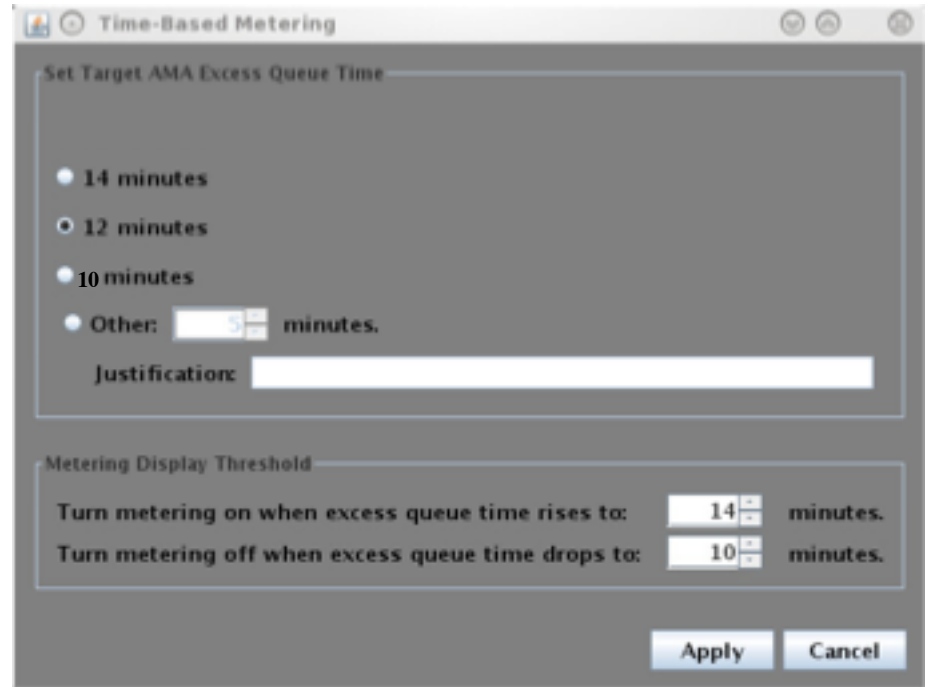
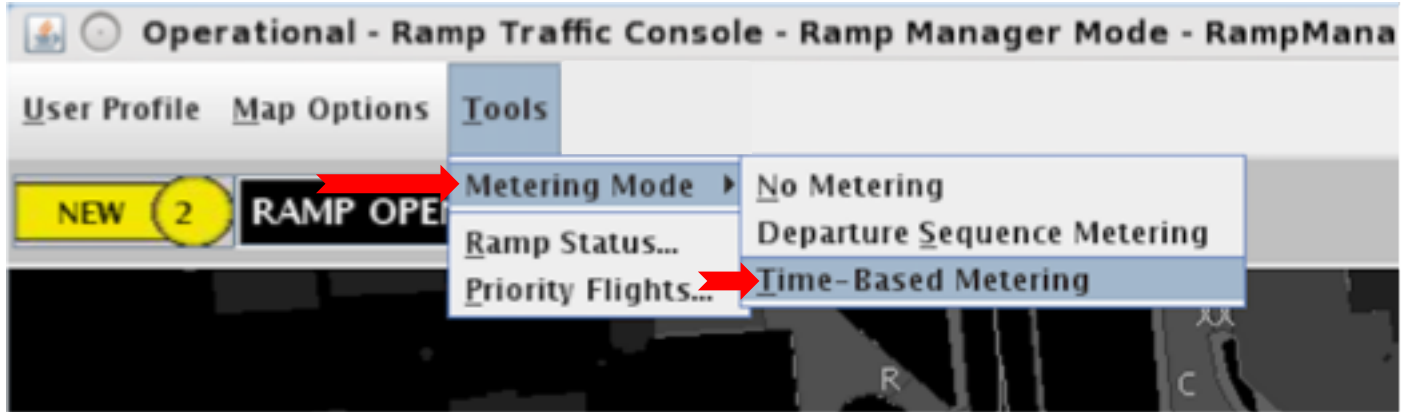
Airline Ramp Tower



Ramp Manager



Set Metering Mode to Time Based Metering from Tools Menu



Set Target AMA Excess Queue Time



The screenshot shows a dialog box titled "Time-Based Metering" with a standard Windows-style title bar. The dialog is divided into two main sections. The first section, "Set Target AMA Excess Queue Time", contains four radio button options: "14 minutes", "12 minutes", "10 minutes", and "Other: 5 minutes." The "Other" option is selected, and the number "5" is entered in a small numeric input field. Below this is a text field labeled "Justification:" containing the text "test1". The second section, "Metering Display Threshold", contains two rows of settings. The first row is "Turn metering on when excess queue time rises to:" followed by a numeric input field containing "16" and the text "minutes.". The second row is "Turn metering off when excess queue time drops to:" followed by a numeric input field containing "12" and the text "minutes.". At the bottom right of the dialog are two buttons: "Apply" and "Cancel".

Metering Procedures



5

Everyone receives notification on their respective clients.



ATC Tower



Airline Ramp Tower

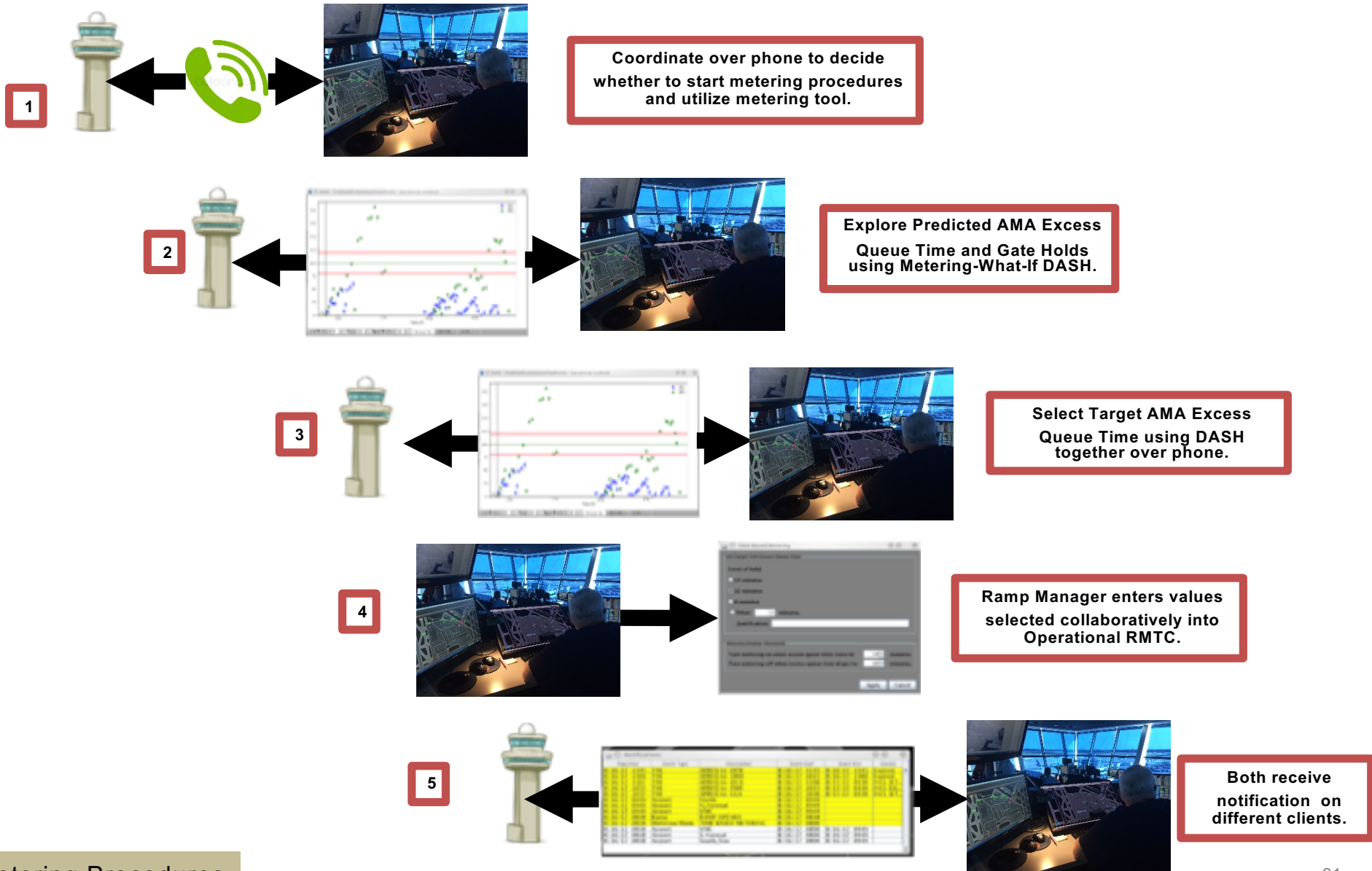
Notification of Time Based Metering



The screenshot shows the Operational STBO Toolbar interface. The 'TIME BASED METERING 1959' button is circled in red. A red arrow points to the first row of the Notifications table.

Reported	Event Type	Description	Event Start	Event End	Target
11/21/17 1959	Metering Mode	TIME BASED METERING	11/21/17 1959		Target
11/21/17 1958	Metering Mode	NO METERING	11/21/17 1958	11/21/17 1959	
11/21/17 1936	TMI	APRIQ to BWI	11/21/17 1630	11/21/17 1936	Cancel
11/21/17 1936	TMI	APRIQ to JFK	11/21/17 1730	11/21/17 1936	Cancel

Metering Procedures



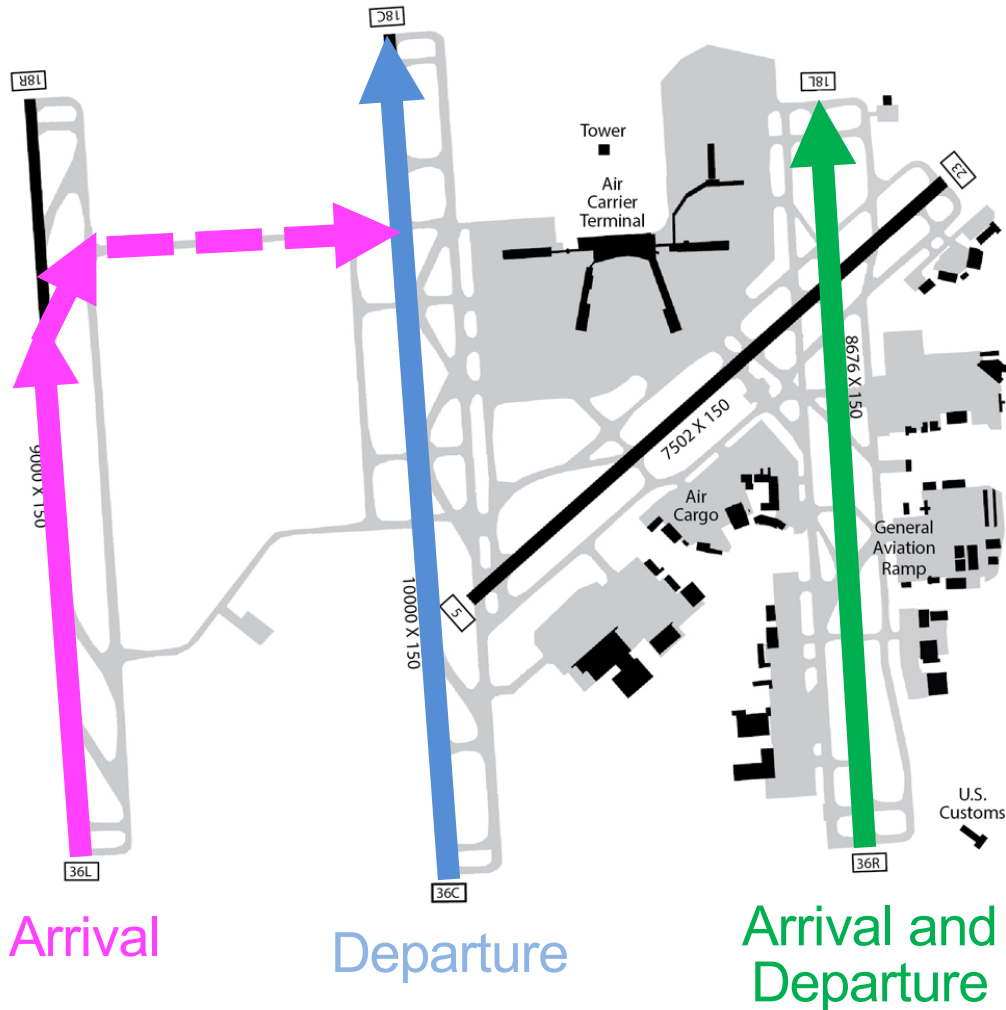


Initial Feedback and Analysis

Data Collection at CLT



CLT in North Configuration



Data collected from **operational system** from 9:00AM to 11:00AM between 2017-11-29 and 2018-01-28

Feedback and Observations



- Metering was triggered early and the users had to wait to pushback the flights
- Users were suggested to increase the Target thresholds or Target Excess Queue Time so that metering was triggered later in the bank
- The number of flights impacted by metering was high and users were not holding them back
- Also the users did not hold the flights for the entire recommended gate hold time

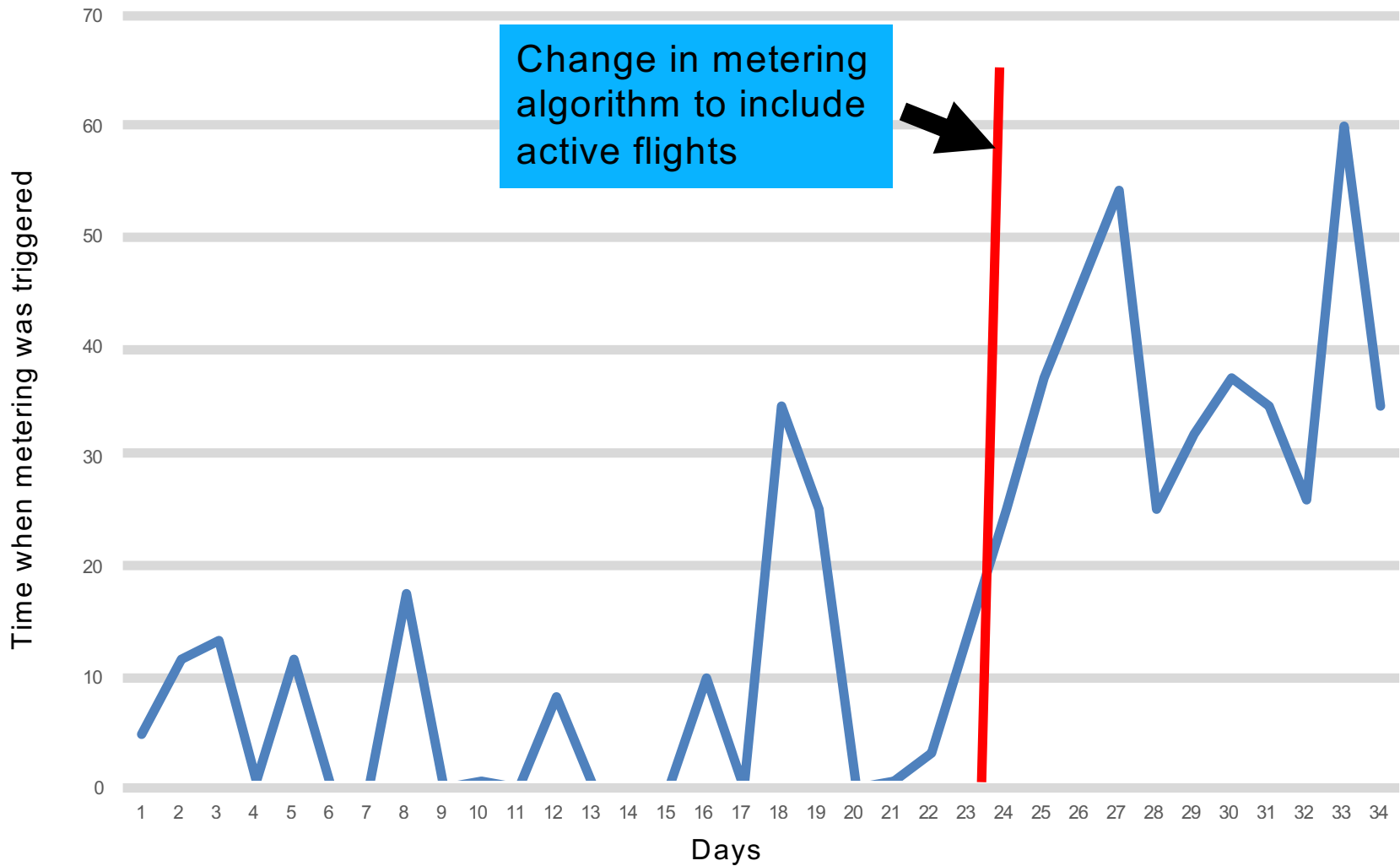
Preliminary Analysis and Feedback



- Metering was triggered early and the users had to wait to release the flights
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Metering triggered too early (36R)



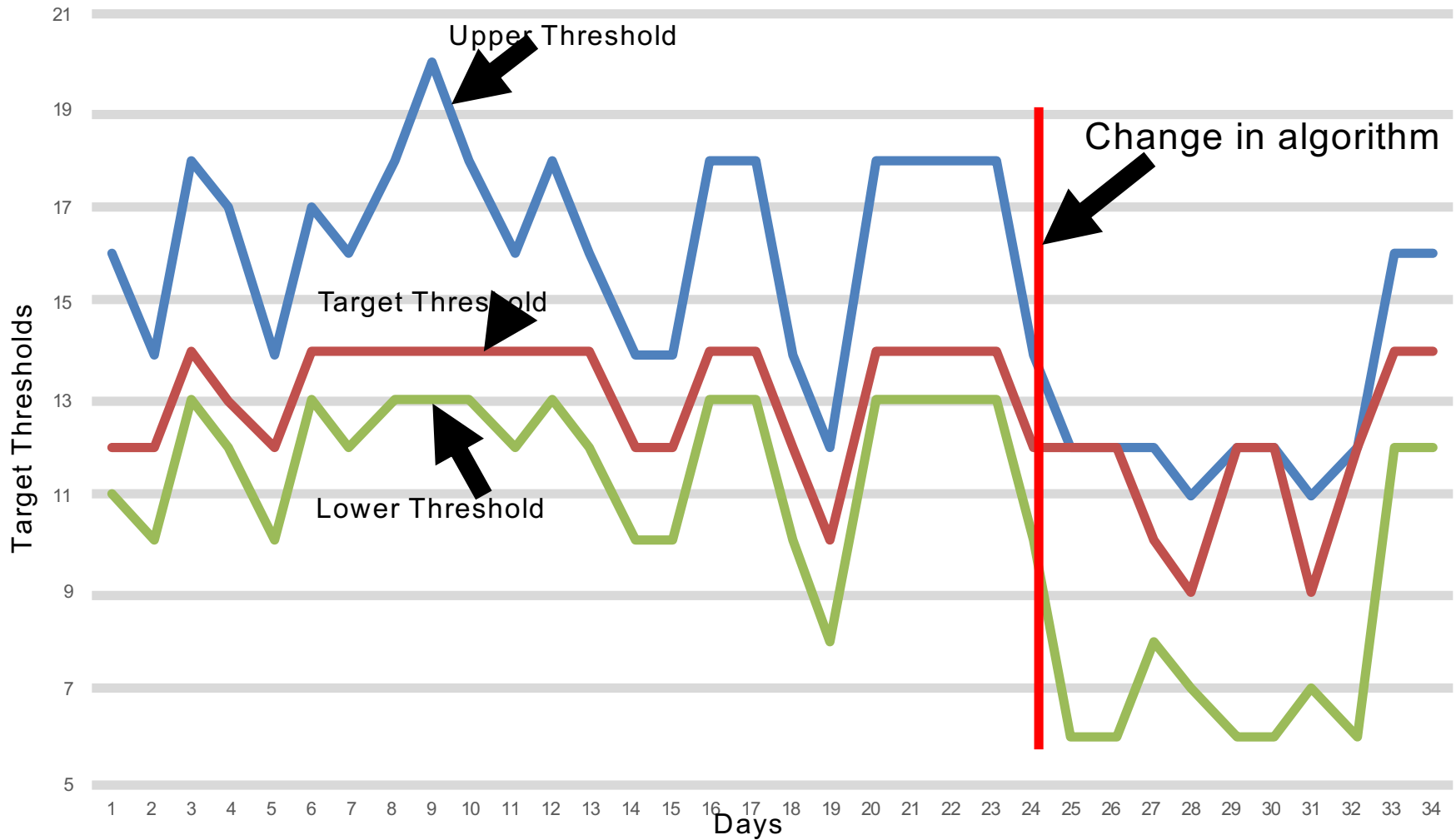
Metering caused flights to be held back when there were few/no flights in the AMA

Preliminary Analysis and Feedback



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Target Thresholds Set by Users (North Flow)



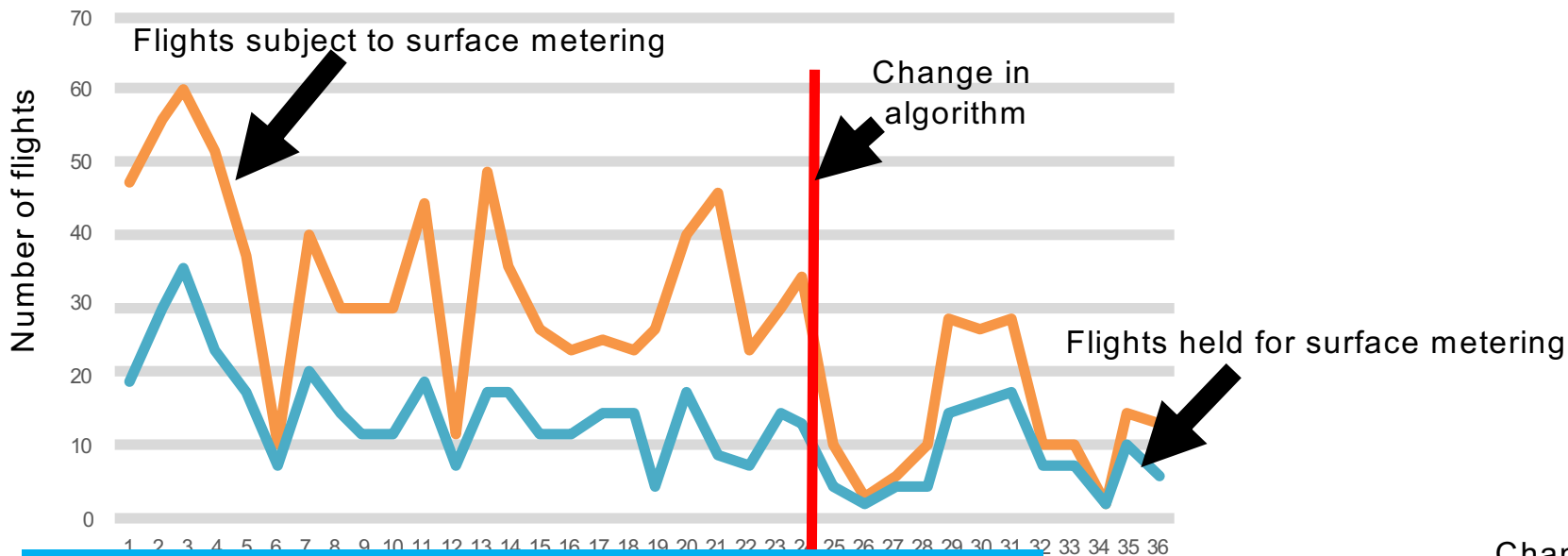
Metering procedures were adjusted here to enter higher upper thresholds

Preliminary Analysis and Feedback

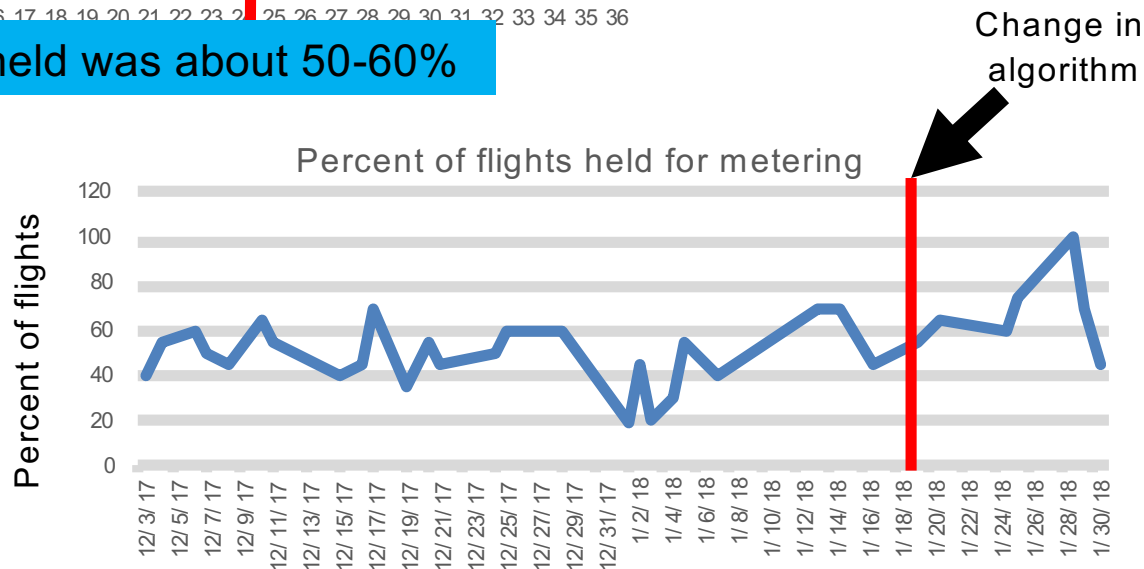


- Metering was triggered early and the users had to wait to release the flights
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- **The number of flights impacted by metering was high and users were not holding them back**
- Also the users did not hold the flights for the entire gate hold recommended by the tool

Flights Subjected to and held for Metering (North Flow)



Percent of flights that were held was about 50-60%

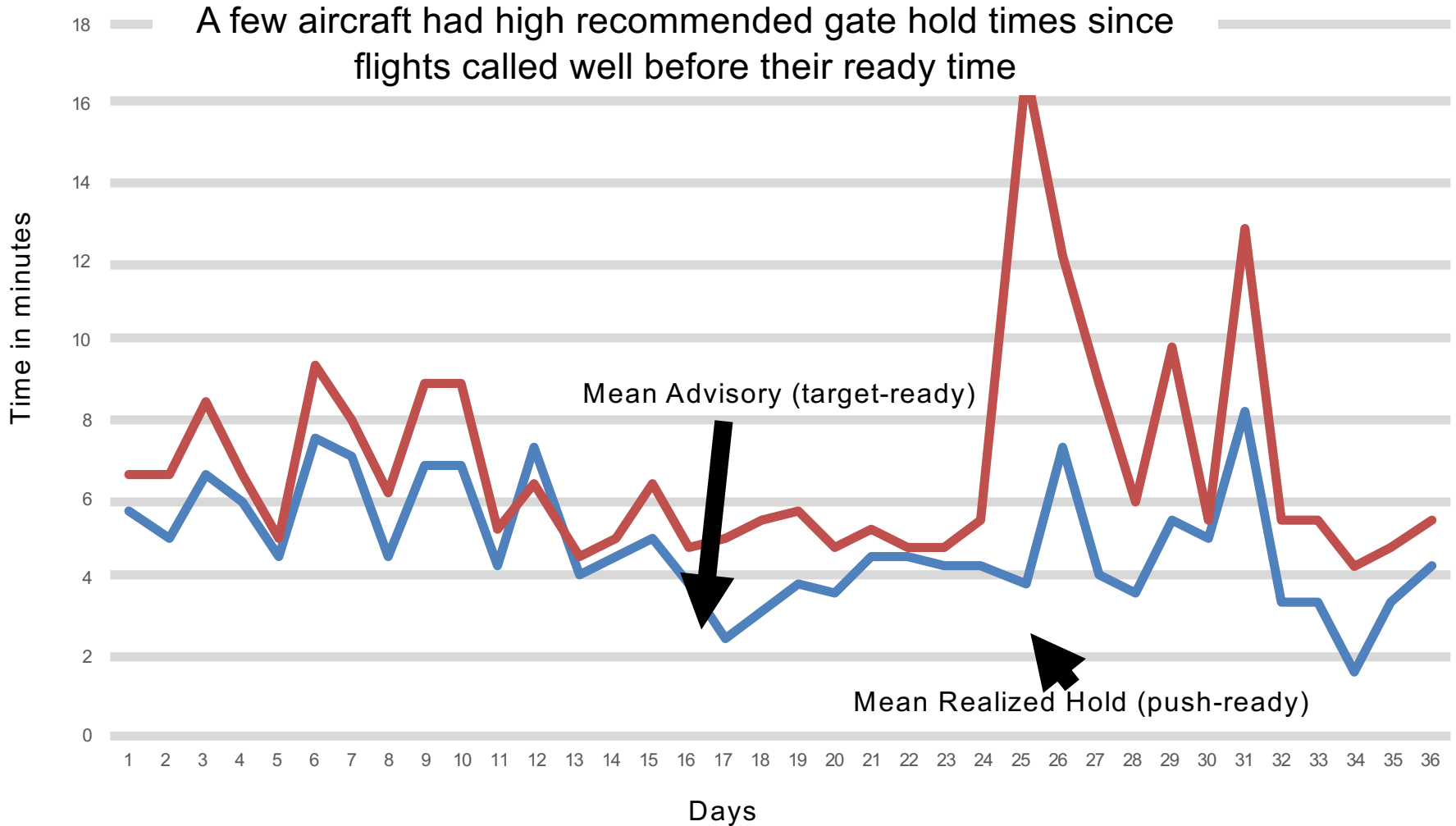


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- **Also the users did not hold the flights for the entire gate hold recommended by the tool**

Recommended Gate hold times and Realized holds (North Flow)



Holding aircraft at the gate is a paradigm shift for the users

Summary



- Surface metering procedures were defined for deployment
- Initial analysis and feedback allowed improvement of the surface metering algorithm
 - Surface metering algorithm used expected traffic instead of actual physical queue, which led to many issues revealed earlier
- To hold flights for surface metering is a shift in user's paradigm
 - Training can facilitate the understanding of gate hold times as compared to ready times
 - High gate holds have several factors and one of them was flights calling much earlier than their estimated ready time
- Future work continues to explore compliance to pushback times as compared to spot times