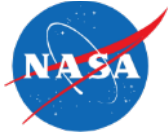


Ramp Traffic Console (RTC) Lessons Learned

NASA ATD-2 Industry Workshop

**Yoon Jung (NASA ATD-2)
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Lindsay Stevens (NASA ATD-2)
Debi Bakowski (NASA/SJSU ATD-2)**



- **Field Evaluations**
- **Minimum Feature Set for Situational Awareness**
- **Ramp Manager Traffic Console (RMTC)**
- **Customization**
- **Surface Metering**
- **Design Principles**
- **Challenges**
- **Wish List**



- **Field Evaluation**
- **Minimum Feature Set for Situational Awareness**
- **Ramp Manager Traffic Console (RMTC)**
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- **Design Principles**
- **Challenges**
- **Wish List**



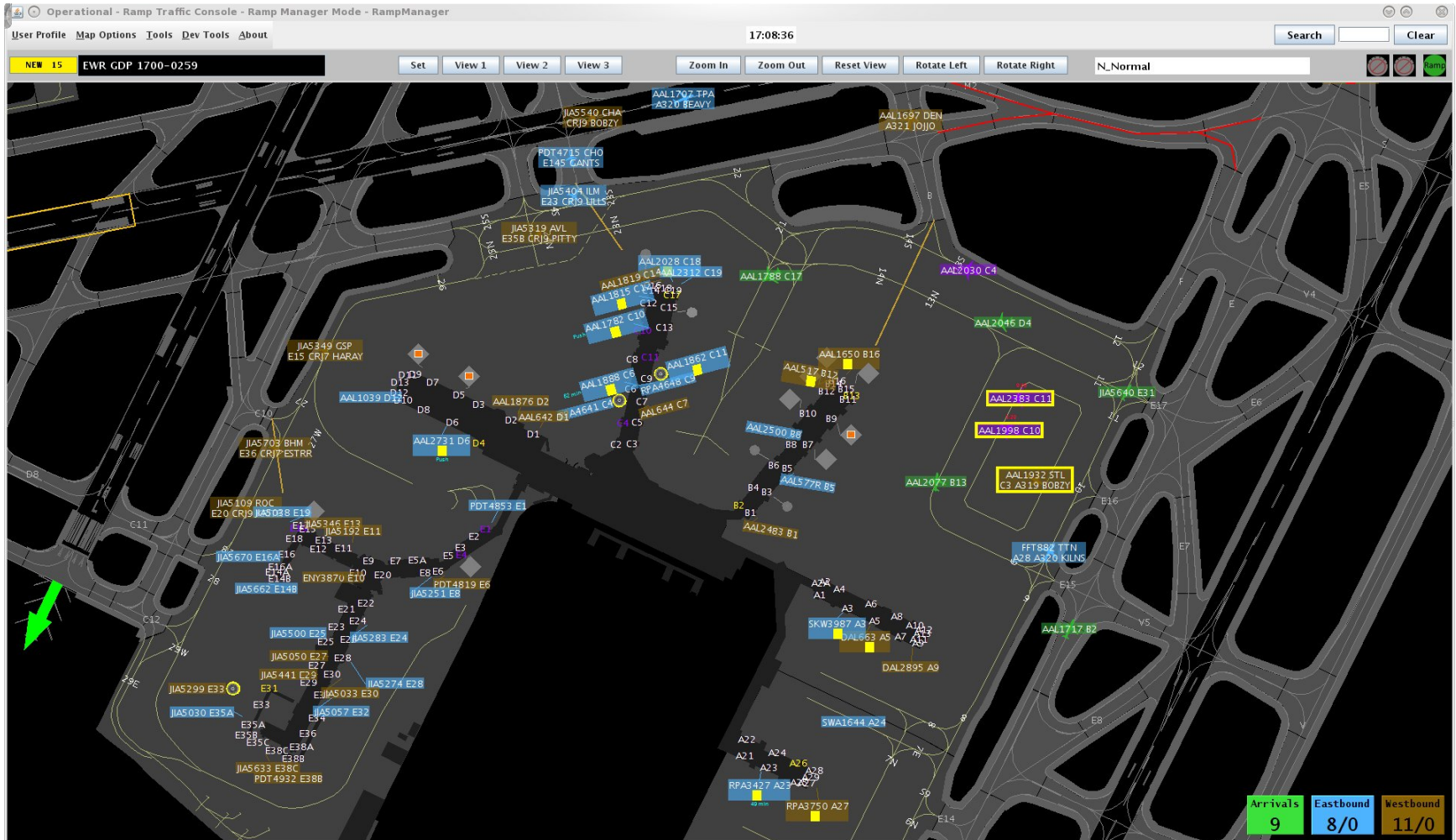
- 10 *Engineering* Shadow Evaluations over 15 months were not as impactful as 3 *Operational* Shadow Evaluations over 3 months.
- Operational Shadow Evaluation period was not long enough to address the sheer amount of feedback we received.
- Why? Because when the users had the chance to see/use the tool 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.

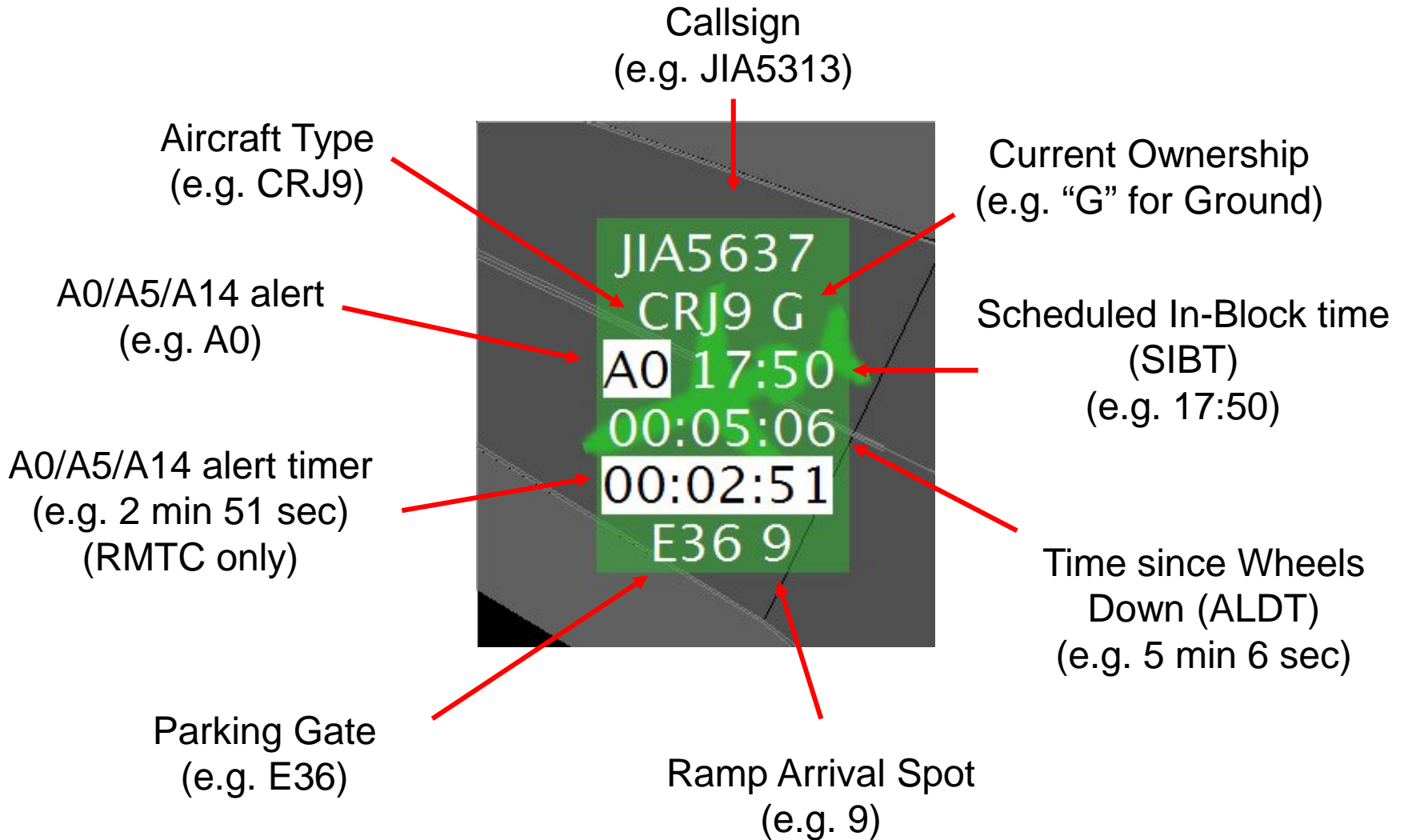


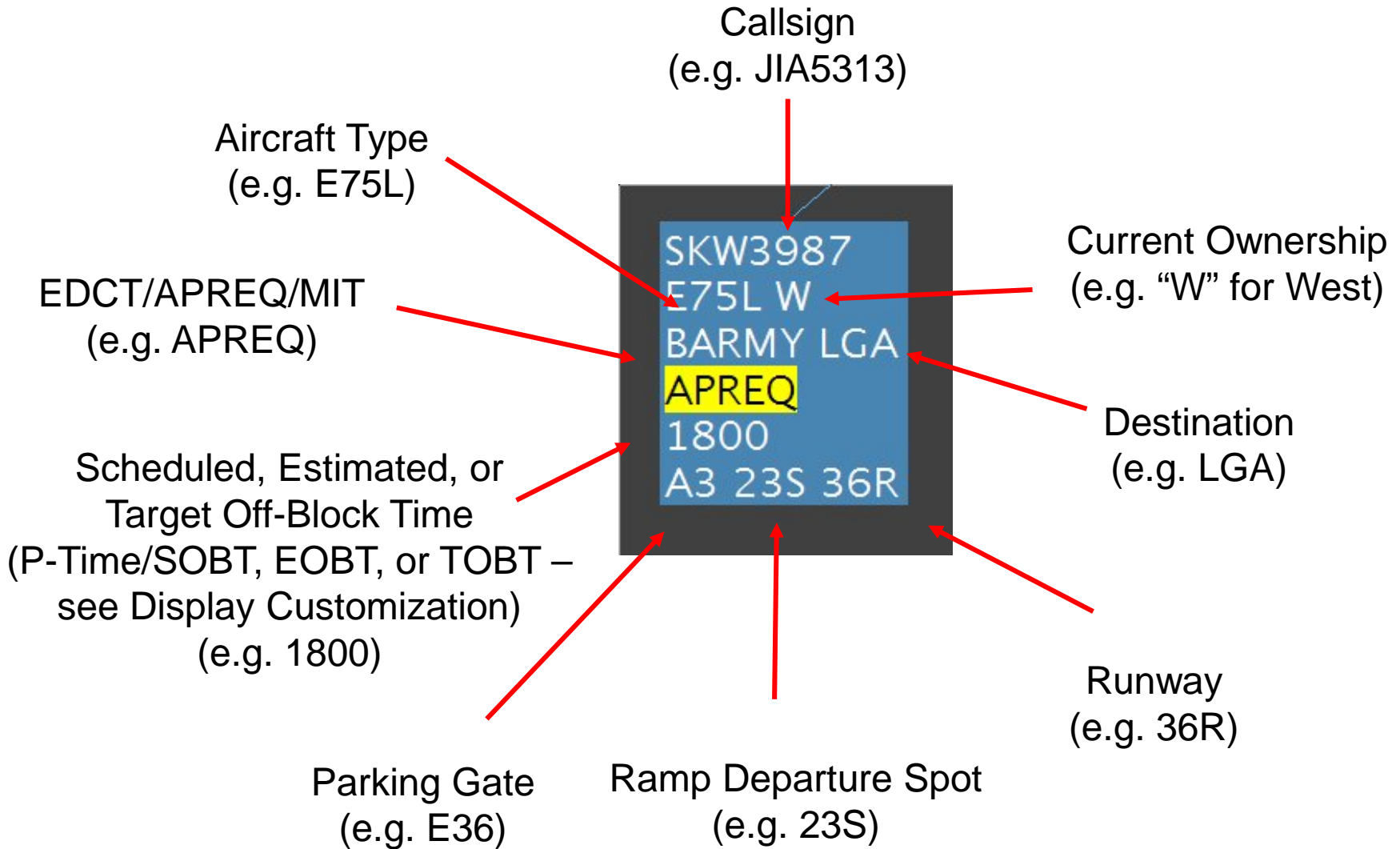
- Field Evaluations
- **Minimum Feature Set for Situational Awareness**
- Ramp Manager Traffic Console (RMTC)
- Customization
- Surface Metering
- Design Principles
- Challenges
- Wish List



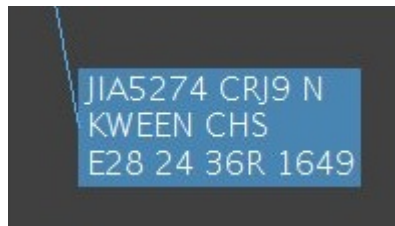
- Minimum feature set to provide situational awareness
 - Flight Data
 - Flight State
 - Aircraft Type
 - Flights to Expedite
 - Flights with TMIs
 - Target Management
 - Target Location / Orientation
 - Intent
 - Gate Status
 - Airport Status
 - Notifications
 - Count Lists
 - Search







At gate
not pushed back



At gate
spooling up /
pushing back



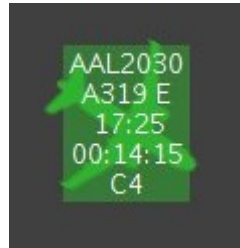
Pushed back,
proceeding to spot
– no tracks



Taxiing –
tracked



Taxiing –
tracked



At gate, subsequent
departure will be using
the aircraft



Taxiing –
lost tracks



Aircraft (no flight
associated with
the piece of metal)





B757 aircraft



Heavy aircraft

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

Arrival Example

ARRIVAL DETAILS	
Tail:	N562UW
SIBT:	1916
Taxi Time:	00:06:27
Next Departure:	
SOBT:	
Destination:	

Departure Example

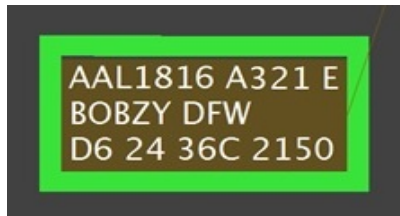
DEPARTURE DETAILS	
Tail:	N680AW
P-Time:	1843
LOBT:	1842
EOBT:	1840
TOBT:	
TMAT:	1841
APREQ:	1855
EDCT:	
MIT:	
Departure fix:	KILNS
Previous fix:	

A0, A5, A14

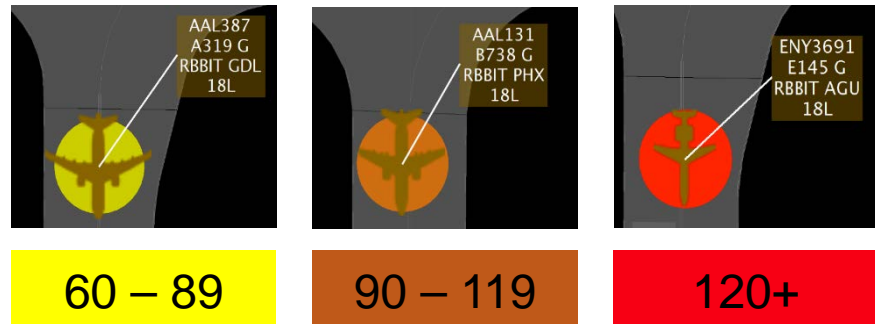
Emergency



Priority



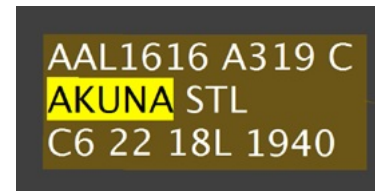
Long on Board



- 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

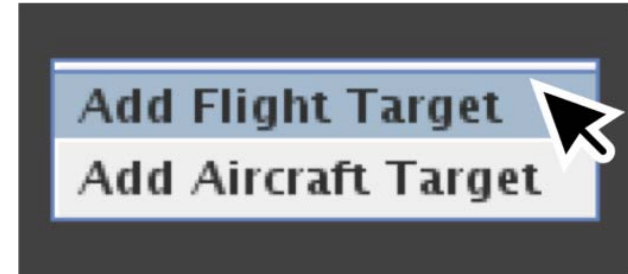


- APREQ but no release time – still at gate
- APREQ but no release time – pushed back
- APREQ with release time
- EDCT
- APREQ and EDCT
- Changed APREQ or EDCT
- Ground Stop
- Miles-in-Trail
- Departure fix change
- Departure fix closure

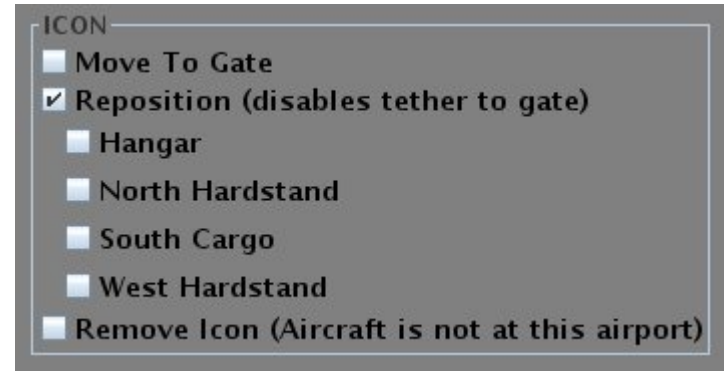


Examples of TMI indicators

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



- Strip/icon management
 - Reposition flight/aircraft to another location; repo location set in data tag, flight pops to selected location
 - Move flight/aircraft to gate
 - Remove target

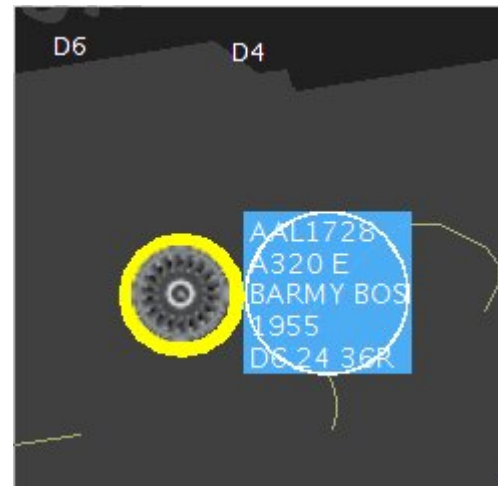


- DON'T show General Aviation/Cargo flights in their ramp
 - A distraction/clutter to controllers

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

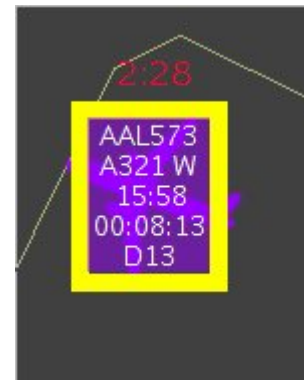


Controller can drag and rotate strip to expected position and orientation when it completes spool / pushback procedure



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

- 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



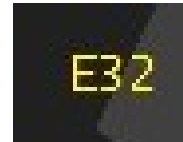
- Owned (white)



- Unowned (gray)



- Incoming Arrival (yellow)



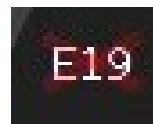
- Gate Conflict (purple)



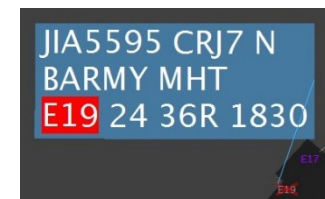
- Special Handling (red outline)
(e.g. "Air Start required")



- Closed (red X)



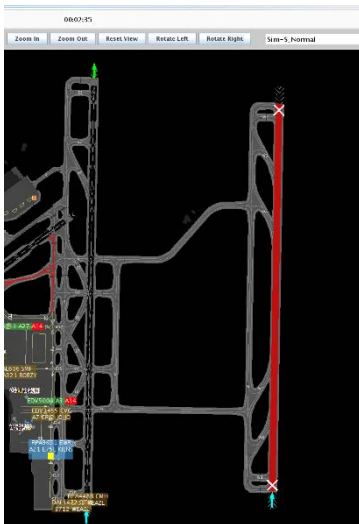
Gate Closure also reflected in flight datatag



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



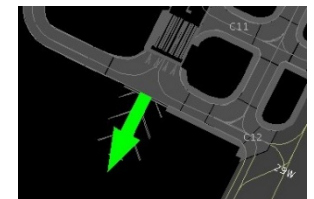
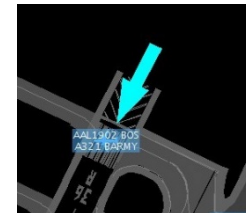
Runway utilization, metering status, ramp status



Runway closure



Taxiway closure



Arrival and departure flow indicators

- 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

Operational - Ramp Traffic Console - RampSouth

User Profile Map Options Tools About 01:49:23 Search Clear

Reported	Event Type	Description	Event Start	Event End	Details
4/15/19 0200	TMI	APREQ to DCA	4/14/19 12...	4/15/19 0200	Cancelled
4/15/19 0200	TMI	APREQ to LGA	4/14/19 10...	4/15/19 0200	Cancelled
4/15/19 0200	TMI	APREQ to EWR	4/14/19 10...	4/15/19 0200	Cancelled
4/15/19 0200	TMI	APREQ to JFK	4/14/19 10...	4/15/19 0200	Cancelled
4/15/19 0159	TMI	PHL GDP	4/14/19 13...	4/15/19 0159	Expired
4/15/19 0155	TMI	LGA GDP	4/14/19 15...	4/15/19 0155	Cancelled
4/15/19 0024	TMI	JFK GDP	4/14/19 17...	4/15/19 0459	TFM
4/15/19 0009	TMI	JFK GDP	4/14/19 17...	4/15/19 0024	TFM INCL DLH400 JBU636 DAL...
4/14/19 2357	TMI	ATL STOP	4/14/19 22...	4/14/19 2357	Cancelled
4/14/19 2330	TMI	APREQ to ORD	4/14/19 21...	4/14/19 2330	Cancelled
4/14/19 2130	TMI	ORD STOP	4/14/19 20...	4/14/19 2130	Expired
4/14/19 2100	TMI	APREQ to IAH	4/14/19 19...	4/14/19 2100	Cancelled
4/14/19 2100	TMI	APREQ to IAD	4/14/19 18...	4/14/19 2100	Cancelled
4/14/19 2015	TMI	APREQ to HOU	4/14/19 18...	4/14/19 2015	Cancelled
4/14/19 2010	TMI	PHL GDP	4/14/19 13...	4/14/19 2025	TFM INCL NKS1008 LXJ452 PDT...
4/14/19 2006	TMI	ORD STOP	4/14/19 18...	4/14/19 2006	Cancelled

New Notifications shown in yellow

New Cancellation Notifications shown in blue

Previously acknowledged Notifications shown in white

Notification Panel
(click anywhere in the Notification Panel to acknowledge all new notifications)

Arrivals 13 Eastbound 6/0 Westbound 4/0

- Flights in each departure category 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

The screenshot displays the ATD2 interface with three main panels: Arrivals, Eastbound Departures, and Westbound Departures. A red arrow points from the 'RPA4426' entry in the Eastbound Departures list to its location on the map. The Westbound Departures list also highlights 'RPA4426'.

Callsign	Gate	Runway	Est. ON
GGN7346	A29	36L	15:16
AAL1930	C3	36L	15:19
N307DM	GA1	36R	15:20
JIA5324	E36	36L	15:20
DAL2083	A7	36L	15:22

Seq. #	Callsign	Taxi Time	Dest.
1	ENY3799	3:18	CHO
2	AAL1195	2:32	STT
3	JBU1246	6:02	BOS
4	JIA5055	1:42	CHS
5	AAL859	4:14	NAS
6	AAL1119		GSO
7	AAL2495		RDU
8	PD14		AGS
9	AAL1922		DCA
10	JIA5140		CAE
11	JIA5151		ILM
12	JIA5331		PAI
13	AAL2001		TPA
14	JIA5180		HPN
15	AAL1687		PHL

Seq. #	Callsign	Taxi Time	Dest.
1	PD14922	4:31	ITS
2	JIA5312	4:48	PIA
3	JIA5420	4:57	MKE
4	PD14990		MGM
5	AAL620		IAH
6	AAL557		SFO
7	PD14839		AVL
8	ENY3327		CMH
9	JIA5119		MEM
10	AAL1532		PHX
11	AAL898		SDF
12	JIA5224		FWA
13	JIA5592		LIT
14	RPA4426		YUL
15	JIA5240		CRW

At the bottom right, a status bar shows: Arrivals 5, Eastbound 5/0, Westbound 3/0.

- Field Evaluations
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- RMTC has all the functionality as RTC plus a few extra features
 - Ability to set a list of priority flights for an entire day instead of flight-by-flight as flights show up on the display
 - Ability to set the Ramp Status (Open, Pending Closure, Closure)
 - TMI fields don't flash
 - A0/A5/A14 timer in arrival data tags (not in RTC)
 - No visual indicator of “owned” or “unowned” gates (on RTC, owned gates are white and unowned gates are gray; on RMTC, all gates are white)
 - No visual indicator of “owned” or “unowned” flights (on RTC, owned flights are a slightly brighter shade than unowned flights)

- **Field Evaluations**
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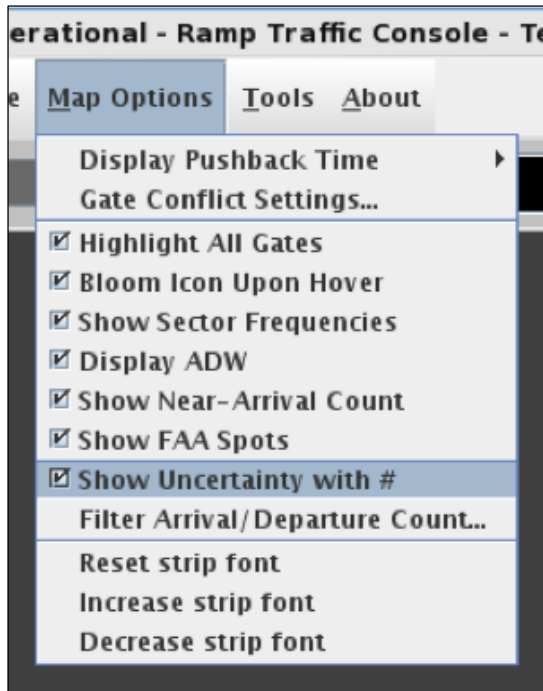


- Departure categories (e.g. Eastbound, Westbound)
- Colors (e.g. departure categories, arrivals, advisories, ...)
- Time thresholds
 - How soon before pushback to display flight strips
 - How soon before scheduled time to display advisory
 - Flight list population (Priority list, target creation list)
 - 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
- Whether airport supports metering; if so, metering advisory to display: TOBT or TMA

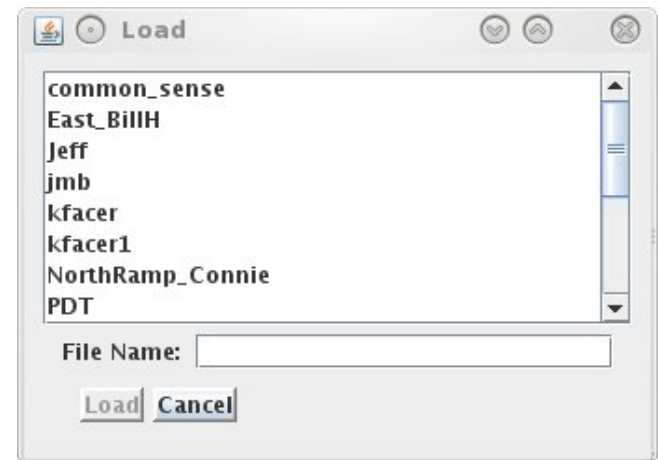
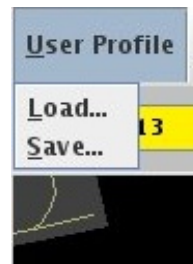


- Runway change due to Operational Necessity
- Sector boundaries
- Sector frequencies, if displayed on map
- Hardstands
- Drop / Hold points
- Spots
 - Internal to the ramp vs the FAA transition point
 - Some displayed the same name at multiple locations (e.g. ramp spot “27” displayed from north approach and south approach)
- Ramp bypass (e.g. “Mike-Charlie” at CLT)
- List of “Special Handling” gates (e.g. “Air Start required” at CLT), if any
- Reposition locations

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



- Allow users to save their preferences





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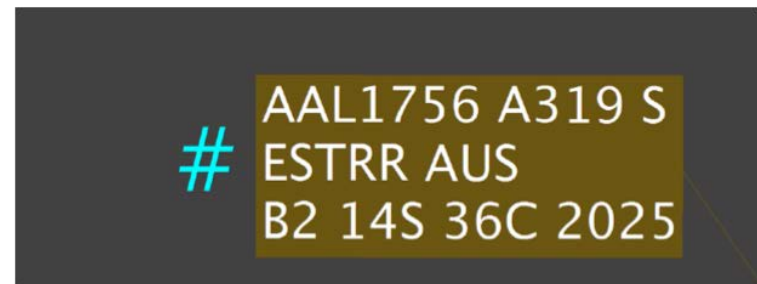
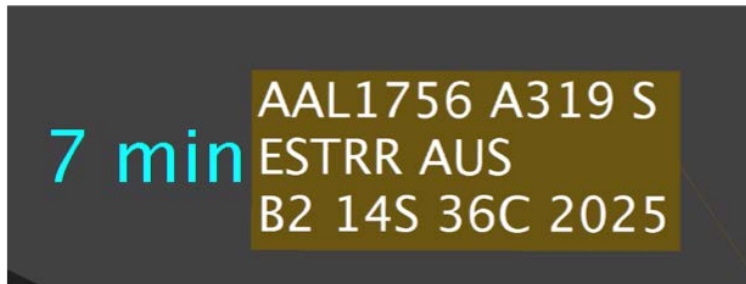
- Scheduling algorithm needs to have tolerances for when to activate and de-activate metering – advisories flickering on and off when at the “cusp” of metering was very distracting to controllers; if scheduling process does not provide the tolerance, the display needs to create its own
- Controllers want surface metering to be per-runway, not airport-wide
- Controllers want to be notified when surface metering is de-activated for each runway

18L METERING IS OFF
Holds are no longer recommended for metering

- 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



- 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 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

METERING STATUS
<input type="checkbox"/> Exempt from metering
PRIORITY STATUS
<input type="checkbox"/> Priority Flight

- 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

SURFACE	
Hardstand:	Clear
Bypass:	Clear
Gate:	B13
Spot:	12
Runway:	36C

FLIGHT STATUS	
<input checked="" type="radio"/>	Normal
<input type="radio"/>	Suspend Flight (problem of uncertain duration; flight expected to proceed at problem resolution)
<input type="radio"/>	Returning to Gate (pushed flight has problem severe enough to require return to the gate)
<input type="radio"/>	Cancel Flight (cannot be undone)

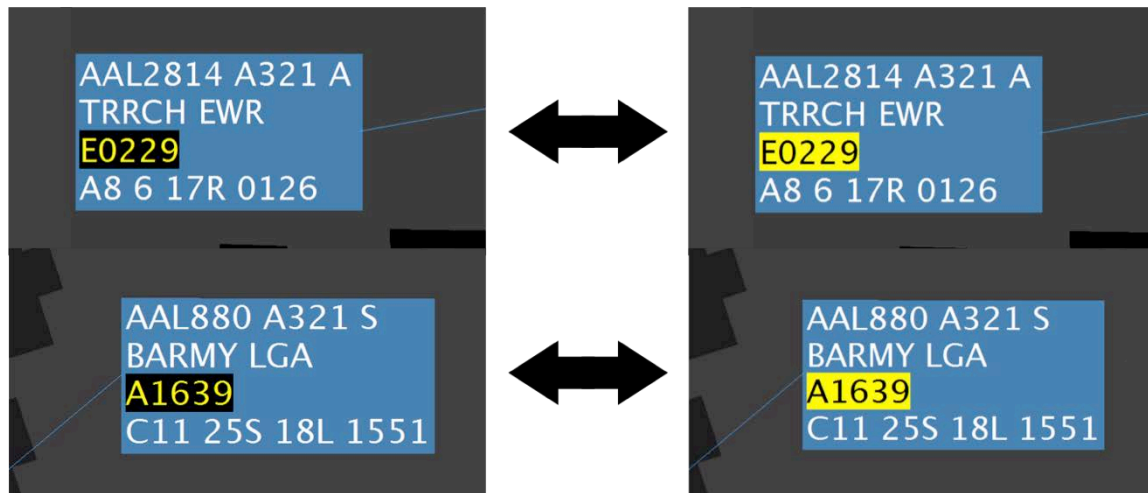


- **Field Evaluations**
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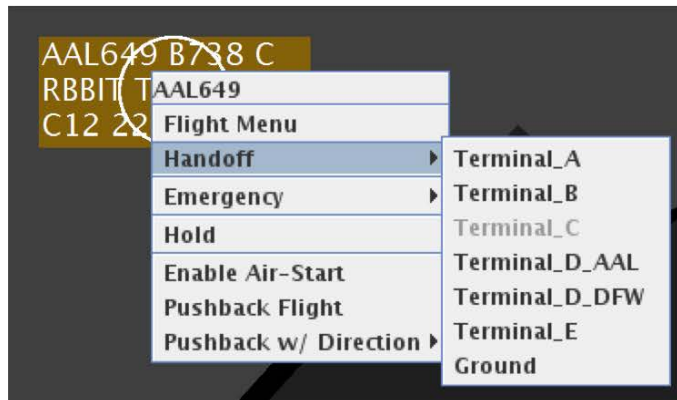
- Judicious use of color
 - Red for stops/closures, yellow for TMI alerts
 - Avoid too many colors, shading nuances
- Consistency
- Affordances (a visual cue that offers an indication of how an object functions; e.g. the count boxes look like buttons and have a responding action to a mouse click)
- Saliency (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)

- 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 Ramp Controller attention
- Clicking acknowledges the notification (turns off flashing)
- Only the flight owner / sector Controller receives and acknowledges the blinking alert instead of everyone



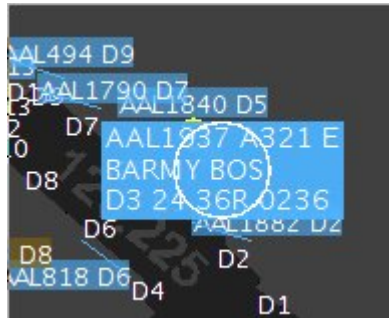
Alternating black and yellow highlighting to create blinking alert

- 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

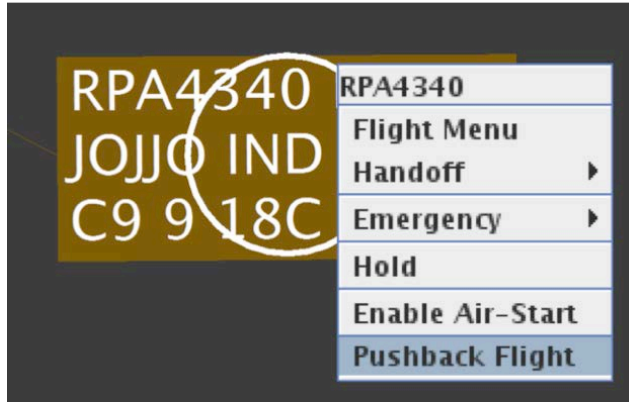


E.g., Handoffs are too complicated/time consuming to do for each flight

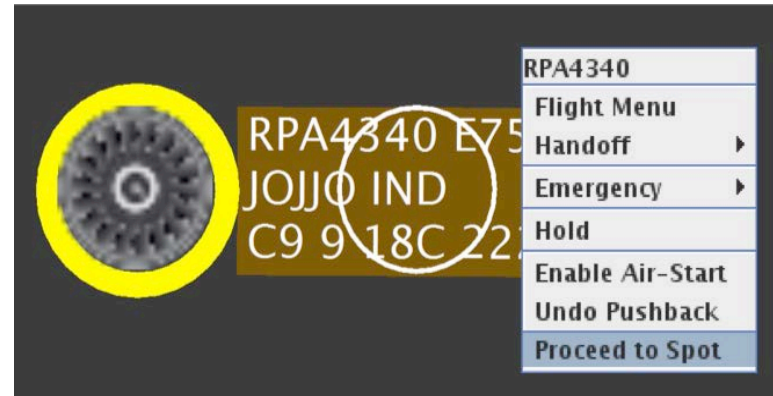
- “Bloom” on mouse hover allows controllers to keep map zoomed out for greater situational awareness but able to see flight details without clicking



Options displayed are relevant for flight's current state.



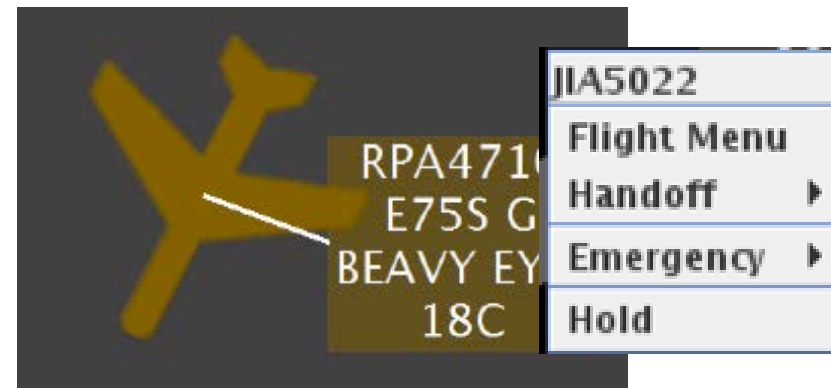
Flight Strip Parked at Gate, prior to Pushback



Pushback/Spool-Up State w/ Attached Engine Icon

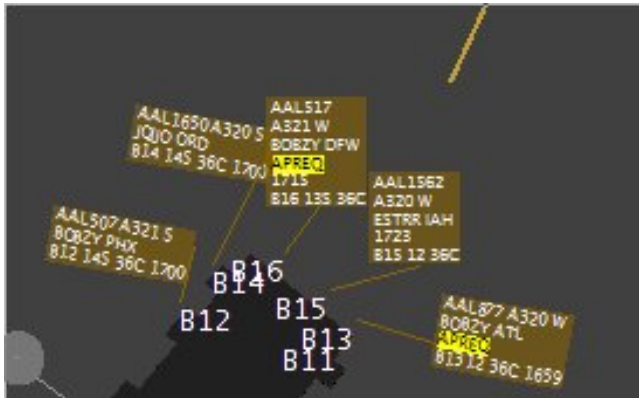


No Surveillance: Hollow Icon

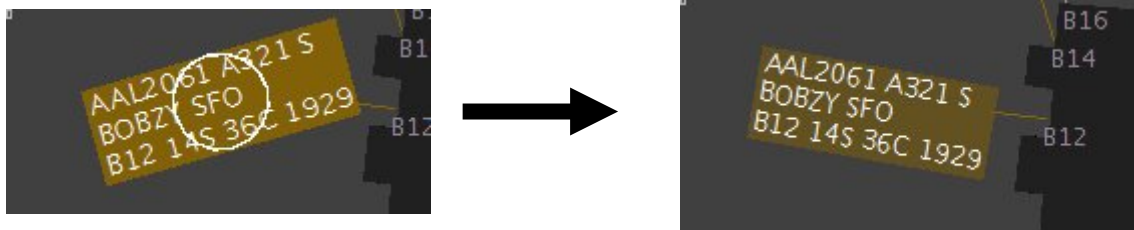


Surveillance Data: Solid Icon

- 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)



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

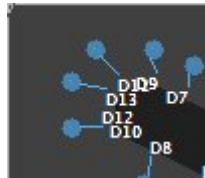


- Ability to drag a flight data tag away from the icon to avoid overlap; dragging tag back over icon re-attaches it

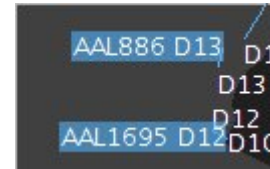


- Five zoom levels show different levels of detail

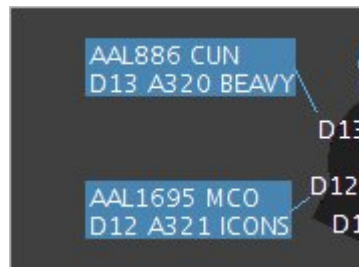
Colored disk with no text
when zoomed out to
full airport view



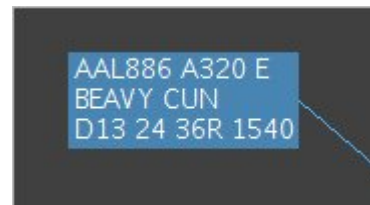
First zoom level -
Single line of text with
callsign and gate



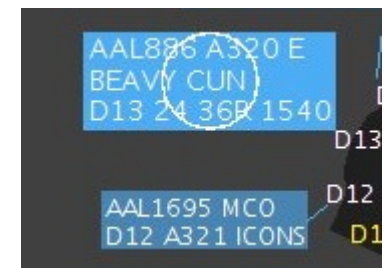
Second zoom level -
Two lines of text line with
callsign, destination
gate, actype, fix



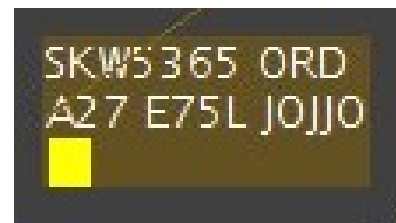
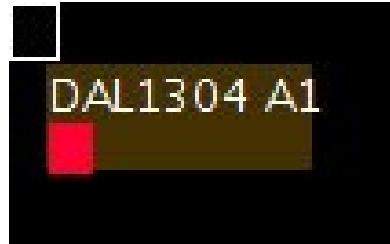
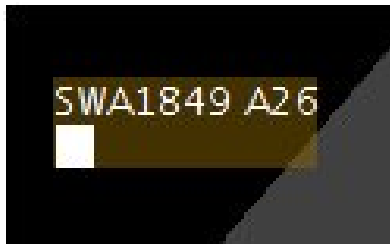
Third zoom level -
Full text of
callsign, actype, owner,
fix, destination
gate, spot, runway, gate time



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

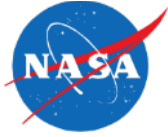


- Ramp Controllers need to be aware of pertinent information but don't need to see the data all the time and so don't want the clutter of unneeded data
- Colored blocks notify the controller the flight has important information; controller can zoom in or bloom the strip if he wants/needs to see the data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





- 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)



- **Field Evaluations**
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- **Wish List**



- 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



- 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

44 min

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- 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)



- Send request to ATCT to hold arrivals in AMA
- 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, not per user)

Questions?

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