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## **Pilot Reports (PIREPs) End-User (Pilots and Controllers) Focus Groups**

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## List of Acronyms

Acronym	Definition
ACARS	Aircraft Communications Addressing and Reporting System
ADS-B	Automatic Dependent Surveillance-Broadcast
AFB	Air Force Base
AGL	Above Ground Level
AIREP	Aircraft Report
AIRMET	Airmen's Meteorological Information
AOPA	Aircraft Owners and Pilots Association
ARINC	Aeronautical Radio, Inc.
ASOS	Automated Surface Observing Systems
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATO	Air Traffic Organization
AVS	Aviation Safety
AWOS	Automated Weather Observing Systems
CAMI	Civil Aero Medical Institute
CAVU	Ceiling and Visibility Unlimited
CFI	Certified Flight Instructor
CFII	Certified Flight Instrument Instructor
CPDLC	Controller Pilot Data Link Communications
DME	Distance Measuring Equipment
EFB	Electronic Flight Bag
FAA	Federal Aviation Administration
FBO	Fixed-base Operator
FO	First Officer
GA	General Aviation
GPS	Global Positioning System
IFR	Instrument Flight Rules
METAR	Meteorological Aerodrome Report
NAT	North Atlantic Track
NATCA	National Air Traffic Controllers Association
NDB	Non-Directional Beacon
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board
OASIS	Operational and Supportability Implementation System ...
PIREP	Pilot Report
PPL	Private Pilot License
R&D	Research and Development
RWY	Runway
SIGMET	Significant Meteorological Information
TAPS	Turbulence Auto PIREP System

TIS-B	Traffic Information Services – Broadcast
TRACON	Terminal Radar Approach Control
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	Very High Frequency Omni-Directional Range
WINGS	Pilot Proficiency Award Program
WSI	Weather Services International

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## **Introduction**

In June of 2020, the FAA Aviation Safety (AVS) Aerospace Human Factors Research Division at the Civil Aero Medical Institute (CAMI), the Air Traffic Organization (ATO), and the MITRE Corporation hosted a PIREPs Summit that provided an opportunity for PIREPs users and stakeholders to share information about how PIREPs solicitation, submission, and dissemination processes could be improved to support user needs. Prior to the summit, the AVS Aerospace Human Factors Research Division conducted a series of focus groups.

The focus groups and summit were in support of the ATO's Top 5 Corrective Action Plan for PIREP Solicitation and Dissemination Strategy 5 that is managed through the Safety & Technical Training/Safety Performance Monitoring Team (AJI-313). These tasks were completed in light of the PIREP's system modernization plans managed through the Aviation Weather & Aero Services Programs Group/Aviation Weather Dissemination (AJM-33).

The objective of both the focus groups and summit was to improve stakeholder understanding of the deficiencies in the PIREP submission and dissemination process and to develop a research road map that will inform end-to-end solutions targeted at increasing the number of PIREPs, quality of PIREPs, distribution and accessibility of PIREPs. By conducting focus groups with end user populations (pilots and air traffic controllers), valuable feedback was obtained addressing some of the following questions:

Why are pilots providing relatively few PIREPs? Where are the deficiencies in the submission process? Are the deficiencies due to the current format or medium? Are they due to current avionics limitations? Are they due to the current submission process? Are they due to the lack of a timely feedback process?

Why are air traffic controllers not consistently soliciting and/or correctly inputting PIREPs? Is it due to task saturation? Is it due to protocol/process/work flow? Is it due to the current format/submission form design?

## **Background**

After a long investigation, the National Transportation Safety Board (NTSB) identified deficiencies in the handling of PIREP information that resulted in delays, errors, and data losses. Released in the spring of 2017, the NTSB's special investigation report included safety recommendations to the Federal Aviation Administration addressing two broad categories of issues that reduce the effectiveness of PIREPs: submission issues and dissemination issues. The report addressed submission deficiencies by stating that pilots are providing relatively few PIREPs, particularly during good or as-forecasted conditions, and air traffic controllers are not consistently soliciting PIREPs during weather conditions that mandate such services.

According to the NTSB report, the dissemination problems are associated with the ATC, Flight Service stations, or company personnel handling PIREPs introducing delays and errors, or even failure, to distribute the information. In addition, the board identified ongoing issues with procedural inefficiencies or noncompliance, low task prioritization of PIREPs processing, data-entry errors, and problems with data-entry interfaces including the lack of current automation functions for PIREPs within NextGen platforms. Proprietary practices where PIREPs are not shared in the NAS were identified as a serious issue as well.

The NTSB recommendations focused on pilot, flight instructor, Flight Service personnel, and air traffic controllers' training and education to help them better understand the essential role their efforts play in prevention of accidents. The board also underlined the role technology plays in increasing the efficiency of that training, as well as, PIREP solicitation, gathering, and dissemination. The board's recommended course content should include scenario-based training using real-world examples to illustrate the value of both fair-weather and adverse-weather PIREPs, explain how meteorologists use PIREPs to verify and revise aviation weather forecasts, models and advisory products to improve safety in the National Airspace System (NAS).

The NTSB's recommendations to the FAA included reviewing the process by which federal and contract flight service station specialists receive verbal pilot weather reports. This NTSB's recommendation was aimed at simplified and systematized procedures to reduce the amount of time the specialists take to gather the necessary information from pilots.



To begin addressing these deficiencies, the ATO enlisted the help of multiple lines of business within the FAA and user communities outside the FAA. The "FY20 Top 5: PIREP Solicitation/Dissemination CAP" consists of the following five strategies intended to address PIREP solicitation and dissemination issues:

- Strategy #1: Encourage pilots to file more PIREPs.
- Strategy #2: Improve automation capabilities with regard to PIREP solicitation, entry, and dissemination.
- Strategy #3: Improve knowledge of PIREP processes, tools, and system impacts through ATC training and education.
- Strategy #4: Align policy and procedures to provide consistent and sufficient guidance on PIREP solicitation and dissemination.
- **Strategy #5:** Improve understanding of the deficiencies in the PIREP submission and dissemination process.

FAA Aviation Safety's (AVS's) Aerospace Human Factors Research Division at CAMI partnered with the ATO to address **Strategy #5**. The feedback from six focus groups conducted in May of 2020 is presented in this document.

## **Method**

### **Participants**

Ten general aviation pilots, twenty-one air transport pilots, five regional aviation pilots, and twelve air traffic controllers/flight service specialists participated in six focus groups. There were eight participants in each group: six were pilots and two were controllers/flight service specialists. However, many of the controllers/flight service specialists were pilots, as well. The participants' background and expertise were very diverse, including military and civil aviation service, with tenures spanning from only a couple of years and a couple of hundred flight hours to 35+ years with thousands of flight hours. All air traffic controllers who participated had 30+ years of experience in the full spectrum of ATC positions.

## Procedure

Due to the COVID-19 pandemic, the focus groups were conducted online, via GoToMeeting videoconferencing and each lasted approximately two hours. The participants were asked to sign in via an Internet connection using both audio and video. The discussions were moderated by the Principal Investigator for this project, and were structured around understanding the deficiencies in the PIREP submission and dissemination processes as identified in the NTSB special investigation report. An open and honest dialog about the issues associated with PIREPs and potential solutions to those issues as seen through the eyes of the end user populations – pilots and controllers – was encouraged.

At the beginning of each focus group session, participants introduced themselves and shared information about their expertise and career experience. **Appendix A** contains a transcription of participants' introductions. Although participants were attending an event traditionally conducted face-to-face, "going around the room" virtually led to an almost immediate sense of fellowship between participants that greatly facilitated the rest of the discussions.

The discussion was structured as follows:

- Each slide of the moderator's presentation contained thematically grouped questions directed to either the participating pilots, controllers, or both (Figure 1)
- The screen-sharing function of the GoToMeeting platform was used to present each slide for all participants to see on their devices (e.g., personal computers, tablets and smart phones).

**The trouble with declining number of PIREPs**

- **Why do you think the number of PIREPs has been on decline?**
- **Pilots respond:**
  - Where are the deficiencies in the submission process?
    - Are they due to current the format/medium?
    - Are they due to current avionics limitations?
    - Are they due to the current submission process?

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Figure 1. Example of a thematic group of questions.

If a participant wished to contribute to the discussion, they raised their hand to the camera. The moderator either gave them the virtual floor immediately or acknowledged the request and requested that they wait until it was their turn to speak. All sessions were recorded and the audio later transcribed. The audio transcriptions of the participants' answers can be found in **Appendices B to H**. Each appendix contains a transcription of all the participants' answers to one of the groups of questions in chronological order. All personally identifiable information was removed from the transcripts including participant names, employer names, affiliation, etc.

## Results

The feedback from each thematic group of questions is summarized in the sections below. These summaries echo the answers to the specific questions as well as new issues raised during the discussion. To ensure that participants were given multiple opportunities to share their

views throughout each session, a certain amount of redundancy was built in the different question groups.

## **Group 1 Questions**

**Why do you think the number of PIREPs has been on decline?**

**Pilots were requested to respond to the following questions:**

- *Where are the deficiencies in the submission process?*
- *Are they due to current the format/medium?*
- *Are they due to current avionics limitations?*
- *Are they due to the current submission process?*

The answers to **Group 1 Questions** confirmed the existing perception within the aviation community that deficiencies in the submission process, from the pilots' point of view, are a combination of outdated format, differences in avionics equipment capabilities between different types of operations (e.g., general aviation vs. air transport) and a cumbersome submission process. The majority of pilots view the PIREPs submission as a *very informal* voice exchange with an air traffic controller rather than a formal process of filing a report. In simple terms, pilots described the PIREP submission process as starting with a request coming from a controller or Flight Service specialist. In response, pilots convey what they see outside via an informal voice radio communication. Pilots repeatedly stated that they never follow any particular format per se. Furthermore, when pilots give reports to their company dispatch, they also do not use any particular format and simply give a brief ARINC Addressing and Reporting System (ACARS) message. For example, if the ceiling forecast in the pre-flight briefing paperwork was for 2,000 feet, and it is at 1400 feet, the pilots would convey that difference to dispatch.

The majority of pilots participating in the focus groups were unaware of any formal process of submission and most of them indicated that they had never filled out a “proper” or “official” PIREP, except possibly in flight school. They stressed the fact that most of the times when they are asked to give a report, they are busy looking at the instruments, flying an approach, arrival, etc. They see PIREPs as a lower priority task that is more of a process of

sharing with ATC/Flight Service of what they are seeing outside, at their discretion, and when they are not task saturated.

A full transcription of the answers to **Group 1 Questions** can be found in **Appendix B**. Listed below are selected participant quotes:

*“Most of the time we're not really concerned with PIREPs unless they are relevant to our current flight or conditions that we're in.”*

*“The last thing you want to do is go through a bunch of codes and slashes and fill out a form.”*

*“...not really concerned with anything other than probably turbulence or winds.”*

*“Things are busy. Radios are congested. And really ... I'm not really paying attention to tops and bases. Unless I'm asked specifically to give information on that. Like if we're coming down, can you give a tops report and we're already in it, I'm like, I could give you a guess when we entered it. But I can't really tell you exactly. I mean give you a bases report when we come out of it. You know temperature and icing if their present. Most of the time we're not really concerned with PIREPs unless their relevant to our current flight or conditions that we're in.”*

*“...with technology now, even in my helicopter, I've got almost every bit of weather information I could want right there at my fingertips. And we do put a lot of weight into the PIREP as far wind shear and things like that on short final. But other than that I think we're really almost moving to where we're more dependency on avionics than we are each other.”*

*“...if we're busy, the controllers are busy too. So a lot of times if we don't have time or it's not asked. We don't have time to present it to the controller. Even then the frequencies are jammed up because the FAA's got overlapping frequencies and everybody's talking over each other. So there's quite a few problems with the submission process just in that, if you're trying to do it by radio. I mean trying to submit something from dispatch [laugh] yeah right.”*

*“...we always talk about aviate, navigate and communicate, right? So PIREPs would fit down at the communicate level. So in terms of what a pilot needs to do, you know, to be effective and safe. It's the farthest thing down the list. And then on top of that the communicate would be talking to controllers and everything else that you have to do. So I mean, I just think the normal priority that we have established sets the first reason.”*

*“...we'll just pass it along to controller and assume that the controller is going to put it in the system.”*

*“...to do that within the ACARS system requires you know shifting your focus away from primary flight displays and going kind of heads down into your ACARS. Punching it, if you have to go find the page. In the 737, I think [Participant] will concur with this. In the*

*737 that's a, you're 5 or 6 buttons away from that page. So this is not at the tip of your finger. And then you have to you know on a non-qwerty keypad right, just a straight alphabetically order keypad. Which is a little bit clumsy. So it's a workload thing. I mean it's going to take time out of doing other things. So it's not easy to do. It's much easier to report it on the radio. Now you're taken that same workload and putting it onto another person that's doing a whole bunch of other stuff that we don't know. So I always would prefer as a pilot to hand it off verbally to a controller because I don't have to do that big multi step process that I was just describing. Because it's cumbersome.”*

*“Yeah I'd say PIREPs aren't declining. It's the formal PIREPs that are declining that's what we're all talking about. It's just a matter of communication back and forth ... So I think formal PIREPs aren't given very often. But just informal, hey, this is what we got. What's going on with the plane 30 miles in front of us? We do that daily.”*

During the **Group 1 Questions** discussion, the pilots brought up an issue about reporting turbulence automatically based on Apple iPad sensors used on the flight deck. The quotes below illustrate the different, and at times opposing, attitudes different pilots had regarding the accuracy of this method of “measuring” turbulence. The utility and usability of such technology would be debatable, unless such an automatic sensor is designed, tested and evaluated to provide a “reading” equivalent to the subjective human perception about the magnitude of the same phenomenon (e.g., turbulence).

*“These are actually not connected to the airplane per se. They're on our iPads. And this one actually will give you a graphic. You do the program on. And then it will automatically detect turbulence in the airplane. And transmit it through the internet connection on the airplane to other airplanes, to other people that have the iPads. And then you can see actually a track where an airplane has flown across whatever the distance it is and whatever area, where its color coded based on whether it's been smooth. Or there's been any kind of turbulence or chop. Or anything along the way. The one thing I will say about that is, it's actually very good in real time. The only thing is it tends to slightly inflate the turbulence that we're feeling in the airplane. Which is you know if you think about it you'd rather have it that way then the other way. So we have those things.”*

*“It's just that on that WSI app I know you look at your route of flight and there's a little icon. You can click on and it'll tell if its light turbulence, moderate turbulence, severe turbulence all that stuff. And the only thing I'd add is it's automated so it comes from what the plane expects. And I found that when a plane auto reports light turbulence it's what we'd normally call more like moderate turbulence. It's a little more.”*

*“All I know is that if see a light turbulence TAP report that's usually when we're going to have the flight attendant sit down. Because it's going to be the point where it's bumpy enough to be dangerous to them. We don't definitely want passengers up and stuff that it'd be dangerous, when there's a light turbulence. Normally light turbulence for us, that's you know alright, we can still let them work in the back. We'll keep the seat belt sign on.*

*But when the TAP's report light it's getting more into the dangerous air. Where it's not going to seriously injury anybody. But it can knock someone off their feet. And we're going to have everybody sit down for that. So it's not real, it doesn't match up with what a human would expect and what the computer on the plane thinks."*

*"Thinking about this from both angles. Both as being a controller receiving it and both as a pilot given it. As far as giving the turbulence I'm pretty quick at it. I agree with [Participant]. What we consider light turbulence is really more of a chop or something like that. Where I can only imagine what the automation is doing. I learned real quickly that severe turbulence is something that we don't want to report because it requires a maintenance check after we do it. I don't say severe anymore."*

## **Group 2 Questions**

**Why do you think the number of PIREPs has been on decline?**

**Pilots were requested to respond to the following questions:**

- *Are the pilots putting in way more information than they're getting back, and are losing interest in the system?*
  - *Is it due to task saturation?*
  - *Is it due to a lack of timely feedback or dissemination back to the cockpit?*

The answers to **Group 2 Questions** supported the perception that PIREPs are a lower priority task for pilots. While the pilot participants echoed how much they appreciate a PIREP, they also made it clear how much they do not appreciate being asked to provide one during critical phases of flight when the task saturation is high.

According to the pilot participants, while the widespread use and availability of weather information on a variety of new platforms, applications and devices makes the PIREPs seem less relevant mostly due to the significant time delay between PIREP submission and dissemination; it has not diminished their importance for aviation safety.

Pilots gave multiple examples highlighting the wide availability of new weather applications and display technologies that are capable of presenting all weather products graphically, including PIREPs, on devices such as iPads, as well as on flight deck displays. Such

applications and technologies are in stark contrast with the traditionally textual shorthand used for weather reporting including for PIREPs.

Furthermore, the pilots were concerned that the significant time delay between PIREP submission and dissemination significantly contributes to the perception that there is not much of a return on investing the time to input information into a “cumbersome” and “outdated” system. Especially, given that the information is already “old” by the time it is disseminated.

Lastly, the pilots pointed out that, especially on large air transport airplanes, the avionics is capable for sending automatic PIREPs/AIREPs. This allows multiple reports to be sent to the ground frequently, automatically, along the entire flight route and without pilot involvement. However, pilots also highlighted the important limitations of AIREPs. These limitations include the lack of information identifying the direct human perception/observation of phenomena such as turbulence or icing. Preserving the human element inherent in PIREPs was emphasized throughout each focus group session.

A full transcription of the answers to Group 2 Questions can be found in Appendix C. Listed below are selected participant quotes:

*“Well I think that part of the issue is ... the controller asking during task saturation points. If somebody is coming through down to minimums. The last thing on their mind is oh well I need to remember where my bases are or I need to remember this. They are trying to land an aircraft safely .... After they land you can ask them and you are going to get four different answers. Because they were so saturated with doing their job at the time. That they weren't thinking about giving information.”*

*“The reason I do not file more is not due to task saturation. Because normally an IFR flights once in cruise mode, you're just there, you're kind of monitoring everything so you've got time. If there's time on frequency it's usually not a problem. Again it's more of an issue of trying to get flight service to answer. Finding the VOR you need. In terms of feedback one of the coolest things ever is when you put a PIREP in and then 10 minutes later it shows up on your EFB... But that happens maybe 1 in 10 times. Will I see my PIREP before I land? And so, it doesn't happen very often, I don't know what that is but it's probably 10 maybe 20% of the time that I see a PIREP an hour, hour and a half after I've uploaded it.”*

*“So from the Part 61 and training world. I feel like approach, or whoever I'm talking to never really cares about what I'm saying. So for me, flying in the GA world, knowing*



*where the bases and tops are is important to me. Because if I'm on the ground looking to see if I want to go fly or not. And someone reports a PIREP that the clouds are low or higher than forecast. Or that are reporting on the METAR. Then that will help determine if I'm going to go or not. So I'll be flying into OK City and I'll be talking to approach and I'll say, tops 6500. Bases 2000. Or whatever they maybe. And I feel like approach whenever they're replying say roger or whatever. They don't really care. And I feel like it's not going anywhere. And so as a pilot, I feel discouraged to submit them if I feel like they aren't going to be beneficial to anybody. Or get entered into the system. Because the jets coming in after me that are on the frequency already aren't going to care if the bases are at 2,000. But a little Piper coming out of David Jay Perry might, that might make a difference for them whether they're going to fly or not. So I think the biggest thing for me is, is feeling that the PIREPs that I submit aren't going anywhere. And they're just getting thrown in the trash before they can do any good.”*

*“...it just frankly it doesn't matter all that much. I mean it's certainly nice to know in terms of ride reports and things but it's just not something we need or have a lot of use for and then so that turns into not really participating much since we're not using it. It's really not on the top of our brain. And we're not thinking about submitting them for others who certainly could benefit from it. Just like you said the loss of interest maybe because that information is coming from other places. Or it's just not relevant to your type of flying. Again, I realize that sounds selfish and it probably is. But I think there's probably a lot of that.”*

*“I don't think a PIREP really would give you a good representation when you're right in the thick of bad weather. It is great for en-route but as far as instantaneous information to make a decision on where you're going, I don't know that it's that pertinent. I don't know if they can do it that quick or not.”*

*“I am thinking that it's possible that, we now have so much access to weather with WSI, en-route and now we've got radar. We've got... so much great information. A lot more than we did in the past. So that might be a reason why some pilots might not think to give a PIREP. The other thing that I thought was like, I fly the A320 and I do know that we have TAPS that are automatically being reported. So am I, maybe pilots are less likely to give a pilot report for turbulence knowing that we do have an automatic TAPS report.”*

### **Group 3 Questions**

**Why do you think the number of PIREPs has been on decline?**

**Pilots were requested to respond to the following questions:**

- *Why are air traffic controllers not consistently soliciting and/or correctly inputting PIREPs?*
  - *Is it due to task prioritization?*
  - *Is it due to task saturation?*
  - *Is it due to protocol/process/work flow?*

- *Is it due to the current format/submission form design?*

The answers to **Group 3 Questions** further solidified the perception on the part of both end-user populations (pilots and controllers) that soliciting, submitting, capturing and disseminating PIREPs is not a priority for either pilots or controllers. Task saturation, lack of standardization, and outdated format and technology used were identified as major contributors to such perception. Controllers were convinced that only “official” PIREPs are on decline. They stressed that lack of staffing was one of the main reasons for the perceived decline.

A full transcription of the answers to **Group 3 Questions** can be found in **Appendix D**. Listed below are selected participant quotes:

*“The coordination only takes sometimes seconds. But it is seconds sometimes you don't have when you're separating airplanes.”*

*“Also the forms ... no one knows a lot of these acronyms. The forms aren't very human friendly let's say.”*

*“I think the official PIREPs are probably on decline. But we solicit PIREPs all the time. The process is once we get the PIREP we have to write it down. Pass it to our weather. Then our weathers supposed to put it in the system, whatever system they put it in. Which I don't know it goes where ever. And then that information is disseminated that way. But once the information gets to weather, I feel a lot of times, they just set it to the side and they don't even put it in the system. Especially on days when the weather's pretty bad.”*

*“Okay, so for task prioritization yes. Because often times especially in en-route environment now you're working by yourself on a sector. So you're much less apt to put in a PIREP especially if it's only affecting your sector. Because again, you're going to brief the next controller on the phenomena. And you're telling the pilots as you talk to them. So it's why am I also going to put in a PIREP in the airspace that I have. Now if I'm working over in approach control for an example, and there's icing or tops of course things like that. And I get a PIREP. That PIREP I will put in because now for example if [Participant]'s working approach control under me, I'm given him information he needs. But if it's just you know specific to my sector I'm much less apt to put in a PIREP.... With the protocol you know when there are times that we are required to put in PIREPs, yes we do. But if it's just informational and again if it's just my sector, I'm probably not going to put in a PIREP. But I am going to tell the pilots as they check in. And I am going to tell the controller that relieves me here are the ride conditions. Here's winds. Whatever needs to be disseminated.”*

*“And it's real antiquated you know disseminating the PIREPs, very antiquated. But more often than not occasionally you'll get some guy unsolicited in clear weather, he wants to give me the winds aloft. I had a guy give me the winds aloft all the way down from 3000*

*feet. I was about 10 calls behind after he shut up. And I'm not, I don't mean any offense to the pilot, but I didn't even ask for that. It was some guy, I guess he felt like chatting awhile. But you want it short and sweet. And shorter and sweeter as possible. I mean, I just want 1 or 2 words like. Light chop/smooth. Or breaking action, good/fair. Because we're so busy at some of the facilities that we don't have time to listen to everybody. Because we're too busy working airplanes."*

*"I would say in many cases it's duty prioritization. Because as a controller it's drilled in your head like you said earlier, separate them. First and foremost separate them. And if you've got 10 to 15 aircraft on frequency and you don't have a lot of time to solicit but the basic information. Like I will ask you, you know, say flight conditions. And I'm expecting to get it back a very concise answer, you know. Light icing at 8500 or whatever. But what happens 90% of the times is our pilot friend, and I don't mean this in any disrespectful way whatsoever. But like to talk on the radio too. And before you know it as a controller you are so behind especially if you're working approach control and you're trying to get guys on the localizer and the whole nine yards. I get 4 calls behind, I'm in a world of hurt. I've got to really hustle for a few mins to get things back under control. And it's just a matter of what we want the information of course. Because is definitely helpful. But we want it in a concise of manner as possible. Because we do not want to take up time on the frequency. And then like everyone has already mentioned to, the FAA rules for soliciting PIREPs are antiquated. And because they're antiquated a lot of people will do just the bare minimum. And the bare minimum is under certain conditions you solicit a minimum of 1 per hour. Which really doesn't help the pilots much at all. I don't think."*

*"...when we got to talking about official and unofficial [PIREPs]. Here's the actual event that's taken place. The arrival. The departure.... when you have a wind shear alert - you get an alert. You issue the alert right away. Minus 10 knots or whatever it is. And that's very pertinent information that pilots pass onto controllers. And tower controllers make every effort to pass that information to the pilots that follow on the approaches."*

*"We're using PIREPs as a tool that informs the guy behind the guy that we're talking to. We don't usually take time to write it out. Because we don't have that time. Especially in low altitude approach control environment. We don't have time enough to barely write down aircraft identities. So, we don't have time to be writing down weather sequencing. So we'll ask that question. And hopefully it's been transmitted on that frequency so the following pilot knows what to expect when I talk to him. But I mean, you know I think that PIREPs really as far as being disseminated like that, I think when we got rid of flight service station is when we actually started to see that change. Because in the controller environment we really don't have that kind of time. I mean we're pretty much busy. High altitude, they are, the center controllers they'll have more time to talk to a pilot about what he's encountering because they don't have anything to do, right. We stay 10,000 feet and below. We don't have time enough to talk to you very long. And going back to what [Participant] was saying. I'm surprised that a tower controller would argue about weather. But because usually controllers just except it and move on. But like what [Participant] was saying that he's given a pilot report. Most of the time we don't have time to listen to that. We really don't. Because I'm trying to get whatever I can to be able to help the following aircraft. But I don't have enough time to sit there and hold a full blown conversation with you about it, right. You tell me what you're going through the*

*chop plus/minus, that's good enough for me. And then I'm going to ask the next pilot did you get what the proceeding aircraft just said? And he'll say yes I got that. And we usually work from there. But really I'm almost surprised other than when maybe [Participant] can relate to this. Other than when we're working flight data and a controller might ask you to put in a PIREP that he's gotten. Other than that we don't do PIREPs like that."*

*"Flight Service usually gives, that was pretty much what they did was. Other than taken pilot reports, PIREPs or keeping up with NOTAMs. And doing flight stuff with pilots. High altitude center controllers have a little bit more time because they're not pressed for time. Their separation is usually many miles apart. Where the closer you get to the ground we start off with 3 miles. When we normally we might start off with 5 miles going down to 3 miles. And we're trying to get that down to a 1 1/2 mile on the final if we can at the most. But we use PIREPs and pilot information about weather on a real time basis. Not the whole around. Sort of like what [Participant] said. If you tell me that you got chop now. That might not exist 10 minutes from now. So I'm using that on a real time basis as I'm talking to airplanes. And again it all depends on my priority. My 1st priority is separating airplanes. My 2nd priority is, I mean my 1st priority would be an emergency, separating airplanes. And where PIREPs fall on from there is, you ask 10 different controllers, you'll get 10 different answers."*

*"You mentioned the flight service stations the way they used to be. You could talk to them and pass PIREPs onto them. And now they've consolidated all these flight service stations into a couple of units and they reduced personnel. So sometimes you can't get through with pertinent information with time enough to present a PIREP anymore. Flight service used to take that role on. Now they don't do it anymore."*

*"I worked in a TRACON environment like I said in [city] and [city]. And it didn't seem like some of the extraneous stuff the pilots really needed. They needed to know where the severe weather was. How they can avoid it. And at the smoothest ride down. All the other stuff didn't seem to matter much. And it didn't matter to me at all, in terms of getting them where they had to go safely. My first duty was to get them on the ground as safely and as smoothly as possible. So I didn't really, I just didn't care much about, you know, obviously I don't care anything about icing at 20 or 30,000 feet. And when the weather was the worst, I was my absolute busiest. And so it was just not a big priority of me unless it was relevant right at the time of airplanes going into what was, what I considered, or what they considered to be terrible weather. So I don't know just reading your slide here is it the process, the protocol, I don't, I just don't, I don't think any of that stuff is really important to be honest with you. And I will agree with what somebody said yesterday like you said, they said it's not that the frequency has gone down. It's just the formal PIREPs"*

*"Well I was just going to say that you know if it's going into the system, it's going into the flight service station. If you're actually flying in the terminal area or you know getting close to the terminal area, I mean, there's really no time or anyway for pilots to start bringing that up. We'll rely on our dispatch to give us a heads up. Because they're going to focus it towards us. Or like talking to [Participant] and [Participant] we'll be relying on the controller over the VHF radio to tell us what's going on. I mean nobody would, I*

*don't think any pilot would sit there and go into the ACARS system try to bring up PIREPs in a textual format, while they're in that kind of environment. It just doesn't work. It's not safe. It would be a, and then as everybody has said what's the value, how old is this? By the time I got sorted down what it is, I probably traveled 20 miles.”*

*“The majority of the airlines rely more on their dispatch than they do on PIREPs. Because they're not going to call flight service on the available flight service frequency in the area. Because they're too busy and they can get the information from their dispatch faster than they can from flight service. And again the next level is getting the information directly from the controller in the sector they're working, that they're talking to. I know having worked [city] center, I'm working high altitude feeding the corner post. I'm going to brief them, let the guys know, let the aircraft know what is going on. Hey we're deviating to the right up here about 20 miles for weather. Deviate as necessary when able direct to Blue Ridge or direct this fix. And again, they're getting a better presentation on their weather radar than what I'm seeing on the scope. It's getting better now with the newer radars. But again, they still get the best presentation off their display in the cockpit.”*

#### **Group 4 Questions**

##### **Errors & Delays in PIREP Distribution**

###### **Pilots were requested to respond to the following questions:**

- *Why ATC, FSS, or company personnel who handle PIREPs introduce delays and errors or even fail to distribute the information?*
  - *Is it due to procedural inefficiencies or noncompliance?*
  - *Is it due to low task prioritization of PIREP processing?*
  - *Is it due to the lack of awareness of the importance of PIREPs?*
  - *Is it due to problems with data-entry interfaces?*
  - *Is it due to proprietary practices (companies protect information from competitors)?*

The answers to **Group 4 Questions** further echoed the notion that minimal/reduced staffing or lack of trained and qualified staff (“data person”, “weather person”, “controller’s assistant”, etc.) are significant contributors to errors and delays in entry and dissemination. All participants agreed that pilots and controllers are well aware of the importance of PIREPs. However, they also stressed an immediate need for a major system overhaul. Furthermore, they suggested that until such system-wide overhaul is completed; trained, qualified, and most

importantly dedicated personnel whose job is exclusively the timely and error-free entry and dissemination of PIREPs, would be necessary.

A full transcription of the answers to **Group 4 Questions** can be found in **Appendix E**.

Listed below are selected participant quotes:

*“We had air traffic assistants back in the 90's. They were a lot of furloughed pilots and things like that. But they were real handy. But once we got rid of them. Nobody wants to staff data because there's somebody back there pulling strips for departures. Because you're not going to pull a controller off a busy position that you need to put them on data.”*

*“The system to me is broken. It's not really a system it's just a lot of information thrown out there and hopefully you can do the best you can with it. And I think the pilots like they just said they talk to themselves and they talk to the pilots especially in the terminal area, I mean, the controllers. And they give them up-to-date weather right on the spot or up-to-date PIREPs and stuff. It takes too long for the information to get through the system. If it ever gets through the system.”*

*“I think you were talking about several people calling several other people that they call this guy. And then this guy's got to call this other guy just to submit a piece of information that could be vital stuff in our flight operation. It definitely sounds like you have a lot of [unintelligible], talking to a lot of other [unintelligible]. Where submitting it through various mediums just to, you know, get that information to us. ... So it definitely sounds like you have a lot of people talking to a lot of other people about a simple piece of information. We know that the more receivers that information goes through, by the time it gets to us it may not even be the same information.”*

*“Because and not really the key going back to the usefulness or the purpose of the flight service station that we had. But flight service stations were the best friends that general aviation pilots had. Because they were always in constant contact with flight service. Even when they weren't in constant contact with approach control or tower control. They were always monitoring 122.1 at that time. So as far as today and I believe that, and especially in the big facilities. We use PIREPs as a tool, as I said before. It's what's going on right now, what's going to be happening within the next 5 minutes. It's not looking beyond that and I don't care what happened before that. Because I'm watching weather or whatever situation is going on right now, that is going to best help me serve the pilots that are in my area at that time. And really that's basically the way that controllers have to think now a days. Because we can't worry about what was and we try to look at what's coming but we're dealing with the what is right now. And that's our priority.”*

*“Yeah I was just going to say that most airports, I mean, busy airports that have an ATIS, I mean any hazardous weather or anything that's really critical to flight information that's usually included on the ATIS in a NOTAM anyway. I mean, when controllers basically use PIREPs for a real time information that is referencing what I'm doing right*

*now and for the airplanes that I'm working. Other than that I mean we have an ATIS for the hazardous weather. If someone reports that on takeoff that they lost plus or minus 10-knots, 20-knots. That is automatically put on the ATIS within the airport. So anybody coming in that area should have that broadcast.”*

## **Group 5 Questions**

### **Pilots were requested to respond to the following questions:**

- *What are viable solutions to modernize the means information is passed back to the aircraft?*
  - *How best to present it in the cockpit?*
  - *What are the factors affecting the geographical placement and temporal display of the PIREPs?*
- *How can these deficiencies be mitigated and eliminated by design?*
- *How can the end-to-end PIREP process be optimized in terms of efficiency and effectiveness?*
- *How can the potential for human error in the submission process be minimized by design?*

At a higher level, the answers to **Group 5 Questions** highlighted the need for:

- a) improved user interface design and overall user experience by eliminating the antiquated forms and format, simplifying the process of submission and dissemination, and
- b) sensible use of automation and new technologies and the need for a hybrid solution involving both automation and human input.

In addition, and at a more applied level, the answers were driven by participants' experience with already existing smart technologies and applications such as Google Waze, ForeFlight, etc. They suggested that transferring similar (e.g., Waze) functionality to the flight deck would significantly improve the user experience and ultimately minimize errors, increase the number and improve the quality of PIREPs. Furthermore, improving the user interface by allowing the use of plain language and free text was seen as the most effective way to improve the efficiency and effectiveness of the system as a whole. There were participants who cautioned against too much technology, as well. They believed that simply hiring trained and qualified data-entry personnel would be a good near-term solution.

A full transcription of the answers to **Group 5 Questions** can be found in **Appendix F**. Listed below are selected participant quotes:

*“... there is an awful lot of things that can be automated from the get go. That the airplane, as far as my operation, having ACARS. There is a lot of stuff on the form that goes out the window with a button. Because the airplane knows all that information already. Such as altitude, type of airplane, time stamp and all that stuff. So it will be much easier to categorize the PIREPs. Now there is only 2 types. I mean that's like kind of silly. I don't understand origin and non-origin. Well I understand what the nature is but why isn't a turbulence report? Why isn't a visibility PIREP? Why isn't it an icing PIREP? There is no categories for PIREPs except urgent and non-urgent. Which is kind of like goofy. The other thing is we, as pilots, have no way to tell you what the visibility is exactly. I don't have a way. My eye doesn't tell me. I either see the runway or I don't see the runway. Now it might be regarding cloud coverage. I might be in a spot that isn't scatter and the guy 3 miles to the East of me might be in a solid layer. So when he goes down to that he's kind of like, really hard for me to see now. I can tell if I'm getting ice and what type. I can tell you if I'm getting chop or if I'm getting turbulence. Now that also changes because the chop that a 757 feels in front of me, it's not the same that I'm going to feel in my 145. Because just of pure physics. It's a heavy airplane. Harder to displace. It's going to be different. So all the perceptiveness when you're trying to help general aviation, 121 should be separated from general aviation because a lot of the stuff that we do doesn't apply to them and these are the people that needs the most help because they have the less amount of tools. So it's a lot of the stuff. Like automation would help big time. Automation would help big time here. There is a lot of the stuff that goes out of the form immediately with the push of a button. Importance, like I mean, how relevant a PIREP is.”*

*“I think that with the coming of ADS-B, I think that's going to allow the pilots to talk to one another a little bit more. So I think it's next year the ADS-B is pretty much going to be nationwide next year or the year after. But with that, with the ability for pilots to communicate with one another cockpit to cockpit and let each other know what their flight conditions are. I think that will pretty much eliminate as far as the controllers need for PIREPs. Other than like I said, on a need to know basis. And what we're doing, dealing with at the present time.”*

*“I've put some thought in some of things that you're looking for in your study here. As far as a system, [Participant] mentioned we used WSI as well. That's my real time information as long as my internet connections working in the airplane and it's extremely valuable. Again, we talk about flight service stations going away and things like that. That's because today I don't need to look at a hand drawn weather chart. Try to figure it out. Then I'm dependent on the PIREPs that are given me up to date more accurate information than this weather chart that was drawn by the weather service guy, six hours ago. Now it's all real time. When I give a PIREP I'm trying to update the most current information that's different from what I've been told or what I'm seeing right now. So that the person behind me, the aircraft, behind me can use it or the controller can use it. If I were in the airplane and there was an easy way for me to open something up and I could put in the cloud tops let's say of that thunderstorm. And now that goes to everybody else. But that has to be integrated with every weather system. Every company. You know whatever their using. But I can give it turbulence, hey we just picked up moderate turbulence here. Well if I could type that in real quick on my iPad and that updated*



*everybody's weather system, whatever their using. Now it's not dependent on the controller relaying it to every single airplane that's about to enter his airspace. The guy that's 80 to 100 miles behind me can see it without even asking and the controller having to relay it. But I don't know. That's a big leap there."*

*"... the 121 world, we need an ACARS submission form. Or on or JEP app we need submission form. As far as formal PIREPs go. With the formal PIREPs I think you just take the controllers out of it. And then with the informal PIREPs that's where the controllers are going to play a part. And then also the, if we do have a submission form we also need to have the Wi-Fi or a satellite connection to be able to receive those reports that are submitted. And the FAA needs to communicate the need for these reports. Like if they want the reports so bad that needs to be the initiative the FAA tries to roll out and say hey we need these reports. Please fill out as many as you possibly can."*

*"I was just going to say that it seems like one of the common problems that keeps coming up is the fact that everything has to go through flight service. That seems to be the big hang up. And it's difficult to get a hold of them. Takes too long to talk to them. It seems like that's a big trouble point. But then they're also the solution to what you brought up before if it's a private thing ForeFlight/Garmin/WSI well that's just going to be for subscribers. Or if airlines develop their own technology they're not going to want to share it. And flight service well that's the public good free for everyone. But it's also the problem. So somehow that needs to be worked out where the public good has the technology or is updated with what other people are developing."*

*"My thought was much of what he just mentioned to you but if you look at ForeFlight. Which I don't know if you can see but I have up here. It gives you imagery. It gives you a bunch of different formats to look at different things that are going on. If you had the option of PIREPs there that were pertinent, that purged itself, that would be really super helpful to disseminate that information in several places.... When flight service went, became privatized to Lockheed Martin. There was a real, real slow down in the flight service people. People couldn't get flight plans. They started filing through ForeFlight. A lot of other places. They looked for alternatives because flight service for a couple of years there just could not get the job done. And I think what happened is a lot of pilots just kind of disregarded flight service after that. It was too much of a hassle. You've heard [Participant] talk about it up there. That their hard to get a hold of and [Participant]. It's better now. But I think they lost a lot of customers support and usage. Because they just weren't getting the job down there for a while."*

*"I will say, there's probably a reason for this, but I've always wondered why there isn't just a, you know, we used to have flight watch at 122.0 and they took that way. I've wondered why there's not just one frequency. Because the only way I can find that frequency is I'll follow, I'll find an airport on ForeFlight. I'll highlight it. I'll look under the frequency tab to see what, you know, is it Jonesboro radio, McAlister radio and what that frequency is. And it's different then it is you know 200 miles the other way. Well I've always wondered why we can't just have one frequency for those guys and there's probably a reason I just don't know."*

*"...I didn't like flight service when it just had a single frequency because you would get calls from a hundred of miles away sometimes. And it was always crowded. And it was*

*difficult to get on which is why I would always call from the specific VOR's because usually nobody was on there. I think that maybe it, it's a single frequency, you're going to get calls from hundreds of miles around to the same one. Because at 35,000 feet you can see quite a ways."*

*"...you've got the WSI thing right? It would be, I think, the focal point here not to give the controller more things but maybe something from the center. If those PIREPs are those just the audio VHF PIREPs were put into a system whereas we were talking about let's say, potentially about turbulence or something, right. So a guy puts in a PIREP for turbulence and it's available through a means like WSI, right. And pilots would get that automatically. And possibly it could be an addition to the ADS-B stuff for general aviation people. And then automatically let's say it's a turbulence PIREP. So it starts a 15 minute fade out. So after 15 minutes if a controller doesn't put in another one when [Participant]'s or you know somebody's [Participant]'s Airbus is coming through there, he doesn't refresh that PIREP it stays off. I mean it seems like the focal point here would be to have the controller put it in and have it displayed graphically for the pilots. Either via ADS-B, WSI is another means. You know something like that. Obviously, the GA guys wouldn't benefit because missing Wi-Fi. But through ADS-B. And then it would actually be meaningful. Real time. It would be graphic. You could see your relative position to where things are going, right. Instead of trying to figure it all out."*

*"All of these little gray things at least in ForeFlight are what the pilots look at. And for me as a general aviation pilot it is so much more useful to see it in this format in a graphical way. Then it is to say off the [airport] VOR 293 radial 15 DME, whatever. If I'm flying in the soup the last thing I want to do is be calculating where I am. Where that DME is. Where that radio is. It takes, having it graphically like this, takes all of the guess work out of it. And I can say, oh if I'm going, if I'm final for RWY 36 at [airport]. This PIREP is going to be very beneficial to me. And so having it graphically somehow whether it be in an application like ForeFlight. Or through the [TIS-B] that we have with ADS-B on our GPS's in the cockpit. I think that's extremely beneficial to increase your situational awareness and make the process a lot easier. And task saturate you a lot less."*

*"... in terms in of when you're getting ready to start an arrival, right. You obviously going to see radar information. See it on WSI. I mean you look at it. I look at it. Everybody, [Participant]'s looking at it right. But also having more of what the controllers getting. Those real time things, as opposed, to this formalized PIREP thing. If you had a guy sitting there that was saying hey, you know, United 1234 reporting whatever. He could just hit the tag up on the screen, because you have the current position, right. Now it's even more accurate with ADS-B. And then they can just pull in whatever the small thing. They've got the aircraft type. They've got the aircraft position. They got the date. The time. And all of it's turbulence. Boom, end of discussion. And it automatically would feed into something that you could see. So when you're getting ready to start the arrival you would look down at that. You'd say oh wow man looks like we're going to get hammered on the diamond coming into San Fran going over the Cascades or something, right. So I mean that's the only thing I was saying that would be nice. I think there's a lot of information that [Participant] eluded to that goes in his head, that if he doesn't pass it onto the new controller sitting down. You guys all know, when we check*

*in, a guy goes I just sat down. I'll talk to the next guy, I'll find out. I don't know. So that's all I was saying. And then after 30 minutes some of that stuff could fade off if it wasn't refreshed. So starting the arrival I'd know what's going on. I'd need my heads up, I'd say cool. It's going to be clear sailing or it's not going to be. And then we would at least capture more of that incremental data that's getting lost. Which would show up on the ADS-B stuff that [Participant] was showing us, right.”*

*“I think in terms of, in this day and age the popularity of iPads and electronic flight bags and what not. Definitely the PIREP needs to be displayed on a map display so that a glance you can tell where it's situated. And I mean there are a variety of ways of displaying it. That's a whole other conversation. In terms of the timeliness factor I guess the problem I've experienced isn't necessarily been the PIREPs are delayed getting to me. In some cases in fact they're taken away too soon. That is for a while I think flight service was actually with holding them if they were more than an hour old. And again there are multiple uses of pilot reports. I mean if I'm in-flight at the moment obviously I want something that's current. If I'm sitting in my office trying to figure out to go flying today or whether I can go flying tomorrow. Being able to look back and the weather service allows us to filter pilot reports back to 24 hours. That's probably the limit of anything I can anticipate needing. But I certainly want to be able to see you know over 6 hours ago, what conditions were doing in certain areas. In part because that maybe the only data available. So knowing what was going on a few hours ago versus knowing nothing is very helpful information.”*

*“The only thing I can think of as [Participant] said is to increase staffing. And also make it somewhat simpler. Because again, we're told to separate. And not necessarily disseminate. And we got to change the focus to get everything kind of under control.”*

*“But again, we're getting real time PIREPs. ... Very, very important and that's the braking action. So at [airline]and probably most airlines at the top of descent or sometime in the descent we're going to brief the approach right with the other pilot. And that's the time that we talk about the approach and the runway conditions. What kind of auto brakes we're going to be using. And so when we do that, we look at the ATIS, right. So we're looking first at the ATIS. And now we've got this Jepp Pro program, most of us are, we're not tuning into the ATIS to listen. We're downloading it on our app. I think it would be really, really great if we could get those braking action reports on the ATIS. I remember and I still do it today. That we're on the approach frequency and let's say I'm the pilot not flying. And I'll say I'm off the radio for a bit because I'm on Tower listening to the airplanes landing in let's say icy or snowy conditions. And I'm listening to the PIREPs being reported on tower. They're not being reported on approach. But those are very, very important if not the most important PIREPs. So if we could get them to us much earlier than waiting until we get on tower. Such as maybe through the ATIS system.*  
“

*“Sure just real quick and not to beat up on the Waze thing. But some smart person at Waze and they probably work for Google now. But has figured out a way to filter those reports and decide what is useful for the driver. As their going from A to B on their route. And it'll tell you when traffic's ahead. It'll tell you when there's a wreck. Or a cop, or whatever. Well I think that same principle can probably be applied. Because like*

*[Participant] was saying. You know part of my preflight routine is I go in and I put in the origin/destination airports. And then the routes will pop up and you can populate the entire route. And WSI, it is a great program but it's almost like information overload if you let it be. And so it has ways where you can like set, there's like preset filters and so I have one that's called turbulence. Where is just gives me turbulence PIREPs and the TAPS reports. And then the WSI kind of has a propriety turbulence deal that I bring up. And then I have another one that's called weather where you can bring up thunderstorms and stuff. But you know I guess what I'm getting at is, there's so much information we almost need and it probably comes from focus groups like this. But someone that can decide what is important to pass to us when. And is able to push those alerts either through WSI. Or you know if you're talking general aviation the ADS-B or something like that. So that the end user gets it in a format that's useful. Either plain English or something that's close to it. And it's timely. And it's also, you have to think about whether it's appropriate. Because sometimes if you're below 10,000 feet on a approach especially into somewhere, so we'll use [city] as an example. We get a lot of PIREPs going into [airport]. And the controllers there are great passing from center to approach to tower. Because the weather there changes so rapidly and there's so much that goes on there. Well if you're below 10,000 feet in [city], you know, you're 5,000 feet from touchdown. You don't want to know if there's light turbulence in the area. But you do want to know if there's wind shear on the field. So you know, those are all decisions that a program, if we're using a technological solution, would have to make in order to provide those timely updates to pilots. Otherwise, I think the controllers do a good job of just passing them to us you know as the system works now."*

*"... if the design is right to begin with, controllers will be a lot more willing to share that, if it's easy and if it's not cumbersome old fashioned form. If there is a way to optimize your workload to a point where it's not going to be extra work that you have to do in order to submit a PIREP. I believe that the technology can help a lot. In addition to awareness and training about the importance of it. I think it's not one or the other I think they're both from the top down the importance. Also creative use of technology. Like vast technologies that can capture the information without having to use really structured form. Because the form itself, any form, is making the human being [unintelligible] error. If it is more app design such that can reflect the human nature to use plain text, plain language and not exactly you know standard phraseology. How many of use standard phraseology? I mean you're supposed to but when you think about it listening to the chatter, I mean, there is everything but standard phraseology. They train you, they train you, they train you again almost nobody uses it. There is a reason and that's just the nature of the human, you know, part of the human condition. The more we design it such that it reflects the nature. And I'm one of those kind of [unintelligible] type that I am on a quest to educate people, hey we need to design such that it is natural to the human not having to specifically train them in and impose something to them that is not coming natural to them. Go ahead [Participant]. I'm preaching to the choir I know."*

*"I'm not too sure with this voice recognition that's going to fly in the 121 world. For privacy issues. A lot of people are concerned about being monitored while we're up there on the flight deck. I think most pilots would be fine with a drop down menu but I think you'll get a lot of push back from the Unions and the 121 pilots for the FAA to have*

*access to our EFB's and be able to hear. You know access to the camera and the microphone.”*

*“From what I can remember my training covered PIREPs mostly for, and I’m kind of sad to this I guess, for the oral exam. So just kind of going over what are they? You know, why are they useful? When would you maybe submit one? But I can't say that it was ever simulated or practiced. Or like gone into any more depth than that in training. And that does actually have to do with maybe that I trained at a pilot controlled field. Those students who are training at maybe a [controlled, uncontrolled] airfield might get a different training I'm not sure. But there is a more I think a relaxed feel around PIREPs and it was a little bit more in the background for the students at Princeton Airport. And maybe that has something to do with it. So I can't speak for those students. But from my experience that's kind of where it's at.”*

*“Yeah frankly there's not much in the way of education about them. I mean in like private ground, they go through it. We've got like a [task sit] at [university name] for 141. You know interpreting them. But just the basic ones. Nothing with any sort of complicated short hand really. And then it's pretty much that's it. After private ground I never did a PIREP until I asked the instructor to do one and demonstrate it for me. Because I had never actually seen one in practice. And still with 250 hours or so in the program I've been 2 total. Both because I asked the instructor to demonstrate. And that's the extent. I mean it's probably more than most of the people in the program are getting. So it's very bare bones.”*

*“I'm right along the same lines what [Participant] was describing. I think it wasn't, I mean, I can't remember off the top of head now. But it was a similar situation where the instructor said he wanted to fill out, you want to submit a PIREP to flight service? And I looked at him and said what? So there's very little pertaining to my background and [Participant] just kind of verified as well. There's little initial instruction on it. I think the reason for that is because the system is outdated. And we rely on other weather products to help paint our complete picture here..... And the way that this system is organized makes it very archaic. I think that's the reason why a lot of students are coming out of these days. And even when I went through the training it's archaic and we don't really touch upon on it because there are other weather resources/weather platforms that could give us a more complete picture. But I think truly because of the archaisms of the way the information is submitted and presented. Even with a few of the examples that I looked up online before this meeting took place. I had to go in and look up what a few of the symbols even meant. So, I mean, because of the outdated system the outdated information that the way it's submitted I think that there's definitely a factor there.”*

*“... by the color delineation you can tell whether it's something you want to click on and read. Or whether it's something that's not pertinent to your flight category. So that would be excellent.”*

*“I like what you're saying there but I do believe that all of us controllers and pilots are all very visual oriented. I doubt there's very many of us that want to read a report and try to disseminate whether there's turbulence or there's what or who it was. The ForeFlight app is much like a lot of the others but it'll, you can pick, you know, you pick your different layers of what you want to look at. So if I were flying at altitude and I was Part*

121 and I'm at you know 22 to 32,000 feet if I could select those altitudes and if there was a pilot report and I'm sure they'd have to time out after a certain amount of time. But if I could look on there and there was moderate turbulence and it had a circle with a T in it that was yellow. And if it was severe turbulence it'd be a circle with an S in it. And it popped up just like VFR and IFR show up on a ForeFlight map you would get your reports now. If you wanted to slew over and click on it to get the actual information you could but you know that's already being done. I just know we're visual. Like if I looked at a map and I see a bunch of magenta and pink looking colors or blue I know its IFR marginal VFR. “

“I would say it's not either this or that. It should be a hybrid of those two. Yeah I think the technology has improved in the airplanes. The avionics. I think it's great that information can be passed along. TAPS I find is of, it's you know, it has utility but it's pretty limited utility. Because I think that TAPS reports are very understated as [Participant] mentioned earlier. But I use [airport] as the example because of the weather there is so nutty... you know you might hear, they might be reporting winds down the runway at 9-knots. But then, a controller will pass to you, hey A320 that just landed. Reported a gain and loss of 20-knots of airspeed at 500 feet. Well that's crucial. I mean that's huge. Or whatever it is. Turbulence PIREP or whatever. So I think that it shouldn't really be one or the other. I think it should be a hybrid approach. As [Participant] mentioned those reports that are passed to you in a time crucial and when your workload is just really high. Or just super important. I don't think that can be stated enough.”

“So it's really got to be a voice report. Because like [Participant] also said. When we're taken off or we're on approach in a landing phase. We don't have that app up and we're not going to use it. In fact, I don't think we're allowed to use it. I certainly wouldn't be using it. So really someone on the ground has to be relaying that stuff via voice. And I think, you know, that would be the best way so that your general aviation traffic, everybody gets the same information as it is pertinent to them. So hopefully we can have that available as a situational awareness tool for us that have the Wi-Fi equipment on our airplane. But really the critical information's got to be passed by voice. Probably via the air traffic controller.”

“I was interested in something that both [Participant] and [Participant] said. [Participant] said that the airplane tells on them everywhere, you know everything, every switch he flips. Everything is recorded. Wouldn't it be great if the technology could record those things that are pertinent to flight information like PIREPs or icing? Or wind shear. Or low bases or whatever. And could transmit that data to controllers on their screen so it can say that [Participant]'s plane said that this was that. This is what's happening at this particular point and space. And then it would take out the need for education or probably a PIREP because it would be directly given to the controller. And so that I could disseminate to the pilots, I'm looking at my scope. It seems like you could take the human element completely out of it with the technology that we have today.”

## **Group 6 Questions**

**Pilots were requested to respond to the following questions:**

- *In addition to design solutions, what is the best way to educate/train pilots in order to improve the quality and quantity of PIREPs?*
- *In addition to design solutions, what is the best way to educate/train controllers in order to improve the quality and quantity of PIREPs?*
- *In addition to design solutions, what is the best way to educate/train controllers in order to minimize inaccurate or incomplete PIREPs?*

Towards the second half of each focus group session, the discussion became even more energized and participants took the opportunity to go back and forth and reiterate their feedback on topics/questions covered earlier in the discussion. This was to be expected, as with time, participants also became more comfortable and open to share thoughts as well as relate them to what was already said.

The responses to Group 6 Questions identified the necessity for stronger FAA leadership in:

- a) overhauling and modernizing the outdated system by focusing on design simplification and process streamlining,
- b) training and cross training of pilots and controllers,
- c) standardization of training requirements for both pilots and controllers, and
- d) standardization of work processes for controllers.

A full transcription of the answers to **Group 6 Questions** can be found in **Appendix G**.

Listed below are selected participant quotes:

*“I think it's going to have to come from the top of the FAA to re-emphasize the training that goes along with dissemination of these PIREPs. Why they're important? And how to put them into the computer that is available to them...The emphasis has to come from the top and then filter down the 1st line supervisors. And have them plug in coordinators to the positions so that they can take the information. Put it in the right format and disseminate it through the network that is available to them. But it's got to start at the top and it's got to become an initiative, it's going to have to be followed up by the floor supervisors and the controllers”.*

*“Well it's going to be a pilot entering it through technology, through some kind of app or whatever. Then it's, you know, it would be easy to do, fill in the blanks. Not all blanks required. But you know the ride, the icing, the weather, whatever. But if it's going to voice one whether it be calling flight service or a controller trying to relay to flight service. It should be the option of just the, you know, free-text speech sort of speak. Not*

*have to be a specific format. A much shorter conversation to get that information around.”*

*“Yeah I think it's definitely not a one size fits all. I think we need to automate where we can. And especially the more sophisticated airplanes that can feedback a more constant stream of data. Now unfortunately that's often the higher flying airplanes. And we need data as much in the mid and lower sections of the atmosphere as we do at 30,000 feet. So I think and [Participant]'s touched on at least on one approach to being able to do that. Which we should certainly explore. But I think in addition to and in parallel to whatever automated systems that we can pursue. We, I mean hopefully, actually some of this automation will free up time on radio frequencies, for either controllers or flight service specialists, to be able to have a little bit more time to take other reports. And to that end and again this is focusing on flight service now not on ATC. I think one of the things that's needed there is for ATC, or is for flight service, to actually have some basis for knowing and asking, making an intelligent request for a pilot report. As opposed to a generic, when I open my flight plan saying pilot reports are requested along your route of flight. Which means they need some sort of information for themselves to be able to say, hey we need a report between these two points. Who do we have flying in that area? And now can be queried on a basis that would be most useful to the system. As opposed to a generic request. But again that's something that needs to be designed.”*

*“No one or few people think they [PIREPs] have value so it's kind of overcoming that barrier of entry, right. And so I think one that we could do to help kind of promote that is find case studies where PIREPs saved a life. And so kind of the opposite or even use Delta 191 as an example of a time that PIREPs really could have saved a lot of people's lives. And so show some positive and negatives outcomes of not or using PIREPs. To help get the public onboard. To the conversation, I don't want to say the uphill challenge but set activation energy that will take to get that to a wide level across the industry.”*

*“I think you'd have to have the human touch. I believe it was [Participant] who stated at the mid altitude type strata. Because approach control in say for instance in Tulsa we work 15,000 feet to the ground. And some of the most important PIREPs we took besides bases and tops. It was always icing. And you always wanted to disseminate, make sure disseminated those. Also the FAA to kind of change the rules a little bit on liability. Because a lot of times pilots will ask you for things that technically, we're not really trained to provide that service. For instance, vectors around weather. Or areas of known icing. Or something like that. Because we don't have the equipment that really shows us specifically what's there. I mean we don't if it's real. Whether it's a false echo. Or whatever. And the FAA will refuse to provide us legal protection. If I tell a guy to turn 20 degrees right, vector around weather and it runs smack into something. They're not going to protect me in court. And so I'm not willing to hang my career on the line trying to do more than I'm qualified to do.”*

*“I'll make two observations there. I have a 30-ish year old son that a year ago finished his private pilot training in [state]. And at no time during his primary flight trying, did he or his instructor file a pilot report in any of their time aloft. They pulled pilot reports, they analyzed them for their use. But they did not file any pilot reports. So I think part of the reluctance on pilots is you know if you're really aren't kind of trained on that as well,*



*and I don't mean the academic training. I mean the actually pick up the mic and file one. And get comfortable to doing that. And primary flight training I think that's a big deficiency. The other thing that I think is important here and I don't think I appreciated this until I sat through that NTSB session on PIREPs a couple of years ago. Is I certainly know about my only use of pilot reports to figure out whether to fly and inflight. I wasn't as aware that the weather forecasters are also looking at those pilot reports. And at times adjusting their forecast based on pilot reports. Much less that academic researchers 3 or 4 years after the pilot report was filed maybe pulling that data and using it to run against forecast models that they're trying to develop to give us better products. So I think that much more needs to be done to help people understand the broader spectrum of uses the pilot reports serve beyond just our immediate tactical use at the moment.”*

*“... then from a controllers stand point what it does is, it takes me out of the loop of having to put PIREPs in. If the pilots have the ability to put them in and then there's someone out there who's judging where it needs to be disseminated. Then now that's time I don't have to take off the frequency. And as [Participant] said, often times for us, it's okay I'm separating airplanes. And that's priority one. Disseminating weather is a little lower and now if I don't have to push that out there, that gives me more time, to do my job. So it would be a beautiful thing. If there was some type of interface that allowed the pilots to put them in themselves and then also pass them along. Now I'm still as a controller when you check in, I'm going to tell you the weather. I'm going to tell you what to expect along your route of flight. If I know something, if there are, conditions that are going to affect you. But not having to put it in the system does make it a lot easier for me.”*

*“Well to reduce errors we need to take as many different hands out of the actual dissemination of the PIREP as possible, that's one thing. Two. Again I know that you want to keep the human element in but if you could eliminate humans as much as possible I think it would be a better system. If airplanes that are going through actual phenomenon could transmit that to different sources. And so then errors are eliminated. There's no need for education. I mean we are so technology advanced with everything else we do except for our aviation system in certain areas. I mean still uses very old technology. I just think we need to get up-to-date, up to speed with the technology. And it exists. You just showed us all. Obviously you're going to use them if it helps your traffic flow. If there is something that is eminent like right now that I could pass onto everybody else that is in my scope I would be able to do that. But I just think we need to advance technology.”*

*“Improving the quality of the PIREPs is going to be a function of everything we've talked about... Less paperwork. Less, you know, better information with less superfluous stuff that you don't need to put in there. As far as training controllers, I mean, we're under pretty rigorous training demands. I mean the FAA can implement anything they want. And say alright, during your training process you'll go through this pilot report training program. You can also make it mandatory that they have, you've got to in certain facilities you have an assistant or D-side. A person there that, you know, you can test them with getting several PIREPs per hour. It all can be done. It just needs to be integrated a lot more user friendly way is what I would say.”*

*“Years ago and I don't know what we're doing FAA-wise now for cross-training. And when I say cross training, years ago Southwest airlines had a program where they took all of their people and ran them through a class where they had the flight attendants there. They had the gate agents. They had the pilots. And everybody got to play a different role as to who was under what pressure to do what. And we put controllers over there and went through some of those classes at [airport] for that. And [airline] had a program ... Where we had meetings, like once a month. To discuss issues between controllers and pilots. What was going on? What could the FAA do help [airline], help [airline] or help any of the airlines. And different regions were meeting wherever the airlines were based. So I think some cross-training we had the general aviation program also. People would come into the centers to see what goes on and how things [unintelligible] and what we could do help them. So when we talk about education we need to cross all the barriers with each of the different groups. To try to get the best education for everybody. Controllers, pilots, general aviation pilots, or whatever Commercial side that you're doing.”*

*“What I was saying about all the 9 or 10 fields that there is in the PIREP. I think that training should be more focused on 1) the importance of the PIREPs. So what [Participant] said maybe implementing this to show how important they are. But also not showing it as a complicated process. Focus more on the simplicity. You can just simply say tops are at I don't know 5,000. Or bottoms are 2,000. Focusing more on the simplicity of just telling ATC what you're seeing rather than having the pilot think that they have to calculate their position. Or their location. And their altitude at the time. And the aircraft type. And just focusing on, you know, how its more simple than we think it is. Learning about other people so including [unintelligible]. Right here in this focus group I've learned a lot [unintelligible]. I think most pilots don't have no idea of what's going on when we talk about weather. And what ATC does with our weather information. So including in training part of the perspective of what happens on the other side can help pilots understand the whole system. And I think that would contribute more with PIREPs.”*

*“I think a lot of comes down to what type of programs are you using. The 61 versus 91. Versus the 141. And until it's added as a specific task and private pilot level. But I can't even remember seeing a question in any exam I've ever taken regarding PIREPs.... until you put that as a required task into testing and training, it's going to get glazed over.”*

*“I wish we had the ability to disseminate PIREPs as we get them. Because there have been certain situations on the local at [airport] one time, departure reported a 40-knot drop on departure. Wind shear on the West side. The controller over there didn't pass it on to the controller on the East side. And then this guy on the East side took off and got the same thing. There was no coordinator involved. She's busy. She doesn't have time to call whoever he/she maybe working on the other side. But there's a lot of times when pilots expect you to put the information out. And I ask for them all day long when it comes to wind shear, breaking action or icing. And the main thing is when you do disseminate one, it's so important to put the type of aircraft. And icing type and intensity. And the temperature when icing is occurring. We don't have, we never had the staffing to do that. I mean you just did the best you can putting it out there. And I wish we could do*

*better. But that's not stressed for our training. I don't know about you [Participant] but they never stressed PIREPs for us."*

*"Well the only way PIREPs were stressed to us make sure you got the minimum when they were required. And unless there was something very strange going on as far as convective weather. That was the only thing we were really taught. It's sad but it's true."*

*"I just wanted to add this real quick. My son was working on his PPL, he's trying to solo ... So I grabbed his pilot handbook and looked up PIREPs. And he's got 1 page on pilot weather reports under the aviation weather services chapter/study guide. And just kind of talks about the element codes and when to give them I guess. But it's just 1 page. I just thought I'd throw that out."*

*"... As far as 7110.65 getting the requirements and their first priority being separation of traffic. Which you're not usually the only one working in the tower and so that information that comes in should be passed to somebody else to get the work put into the system. I think, to me, controllers know their job and they that realize PIREPs are important. But I think it depends like [Participant] is saying as far as it being their priorities to do these. I think there's other people in, you're never usually working by yourself, there's always someone that can help you. But I just think it's not maybe it's not reiterated enough about PIREPs. And it's really not a focus. I think the fact that when, before it was moved from flight service all controllers knew all they had to do was call the flight service station and pass a PIREP and it would get put into the system correctly. Now that's not an option for them. They have to do it themselves. And I don't know that they have the ability, or even the knowledge, or want to put those PIREPs into the system. So I think the training of it, the requirements are already in the 7110. Both the 65 and .10 for flight service people. It's in both of those orders. And as far as what their duties and responsibilities are. And so it just has to be reiterated that this is important. And I think maybe we iterate it. When you're saying training I don't know and if training is necessary then so be it. Then train everyone. And then after you've trained them all then you make it a requirement. This is what you're supposed to be doing. There's no excuse after that. As far as design solutions, again, I'm still hearing you know that some folks think the form is antiquated. The equipment's not needed. Everything is automated. But you know PIREPs usually pop up where you put them. If you put them up in the right format, they're going to show up in the right place, where they can be useful. They're not going to pop up all over the entire group. They're only going to pop up in an area that you put them into the system. Using a NAV aid or whatever equipment that you put in and place around them. So there not something that everyone would be getting. They don't apply to everyone. If you're flying 30,000 feet the PIREPs at 5,000 feet don't apply to you. So I just think that it has to be understood and put in correctly. I just think that there should be either if it's going to a priority for the FAA to want these things to happen they need to make sure people are properly trained and it's required. If you don't make it a requirement it's not going to happen. So, you know, nobody wants to do additional work but if this a requirement of what I'm supposed to be doing we do it. I don't know if a re-design is necessary. I think if you want to put into give the pilots the ability to put their own in, that's fine. But if it comes through the FAA then we know it's supposed to be done a certain way. And that's the part that needs to be reiterated in training. So that, everything is done using a computer these days anyway. Doesn't take but a couple of*

keystrokes. And if you couldn't do it using the keystrokes then back in the day we used to have to use UA and use it. [Put in an identifier / unintelligible] and everything that goes along with it to put it into the service [unintelligible] program. So there's ways of getting the thing done. But I do think it has to be that training has to be redone and people have to know that this is important and its part of their duties and I think it would get better.”

“The problem has gotten to be that the duties have been removed from flight service, most of them. And now they've been put into the terminal option or the center option. The duties of putting PIREPs in, are now told, to be done at the center or the tower. The tower and approach controllers supposed to contact the flight data at the center to put the PIREPs in. That's the issue now. Flight data doesn't do PIREPs unless it comes through inflight or unless it's completed during a briefing. If a pilot asking for a briefing, so that's the only way. So if you're doing a pilot weather briefing, you're not going to get PIREPs unless someone gives it to you. If you're working a radio position or an inflight position you can receive a PIREP. From a pilot if the pilot comes to your frequency. Otherwise the PIREPs are going to the center or their going to approach control. The approach control now as the responsibility to contact the center to put the PIREP in. If the center get it, the center is supposed to put it in. So what I'm saying and what I'm hearing from the flight service side of the house is that the requirements have been removed from them to put the PIREPs into the system. So even though you say that there not, you know, you can't require them to do it, you can require them because it's a part of their duties. But if you removed it from their duties and you're now saying you can't do these duties any longer it has done by an FAAer unless it comes in over the radio. You just crippled them as far as being able to take PIREPs and put PIREPs into the system. So that's the difference. So center and approach controls are the only place that PIREPs are going now. Unless you're working the inflight position. And the FAA has caused this. According to what I'm getting from the flight service side is it looks as though their duties are being totally removed so that eventually flight service can close up. Because it's contracted out. So little by little the duties that they were doing are being removed and transferred back into the FAA side of the house. So FAA wants to do what they want to do on that side of the house and that's an FAA issue. Where I think the training side now has to be given to the approach/tower/center and said this is what you will do and you shall do this. That's where the issue is from what I'm seeing.”

## **Group 7 Questions**

### **Pilots were requested to respond to the following questions:**

- *What is in your opinion a good direction(s) for R&D in terms of introducing new technologies in the PIREP system?*
- *Please identify at least two important benefits from introducing these new technologies*
- *Please identify at least two important issues with from introducing these new technologies*

At the end of each focus group, the participants were asked to suggest future research and development (R&D) activities that would facilitate the introduction of new technologies in the PIREP system. They were encouraged to identify important benefits and potential drawbacks associated with such technologies.

The majority of suggestions were centered on the following characteristics of a simplified PIREP user interface:

- a) It is a synergistic combination of automation and human input;
- b) It is graphical;
- c) It is streamlined and easy to use;
- d) Makes it possible to submit a PIREP directly and near real-time to weather portals;
- e) Uses plain language and free text;
- f) Takes advantage of multiple input modalities (e.g., voice input) and technologies and applications matured by the industries inside (ForeFlight) and outside (e.g., Google Waze) the aviation domain;
- g) Allows the entry of “incomplete” or ”special” PIREPs that address only one weather phenomenon;
- h) Utilizes artificial intelligence, machine learning and natural language processing;
- i) Controllers’ interface includes graphical depiction of weather and PIREPs.

A full transcription of the answers to Group 7 Questions can be found in **Appendix H**. Listed below are selected participant quotes:

*“A good direction's going to be the user or easier interface to submit the PIREP. We agreed that you know in talking through flight service is too cumbersome. Going through the controller is you know puts more work load on them. And doesn't necessarily get to where it needs to go. So whether it's something on an iPad or whatever device. Pre-filled in to make it as simple as possible. And as minimum amount of heads down time. But if it's you know right there on the airplane and you're just submitting whatever information you need to add to it and then it's going to the right people in a timely fashion. The benefits obviously if it's easier to do you get more submissions. This of course the costs and making it universal. And then again anytime you're adding more heads down time to the pilot there's a potential risk there. So that would have to be considered as well.”*

*“In terms of pilot education I would say you should talk to some of the online and paper magazines. Like IFR magazines is one of my favorite ones. AOPA. Av Web. These are all that things that pilots read to keep up to date. If there was an emphasis on filing PIREPs and an explanation of what good PIREPs did for the weather forecasting community I think that would really help. Also bi-annual reviews if it was a point of emphasis to talk about PIREPs and why it's important to file them and what good their use that would be good to. In terms of the take a ways. I would 2nd the call for something simple. Text space. Drop down menus.”*

*“We've talked about older pilots are not very comfortable with technology. Making it simple enough for them to use. Making it simple enough for people who speak English as a 2nd language to use. I think that's an important part of it, yes. So it's perfect that you're looking at it.”*

*“I just want to say from a research standpoint as you guys move forward just remember that flying is a human endeavor. And that PIREPs are inherently subjective to try to utilize technology to enhance the PIREP system is great. However, you have to kind of realize when you try to automate something that's inherently subjective and human. Could change the thing from something that's not, that goes from something that's useful. Where experienced of an aviator going through a certain ride condition is passed on subjectively to aviators behind them. That maybe you don't change that thing to something that's not wanted. Or not useful. Or not trusted by pilots just based on our subjectivity. Needs to be emphasized to, start with the major operators. Along with all of the GA stuff as well. And FAA being the controlling agency could bring everybody together at the same table and make this thing collaborative effort, where it's needed. And that's the only person, or that's the only entity that can lead this thing. Unlike an airline or small operators. Or even up North Alaska. If everybody starts participating I think we'd get a better understanding of the PIREPS and get better data points. But FAA's got to be the leader in this case.”*

*Yeah I've got a couple of questions. Obviously the research and develop needs to continue forward into some of these automated PIREP systems. But we're also kind of at a point where there is a lot of technology that exists. But we haven't implemented one probably because of funding. But I mean also to, I know our controllers get hammered a lot and it's not on them at all. You know you hear them clicking these 1970 keyboards. Or the fact they're having to stop go offline and pick up a telephone to communicate information to another controller. Because we can't even bring technologies into their lap. That allows them to give us simple you know touch the screen and flip a little bit of information to their controllers sitting next to them, without going offline on a telephone. So we've got to bring up our capabilities to what technologies we already have. That we just haven't been willing to pay for. But as far as the benefits obviously awareness and safety, anytime you get new information available is an increase. Decrease at the end of the day is one it costs to train. And that's the other side of it, is there's a cost to everything.”*

*“We've been talking about the fact that pilots now have iPads or other devices that they can take with them in the cockpit that enable us to see what's going on. So even if you're*

*GA if you have an iPad with ForeFlight on it you can do your flight planning, and you can do all that on there. It's been a while since I used it. So I don't know how advanced the capabilities are. Although I'm sure they've continued to improve it through time. So I'm wondering instead of spending money on whole new systems for air traffic controllers and flight service stations. Where you have everything hardwired. Is anybody looking at doing something similar in that particular arena, like we're doing with pilots in the cockpit?"*

*"Yeah I guess especially based on how difficult it is you know for the controllers to have time and what their primary task is. It looks to me like pursuing perhaps a couple of lines in the automated. One is the apps that would allow us to put things in through our flight bags and of course the communication section of that, getting that back to Earth is still an issue. But as [Participant]'s pointed out some of the outfits like spider tracks. Or others that are using the Iridium satellite system probably would make that possible today. And by the time you get his developed we may have Wi-Fi everywhere. And also in parallel to that I think this whole voice, the notion of actually being able to make a voice pilot report that is in some fashion automated might also get by. But the biggest thing I think is we shouldn't put all of our eggs in a single basket. The Part 121 world needs one set of solutions. That Part 135 and Part 91 are liable to need some different systems just because of the different operating environments that we're living in."*

*"...it's not going to be a priority for the FAA unless somebody gives a PIREP for like a wind shear or something like that. And it's not passed on. And then somebody crashes. Like after Delta 191, that's when we got the terminal Doppler weather radar at DFW. They're not going to spend the money."*

*"Okay technology, the newest technology and I love what I believe it was [Participant] said about the Waze app. I use and [Participant] this is one you might like for updated weather. There's an app called FBO Link. And as a corporate guy I'm able to, again if Wi-Fi's working, I'm able to bring up the weather the exact digital ATIS that's ahead of me. The problem is that's good for digital ATIS's but when you're looking at ASOS's and METAR, which I can also bring up. I'm not going to get any NOTAM information, or PIREP information or anything like that. Maybe there'd be a way that an app that simple could be upgraded or software updated. Where it can provide that data to the corporate and the private pilots that are out there flying around. So I see that as a big positive. I definitely see any kind of automation that takes pressure off of people helping [Participant] as a controller. Anything that takes that one less thing, it's still not going to take updated information which is what [Participant]'s going to say. As far as you know the instance. You know here's what's happening on final. Or you know we just got a wind shear. Obviously that's something that controllers are mandated by regs to do that and provide that information. As far as the negative sides of this obviously costs. Anything automated is going to add a cost somewhere. And you know the private sector, well everybody's going to complain about it. But basically it's really going to affect the GA guys and the private sectors. More so than the commercial end of it. It's going to affect them but it won't be as well accepted. And another one, I guess the learning curve would probably be the other side of it. You know I know from both being a controller and as a pilot and I would actually write in a PIREP format, short hand. So from a controller*

*stand point in speed I could do it much faster in that short hand. But I had to take the time to learn it initially.”*

*“The direction that I think they should go is to just utilize the technology advances of the last century. You know it seems like we're pretty far behind. And then smart workload practices to increase the quality and the quantity of submissions. And by that I mean there are so many barriers to submitting them into the system right now. That I feel like that they could really do a lot to kind of break those barriers down. And I think when you do that, it's going to naturally increase things. Instead of saying hey you guys need to submit more PIREPs. Just let the system kind of work and I think people will. Benefits of that I think is you'll get more PIREPs. And there's a potential safety benefit to that. Obviously since you're going to have better information. Issues with that is too much information becomes a distraction. And then like [Participant] said there's a cost and I'll use ADS-B as an example. Implementation of ADS-B is a huge cost to be borne by both private pilots and by the airlines. They hate it. Which is why they're so far behind. And then private pilots, old timers like me and people who aren't familiar with the technology. As these things go that direction they're going to be kind of left behind as far as like a training aspect goes.”*

*“I wasn't aware of the avionics of the airplane being able to pass that information back. That's great. So I would say just using the technology that we already have to also input information into the system. But it's still never going to replace actually asking a pilot what they're experiencing in the air. But I think it's a good direction. From a benefit stand point as a controller you're taken a task off my plate and you're now given me more frequency time because I'm not having to solicit these PIREPs. Costs is going to be a huge issue. And then also just information overload. So as long as it's a program that has that ability to kind of filter that information so that you're not inundated with PIREPs. Because then you become numb to them. You know I think it's just finding a happy medium in there. But I think it's a good direction that you're taken right now.”*

*“I think you know the biggest place for R&D is to updating/automate our abilities to submit PIREP information from everyone. With that flexibility to add [personalized] info. Like you said, smooth as frog's hair or whatever like that. It's kind of nice to not have to have just boxes to check. But if you want something specific that you can add in there that can be passed along and be relevant that'd be good. You know because that'd remove the middle man. And that middle man basically takes up time and adds task loading to everybody involved. So kind of automating it would be useful. But at the same time for the R&D when you automate stuff you're going to get a lot of information overload. So there needs to be a lot of research into combining, prioritizing, filtering all that information from the forecast, the observations, the PIREPs. The TAPS that come from the airplane. You know if you can kind of combine all those and get kind of a best juice, most relevant information out to folks. That's where I think the R&D should go, is taken all that information that we have, combining it and then filtering it into something useful. The benefits I think would be timely and relevant planning for a pilot. If we can see it on our thing we can look ahead. And if we see 200-miles ahead that there's weather or turbulence that we can avoid. We can start putting that submission in so that we're not overloading the air traffic controller. He can work us in with traffic, when it's most*



convenient for them and we're happy, they're happy. And then obviously a modernized dissemination information. You get those PIREPs in your ACARS. They're really difficult to read and you have to kind of go out of your way to understand exactly what it's telling you. So a lot of those do get ignored. The issues obviously we've said, I've said information overload a lot. And I think that's a huge issue with a lot of information comes, you know, the tendency to ignore it because you're overloaded with too much stuff. And like [Participant] has said several times the technology is limited to our ability to connect. Or like [Participant] said our ability to reference it. If we're busy, we're not going to reference the information on our iPad. It's great. It might have good stuff for us but if we're not looking at it, it does us no good. That's the kind of two issues I see with it I think a good direction would be, one for identifying how the technology in 2020 now can help us in the cockpit. And the problem with that for one is the technology ranges in the different cockpits. .... finding a way to utilize the technology. To streamline and get up the communication, the information that we can use in a good amount of time. I think that would be a direction of trying to find a simplest way of communicating this through the technology to our aircraft. Two important benefits would be real time for one. And the second benefit I think kind of underlying is finding a way for like me, [Participant] and [Participant] to talk to each other. Maybe not voice to voice but you know if [Participant] submits a PIREP and I'm talking about in here, real time. Not talking to flight service. Not to talking through or looking at dispatch release or something like that. I think a direction to me just personally would be just trying to streamline the communication in the air in real time. What got me thinking about this was when you brought up the page about the AIRMET. If there's a 78 going through a NAT route above Greenland. .... how can I have access to that same information without asking the ATC? Or without getting in touch with that pilot in the meantime? Or as we're coming into approach if a guy goes around and I haven't talked to approach control yet. Is there any technology or any real time information where I can access the folder or somewhere through data link? Where you know last two aircraft have gone miss or something like that. Could ATC type that into a new streamline piece of technology where it talks to my aircraft? And I'm just kind of spit balling out right now. But I think the dissemination of information and the timeliness of it, would be a direction that I would recommend the R&D to go. The issues through it would be if it's coming from ATC, you guys are doing a lot, obviously in the terminal area along with the en-route area. But I'd be willing to guess that you guys are probably busier with specific tasks in the terminal area. And issue could be if we have to rely on that, that's one other thing that these guys have to do. You can train on it all you want. But if you're handling several aircraft and I am seeing conditions with a front moving through, I mean, there's a lot of things that you guys are looking at. That's different then what we're looking at. We're looking at one airplane. You guys are looking at fourteen/fifteen. So the issue would be task saturation of course. And the other issue would just be the timeliness of it. I mean if I get an ACARS saying that you know [Participant] went around and we're at the gate with the [GV running] that doesn't really mean anything to me because we got in. Sorry [Participant] you diverted. Let's just go home, we're getting there for sure. But I think there's a timeliness as a catch 22 and a two-sided of a coin there but that's what I feel the direction, me personally, that R&D can take it."

*“...ensuring that reports can go in and come back right away to pilots. Because with PIREPs it's an instantaneous report and it does not do me a lot of good. Especially when I'm already flying. I'd like to have, even a half hour old PIREP. It doesn't really tell me what's going on. And whenever I'm trying to pick my way around weather in a plane that doesn't have radar or anything to tell me anything instantaneous. That's the best that I can get. So having something that isn't going through a million steps to go in and come back out to pilots is going to be crucial. Especially for the GA pilots.”*

### **Conclusion**

The main objective of the focus groups was to improve stakeholder understanding of the deficiencies in the PIREP system from the standpoint of the end-user populations – pilots and controllers. Notwithstanding the different ways these two populations interact with the system, the purpose of the focus groups was also to identify their shared experiences while participating in the system. During the discussions, pilots and controllers demonstrated their appreciation of the PIREPs significance for aviation safety and stressed the importance of PIREPs during all phases of flight and across the full spectrum of flight operations.

At the highest level, the issue of what constitutes a PIREP was very prominent during the discussions. More specifically, both pilots and controllers were genuinely surprised to hear that PIREPs were on decline and their feedback was remarkably consistent in that only what they called “official” PIREPs might be on decline. While controllers soliciting PIREPs or pilots filing PIREPs was not seen as a high priority task by either group of users, they were convinced that it is successfully accomplished in an informal manner, in real time, consistently and continuously by the use of voice radio communications between pilots and controllers. This very organic process of solicitation and immediate dissemination of weather information allows pilots and controllers to maintain a common awareness of the weather in the area and along the flight path.

Presently, the most contended and error-prone portion of the PIREP system was identified as the official entry/encoding of the information into the system that is currently in place for aviation weather product dissemination. The consensus among controller participants was that this bottleneck exists because of the lack of trained and qualified support personnel whose sole job is to complete this task in a timely manner without introducing errors, and it is the main reason for the perceived decline in quality and quantity of PIREPs. Furthermore, according to the controllers, in the past when dedicated personnel conducted the encoding /data-

entry task, many of the PIREP issues associated with errors and delays in dissemination did not exist.

One risk mitigating solution for this issue was recommended in the NTSB PIREP special investigation report as follows:

*“Provide a reliable means of electronically accepting pilot weather reports directly from all users who are eligible to submit reports, and ensure that the system has the capacity to accept and make available all such reports to the National Airspace System”* (National Transportation Safety Board, 2017).

Following is a summary of some of the many PIREP system improvement ideas proposed by the focus group participants:

- a) New and novel user interfaces and input modalities allowing for direct, near real-time, error-free entry of the information by qualified users,
- b) Utilization of datalink communications such as CPDLC,
- c) Dedicated, well-trained and qualified staff equipped with technology that supports easy-to-use and error-free entry of information,
- d) Utilization of artificial intelligence/machine learning, multi-modal input/output and natural language processing of the pilot-controller voice communications in lieu of the current information encoding/entry solutions,
- e) Implementation of a hybrid human-machine interface that allows automation to fill out known parameters such as aircraft type and GPS position while preserving the human elements of the current system such as first-hand observations and perceptions of magnitude of weather phenomena, and
- f) Continued education and training for pilots and controllers about the importance of PIREPs for aviation safety.

The results from the six PIREP end-user focus groups conducted by the AVS Aerospace Human Factors Research Division at CAMI strongly correlate with the NTSB’s special investigation report findings. Ultimately, the successful outcome of the PIREP system modernization will depend on how well this end-user feedback is incorporated into the PIREP system modernization road map under the leadership of the Federal Aviation Administration.

## References

National Transportation Safety Board. (2017). *Improving pilot weather report submission and dissemination to benefit safety in the national airspace system* (Special Investigation Report No. NTSB/SIR-17/02 PB2017-101424).