

A4A

Airspace for All

Airspace4All GA Airfield ATS ADS-B Traffic Display Trial

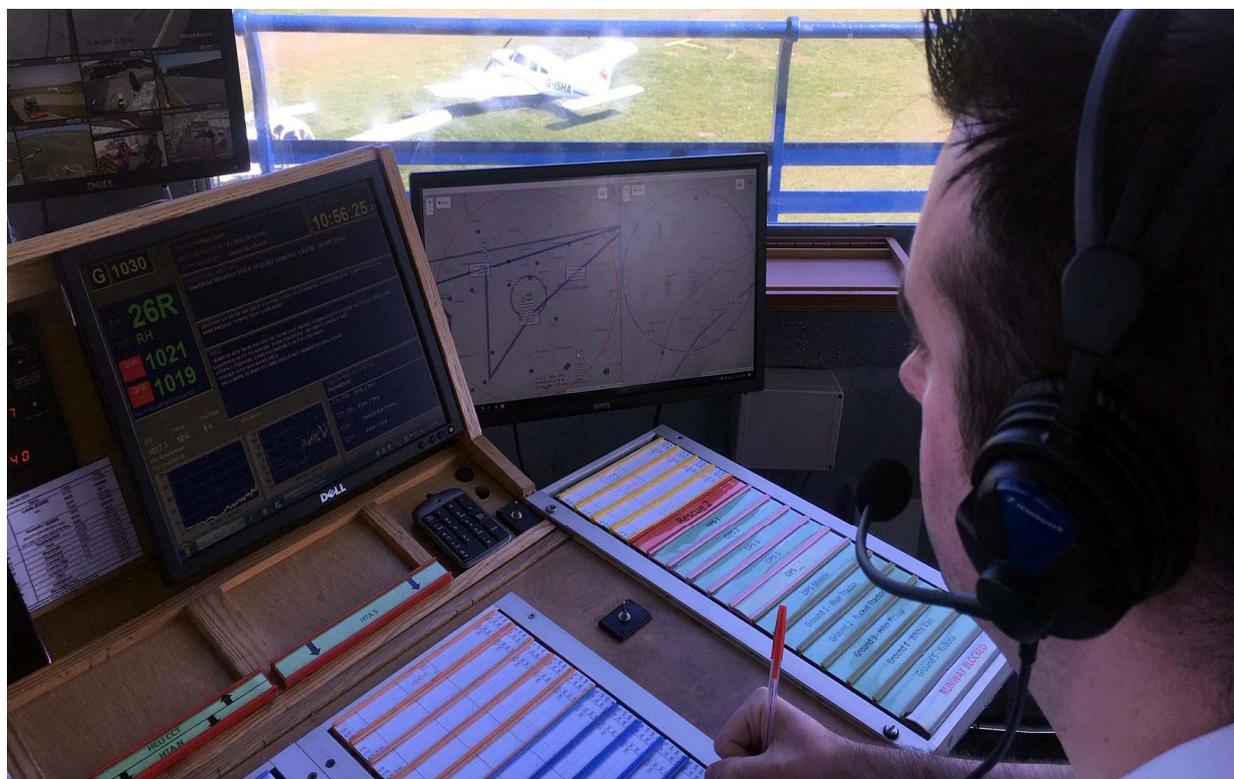
Trial Report Summary

Author: Steve Hutt

Version 1.0

Status: Approved

Published: 02/10/2019



1 Executive Summary

This document reports the findings of the Airspace4All GA airfield ATS ADS-B Traffic Display Trial which sought to test mitigations to the increased risk of mid-air collision that had been identified¹ to occur in airfield traffic circuits and adjacent airspace.

For the 6 month duration of the trial AFIS and AGCS units at three UK GA airfields were equipped with real-time flight tracking equipment that provided a situational awareness tool with the potential to enhance the level of service and thus the safety of aircraft flying in the vicinity of the airfields. The Traffic Display was not used to provide any form of Air Traffic Control service.

The aim of the trial was:

To gather information to assess the use of ADS-B Traffic Displays at GA airfields with a view to future authorisation and to assess the potential to:

- Reduce the probability of mid-air collisions.
- Provide increased situational awareness resulting in a reduction in airspace infringements
- Monitor compliance with local traffic regulations

Additionally, it was expected that this trial would encourage further development and carriage of conspicuity technology to support ATS and AGCS provision at UK GA airfields and to provide aircraft-to-aircraft situational awareness

The trial safety plan and safety case were reviewed and approved by the UK CAA prior to commencement.

ATS and AGCS units provided daily and monthly feedback via online forms. The trial results are based on analysis of this feedback plus direct engagement with the technology and the units concerned.

“Having been a FISO for some 20 years it has been nothing but a positive. It enables me to provide a much better service as a FISO giving me a tool to enhance my own situational awareness.

I can now confidently know where aircraft are and identify relevant traffic information and assist pilots in avoiding conflict”

The ADS-B Traffic Display system is relatively low-cost – some 3% of the implementation cost of a multilateration surveillance system formally trialled elsewhere – making it within the means of virtually all UK GA airfields. Setup is reasonably straightforward, only requiring a modicum of IT expertise.

¹ *Mid-Air Collisions: An Evidence-Based Analysis of Risk – 1975 to 2018; Airspace4All, 24th April 2019*
<https://airspace4all.org/mac-risk-analysis-1975-2018/>



Airspace for All

Airspace4All GA Airfield ATS ADS-B Traffic Display Trial

Trial Report Summary

The ADS-B Traffic Display was reported to be reliable, very accurate and did not constitute a distraction hazard; it was safe to use. It was perceived by a large majority of operators to be a valuable enhancement to their existing tools and procedures, improving situational awareness and service and providing a positive safety benefit to aircraft. It also had a positive effect on ATS and AGCS staff's well-being and confidence. However, achieving the benefits required commitment from airfield management and staff to provide the installation, training and supervision, and an openness to change. Its use raised awareness of the benefits of ADS-B carriage which is already leading to increased aircraft fitment and deployment.

The trial concluded that GA safety would be improved by authorising GA airfield ATS and AGCS units to use ADS-B Traffic Displays. That would require amendment to regulations relating to staff licensing, ATS and RTF procedures and surveillance systems. Bringing ADS-B Traffic Display installation and operation within the means of UK GA airfields would require light and proportionate regulation together with simple and inexpensive start-up procedures.

Limitations caused by range and obscuration of portable ADS-B device transmissions were identified but investigating these was outside the scope of the trial. These need to be understood; this could be done by further work using the existing Airspace4All trial equipment and locations.

Clutter caused by ADS-B devices left on in parked aircraft needs to be resolved by procedures and that and other configuration control measures need to be developed to provide a robust system for further deployment.

Overall, the ADS-B Traffic Display was found to be an effective and economic means of providing accurate and timely traffic information to aircraft at and around a GA airfield. Its installation was welcomed by ATS and AGCS operators.

2 Introduction

Removed for brevity in this summary version of the report.

3 Literature Review

Removed for brevity in this summary version of the report.

4 Methodology

Removed for brevity in this summary version of the report.

5 Trial Results

Removed for brevity in this summary version of the report.

6 Discussion

Removed for brevity in this summary version of the report.

All of the above sections are available in the full version of the report which can be accessed here:

<https://airspace4all.org/reports/report-on-airspace4all-ga-airfield-ats-ads-b-traffic-display-trial/>

7 Conclusions

The trial period at Barton is complete but the CAA has authorised the continued use of the equipment there. The trials at Goodwood and North Weald started later and are still in progress but the results gathered to date are sufficient to complete this report now. Any additional issues that come to light will be issued in an addendum.

This was a 'real-world' long-term trial taking place in fully operational UK GA airfield environments with all the necessary safety-related considerations respected. Although a limitation, this aspect was vital to ensure that if the ADS-B Traffic Display proved successful in the trial it could be deployed on the basis of this work.

7.1 Aim

The aim of the trial was to gather information to assess the use of ADS-B Traffic Displays at GA airfields with a view to future authorisation. It found that:

7.1.1 Safe to Use

The ADS-B Traffic Display was reliable, safe to use and highly accurate in presenting real-time low latency traffic position information for ADS-B equipped aircraft to enhance both ATS and AGCS situational awareness. It was not a distraction safety hazard. It had a positive effect on ATS and AGCS staff well-being and confidence in doing their job.

7.1.2 Range

Mode S ES transponder ADS-B devices displayed well at range up to and beyond the DOC. Portable ADS-B devices were displayed consistently within the range of the ATZ but inconsistently beyond that.

7.1.3 Viability

ADS-B Traffic Display technology, equipment and deployment was manageable within the financial, expertise, staffing and operational constraints of typical UK GA airfields.

7.1.4 ATS Unit Commitment

The benefit accrued from use of Traffic Displays was affected by the degree of commitment from airfield ATS management and staff. It was not simply about training. Openness to new ways of working was essential.

7.2 MAC and Airspace Infringement

In addition the trial was to assess the potential of ADS-B Traffic Displays to:

7.2.1 Reduce the probability of mid-air collisions.

The ADS-B Traffic Display increased awareness of traffic and enabled accurate information on traffic position and altitude to be passed to other aircraft within the DOC of the airfield.



Airspace for All

Airspace4All GA Airfield ATS ADS-B Traffic Display Trial

Trial Report Summary

A side-benefit of the introduction of the ground system was that more aircraft are likely to install ADS-B Out and many of those are likely to also fit ADS-B In which would enable direct aircraft-to-aircraft traffic awareness without necessarily having a ground station in the loop. This would give it utility beyond the coverage of ground systems and where no service is provided.

7.2.2 Provide increased situational awareness resulting in a reduction in airspace infringements:

No event occurred to test the utility of the system in preventing or mitigating an infringement of regulated airspace. However, the system provided valuable awareness of aircraft entering the ATZ without first making contact, enabling safety to be maintained. This suggests that the ADS-B Traffic Display would provide this capability.

7.2.3 Monitor compliance with local traffic regulations:

When there was a need to confirm aircraft were complying with local traffic regulations, the Traffic Display provided helpful assistance.

7.3 Other Relevant Results

The trial identified a number of other results which will be relevant to any future development, authorisation and deployment:

7.3.1 Accuracy

Strong confidence in the accuracy of the system as a whole was achieved by monitoring the accuracy of displayed ground movements on taxiways.

7.3.2 Treat ADS-B Position Data the Same as Pilot Position Reports

Pilot position reports were often less accurate than ADS-B position data. As it is more accurate, ADS-B position data should be treated the same as pilot position reports for the purposes of ATS and ATS giving traffic information.

7.3.3 Separate Displays (Ground/ATZ/DOC)

Separate displays for ground and flight areas (on the same screen) with different scales were very effective and overcame the clutter effect close to the airfield.

Separate displays (on the same screen) with different scales covering the DOC and the ATZ were very effective in separating aircraft symbology close to the airfield whilst maintaining a wider picture of traffic.

7.3.4 Managing Clutter

ADS-B Out from aircraft on the ground, and especially from inactive parked aircraft with portable devices, was found to clutter the display but could be resolved by activating the aircraft transmission only above 30kts or by altitude screening at the ATS display. However, this would need further consideration to determine the optimum arrangement and its consequences.



Airspace for All

Airspace4All GA Airfield ATS ADS-B Traffic Display Trial

Trial Report Summary

7.3.5 Raising General Awareness of ADS-B

The trial has raised the general awareness of ADS-B in the UK GA community. Since the trial began there has been an increase in independently funded installations of ADS-B into aircraft based at Barton.

7.3.6 Incentive for Operators to Equip with ADS-B

The knowledge that the airfield ATS/AGCS unit had an ADS-B Traffic Display appears to incentivise operators to equip their aircraft with ADS-B.

7.3.7 Standard Display Configuration

The Traffic Display is highly configurable and whilst this provided flexibility during the trial, there is a risk that operational installations could be reconfigured to different operators' personal wishes which may become confusing. If the system is to be deployed operationally, a standard format configuration could be prepared.

7.3.8 No Safety Issues Found with Simultaneous Mode S/CAP1391 Transmission

Simultaneous transmissions by a Mode S transponder and a CAP1391 portable ADS-B in the same aircraft did not produce any false or confusing data on the Trial Display.

8 Recommendations

At the outset, the object of the trial was to provide the CAA with evidence on which to base a review of potential ADS-B deployment at GA airfields. This report sets out that evidence but makes no recommendation as to the CAA decision. However, if the CAA decides to progress this area of policy the following considerations, which were highlighted during the trial, may be relevant:

8.1 ATS Unit Approval

The work needed to obtain CAA approval to proceed was substantial and most GA airfields are unlikely to be equipped to prepare the necessary documents and procedures. Neither are they likely to be able to afford to pay for such work. If deployment is to be encouraged a standard set of documents would need to be made available and a standard and low-risk approval process set up. Airspace4All Ltd has the expertise and experience to prepare this material.

8.2 Intermittent Loss of Signal from Portable Devices

Intermittent loss of signal from aircraft equipped with portable ADS-B devices has an impact on ground station displays and on other aircraft equipped with ADS-B In. This is likely to be due, in the main, to obscuration by aircraft structure and crew and will vary with aircraft configuration, device position, range and aircraft orientation to ground antenna. This will affect the safety and operational benefits delivered by the system. This issue is expanded further in Appendix A.

If it is decided to deploy ADS-B in any form, this issue needs to be quantified. Airspace4All has the experience and access to the equipment needed to carry out the measurements necessary to understand and mitigate this issue. A follow-on investigation would be required.

8.3 AGCS & Traffic Information

Airspace4All is aware that consideration is being given to limiting what information may be passed to aircraft by an AGCS operator. Currently they can pass traffic "information based primarily on pilot reports", a phrase that does not exclude information from other sources which could include ADS-B Traffic Displays. ADS-B position data has been shown to be highly accurate and often far more accurate than pilot position reports. Most GA airfields operate an AGCS at the most and would not have the resource to change to an AFIS.

It would be unfortunate if in the future they were not able to utilise a safety system that is available to them today.

Appendix A

Portable ADS-B Devices

The trial exposed issues regarding pilot use of CAP1391 portable ADS-B devices that had a negative bearing on the ATS use of the Traffic Display. These airborne device usage matters are beyond the scope of this trial but are reported here for completeness. Feedback which illustrate this related to inappropriate usage and positioning:

- poor positioning of the device in the aircraft
 - resulting in 'shielding' or 'masking' of the signal (both in and out) by the airframe and poorer reception on the Traffic Display
- omitting to charge devices before use
 - resulting in no signal or loss of signal during flight
 - occurring on first flight in morning – not charged overnight
 - occurring later in day – poor battery management during the day
- not switching the device off when parked on the ground
 - resulting in 'clutter' on the Traffic Display screen and possibly loss of signal during subsequent flights due to loss of battery power
- not switching the device on
 - even when available for use in the aircraft
 - more prevalent in flying school and syndicate/group owned aircraft
- difficulty seeing the status led lights or accessing the on/off switch
 - this affected older units and resulted in uncertainty about the state of the device and the need to recycle (reboot) them to maintain contact.
- Using a device programmed with information for the 'wrong' aircraft
 - E.g. in flying school/club environments with multiple aircraft and multiple devices where the device taken flying is not the one programmed for the aircraft being flown.

It might be anticipated that these issues may be resolved with informal advice/education, experience and familiarity with using the system. However, it is clear that portable devices can be a poor fit for shared use aircraft such as those operated by flying schools and syndicate/group owned aircraft. These tend to be relatively higher utilisation aircraft where the benefit of ADS-B Out is consequently greater. For such aircraft a permanently installed Mode S ES ADS-B Out transponder/GPS combination is a better option as this would address all the above issues.

"The pilot of G-YZAB came up to the tower and we found the cause may be down to the device being mounted upside down on the roof of the aircraft meaning it was struggling to maintain GPS signal. The pilot will reposition the device and see if the issue is resolved"



Airspace for All

Airspace4All GA Airfield ATS ADS-B Traffic Display Trial

Trial Report Summary

"G-CDEF took the wrong device and showed as G-GHIJ, the pilot was advised and shut down the device before departure"

"G-KLMN departed and soon stopped showing on the TD. Unit not fully charged prior to departure. Instructor attended the tower after landing to say the unit had stopped working after departure and believes it wasn't charged properly prior to departure"

"G-OPQR (PA28 X Flying School) reported his ADS-B device had not been charged - so non ADS-B equipped"

"One helicopter today (not one with the loan devices but a visitor) was observed on the ground for several hours, even though it was parked and unattended, perhaps indicating a device or something was left transmitting. This adds a little clutter to the display"