



NASA Research to Support the Airlines

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Airline Operations Research Laboratory

NASA Ames Research Center

October 19, 2017

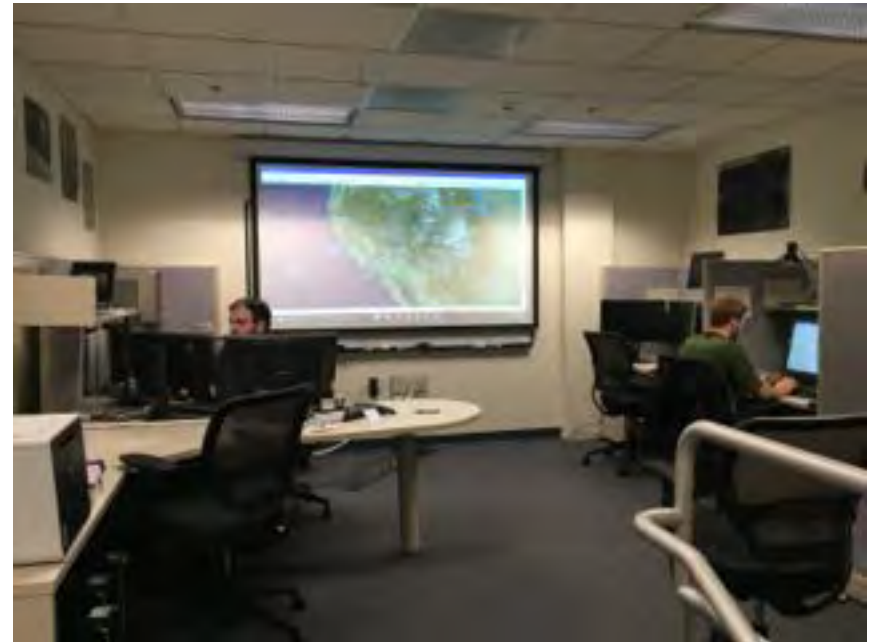
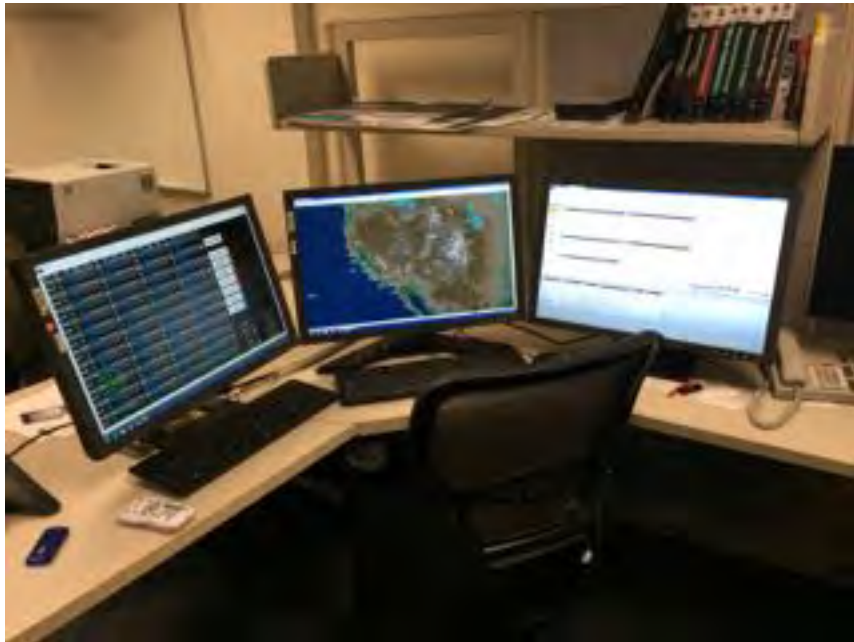
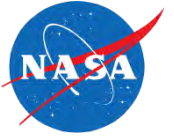


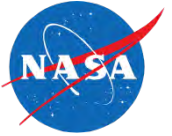
Airline Operations Research Group



- The purpose of the NASA Ames Airline Operations Research Group (AORG) is to perform airline operations research
 - Increase NASA's support of the airlines
- Laboratory created in 2015 in the Human Systems Integration Division
- AORG Projects:
 - Airline Operations Workshop
 - Ramp Incident Data Analysis
 - Turbulence Detection
 - Dispatcher Human Factors Study
 - Airline Operations Forum

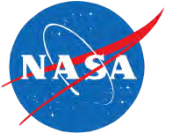
Airline Operations Research Group





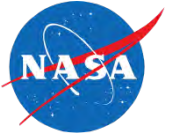
- Held an Airline Operations Workshop at NASA Ames in August 2016
 - About 200 attendees
 - Focused on NASA, FAA, and private sector innovations to support the airlines (AOC and flight deck)
 - Identified gaps where research is needed
 - Formed partnerships with airline industry
- Research themes
 - AOC simulation
 - Study dispatcher workload, situation awareness, errors
 - Display/system integration
 - Managing/accessing large information databases from multiple sources
 - Preferred routes

Airline Operations Research Forum



- The need for a collaborative online environment was suggested as a follow up to the Airline Operations Forum
- The AORG is creating the Airline Operations Forum to support discussion of industry problems
- NASA researchers will participate to review posts and suggest solutions
- The forum is membership access only (not open to the general public)
- It is moderated by NASA personnel and securely hosted on NASA servers
- The forum goes live on November 3, 2017

Airline Operations Research Forum



Welcome

Welcome to the Airline Operations Forum. This forum, sponsored by the National Aeronautics and Space Administration's (NASA) Ames Research Center, is for the airline industry, Federal Aviation Administration, NASA, airline industry organizations, and aeronautics research groups to identify and discuss airline operational issues. The goal of the forum is to raise airline industry issues that need attention with an aim to identifying possible corporate or government resources to address them. However, there is no assurance that by starting a topic on the forum, efforts will be made to solve it. This depends upon the availability of private or government funds and personnel.

Access to the forum is on a member-only basis. The contents of the forum are not available to the general public. Forum posts will be screened prior to publishing. We want participants to feel comfortable with raising and talking about possibly sensitive issues with each other. Please keep the discussions positive, respectful, and polite. Mention of political opinions and issues should be avoided.

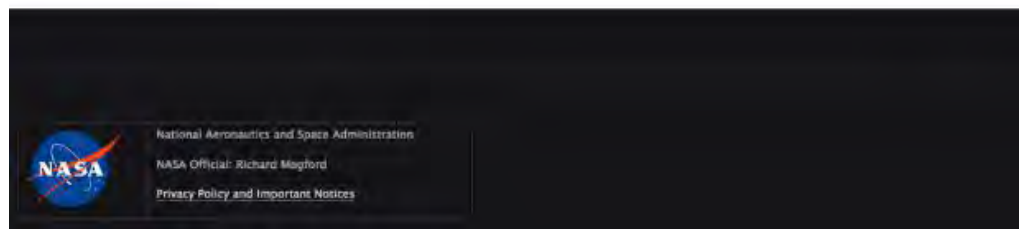
The identities of participants will be held in confidence. Of course, you can identify yourself in your posts, if you want. The text of the ongoing discussions will also be kept in confidence on the NASA server. When NASA identifies an issue for further follow up, the problem statement used for project planning will be shared and reviewed with the forum members prior to using it in an internal NASA document. Any specific or identifying information will be cleared with the specific participants prior to use by NASA.

We are starting the forum with a few basic topics. Members are invited to suggest new topics at any time to help organize the forum.

Please tell your co-workers and colleagues about the forum. We hope to build industry-wide participation for the forum as another place that you can discuss what is important to your operations, work, or research.

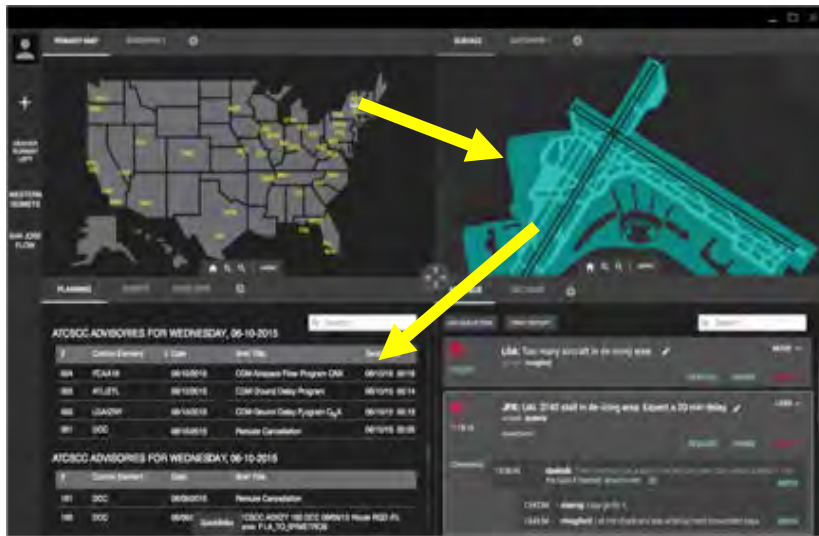
Please contact me if you have any questions.

Richard Mogford, Ph.D.
richard.mogford@nasa.gov
NASA Ames Research Center

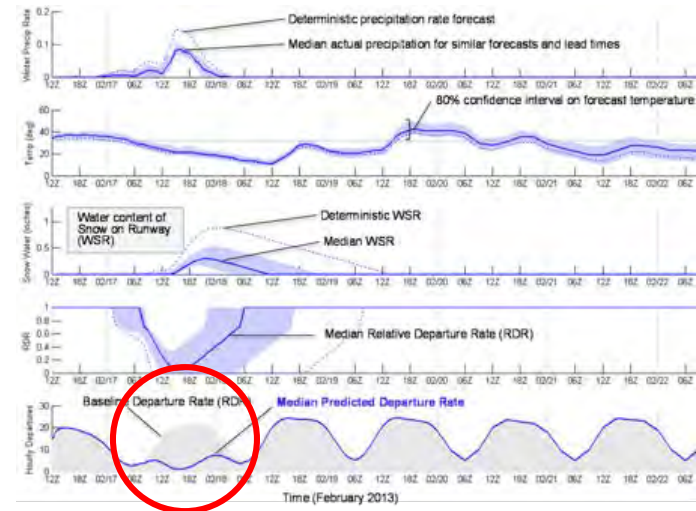


Flight Awareness Collaboration Tool

- Developing the “Flight Awareness Collaboration Tool” (FACT)
- Concentrates information about winter weather events on one display
- Includes predictive tools
- Supports collaboration between airline operations center, air traffic control, airport authority, and de-icing operators

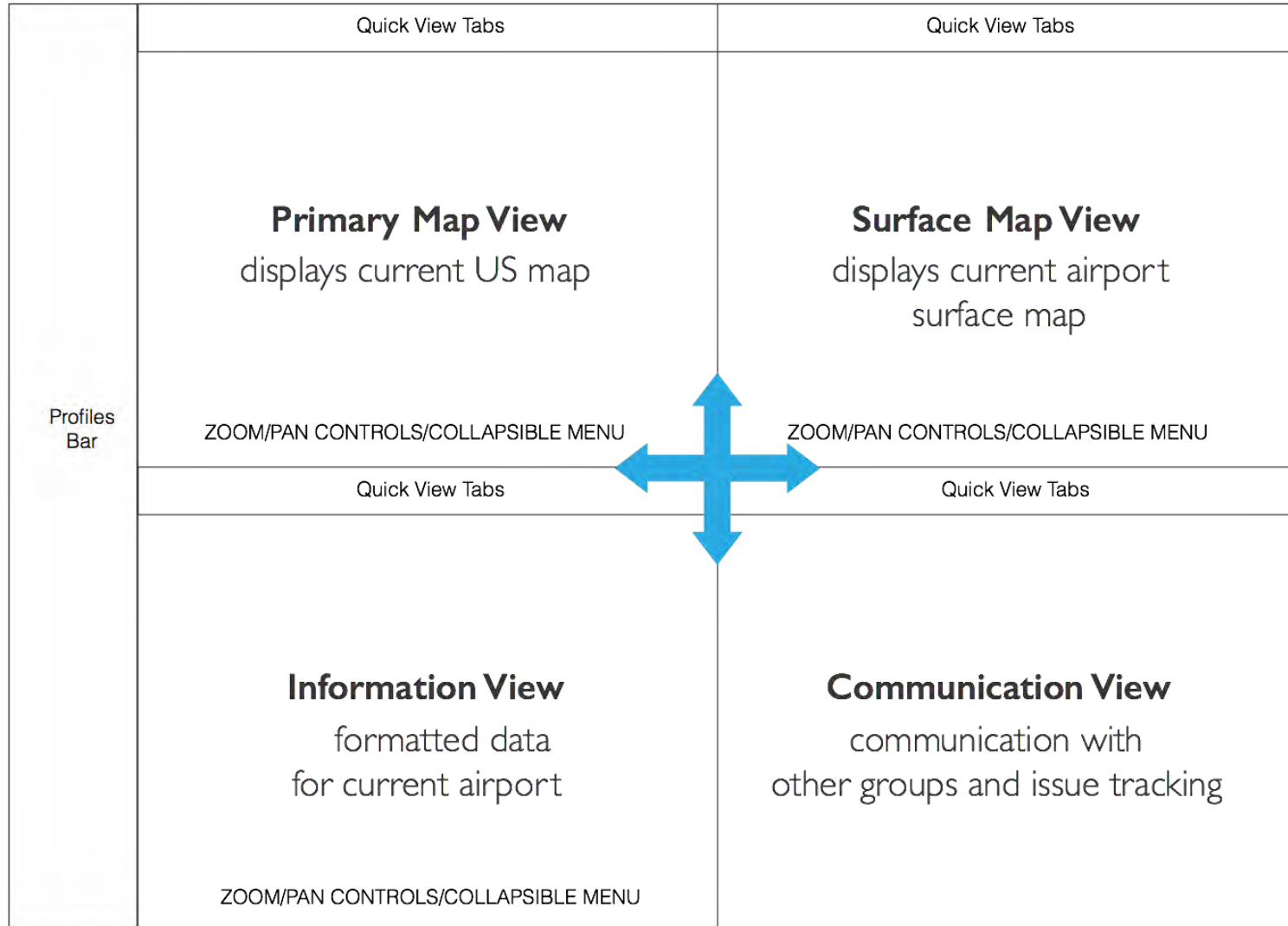


FACT Screen

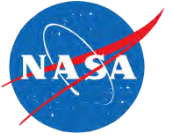


Winter Weather Airport Capacity Model

FACT User Interface Design



FACT User Interface Design



The screenshot displays the FACT User Interface with three main sections:

- PRIMARY MAP:** A map of the United States with various airports labeled. A yellow arrow points from the BOS/LGA area to the detailed view.
- SURFACE:** A detailed view of an airport terminal and runways, highlighted in cyan. A yellow arrow points from the map to this view.
- QUEUE:** A list of advisories for Wednesday, 06-10-2015. A yellow arrow points from the 'Send' button of the first advisory to the 'ADD QUEUE ITEM' button in the queue panel.

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

#	Control Element	Date	Brief Title	Send
004	FCAA16	06/10/2015	CDM Airspace Flow Program CNX	06/10/15 00:18
003	ATL/ZTL	06/10/2015	CDM Ground Delay Program	06/10/15 00:14
002	LGA/ZNY	06/10/2015	CDM Ground Delay Program CNX	06/10/15 00:13
001	DCC	06/10/2015	Reroute Cancellation	06/10/15 00:05

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

#	Control Element	Date	Brief Title
161	DCC	06/09/2015	Reroute Cancellation
160	DCC	06/09/2015	ATCSCC ADVZY 160 DCC 06/09/15 Route RQD /FL ame: FLA_TO_NYMETROS

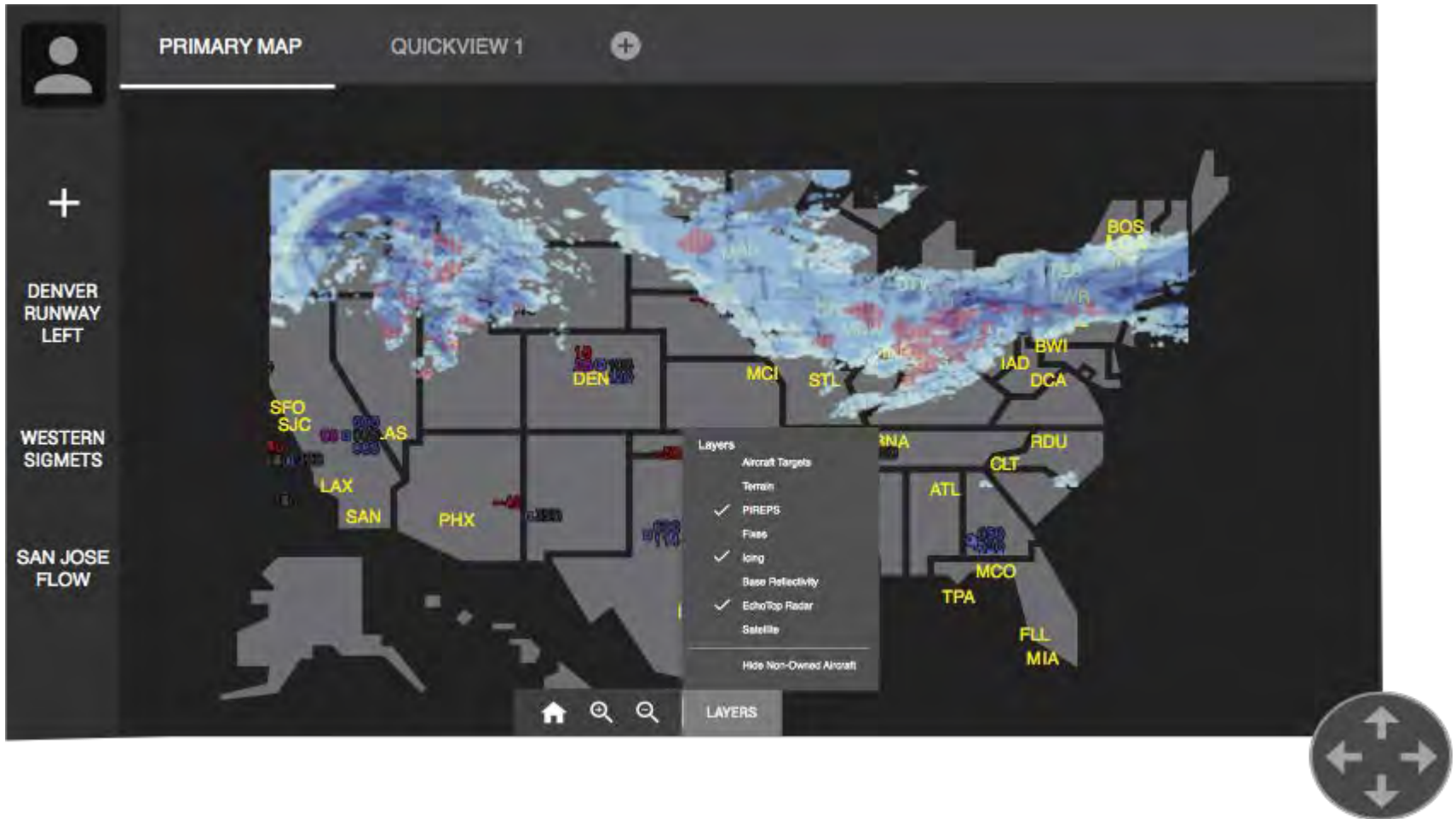
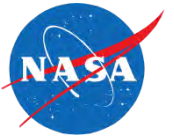
QUEUE:

- LGA: Too many aircraft in de-icing area.** (15:30:02) AUTHOR: imogford. Actions: RESOLVE, SHARE, DELETE.
- JFK: UAL 3740 stall in de-icing area. Expect a 20 min delay.** (11:18:16) AUTHOR: dpeknik. Actions: RESOLVE, SHARE, DELETE.

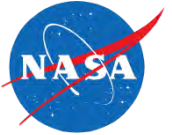
Comments:

- 13:30:45 dpeknik: There seems to be a stall in the de-icing area. Can we set a delay? I'll do the calls if needed. attachment
- 13:42:34 eleong: I say go for it.
- 13:42:34 imogford: Let me check and see what our next crew roster says.

FACT Primary Map View



FACT Surface Map View



The screenshot displays the FACT Surface Map View interface. At the top, there are tabs for "SURFACE" and "QUICKVIEW 1". Below the tabs, there is a search bar with the text "ARR: 28L/ R, DEP: 1L/ R" and an information icon. The main map area shows a teal-colored airport layout with several aircraft icons (white and yellow) and a yellow truck icon. A "6500" label is visible on the map. In the top right corner, there is a "CLT ISR" graph showing a line plot with the text "Last Update: 1215 04/17". A "Layers" menu is open in the center-right, listing the following options: "De-Icing Areas" (checked), "Airport Configurations" (checked), "Runway Closure Status" (checked), "Braking Action", and "RVR" (checked). Below the layers menu is a "Filter Non-Owned Aircraft" option. At the bottom left, there is a directional pad (compass) with four arrows. At the bottom center, there are icons for home, search, and zoom, along with a "LAYERS" button.

FACT Information View



PLANNING CHARTS QUICKVIEW 1 +

Search

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

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004	FCAA16	06/10/2015	CDM Airspace Flow Program CNX	06/10/15 00:18
003	ATL/ZTL	06/10/2015	CDM Ground Delay Program	06/10/15 00:14
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001	DCC	06/10/2015		06/10/15 00:05

ATCSCC ADVISORIES FOR WEDNESDAY, 06-10-2015

#	Control Element	Date	Brief Title
161	DCC	06/10/2015	
160	DCC	06/10/2015	DCC 06/09/15 Route RQD /FL

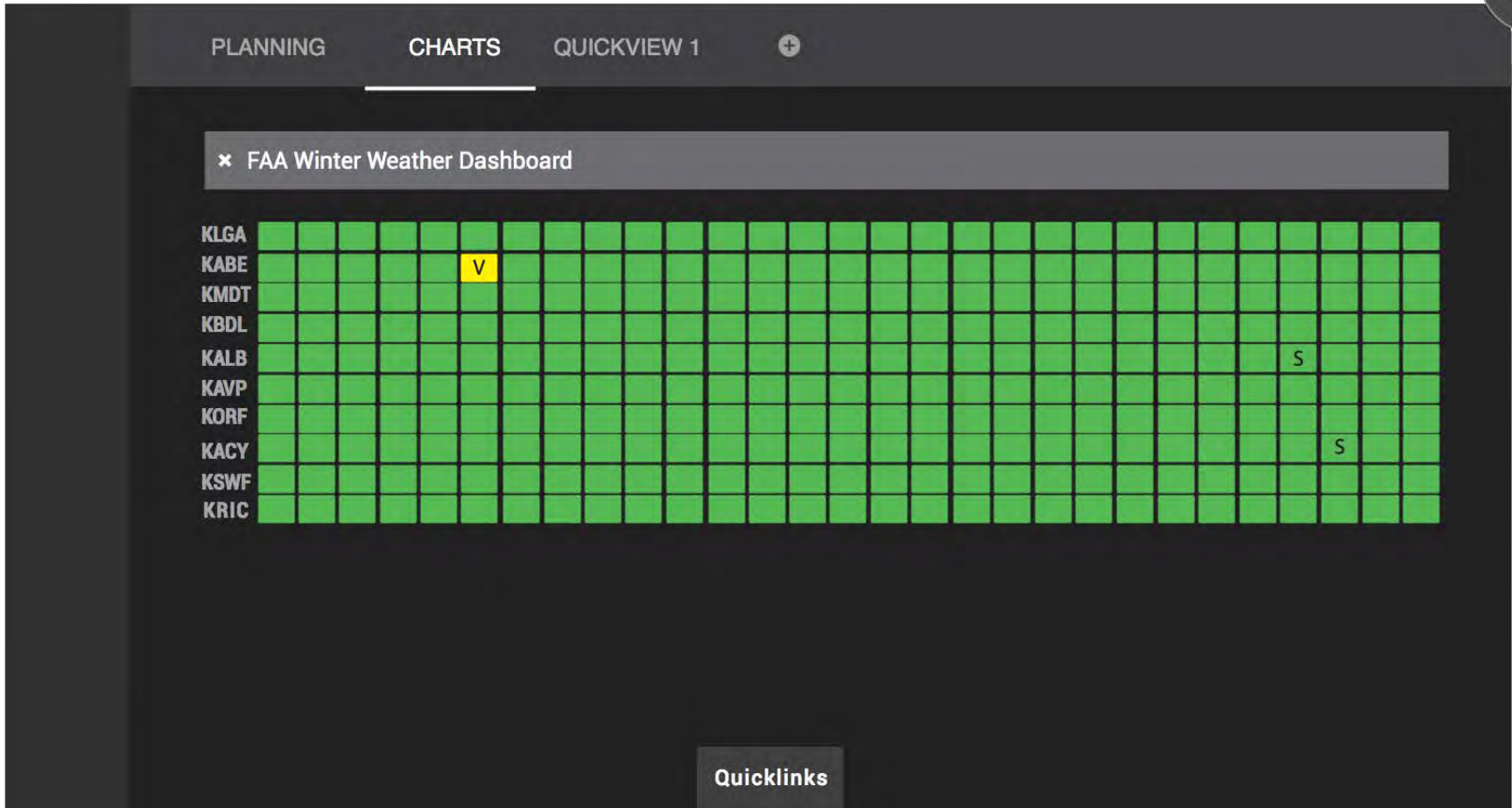
Quicklinks

- FAA OIS
- ✓ Aviation Weather Center
- FAA NOTAMs
- WWACM

Quicklinks

Name: FLA_TO_NYMETROS
Constrained area: ZJX/ZMA

FACT Information View (Graphical)



FACT Communication View (MyQueue)



MY QUEUE FACT CHAT +

ADD QUEUE ITEM PRINT REPORT Search

LGA: Too many aircraft in de-icing area. ✎ MORE ▾
AUTHOR: **rmogford**
15:30:02 RESOLVE SHARE DELETE

JFK: UAL 3740 stall in de-icing area. Expect a 20 min delay. ✎ LESS ▲
AUTHOR: **dpeknik**
11:18:16 SHARED WITH: RESOLVE SHARE DELETE

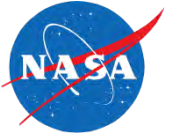
Comments:

13:30:45 **dpeknik:** Not sure how to deal with this one, any suggestions?
Here's the procedure. [attachment](#) 📎 REPLY

13:42:34 **eleong:** That's an old document I believe,

13:42:34 **rmogford:** I'll update and send a new document to the team. REPLY

FACT Communication View (Chat)



MY QUEUE **FACT CHAT** 6

41 users online

- TMC Group
- 2 LGA Dispatchers
- GMTO
- AFP Position Managers
- 4 Information Team
- LGA Controllers
- JFK Controllers

Hello there..
Richard Mogford 8:56:14 AM

Hello there...
Richard Mogford 8:56:14 AM

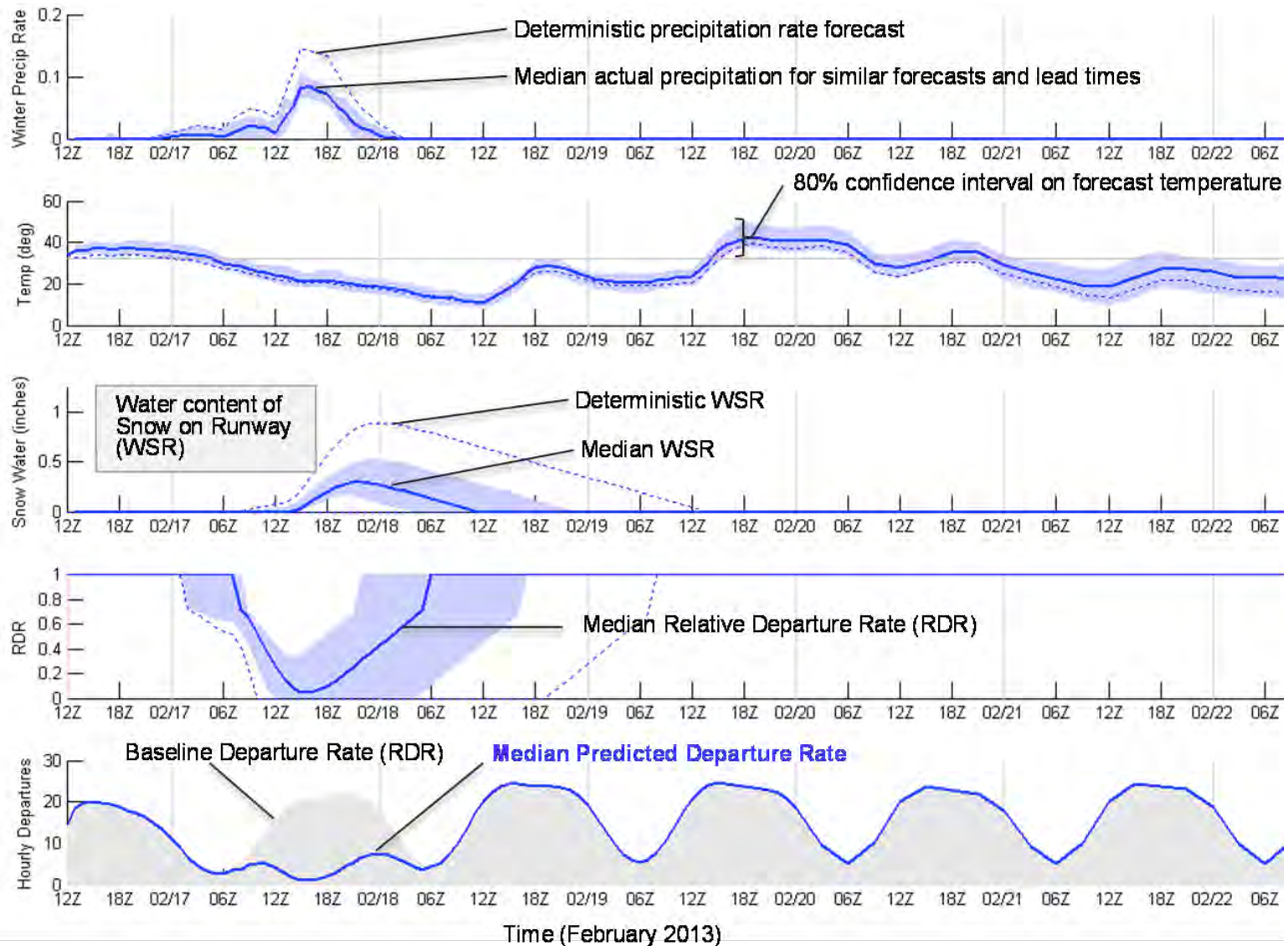
It seems like we're getting a lot of warnings about ice and heavy freezing rain.
Richard Mogford 8:56:14 AM

The group is tracking and shows an hour or more...
Richard Mogford 8:56:14 AM

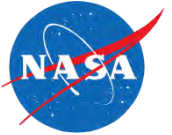
Thanks for the update, have a good one.
Before I forget, there's another front coming in, so stay tuned for additional info.
Richard Mogford 8:56:14 AM

Type your message here & press Enter or the send icon to submit... ➤

Winter Weather Airport Capacity Model



FACT Prototype



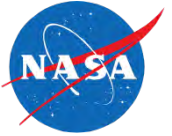
The interface is divided into several sections:

- PRIMARY MAP:** A satellite map of the United States with green airplane icons representing airports. Major airports are labeled with their IATA codes: SEA, PDX, MSP, MIA, BOS, SFO, LAS, PHX, SAN, LAX, DEN, MCI, STL, MEM, BNA, CLT, RDU, IND, CVG, DTW, CLE, PIT, EWR, PHL, BWA, and IAH.
- QUICK VIEW #1:** A detailed view of Denver International Airport (DEN) with a red line indicating a flight path. A tooltip above the map reads "Arr 28L/28R INTRAIL Dep: 01L/01R".
- SURFACE:** A top-down view of the airport's terminal and runways.
- PLANNING CHARTS:** A list of advisories and NOTAMs with expandable dropdown arrows:
 - 57 ADVISORIES FOR TUESDAY, 10-17-2017
 - 61 ADVISORIES FOR MONDAY, 10-16-2017
 - 77 ADVISORIES FOR SUNDAY, 10-15-2017
 - 21 ADVISORIES FOR SATURDAY, 10-14-2017
 - 30 NOTAMs FOR SFO
 - 1 METARS/TAFs FOR San Francisco Intl
- MY QUEUE FACT CHAT:** A section for sharing information, featuring a search bar, a filter, and a list of items. The first item is:
 - DEN: Ongoing Construction at Denver Airport (This item is shared)** - MORE
 - AUTHOR: swapnilg
 - 2017-10-15 02:06:11
 - SHARED WITH: F.A.C.T

FACT Status



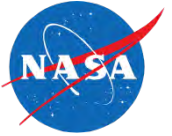
- User interface designed and web-based prototype development completed
- Showing FACT to airlines to request feedback on functionality and user interface design
- Developing a cooperative work agreement with United Airlines for use of FACT
- FACT is available to be integrated into existing tools



Inadvertent Door Slide Activation

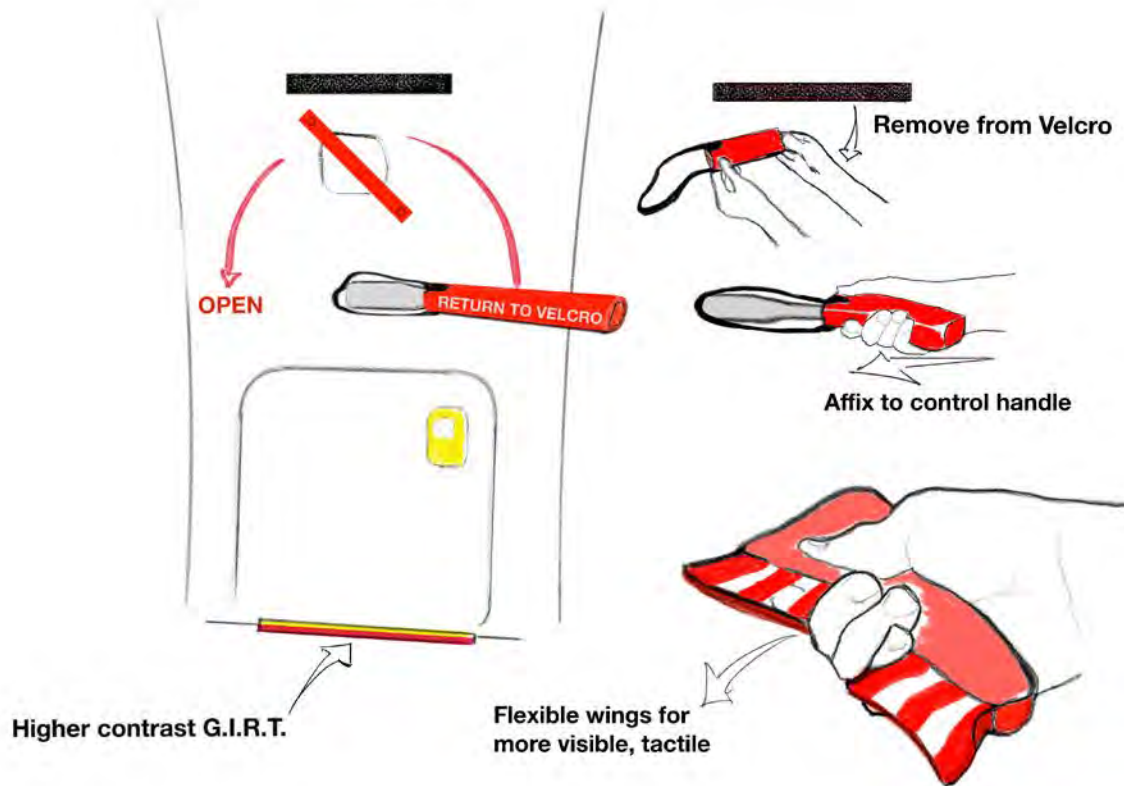
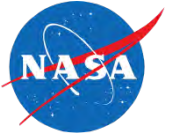
- The AORG investigated inadvertent door slide activations
- May occur if cabin crew does not disarm doors upon arrival
- If the slide partially deploys, the resulting disruption can be costly due to maintenance and schedule delays
- Initial design of a door handle cover “reminder” solution has been drafted for consideration

Door Slide Mechanism (Boeing 737)



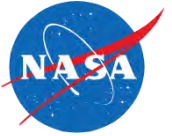
Door slide is armed by hooking a bar (1) under clips (2) on cabin floor. Red strap (3) is fastened over the window to alert jet bridge personnel that the door is armed. Bar is removed from clips to disarm.

Door Slide Sleeve

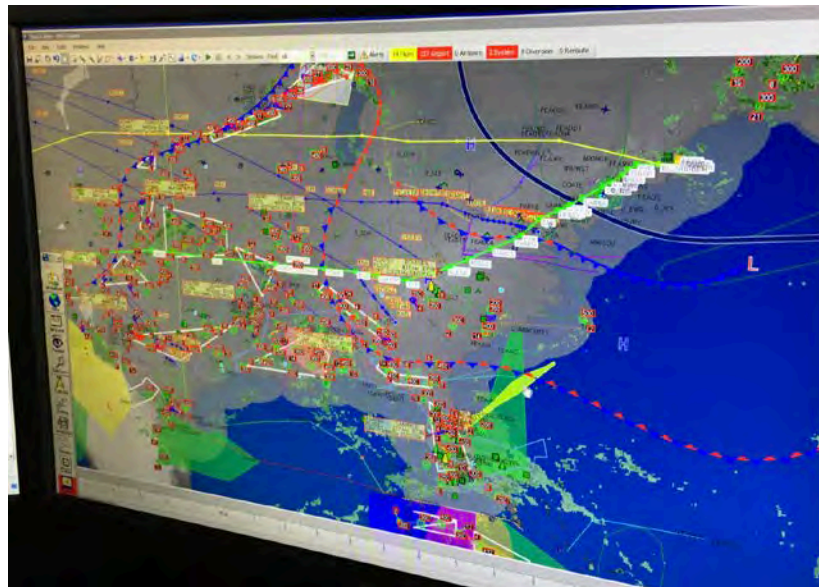


Add a red fabric sleeve that slips over the door handle when crew member arms the door slide. Crew member will feel the cover when they start to open the door if the slide is still armed.

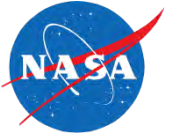
Human Factors Study



- Completed a human factors evaluation of dispatch operations at three major airlines
 - Documented dispatcher tasks and work environment
 - Discussed current methods of assessing dispatcher workload
 - Reviewed typical situation and planning displays
 - One of the first studies of its kind



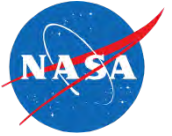
Turbulence Detection Study



- Initiated a study at the University Corporation for Atmospheric Research (UCAR) on turbulence
 - Clear air turbulence is a major problem and causes injuries and damage
 - NASA Langley has a prototype ground-based system for locating turbulence out to 300 km using acoustic arrays
 - Initiated a study with UCAR to evaluate the feasibility of an acoustic system
 - Early indications support Langley approach
 - Report due mid-2018



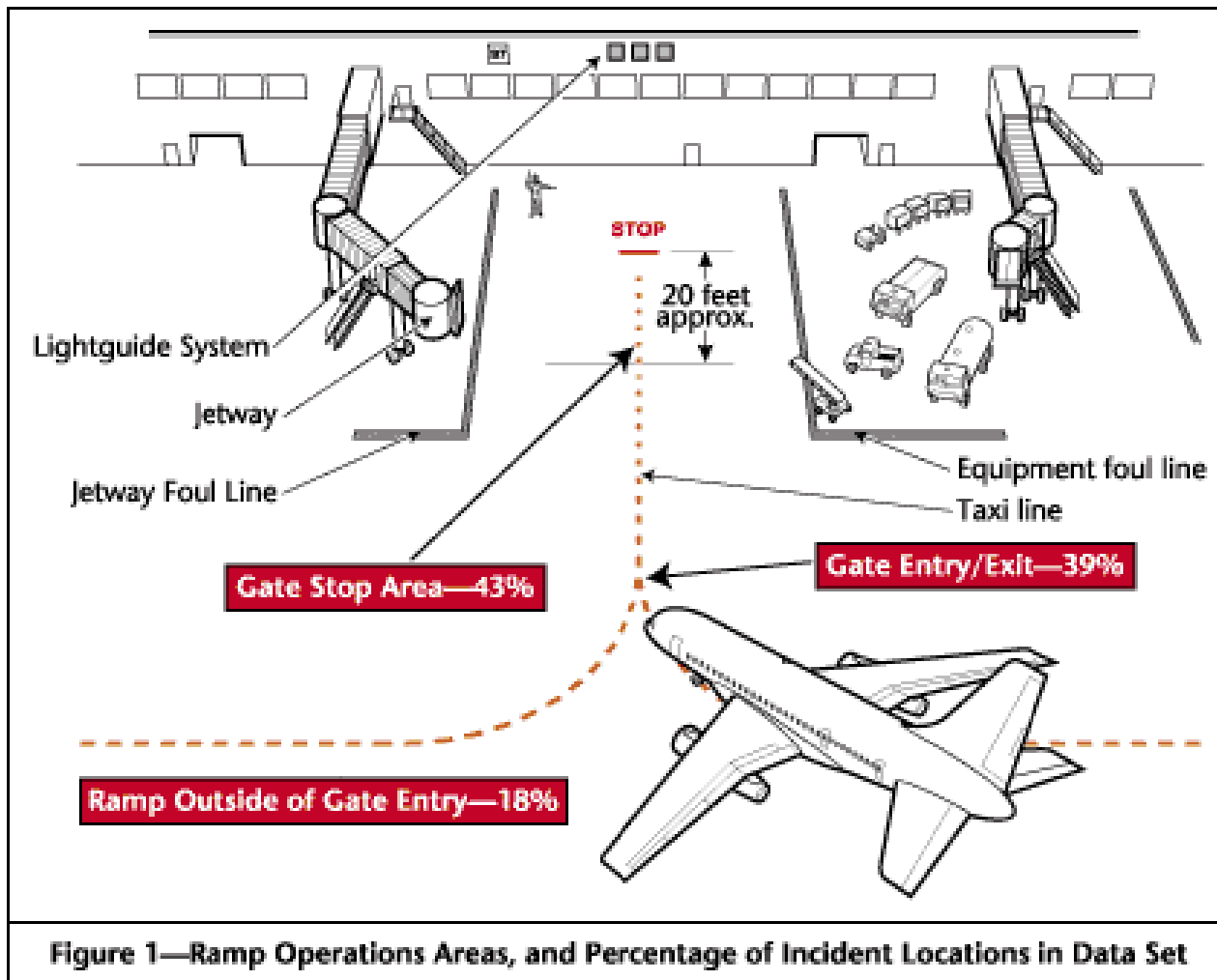
Infrasonic array installed at NASA Langley



Ramp Incident Research

- Worldwide, ramp incidents cause damage to vehicles and aircraft and cost airlines about \$10 billion each year
- Ramp is a very busy area with multiple vehicles and personnel operating on under time pressure
- NASA analyzed several years of ramp incident data for a major airline
- Most frequent events:
 1. Tow bar shear pin breakage
 2. Damage to aircraft by provisioning trucks
 3. Damage to aircraft by belt loader positioning
- Highest out of service costs resulted from:
 1. Towing/pushback
 2. Vehicle movement
 3. Cargo operations
- The AORG will be continuing the analysis of ramp activities

Ramp Incident Data



Accident Percentages in Aircraft Clearance Zones
(from Aviation Reporting Safety System data)



Questions?

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