Ramp Traffic Console (RTC) Lessons Learned

NASA ATD-2 Industry Workshop

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Agenda

- Field Evaluations
- Feature Set for Situational Awareness
- Customization
- Surface Metering
- Design Principles
- Challenges
- Wish List

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- **Field Evaluation**
- **Feature Set for Situational Awareness**
- **Customization**
- **Surface Metering**
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- **Challenges**
- **Wish List**

Operational Field Evaluation is Essential

- 10 *Engineering* Shadow Evaluations over 15 months were not as impactful as 3 *Operational* Shadow Evaluations over 3 months.

- Operational Shadow Evaluation period was not long enough to address the sheer amount of feedback we received.

- Why? Because when the users had the chance to see/use the tool in the field and feel the imminence of using the tool, realization of needed functionality to perform their jobs and ideas about features that they would like to have began to flow. It's important for the users to see/use the tool in the operational environment in order to obtain the most feedback and understand field/user needs.

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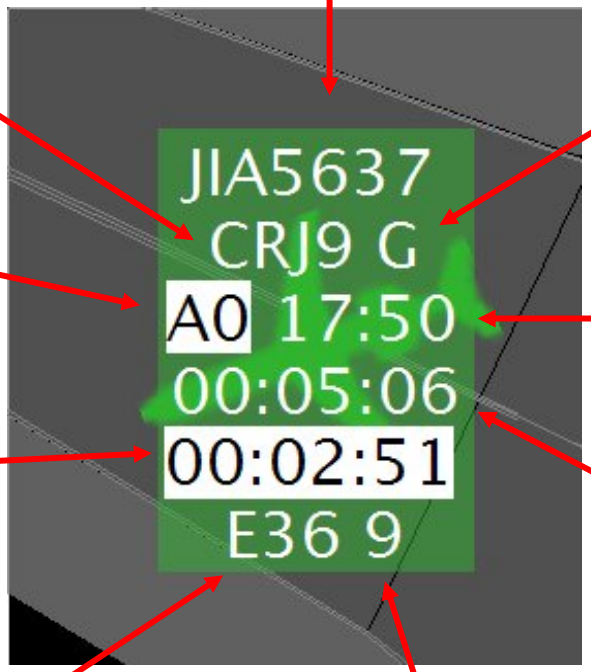
Situational Awareness

- Necessary features to provide situational awareness
  - Flight Data
  - Flight State
  - Aircraft Type
  - Flights to Expedite
  - Flights with TMIs
  - Target Management
  - Target Location / Orientation
  - Intent
  - Gate Status
  - Airport Status
  - Notifications
  - Count Lists
  - Search

RTC Overview

Arrival Data Tag Example



Callsign
(e.g. JIA5313)

Aircraft Type
(e.g. CRJ9)

Current Ownership
(e.g. “G” for Ground)

A0/A5/A14 alert
(e.g. A0)

Scheduled In-Block time
(SIBT)
(e.g. 17:50)

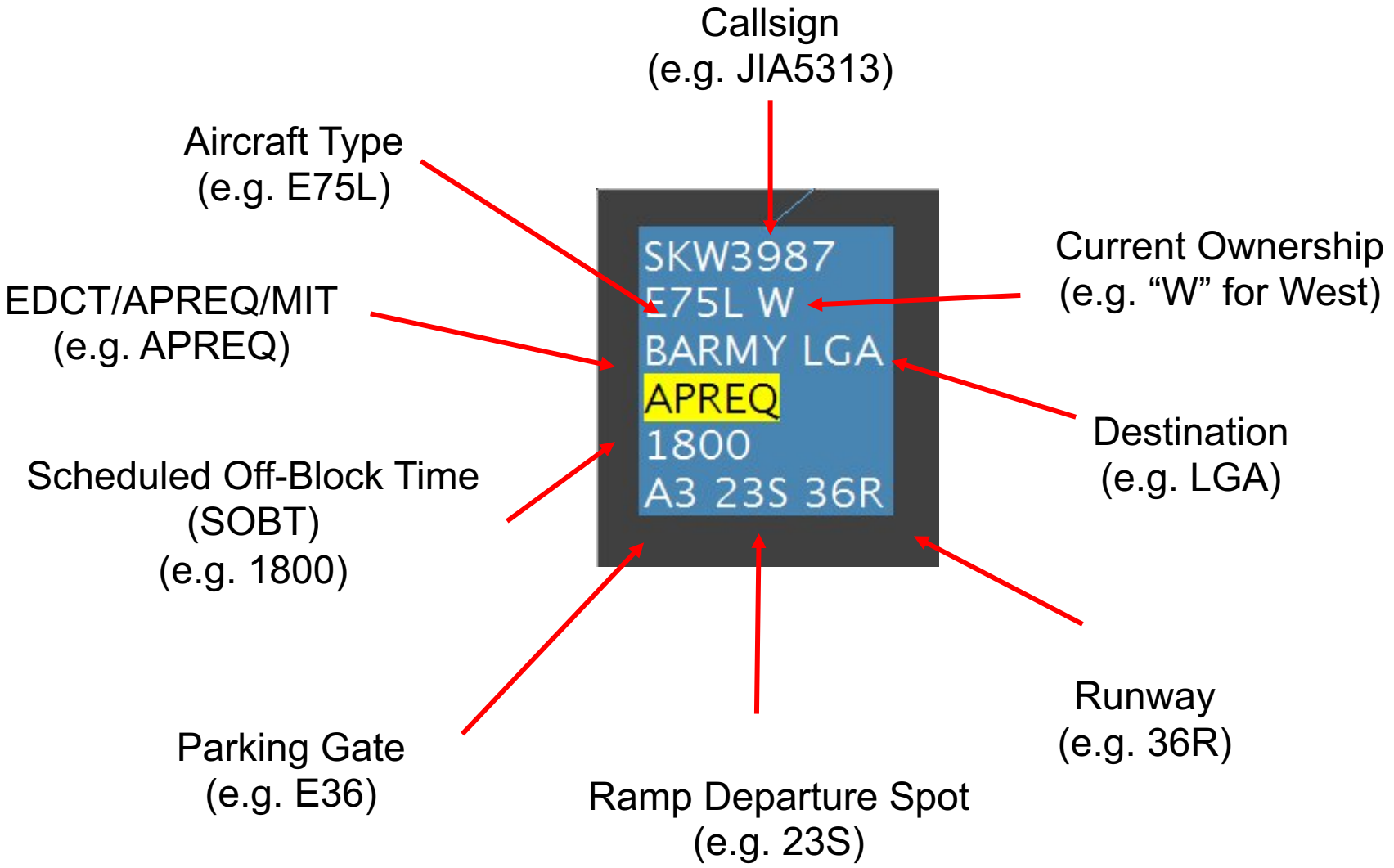
A0/A5/A14 alert timer
(e.g. 2 min 51 sec)

Time since Wheels
Down (ALDT)
(e.g. 5 min 6 sec)

Parking Gate
(e.g. E36)

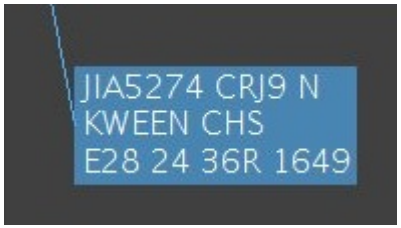
Ramp Arrival Spot
(e.g. 9)

Departure Data Tag Example



Indicate Flight State: Departures

At gate
not pushed back



At gate
spooling up /
pushing back

Pushed back,
proceeding to spot
– no tracks

Taxiing –
tracked

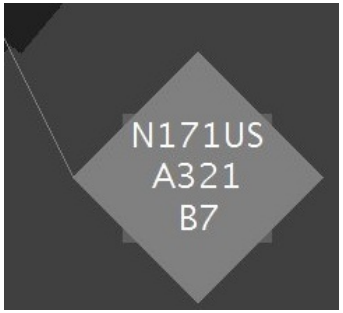
Indicate Flight State: Arrivals

Taxiing – tracked

Taxiing – lost tracks

At gate, subsequent departure will be using the aircraft

Aircraft (no flight associated with the piece of metal)



Distinguish Large Aircraft

B757 aircraft

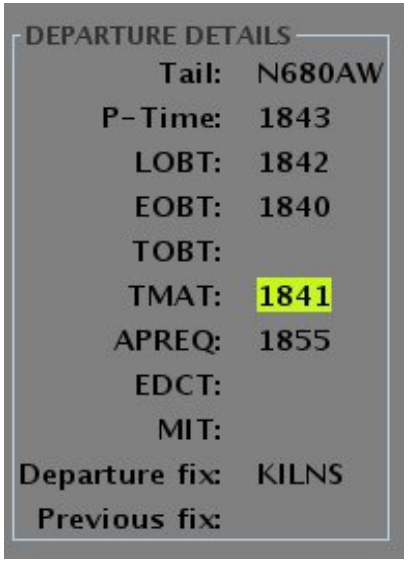
Heavy aircraft

Flight Data

- Ramp Controllers still wanted a place to see all available flight data

Arrival Example

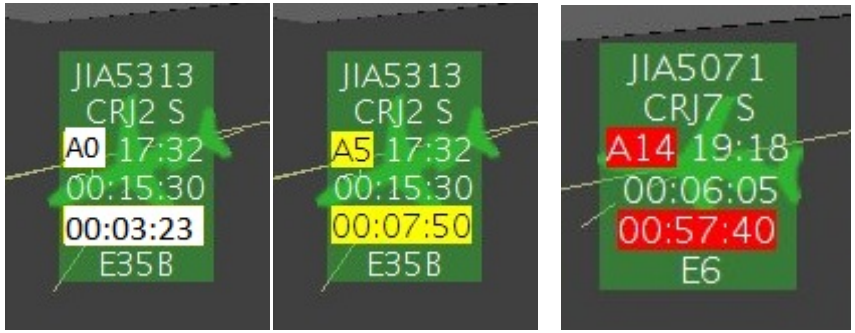
Departure Example



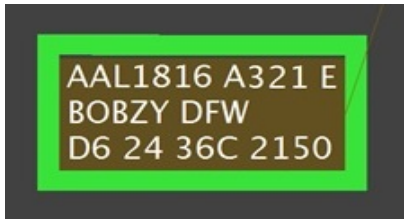
Flag Flights to Expedite (1)

Emergency

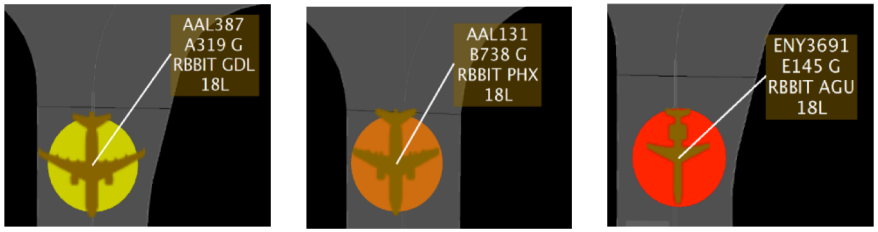
A0, A5, A14



Priority



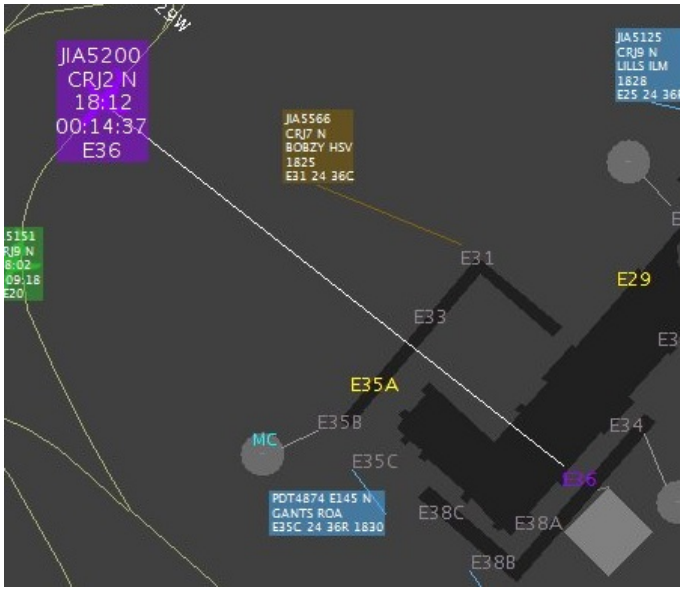
Long on Board



60 – 89	90 – 119	120+

Flag Flights to Expedite (2)

- Gate Conflicts flag the gate and the arriving flight
- Controller needs to expedite the departure or manage the arrival
- Clicking on the gate label draws a tether from the gate to each flight assigned to that gate, helping the user find the flight if it is not in the current field of view.



- Gate conflict also indicated if gate is blocked by a heavy at a neighboring gate
- Gate conflict begins to display when an arrival is N (user-configurable) minutes prior to landing

Indicate Flight TMIs

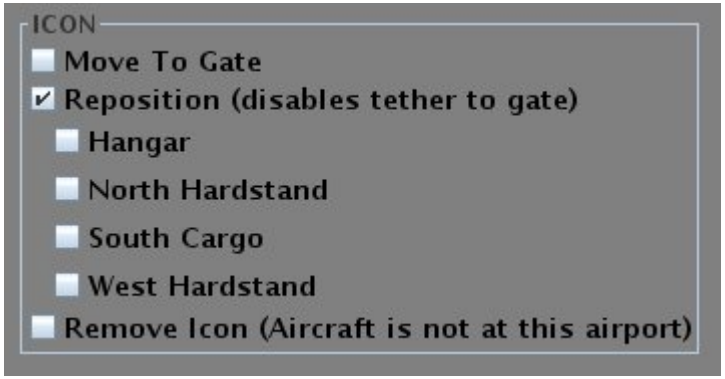
- APREQ but no release time – still at gate
- APREQ but no release time – pushed back
- APREQ with release time
- EDCT
- APREQ and EDCT
- Changed APREQ or EDCT
- Ground Stop
- Miles-in-Trail
- Departure fix change
- Departure fix closure

Examples of TMI indicators

Flight / Aircraft Management

- Create missing targets
  - Flight must be from system list
  - Aircraft can be created from scratch

- Strip/icon management
  - Reposition flight/aircraft to another location
  - Move flight/aircraft to gate
  - Remove target

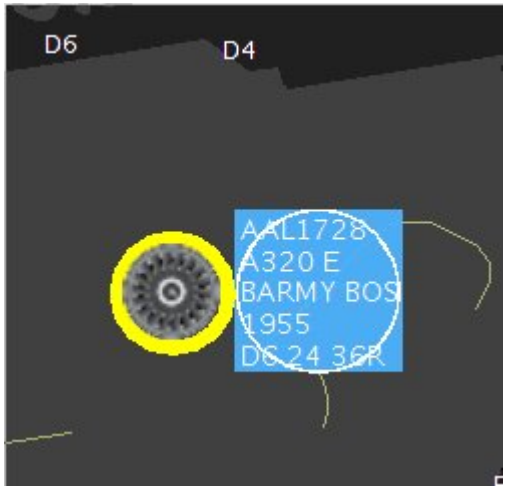


- DON'T show General Aviation/Cargo flights in their ramp
  - A distraction/clutter to controllers

Position and Orient to Expected Location

By default, strip for pushed flight displayed away from the gate

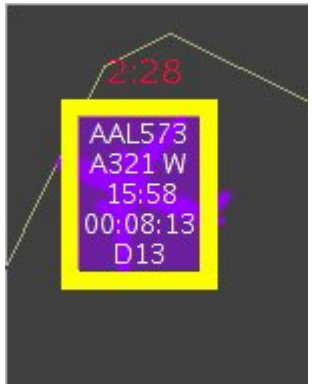
Controller can drag and rotate strip to expected position and orientation when it completes spool / pushback procedure

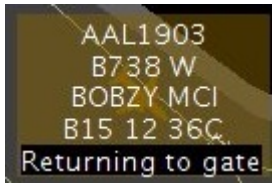


Hollow icons can also be rotated and dragged to their expected position and heading

Intent / Reminders

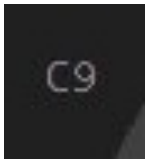
- Red “hold” border and yellow “hardstand” border communicates intent to other controllers
- Timers inform a controller how long a flight has been held
- Scratch pad used to communicate intent or convey important information to other controllers





Gate Status

- Owned (white) 

- Unowned (gray) 

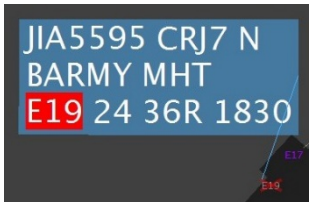
- Incoming Arrival (yellow) 

- Gate Conflict (purple) 

- Special Handling (red outline) 

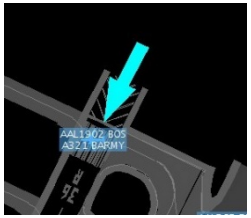
- Closed (red X) 

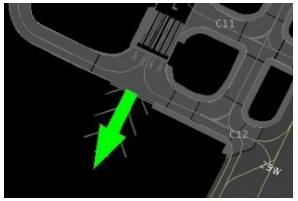
Gate Closure also reflected in flight datatag



Airport Status

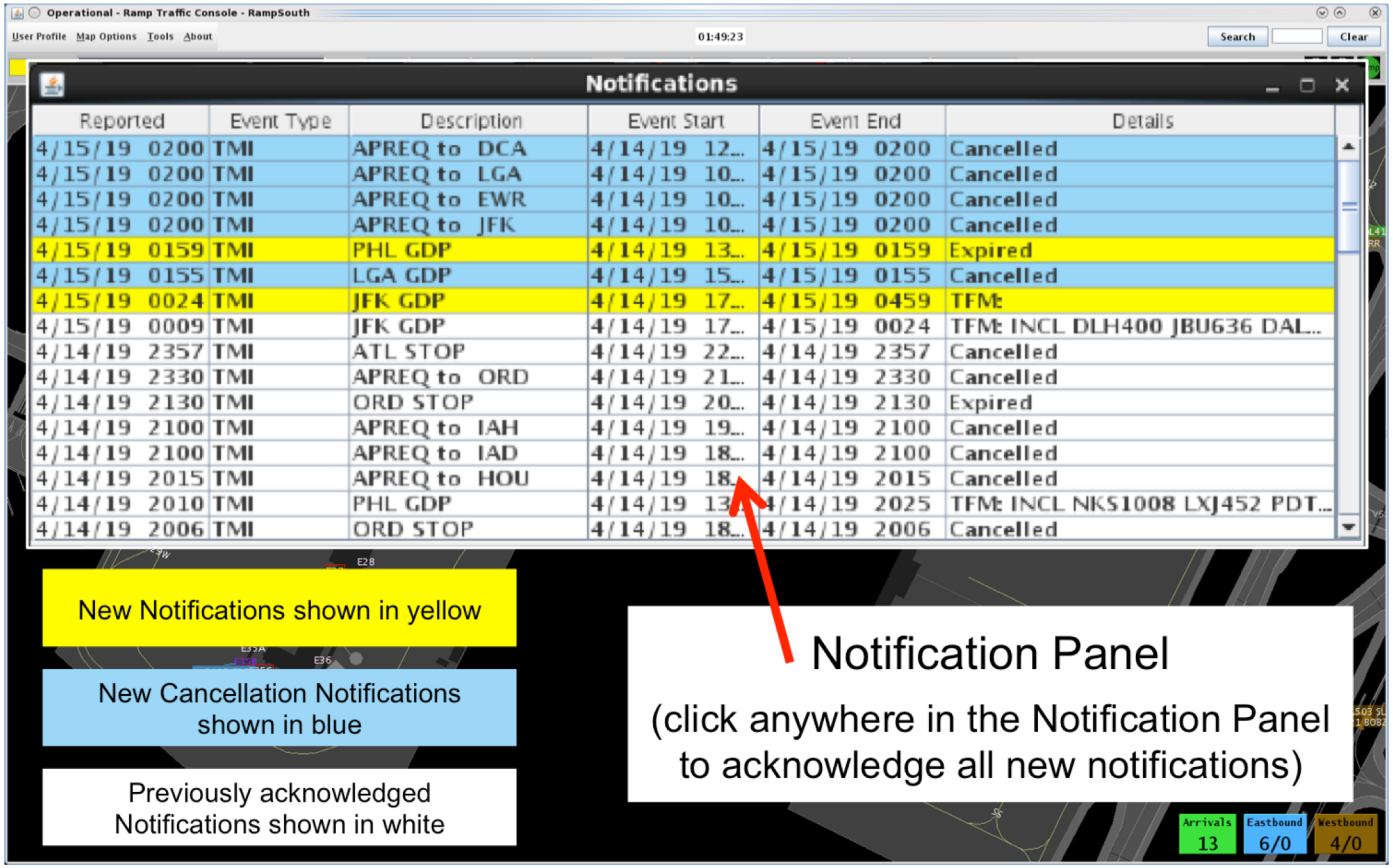
- Airport Configuration / Runway Utilization
- Runway Closure
- Taxiway Closure
- Ramp Status (Open, Pending Closure, Closure)
- Metering Status





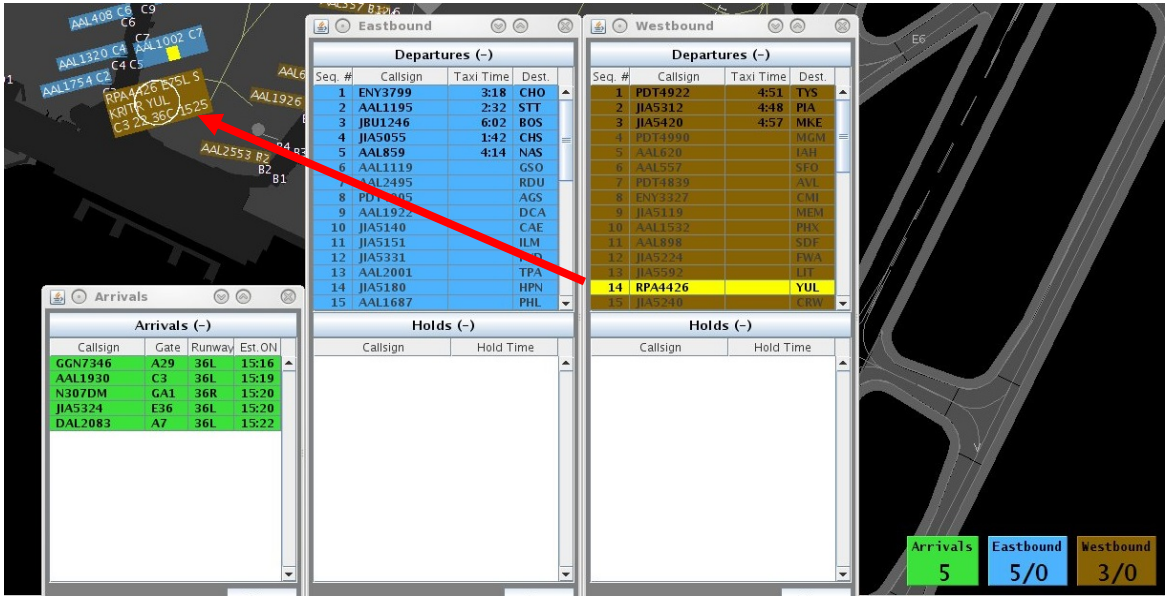
Notifications

- Airport or airspace events that affect multiple flights
  - Airport configuration, runway closures, departure fix closures, miles-in-trail restrictions, ground stops, APREQ schedules, metering status



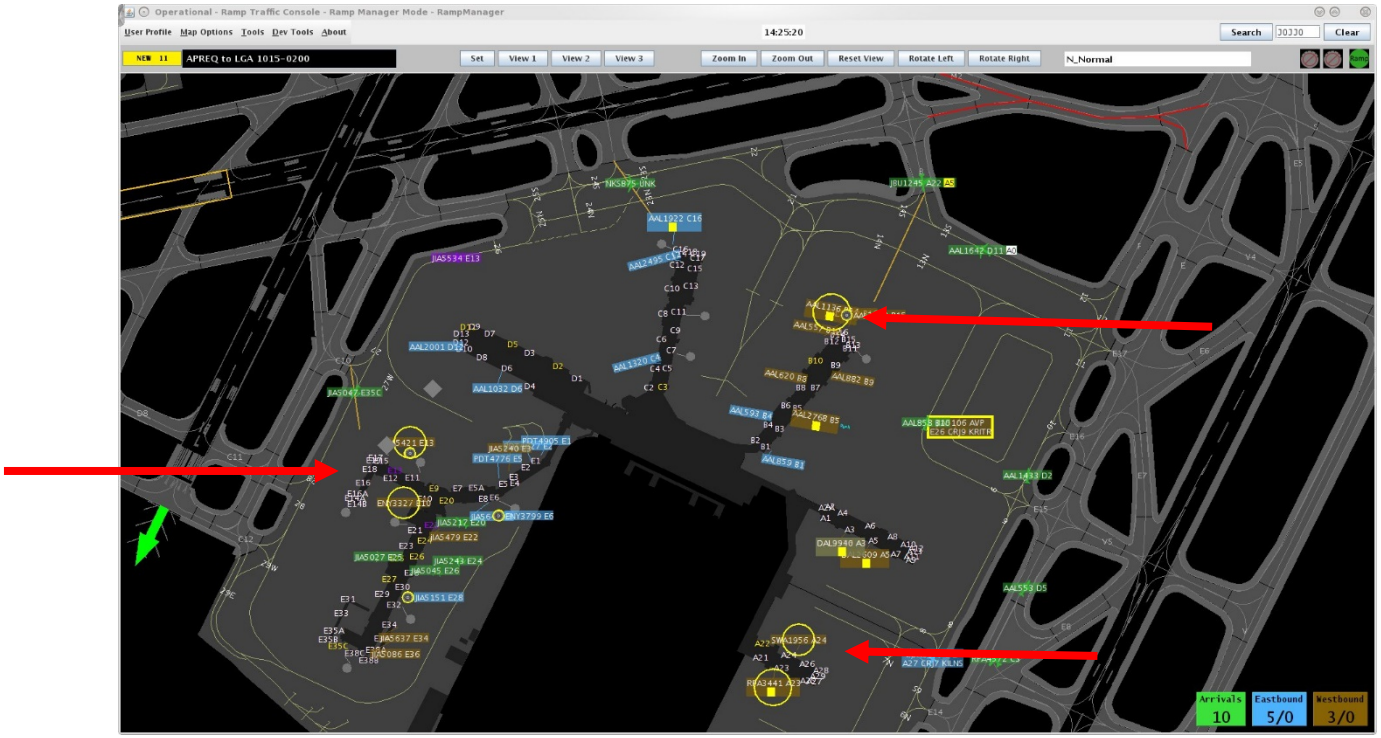
Count Lists

- Flights in each departure category (configurable) and Near Arrivals
- Clicking the count box details the list of flights in that category with pertinent information
  - Bold flights have pushed back
  - Gray flights are scheduled to push back
  - Selected flights also highlight on the map



Search

- Search by callsign, airline, airport, departure fix, arrival fix, or “GA”
- While typing, a “ping” is drawn around each matching flight



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Airport Customization

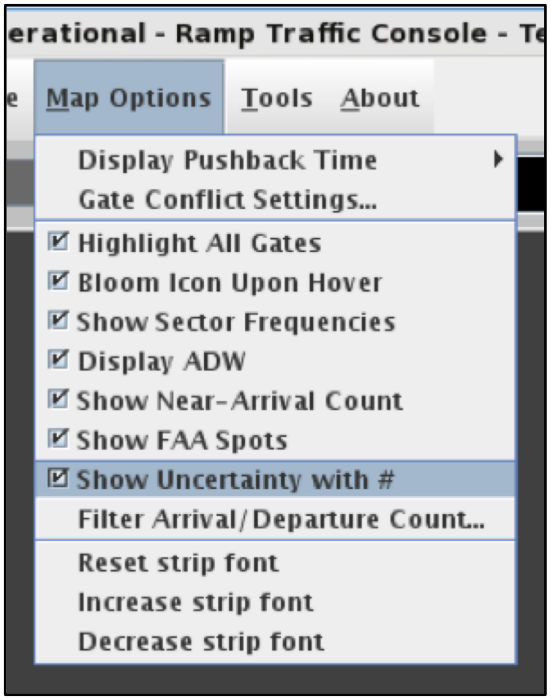
- Departure categories (e.g. Eastbound, Westbound)
- Colors (e.g. departure categories, arrivals, advisories, ...)
- Time thresholds
  - How soon before pushback to display flight strips
  - How soon before scheduled time to display advisory
  - Flight list population (Priority list, target creation list)
  - Target automatic removal
  - Etc…
- Flight strip orientation at each gate
- Pushback Direction options for each gate, if shown at all
- Count lists (look ahead window, sector filters)
- Data tag elements and location in the tag
- Metering mode – if any, advisories – TOBT vs TMAT
- Runway change due to Operational Necessity

Airport Surface Customization

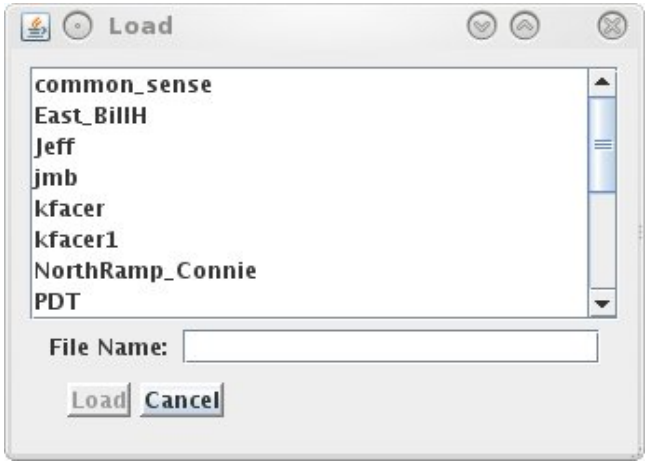
- Sectors
- Sector frequencies, if displayed on map
- Hardstands
- Drop / Hold points
- Spots
  - Internal to the ramp vs the FAA transition point
  - Some displayed the same name at multiple locations (e.g. ramp spot “27” displayed from north approach and south approach)
- Ramp bypass (e.g. “Mike-Charlie” at CLT)
- Flag “Special Handling” gates (e.g. “AirStart required”)
- Reposition locations

Display Customization

- Add options for configurability of the map and flights to provide users flexibility



- Allow users to save their preferences



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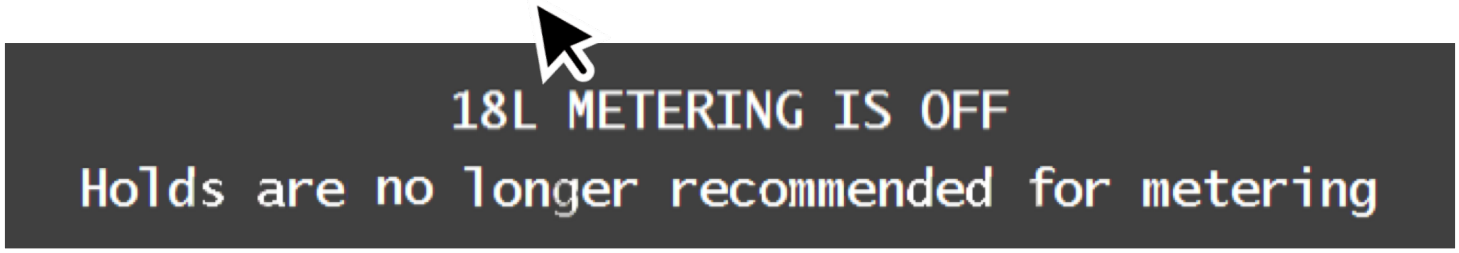
Active Metering

- Scheduling algorithm needs to have tolerances for when to activate and de-activate metering – advisories flickering on and off when at the “cusp” of metering was very distracting to controllers
- Controllers want surface metering to be per-runway, not airport-wide
- Controllers want to be notified when surface metering is de-activated for each runway



Flight Ready

- Pilot ready time entries are **critical** for surface metering.
  - No way to get those times except user inputs
- Selecting “Hold” or “Pushback Flight” sends a notification to the scheduler that the flight is ready

Expected Hold Times

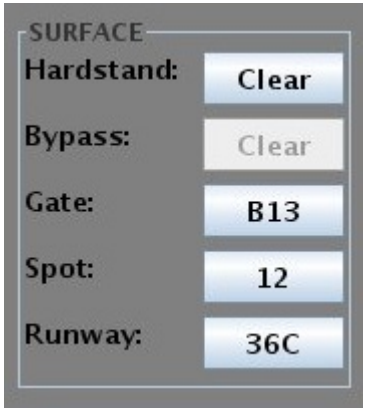
- Ramp Controllers want to know expected times for metering holds
- “Uncertain” flights (e.g. with no EOBT) have higher uncertainty and may have fluctuating gate advisories
  - Controllers can optionally display “#” instead of a time

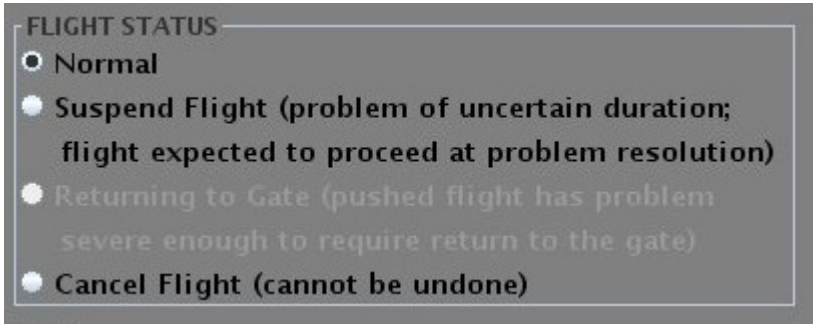
Advisories

- Advisories for non-TMI flights are only displayed when surface metering is enabled
- Advisories for TMI flights are always displayed, even when surface metering is disabled
- Ramp Manager/Controller can exempt a non-TMI flight from metering or set a priority status

Improving Accuracy

- The user can provide additional intent information if needed; e.g., additional hold time
  - Notification is sent to the scheduler, which updates its schedule accordingly
  - Additional hold time will be reflected in new advisory
- Updating surface usage and flight status improves scheduler predictions and scheduler accuracy





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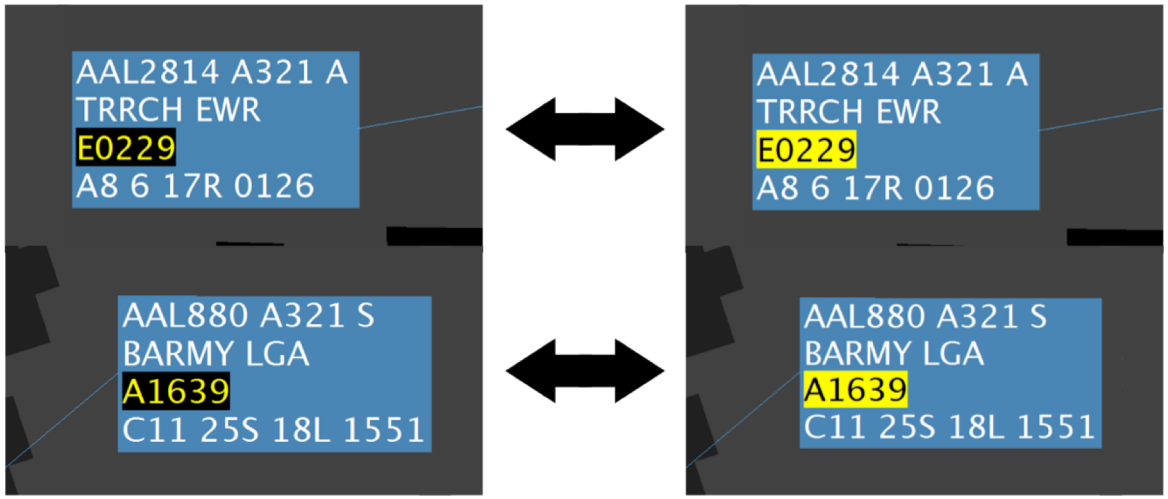
Human Factor Principles

- Judicious use of color
  - Red for stops/closures, yellow for TMI alerts
  - Avoid too many colors, shading nuances
- Consistency (e.g. use of borders or data tag fields)
- Affordances (a visual cue that offers an indication of how an object functions; e.g. the count boxes look like buttons and have a responding action to a mouse click)
- Salience (the quality of being noticeable; e.g. an APREQ turns red on the strip if the flight leaves the gate without a time)
- Keeping pertinent information in focus (e.g. hover to view full strip – no need to look at auxiliary display)
- Alerts that need to be acknowledged use peripheral vision (e.g. blinking alerts in flights strips)

Flight Notification Principles

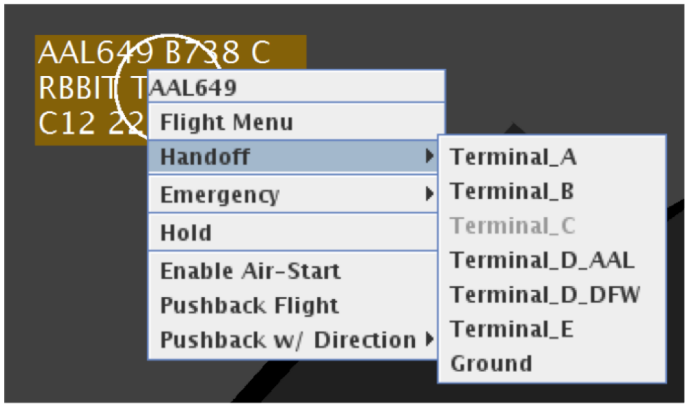
- Proximity principle: Flight strips get notification instead of central list to keep information in the field of view
- Flashing/alternating alerts flights are detectable with peripheral vision to attract Controller attention
- Clicking acknowledges the notification (turns off flashing)
- Only the flight owner / sector Controller receives and acknowledges the blinking alert instead of everyone

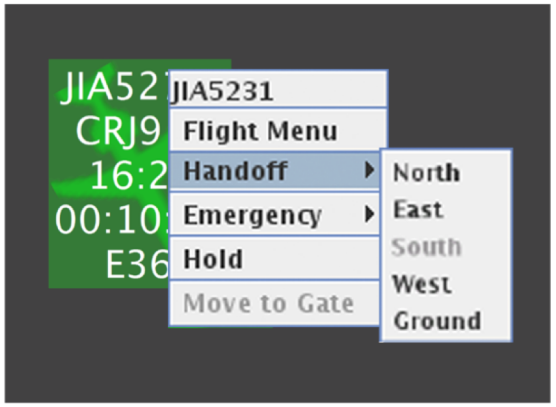


Alternating black and yellow highlighting to create blinking alert

Less is More when Mouse-Clicking (1)

- Ramp environment is fast-paced and users don't have time to make complicated entries
- Reduce physical workload: Fewer mouse clicks
  - Automate handoffs between sectors
  - Detect pushbacks from surveillance when able
  - Detect pushback location from surveillance rather than making Controllers manually move flight icons to expected pushback locations

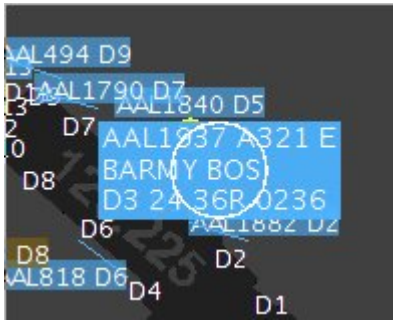




E.g., Handoffs are too complicated/time consuming to do for each flight

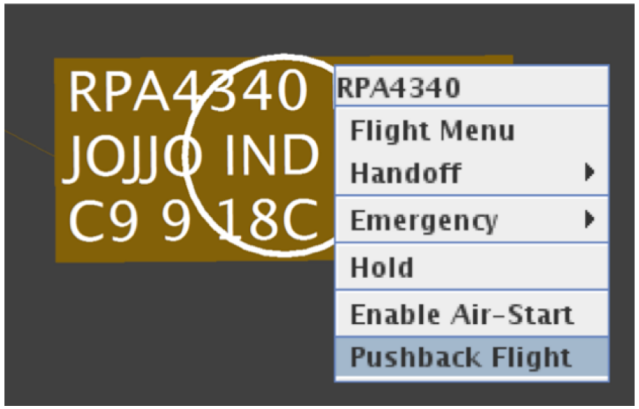
Less is More when Mouse-Clicking (2)

- “Bloom” on mouse hover allows controllers to keep map zoomed out for greater situational awareness but able to see flight details without clicking

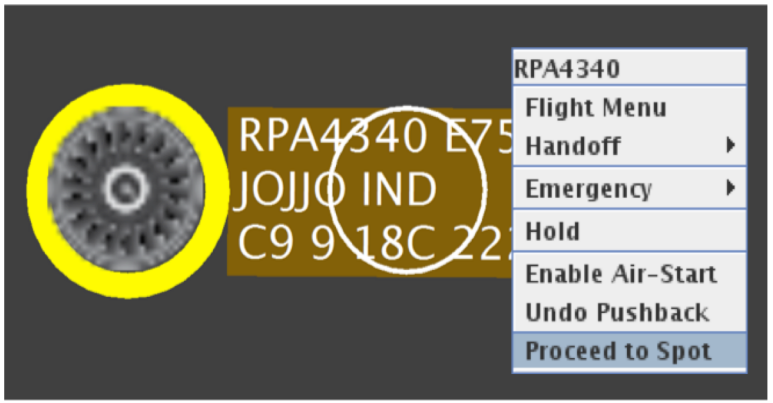


Logical Menus: Right-Click Menu

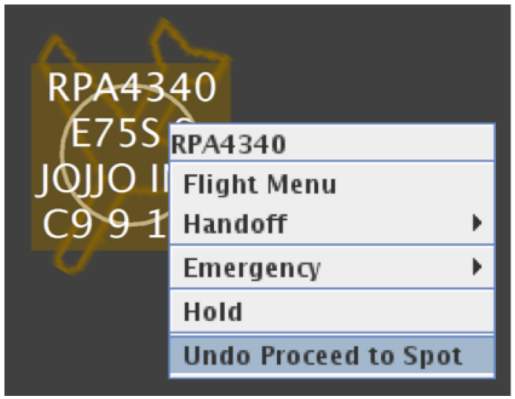
Options displayed are relevant for flight's current state.



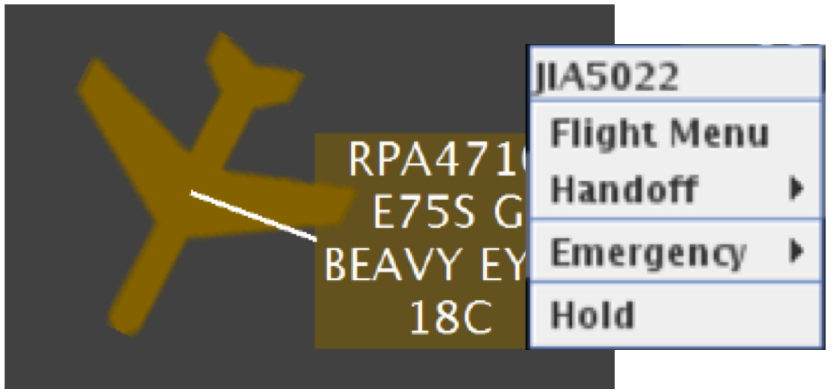
Flight Strip Parked at Gate, prior to Pushback



Pushback/Spool-Up State w/ Attached Engine Icon



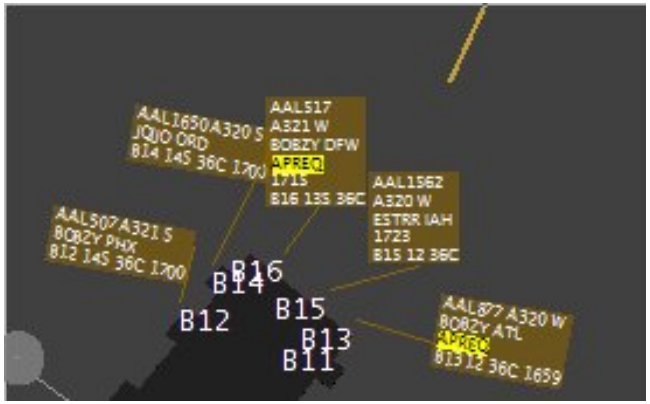
No Surveillance: Hollow Icon



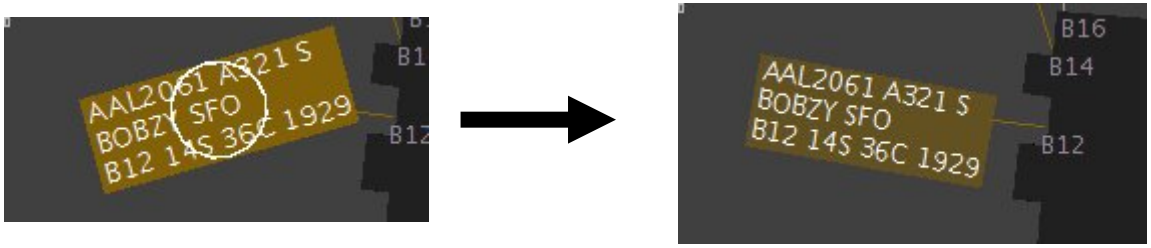
Surveillance Data: Solid Icon

Readability

- Many iterations with users to define font style and size
- Horizontal vs vertical orientation of strips at the gate set for each gate to reduce overlap



- Strips can be rotated, allowing controller to adjust overlap (circle shows region to grab)



Readability

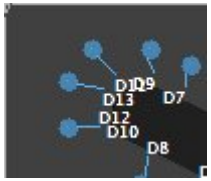
- Ability to drag a flight strip away from the gate to avoid overlap

- Ability to drag a flight data tag away from the icon to avoid overlap; dragging tag back over icon re-attaches it

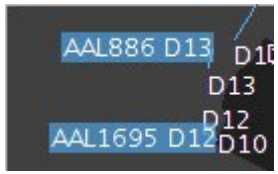
Zoom

- Five zoom levels show different levels of detail

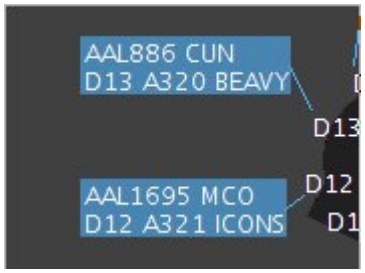
Colored disk with no text when zoomed out to full airport view



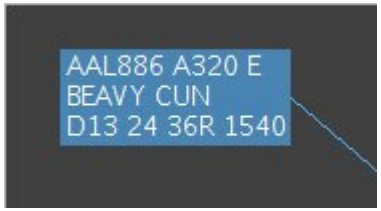
First zoom level - Single line of text with callsign and gate



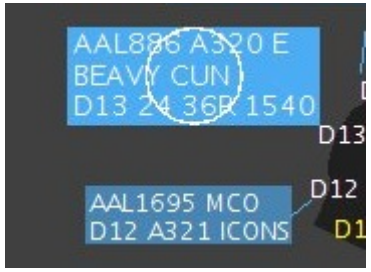
Second zoom level - Two lines of text line with callsign, destination gate, actype, fix



Third zoom level - Full text of callsign, actype, owner, fix, destination gate, spot, runway, gate time

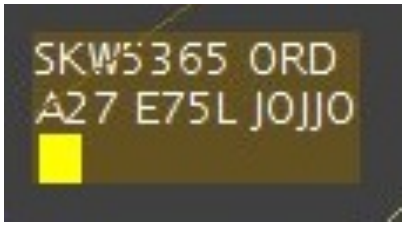


Bloom zoom - Full text independent of zoom level when flight is selected



Notifications Needed at Far Zoom

- Ramp Controllers need to be aware of pertinent information but don't need to see the data all the time and so don't want the clutter of unneeded data
- Colored block notify the controller the flight has important information; controller can zoom in or bloom the strip if he wants/needs to see the data
- Yellow and red blocks correspond to their respective TMI fields, and white indicates a scratch pad entry
- Multiple blocks display if appropriate



Abandoned: Touch Screens

- On-going maintenance to keep them calibrated
- Arm-length distance to screen too close for large screens
- Fatigue is a serious problem with large screens
- Finger not as precise as a mouse, especially for zoomed-out displays or gentlemen with larger fingers
- Accidental touches hard to undo
- Reduced amount of functionality available
  - Finger: long and short press, swipe, pinch
  - Mouse: single and double click, drag, right mouse menu, mouse wheel
- “Cheetos factor” (dirty fingers make screens filthy/gross)

Agenda

- Field Evaluations
- Feature Set for Situational Awareness
- Customization
- Surface Metering
- Design Principles
- Challenges
- Wish List

Challenges (1)

- Flight matching
  - TFM, FBFM, SFDPS, STARS, ASDEX, FlightStats, Airlines, …
- Data Feeds vs. Out-the-Window
  - Knowing when in-gate arrival is parked at the gate vs towed elsewhere
  - Knowing when to display departure at the gate vs waiting for it to be towed from alternate location
- Gate conflicts
  - Uncertainty in knowing when aircraft is at the gate
  - Uncertainty in pushback times
- Noise in surface surveillance around gates

Challenges (2)

- Inaccurate/erroneous incoming data
- Differences in company policy for “OUT” event
- Only have gate assignments from participating airlines
- Controllers had different preferences on when they wanted to see large hold advisories in advance of flight pushback. E.g. if a flight had a 44 minute advisory, some controllers wanted to see that “44 min” to give them awareness of the flight’s status, while others found the “44 min” to be a distraction and didn’t want to see information until closer to when they would expect to interact with the flight

Agenda

- Field Evaluations
- Feature Set for Situational Awareness
- Customization
- Surface Metering
- Design Principles
- Challenges
- Wish List

Wish List (1)

- Tugs
  - Display
  - Impacts metering
- Deicing
  - Display pads
  - Assign flights to deicing stations
  - Cannot meter during deicing
- Diverted flights
- Finer control on gate status: blocked vs out-of-service
- Ramp Manager notified if Ramp Controller has not acknowledged an alert
- User-customizable flight data tags (what fields display on what lines)

Wish List (2)

- Add customization to count lists
  - Time ranges
  - Colors based on time range
- Set strip pushback locations to match out-the-window
- Add option to not display unowned strips
- Draw on spot the list of flights assigned to that spot
- Provide aircraft types available for assignment to a gate
- History of scratchpad entries
- Customize gates that provide the “Air Start” menu option
- Allow spots to be closed
- Option to show time values in local time instead of UTC (per airport)

Questions?