



2021 Weather Survey

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Introduction

For the past five years, AOPA has conducted an annual Weather Survey to investigate how pilots access weather information. The results of the 2021 Weather Survey build on knowledge obtained from previous years of research on Weather, PIREPs, and Flight Service.¹ The 2021 Weather Survey focused on technologies used by pilots, FIS-B, PIREPs, the Graphical Forecasts for Aviation (GFA) website, the Helicopter Emergency Medical Services (HEMS) tool, the cloud cross-section product from the National Oceanic and Atmospheric Administration (NOAA), and more. When appropriate, these survey results are trended over time and segmented by demographics such as age, pilot certificate, and location.

Method

The 2021 Weather Survey was created in Qualtrics, an online survey tool. The survey contained 37 unique questions, including subsets specific to pilots from different regions. Survey responses were collected over a six-week period from April to June 2021. A total of 582 AOPA members from Hawaii, 3,233 from Alaska, and a random sample of 30,000 AOPA members from the continental United States (CONUS) received an email invitation to take the survey. Members from Hawaii and the CONUS received one additional email reminding them to take the survey, and members from Alaska received two reminder emails. Respondents did not receive any incentives in exchange for participation.

Key Findings

1. Less than a third of the survey respondents are familiar with FAA Advisory Circular 91-92, regarding preflight self-briefing procedures for pilots. The FAA and industry should continue outreach to increase awareness of the guidance and resources available in this document.
2. The use of Flight Service specialists for preflight weather briefings continues to diminish, yet they are an important primary source of information for pilots (particularly in Alaska). The percentage of pilots conducting self-briefings has also increased. Based on these trends, the FAA should evaluate changes in use patterns to evolve staffing utilization in response to these trends.
3. The FAA Weather Camera Program continues to be a heavily used weather resource for pilots in Alaska, where the program was first developed, with approximately three-quarters of the pilots using it as an initial weather source and immediately prior to flight. AOPA

¹ Duke, R. & George, T. (July 26, 2016). [AOPA 2016 Pilot Report Survey](#).

Duke, R. & George, T. (Aug. 4, 2017). [AOPA 2017 Weather Survey](#).

Duke, R., George, T., Davis, K., & Bell, E. (July 6, 2018). [AOPA 2018 Weather Survey](#).

Duke, R., George, T., Davis, K., & Bell, E. (June 12, 2019). [AOPA 2019 Weather Survey](#).

Duke, R., George, T., Davis, K., & Bell, E. (May 22, 2020). [AOPA 2020 Weather Survey](#).

recommends continuing to expand the program, both in Alaska and the CONUS, and to fund research to make it a 24-hour source of information, as opposed to a daylight-only system.

4. Despite efforts by the aviation community to increase the filing of PIREPs, the number of unsolicited reports has remained flat or even slightly diminished. Industry and government should continue efforts to encourage pilot participation, with special emphasis during initial and recurrent training.
5. Several new experimental weather products, now available to pilots, show promise for providing additional sources of current conditions and forecasts. More outreach and monitoring of these products is needed to provide feedback for further refinement as they mature.
6. The Aviation Weather Center Helicopter Emergency Medical Services (HEMS) tool provides weather information for low-level VFR operations, yet pilots are largely unfamiliar with it. A change of the name of this tool is recommended to help increase awareness of this information source.

2021 Survey Results

A total of 2,409 pilots from the CONUS, 148 from Alaska, and 7 from Hawaii responded to the 2021 survey. The margins of error at a 95% confidence level were 1.9% for CONUS pilots, 7.9% for Alaskan pilots, and 1.9% overall (considering pilots from all regions).

Sample Characteristics

The Weather Survey sample characteristics have remained constant over time. About half (53%) of all respondents were private pilots (Table 1, Figure 1), half (54%) were instrument current (Figure 2), and most (67%) flew single-engine piston, fixed-gear aircraft (Figure 3). Most respondents were at least 55 years old (74%).

Table 1. Highest level of pilot certificate held.

Certificate	2017 WX Survey	2018 WX Survey	2019 WX Survey	2020 WX Survey	2021 WX Survey	FAA
Student	17 4%	71 2%	98 4%	77 3%	51 2%	197,665 30%
Sport	0 0%	19 1%	16 0.7%	1 0.03%	1 0.04%	6,467 1%
Recreational	0 0%	4 0.1%	3 0.1%	4 0.1%	0 0%	127 0.02%
Private	191 50%	1,530 54%	1,134 50%	1573 52%	1,358 53%	161,105 24%
Commercial	107 28%	767 27%	619 27%	768 26%	665 26%	100,863 15%
ATP	63 17%	458 16%	392 17%	573 19%	494 19%	164,947 25%
No pilot certificate	2 1%	0 0%	5 0.2%	5 0.2%	0 0%	-
Total	380 100%	2,849 100%	2,267 100%	3001 100%	2,569 100%	664,565 100%

Note. This table compares responses to AOPA’s 2021 Weather Survey with AOPA’s previous annual Weather Surveys and the most recent FAA active airmen certificate numbers. FAA certificate numbers also include rotorcraft and glider pilots and are current as of the most recent update on 12/31/20 (source: [FAA U.S. Civil Airmen Statistics](#)). Only certificated pilots completed the remainder of the Weather Survey.

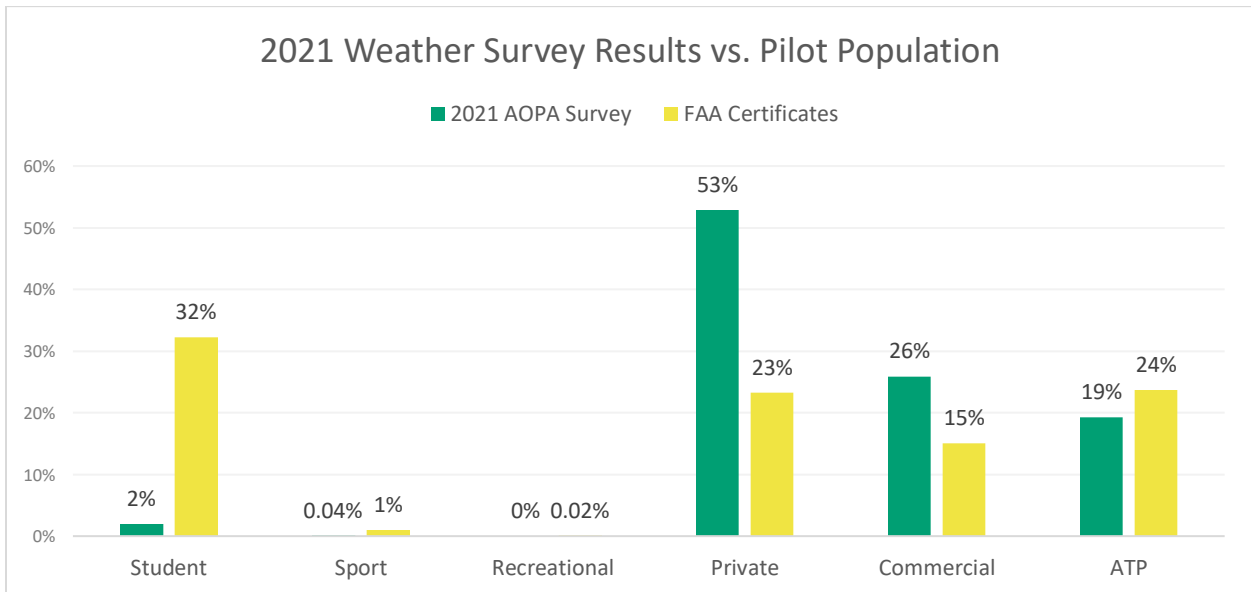


Figure 1. Responses to “What is the highest level of pilot certificate that you hold?” from 2021 Weather Survey (n₂₁ = 2569). FAA-estimated active airmen certificate numbers also include rotorcraft and glider pilots, and are current as of the most recent update on 12/31/20 (n_{FAA} = 664,565; source: [FAA U.S. Civil Airmen Statistics](#)).

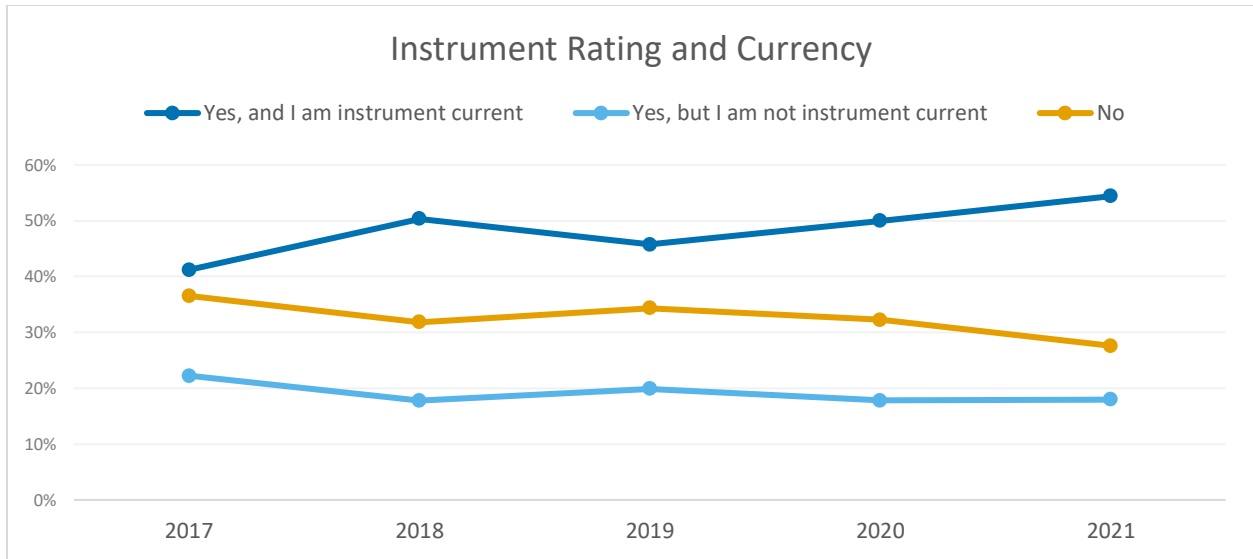


Figure 2. Responses to “Do you currently hold an instrument rating?” (n₁₇ = 364; n₁₈ = 2327; n₁₉ = 2071, n₂₀ = 2696, n₂₁ = 2028). The FAA reported 316,651 instrument-rated pilots as of 12/31/20 (46% of total pilot number; source: [FAA U.S. Civil Airmen Statistics](#)).

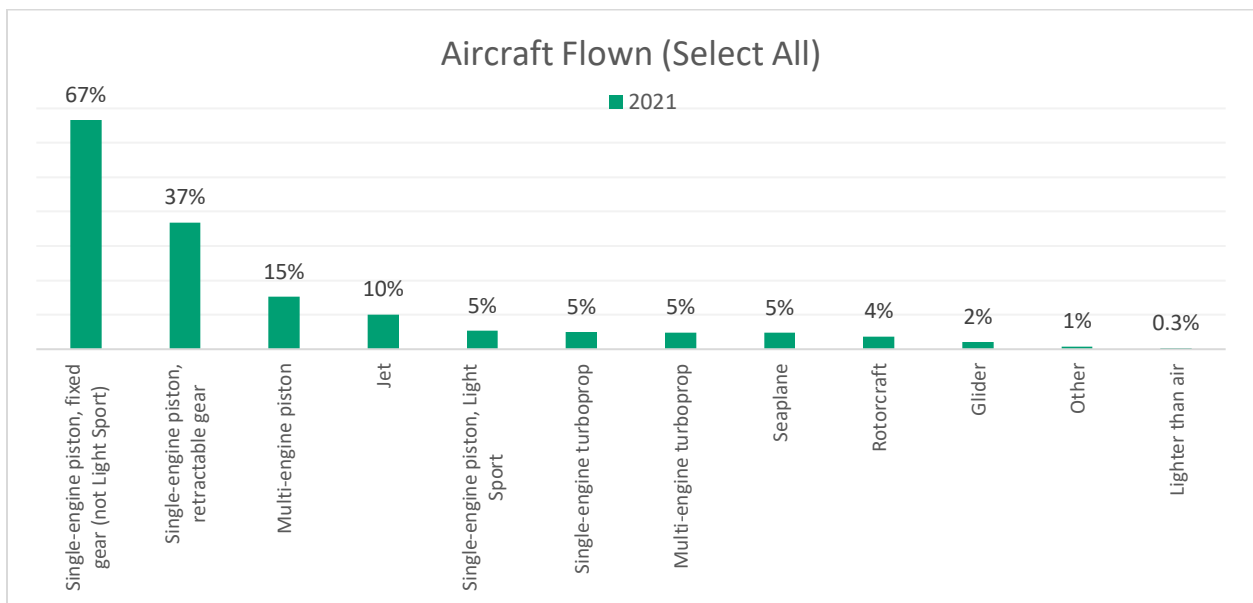


Figure 3. Responses to, “Which kind(s) of aircraft do you currently fly? (Check all that apply).” Percentages reflect the number of people who selected that response out of the total number of subjects who answered the question (n₂₁ = 2030).

FAA Self-Briefing Guidance

As the use of online weather resources continues to increase, more and more pilots are conducting their own preflight self-briefings. As a result, in 2021, the FAA released AC 91-92 to provide guidance for pilots on proper self-briefing procedures, describing different types of

briefings and other sources of government-provided weather. A set of questions in the present survey gauged awareness of the new FAA guidance and how it might affect pilot behavior. Only 34% of respondents said they were at least moderately familiar with AC 91-92 (Figure 4). Of those respondents, about 75% said that reading the guidance had no impact on their likelihood of conducting a self-briefing in the future (Figure 5).

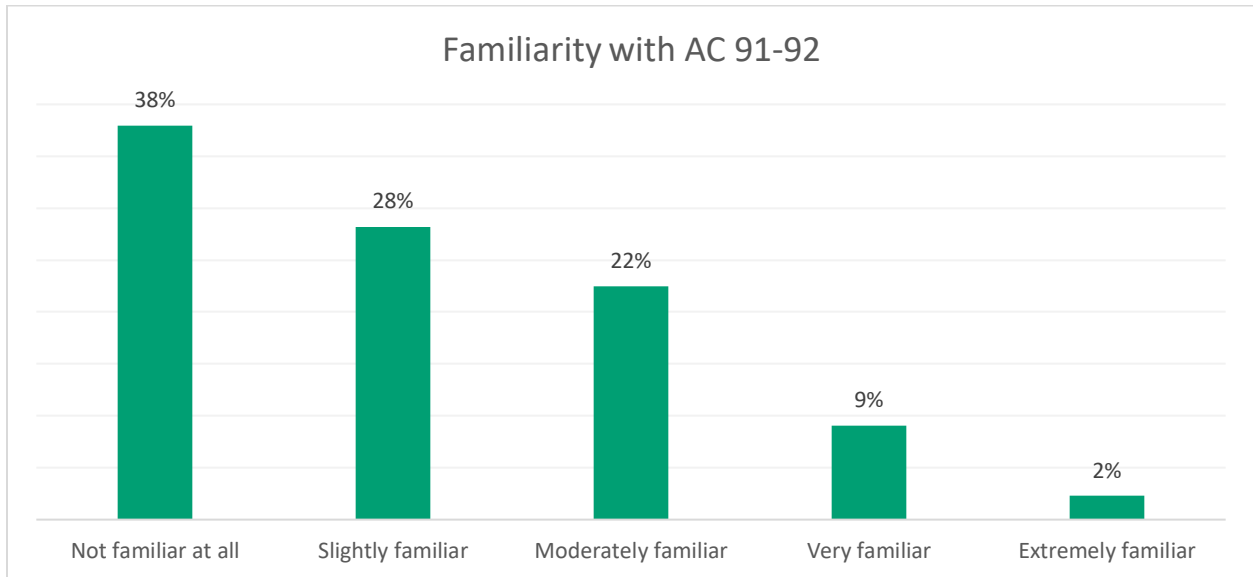


Figure 4. Responses to “Recently, FAA made available guidance on conducting pilot self-briefings in AC 91-92. [...] How familiar are you with this guidance?” (n = 2369). 2021 data only.

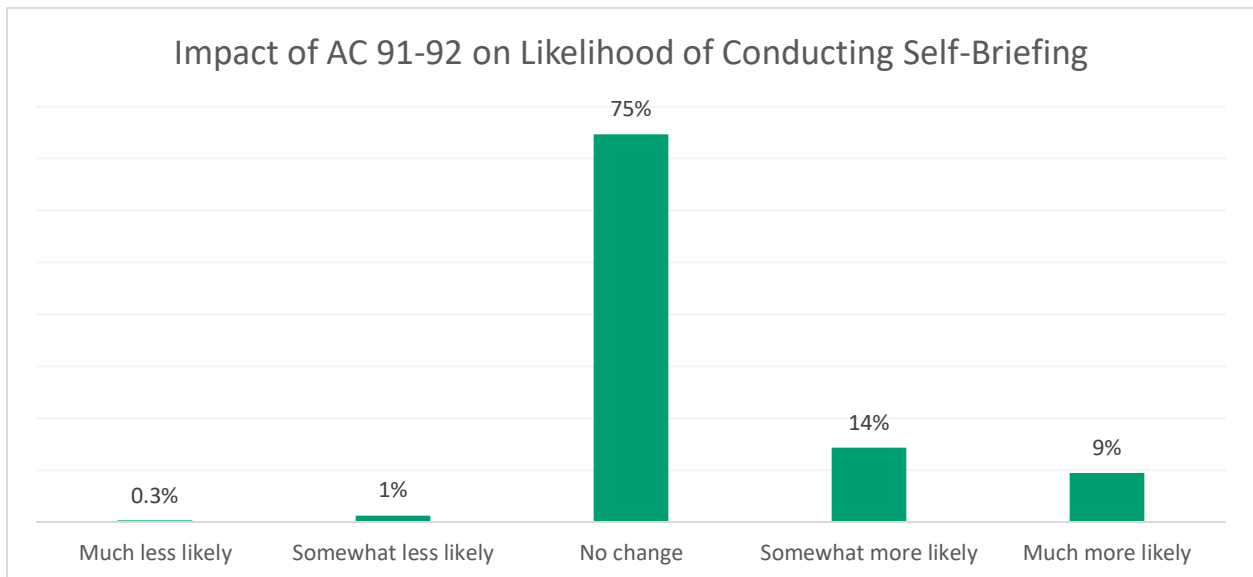


Figure 5. Responses to “How has reading the FAA's guidance on pilot self-briefings available in AC 91-92 impacted your likelihood of conducting a self-briefing now?” (n = 783). Follow-up question posed to respondents who were moderately, very, or extremely familiar with AC 91-92. 2021 data only.

Preflight Weather Resources

AOPA asked pilots for more information on the sources they use to check the weather during initial weather briefings and immediately prior to flight under challenging conditions.

Responses from pilots in Alaska and the CONUS were summarized separately, since different sources are available in those regions.

Initial source used. Since 2017, FAA weather cameras² and the Alaska Aviation Weather Unit (AAWU)³ website have remained the most popular sources for initial weather briefings among Alaskan pilots, neither growing nor losing ground to other sources (Figure 6). Aviation applications and the Aviation Weather Center's (AWC) website remained the most popular sources for pilots from the CONUS (Figure 7). Aviation applications continue to grow in popularity for CONUS pilots, while the AWC website's popularity has not changed over time.

AOPA noted the growing popularity of Windy.com as a write-in response for pilots from all regions in previous years, and so added Windy as a fixed response choice in the present study. In 2021, we found Windy to be the fourth most popular source for Alaskan pilots, with aviation applications coming in third. Windy was the fifth most popular source for CONUS pilots, with Flight Service specialists and the Weather Channel in third and fourth, respectively.

While aviation applications and Windy have grown in popularity over time, there has been a corresponding decrease in the use of Flight Service specialists to provide this information. In 2021, Flight Service specialists were the third most popular source for initial weather briefings for CONUS pilots and the fifth most popular for Alaskan pilots. In each region, the percentage of pilots who consult a Flight Service specialist for initial weather briefings has steadily declined over the past five years. In 2021, just 41% of Alaskan pilots reported consulting a Flight Service specialist for initial weather briefings, a decrease of 23 percentage points since 2017. Similarly, 27% of CONUS pilots consulted a Flight Service specialist for initial weather briefings in 2021, a decrease of 27 percentage points since 2017.

Common write-in responses for "other" sources included a wide range of flight apps and web sources, available for free or on a subscription basis.

² The FAA Weather Camera Program is an activity in Alaska that provides web camera views updated every 10 minutes to improve situational awareness regarding weather conditions for aviation use. Views are available at 235 locations across the state. For more information, visit <https://weathercams.faa.gov/>.

³ The Alaska Aviation Weather Unit is the counterpart of the Aviation Weather Center serving Alaska, also operated by the National Weather Service.

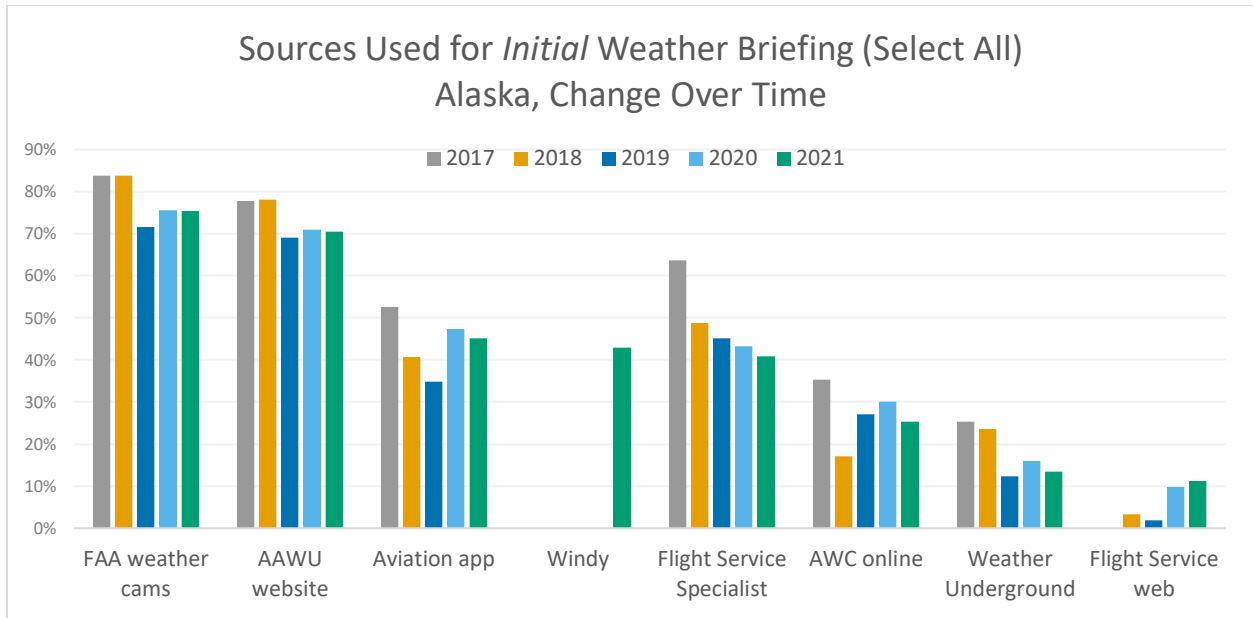


Figure 6. “What weather source(s) do you use for your initial weather briefing during preflight planning? (Select all that apply).” Percentages reflect the number of people who selected that response, out of the total number of people who answered the question, for Alaskan respondents. Sample sizes were: $n_{17} = 99$; $n_{18} = 123$; $n_{19} = 155$; $n_{20} = 213$, $n_{21} = 142$. Windy was added as a response option in 2021. Less than 10% of respondents selected the Weather Channel (7%), AOPA Flight Planner (2%), or other individual sources in 2021.

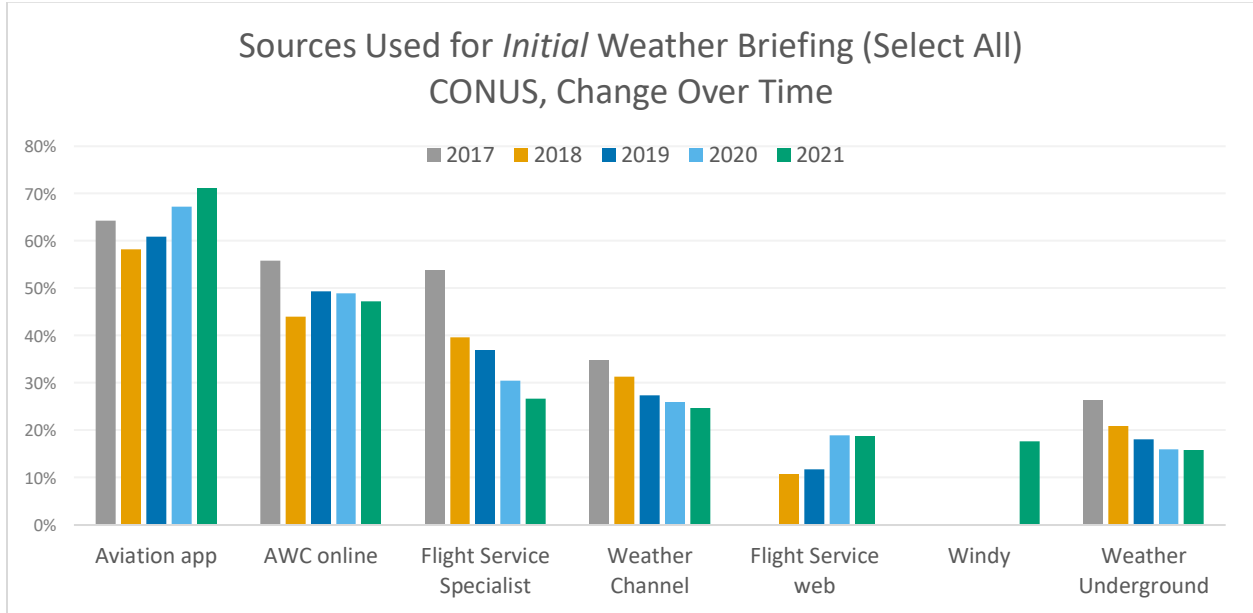


Figure 7. “What weather source(s) do you use for your initial weather briefing during preflight planning? (Select all that apply).” Percentages reflect the number of people who selected that response, out of the total number of people who answered the question, for respondents from the CONUS. Sample sizes were: $n_{17} = 258$; $n_{18} = 2650$; $n_{19} = 2003$; $n_{20} = 2698$, $n_{21} = 2339$. Windy was added as a response option in 2021. Less than 10% of respondents selected AOPA Flight Planner (9%), FAA Weather Cameras (4%), the AAWU website (0.3%), or other individual sources in 2021.

Sources used immediately prior to flight. For several years, AOPA has noted a few trends in the weather sources pilots use immediately prior to flight under challenging conditions. Those trends continued through the COVID-19 pandemic and into the current year. For example, Alaskan pilots most often used FAA weather cameras to check the weather immediately prior to flight (Figure 8). Many Alaskan pilots also referenced the AAWU website immediately prior to flight, but most did not rely on it as their primary source of information. The percentage of Alaskan pilots who listed AAWU as their primary source of information immediately prior to flight has continued to decline over time, from a high of 20% in 2017 to a low of 9% this year (Figure 9).

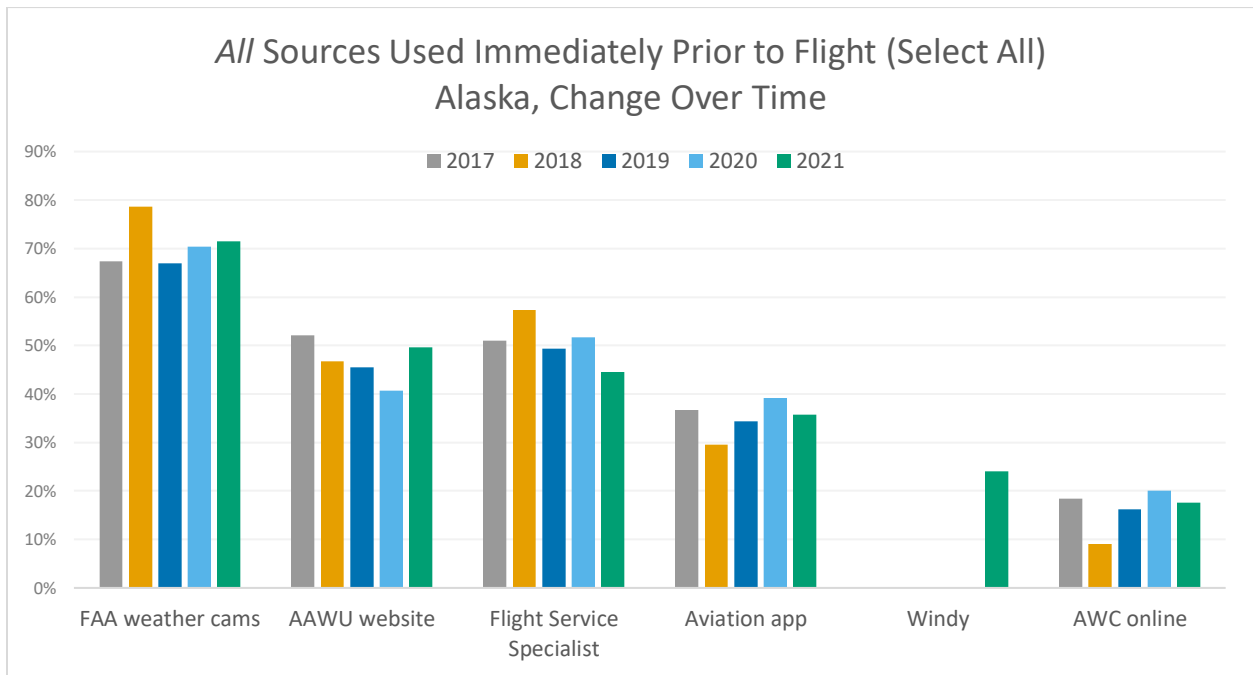


Figure 8. “What weather source(s) do you use immediately prior to flight under challenging conditions? (Select all that apply).” Percentages reflect the number of people who selected each option, out of the total number of subjects in Alaska. Sample sizes were as follows: $n_{17} = 98$; $n_{18} = 122$; $n_{19} = 154$; $n_{20} = 209$; $n_{21} = 137$. In 2021, less than 10% of respondents selected Weather Underground (5%), Flight Service web (4%), FIS-B weather (3%), Weather Channel (2%), SiriusXM weather (1%), or other individual sources.

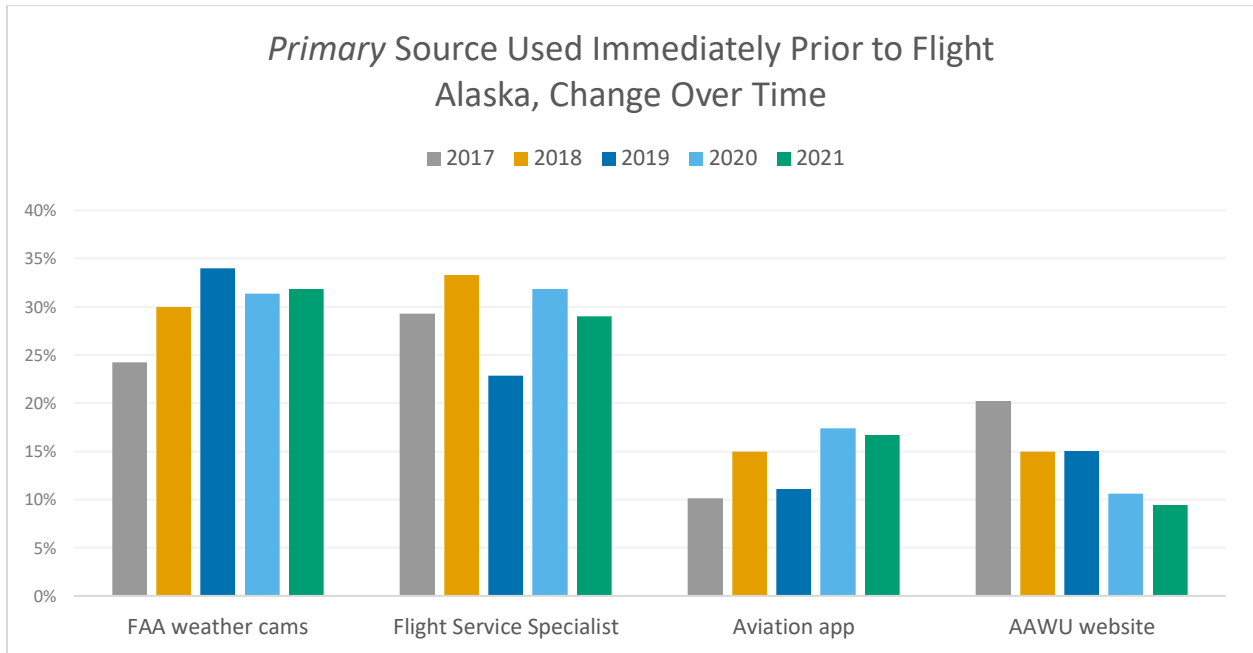


Figure 9. “What is the **primary** source you use to check the weather immediately prior to flight under challenging conditions? (Select one).” Results for the top 5 most frequently selected sources used by Alaskan pilots. Sample sizes were as follows: $n_{17} = 99$; $n_{18} = 119$; $n_{19} = 153$; $n_{20} = 207$; $n_{21} = 138$. Less than 5% of respondents in 2021 selected Aviation Weather Center online (1%), Windy (1%), or other individual sources.

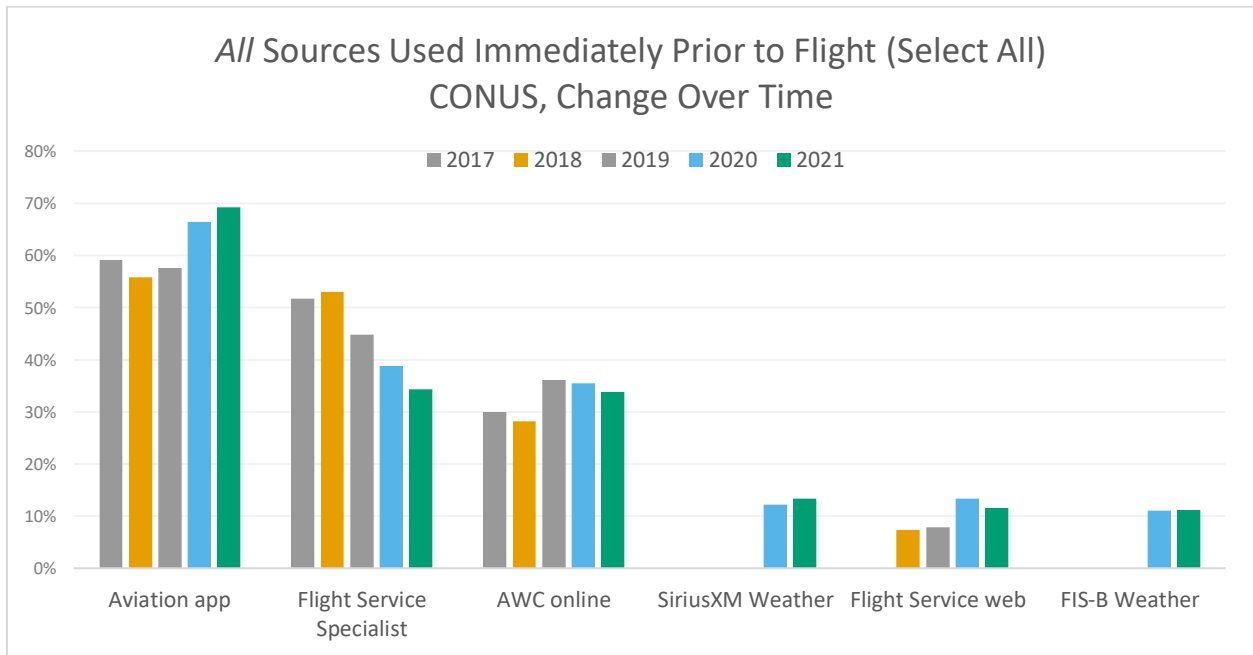


Figure 10. “What weather source(s) do you use immediately prior to flight under challenging conditions? (Select all that apply).” Percentages reflect the number of people who selected each option, out of the total number of subjects from the CONUS. Sample sizes were as follows: $n_{17} = 257$; $n_{18} = 2638$; $n_{19} = 1991$; $n_{20} = 2687$; $n_{21} = 2332$. In 2021, less than 10% of respondents selected Windy (8%), Weather Channel (8%), Weather Underground (5%), AOPA Flight Planner (4%), FAA Weather Cameras (2%), the AAWU website (0.2%), or other individual sources.

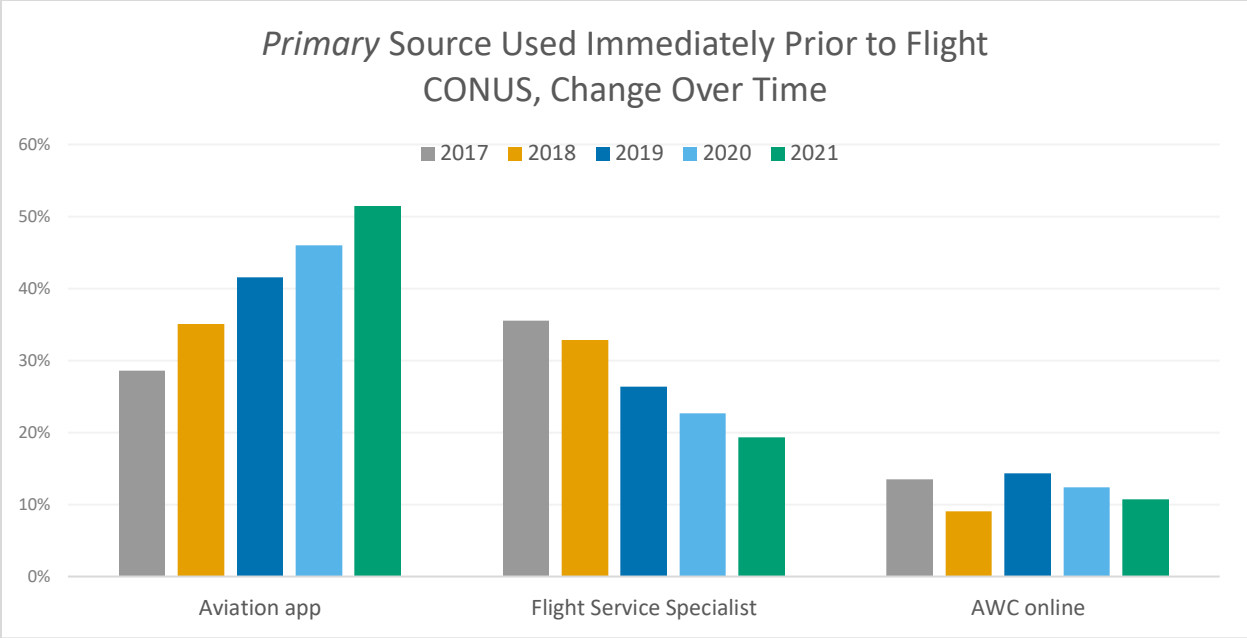


Figure 11. “What is the **primary** source you use to check the weather immediately prior to flight under challenging conditions? (Select one).” Results for top 5 most frequently selected sources used by CONUS pilots only. Sample sizes were as follows: $n_{17} = 259$; $n_{18} = 2512$; $n_{19} = 1956$; $n_{20} = 2652$ $n_{21} = 2271$. Less than 5% of respondents in 2021 selected SiriusXM weather (4%), Flight Service Web portal (3%), FIS-B weather (1%), AOPA Flight Planner (1%), Weather Channel (1%), Windy (1%), Weather Underground (1%), or other individual sources.

Aviation applications and Flight Service. Each year, AOPA finds aviation applications and Flight Service specialists to be among the most popular weather resources. Of all aviation weather sources, aviation applications (such as ForeFlight and Garmin Pilot) have enjoyed some of the most consistent adoption and growth over time, particularly in the CONUS. In 2021, about 69% of CONUS pilots consulted aviation applications immediately prior to flight (Figure 10), and 51% relied on those applications as their primary source of weather information (Figure 11). About 36% of Alaskan pilots used aviation applications immediately prior to flight in 2021, and just 17% relied on those applications as their primary source of information.

The story regarding Flight Service specialists is more complicated. In 2017, Flight Service specialists were the top primary source of weather information for pilots in both the CONUS and Alaska. About 36% of CONUS pilots and 29% of Alaskan pilots cited Flight Service specialists as their primary source of weather information. In 2021, Flight Service specialists were the second most popular primary source in each location, just one spot down on an ordered list of popular sources. The overall percentage of pilots that relied on these specialists has consistently decreased over time for the CONUS, but not Alaska. In 2021, 19% of CONUS pilots and 29% of Alaskan pilots listed Flight Service specialists as their primary source of weather information, representing a decrease of 17 percentage points for CONUS pilots and no change for Alaskan pilots.

About 19% of all respondents (including 10% of Alaskan pilots and 19% of CONUS pilots) reported *not* contacting Flight Service at all in 2021, an increase of 4 percentage points from 2020. Almost two-thirds of those who did contact Flight Service *always* conducted self-service planning opportunities beforehand (62% of all respondents in 2021, including 63% of CONUS pilots and 58% of Alaskan pilots; Figure 12). Those who are instrument current were less likely to contact Flight Service; 23% of instrument current pilots said they never called Flight Service, compared to 16% of those without an instrument rating.

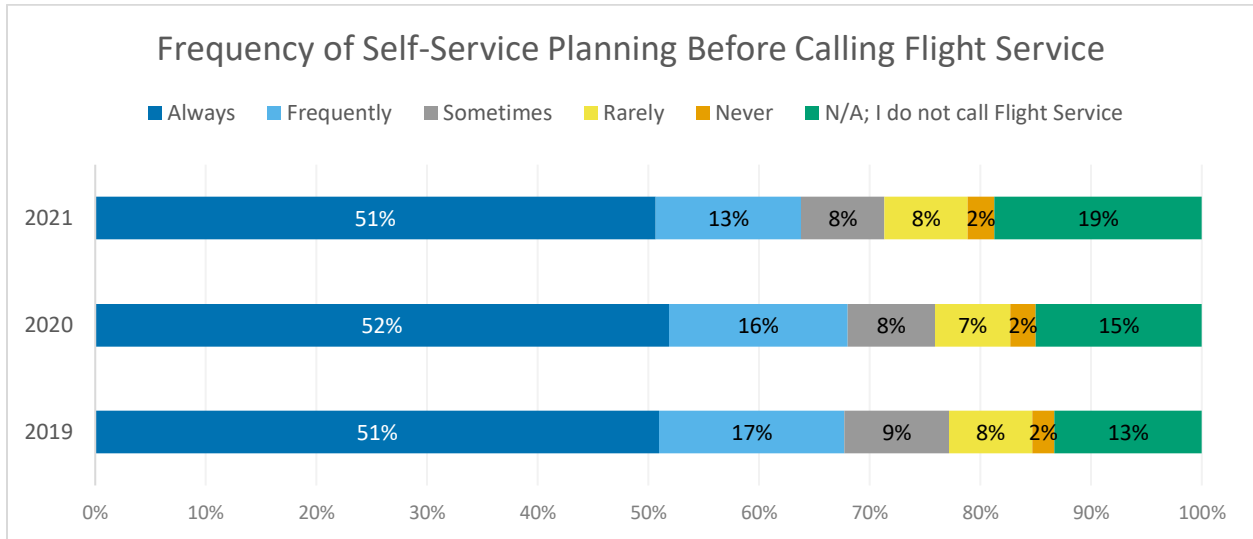


Figure 12. “How frequently do you conduct self-service planning activities prior to contacting Flight Service?” Including those who selected “N/A”, $n_{19} = 2105$, $n_{20} = 2792$, $n_{21} = 2367$. Excluding those who never contact Flight Service, $n_{19} = 1824$, $n_{20} = 2372$, $n_{21} = 1923$. Percentages shown above include those who selected “N/A” option.

Differences by age and instrument rating/currency still existed in 2021, and followed the same patterns as noted in previous years. Younger pilots and current, instrument-rated pilots used aviation applications more often than their counterparts (Figures 13 – 14). Older pilots and VFR pilots used Flight Service specialists more often. In all groups, aviation applications became more popular over time, while Flight Service specialists were used less often.

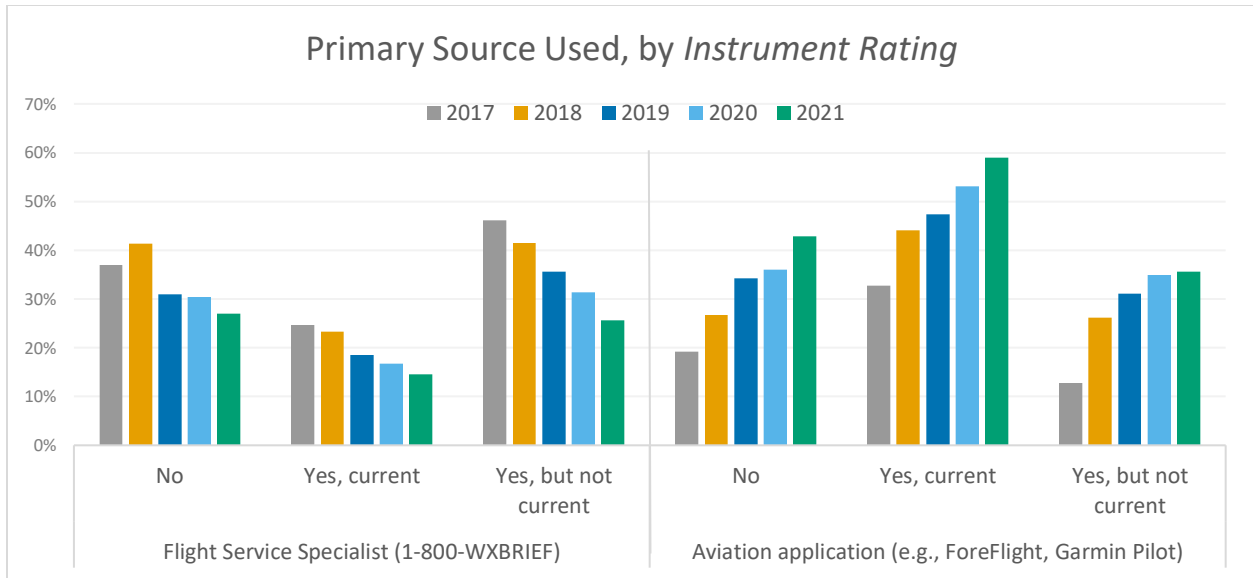


Figure 13. Top 2 most commonly selected primary sources used to check weather information immediately prior to flight, by instrument rating/currency, over time.

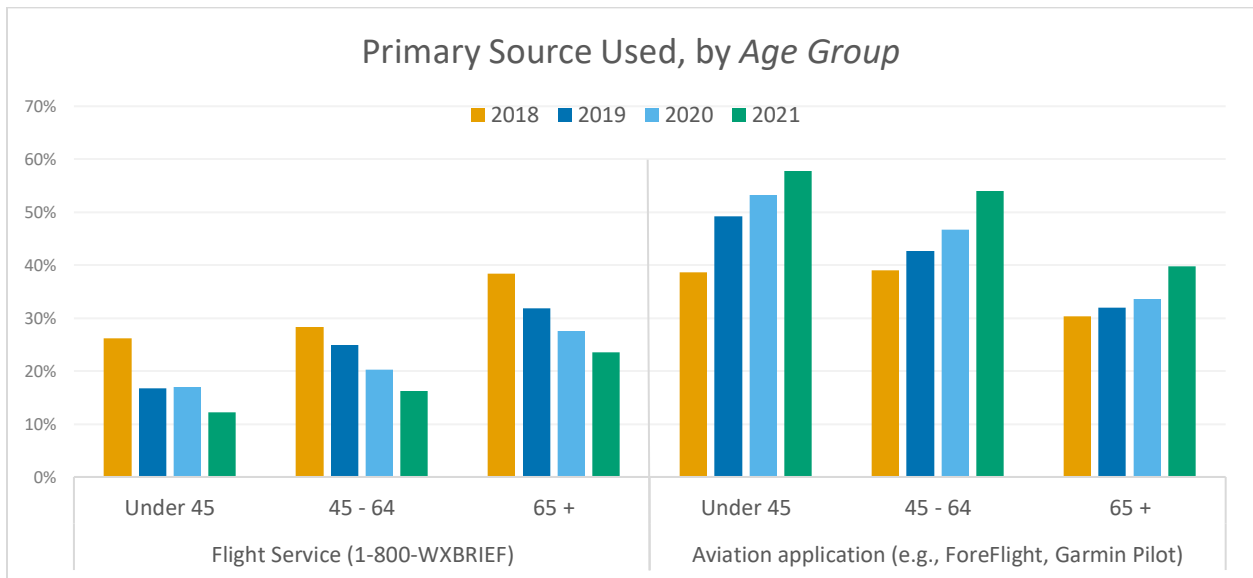


Figure 14. Top 2 most commonly selected primary sources used to check weather information immediately prior to flight, by age group, over time. Percentages reflect the number of people from each age group who selected each source, out of the total number of people in that age group.

Pilots primarily called Flight Service specialists to ask questions and receive a professional opinion (Figures 15, 17 - 18). The ability to ask questions and receive professional opinions was the least popular reason for consulting an aviation application (Figures 16 - 18). Instead, pilots who used aviation applications cared about the graphics, comprehensive features, and portability.

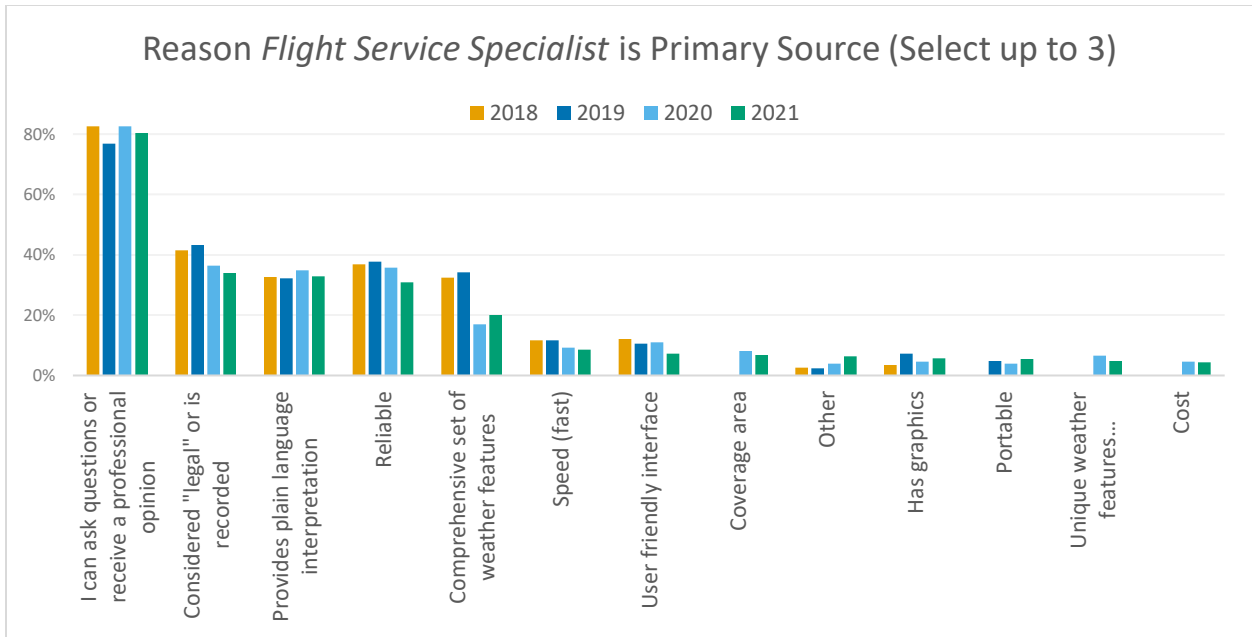


Figure 15. Close-up look at subjects’ reasons for selecting Flight Service ($n_{18} = 896$; $n_{19} = 559$; $n_{20} = 670$; $n_{21} = 480$) as their primary source, over time. The response choice “portable” was added to the survey in 2018, while choices “coverage area,” “unique weather features not available with other services,” and “cost” were added in 2020.

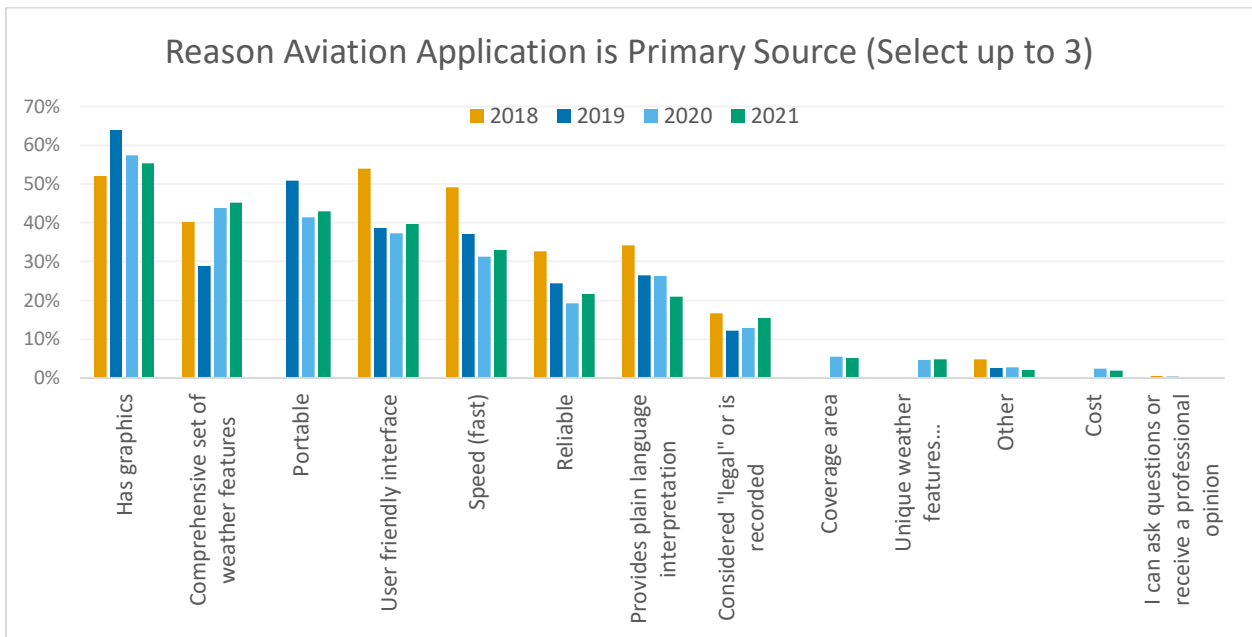


Figure 16. Close-up look at subjects’ reasons for selecting an aviation application ($n_{18} = 932$; $n_{19} = 839$; $n_{20} = 1260$; $n_{21} = 1195$) as their primary source, over time.

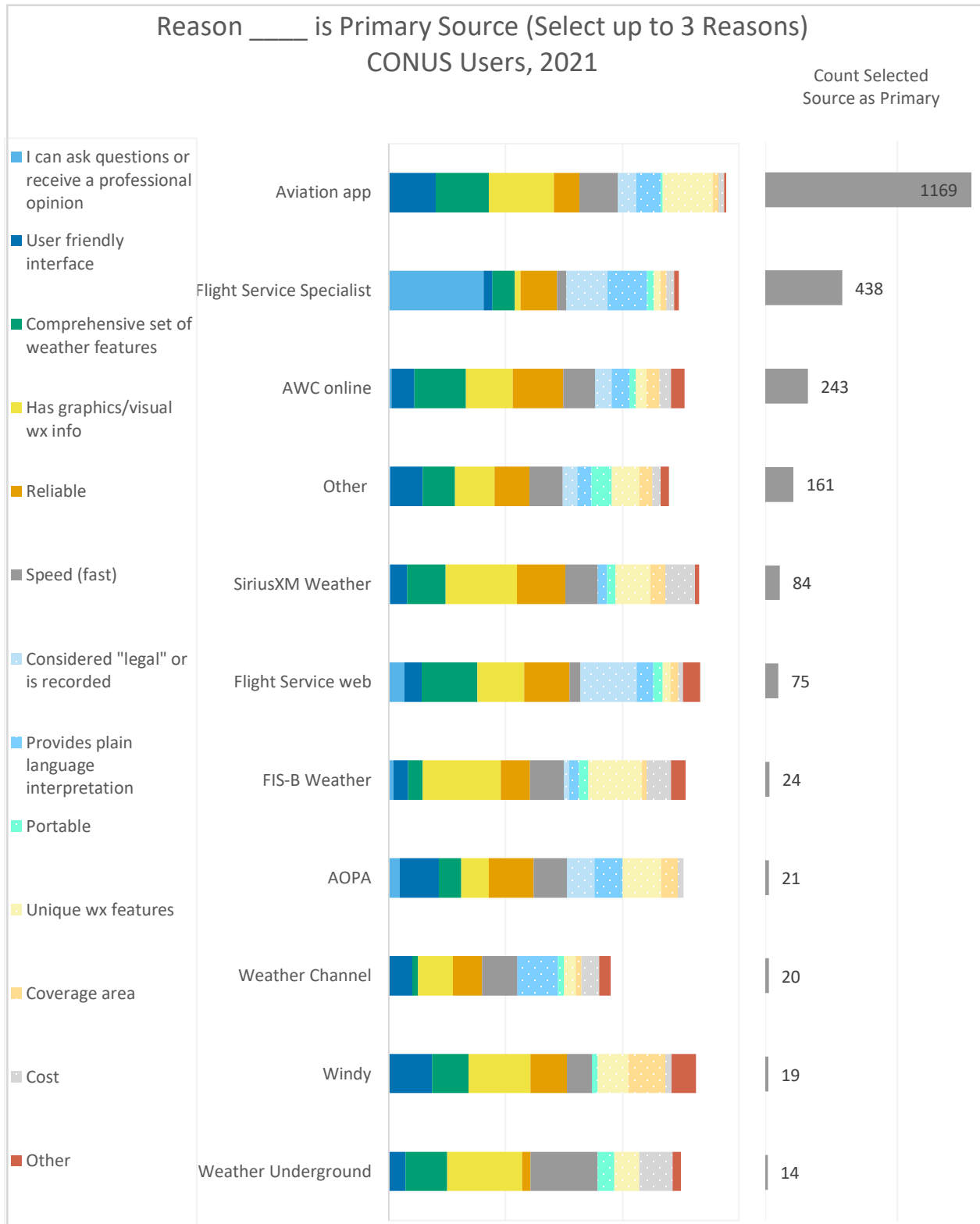


Figure 17. Reasons for choosing given preferred source, CONUS. Percentages reflect the number of people who chose each given reason, out of the total number of people who selected that source as their primary source. Subjects could select up to 3 reasons for their preference, so summed percentages may exceed 100 percent. 2021 data only.

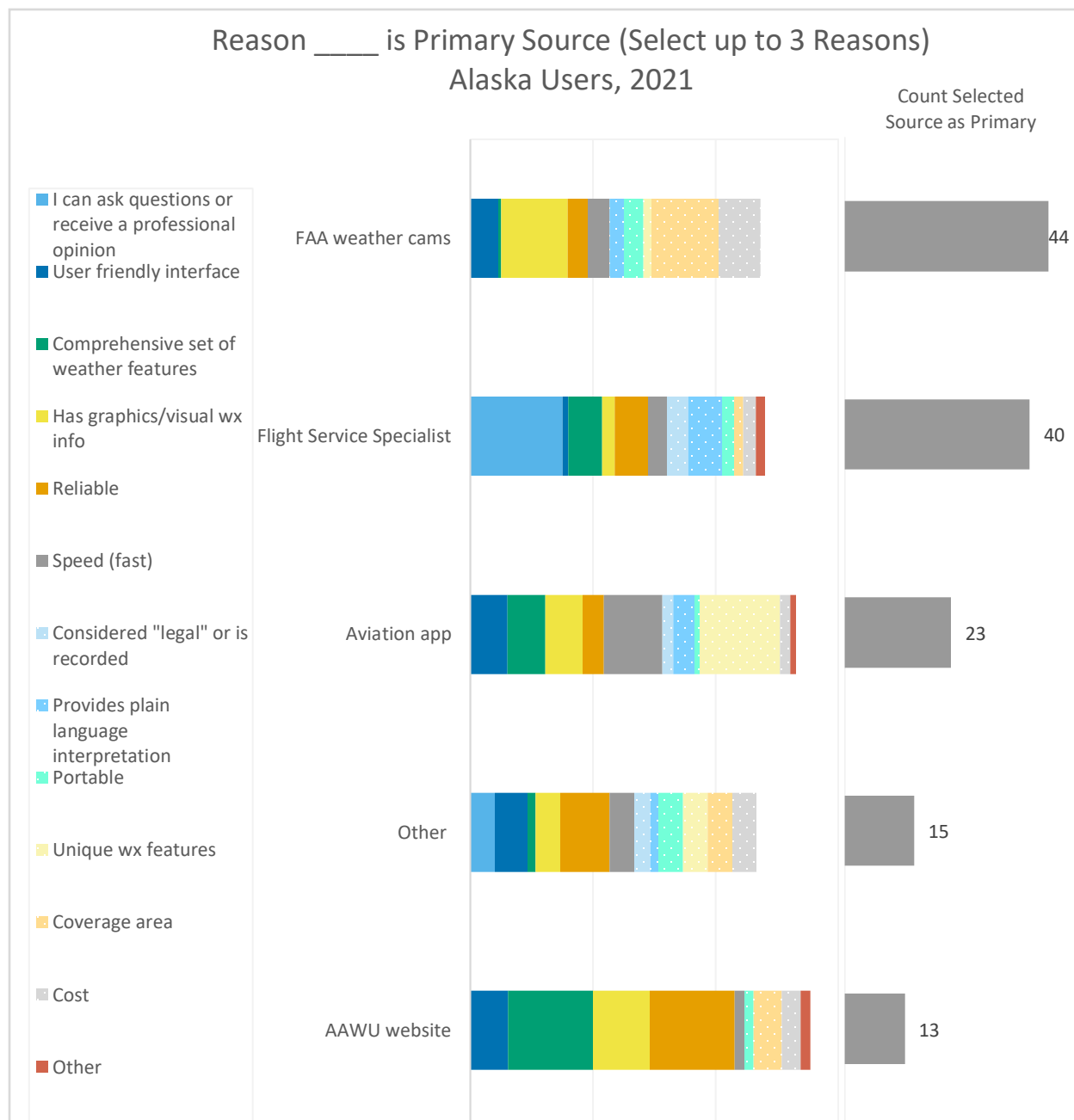


Figure 18. Reasons for choosing preferred source, Alaska. Subjects could select up to three reasons for their preference, so summed percentages may exceed 100 percent. 2021 data only.

FAA weather cameras. The FAA Weather Camera program⁴ provides supplementary information on weather conditions to improve pilots’ situational awareness. During daylight hours, images acquired in multiple directions allow pilots to view weather within the previous 10 minutes, and loop back over the previous six hours. The program has camera constellations at 235 locations across Alaska, and recently expanded coverage into Colorado (23), Montana (1)

⁴ Learn more about the program at <https://weathercams.faa.gov/>

and Hawaii (1), with more cameras currently being deployed. The program also hosts data from 220 stations in Canada.

FAA weather cameras are consistently one of the most popular weather resources for Alaskan pilots. In 2021, most Alaskan respondents reported checking FAA weather cameras during initial preflight planning (75%), and immediately prior to flight (72%). About one-third (32%) of Alaskan pilots relied on weather cameras as their primary source of information immediately prior to flight. Within the past year this program has started to provide coverage in Western states and Hawaii, so it is not surprising that only two CONUS pilots (less than 1%) listed FAA weather cameras as their primary source of information this year. Most pilots who rely on FAA weather cameras did so because of the graphics (57%), unique weather features (52%), and coverage area (33%; Figure 19).

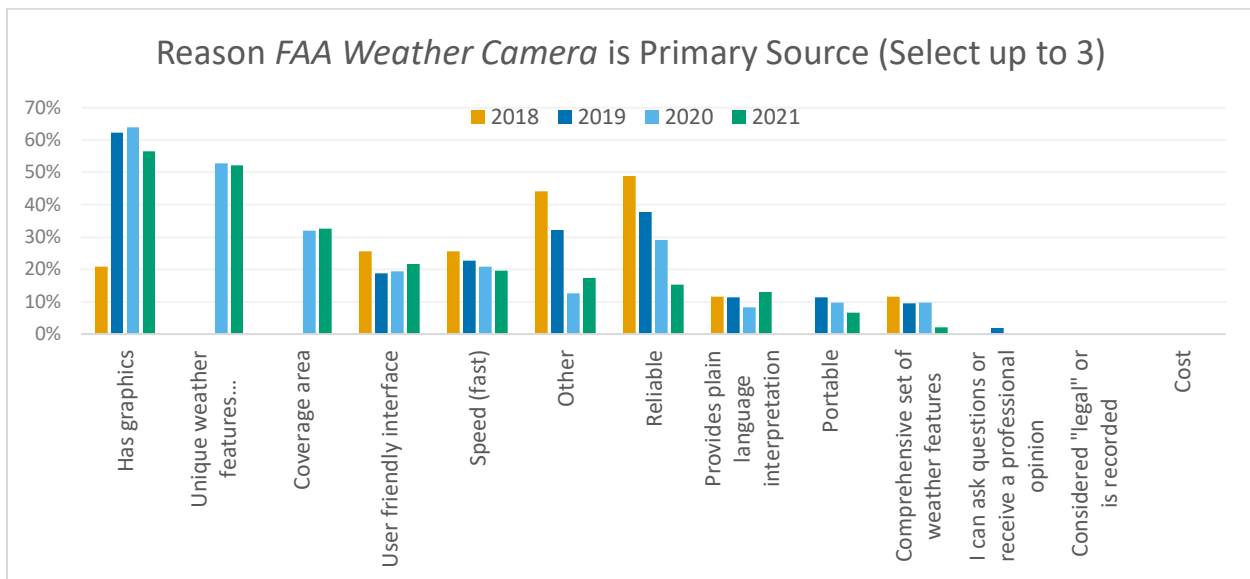


Figure 19. Reasons for choosing FAA weather cameras as preferred source (n₁₈ = 43; n₁₉ = 53; n₂₀ = 72; n₂₁ = 46).

Alaska Aviation Weather Unit (AAWU). The National Weather Service (NWS) operates the AAWU in Anchorage, Alaska, the official Meteorological Watch Office for Alaskan aviators. The AAWU website provides pilot reports, weather forecasts, and surface observations, along with weather radar and satellite imagery.

Last year, AOPA noted that the percentage of pilots who always or frequently consulted the AAWU website before a flight was declining over time, from 79% in 2018, to 75% in 2019, and 65% in 2020 (Figure 20). That trend did not continue in 2021, as 74% of Alaskan pilots reported always or frequently accessing AAWU before flights. About 70% of Alaskan pilots reported using AAWU during initial preflight planning in 2021, though only 50% used the website immediately prior to flight (Figures 6, 8). About 9% of Alaskan pilots selected AAWU as their primary

information source immediately prior to flight, a decrease of two percentage points from last year (Figure 9).

When accessing the AAWU website, pilots often used the graphic forecasts (flight categories; 44%), TAFs (43%), observations (METARs; 42%), and SigWX charts (40%; Figure 21). The most common feature pilots requested be added to the AAWU website in the future was more integration with FAA weather cameras.

Major website changes may have contributed to the drastic decrease in the percentage of pilots who believed the site had a user-friendly interface from 2018 (peaking at 39%) to 2019 (a low of 17%). In 2021, about 29% of users indicated the site had a user-friendly interface, an improvement from previous years.

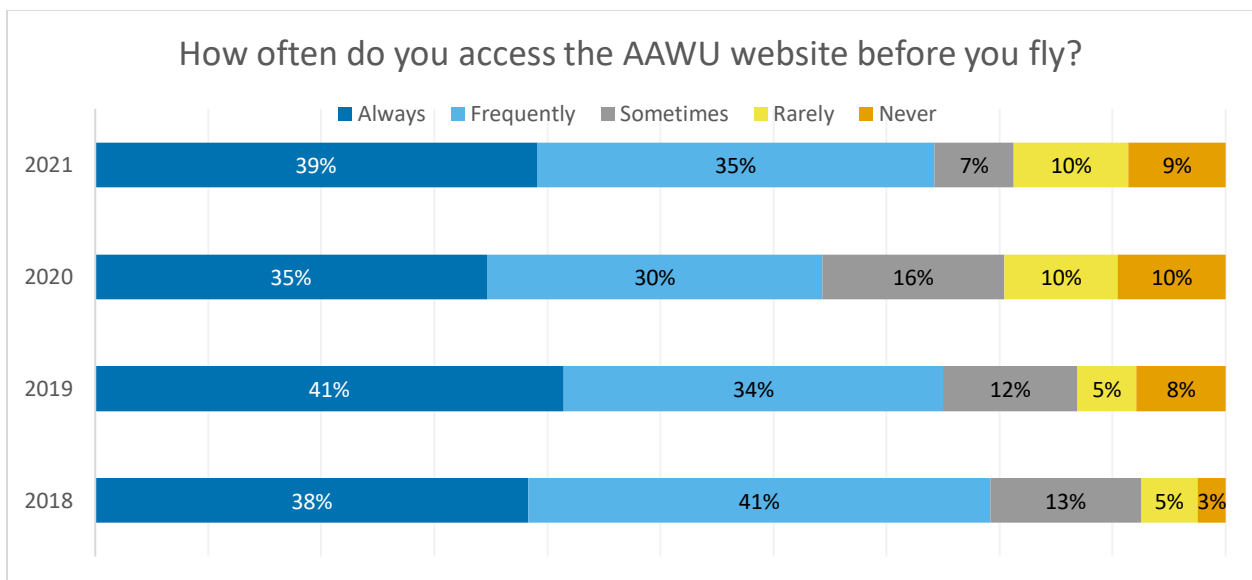


Figure 20. “How often do you access the AAWU website before you fly?” over time. Question was directed only toward Alaskan subjects (n₁₈ = 120; n₁₉ = 152; n₂₀ = 199; n₂₁ = 128).

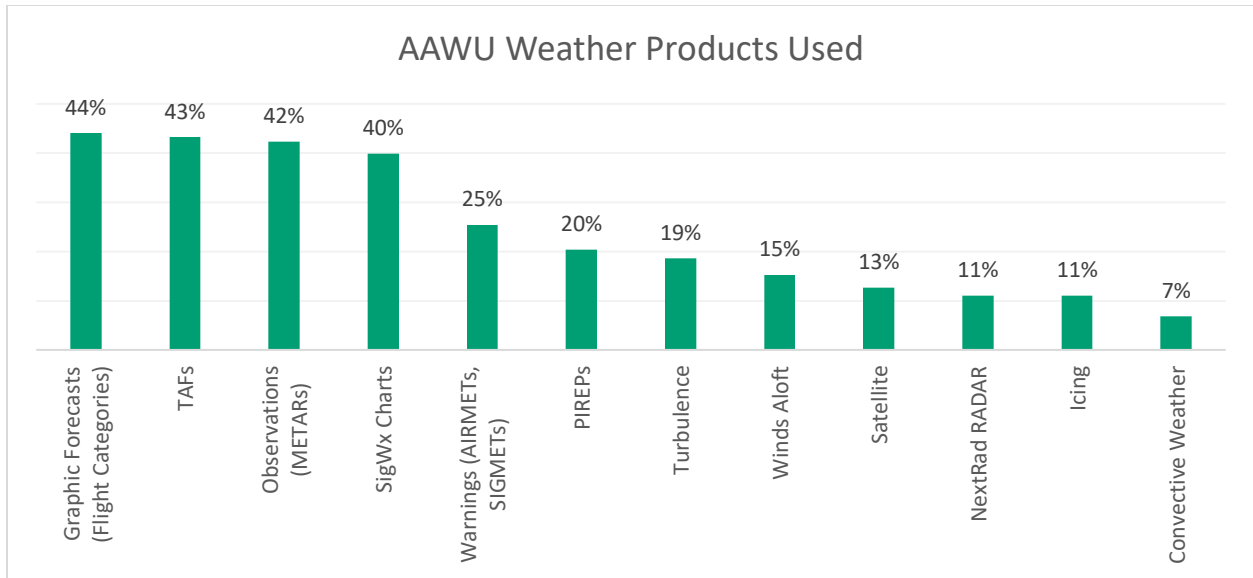


Figure 21. Responses to, “When you access the Alaska Aviation Weather Unit (AAWU) website, what weather products do you primarily use?” (n₂₁ = 118). Respondents could select up to 3 options. Percentages are out of the number of people who answered the question, and so can exceed 100% in total.

Cruise Weather Resources

Needs for weather information and communication channels change once pilots are airborne. To assess those needs, AOPA asked pilots how they accessed weather information during the cruise phase of a long cross-country flight. Listening to AWOS, ASOS, and ATIS on the radio remained the most common sources of weather information during this flight phase (Figure 22). FIS-B weather continued to grow in popularity, with half of all respondents (50%) using FIS-B in 2021, an increase of 10 percentage points from 2020 and an increase of 23 percentage points from 2019. As noted last year, current, instrument-rated pilots used FIS-B more often than VFR-only pilots, and used Flight Service, AWOS, ASOS, and ATIS less often.

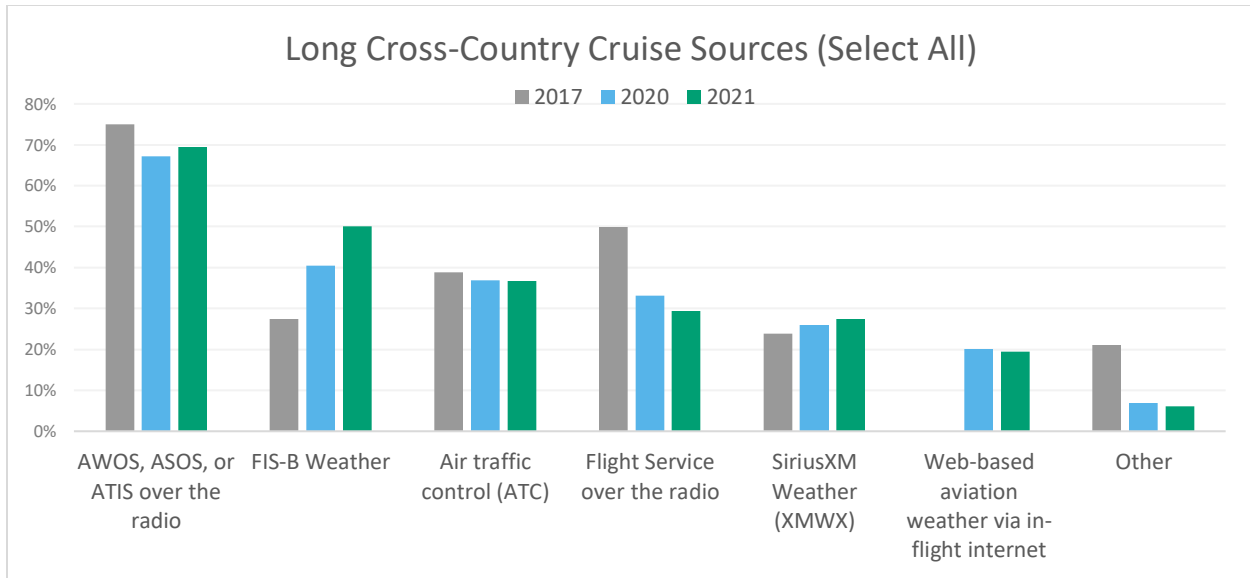


Figure 22. Responses to the question, “When on a long cross-country flight, how do you get in-flight weather information during the cruise phase?” Only asked in 2017 and 2020 (n₁₇ = 347; n₂₀ = 2807; n₂₁ = 2372). Percentages are out of the total number of respondents who answered the question. Since respondents could select more than one answer, the total percentage may exceed 100% each year.

EFB, FIS-B, and SiriusXM Weather

In general, pilots in all locations show increasing use of these new technologies (Figure 23). Pilots in the CONUS used each of these sources more often than pilots in Alaska. While EFBs are popular in both regions, the difference in FIS-B and SiriusXM weather usage, between the CONUS and Alaska, is probably due to service availability. ADS-B coverage in Alaska at typical general aviation aircraft altitudes leaves as much as 40% of the state without coverage. SiriusXM weather is only available for portions of southeast Alaska, leaving the bulk of the state without access to this data feed. The general lack of “rule airspace” in Alaska, which would tend to drive ADS-B equipage, is also a factor in the lower utilization of these services.

AOPA asked follow-up questions to those who reported using FIS-B before flights frequently or always. CONUS pilots tended to be more satisfied with FIS-B than Alaskan pilots (Figure 24). In 2021, that difference was particularly large, due to a sharp decrease in Alaskan pilots’ average satisfaction with the service. In 2021, 4% of Alaskan pilots said they were extremely satisfied with FIS-B, a decrease of 11 percentage points from 2020. The percentage of Alaskan pilots who were satisfied with FIS-B decreased by 5 points in the past year, while the percentage who were neither satisfied nor dissatisfied increased by 12 points during the same time. While this group was certainly less satisfied with FIS-B in 2021, they were not necessarily more dissatisfied; the percentage of Alaskan pilots who were dissatisfied with the service increased by just 4 points in the past year. No matter the region, dissatisfied pilots shared the same complaints. Those who were dissatisfied with FIS-B cited issues with a lack of coverage in their area and said the service could be slow and unreliable.

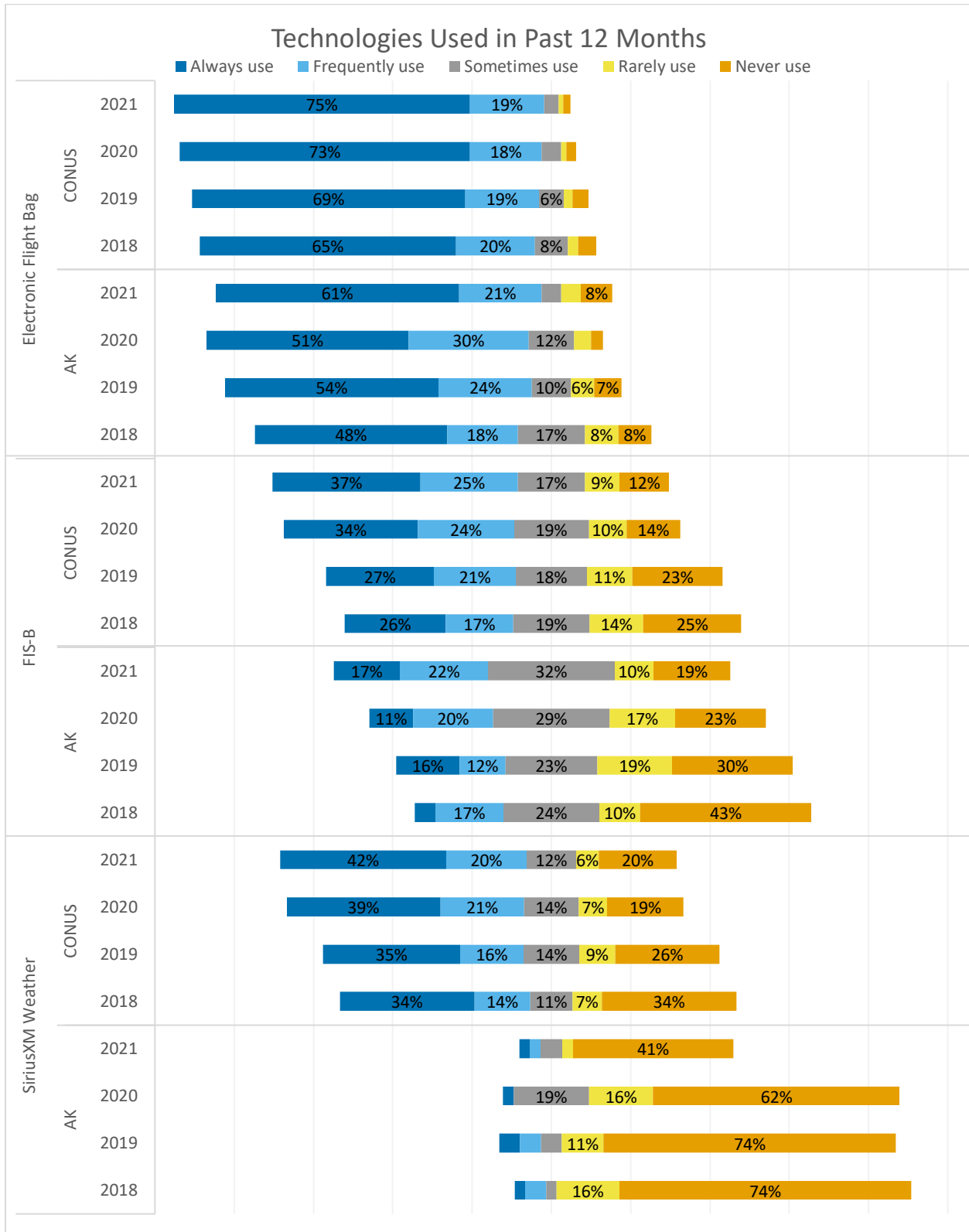


Figure 23. “Which of the following technologies have you used in the past 12 months?” by location and year. Note: SiriusXM weather is largely not available in Alaska.

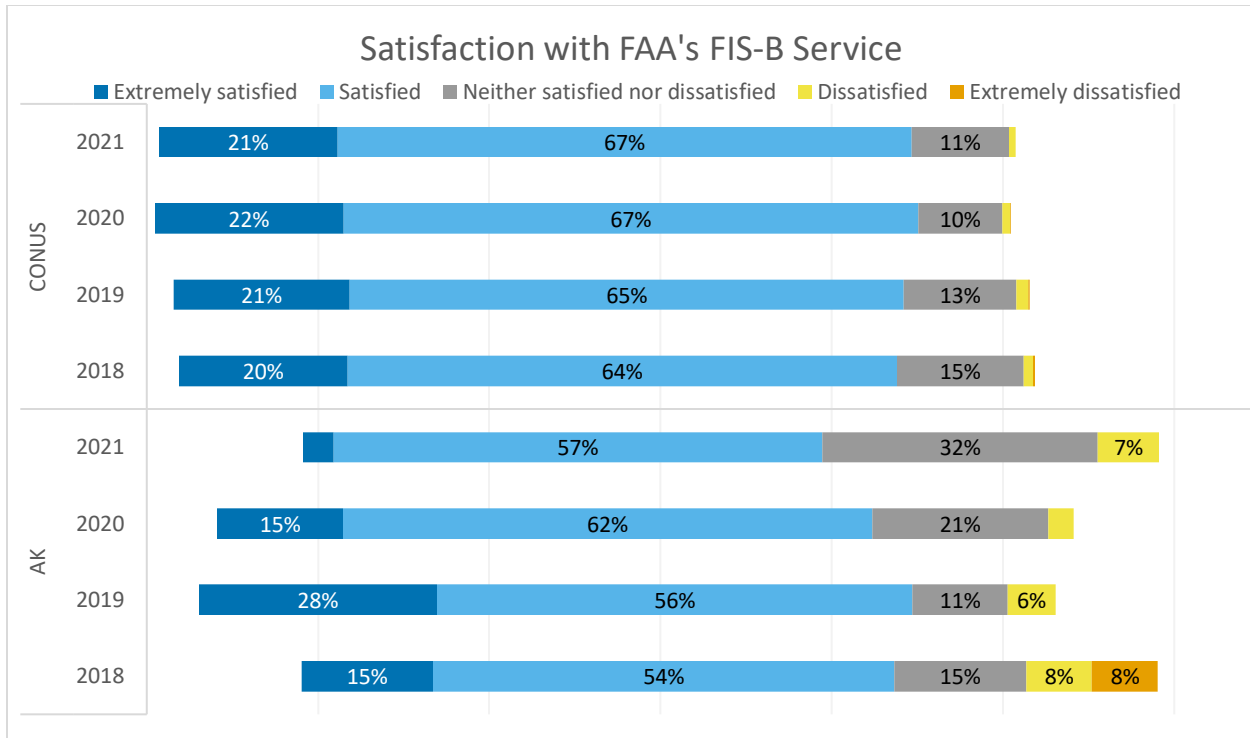


Figure 24. Responses to, “How satisfied are you with the FAA’s FIS-B service?”. Question only asked of those who used FIS-B at least “frequently.” For Alaska, $n_{18} = 13$; $n_{19} = 18$; $n_{20} = 34$; $n_{21} = 28$. For the CONUS, $n_{18} = 731$; $n_{19} = 524$; $n_{20} = 1067$; $n_{21} = 1047$.

Pilot Reports (PIREPS)

PIREPs continue to be a focus for FAA and industry groups. Questions in the survey this year probed at several elements of the PIREP system. Most pilots were unfamiliar with AWC’s web-based PIREP submission portal, similar to previous years. In 2021, 75% of pilots said they were *not at all* or only *slightly* familiar with the portal (Figure 25).

Less than half of all respondents (47%) said they provided unsolicited PIREPs at least sometimes, and the remainder (53%) rarely or never did so. The percentage of pilots providing unsolicited PIREPs has not increased significantly over time in either the CONUS or Alaska, though Alaskan pilots were consistently more likely to provide those reports.

ATPs, commercial, Alaskan, and current instrument-rated pilots were all more likely to provide unsolicited PIREPs than their counterparts (Figures 26 - 27). Those who did not file unsolicited PIREPs most often reasoned that they only fly in good weather (57%; Figure 28). About 32% didn’t know how to file PIREPs, and 13% said the process was too difficult. The comments provided were wide and varied.

Reasons given for not filing PIREPs often indicated a lack of time during the flight. Pilots reported being “busy on flight following and other comms,” and “focused on other aspects of the flight.” In many cases, pilots described a lack of confidence in filing PIREPs, saying they were

“not sure of giving correct information” or that the information “might not be accurate.” Some also believed that ATC is too busy to take their report or is not appreciative when they do file. One respondent commented, “Controllers seem impatient, irritated when I have tried in the past.” Another wrote, “Concerned with adding to ATC frequency congestion; not certain what’s considered helpful and what’s not.”

Numerous pilots reported that they either forget, or just don’t think to file PIREPs, saying they “don’t always remember to give them,” or “just forget to do it,” or “never occurs to me.” Some pilots are operating in the mode that they only report adverse or unforecast conditions and are not in the frame of mind to view PIREPs as filling holes in the observation network.

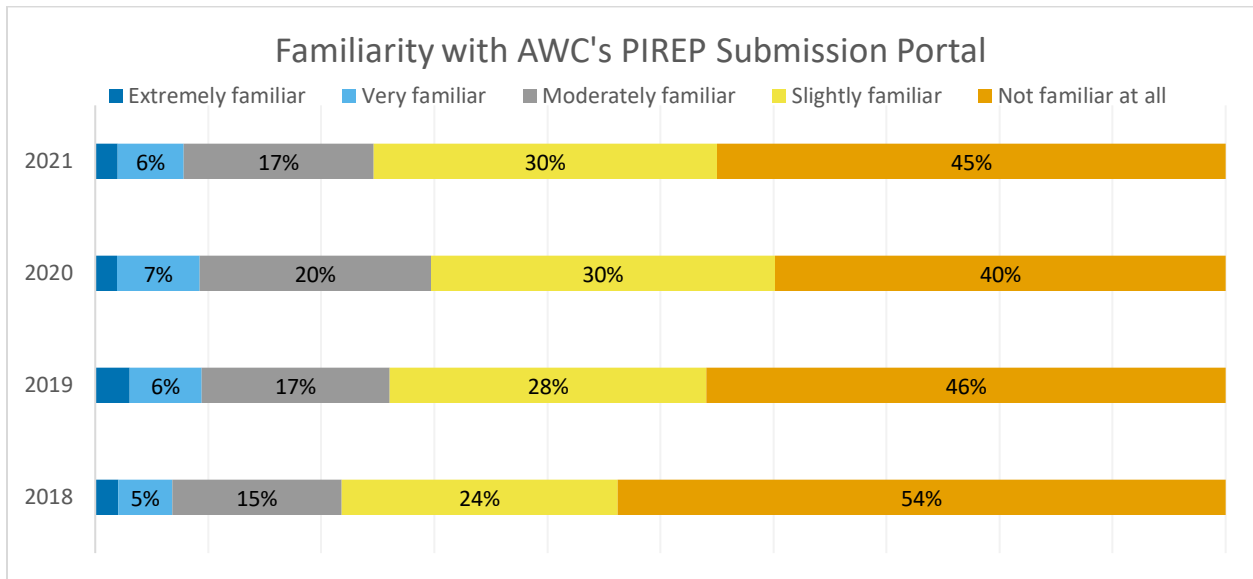


Figure 25. Responses to “How familiar are you with the Aviation Weather Center’s web-based PIREP submission portal for pilots?” (n₁₈ = 13; n₁₉ = 16; n₂₀ = 27; n₂₁ = 28).

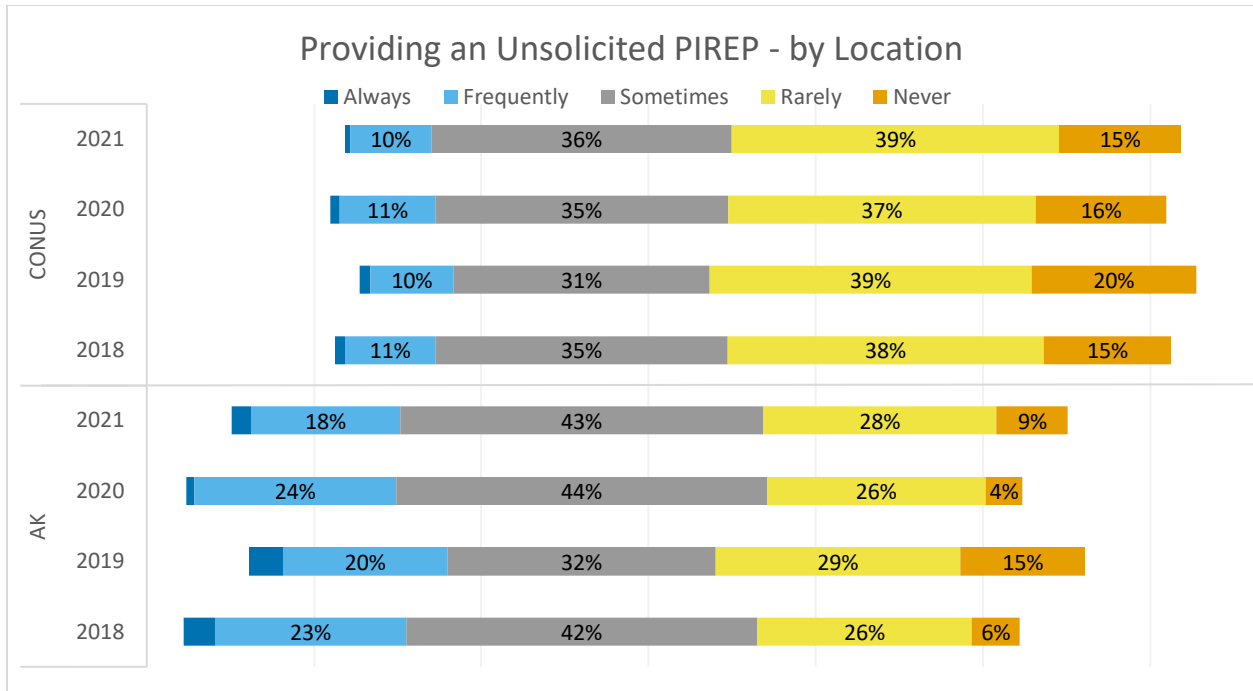


Figure 26. “How often do you usually provide an unsolicited PIREP?” broken down by location and year.

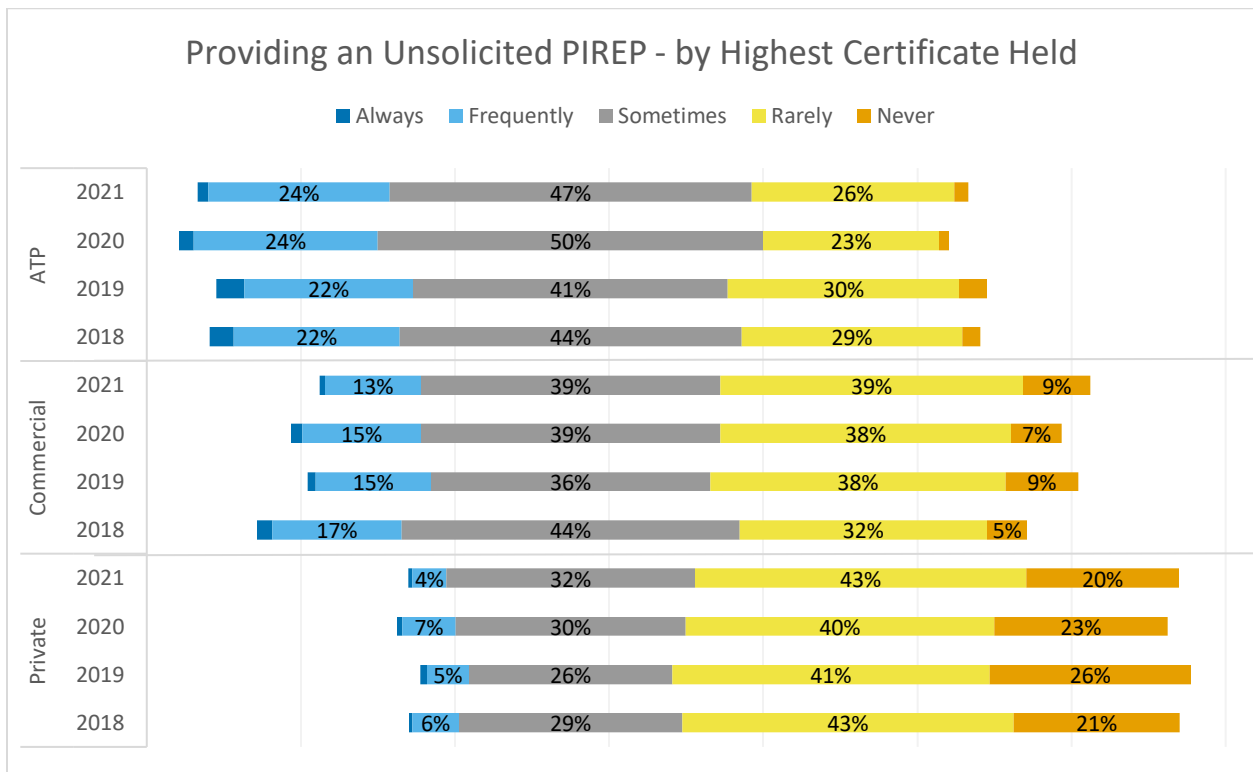


Figure 27. “How often do you usually provide an unsolicited PIREP?” broken down by highest certificate and year.

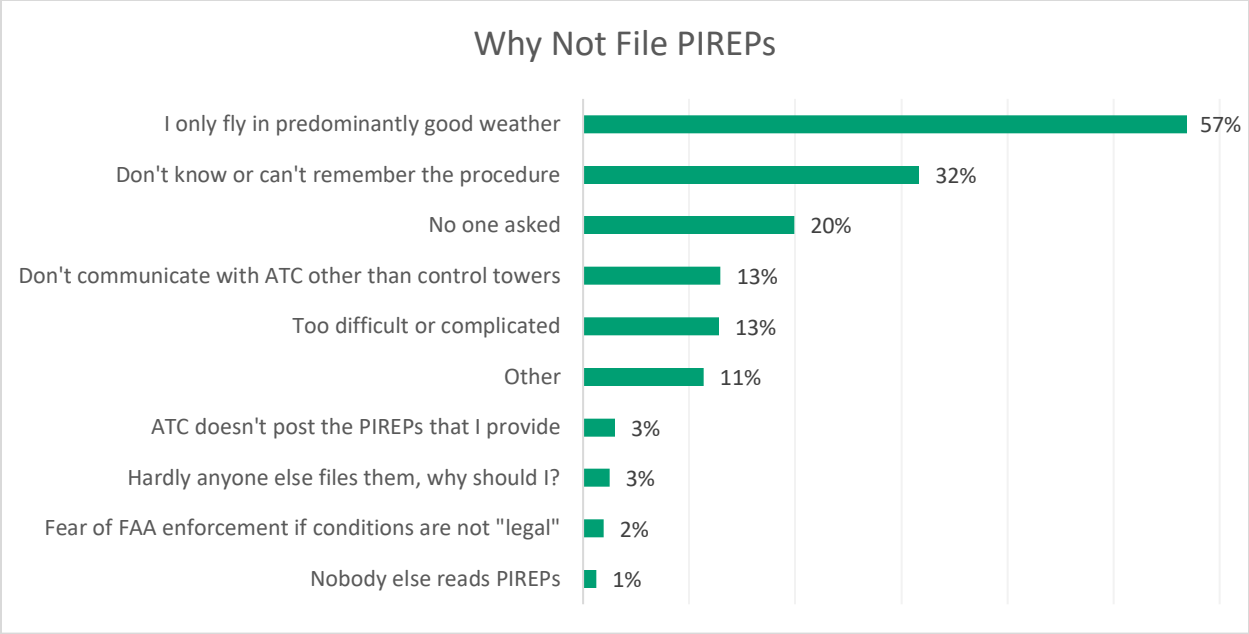


Figure 28. Responses to “Why might you not file PIREPs? (Check all that apply)”, a follow-up question asked of those who never or rarely file PIREPs in 2021 (n = 1197). Percentages are out of the total number of respondents.

Emerging Weather Resources

Alaska Aviation Guidance (AAG). The National Weather Service produces the experimental Alaska Aviation Guidance (AAG) product⁵, an automated, TAF-like forecast. Produced at over 60 sites across Alaska, it generates a forecast for VFR flight planning, covering expected conditions over the next six hours. Awareness of this product grew over the past year. In 2021, about 27% of pilots were familiar with the AAG (Figure 29). Of those who were familiar, almost half (47%) frequently or always used the product before flying (Figure 30). While 59% of respondents were satisfied with the product, no one was *extremely* satisfied or dissatisfied with it (Figure 31). There were no significant differences in how pilots of different ratings or certificate levels used the AAG product.

⁵ Learn more about the AAG by visiting <https://www.weather.gov/arh/aag>

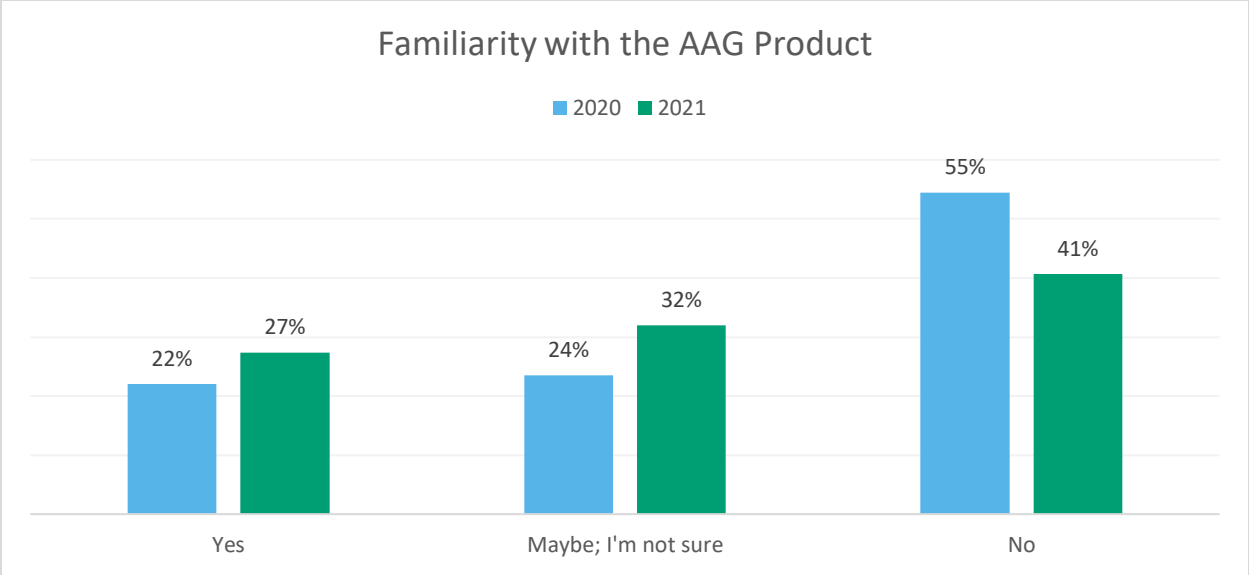


Figure 29. Responses to “Are you familiar with the Alaska Aviation Guidance (AAG) product?” (n₂₀ = 200; n₂₁ = 128). Only shown in 2020-21 to Alaskan respondents.

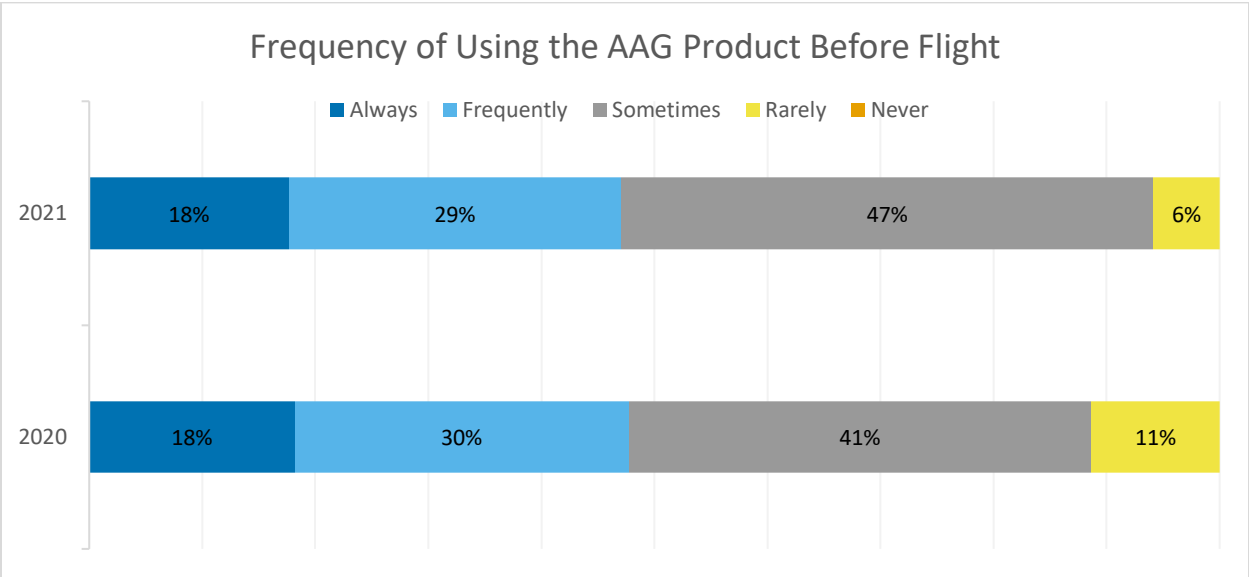


Figure 30. Responses to “How often do you use the Alaska Aviation Guidance (AAG) product before you fly?” (n₂₀ = 44; n₂₁ = 34). Only shown in 2020-21 to Alaskan respondents who were familiar with the AAG product.

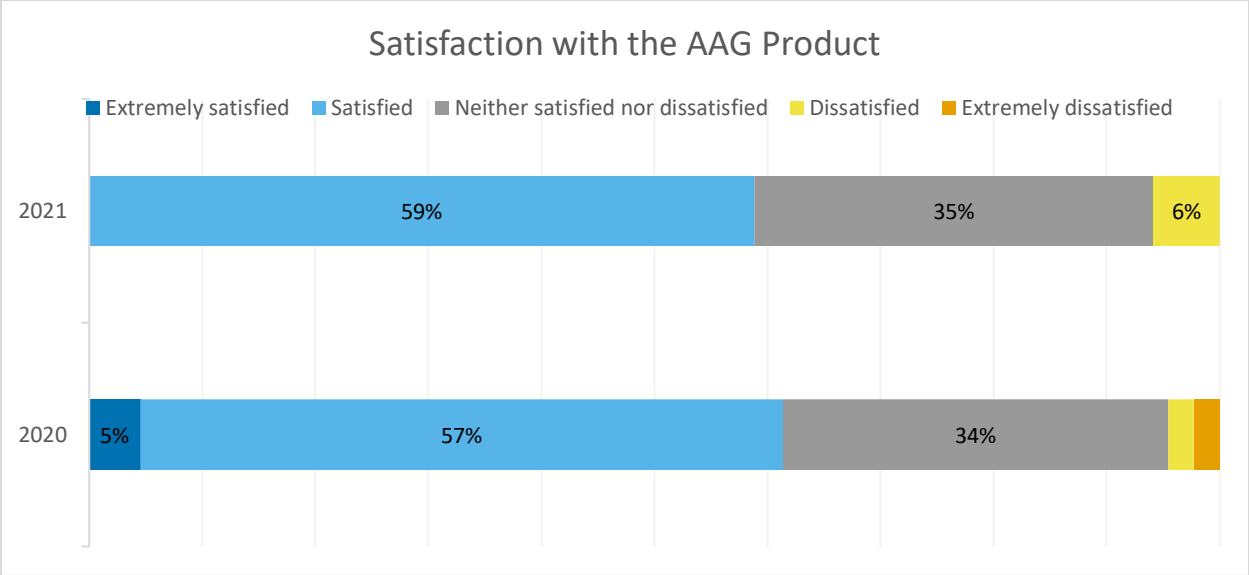


Figure 31. Responses to “How satisfied are you with the Alaska Aviation Guidance (AAG) product?” (n₂₀ = 44; n₂₁ = 34). Only shown in 2020-21 to Alaskan respondents who were familiar with AAG and used it before flying at least “rarely.”

Graphical Forecasts for Aviation (GFA). In 2021, we asked respondents from the CONUS and Alaska about the GFA product⁶. This product is produced by the Aviation Weather Center and has been available in the CONUS since 2017 but was only populated with Alaska data on an experimental basis starting in December 2020. About 34% of all respondents in 2021 were very or extremely familiar with the GFA product, including about 35% of CONUS pilots and 19% of Alaskan pilots (Figure 32). About 65% of CONUS pilots and 43% of Alaskan pilots used the tool before a flight at least sometimes (Figure 33). As familiarity increased, so did use. CONUS pilots, current instrument-rated pilots, and commercial pilots were more familiar with and more often users of the GFA product. While younger pilots tended to be more familiar with the product than their older counterparts, usage among both age groups was similar.

⁶ Learn more about the GFA product by visiting <https://www.aviationweather.gov/gfa>

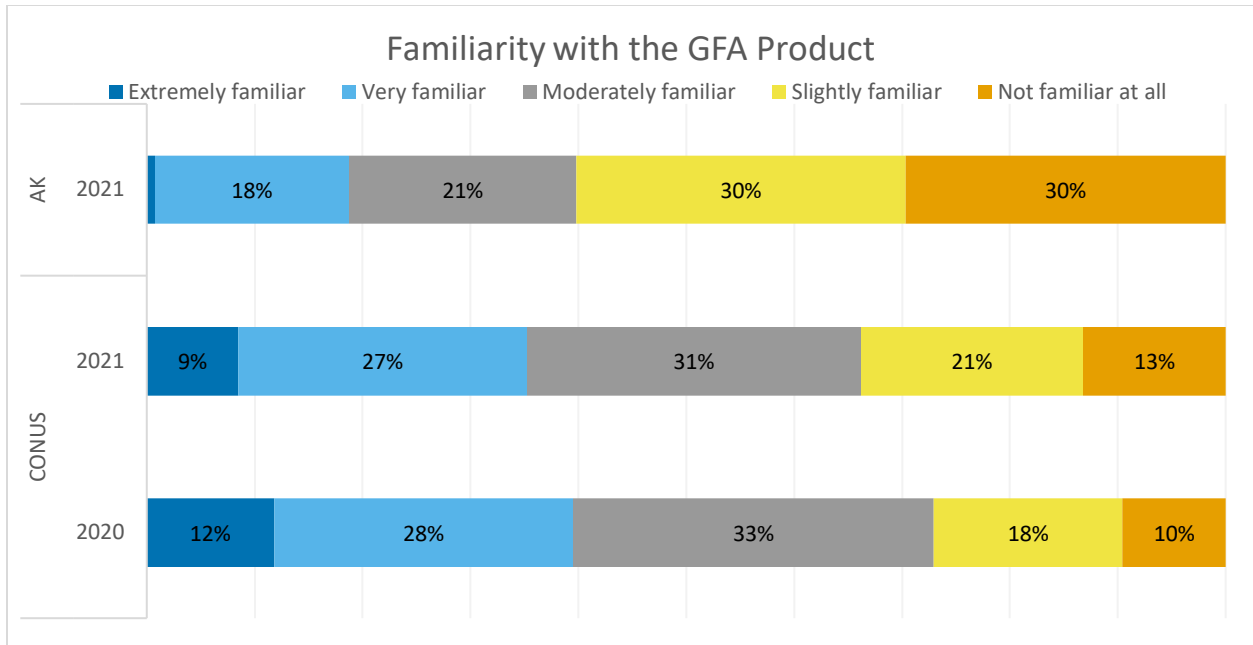


Figure 32. Responses to “How familiar are you with the Aviation Weather Center's Graphical Forecasts for Aviation (GFA) Product?” (n₂₀ = 2479; n₂₁ = 2287). Only shown in 2020 to respondents from the CONUS but shown to all respondents in 2021.

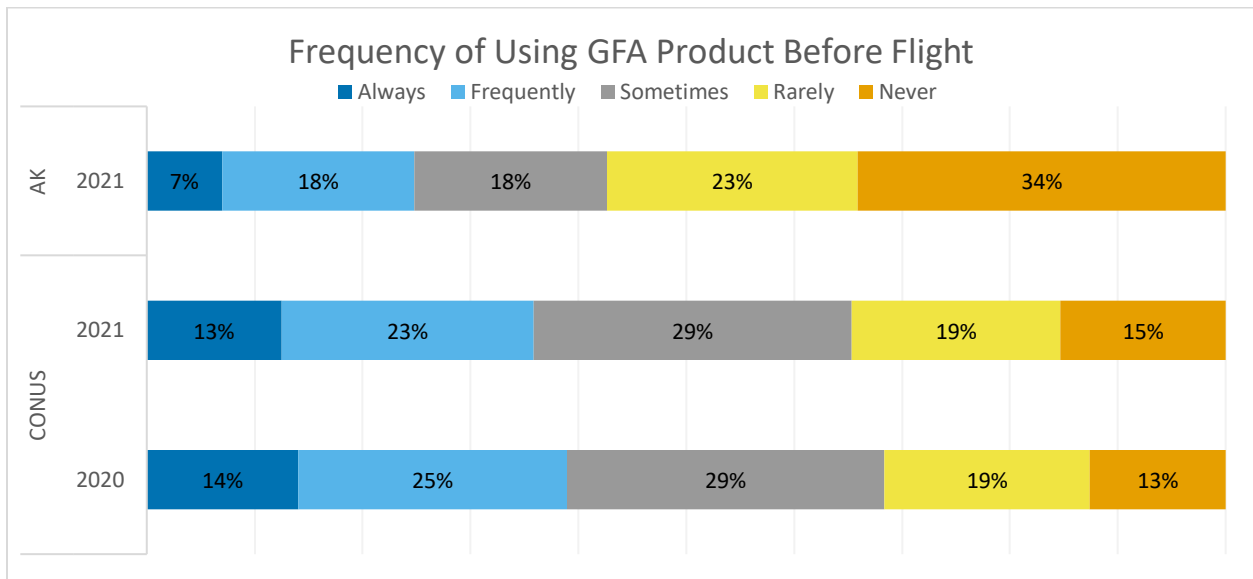


Figure 33. Responses to “How often do you access/use the Aviation Weather Center's Graphical Forecasts for Aviation (GFA) before you fly?” (n₂₀ = 2473; n₂₁ = 2287). Only shown in 2020 to respondents from the CONUS but shown to all respondents in 2021.

Helicopter Emergency Medical Services (HEMS). The Helicopter Emergency Medical Services (HEMS) weather tool provides information for low-altitude and short-distance flights. It uses an interactive, zoomable, scrollable map display and has several overlays available, including

weather radar, visual satellite, and more.⁷ Previous research by AOPA showed that many pilots had never heard of the tool, and many of those who had heard of it had still never used it. AOPA wanted to investigate whether the *name* of the tool was preventing pilots from exploring it further. Did pilots see the words “helicopter” and “emergency medical services” and think that the tool would not be relevant to their flying—especially for those fixed-wing, general aviation pilots not flying for emergency medical services?

To answer this question, AOPA ran an experiment. Respondents from the CONUS were randomly split into two groups as they answered the survey. The first group saw a description of the HEMS tool and were asked (1) if they were familiar with the tool, (2) how often they used the tool, and (3) how relevant they thought the tool was to their flying. The second group saw the same description and questions, with one important difference: The name of the tool was removed. Since the only difference between the two randomly divided “named” and “unnamed” groups was whether the respondents saw the name of the tool, any observed differences in responses would be due to the name of the tool (or lack thereof).

About 87% of respondents in the named group said they were not at all familiar with the HEMS tool as it was described (Figure 34). These results are similar to the percentages found in 2020; about 81% of respondents were not at all familiar with the HEMS tool last year. However, significantly fewer people in the unnamed group felt that they were unfamiliar with the tool; just 52% of the unnamed group said they were not at all familiar with the tool based on the description alone. It is possible that the unnamed group read the description and felt that it could be applied to some other weather tools they have seen and used, not necessarily the HEMS tool.

Next, respondents answered how often they would use the described weather tool (Figure 35). The named group again answered similarly to respondents of previous years. Excluding those who had never heard of the tool, about 71% of pilots in the named group said they never used the HEMS tool. In the unnamed group, only 11% of respondents said they would never use the tool described.

Finally, respondents were asked how relevant they felt the tool was to their flying. About half (51%) of pilots in the named group said that the HEMS tool was not at all relevant to their flying (Figure 36). Pilots in the unnamed group more often felt that the tool described would be relevant to them; 57% said the tool would be very or extremely relevant to their flying, and just 3% said it would not be relevant at all.

⁷ For more information, visit <https://www.aviationweather.gov/hemst>

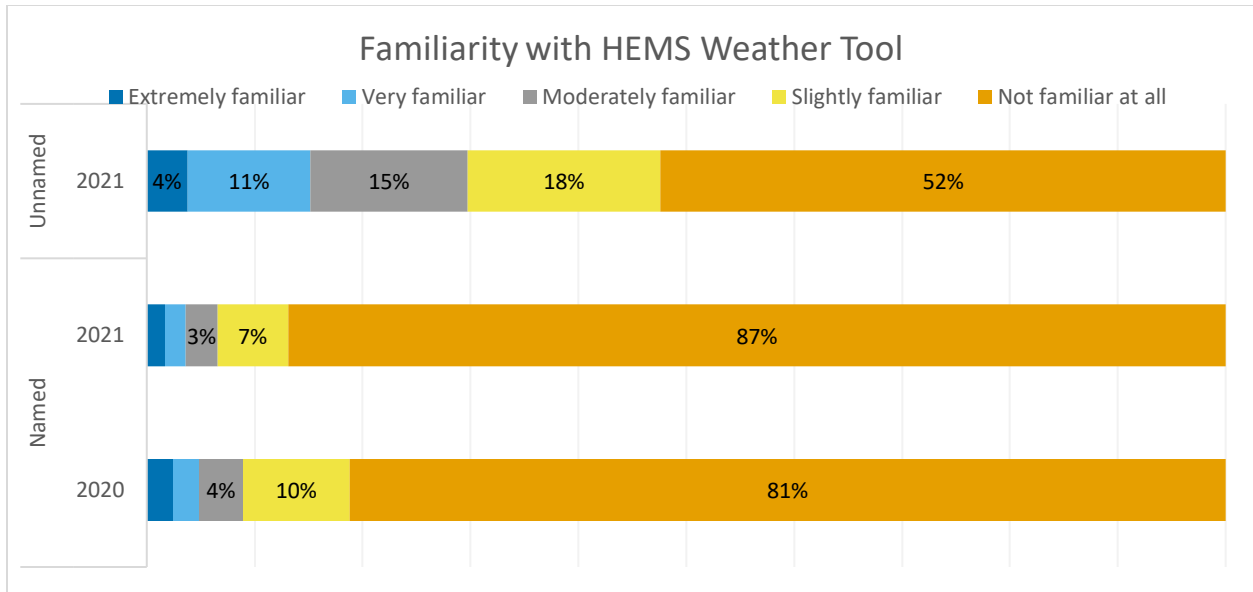


Figure 34. Responses to “How familiar are you with the Aviation Weather Center’s Helicopter Emergency Medical Services (HEMS) weather tool product?” ($n_{20} = 2465$; $n_{21, \text{named}} = 993$; $n_{21, \text{unnamed}} = 1029$). Only shown to respondents from the CONUS. Respondents in the unnamed group in 2021 received the question: “How familiar are you with the weather tool product described above?”

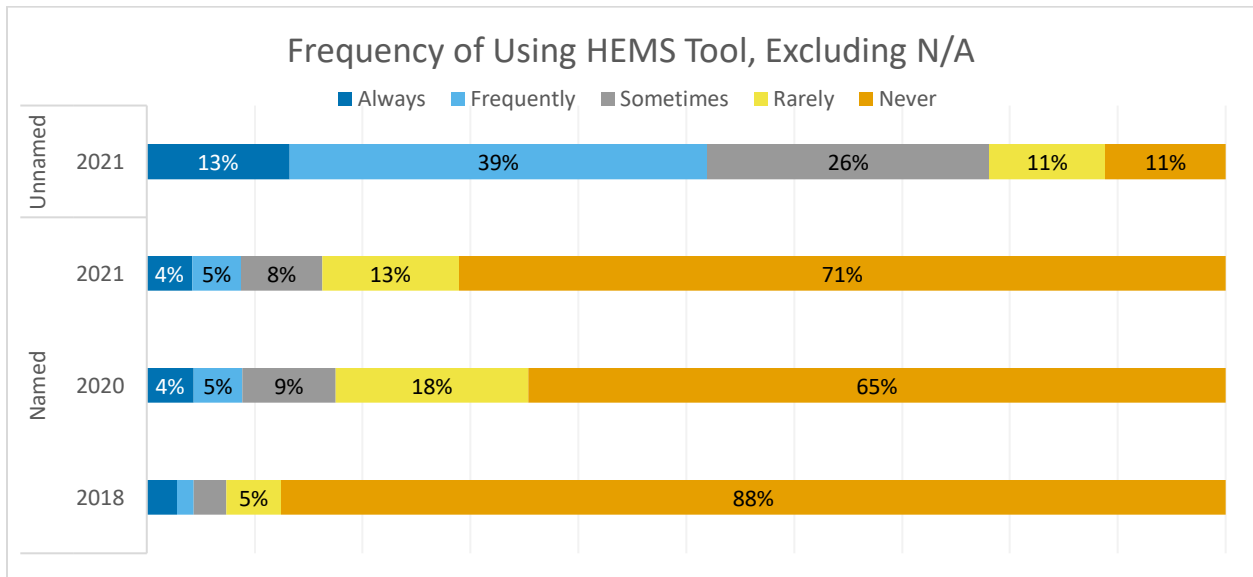


Figure 35. Responses to “How often do you use the Helicopter Emergency Medical Services (HEMS) weather tool on the Aviation Weather Center website?” excluding those who selected N/A ($n_{18} = 716$; $n_{20} = 993$; $n_{21, \text{named}} = 332$; $n_{21, \text{unnamed}} = 1027$). Respondents in the unnamed group in 2021 received the question: “How often would you use the weather tool described above?”

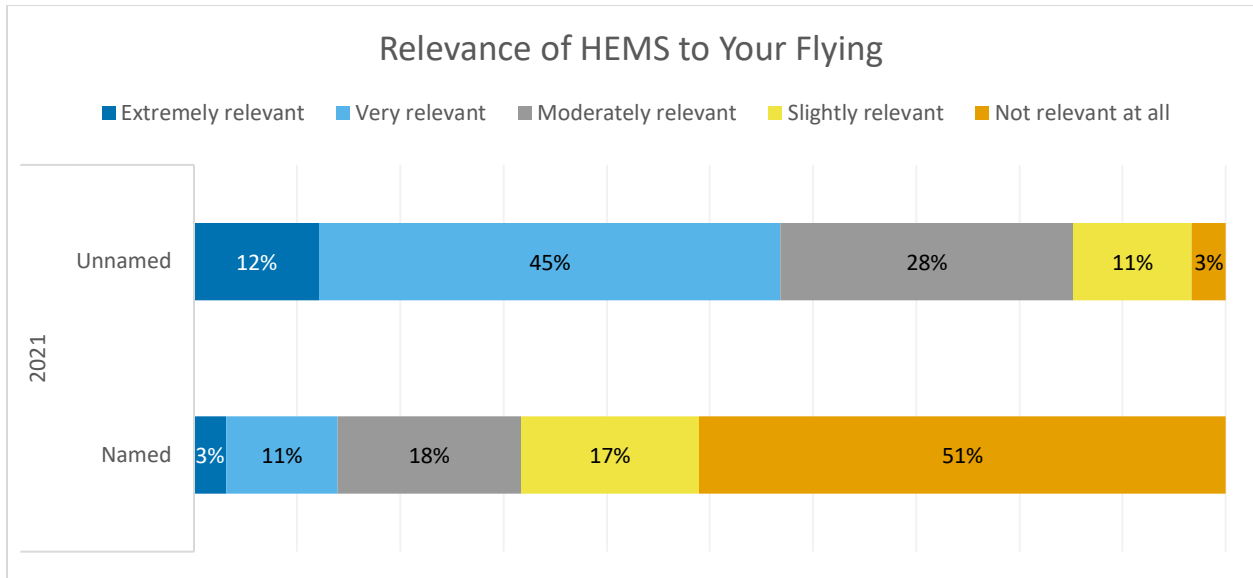


Figure 36. Responses to “How relevant do you feel the Helicopter Emergency Medical Services (HEMS) weather tool is to your flying?” (n₂₀ = 956; n_{21, named} = 1029). Respondents in the unnamed group in 2021 saw the question, “How relevant do you feel this weather tool would be to your flying?”

NOAA Cloud Cross-Section. The National Oceanic and Atmospheric Administration (NOAA) continues to develop a new weather product that estimates cloud and icing conditions using satellites across Alaska and the CONUS. The clouds cross-section product is currently an experimental product.⁸ In 2021, most respondents (82%) were not at all familiar with this product (Figure 37). Most of those who were at least slightly familiar with the product were neither satisfied nor dissatisfied with it (66%; Figure 38).

Those who were at least slightly familiar with the product had the opportunity to leave a comment about it. The most frequently expressed desire was to be able to define a custom route.

⁸ Learn more about the NOAA clouds cross-section product by visiting <https://www.aopa.org/news-and-media/all-news/2020/august/27/new-weather-product-helps-pinpoint-icy-clouds>

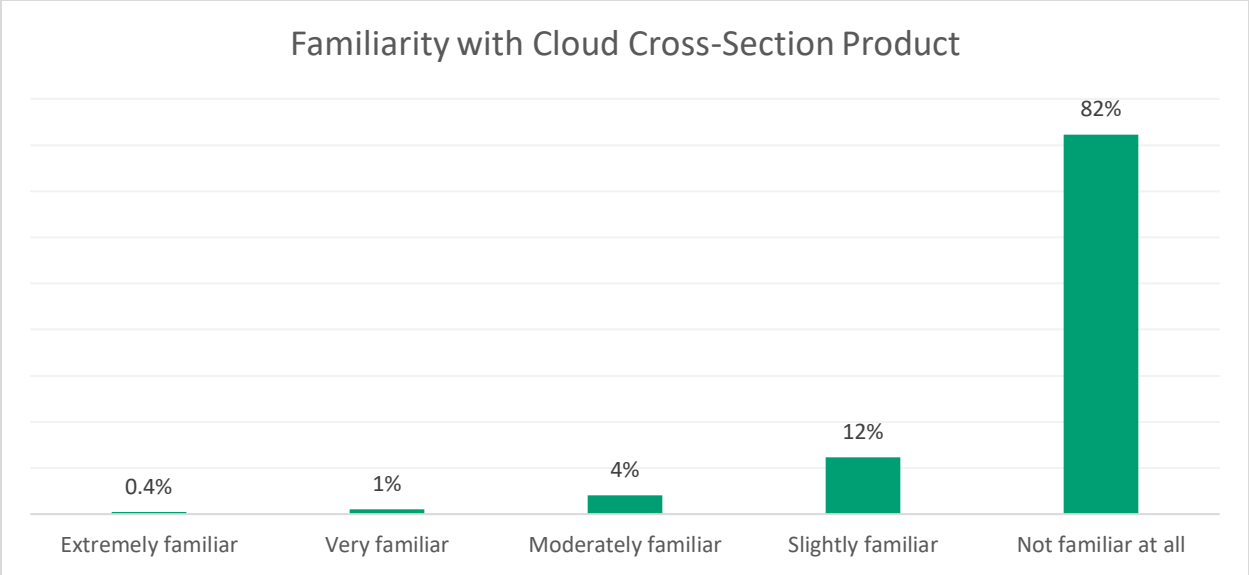


Figure 37. Responses to “How familiar are you with the cloud cross-section product?” (n = 2043). Added to survey in 2021.

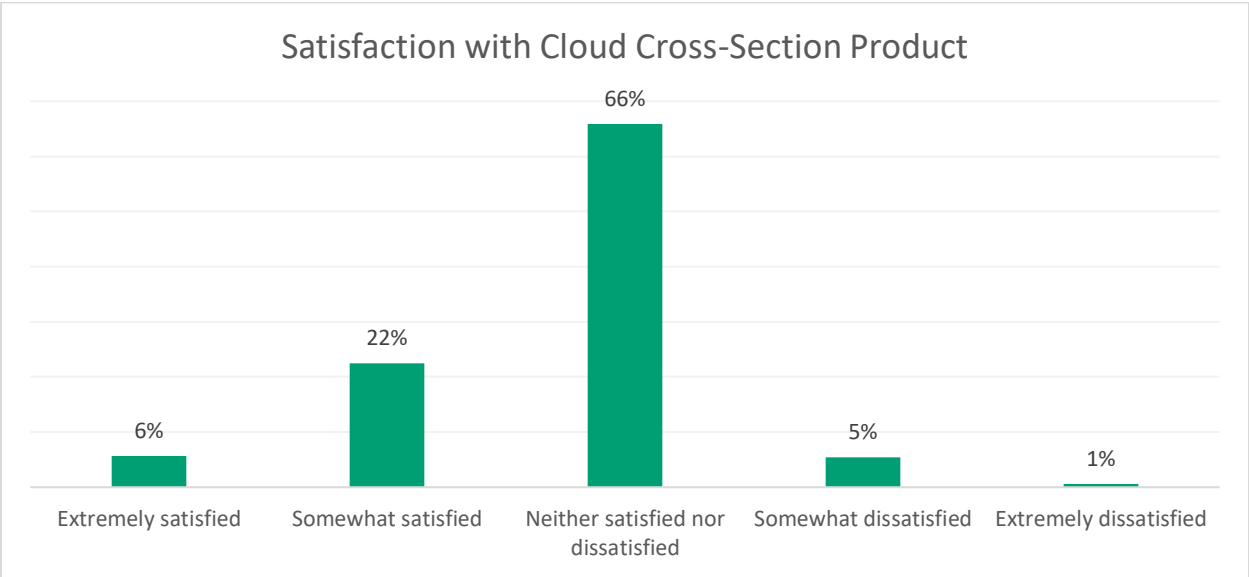


Figure 38. Responses to “How satisfied are you with the cloud cross-section product?” (n = 352). Only shown in 2021 to those who were at least slightly familiar with the product.

Discussion

The 2021 Weather Survey builds on research AOPA has conducted annually since 2016. The survey aims to understand how general aviation pilots access and use weather information. Based on the combination of this year's questions and trending results from past surveys, we offer the following observations and comments.

AC 91-92 and Pilot Self-Briefings

As pilots increasingly utilize alternative sources of weather information, it is important that they understand how to conduct an effective self-briefing. Providing relevant guidance on the topic was the intention behind the FAA's publication of AC 91-92, and the FAA is to be commended for publishing the AC, along with an accompanying online training course. However, 38% of respondents indicated that they are not familiar at all with the AC, with 28% being only slightly familiar. This means that fewer than half of respondents have meaningfully read the FAA's guidance. At the same time, an increasing number of pilots (this year almost 20%) reported that they no longer call Flight Service for flight planning information. These results would seem to indicate the need for further outreach by the FAA and industry regarding the contents of this publication.

Role of Flight Service

Survey results over the past few years show a change in how pilots gather weather information prior to flight. Use of aviation apps continues to increase, allowing more pilots to conduct self-briefings. While usage of Flight Service specialists is down for this service, their role as an information source that can respond to questions remains important to pilots. Even as the need for specialists to convey basic data diminishes, their ability to translate and interpret information and interact directly with pilots remains high.

FAA Weather Cameras

The ability to view weather conditions in multiple directions in "near-real" time, either to supplement an automated weather system, or as the only source of information, has proven to be wildly beneficial to the aviation community. Where available to pilots, primarily in Alaska currently, it has become a principal information source both initially and immediately prior to flight. We look forward to seeing the effects of this program as it expands to other parts of the country. We also continue to advocate for research into low-light or infrared sensors to see if this tool could be expanded to provide information on a 24-hour basis, as opposed to the current daylight-only utility of the system.

EFB, FIS-B, and SiriusXM Weather

The use of both FIS-B and SiriusXM weather continues to increase as it has for the past few years, along with the use of Electronic Flight Bags to acquire or view in-flight weather. That trend may be flattening with Alaska pilots, although the percentage of pilots who "always use" EFBs increased by 10% between 2020 and 2021. While we asked Alaska pilots about their use of SiriusXM weather, the availability of that service (based on satellite coverage) is confined to a very small portion of the state, which probably accounts for the low rates of reported usage.

Satisfaction with FIS-B service remains high among CONUS pilots. Alaska pilots show a different pattern, with an increase in dissatisfaction. We can only speculate that pilots who have equipped with ADS-B are now finding the lack of coverage to be a frustration, as that was the most frequently expressed comment in response to that question. The FAA is expected to expand ADS-B coverage in Alaska, so we will continue to monitor this trend in future surveys.

PIREPS

Despite efforts made to date, the growth rate of unsolicited PIREPs remains flat. Based on the responses in this year's survey, the reasons for this seem to fall into several categories:

- Lack of experience filing PIREPs.
- Lack of understanding regarding the value PIREPs provide to multiple audiences beyond immediate local use.
- Feeling that PIREPs are largely a "flight level thing."
- Feeling that PIREPs are not valued by ATC.

Increasing attention to PIREPs during primary training, helping new pilots become familiar with the reporting format, developing confidence in their observation skills, and understanding the longer-term value of PIREPs should be stressed. Broadening the methods available to file PIREPs, through flight apps or other means, should also be pursued to help increase the frequency of these reports.

Alaska Aviation Guidance (AAG)

The Alaska Aviation Guidance represents an additional tool to project weather conditions locally in the short term (the next six hours). As an automated product, this TAF-like projection of forecast conditions provides an additional tool for VFR pilots to consult when planning flights. Given the testing of new, lower-cost weather reporting stations that are being fielded in Alaska, the AAG has the potential to provide an increased density of information available for VFR flight planning in areas lacking conventional TAFs. We encourage the National Weather Service and the FAA to continue to monitor this product with the goal of making it an operational tool. While awareness of the product increased significantly in the past year, additional outreach should be conducted to help the AAG become more widely known.

Graphical Forecasts for Aviation (GFA)

Awareness of the GFA among pilots in the CONUS actually shows a slight decrease over the past year. The awareness in Alaska is understandably lower, given that it has only recently been released with data for this region of the country. This product represents a change from the conventional text-based area forecast to a more grid-based forecast depiction of some weather parameters. More pilot outreach and monitoring of usage should be conducted to determine the utility of the GFA and/or future development needed to increase acceptance of this product.

Helicopter Emergency Medical Services (HEMS) Weather Tool

The HEMS tool is a valuable resource from the Aviation Weather Center of which, according to this survey, most pilots are unaware. We believe that the name of the product, which suggests it is only for rotor-wing aircraft engaged in medical services operations, is influencing this situation. Whether the cause is confusion from its name or something else, it is disappointing that it has failed to receive more attention. Based on this year's survey results, showing that pilots looking at a description of the information the tool provides believe it is relevant to their flying, we strongly believe the tool should be renamed to help achieve increased visibility and use of this product, which has general applicability to general VFR low-altitude flying.

NOAA Cloud Cross-Section

The NOAA Cloud Cross-Section is a new type of product that combines swaths of satellite imagery with other data to identify cloud tops, bases, and icing conditions. Not surprisingly, most respondents were not familiar with this new type of data product, and those using it are undecided about it. The most frequently received comment was the desire to be able to create a pilot-defined route, as opposed to being limited to the defined routes currently displayed. In the time since this survey was conducted, the project team at the University of Colorado's Cooperative Institute for Research in the Atmosphere has added this feature to its [website](#).

Additional outreach is called for to increase the awareness of this evolving product and to obtain feedback from the aviation community to help further shape development of this innovative, graphical weather tool.

Recommendations

There are several developments in the weather arena, including refinement or expansion of new forecast and current condition products, that were explored in this year's survey. We plan to continue monitoring these efforts to help provide feedback on these projects. Based on the results of this survey, AOPA specifically recommends:

- 1) The FAA and industry should continue their outreach efforts of AC 91-92 to ensure that more pilots are aware of the guidance and resources available for conducting preflight self-briefings.
- 2) The Flight Service Program should evaluate changes in pilot use patterns based on the increasing popularity of Electronic Flight Bags and in-flight weather tools and consider how to evolve the services they provide in response to these changes in technology.
- 3) The FAA should continue with its expansion of the Weather Camera Program, both within and beyond the state of Alaska, and fund research into making it a 24-hour source of information.

- 4) Industry and government should continue outreach and educational efforts to encourage all pilots to supply unsolicited PIREPs as they fly. They should further focus on providing student pilots with specific instruction and operational experience filing PIREPs and encourage CFIs to include PIREPS in flight reviews. They should also stress the multiple audiences that use these reports to help pilots see the value that routine reports provide to the extended aviation community.
- 5) Government and industry should conduct additional pilot outreach for the Graphical Forecasts for Aviation, Alaska Aviation Weather Guidance, and NOAA Cloud Cross-Section products to increase visibility and utilization. Additionally, further pilot feedback on these products should be solicited and used to improve functionality.
- 6) The Aviation Weather Center should rename the HEMS tool to illustrate that it is appropriate for use by a wider audience, particularly general aviation. The tool should also be better highlighted by the FAA and industry to increase its usage.

Survey Limitations

Two of the largest limitations of the present study include the margin of error and potential for bias. The margin of error is a statistic tied to sample and population sizes. The margin of error helps estimate how close observed results are to the truth. Larger sample sizes will lower the margin of error and increase confidence in a study's results. The margins of error for the 2021 Weather Survey were 1.9% for CONUS pilots, 7.9% for Alaskan pilots, and 1.9% overall (considering pilots from all regions) at a 95% confidence level. In other words, if AOPA were to run this exact study again, then 95% of the time, the results would fall within 1.9% of the true population value for CONUS pilots, 7.9% of the true population value for Alaskan pilots, and so on. If an individual question has fewer responses recorded, then the associated margin of error will be higher. The margin of error for Alaskan respondents is particularly high, due to the small sample size collected and the overall smaller population size in that state.

The potential for bias in this study can come from many sources. First, there is the potential for bias toward AOPA. The survey was released by AOPA, with AOPA branding, to samples of AOPA members. It is possible that invitees who recognized and had strong opinions toward AOPA were more likely to respond to the survey.

The next source of bias is in the interpretation of results, particularly open-ended responses. AOPA recognizes the importance of avoiding bias when reading, interpreting, and summarizing open-ended responses. Coders must be consistent and avoid making assumptions or projecting intent onto vague responses. The limitations of coding free-response questions are always present, though they may be mitigated by using multiple properly trained coders. As noted in previous years, AOPA uses a single coder, which precludes calculations of interrater reliability statistics to measure coding accuracy.

AOPA strives to provide accurate, reliable, and comprehensive assessments of all available data, and so openly acknowledges these limitations.

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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.