



AOPATM

your freedom to *fly*

2017 Weather Survey

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Introduction

Background

The Aircraft Owners and Pilots Association (AOPA) has conducted a survey of a portion of our membership to better understand how general aviation pilots access and perceive the weather information that is available. Following two AOPA Flight Service surveys¹ and a Pilot Report (PIREP) survey², all conducted in 2016, we saw the need to further investigate the weather questions that remained unanswered that would point to the challenges, barriers, and needs of pilots. The survey was conducted in support of the Friends and Partners in Aviation Weather, an industry and government weather group, as well as to inform various efforts underway at the Aviation Weather Center (AWC) and Federal Aviation Administration (FAA). This weather survey was constructed with input from the AOPA Air Safety Institute, FAA's Flight Service and Weather Technology in the Cockpit departments, and Leidos Flight Service.

Method

The study was conducted using Qualtrics, an online survey tool. A twenty-eight question survey targeted pilots with current medicals, and was emailed to 2,851 AOPA Alaskan members and a random sample of 6,004 AOPA members located in the continental United States (CONUS). Several reminders were sent to these participants over the course of the three-week period that the survey was open.

The results published in this document are categorized by topic and not necessarily presented in the chronological order the questions were asked. When warranted, the differences between those answers provided by Alaskan pilots and those in CONUS are highlighted. The numbers shown in different figures correspond to the questions in the survey. Not all questions were presented to all pilots with that noted in the pertinent section.

Key Findings

At the highest level, here are a few bullet points that summarize the results of this survey.

- General aviation pilots voice their primary desires are for weather resources to be Electronic Flight Bag (EFB) and touchscreen friendly;
- Graphical weather products are perceived to be a better value than textual products while also being easier to interpret;
- Pilots are skeptical when a Flight Service specialist states "VFR not recommended," and they desire greater rationale when it is provided and would find it helpful if there was a similar cautionary statement when briefing online;
- Many pilots voice a need for Flight Service and access to a professional's weather interpretation;
- FIS-B is improving pilots weather awareness in the cockpit but many pilots remain ignorant of the limitations of the products;

¹ Middlestadt, S. E., Smith, T., Hu, Y., & Ison, D. (June 1, 2016). Technical Research Report on General Aviation Pilot Beliefs About Obtaining a Standard Pilot Weather Briefing.

² George, T., & Duke, R. (July 26, 2016). AOPA 2016 Pilot Report Survey.

- Alaskan pilots access their weather differently from CONUS pilots and use different products, with weather cameras being very popular in Alaska.

The results are provided in the sections that follow in more detail, both numerically and illustrated with comments, where appropriate. A series of recommendations are at the end of the document.

Survey Results

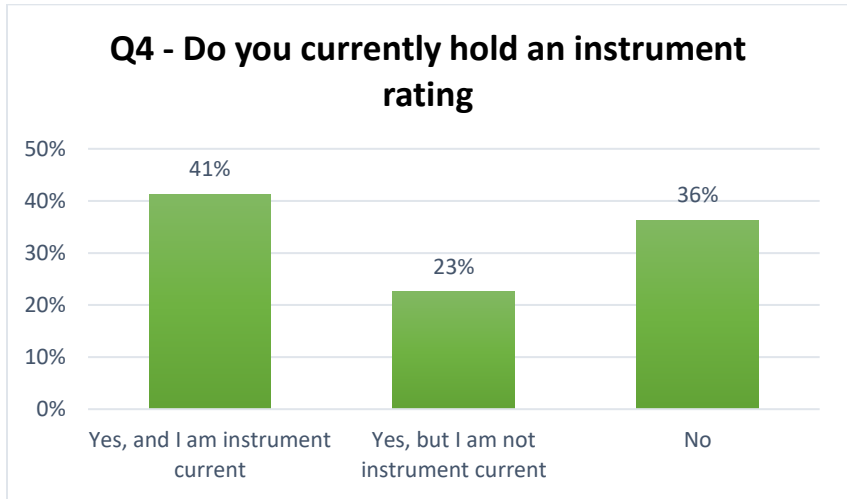
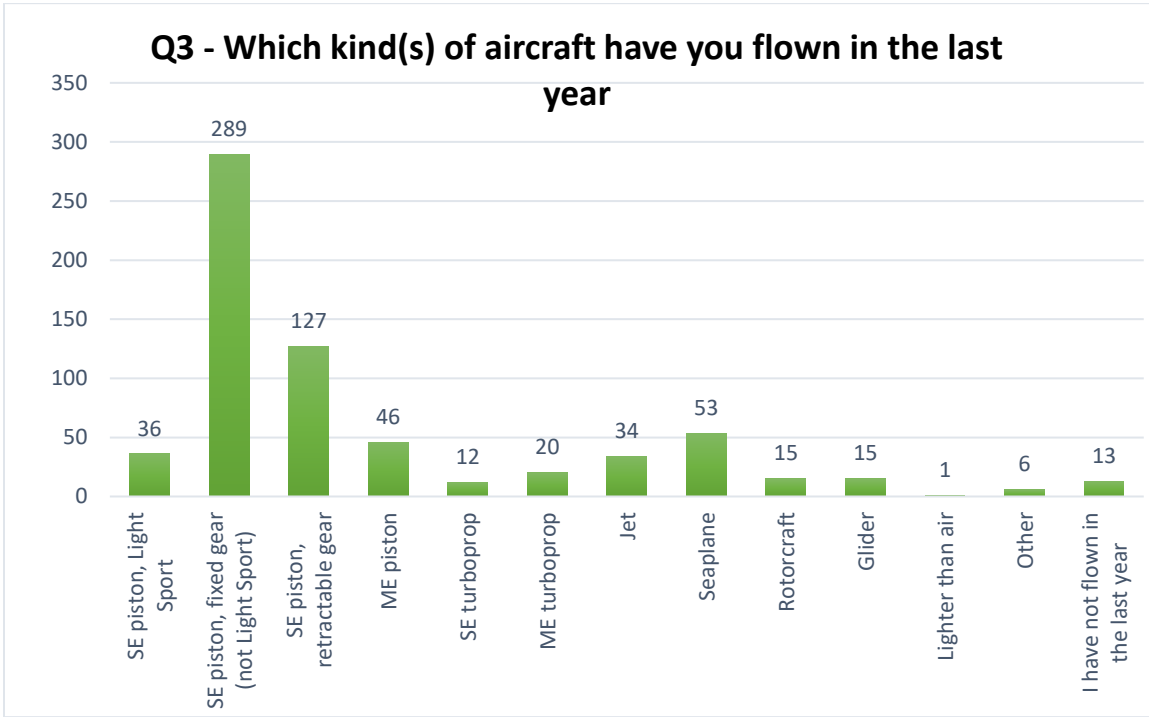
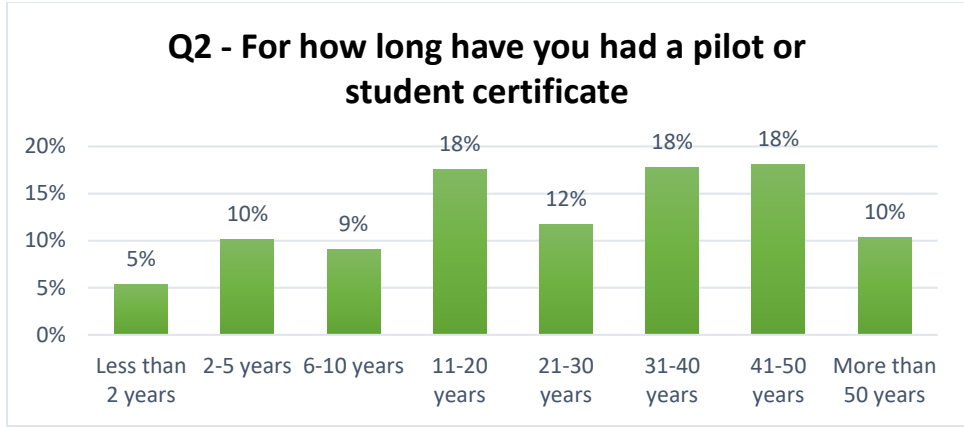
A total of 103 Alaskan pilots and 275 pilots in CONUS responded, amounting to 378 pilots throughout the United States who responded during the three-weeks in June 2017 it was open. The number of Alaskan responses allows for a margin of error of 10% at a 95% confidence level. The margin of error for CONUS pilots is 6% at a 95% confidence level. For the sample overall (all pilots who answered throughout the US), the margin of error is roughly 5%.

Demographics

Individuals responding to this survey represented a cross-section of the pilot population, slanted towards older pilots, with a wide range of flight experience. Most respondents have held their pilot certificate at least 20 years, about 40% are instrument rated and current, and most have flown a single-engine piston airplane in the last year. Private and Commercial certificate holders made up a larger share of respondents than are found in the total pilot population.

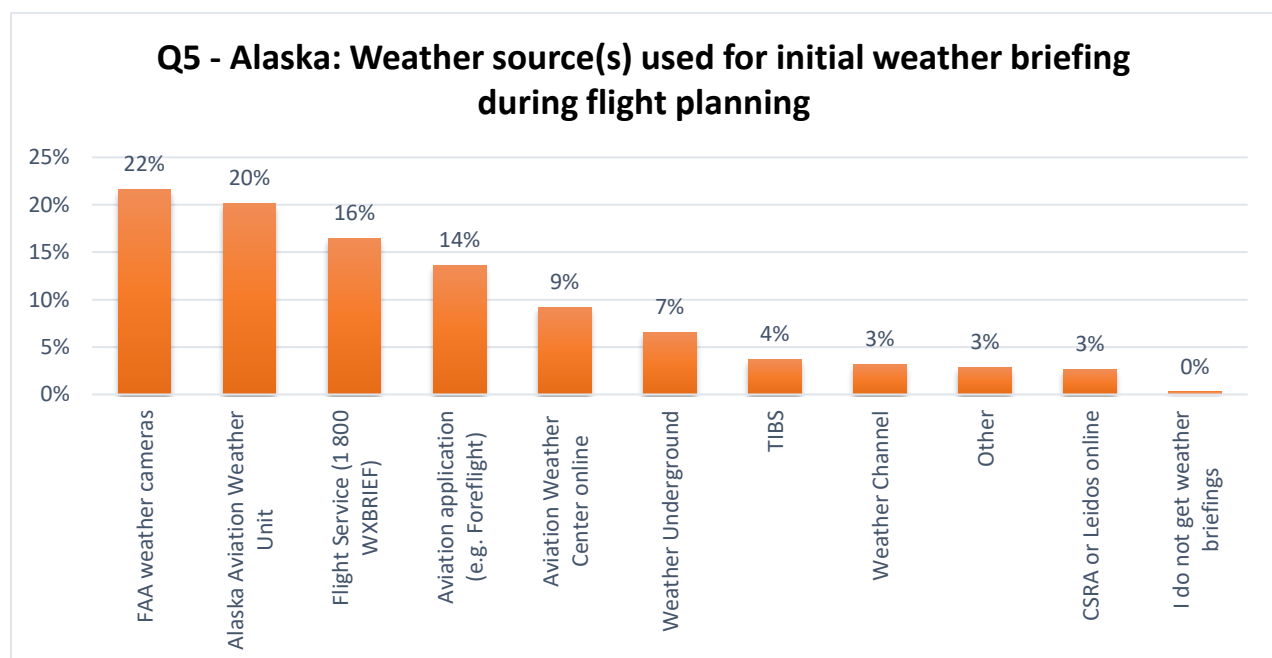
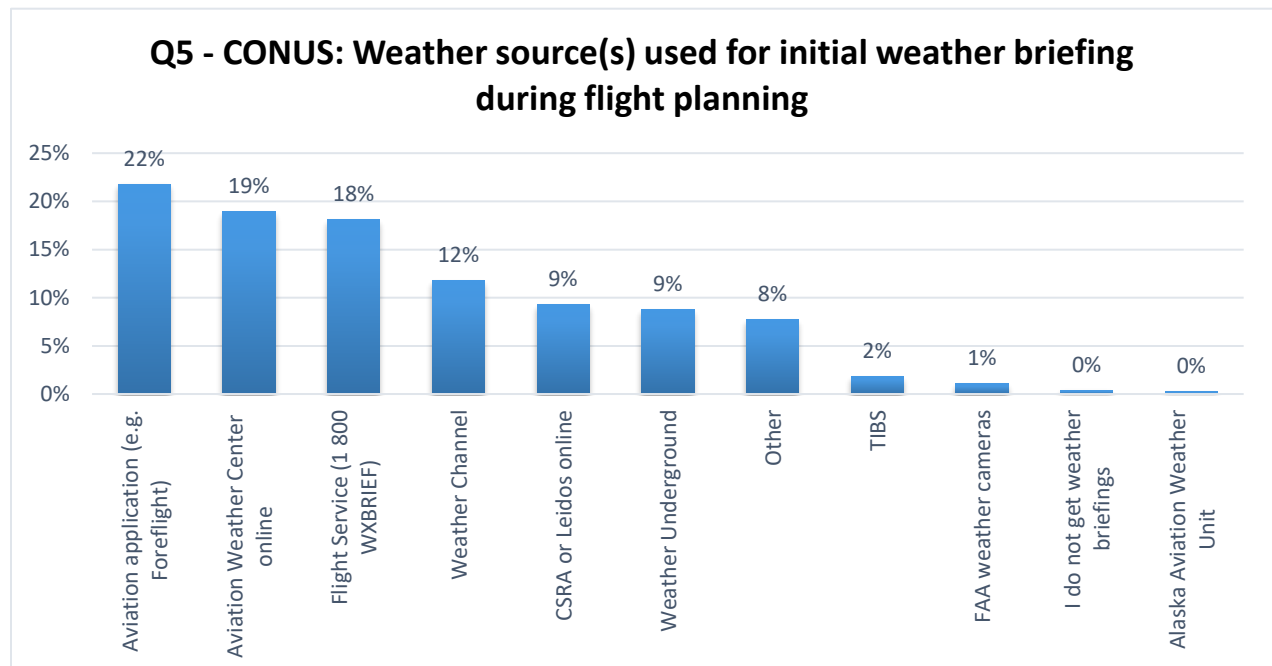
Question #1: What is the highest level of pilot certificate that you hold?

Certificate	FAA	FAA	AOPA Survey	AOPA Survey
Student	122,729	20.8%	17	4.50%
Sport	5,482	0.9%	0	0.00%
Recreational	191	0.0%	0	0.00%
Private	186,786	31.7%	190	50.26%
Commercial	116,291	19.7%	108	28.57%
ATP	158,559	26.9%	63	16.67%
	590,038	100.0%	378	100.00%



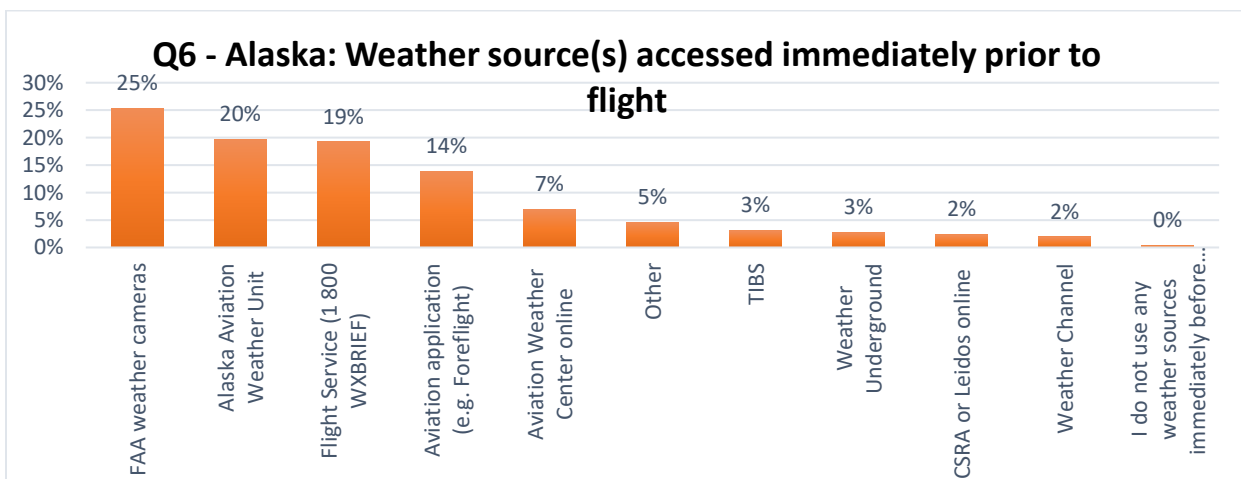
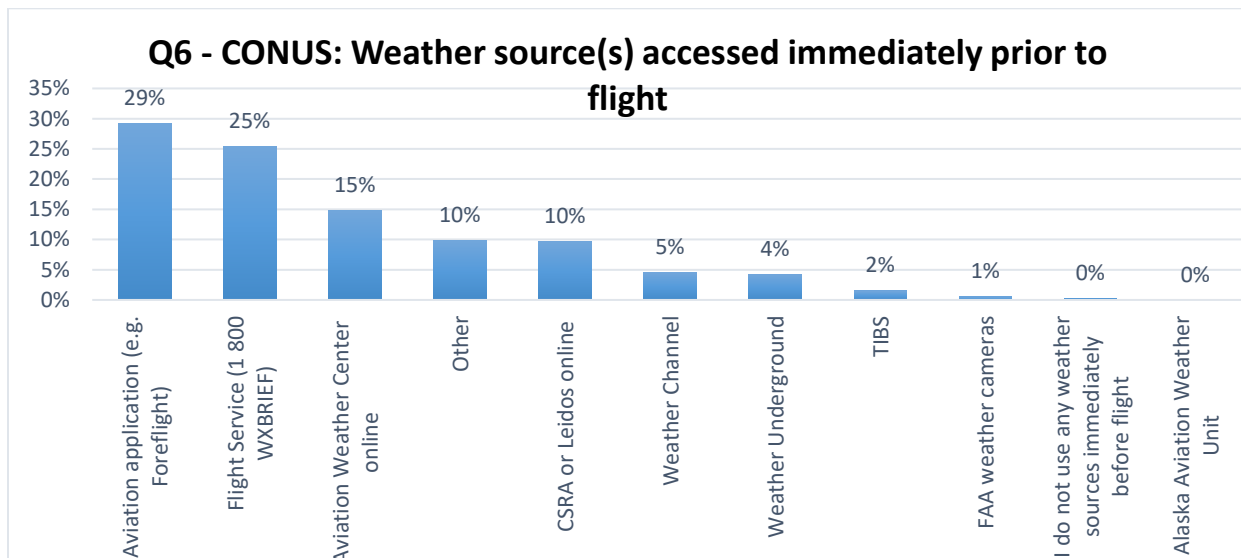
Pre-Flight Weather Resources

A series of questions were presented to pilots regarding their sources of weather information at different stages of flight planning. Question 5 probed at the information sources used during the initial weather briefing during flight planning. This might take place anywhere from an hour before the flight to the evening before. The responses to this question are presented in two graphs to easily compare answers between pilots flying in Alaska and those flying in CONUS as there are infrastructure and cultural differences.



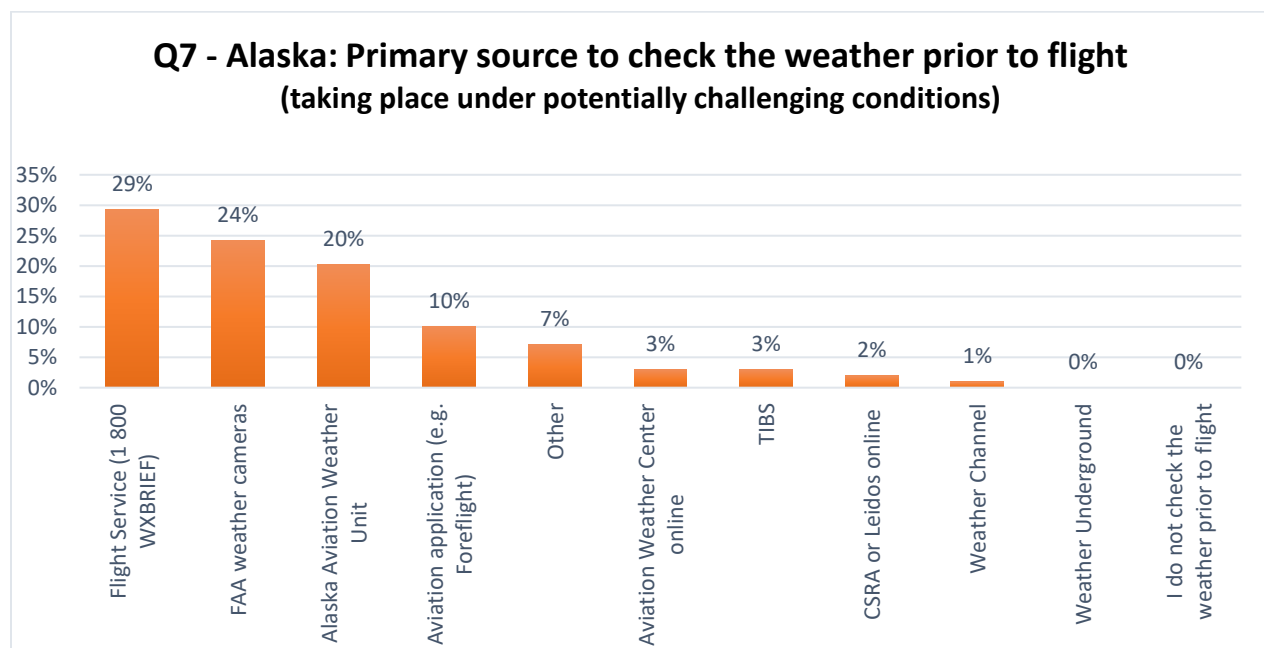
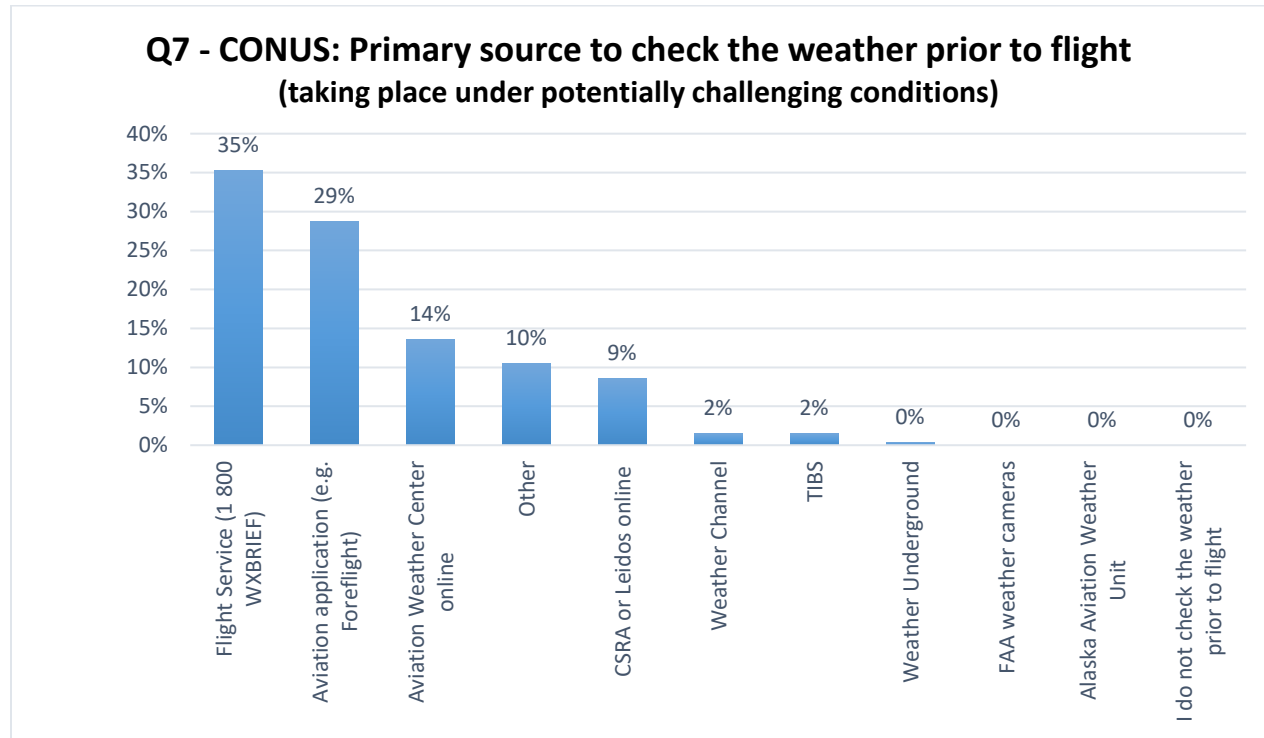
There are some significant differences between how pilots check the weather when comparing those that fly in CONUS versus Alaska. There is a strong utilization of FAA weather cameras in Alaska, while more pilots in CONUS use aviation applications, like ForeFlight or Garmin Pilot. This is undoubtedly influenced by the availability of a state-wide network of weather cameras in Alaska, while CONUS pilots have a denser matrix of weather stations reporting METARs, which are generally accessible via aviation apps. In both cases, government provided aviation weather websites (AWC and AAWU) are the next most popular source of preflight data, with calls to Flight Service as the third most popular source. It is notable that according to past surveys, greater than 80% of general aviation pilots regularly use an EFB in the cockpit with most having some aviation app installed that can provide weather information. Both groups of pilots rarely utilized the Telephone Information Briefing Service (TIBS). Those who selected “other” predominantly indicated AOPA’s weather webpage, FltPlan.com, Intellicast, or WSI.

Comparing the resources pilots access immediately prior to flight, CONUS pilots increase their utilization of EFBs and contacting Flight Service via the telephone. Alaskans similarly increase their utilization of calling but also their usage of the FAA’s weather camera website <http://avcamsplus.faa.gov/> as a source of preflight weather.

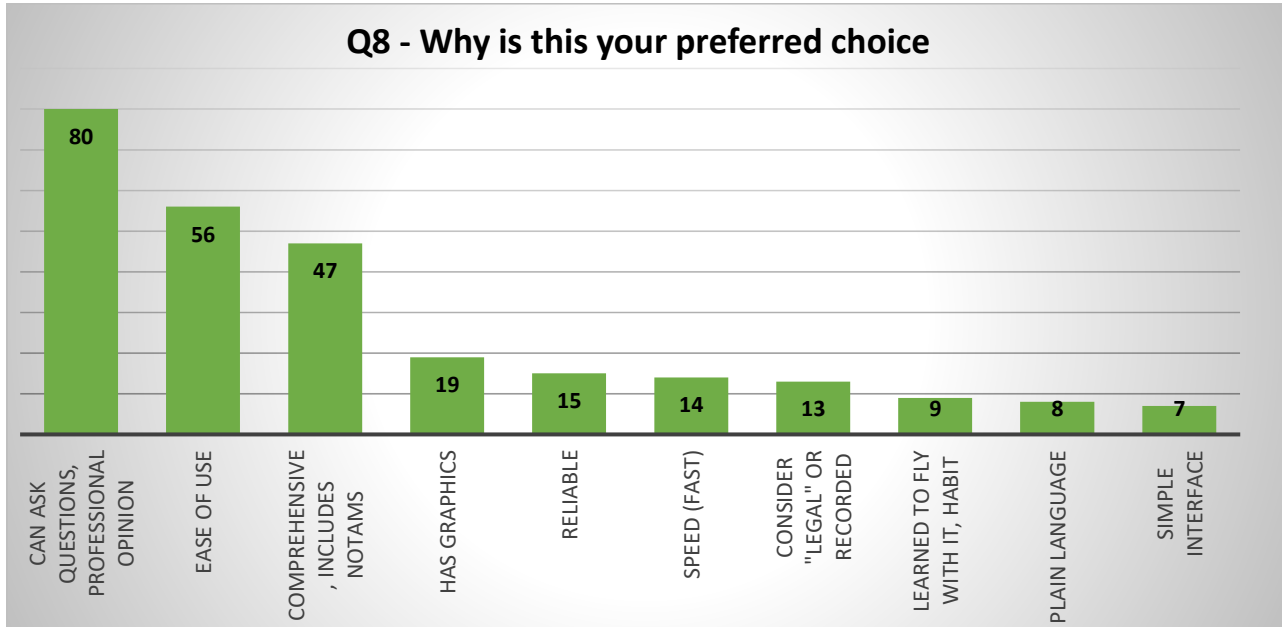


When asked about weather sources closer to departure (question 6), CONUS users still preferred aviation apps, but increased their calls to Flight Service. Alaska pilots continued to favor weather cameras, which update every ten minutes, with calls to Flight Service being third most popular.

When asked their primary (can only select one) weather resource prior to a flight “under potentially challenging conditions,” the number of pilots who call Flight Service increases, and moves to first place for both CONUS and Alaska pilots.



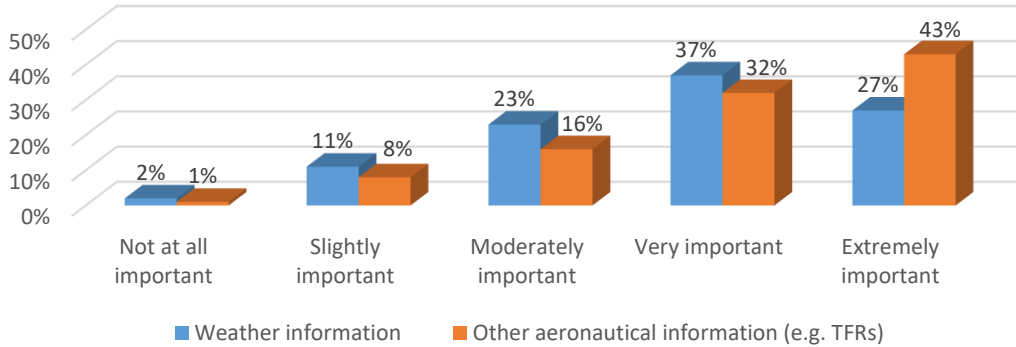
The next question asked, “why is this your preferred choice?” We received 349 open responses when including Alaska and CONUS pilots; however, not all were usable. After categorizing the responses, the primary rationale for preference was the ability to ask questions and get a professional’s interpretation, i.e., calling Flight Service. Other frequently provided answers touched on the resource being comprehensive and like a one-stop-shop, which many EFB apps may be.



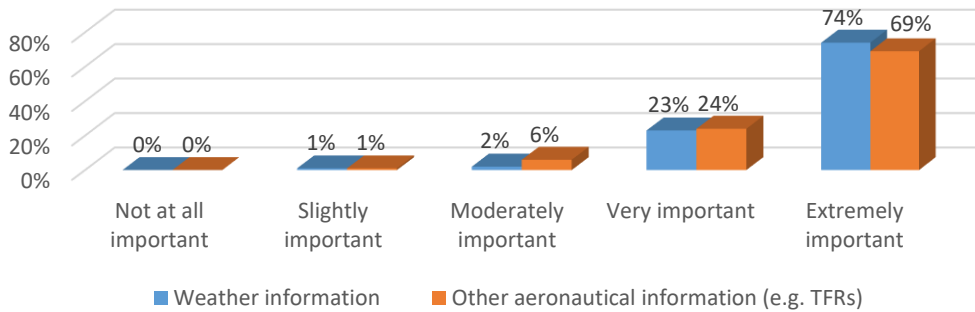
Emphasis on Weather Information

One of our research goals was to better understand how much emphasis pilots place on receiving weather information in comparison to aeronautical information, such as NOTAMs. By regulation, pilots are required to obtain both; however, depending on whether the flight is local or not can change a pilots’ priority. For example, pilots place greater emphasis on weather information when flying under Instrument Flight Rules (IFR) or when on a long cross-country versus when they are staying local. When remaining in the local area, many pilots place greater emphasis on aeronautical information.

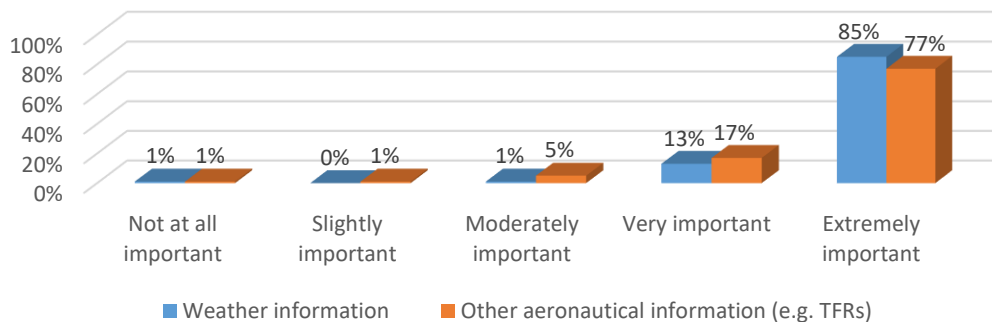
Q9 - When preparing to fly VFR in the *local area*, how important do you feel it is to gather weather information and other aeronautical information like NOTAMs, TFRs, etc.?



Q10 - When preparing to fly VFR on a *long cross-country*, how important do you feel it is to gather weather information and other aeronautical information like NOTAMs, TFRs, etc.?

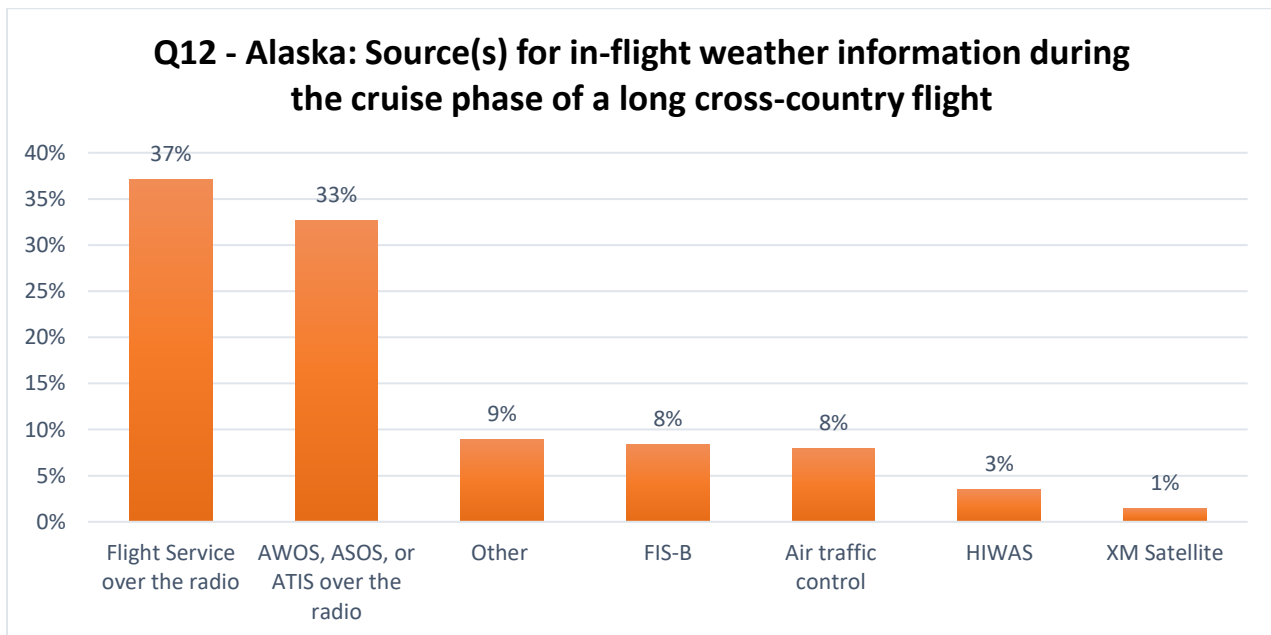
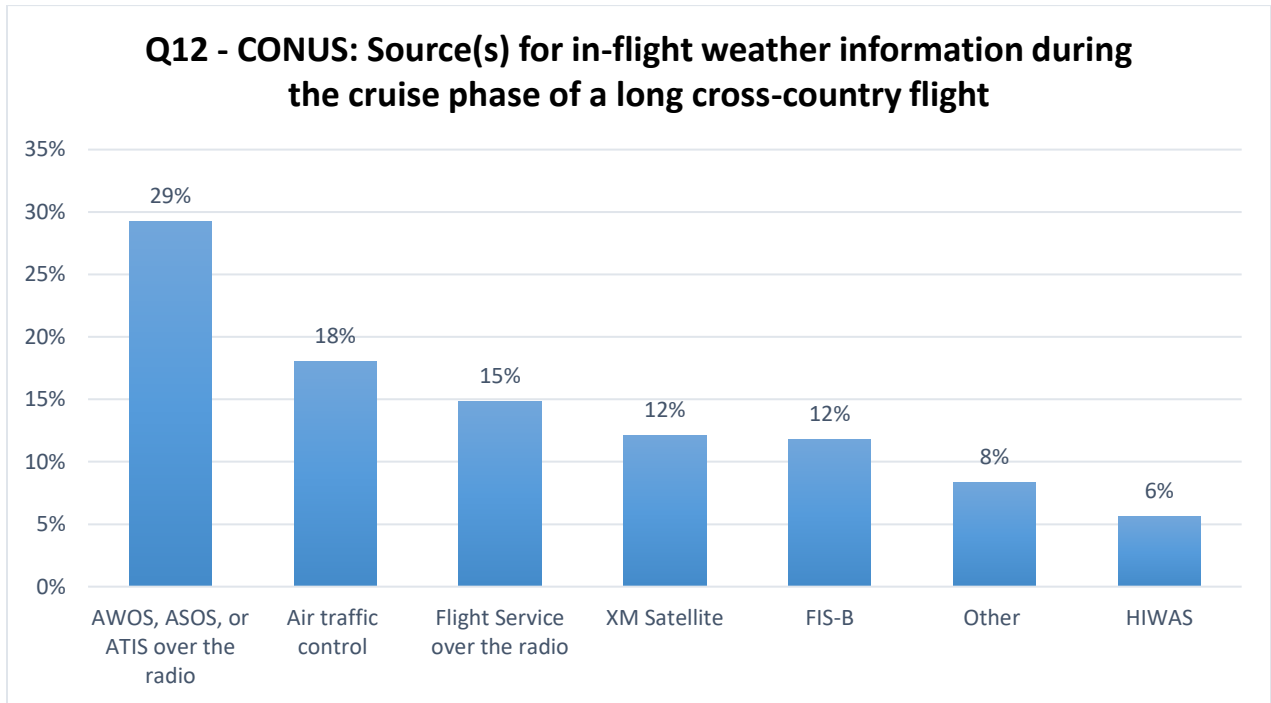


Q11 - When preparing to fly under *instrument flight rules (IFR)*, how important do you feel it is to gather weather information and other aeronautical information like NOTAMs, TFRs, etc.?

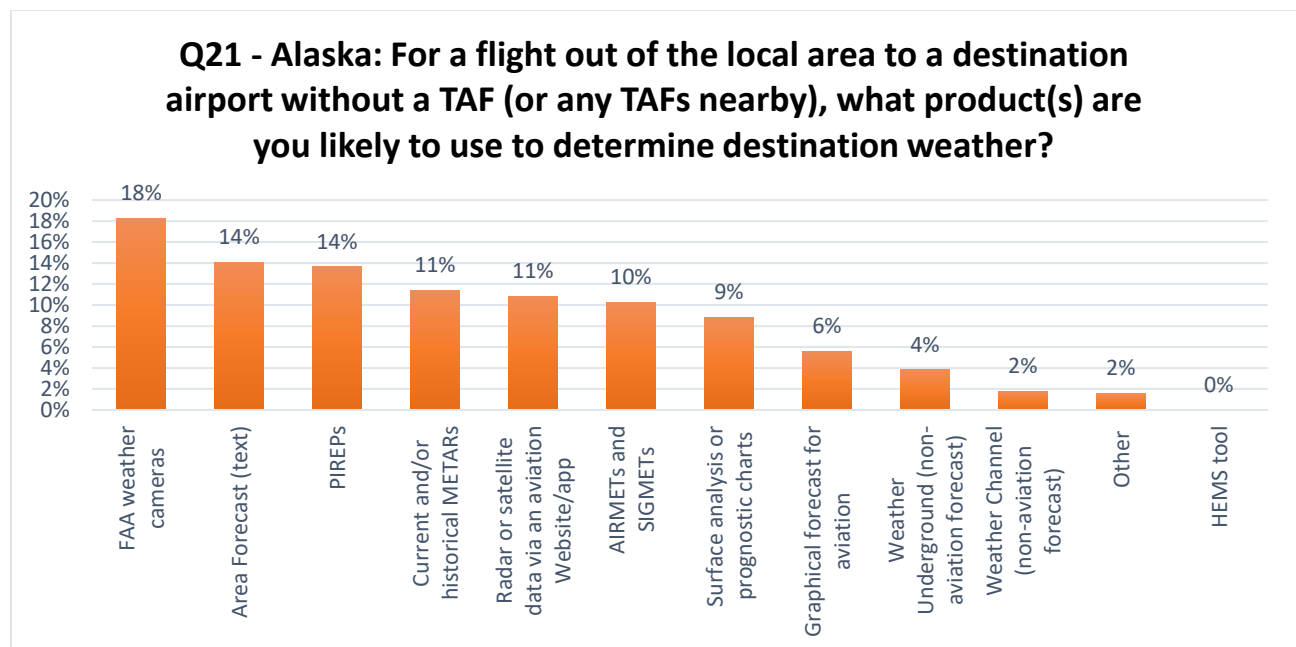
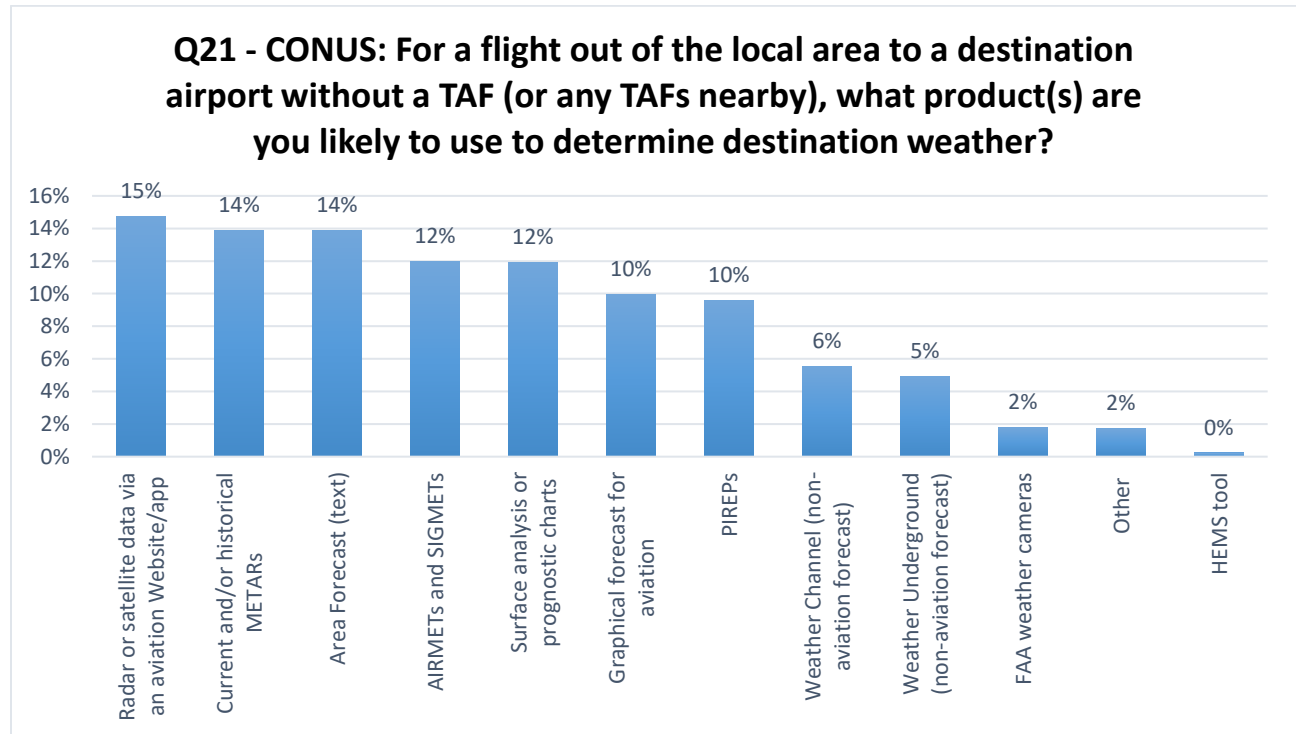


Access to Weather

Two of the weather challenges in general aviation are: (1) making the decision to fly to an airport that may not have any weather reporting; and (2) obtaining weather information enroute. Many small airports do not have weather reporting, and connectivity challenges can make accessing weather inflight a challenge. This question was again evaluated to compare CONUS versus Alaska pilots.



Per question 12, we know pilots operating in CONUS typically are accessing weather directly from automated stations, or picking it up from ATC, with Flight Service being the third most popular source identified. In contrast, Alaska pilots often are outside the range of AWOS/ASOS stations due to the lower density of stations, and have much more limited access to ATC for flight following, which makes their ability to communicate directly with Flight Service the most frequently used source. Those pilots who selected the “other” category generally indicated ADS-B weather, ForeFlight, or Stratus, which likely fall under the “Flight Information Service Broadcast (FIS-B)” category.

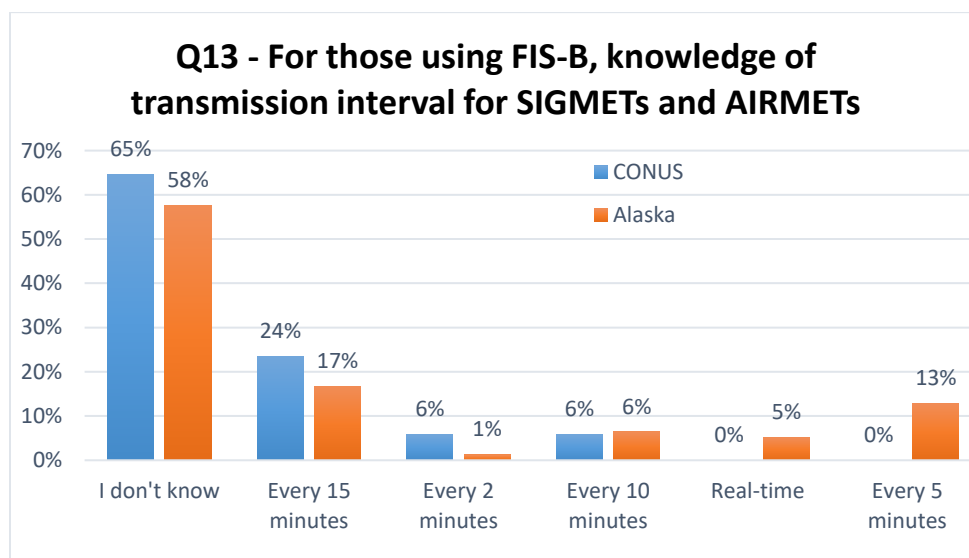


For flights to a destination airport without a Terminal Area Forecast (TAF), (Question 21, above), CONUS pilots rely on observations (radar/satellite data or METARs) before turning to more general forecast products (Area Forecasts/Airmets, prog charts, etc.). Interestingly, PIREPs are only the seventh most popular selection to anticipate local conditions. Alaskan pilots turn to weather cameras, then turning to Area Forecasts or PIREPs as their next products of choice. The general spread across the responses to this question by both CONUS and Alaska pilots suggests that there isn't any magic bullet, and pilots are turning to anything they can find to predict flight conditions.

Knowledge of FIS-B

AOPA's 2016 surveys indicated about 27% of general aviation pilots use FIS-B, very similar to this survey's results as 26% of respondents indicated they utilize it. For those who indicated they have it, several follow-up questions were provided. Our goal was to gauge pilot's knowledge of this capability and its latency.

The first question in the series asks pilots about the transmission interval for two weather products. Per the Aeronautical Information Manual (AIM), the Transmission Interval is the amount of time within which a new or updated product transmission must be completed and the rate or repetition interval at which the product is rebroadcast. The correct answer to this question is 5-minutes; however, very few pilots chose this option with most admitting they did not know.



Another important topic is latency in radar products, discussed at length in a 2017 FAA report³:

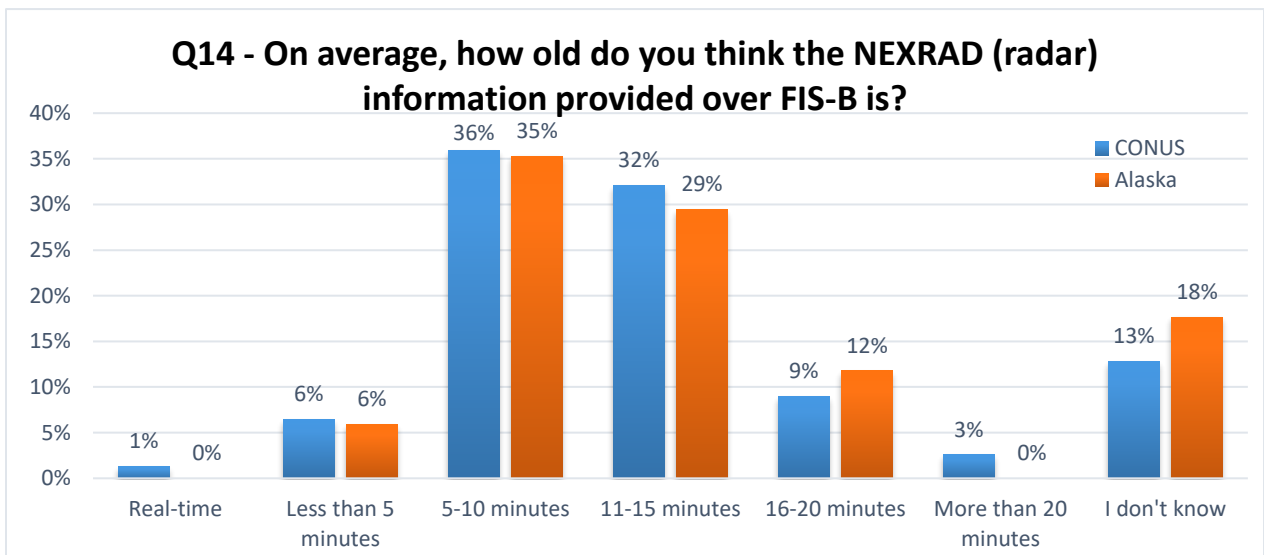
“Weather radar ‘mosaic’ imagery created from Next Generation Radar (NEXRAD) data is available to pilots in the cockpit via the Flight Information Service-Broadcast (FIS-B)...The age indicator associated with the mosaic image on the cockpit display does not provide an appropriate representation of the age of the weather conditions as observed by the NEXRAD network. Instead, the age indicator displays the age of the mosaic image created by the service

³ Frazier, E. (June 12, 2017). Report No: FAA-20170614.1: Weather Technology in the Cockpit Program, Subtask 4.01, NEXRAD Industry Providers Survey Final Technical Report.

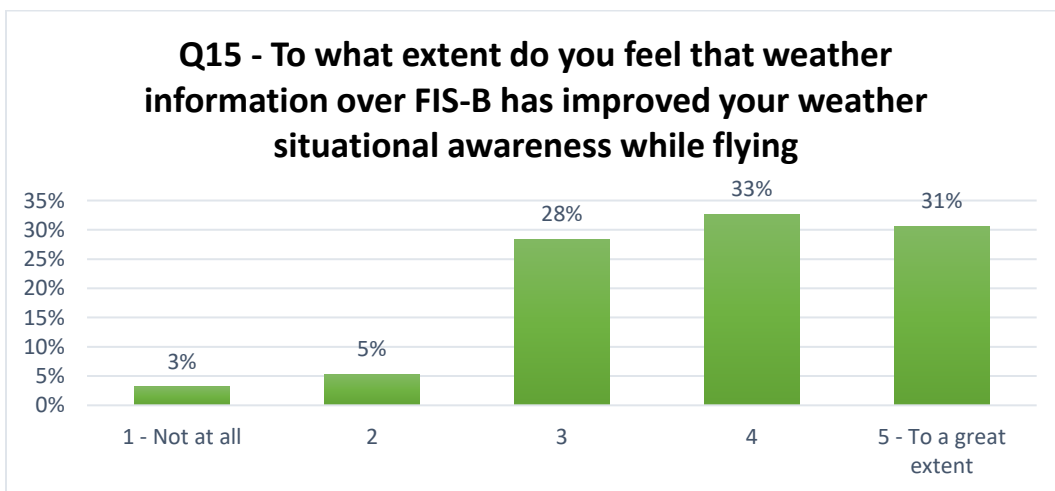
provider. Weather conditions globally depicted on the mosaic image will ALWAYS be older than the age indicated on the time stamp.

Although such situations are not believed to be typical, in extreme latency and mosaic-creation scenarios, the actual age of the oldest NEXRAD data in the mosaic can EXCEED the age indication in the cockpit by 15 to 20 minutes. Even small time differences between the age indicator and actual conditions can be important for safety of flight, especially when considering fast-moving weather hazards, quickly developing weather scenarios with fast-moving aircraft. The National Transportation Safety Board (NTSB) issued its 'In-Cockpit NEXRAD Mosaic Imagery' Safety Alert, clearly stating that age could exceed 15 to 20 minutes by service type or provider."

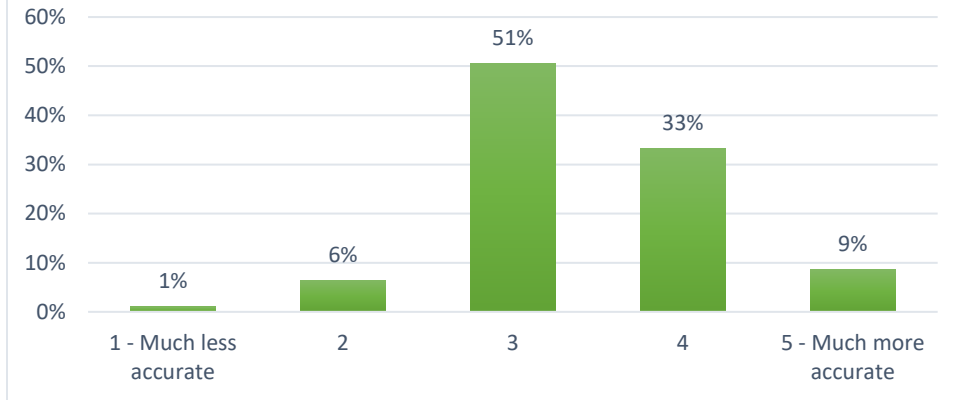
At a minimum, NEXRAD is at least 5-minutes old and is likely to have latency adding more time. Most respondents indicated an adequate amount of time, but many pilots are still not aware of this latency.



Overall, many pilots feel FIS-B has improved their weather awareness and that it is an accurate resource for information. It is important for pilots to not have the misperception that FIS-B data is more accurate than other sources as generally they provide the same information.



Q16 - How accurate do you perceive your FIS-B information to be compared to other methods of obtaining the same information

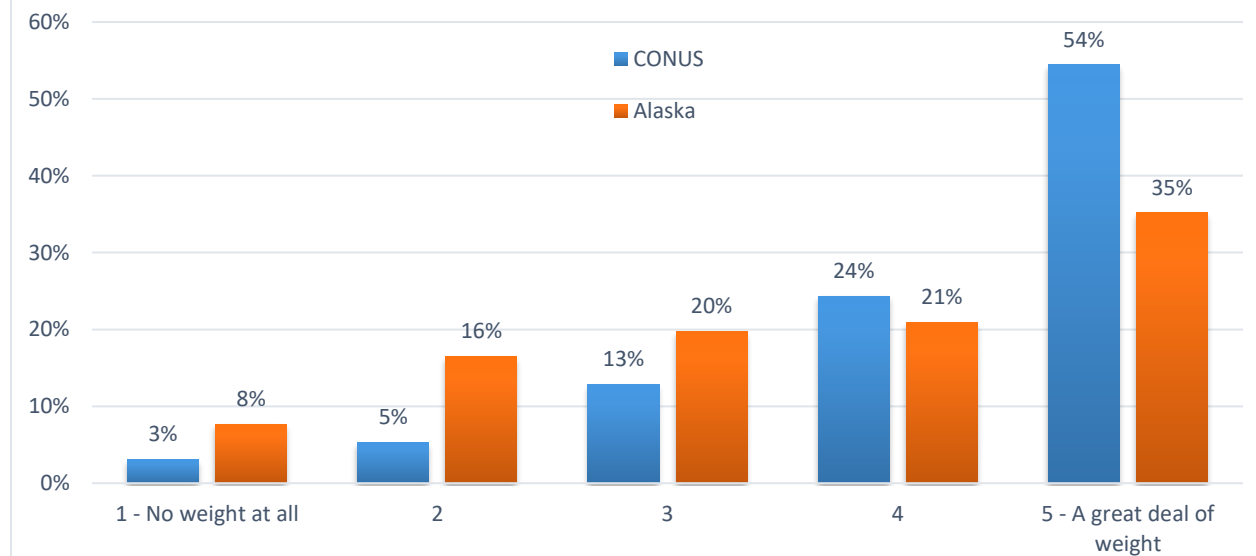


VFR Not Recommended (VNR)

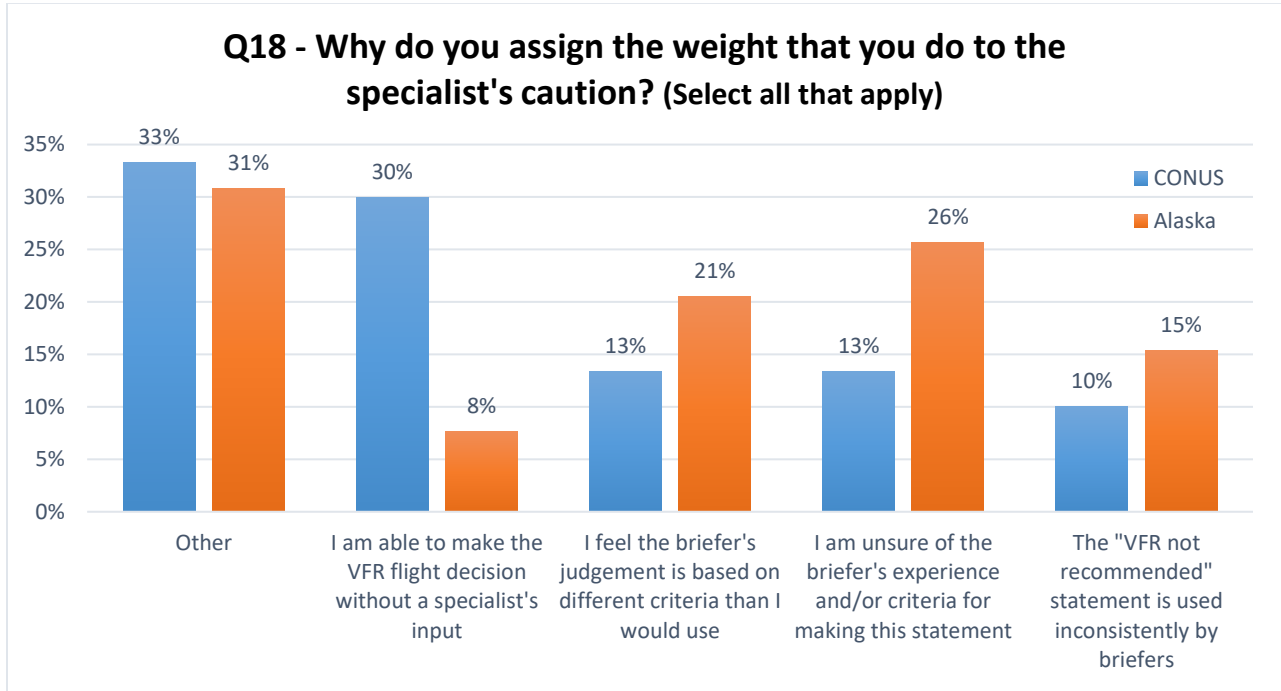
Flight Service specialists, primarily reached by telephone, are required to inform a pilot if their flight may encounter certain weather conditions that may make VFR flight unlikely. The verbal statement of “VFR not recommended” has become a recent topic following Canada’s decision to discontinue their use of it following pilot complaints.

Pilots in the United States indicate they have mixed feelings about its utilization today but still most give some weight to the statement when it is verbalized.

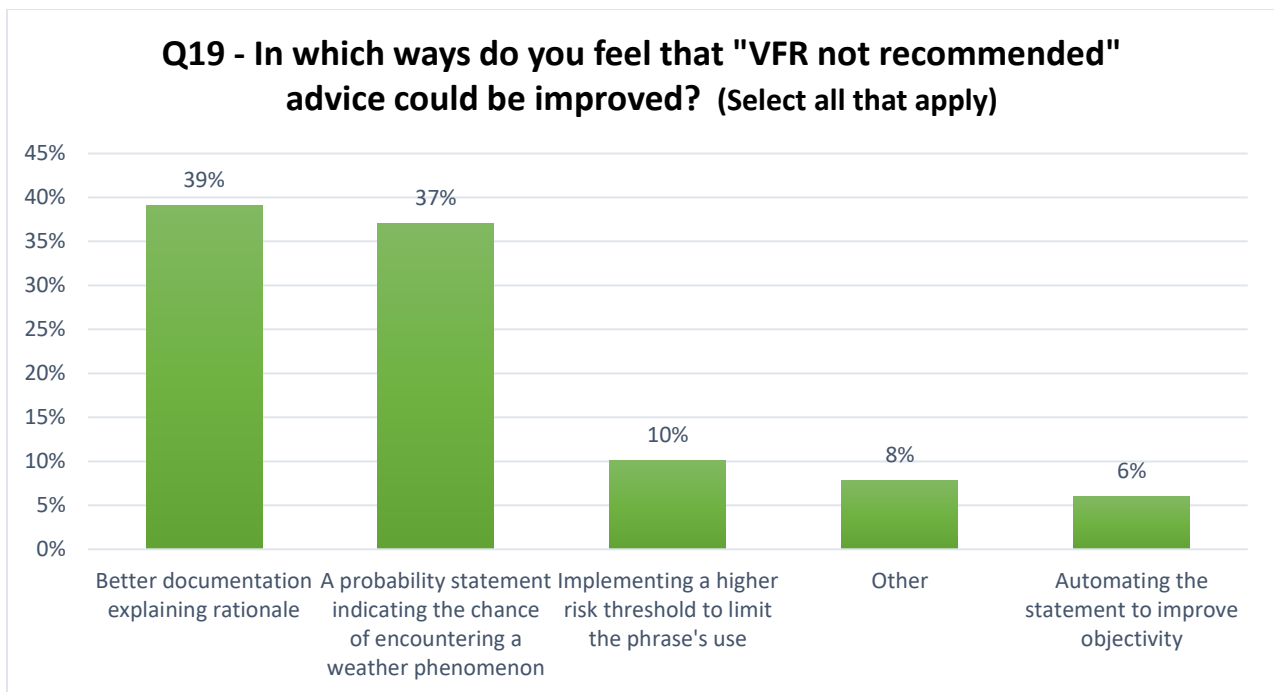
Q17 - How much weight do you typically assign a Flight Service specialist's caution that "VFR is not recommended"?



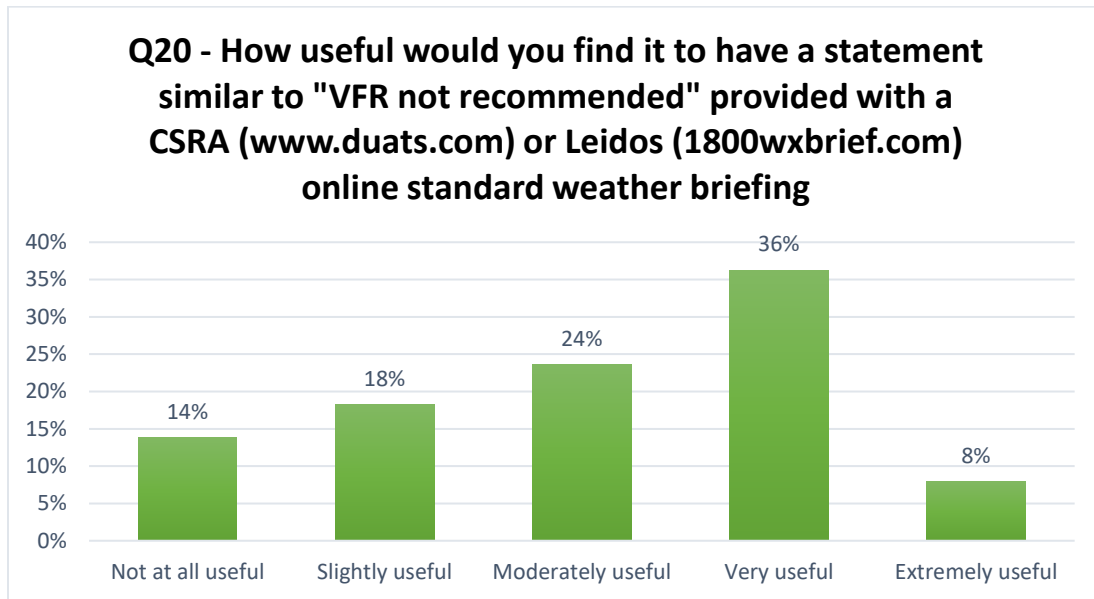
For those pilots who indicated a lower weight, either 1, 2, or 3, a follow-up question requesting a reason was provided. Many pilots indicated “other” and provided a write-in response. Those responses fell into the following categories: VNR is over used; specialists are thinking too much about liability; I can decide without their input; and the briefer uses different criteria than I do.



Pilots showed a preference for more rationale and a probability should VNR be issued by a specialist.

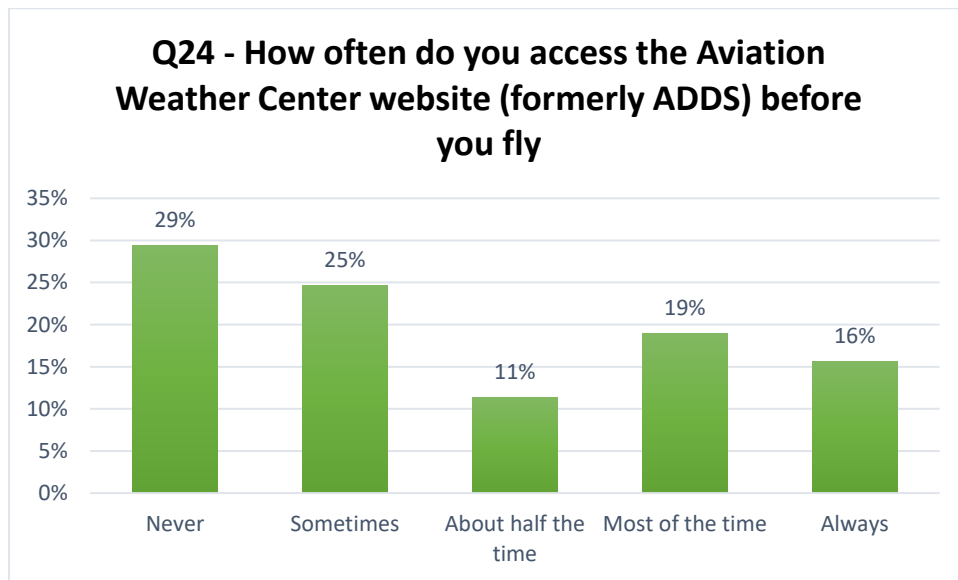


When asked about the possibility of automating VNR, almost 70% of pilots indicated they would find this type of intervention useful.



Aviation Weather Center (AWC) Website

The AWC website is a resource that is available for free to pilots and is used by many, but not all, as a resource. Our goal was to understand how many pilots use this resource and what their opinion is.



For question 25, we asked “are there any improvements that you feel could be made to the Aviation Weather Center website that would cause you to access it more?” About 16% of respondents said “no,” 72% said “I’m not sure,” and 12% said “yes.” There were 39 open responses received to this question with the substantive comments provided below. The themes were increasing mobile-friendliness, need to reduce menu confusion, and requests to alter specific products.

"I wish it was more graphical like MyRadar, and less about stick figures like those pennant flags for wind (as an example). In other words, make them dynamic, not static."

"The icing tool should be made an approved product with legal protection for utilizing the data for avoidance. Also the turbulence tools should be enhanced for lower altitude levels."

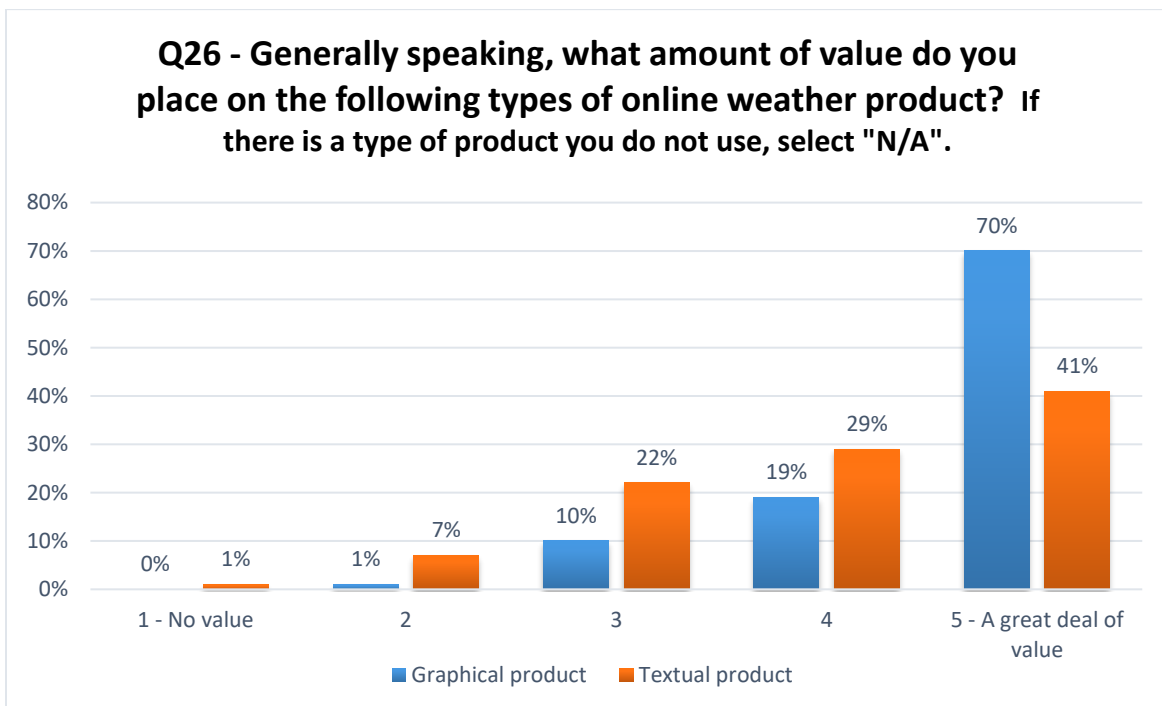
"Organize it better (by use, not by the product name) - maybe combine various products together into fewer whole weather pictures."

"It is not cell phone friendly. Takes too many steps to find an identifier and get a decoded metar. Has scaling and text size issues. Keys i.e. colors and symbols should be available on a pop up. The graphical layers overlap making it difficult to tell which is high or low level for example."

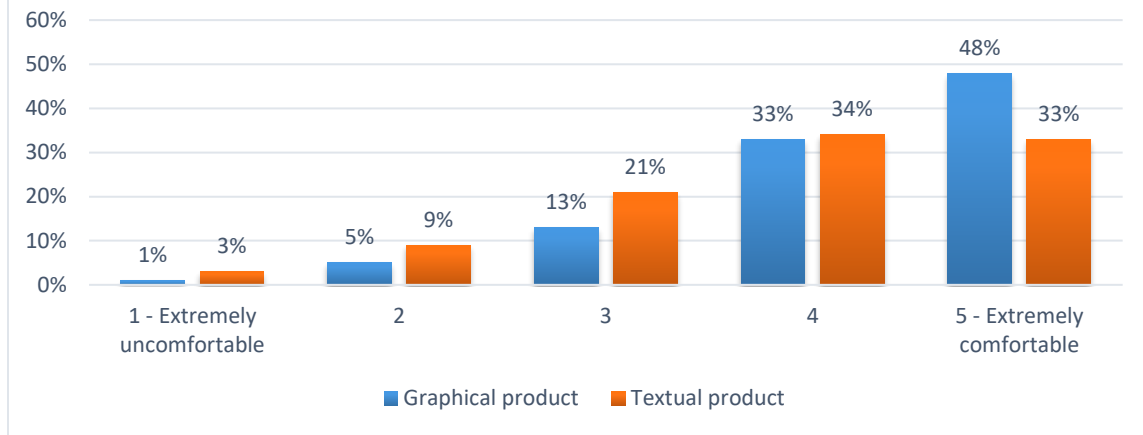
"Go look at skyvector.com and make (ADDS) more like that. The interface and usability of skyvector is great but the products provided by Avn Wx Center is better. I use both because neither website provides me an adequate picture but combined I can get what I need."

Textual versus Graphical Weather Products

As more graphical weather products replace textual products, we wanted to understand the difference between how pilots value these two products. We also wanted to understand how comfortable pilots are as far as interpreting these different products. Overall, pilots place more value in graphical products and are more comfortable interpreting them than textual products.

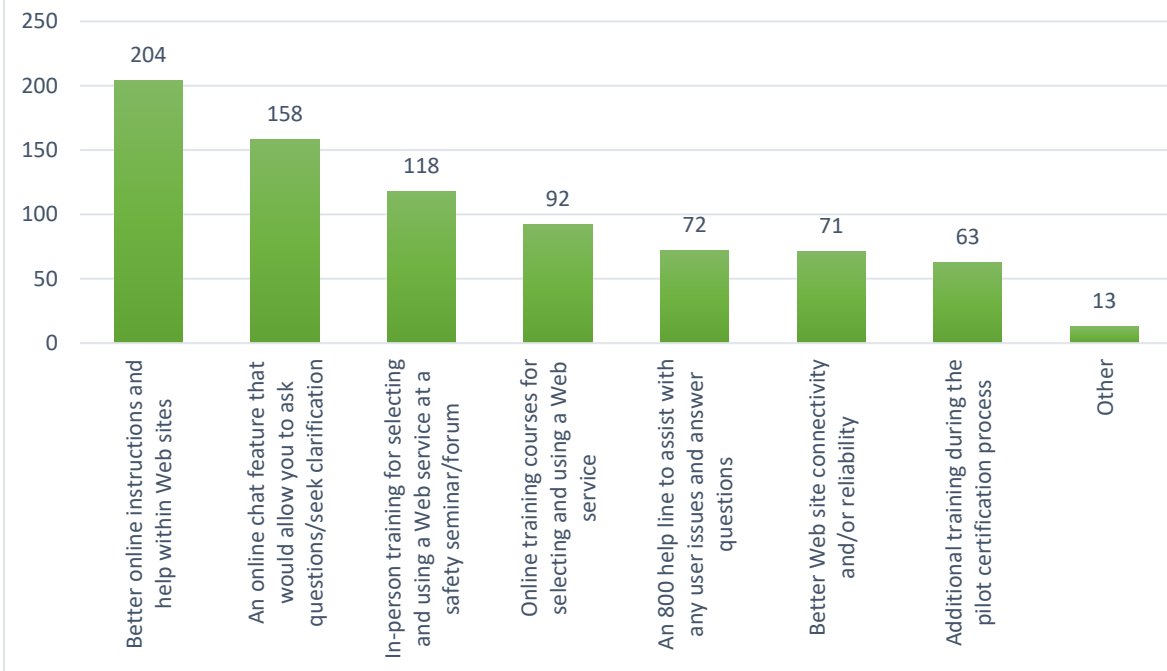


Q27 - Generally speaking, how comfortable do you feel interpreting the following types of online weather product? If there is a type of product you do not use, select "N/A".



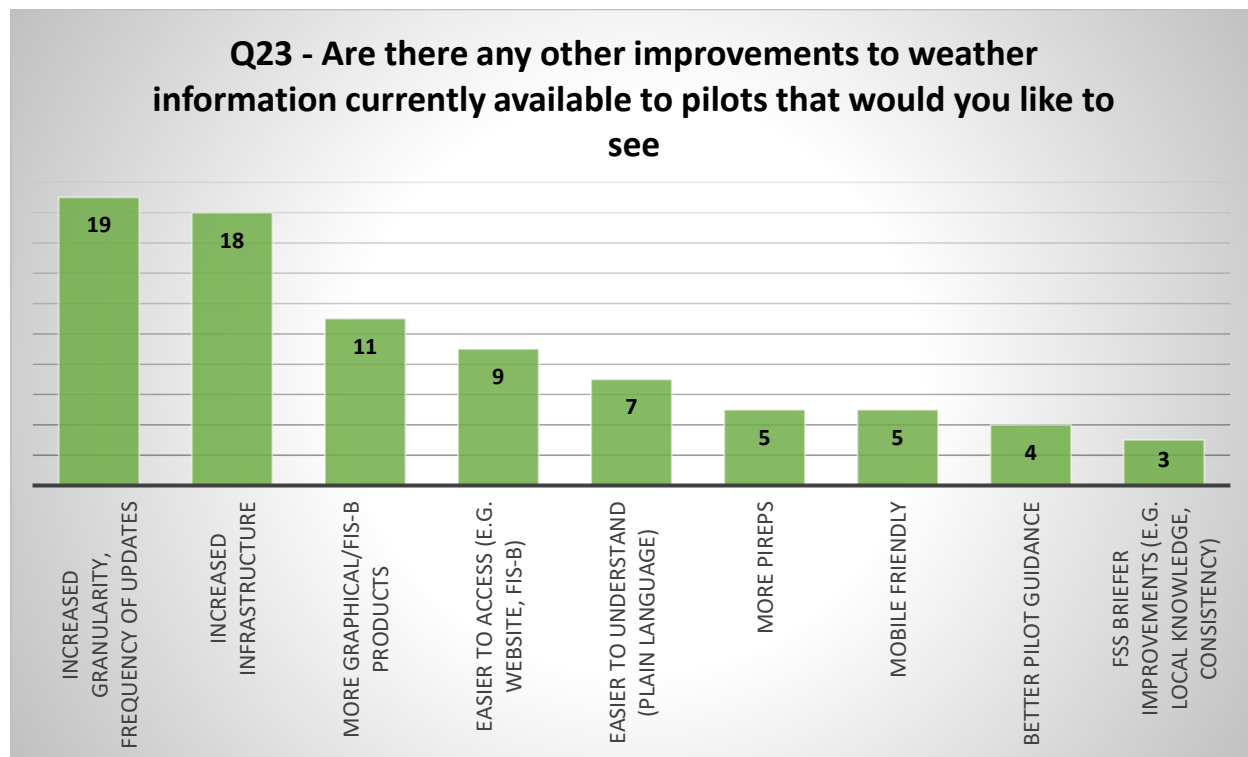
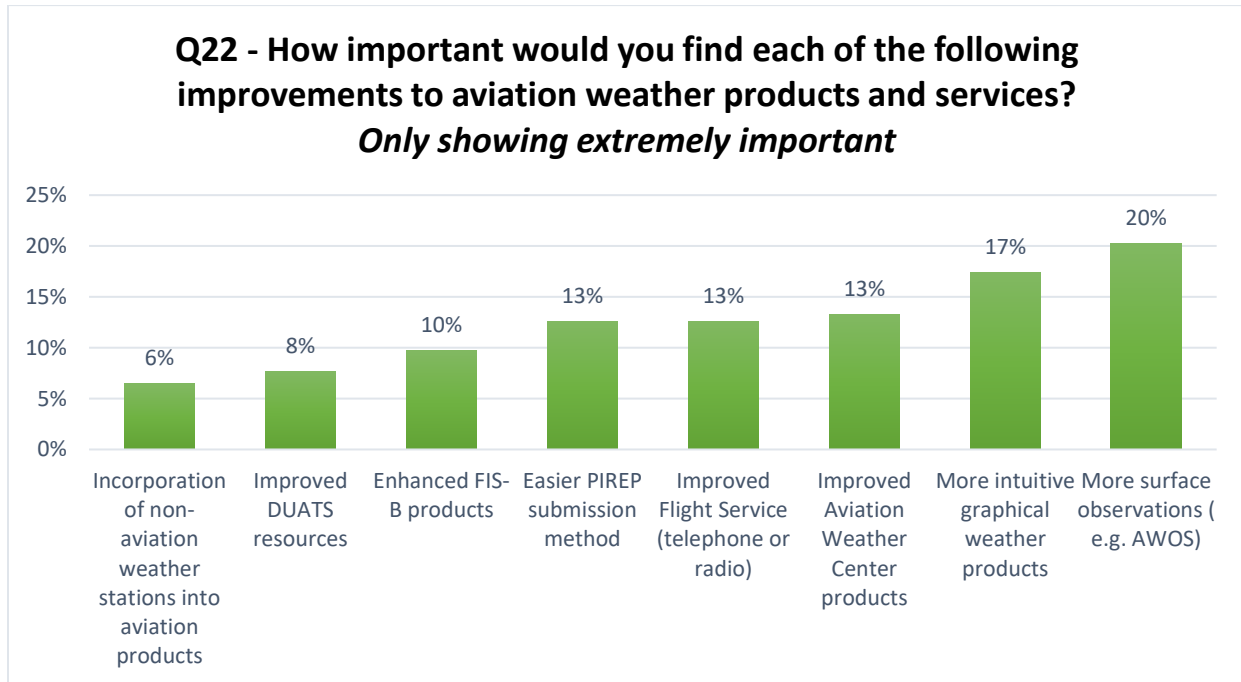
When asked what would help improve interpretation of graphical products, “in-website support/guidance” was the favorite and an online chat feature was second.

Q28 - Which of the following would make interpreting graphical weather products provided via online pilot weather briefing services (such as DUATS) more useful for you? (Select all that apply)



Weather Improvements

Another goal of this survey was to allow general aviation pilots to voice what improvements they would like to see. Question 22 offered several known areas needing improvement for ranking. Question 23 allowed pilots to provide an open response to what improvements they wanted to see. We grouped the open responses from this question into categories for comparison.



Discussion

Our goal with this survey was to better understand how general aviation pilots access weather information, the weather challenges they face, and what improvements they desire. It has been several years since AOPA has conducted a weather-specific survey of our membership but, through the regular surveying of our members, we hope to be able to gauge improvements and gaps over time. These surveys also help drive new AOPA educational products and online courses. Summarizing responses and comments from the different questions and themes identified previously, the following topics are identified.

Access to Graphical Weather Products

How pilots are accessing weather products has changed over time, largely due to the proliferation of iPads and tablet technology, and the widespread availability of internet coverage. Weather providers must keep up with this demand and the new capabilities facilitated by technology. Ensuring websites are mobile-friendly and usable on touchscreens is important. Also important is the continued support for graphical products given the perceived increased value, by a wide margin, they have over textual products. Pilots desire these tools but need them to be provided in a manner that they can access them on the devices they are using, i.e., EFBs.

Flight Service

Despite the benefits of graphical weather products, pilots clearly indicated a strong preference for speaking to a Flight Service specialist under a variety of conditions. General aviation pilots generally do not have a dispatcher or meteorologist available to them, unlike most commercial operators. The option to be able to speak to a specialist is clearly a safety benefit that pilots rely on when it comes to understanding weather and obtaining the most current information.

AWC Website Improvements

The AWC is where many weather products are created and their website serves as a free interface to access this information. Many pilots access this website while many others use their products via third party providers. It appears pilots would access this AWC website more often if there was greater interactivity, such as what is coming online with the Graphical Forecasts for Aviation (GFA). The GFA is new and does not yet have a strong following, but it builds off the many lessons learned from the HEMS tool and integrates aeronautical information with the weather products. Pilots express a preference for products with ease of use and that are comprehensive. Further modernizing products for accessibility via EFBs and incorporating aeronautical data in these products, while also facilitating better granularity, we believe more pilots will use this site as a primary resource.

Alaska Aviation Weather Unit (AAWU) Website Changes

The AAWU is the Alaska counterpart to the AWC, which generates products for the state (approximately one fifth the size of CONUS). As the results for this survey show, it too is a popular source of information for pilots flying in this region. The AAWU has generated graphical forecast products for some time, as well as providing PIREPs, NEXRAD, satellite and other data. They recently (after this survey was conducted) changed the look of their website to conform to an National Weather Service standard,

which makes it difficult to apply specific comments from this survey; however, the need to support mobile devices is clearly important for this site as well.

VNR Improvements

The survey shows many Alaskan and CONUS pilots are skeptical when a specialist states VNR, although it appears they are skeptical for different reasons. Alaskan Flight Service is different than CONUS and our survey shows there are some differences in what pilots think. Some of this lack of trust is the result of pilot experience and the specialist being wrong at some point. VNR is an important intervention that works for some pilots but not all. AOPA had requested via a December 2016 letter that the FAA's Weather Technology in the Cockpit research group evaluate VNR to determine whether it is effective. We appreciate the FAA's swift response by initiating a study in early 2017. We believe an effective intervention that can reduce VFR-into-IMC is important.

FIS-B Supporting Infrastructure and Education

AOPA is encouraged that most pilots who utilize FIS-B find it to be of value and that it improves their weather awareness in the cockpit. More weather products are under development and under discussion at a working group at RTCA, of which AOPA is a member. We support this effort to provide more products that are useful for the general aviation pilot. To ensure pilots can receive these products, additional FIS-B infrastructure, the Ground Based Transmitters (GBT), is needed to facilitate transmission. Coverage is lacking in much of Alaska and parts of CONUS. Greater FIS-B coverage will result in numerous safety and efficiency benefits.

Our survey shows general aviation pilots need further education on the limitations of FIS-B provided products, particularly regarding latency. Pilots must be aware of the transmission intervals and how that is different from the product update. We continue to see pilots not fully understand the delay in NEXRAD information and a wide variety of answers when trying to quantify the delay. Many pilots who use FIS-B are new to this technology and would not have had weather in the cockpit before.

FAA Weather Cameras

When participants were asked about improvements they desire, more surface observations and increased infrastructure were high on the list. In the open response question, many pilots specifically stated the infrastructure they desire is more weather cameras. The cameras in Alaska have become a primary resource for many pilots as they make the decision whether to fly or not. This is most likely due to (a) a severe shortage of conventional AWOS/ASOS observations in contrast to CONUS, and (b) the visual nature of this data source to display details of weather conditions beyond the immediate "spot" measured by an automated weather sensor. Even though the cameras only operate during daylight hours, they have become a significant source of weather data for pilot decision making in Alaska. Based on the results of this survey, more investment in this technology and additional locations are desired.

Recommendations

Based on the results from this survey, and subsequent meetings and discussions with stakeholders, the following recommendations are made.

- 1) Weather products should be mobile-friendly and maximize the advantages of graphical interfaces.
- 2) Flight Service specialists should remain available and accessible, during preflight and inflight, for general aviation pilots as they are a primary resource when it comes to weather understanding.
- 3) The AWC website should be modernized to better integrate different weather products together and incorporate aeronautical information, such as chart layers.
 - a. The AWC should promote the GFA and continue to improve this tool's capabilities.
 - b. Consider adding interactive tutorial options that would assist a pilot's understanding of how to use the products and what the limitations are.
- 4) The FAA should continue their evaluation of VNR to determine if this phrase is an effective intervention for pilots who may be at risk for VFR-into-IMC.
 - a. Flight Service specialists should provide more rationale when conveying VNR to ensure pilots understand why it was given.
 - b. The FAA should evaluate whether a probabilistic based determination can be automated and generate a cautionary statement for pilots who brief online, which is the majority of pilots.
- 5) The FAA should continue supporting and developing FIS-B given the weather benefits it provides.
 - a. Expanding the GBT infrastructure to improve FIS-B coverage is important to delivering these products in the remote areas they are needed most.
 - b. The FAA should provide greater guidance on the topic of latency of FIS-B products and consider testing pilots on their understanding of these limitations.
- 6) The FAA should make a greater investment in weather camera infrastructure as it improves access to remote communities and promotes better weather decision making.

The Aircraft Owners and Pilots Association (AOPA) is a not-for-profit individual membership organization of general aviation pilots and aircraft owners. AOPA's mission is to effectively serve the interests of its members and establish, maintain and articulate positions of leadership to promote the economy, safety, utility and popularity of flight in general aviation aircraft. Representing two thirds of all pilots in the United States, AOPA is the largest civil aviation organization in the world.

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