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January 23, 2017

David E. Gray
Program Management Organization
Surveillance and Broadcast Services
Federal Aviation Administration
600 Independence Avenue S.W.
Washington, DC 20591

Re: Expanding ADS-B Radio Station Coverage to Increase Safety Benefits and ADS-B Out Equipage for General Aviation

Dear Mr. Gray,

The Aircraft Owners and Pilots Association (AOPA), the world's largest aviation membership association, respectfully submit the following recommendations to the Surveillance and Broadcast Services (SBS) program office in support of the benefits case being developed for expanding Automatic Dependent Surveillance-Broadcast (ADS-B) radio station coverage. We believe it is important the qualitative and quantitative benefits to General Aviation are considered as part of a future FAA investment decision. These recommendations are focused on ensuring that the FAA's benefits case is comprehensive and targets expansion in the most impactful areas. AOPA strongly supports expanding ADS-B radio station coverage as it will improve the safety benefits for General Aviation and incentivize equipage.

AOPA's Recommendations

It is important the proposed ADS-B enhancements focus on improving low-altitude air traffic surveillance coverage and radio station coverage for broadcast products like Flight Information Service-Broadcast (FIS-B). ADS-B improvements focused on low-altitude operations will incentivize *ADS-B Out* equipage for General Aviation, and increase the safety and efficiency benefits in the National Airspace System (NAS). We believe the expansion of ADS-B coverage will reduce the General Aviation accident rate, increase efficiency of operations, and incentivize *ADS-B Out* equipage.

AOPA respectfully makes the following recommendations to the FAA:

1. The FAA should evaluate the ADS-B recommendations applicable to expansion of coverage for General Aviation that were made by prior task groups and the National Transportation Safety Board (NTSB). The recommendations made by these different task groups and agencies echo the need and value of increasing ADS-B coverage for low-altitude operators. AOPA strongly urges the FAA to embrace these recommendations and ensure their benefits case fully captures the value of increasing coverage.

2. The FAA should evaluate existing radio station coverage for broadcast products to identify gaps and to promote, as part of their benefits case, the value of filling these gaps. AOPA believes the greatest improvement would be achieved through the addition of radio stations in Alaska and northern Contiguous United States (CONUS), such as Montana, Idaho, Minnesota, and South Dakota, where access to inflight weather information is limited.
3. The FAA should quantify the air traffic efficiency and safety benefits that *ADS-B Only* airspace has provided. There are many areas in the NAS that air traffic control has improved surveillance coverage thanks to ADS-B. Those realized benefits should be documented and referenced to help justify additional ADS-B coverage.
4. The FAA's benefits case should note how expanding ADS-B coverage would facilitate increased efficiency for point-to-point IFR operations conducted at low-altitude, particularly in areas prone to icing or frequented by helicopters. The benefit of extending ADS-B surveillance coverage to more remote places, and to lower altitudes, has increased greatly with the shift to Area Navigation (RNAV). Pilots can save time, fuel, and money by flying point-to-point instead of an inefficient airway system that is predicated on ground-based Navigational Aids (NAVAIDs). As AOPA pointed out in our comments to the 2008 ADS-B notice of proposed rulemaking, "increasing the availability of low-altitude direct-to navigation during instrument operations" is necessary to make voluntary equipage "appealing for General Aviation aircraft owners."
5. The FAA should promote the quantifiable benefits of ADS-B coverage and utilize that data to justify increasing coverage in other areas of the NAS trafficked primarily by General Aviation aircraft. There are operational and safety benefits to VFR and IFR aircraft being under air traffic surveillance that need to be defined and advertised.
6. The FAA should embrace NTSB and industry recommendations of providing the IFR infrastructure necessary to support the helicopter community. Enabling the most at risk community, the low-altitude flyers, to receive greater access to air traffic resources would have a positive impact on the accident rate and on improving access to the IFR system.
7. The FAA should collaborate with industry to identify areas lacking coverage that have numerous operations and that would benefit from ADS-B coverage. AOPA's examination of coverage in Alaska, conducted in collaboration with several local operators, highlights that substantial aviation activity is taking place outside of coverage. The 2013 Volpe Study, *Fuel Consumption of ADS-B and non-ADS-B Helicopter Operations in the Gulf of Mexico*, is an example of the type of investigation that could be conducted for Part 91 and 135 operators in Alaska to quantify the benefits of improved coverage. The Association believes more needs to be done to identify these gaps in coverage in CONUS and Alaska and resources directed towards those areas where improved coverage would be most impactful.
8. AOPA believes additional radio sites are necessary for Alaska to have a minimum operational network of ADS-B to improve access and aviation safety, and for pilots to see a value in equipping. The FAA mandated *ADS-B Out* requirement in Rule Airspace will have little impact on Alaskan operators and likely not drive Alaskan equipage. The Association believes providing the operational and safety benefits of improved coverage for VFR and

IFR operators will be important to incentivizing equipage and obtaining greater General Aviation participation. With about 40% of Alaska lacking ADS-B coverage at General Aviation typical altitudes, there could be a positive impact on equipage and reduce accident rates should ADS-B coverage be expanded to a meaningful level.

Additional details and data regarding qualitative and quantitative benefits to expanding coverage are provided in the attachment to this letter. We are happy to provide additional supporting data if it would assist you with building the benefits case.

Conclusion

We appreciate this opportunity to provide the General Aviation perspective on expanding ADS-B coverage. We request the FAA consider these recommendations when creating the justification for the future enhancements to the ADS-B program.

We believe expanding ADS-B coverage for low-altitude operators will positively contribute to the realization of the FAA's and AOPA's NextGen goals including a greater number of aircraft equipped with ADS-B and a safer overall NAS. Thank you for reviewing our recommendations on this important issue. If you have any questions, please feel free to contact Rune Duke at 202-509-9515.

Sincerely,



Rune Duke
Director, Airspace and Air Traffic



Tom George
Alaska Regional Manager

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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The Benefits of Expanding ADS-B Coverage to Increase Aviation Safety and ADS-B Equipage for General Aviation

In support of the benefits case being developed by the SBS program office for the expansion of ADS-B radio station coverage, AOPA has prepared several qualitative and quantitative case studies that note the benefit of ADS-B coverage to General Aviation. The Association strongly supports expanding ADS-B radio station coverage as it will improve the safety benefits for General Aviation and incentivize equipage.

Past Recommendations Note the Value of Increasing Low-Altitude Coverage

Expanding ADS-B radio station coverage has been a recommendation made by several previous ADS-B task forces. Increasing low-altitude surveillance coverage has been consistently listed as a benefit to increasing the efficiency of the NAS and as a method of incentivizing General Aviation equipage.

The 2007 “ADS-B ARC” made this recommendation:

No. 4 - Extend the coverage of the ADS-B ground infrastructure to include high-value non-radar areas beyond those currently identified. The benefits of ADS-B in terminal surface and en route environments where radar exists today provides substantial value. The FAA should establish a forum to determine which areas outside that baseline would provide the greatest benefits to NAS operators. Surveillance and broadcast services in areas where no coverage exists today provide the most relative value and safety increases to the existing surveillance infrastructure. The FAA should have a mechanism to evaluate how the SBS program’s scope might be expanded to accrue benefits in non-radar areas.

The 2009 “NextGen Mid-Term Implementation Task Force” (Task Force 5) report discusses expanding ADS-B surveillance coverage as a major incentive to equipage:

No. 5 – Access to the NAS: Improve access to and services provided at non-OEP airports and to low altitude, non-radar airspace by implementing more precision-based approaches and departures, along with the expansion of surveillance services to areas not currently under radar surveillance.

The 2011 “ADS-B In ARC” made the following recommendation on expanding ADS-B coverage beyond existing radar coverage areas:

No. 17 - As a result of the need for greater traffic and weather information to improve the GA business case, the ARC recommends the FAA expand ADS-R and Flight Information Service-Broadcast service volumes and associated ADS-B infrastructure to improve coverage at GA airports and low altitude airspace.

The “Performance Based Navigation (PBN) Route Structure CONOPS committee,” under the RTCA Tactical Operations Committee, drafted the following recommendations as part of the *Low Altitude PBN Route Structure Report*, which should be formally submitted to the FAA in March (final draft under revision):

The FAA should identify the areas [in CONUS] projected to lack surveillance coverage in 2025 and evaluate the benefit of expanding ADS-B coverage to surveil these areas.

In areas where helicopters frequently operate, the FAA should establish (a) additional ADS-B radio stations to enable surveillance coverage to altitudes equal to that of the controller MIA/MVA and (b) radio sites where reception issues regularly require the helicopter to operate above MIA/MVA.

The FAA should install additional ADS-B radio stations [in Alaska] to expand coverage of surveillance and broadcast products.

Additionally, the NTSB has made several safety recommendations to the FAA regarding ADS-B and improvements that would benefit low-altitude operators. Two 2009 recommendations, which both remain open with unacceptable responses, are applicable to creating an IFR structure usable for helicopters with ADS-B:

Conduct a systematic evaluation and issue a report on the requirements necessary for a viable low-altitude airspace infrastructure that can accommodate safe helicopter emergency medical services (HEMS) operations. The evaluation should consider improved collection and dissemination of weather data, the role of automatic dependent surveillance-broadcast, approaches to helipad and designated landing zones, and integration into the National Airspace System. Include in the evaluation process HEMS operators, related industry associations, and hospitals, among others. (A-09-93)

Once the evaluation and report as recommended in Safety Recommendation A-09-93 are completed, initiate action to develop this infrastructure. (A-09-94)

Recommendation 1: The FAA should evaluate the ADS-B recommendations applicable to expansion of coverage for General Aviation that were made by prior task groups and the NTSB. The recommendations made by these different task groups and agencies echo the need and value of increasing ADS-B coverage for low-altitude operators. AOPA strongly urges the FAA to embrace these recommendations and ensure their benefits case fully captures the value of increasing coverage.

Improving the General Aviation Benefits Case

Improving Flight Safety by Increasing Access to Weather Information

In 2016, AOPA and the FAA conducted a series of surveys to better understand how pilots utilize Flight Service and access critical flight information. We learned 82% of General Aviation pilots routinely use an Electronic Flight Bag (EFB) in the cockpit. Most modern EFBs can

display weather information and will continuously update while inflight. About 28% of pilots indicated that they routinely use SiriusXM Aviation inflight and about the same number, 27%, utilize the FAA provided FIS-B service. These services provide near real-time weather information in the cockpit and augment or, in some cases, replace Flight Service for pilots.

According to the AOPA Air Safety Institute *25th Joseph T. Nall Report*, weather accidents consistently suffer the highest lethality of all accidents. In 2013, adverse weather accounted for the largest number of General Aviation fatal accidents. General Aviation pilots need timely access to current weather information to make good decisions and to understand the potential impact on their flight.

AOPA notes FIS-B coverage is not complete and is noticeably absent in many remote areas of CONUS and Alaska where ground-based weather sensors (AWOS/ASOS) are also sporadic. Filling this void would have a positive impact on increasing the availability of weather in the cockpit. Much of the General Aviation fleet must avoid icing conditions, which can necessitate low-altitude operations. Increasing the radio station coverage in high risk and remote areas would incentivize *ADS-B In* equipage, given the FIS-B benefits, and could incentivize greater *ADS-B Out* equipage, given the increased surveillance coverage and ability to conduct VFR and IFR flights efficiently.

Recommendation 2: The FAA should evaluate existing radio station coverage for broadcast products to identify gaps and to promote, as part of their benefits case, the value of filling these gaps. AOPA believes the greatest improvement would be achieved through the addition of radio stations in Alaska and northern CONUS, such as Montana, Idaho, Minnesota, and South Dakota, where access to inflight weather information is limited.

Safety and Efficiency Benefits in Terminal and Enroute Airspace

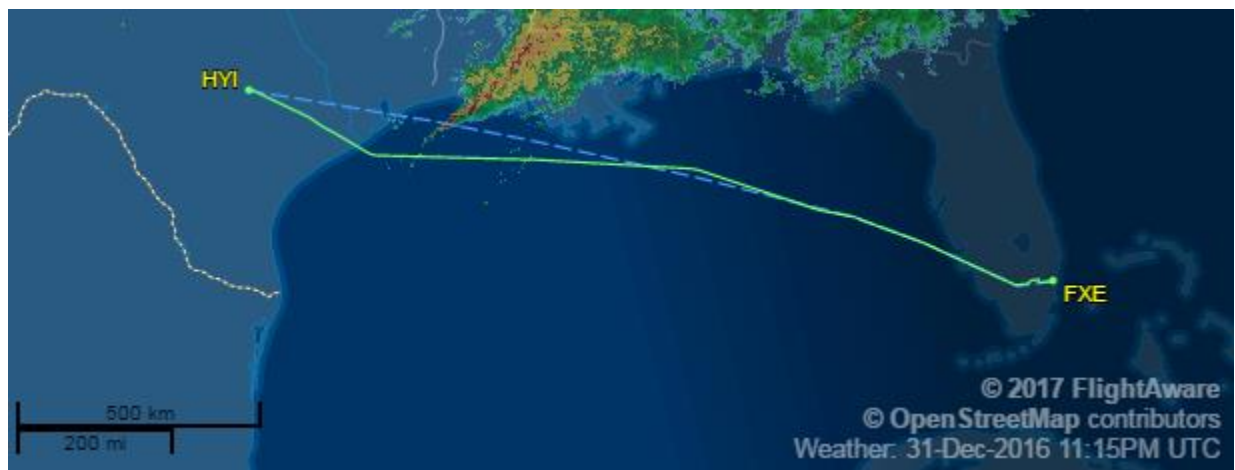
One of the demonstrable benefits of the implementation of ADS-B has been the expansion of ATC services beyond areas only covered by radar through the creation of *ADS-B Only* airspace. This airspace has provided improved efficiency for IFR operations at uncontrolled airports for aircraft that are *ADS-B Out* equipped. In June 2016, AOPA published a story highlighting the benefits of *ADS-B Only* airspace in partnership with NATCA. The Houston ARTCC NATCA representative cited an example in western Texas where air traffic control would normally lose aircraft at 4,000' AGL when relying solely on radar; however, an *ADS-B Out* aircraft in that same area can now be tracked almost to the surface.

Another example of improved coverage, per NATCA, is in Colorado where mountainous terrain previously limited radar coverage. ADS-B equipped aircraft can now be under positive air traffic control surveillance much longer in this challenging terrain. Being in radar contact can be reassuring to pilots who know air traffic control is looking out for them and can help steer them clear of issues like weather or terrain. Increased coverage improves the search and rescue capability and the ability for air traffic control to provide greater assistance in an emergency. In the past air traffic control may have lost radar contact with an aircraft when they descended below radar coverage, but ADS-B now allows them to track and vector aircraft at much lower altitudes. This can be a life saver for a pilot dealing with an emergency.

ADS-B improvements in the Gulf of Mexico for the offshore helicopter operations are well known; however, at the Houma–Terrebonne Airport (KHUM), where many of those helicopters are based, aircraft get the benefit of surveillance closer to the surface. This has led to a definite improvement in the efficient flow in and out of this airport per the controllers who have responsibility for that area. The increased surveillance coverage means pilots do not need to fly the full procedure when on an instrument approach. Flying the full procedure can be inefficient (tying up the airport/airspace for a larger amount of time) and costly (increased flight time for aircraft flying the full procedure and delays for aircraft waiting to depart on the aircraft).

Increased surveillance capability at General Aviation cruising altitudes in the Gulf of Mexico has improved the flexibility of routing for pilots and controllers. One example of the cost and fuel savings ADS-B has provided was reported by a Piper Seneca III pilot flying over the Gulf from San Marcos Regional Airport (KHYI) to Fort Lauderdale Executive Airport (KFEX). Prior to *ADS-B Out*, the pilot, who regularly makes this trip, reports that Houston ARTCC had historically required him to fly initially over land. Air traffic control had previously been strict about filing several waypoints to fly across the Gulf, to allow them to adequately monitor the flight's progress.

On the flight in question, there was a line of convective activity inland that would have previously required the pilot to proceed further inland, increasing cost and time. Air traffic offered a more direct routing over the Gulf, directly attributable to the aircraft's ADS-B equipage, per the pilot. The pilot reports the improved routing saved them approximately 30 minutes of flight time at 17,000 feet, which would amount to a savings of 10.5 gallons of fuel. The savings are conceivably much greater than the flight time, as the inland routing would have required a fuel stop on the west coast of Florida, not uncommon in the past. This flight's savings could be multiplied across the many other General Aviation flights that this pilot and others take across the Gulf.



This graphic depicts the flight route and actual weather for the case study over the Gulf.

Recommendation 3: The FAA should quantify the air traffic efficiency and safety benefits that *ADS-B Only* airspace has provided. There are many areas in the NAS that air traffic control has

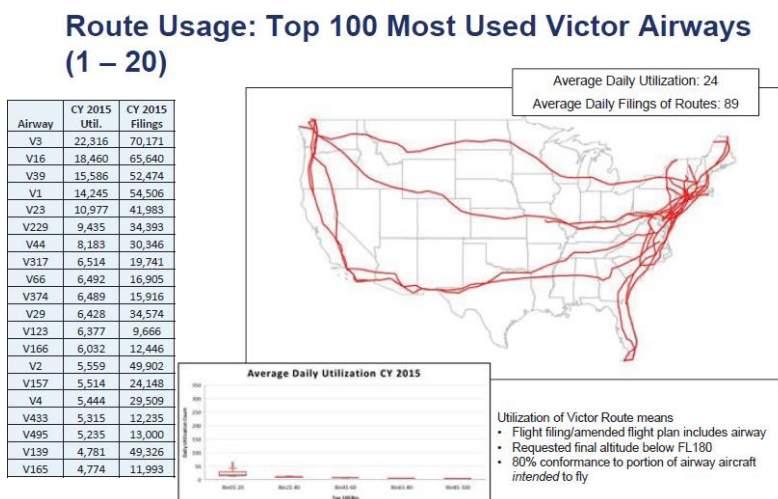
improved surveillance coverage thanks to ADS-B. Those realized benefits should be documented and referenced to help justify additional ADS-B coverage.

Increasing Coverage to Support Point-to-Point Efficiency

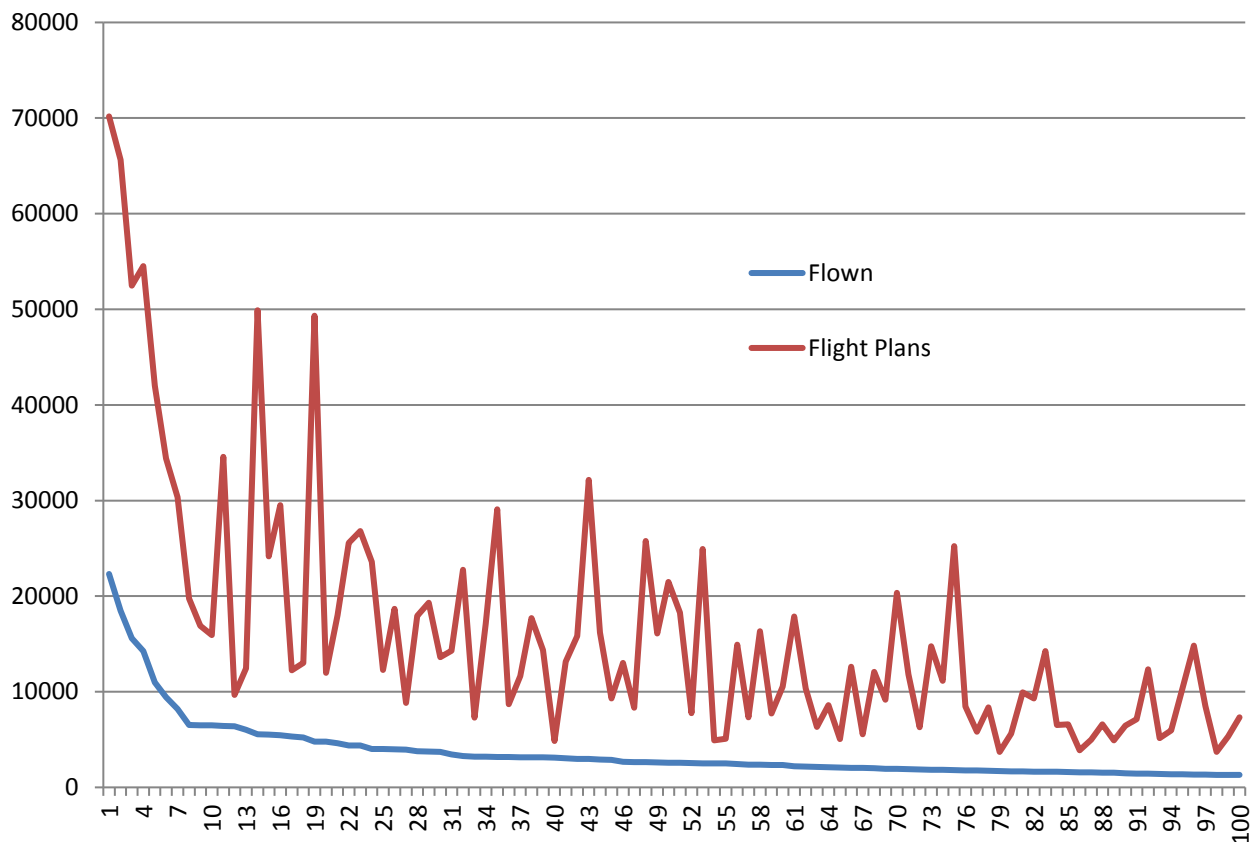
Radar coverage has been historically provided in areas where there is increased density of traffic, normally along an airway in the enroute environment; however, flight paths are changing as operators embrace PBN. Most General Aviation pilots no longer file airways, or fly the airways that they do file, per an analysis by MITRE completed in support of the RTCA PBN Route Structure effort. The data indicates point-to-point RNAV is the predominant method of flying today. This means increasingly more General Aviation aircraft are outside of radar coverage and must climb to higher altitudes to be in coverage, given they are operating off-airways, outside of areas where radar coverage had historically been designed to surveil.

Referencing the FAA's 2014 General Aviation survey and equipage numbers from the Navigation Programs office, AOPA estimates over 90% of regularly active IFR General Aviation aircraft are equipped to fly enroute point-to-point RNAV. Anchorage ARTCC confirmed this advanced equipage in Alaska by reviewing four months of flight data. They determined for the 56,723 flight plans that were filed with an equipment suffix, only 1.63% were non-RNAV and non-GNSS capable. This increase in advanced equipage correlates to a decline in the utilization of the airway structure.

The number of flight plans utilizing Victor Airways continues to decline. Airway conformance also shows a declining use of airways as air traffic control regularly gives pilots "short cuts" to a point further along in their flight plan. Comparing the number of flight plans filed in CONUS via Flight Service or DUATS, which is generally the manner General Aviation pilots will submit a flight plan, to the number of filings of Victor Airways in 2015, one can see (chart below) that approximately 50% of pilots will file a Victor Airway on an IFR flight plan. However, when looking closer at those flights and identifying conformance, just 10% of those pilots will fly the airway that they filed.



MITRE data from 2015 showing how often Victor Airways are filed and then flown. The top 80-100 routes decline to just single digit filings over the course of the year.



This graph shows the number of Victor Airway filings and flights for the top 100 routes. The utilization drops quickly to single digits. There are over 600 Victor Airways in the NAS.

Recommendation 4: The FAA’s benefits case should note how expanding ADS-B coverage would facilitate increased efficiency for point-to-point IFR operations conducted at low-altitude, particularly in areas prone to icing or frequented by helicopters. The benefit of extending ADS-B surveillance coverage to more remote places, and to lower altitudes, has increased greatly with the shift to RNAV. Pilots can save time, fuel, and money by flying point-to-point instead of an inefficient airway system that is predicated on ground-based NAVAIDs. As AOPA pointed out in our comments to the 2008 ADS-B notice of proposed rulemaking, “increasing the availability of low-altitude direct-to navigation during instrument operations” is necessary to make voluntary equipage “appealing for General Aviation aircraft owners.”

Improving IFR and VFR Operations by Expanding Surveillance Coverage

The FAA created a benefit case as part of the August 2007 final investment decision for ADS-B; however, this benefit case did not quantify (monetize) the benefit of increasing surveillance coverage in CONUS, Hawaii, or the Caribbean. The case was made for increasing coverage for General Aviation (*ADS-B Out* equipped) in the Gulf of Mexico (increased capacity and reduction in weather related accidents totaling \$89.2 million) and for Alaska (access to lower altitude routes, fewer aircraft-to-aircraft conflicts, and improved search and rescue services amounting to \$26.5 million). We believe the benefits case can, and should be, expanded to further note the value of expanded ADS-B coverage in additional areas.

Much of the General Aviation fleet must routinely operate at lower altitudes due to icing and performance limitations. Surveillance coverage is better the higher one flies and generally inconsistent at lower altitudes especially in areas of high terrain. General Aviation routinely operates IFR in these scenarios while accounting for more IFR operations in the NAS than air carriers and the military. Consequently, at lower altitudes, thousands of General Aviation operations each year frequently occur outside of surveillance coverage and consequently not in radar contact with air traffic control.

Not being in radar contact with air traffic control has several safety and efficiency implications. First, a pilot flying IFR will not get the benefit of controller provided traffic or terrain alerts. These alerts are a safety benefit which may prevent accidents and collisions. Second, optimal routing may not be available due to the need for air traffic to apply non-radar separation rules. Non-radar rules require greater amounts of separation, are inefficient, and result in longer flights with a commensurate increase in fuel requirements. The inefficiency and increase in operating costs can lead to pilots choosing to fly VFR over the safer IFR. Third, air traffic control may not be able to aid with weather avoidance. Pilots frequently work with air traffic control as a team to avoid adverse weather; however, the controller may not be able to assist effectively if the aircraft could not be displayed on their scope.

The search and rescue benefits of being surveilled by ADS-B are well documented by the FAA. The improved position accuracy of GPS greatly increases the survivability of an accident given rescuers can be directed to a more finite search area. One example where ADS-B directly attributed to a pilot's swift rescue was from an October 28, 2002, accident that occurred in Marshall, Alaska (Accident Number: ANC03LA007). Per MITRE's 2003 study titled *The Safety Impact of Capstone Phase 1: Quick-Look Assessment: 2002*:

The aircraft was reported overdue to the Anchorage En Route Air Traffic Control Center where it had been tracked by ADS-B as it departed Bethel. The plane left coverage as it descended to land in Marshall, but a single ADS-B report had been received as the aircraft was departing from Marshall, presumably as it rose above the ridge-line and encountered the downdraft. A helicopter was dispatched which used night-vision technology to quickly locate the downed aircraft near its last reported ADS-B position.

As a result of ADS-B equipage and surveillance coverage in this area, this pilot's life may have been saved. There are many examples of where an aircraft crashed and the pilot and passengers were awaiting rescue for long periods of times due to the difficulty of finding the wreckage. Notably with this accident, the Emergency Locator Transmitter (ELT) did not activate, leaving only visual methods of finding the wreckage. Establishing surveillance coverage in more areas can further enable precise search and rescue and save lives.

Recommendation 5: The FAA should promote the quantifiable benefits of ADS-B coverage and utilize that data to justify increasing coverage in other areas of the NAS trafficked primarily by General Aviation aircraft. There are operational and safety benefits to VFR and IFR aircraft being under air traffic surveillance that need to be defined and advertised.

Supporting a Helicopter IFR Structure

An example of where ADS-B surveillance was improved specifically for helicopters was in the Gulf of Mexico. Helicopter operators in this area substantially increased the number of flights conducted on an IFR flight plan once surveillance was provided. Pre-ADS-B filings were just 1,200 a year, but the number increased to over 28,000 annually once surveillance was in place. The ADS-B surveillance capability allowed increased enroute efficiency for the helicopter operators and has increased the safety of the operations. Surveillance in the Gulf has also greatly increased ADS-B equipage rates locally. If pilots knew that coverage would be present at the altitudes they fly, many would equip to take advantage.

There is an effort underway with the Alaska and CONUS helicopter air ambulance community to promote the benefits of IFR flying given the high rate of weather related accidents. AOPA is collaborating on that effort. The most frequent complaint from helicopter pilots is the need to fly to higher altitudes to be in surveillance coverage, which can put them into icing conditions. This is an untenable position and can lead to pilots being unable to complete missions or to choose to scud run while VFR.

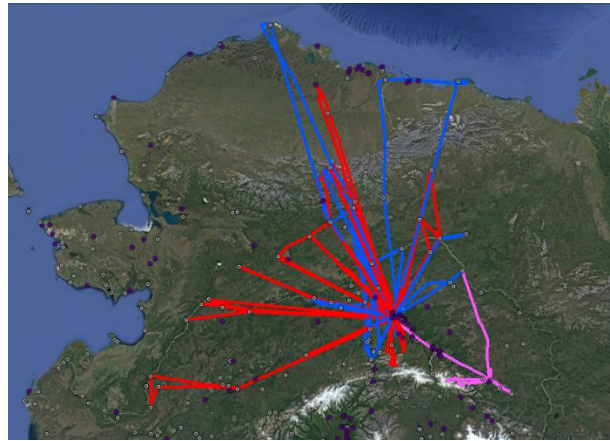
Recommendation 6: The FAA should embrace NTSB and industry recommendations of providing the IFR infrastructure necessary to support the helicopter community. Enabling the most at risk community, the low-altitude flyers, to receive greater access to air traffic resources would have a positive impact on the accident rate and on improving access to the IFR system.

Alaska Case Studies Exemplify Limitations of Existing Coverage

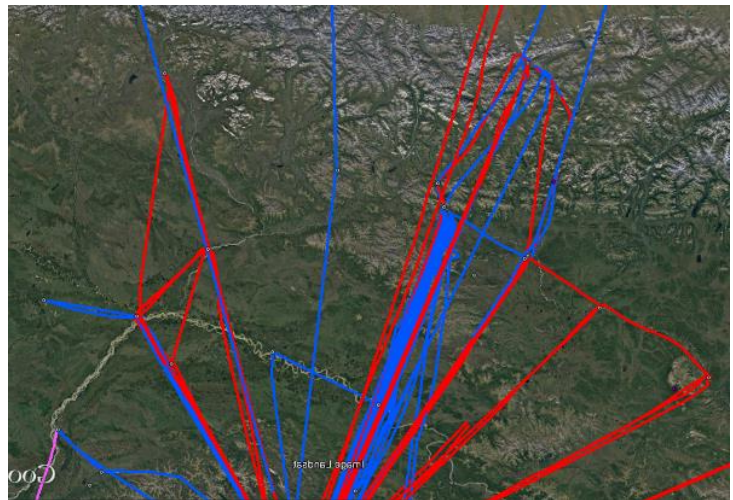
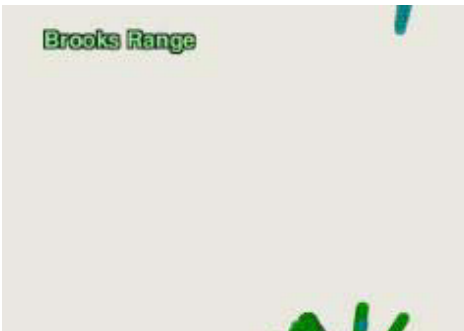
For pilots to get the full safety benefits from ADS-B, additional radio stations are needed to fill major gaps in the current network of radios. AOPA estimates as much as 40% of the state lacks coverage at altitudes commonly used by General Aviation aircraft. To illustrate the magnitude of flight operations taking place outside of ADS-B airspace, data was collected from several Part 91 and 135 operators to document their activities versus the coverage of the current system. Flight tracks were obtained from the Spidertracks or SPOT GPS-based devices installed in the fleet aircraft, some of which were also *ADS-B Out* equipped. In some cases, ADS-B coverage data for below FL180 was provided by the SBS program office for matching timeframes. All flights occurred the fall of 2016. The following examples illustrate some of the differences between the locations these General Aviation pilots operate and current ADS-B coverage, and show significant levels of activity in airspace where no coverage is available.

Northern Alaska Example

The Yukon River Valley and Brooks Range spans the northern half of Alaska and separates Fairbanks, the second largest city in the state, from the North Slope. Scores of flights will access this area over a 24-hour period. Over 80% of communities in Alaska are only accessible by air much of the year. Several Part 135 operators provided their August 29 flight data to allow AOPA to identify gaps in surveillance coverage. The images below show the flight tracks from the over 150 flights that these operators performed that day. Notably, this was not a particularly busy day for these four companies.



FAA coverage on the left; flight tracks from three Fairbanks and one Tok Part 135 operator on the right.



A more detailed look at the central Yukon River and Brooks Range area where the following communities have no coverage: Fort Yukon, Chalkiytsik, Coldfoot, Birch Creek, Bettles, Venetie, Arctic Village, Beaver, Stevens Village, Wiseman, Allakaket, and Hughes.

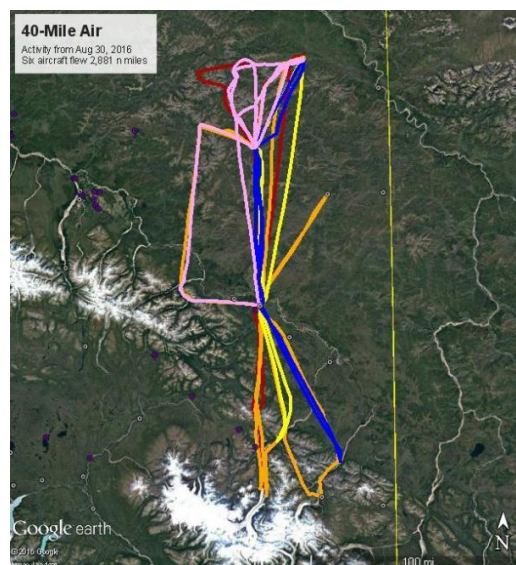
This comparison of ADS-B coverage and where aircraft predominantly fly shows large voids in ADS-B coverage southwest and north to southeast of Fairbanks. These areas would benefit from enhanced surveillance capability given the substantial number of aircraft that fly in this challenging environment. There are certainly more commercial and private operators flying in these gap areas than depicted along with a significant number of military training flights; therefore, increasing surveillance coverage could have a tremendous impact on efficiency and the utility of the air traffic system for low-altitude pilots.

Tok Area Example

The flight tracks provided below illustrate the lack of coverage east of Fairbanks. The Part 135 operator that participated in this study provides scheduled service, medivac, and commercial sightseeing operations.



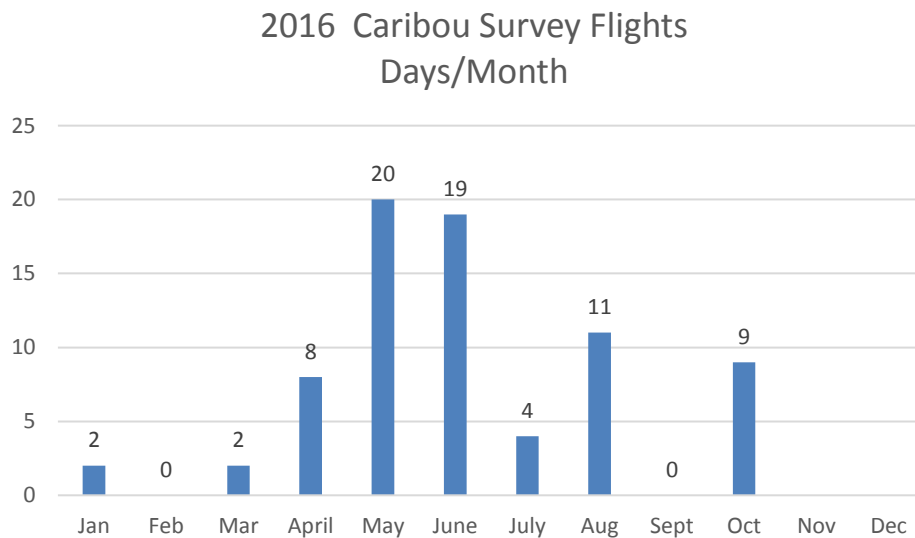
On the left, flight tracks from six Part 135 aircraft that occurred on August 30 are overlaid on an ADS-B coverage map from the previous day. While not on the same day, they show a use pattern more typical of their operations in the eastern interior, which is clearly outside the limits of current ADS-B coverage.



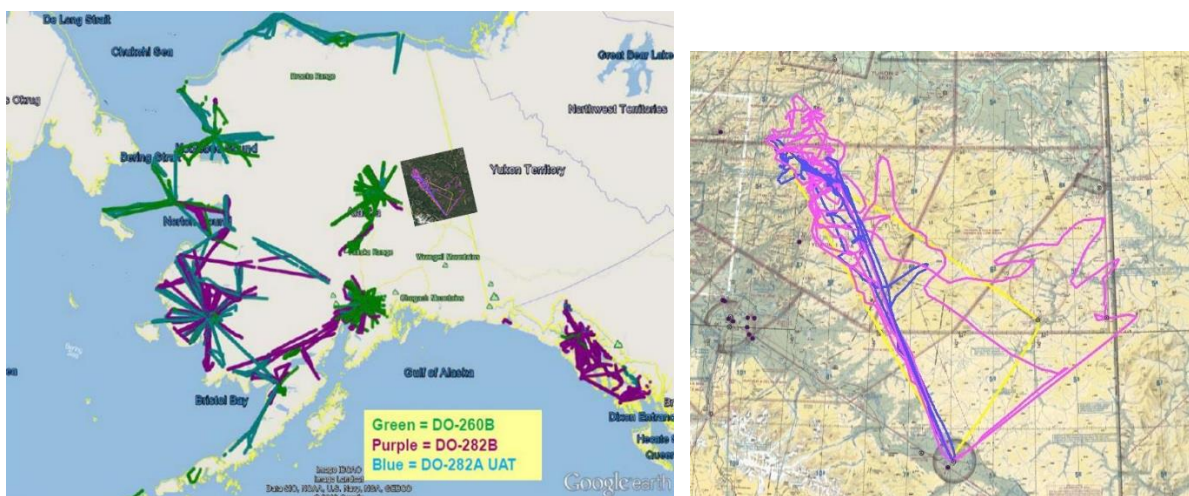
This graphic provides a close-up of the flight tracks which covered nearly 3,000 NMs, providing transportation between communities and field camps in the area.

Another example in the eastern interior shows the lack of coverage and large number of operations that take place west of Fairbanks. This data comes from a commercial operator who is

conducting wildlife surveys. The flight tracks provided are from October 5-7 will all flights occurring outside of existing ADS-B coverage. These flights are conducted under VFR, throughout the year with spring targeting wolves, summer focused on sheep, and fall and winter involved in moose. Caribou survey surveys are conducted during all seasons. The chart below lists the flight days Caribou surveys were flown between January through October in 2016. It is also noteworthy that most of this survey work is flown in Military Operations Areas, used year-around for military flight training. Additional surveillance would be a safety benefit to provide additional situational awareness for this shared airspace.



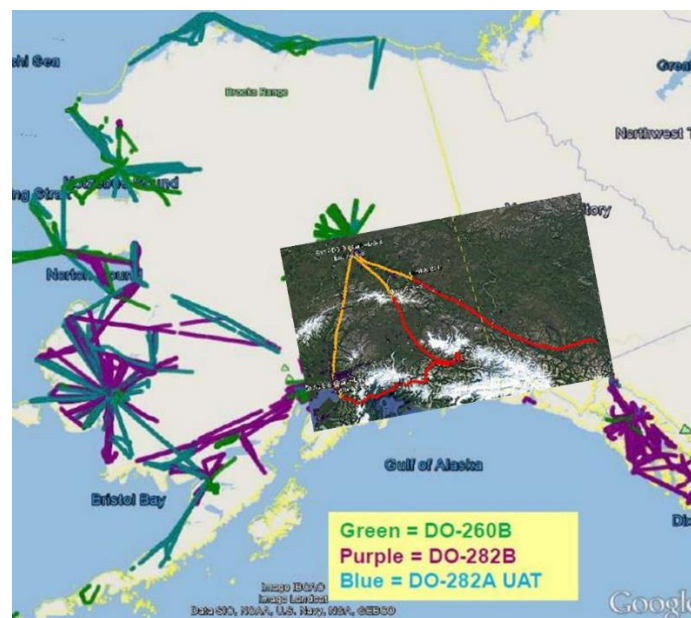
The chart above shows one operators frequency of game survey flights which can be multiplied against the other operators who do similar work.



The game survey flights above occurred over three days in October and were all outside of existing coverage.

Southcentral Alaska: VFR Example

One of the busiest airways in Alaska is the route between the two most populous cities: Fairbanks and Anchorage. Much of this traffic operates under VFR, due to high MEA's and the need to operate at lower altitudes to avoid icing conditions, which may be present much of the year. However, ADS-B coverage is not available along this route at the lower altitudes that General Aviation pilots use to traverse the Alaska Range that separates these cities. Coverage also quickly disappears when flying in the areas of the Copper River Basin, Wrangell Mountains, and the central Gulf of Alaska. In the example below, a Fairbanks based Part 91 pilot, operating a C-177, flew several flights between September 3 and 14. Confirmation reports from the Performance Monitor were used to identify the times his flight tracks were recorded at ADS-B ground stations and within coverage.



The yellow tracks indicate being within ADS-B coverage with the red lines depicting areas where no ADS-B tracks were recorded.

Recommendation 7: The FAA should collaborate with industry to identify areas lacking coverage that have numerous operations and that would benefit from ADS-B coverage. AOPA's examination of coverage in Alaska, conducted in collaboration with several local operators, highlights that substantial aviation activity is taking place outside of coverage. The 2013 Volpe study, *Fuel Consumption of ADS-B and non-ADS-B Helicopter Operations in the Gulf of Mexico*, is an example of the type of investigation that could be conducted for Part 91 and 135 operators in Alaska to quantify the benefits of improved coverage. The Association believes more needs to be done to identify gaps in coverage in CONUS and Alaska and resources directed towards those areas where improved coverage would be most impactful.

Recommendation 8: AOPA believes additional radio sites are necessary for Alaska to have a minimum operational network of ADS-B to improve access and aviation safety, and for pilots to see a value in equipping. The FAA mandated *ADS-B Out* requirement in Rule Airspace will have

little impact on Alaskan operators and likely not drive Alaskan equipage. The Association believes providing the operational and safety benefits of improved coverage for VFR and IFR operators will be important to incentivizing equipage and obtaining greater General Aviation participation. With about 40% of Alaska lacking ADS-B coverage at General Aviation typical altitudes, there could be a positive impact on equipage and reduce accident rates should ADS-B coverage be expanded to a meaningful level.