



**Federal Aviation  
Administration**

# **Survey of Lightning Warning Procedures for Ramp Closures at US Airports**

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Range, and Aerospace Meteorology**

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# Lightning Warning Procedures

- **Major airports employ safety procedures that include observations and warnings of the onset and duration of lightning hazards**
  - Procedures vary by airport and air carrier
  - Wide range of distance and timing values in use, yielding situations where multiple airlines may be utilizing different criteria at any given airport
- **But many regional and small airports have no established lightning warning procedures in place at all**
- **Would they be interested in a set of procedures, and could a set of common procedures be developed?**



# Questionnaire

- **Emailed survey to 73 managers of small, regional and mid-size airports throughout the eastern two thirds of the US about their lightning warning procedures**
  - Did not canvass Rocky Mountain or West Coast airports due to low occurrence of thunderstorm activity
  - 38 responses received
    - One response was a refusal to answer any questions because they “believe that this is an Air Carrier specific procedure”
- **Sent out similar survey to 7 air carrier representatives**
  - One response received so far
  - This study is still in progress
- **The following slides depict some of the key questions, answers and comments from the survey**

# Ramp Closure Criteria

- **Does the airport have criteria and procedures for suspending ramp operations during thunderstorms and lightning events?**
  - Yes (17)
    - Within 5 miles of the airport and 10 or 15 minutes after the last strike or 10-20 miles away from the airport (6)
    - Within 5 miles as a guide to cease and to continue operations (6)
    - “Lighting activity within one mile of the airport. Each airline/fixed based operator (FBO) can make their own decisions.”
    - “We require each fueling agent to have a lightning safety plan.”
  - No (17)
    - Left up to the airlines policies (5)
    - “The Airport does not dictate suspension of ramp operations during thunderstorms and lightning events. Any information we provide to the tenants utilizing the ramp is of an advisory nature only.”
    - “(Airport) has no established procedures for suspending operations when there is lightning in the area.”

# Ramp Closure Criteria

- Does the airport have criteria and procedures for suspending ramp operations during thunderstorms and lightning events?
  - Sort of (3)
    - “We take a common sense approach and monitor fronts and take appropriate action to suspend our activities during an event.”
    - “If thunder is heard, the ramp is cleared (Distance does not matter). When thunder is no longer heard, we resume operations.”
    - “We currently defer to the individual airline to make the decision...when lightning and severe weather is approaching. We do not want to be in a position of being liable for failing to make a timely lightning notification to an air carrier... Generally, airport employees in the field are notified by radio of approaching **severe weather** and told to stop work and seek shelter.”

The liability concern between the airport and tenants is a noteworthy issue

Many people take heed of NWS severe weather warnings but forget lightning is dangerous in any storm

# Ramp Closure Authority

- **Does the airport have sole authority to suspend operations, or do other tenants and operators on airport grounds make their own decisions?**
  - Airport makes decisions (17)
    - “If contractors and the like were working on an airport project then we would have authority concerning safety.”
    - “Although the tenants may or may not have suspension criteria, the Airport reserves the right to suspend any type of operation, at any time, for any reason deemed necessary by Airport staff, as stated in the Airport Emergency Plan – to include facility closure for lightning.”
  - Tenants make decisions (29)
    - “Tenants and contractors do so on their own.” (6)
    - “Each entity makes its own decisions.”
    - “Tenants have continued operations, on their own accord, after being advised by County Airport staff that County employees are ceasing operations.”

# Lightning Detection System Use

- **Does your airport use a lightning detection system (LDS)?**
  - Network system (8)
    - One airport collocated with military base that provides access to LDS data
    - Four airports have contracted weather support services that provide lightning data
  - Local instrument (2)
    - One airport belongs to a university which has a sensor on campus
  - ASOS (2)
    - Nine of the airports that responded have ASOS with lightning detection capability
  - No LDS (25)
    - Two airports do not have systems but the air carriers at the airport operate a system – no access by the airports

Over two-thirds of responders don't use a lightning detection capability. ASOS with lightning detection seems to be under-utilized at airports that have them

# Use of Other Weather Data

- Does the airport use other data such as radar images or forecasts?
  - Yes (28)
  - No (7)
  - Primarily get information and data from:
    - NWS online (15)
    - Commercial vendors online (14)
    - Weather Channel (6), local media (6)
    - NWS or local weather observers (3)



A screenshot of the National Weather Service website for the Baltimore/Washington office. The page features the NWS logo and navigation links for Home, Forecast, Past Weather, Weather Safety, Information Center, News, Search, and About. A "Local forecast by City, ZIP or ZIP code" search box is visible. The main content area displays "NWS Forecast Office Baltimore/Washington" for Sterling, VA, with links for Current Hazards, Current Conditions, Radar, Forecasts, Rivers and Lakes, Climate and Past Weather, and Local Programs. A map of the region is shown with a legend for Watches, Warnings &amp; Advisories, Small Craft Advisory, and Hazardous Weather Outlook. The last map update is noted as Wednesday, December 17, 2014 at 1:39:22 pm EST.



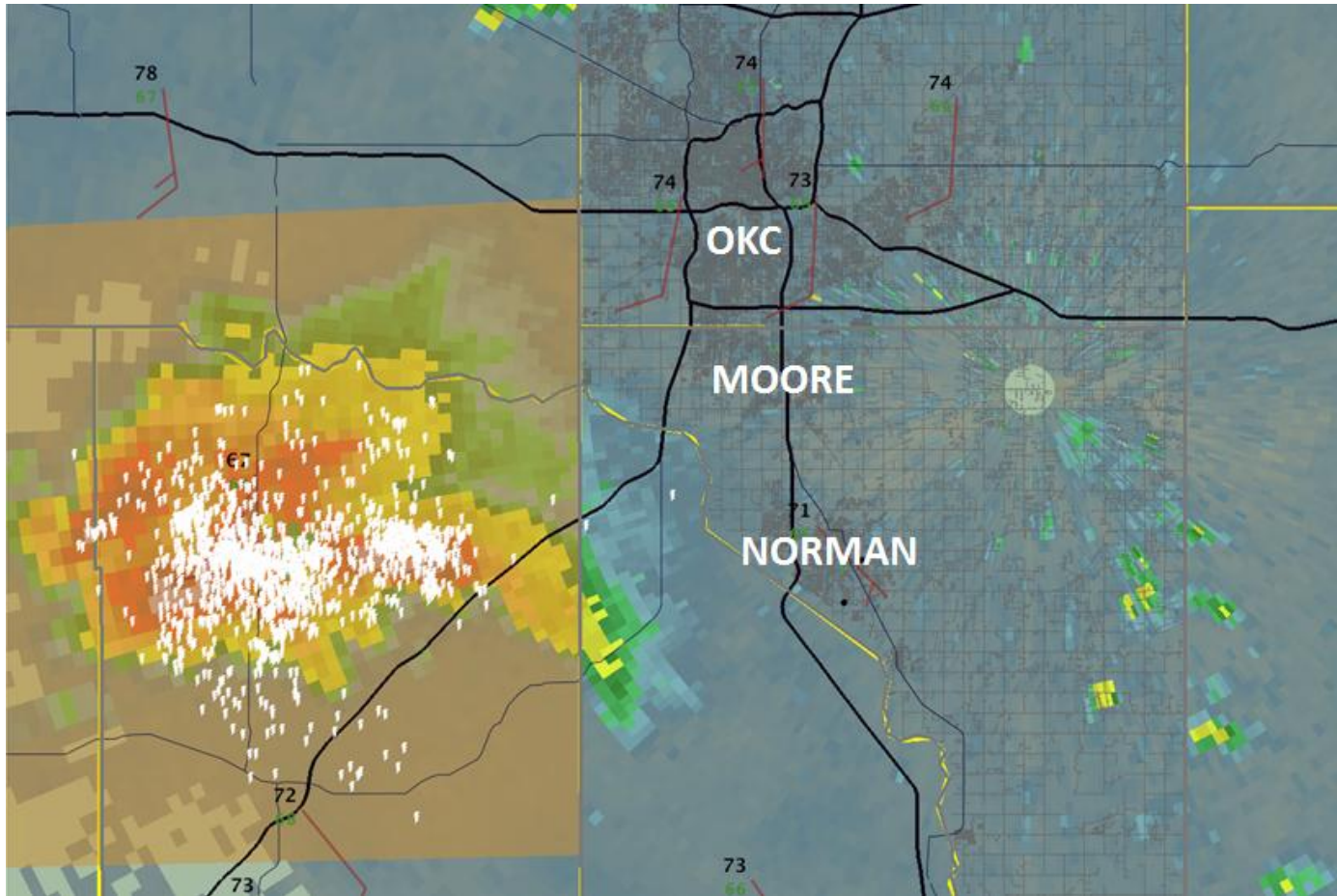
# Decision Makers Training

- **Are decision makers at the airport charged with making ramp closure decisions trained on interpreting lightning data and/or other meteorological data and information?**
  - Yes (6)
    - “We train our line attendants that if they see lightning they need to count to 5 and if they hear thunder, they are to cease refueling and to take cover indoors.”
  - No (23)
    - “The airport authority does not close the airport, or portion thereof, for lightning. We advise all aviation tenants of the lightning conditions.”
    - “We do not and have not closed the airport for lightning.”
    - “In my 28 years employed as an airport manager, I’ve never closed the...ramp because of lightning.”

The majority of decision makers utilizing weather data aren't trained, while some others ignore all but severe convective weather

# Radar Versus Lightning

Central  
Oklahoma  
3:00 pm CDT,  
13 April 2012



Slide courtesy of Dr. Kevin Kloesel, University of Oklahoma

Radar returns do not always indicate the extent of lightning

# Interest in New Guidelines

- **Is your airport interested in a set of recommended procedures or guidelines for lightning warnings and closures?**
  - Yes (30)
    - “If a template guideline and recommended practices would be available we would be more apt to use this information.”
    - “I absolutely would, particularly for small and non-hub airports – current methods in place, and recommended best practices to include procedural and technology pieces in play.”
    - “We would be very interested. We would also be interested in potential liability.”
  - No (2)

Overwhelming positive response indicates respondents want help with establishing lightning warning procedures

# Possible Improvements

- Develop and promote a set of recommended, standardized LOW COST or NO COST procedures that can be tailored by each stakeholder for their operations
- Educate stakeholders about using various sources of lightning information and the lightning predictability issues
- Share lightning information with stakeholders across an airport to enhance common situational awareness
- Use *audible, visual and tactile alerts* to inform airport personnel about lightning warnings and lightning-related safety risks in a timely fashion
- Combine information from various sources (lightning, radar, and other observations) to balance personnel safety with operational efficiency
- Have stakeholders document ramp closure occurrences and duration as well as damage due to lightning; make that information accessible
- Develop real-time performance metrics and feedback on lightning warning events for stakeholder use
- Introduce lightning potential predictions (near-term lightning forecasts) into the ramp closure decision-making process

# Challenges

- **Identifying solutions is easy, developing and implementing them is not**
  - Lightning warning and ramp closure procedures
    - Find a good balance between personnel safety and operational efficiency
    - One size does not fit all. Different operational requirements, business models, risk tolerances, regional and geographic weather differences, and other considerations
  - Lightning detection system variances
    - LDS's are different in detection efficiency, location accuracy and overall performance, but the FAA can not favor or endorse any particular system
    - Fiscal constraints at many airports for purchasing or leasing a system
    - Liability issue could be a significant obstacle for sharing of lightning information
  - Lack of documentation of ramp closures, lightning damage and injuries
  - Human factors
    - Air carrier versus airport responsibility for decision making
    - Education of stake holders and decision makers on procedures, LDS use, dangers of “non-severe” weather
    - Resistance of managers to implement procedures that may increase downtime

# Summary

- **Most regional and small airports across the CONUS have inadequate lightning warning procedures, or don't have procedures in place at all**
  - Just over half of the airports surveyed have formal criteria in place for suspending ramp operations during thunderstorms and lightning events
    - Most airports leave it to the air carriers at their location to establish lightning warning criteria and follow procedures for ramp closures
  - Most airports do not have access to lightning detection information and rely on visibly seeing lightning in the local area
    - ASOS systems with lightning detectors may be leveraged at those locations that have such a system
  - Most airports utilize weather information online or via television for situational awareness, but the large majority of decision makers are not trained on how to interpret and use that information in decision making
  - Many locations lack means to notify personnel outside in the airport area
  - Respondents want help with establishing lightning warning procedures
  - Significant challenges have to be overcome to implement common guidelines

# Questions?

## Contact information:

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# Back Up





# Damage or Injuries

- **Has the airport or tenants sustained any damage or injuries to personnel due to lightning, at least over the last 10 years?**
  - “An employee hit as they were entering the building through aluminum/glass sliding doors but did not suffer serious, long-term injury”
  - Lightning strike damage to paved surfaces (x 8)
  - Damage to airfield lighting systems (x 4)
  - “Airport nav aids”
  - “Numerous lightning strikes each year resulting in damage to airfield pavement, runway/taxiway lighting, gate controllers, CCTV cameras and other components of our access control system”
  - “Two lightning strikes since...2009. Most...damage was to components like security cameras, security gate controllers, parking lot gate controllers, and the fire/alarm system”
  - “Fiber damage to gate apparatus, control board damage to parking lot control equipment and control board damage to fuel farm computer”



# Lightning Warning Procedures

- **The challenge is finding a good balance between personnel safety and operational efficiency**
- **Antidotal evidence and scattered documentation of damage and injuries on airport ramps due to lightning, but no national database exists to determine the extent of the problem**
- **Airports and airlines don't typically track the amount of ramp closure time due to lightning**
  - No way to show the economic costs, safety impacts, or inefficiencies that may be occurring during these closures



# Lightning Warning Procedures

- **Many regional and small airports have no established lightning warning procedures in place at all**
  - A significant amount of airport managers believe lightning warning procedures are solely the responsibility of the air carriers at their facility
  - Most airports do not have access to lightning detection information and rely on visibly seeing lightning in the local area
  - Many locations lack formal means to notify personnel working outside in the airport area



No standardized lightning warning and ramp closure guidance for airports in the US

# Guidance and Procedures

- There are procedures for aircraft fueling operations when lightning is observed
- **National Fire Protection Association (NFPA) 407, STANDARD FOR AIRCRAFT FUEL SERVICING -- Section 5.9 – Lightning Precautions**
  - 5.9.1 Fuel servicing operations shall be suspended where there are lightning flashes in the immediate vicinity of the airport
  - 5.9.2 A written procedure shall be established to set the criteria for where fueling operations are to be suspended at each airport as approved by the fueling agent and the airport authority



# Warning/Closure Dissemination

- Are lightning warnings and closures/suspensions shared with other operators and users? If so, how?

- Yes (18)

- Email, phone call and/or text (6)
- Telephone (4)
- Commercial mass notification system (2)
- Email
- Text
- Radio broadcasts and announcements
- Radio, phone or in person
- Verbally
- Unknown



- No (15)

- Notifies tenants of severe weather warnings, but not specifically lightning (5)

# Lightning Detection System Use

- **Of the ten locations that have an LDS, does the airport pay for this service solely or is there a partnership with other users and tenants?**
  - Airport pays for this service solely (6)
  - The airport pays for this service and then charges tenants that has the system installed at their leasehold
  - The airport receives lightning information from the weather contractor support paid for by the FAA
  - Military tenant pays for the service
  - The university provides the service

# Standardized Procedures

- **Develop and promote recommended standardized procedures that can be tailored by each stakeholder for their operations**
  - Should not be mandatory due to requirement differences, but a set of recommended actions that stakeholders could implement according to their needs, business models and risk tolerances
  - Values for critical distance and waiting period vary significantly among stakeholders
  - Tune the critical distance and timing criteria according to the level of safety risk tolerable by a stakeholder
- **Combine information from various sources (lightning, radar, and other observations) to balance personnel safety with operational efficiency**

More research is needed on stakeholder requirements, procedures and experience before suggestions can be developed. May need to be divided by airport size, location, etc.

# Education

- **Develop an education presentation for airport managers and other stakeholders about lightning warning, safety and closure procedures**
- **Educate decision makers on lightning hazards not just associated with severe weather warnings**
- **Educate stakeholders about using various sources of lightning information, as well as lightning predictability issues**
- **Stress implementation and better application of lightning warning procedures**
- **Highlight the value of implementing and following procedures for improving safety and efficiency**



# Alerting Systems

- **Use of *audible, visual and tactile alerts* of lightning warnings**
  - Outdoor and airline System Operations Control center alerts are essential when the decision to close a ramp is made
  - Combination of alert methods is the best way to reach everyone



# Ramp Closure Documentation

- **Data and statistics on ramp closures is almost non-existent**
- **Request that stakeholders document ramp closures and make that information accessible**
  - Would significantly help in assessing potential safety and inefficiency issues, and provide a basis for developing enhanced procedures and decision support tools
- **Develop real-time performance feedback to stakeholders on lightning warning events**
  - Increased awareness of how they conduct business and what safety risks or inefficiencies they may be incurring

# Sharing of Information

- **Share lightning information with stakeholders across an airport to enhance common situational awareness**
  - While done at a few airports, others claim possible liability issues prevent them from sharing lightning information to other stakeholders on airport property
  - Cost sharing also a concern -- if an entity at the airport is unwilling to pay for lightning detection, should they still be informed?
  - Could be achieved if every stakeholder (i.e., airlines and airport authority) provided support for a lightning detection system and communications network
    - Amount of support could be scaled according to a stakeholders' presence at that airport
  - Stakeholders still apply their own safety procedures as they deem necessary given their corporate risk tolerance

# Lightning Prediction System

- **Lightning potential predictions (near-term lightning forecasts) could be introduced to the ramp closure decision-making process that incorporate all available information (lightning, radar, and other relevant weather data) into a weather decision support tool**
  - Provides lead time for unprotected outdoor workers rather than reacting to a first lightning strike
  - Provides lead time for air traffic management personnel to take proactive steps for effectively managing inbound and outbound flight operations before the actual thunderstorm and lightning impacts occur

# Summary

- **The FAA's Aviation Weather Division continues to study the issue**
  - Service Analysis to determine scope of lightning impacts to the National Airspace System
  - Continued shortfall assessment of lightning warning procedures for airports
  - Development of common lightning warning procedures and guidelines that could be tailored by individual airports for their operations and risk tolerance
  - Investigation of low-cost, effective ways to access and utilize lightning data at airports