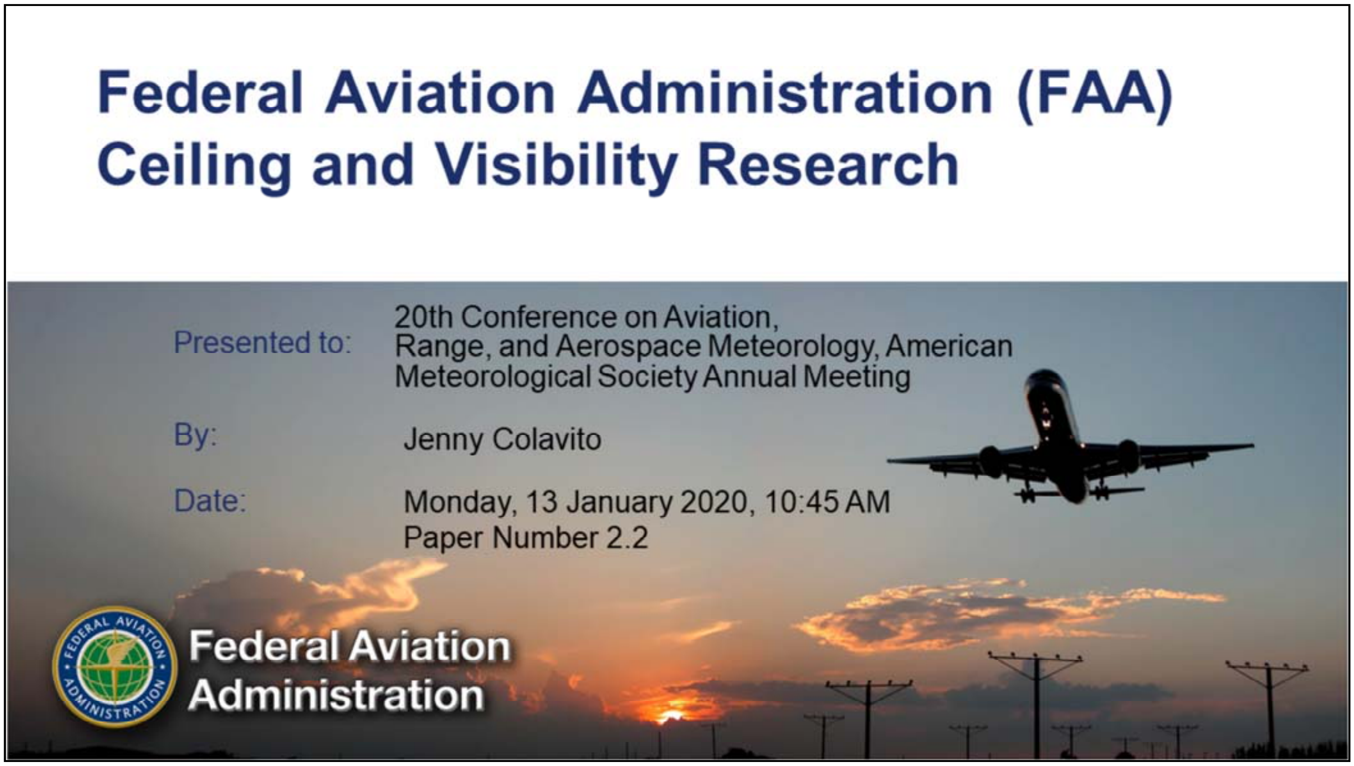
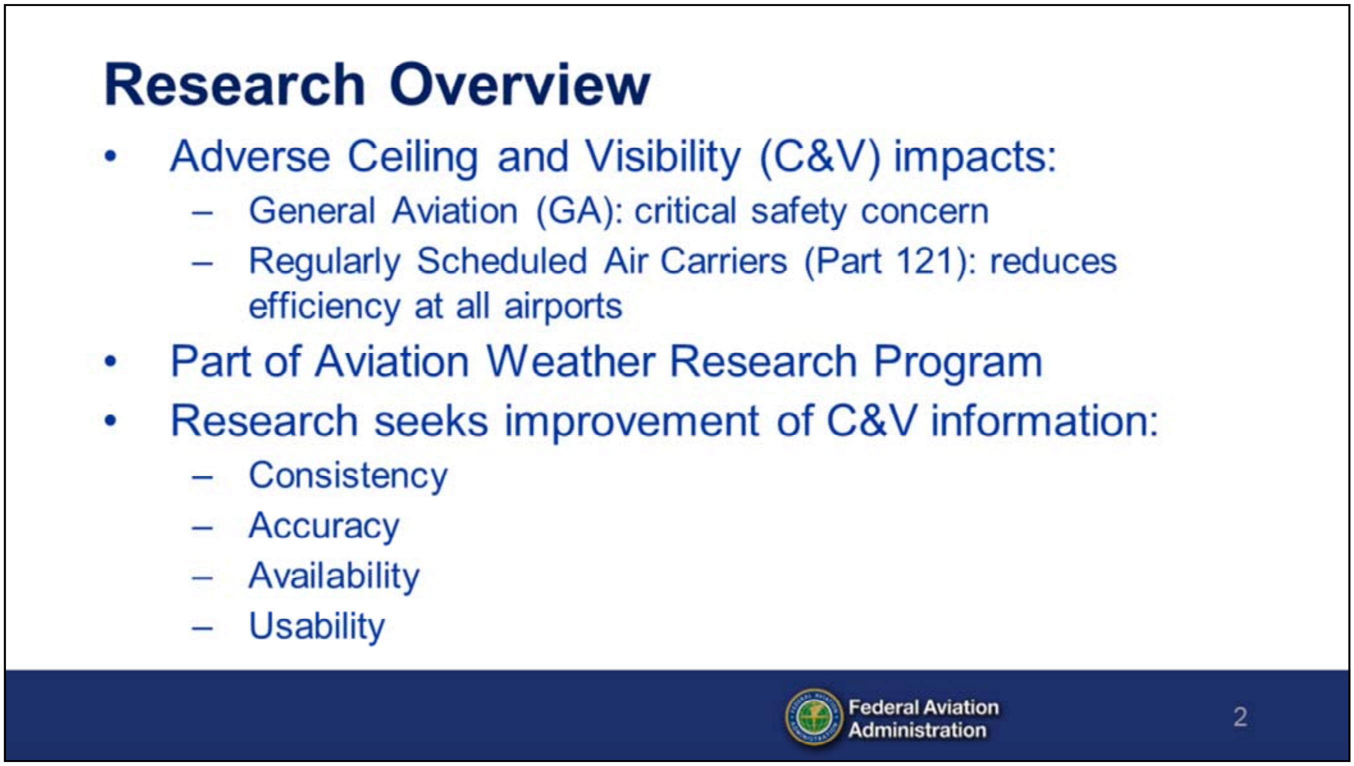
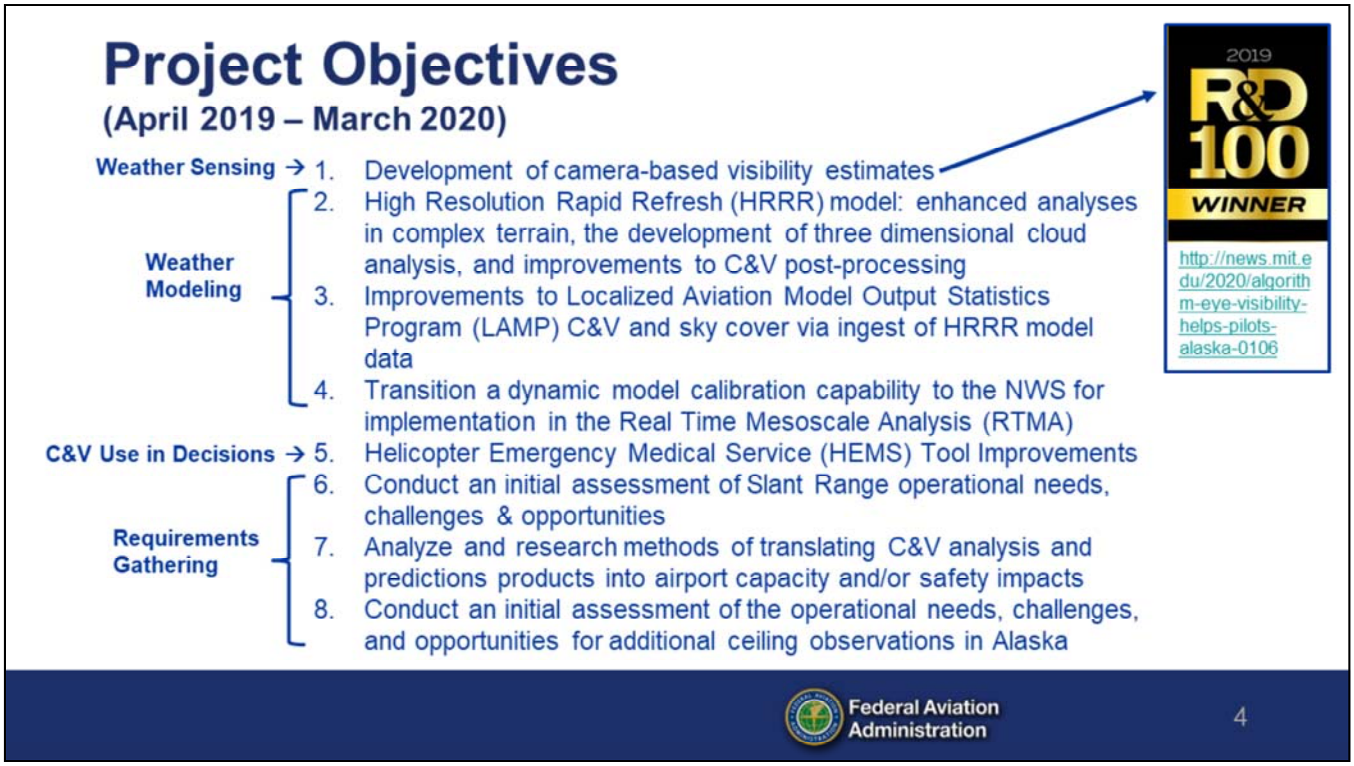


Good Morning, I'm Jenny Colavito and I'm the lead for the FAA's Ceiling and Visibility Research Project. Today I'm will be presenting an overview of the project and I will go a bit more in depth on two of our current efforts.



Ceiling and Visibility, or C&V, is of critical importance to aviation for both General Aviation (GA) and Regularly Scheduled Air Carriers (Part 121). C&V is a critical safety concern for GA pilots and for Part 121 operations, adverse C&V conditions impact the National Airspace System (NAS) efficiency at all airports, with certain terminal areas and high traffic airports being more susceptible to impacts and Traffic Flow Management (TFM) initiatives than others. The C&V program resides within the Aviation Weather Research portfolio and its purpose is the targeted improvement of C&V information used for aviation decision making to support safer and more efficient aviation operations. These improvements include advancements in consistency, accuracy, availability, and usability.

I work at FAA Headquarters, and I'm the sponsor of FAA C&V research, but a lot of the heavy lifting is done by my research partners. I work very closely with the NOAA and the National Weather Service, primarily through direct partnership with the Aviation Weather Center, Earth Systems Research Laboratory, Meteorological Development Laboratory, and the Environmental Modeling Center. At the FAA, we also have a boots-on-the-ground research team at the FAA William J Hughes Technical Center. I also work directly with MIT/LL and the National Center for Atmospheric Research, NCAR.



The scope of the C&V research project includes all steps along the C&V information processing stream: from weather sensing and modeling all the way to the use C&V information in decision making.   I manage the project on an annual planning cycle that is slightly off-set from when we receive our appropriations from Congress – notionally April through March. For the 2019-2020 project year, we had eight primary objectives.

Related to weather sensing, we have been developing an algorithm that uses image processing techniques to produce visibility estimates. This work is being done in Alaska to leverage the FAA weather camera network. That project was a recipient of a 2019 R&D 100 award.

Under weather modeling improvements, we sponsor C&V related development of the HRRR, LAMP, and RTMA.

Related to the use of C&V in aviation decision making, we have sponsored the development of the Helicopter Emergency Medical Services (HEMS) weather tool.

The remainder of our work this year has been focused on C&V requirements gathering. In the future, all of our research projects will be more strongly tied to requirements. These three initiatives will help lay the groundwork for future research in the areas of Slant Range Visibility, the translation of C&V conditions into impacts, and the addition of more ceiling observations in Alaska.

I will be discussing two of these initiatives in more depth:

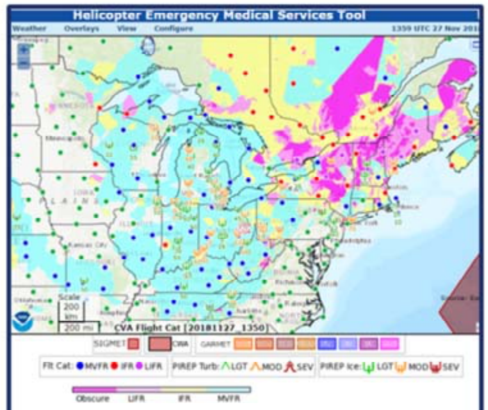
- #5 Improvements to the HEMS tool
- #8 User Needs Assessment for Alaska Ceiling Observations

HEMS Tool

Helicopter Emergency Medical Services (HEMS)

Designed to show weather conditions for short-distance and low-altitude flights that are common for the HEMS community.
https://www.aviationweather.gov/hemst

- **2006:** Experimental HEMS released by NCAR
- **2009:** National Transportation Safety Board recommendation for use as an official product (A-09-092)
- **2015:** Operational release of HEMS
- **2016:** Began work to improve C&V data
- **2019:** A-09-092 "CLOSED--ACCEPTABLE ACTION. Thank you for taking these actions to improve HEMS safety."



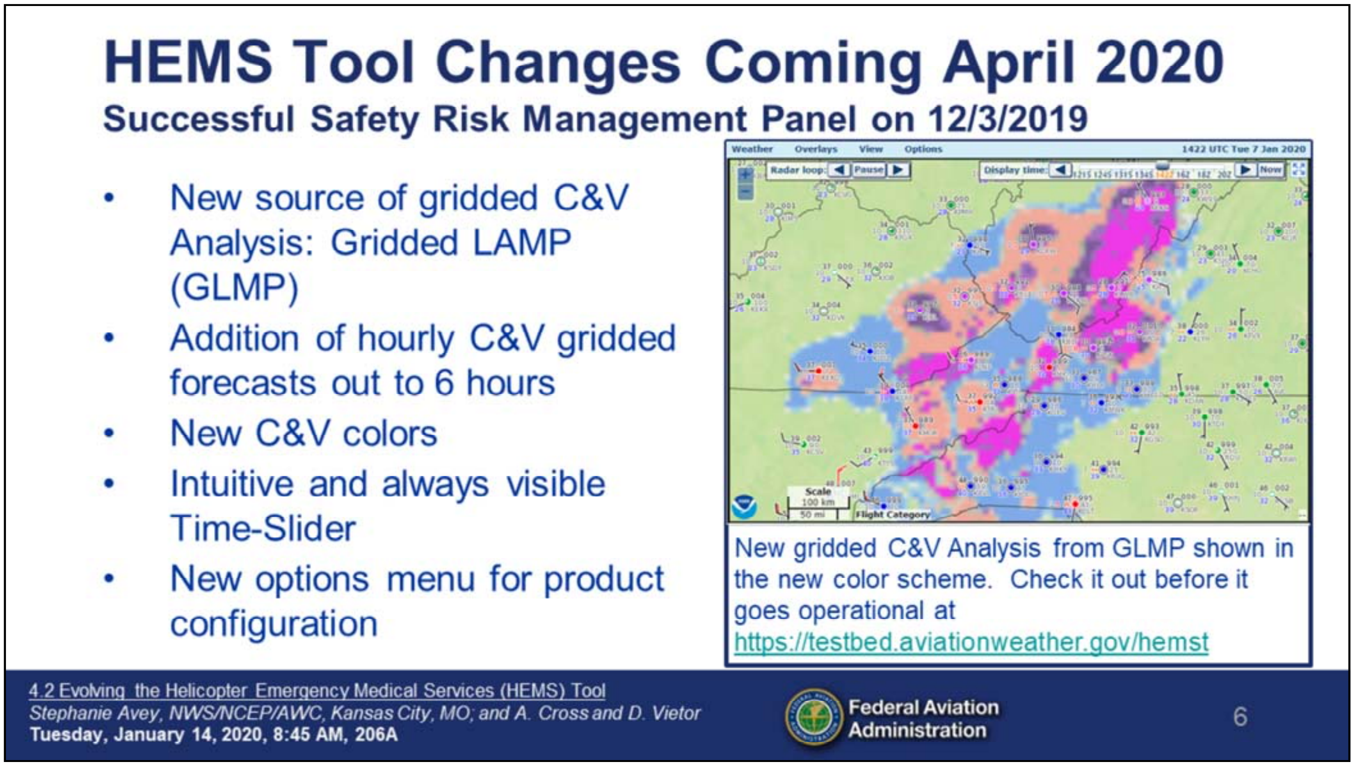
HEMS Tool displaying flight category on Nov 27, 2018, 1359 UTC (Winter Storm Bruce).

Federal Aviation Administration

5

The HEMS tool is an interactive web display of multiple weather products that is designed to use in short-distance, low-altitude flights that are common in the HEMS community. An image of the tool is included here and shows a gridded flight category analysis. This image was taken during Winter Storm Bruce in 2018 – you can see many areas of IFR or worse.

HEMS was originally developed by the National Center for Atmospheric Research (NCAR) under FAA sponsorship. I've included a timeline here to show that HEMS first became operational in 2015 in response to an NTSB recommendation for its use as an operational product. The NTSB has since closed that recommendation, stating that Acceptable Action was taken. Shortly after the operational release of HEMS, we began working to assess and improve the C&V data that HEMS provides.



Updates are coming to the HEMS tool this spring, which are listed here. All of these changes were evaluated by the FAA as part of the formal Safety Risk Management process. The safety panel met on December 3rd, 2019 and all of these changes were approved and accepted. The image here shows some of the changes, such as the new gridded C&V analysis which will be provided by the Gridded LAMP (GLMP). <click> I've zoomed in, so that you can see the area of restricted conditions in the Appalachians a bit better and see the new colors that will be consistent with other tools on aviationweather.gov. HEMS will also have a gridded C&V forecast for the first time which will be controlled with an intuitive new time slider. There will also be a new, more mobile friendly options menu. We are targeting a release date in April 1, 2020, but you can see these changes already on the Experimental HEMS Tool by following the link I've included under the image. To learn more about the HEMS Tool Evolution, please attend Stephanie Avey's presentation tomorrow at 8:45 AM in room 206A.

Alaska Ceiling Observations
User Needs Assessment

What we knew	What we wanted to learn
• Alaska has highest ratio of plane owners to residents • About 82% of communities aren't connected to the road system • 394 public use airports and 761 recorded landing areas (private, public, and military) • Restricted C&V contribute to a disproportionately high rate of GA accidents • Traditional weather observations in Alaska are widely dispersed • Pilots and meteorologists fill gaps by using the closest weather cameras, weather observers, and previous knowledge and experience with the terrain and weather trends	• The issues associated with not having ceiling observations in planned areas of departing, arriving, or flying • The operational impact of supplemental ceiling data vs. certified ceiling observations • The need for additional ceiling observations in Alaska and in particular, the geographic locations where observations are most needed

Federal Aviation Administration 7

The next area that I want to discuss in a bit more depth is the User Needs Assessment for additional ceiling observations in Alaska. Upon starting this research, we knew there were large gaps in the observation network of Alaska and that this contributes to a disproportionately high rate of GA accidents. We wanted to dig deeper and uncover the specific needs related to the sparse coverage of ceiling observations. This initiative is part of our focus on requirements – before we can start research to solve a perceived problem we want to make sure we understand it fully.

Our study was focused on three objectives, which I've included here on the right column. We wanted to learn more about the issues associated with not having ceiling observations in planned areas of departing, arriving, or flying; the operational impact of supplemental ceiling data vs. certified ceiling observations; and the true need for additional ceiling observations in Alaska and in particular, the geographic locations where observations are most needed.

Approach

- Cognitive walkthroughs: plan flight or forecast
  - When cloud ceiling observations are not available
  - Using mix of certified and uncertified ceiling observations
- Structured Interview Questions
- Written Questionnaires

Participant Summary

#	User Group	Primary Geographic Flying Region	Average Flight Hours
11	Business Aircraft Pilots Part 135	Western, Southeast, Southwest, South, North, South Central	56,583
1	Air Carrier Pilot Part 121	Statewide	737 Pilot
4	GA Pilots	South Central, Interior, South Central, North Slope	8,900
2	NWS Weather Forecast Office (WFO)	--	
2	FAA Camera Program	--	
7	NWS Alaska Aviation Weather Unit (AAWU)	--	
6	FAA Flight Services	--	
34	Total		

Federal Aviation Administration 8

Our research approach was to send an evaluation team, from our FAA Tech Center, to Alaska to conduct interviews of pilots and meteorologists. I've included a simplified participant summary here. As part of the interviews, the team used an cognitive walkthrough technique. That means that the participants were taken through scenarios where they were asked to make flight plans, or forecasts when cloud ceiling observations were not available; or using a mix of certified and uncertified observations. Along the way, the research team asked targeted questions to identify the issues that were encountered and to keep the conversation focused on our research objectives. Whatever was not addressed during the scenarios, was covered as part of structured interviews with pre-written questions. After the interviews concluded, the participants were asked to fill out written questionnaires.

I'm going to present some of the Preliminary Findings, but the full research report is due Feb 8, 2020, and I can share it shortly after that date with anyone who is interested in learning more.

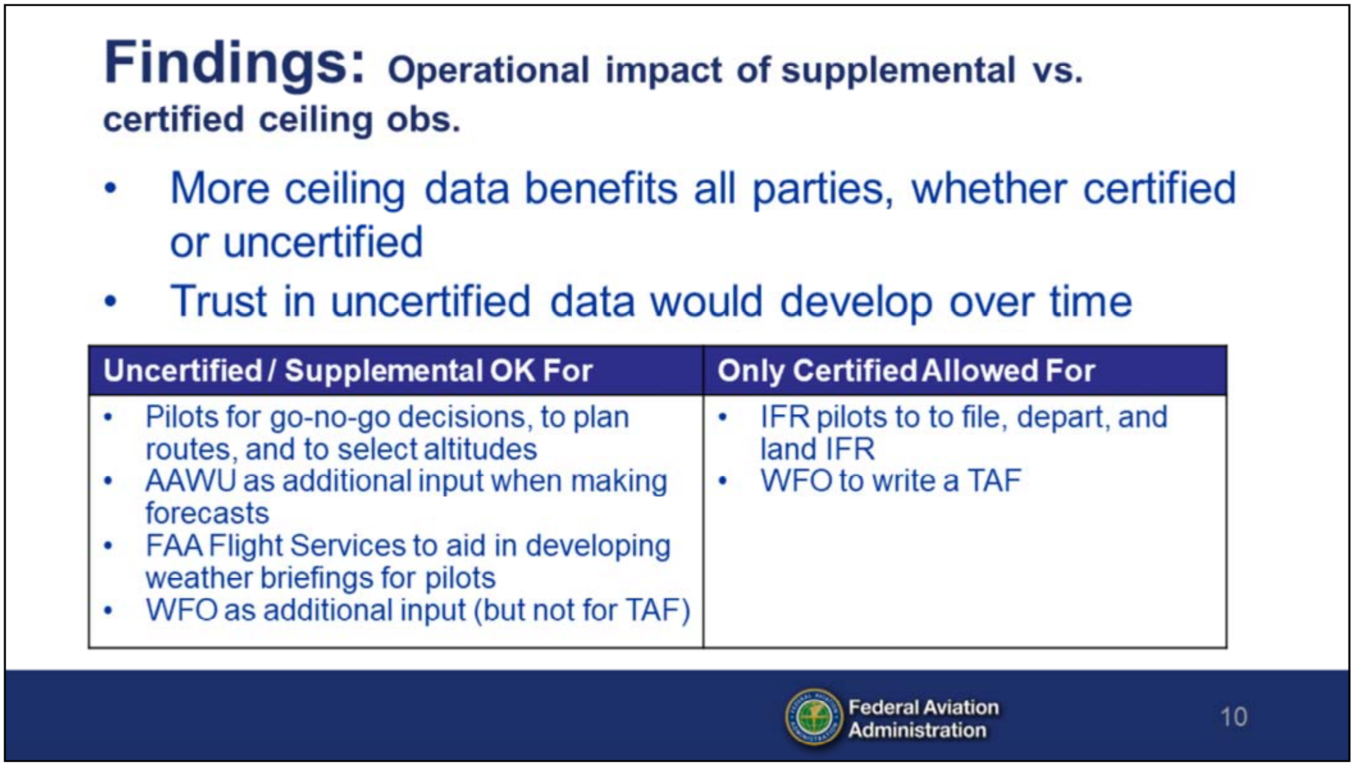
Findings: Issues associated with not having ceiling observations

- Controlled flight into terrain (CFIT) in mountain passes
- Unexpected re-routes or return to start
- Goods can't be delivered
- Delayed medical transportation
- Delayed police response
- Can't fly Instrument Flight Rules (IFR)
- Terminal Aerodrome Forecasts (TAFs) cannot be written

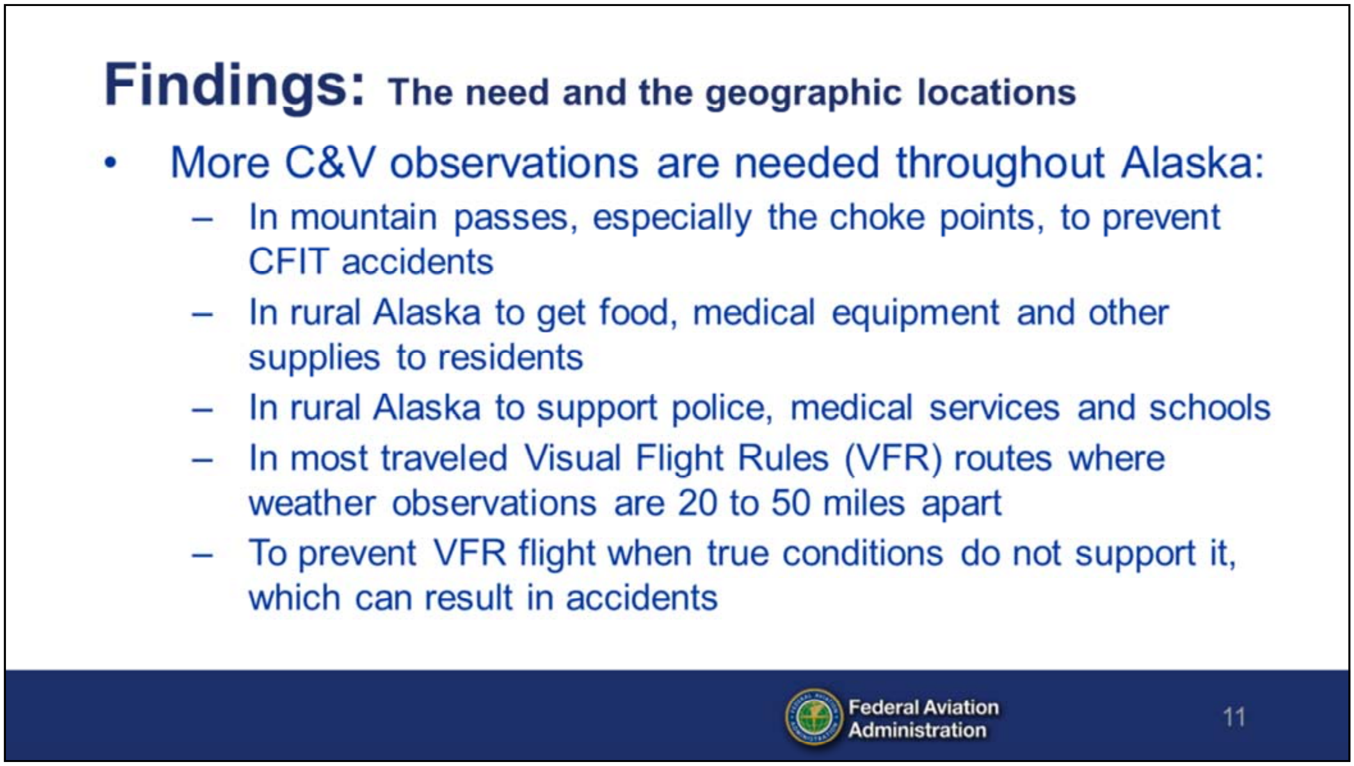
Federal Aviation Administration

9

As expected, the participants of the study mentioned several issues that were associated with not having enough ceiling observations. One of the most severe consequences being controlled flight into terrain. This occurs most commonly when a pilot gets stuck in a mountain pass with unexpected low ceilings and is unable to navigate out. There were many other impacts mentioned including the inability to deliver goods or services to remote areas. Delays in medical transportation or police response can also have dire consequences. The inability to fly using Instrument Flight Rules or write TAFs were also mentioned.



When we dug deeper into the operational impact of supplemental vs. certified ceiling observations we found that overall, supplemental observations are a huge help to all participants, but they won't solve **all** of the problems from the previous slide. Supplemental observations can be used for everything **except** IFR flights and writing TAFs. The TAF is the official forecast for an airport, and it provides critical, local weather information to support airport operation. The inability to fly IFR is also an issue - pilots who are instrument certified often prefer to fly IFR to access restricted IFR altitudes and get more assistance from Air Traffic Control. Not having the ability to file IFR can also lead to pilots filing for Visual Flight Rules (VFR) when the conditions don't actually warrant it, which can lead to accidents.



So, where are additional ceiling observations really needed? Well, overwhelming the participants advocated that the answer is everywhere throughout Alaska. Beyond that, the participants did provide lists of the most critical sites. The specific locations will be included in report. The most critical areas include mountain pass routes, especially in the choke points. Again, this is to prevent Controlled Flight into Terrain. Rural Alaska is also an important consideration because they depend on aviation for food, medicine, education, and police response. Participants also mentioned the most traveled VFR routes where weather observations are 20 to 50 miles apart.

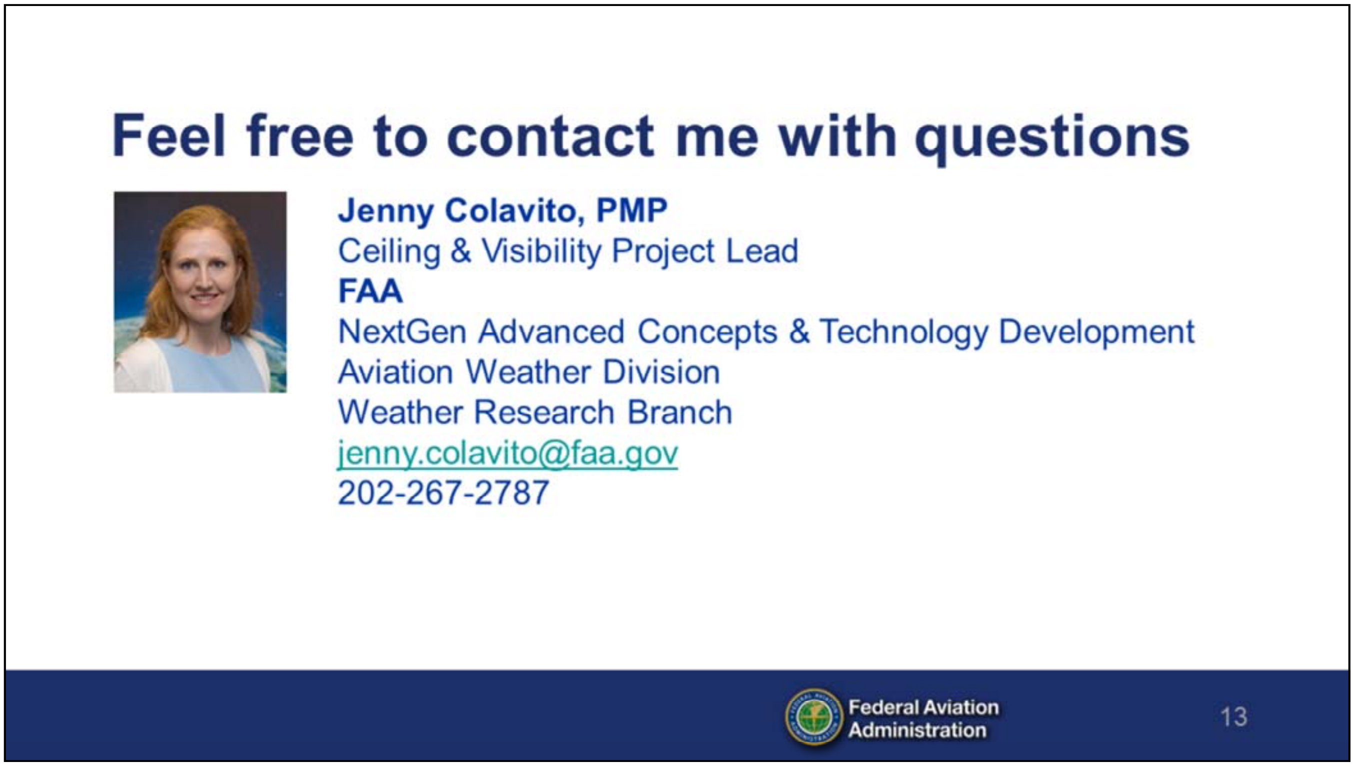
What's Next?

- Support Verified Weather Observing System (VWOS) Program
  - Low-cost automated sensors
  - Self-Verifying
  - Suitable for remote areas without grid power
- Leverage Department of Energy (DOE) research to develop a super-compact, low-powered ceilometer

Vaisala Ceilometer (left) next to the DOE's first prototype of a super-compact low powered ceilometer (right)

Federal Aviation Administration 12

As I mentioned previously, the User Evaluation is part of our requirements gathering process. We want to understand the problem before we try to fix it. One way I hope to address the lack of ceiling observations in Alaska is to support a new emerging FAA program called the Verified Weather Observing System (VWOS). The goal of VWOS is to deploy more automated observing systems in the NAS that are low cost, self verifying, and deployable in remote areas that may not have connection to grid power. Use of the traditional Vaisala Ceilometer, that is currently part of the FAA sensor suite, is not ideal due to its large size and high power demand. My goal is to leverage work by the Department of Energy to develop a super-compact, low-powered ceilometer and have it included in the VWOS sensor suite. This picture is one that I took at the Physical Sciences Incorporated (PSI) laboratory, where they are testing the first prototype of the low powered ceilometer alongside the traditional Vaisala version. I hope to continue to work with PSI to leverage this research to support the FAA mission.



That concludes my presentation. Do you have any questions?