


Response to CAP 1776 Electronic Conspicuity - a call for evidence and future plans - including views gathered at the Share the Air Conference (June 2019)

CAP 1837

A large, abstract graphic composed of overlapping blue and purple shapes, primarily a large blue trapezoid with a curved bottom edge, set against a white background.

Published by the Civil Aviation Authority 2019

Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

You can copy and use this text but please ensure you always use the most up to date version and use it in context so as not to be misleading and credit the CAA.

Published August 2019

Enquiries regarding the content of this publication should be addressed to: esr@caa.co.uk

The latest version of this document is available in electronic format at: www.caa.co.uk

Contents

Contents	3
Executive Summary	4
Introduction	5
Call for Evidence	6
Questions asked	6
Responses	6
Comments	10
Analysis of Asks and Concern Themes by Sector	13
Evidence	14
Mentions of Technology	15
Share the Air	16
Draft Problem Statements	16
Draft Guiding Principles	17
Draft Vision	17
Draft Challenges	17
Responses to Share the Air questions	18
Feedback against “What do you think of guiding principles?”	18
Feedback against “What do you think of our vision?”	18
Feedback against “What do you think of the potential challenges?”	18
Feedback against “What have we missed?”	19
Feedback against “Tell us your feedback on engagement?”	19
Conclusions	21
Next Steps	22

Executive Summary

This document summarises the feedback received from both the Call for Evidence titled “Electronic Conspicuity – a call for evidence and future plans” and the “Share the Air” conference.

This feedback demonstrated there is an appetite within the aviation community to engage with Electronic Conspicuity (EC). However, this is qualified by a desire for any EC solution to be practical and deliver value to the users. Whilst the transmit, receive and re-broadcast approach to EC to internationally accepted standards should offer the greatest safety benefits to users, it is noted that a flexible approach is needed suitable to the circumstances of particular categories of aviation.

A key principle for EC to be effective, is that each aircraft should be conspicuous to all other relevant airspace users. It is acknowledged that there are several non-certified EC solutions in operation providing active assistance in collision avoidance. The CAA does not wish to see any existing solutions becoming prematurely obsolete. However, there is a need for interoperability, so that all airborne solutions provide a satisfactory level of conspicuity both to other aircraft and ground-based services with a legitimate interest in flight safety.

It remains the CAA’s intention to bring forward proposals to require EC where its use reduces the likelihood of mid-air collisions and where such mid-air collisions are a serious risk to those people either engaged in flying or on the ground. EC is viewed as a means to enable the UK to take advantage of the opportunities that might be presented by new technologies, but at the same time allow the volume of commercial air transport to increase efficiently whilst enabling recreational aviation to continue to enjoy the activities they favour.

The CAA has announced its intention to facilitate a proof of concepts trial during the first half of 2020. The precise details of the trial are being developed at the date of this report and will be published separately. The CAA’s ongoing technical work into performance requirements, and the outputs from the trial previously mentioned, will inform a comprehensive framework of EC requirements, which will underpin our recommended strategy to Government. We fully expect that each major deliverable in the path towards an EC environment will be subject to a full public consultation.

Introduction

This document summarises the feedback received from both the Call for Evidence titled “Electronic Conspicuity – a call for evidence and future plans” and the “Share the Air” conference. The CAA’s view is that Electronic Conspicuity (EC) will be the means to allow greater use of the finite resource of UK airspace, which may include widespread use of unmanned aircraft but without reducing safety. This document reports the progress of public engagement by the CAA on developing EC. It indicates the CAA’s conclusions drawn from the often-conflicting views expressed, and outlines the next steps to be taken towards the universal adoption of EC.

On 18 March 2019, the CAA published “Electronic Conspicuity – a call for evidence and future plans”. This call for evidence closed on 25 May 2019.

EC is one of the most important recent airspace modernisation initiatives because of its potential to deliver safety benefits and save lives by reducing the likelihood of mid-air collisions and airspace infringements.

By ensuring the full adoption of EC solutions to enhance situational awareness in targeted blocks of airspace, the aviation sector can transform its approach to integrating different types of operation and lay the foundations for new users like unmanned aircraft systems (UAS) to operate in an integrated airspace environment.

Full adoption means all users operating in a designated block of airspace can be detected electronically in the air or on the ground to a prescribed level of accuracy and reliability.

The CAA hosted a conference entitled “Share the Air” on 27 June 2019 at the Royal Aerospace Society. The purpose of the conference was to discuss:

- The opportunities presented by new technology
- The risk introduced through expanding and conflicting demand for the use of airspace,
- The challenges of ensuring that expanded uses of airspace will not lead to a reduction in safety.

The purpose of this document is to present the answers to the questions posed by the CAA and collate the views expressed within both the call for evidence and at the Share the Air conference.

Call for Evidence

Questions asked

Prior to the specific questions, respondents were asked to identify themselves, provide their contact details to receive responses and to help us categorise the basis of their response and their interest. This information has assisted the CAA to contextualise responses and understand common themes held by different aviation communities within the wider body of external stakeholders.

Respondents were asked the following closed questions:

Q1 Should the CAA act to coordinate the adoption of interoperable EC solutions in targeted blocks of airspace?

Options were Yes, No, Don't know

Q2 Do you agree with our strategy to coordinate the full adoption of interoperable EC solutions in targeted blocks by using location specific mandates?

Options were Yes, No, Don't know

Q3 What EC functions should the CAA focus on when coordinating adoption?

Options were Transmit only, Transmit and receive, Transmit, receive and rebroadcast and A combination depending on the need.

Respondents were asked the following open questions allowing a free textual response:

Q4 What evidence should be used?

This question considers whether the best available evidence is being used and if there is anything that could be done to improve the data available to decision makers.

Q5 Have all the options been considered?

This question considers whether there are other approaches that could also be considered.

Q6 Do you have any specific feedback on the suggested approach?

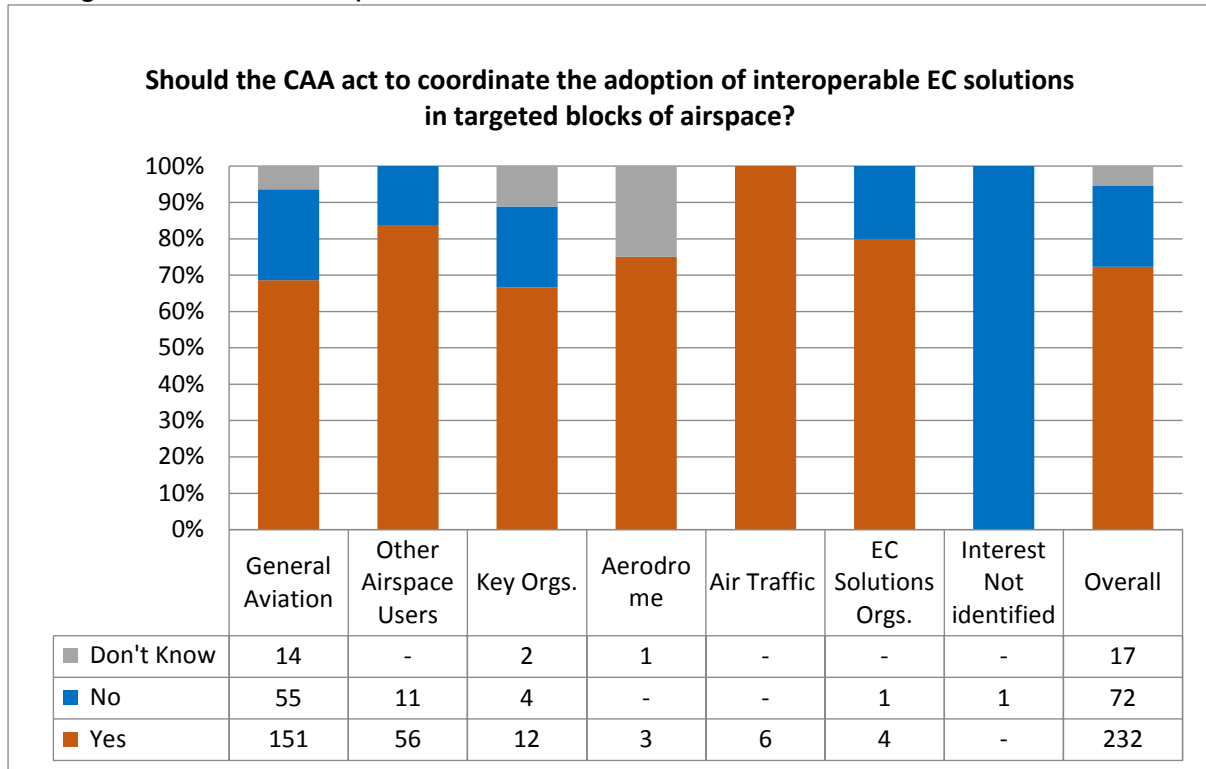
This question aims to gather feedback from stakeholders on the scenarios presented in Part 2 (of the Call for Evidence), the technical functions for EC solutions outlined in Part 3 (of the Call for Evidence) and our suggested approach to coordinating deployment proposed in Part 4 (of the Call for Evidence).

Responses

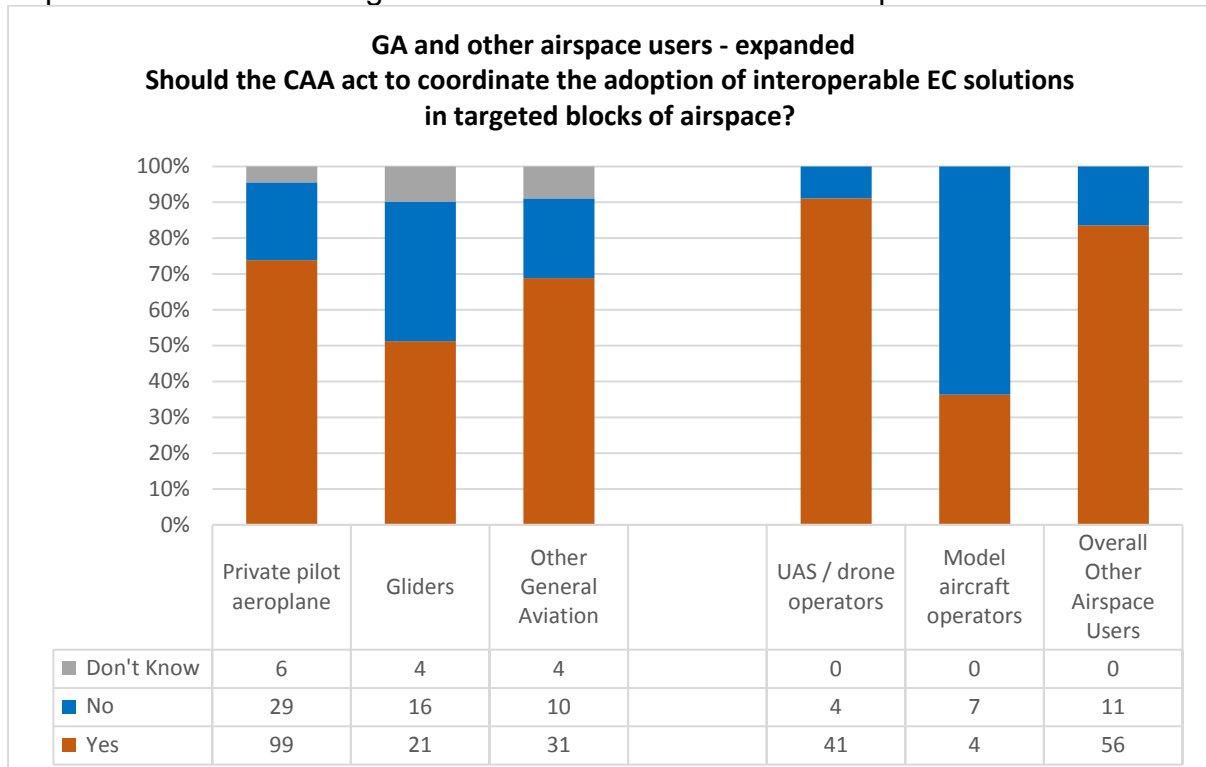
We received 327 responses. The CAA wishes to thank everybody that responded for taking the time and effort. Discrepancies between the total displayed and 327 responses arise from questions not being answered.

Based on the pre-eminent aviation interest of respondents, the headline results to the closed questions were as follows:

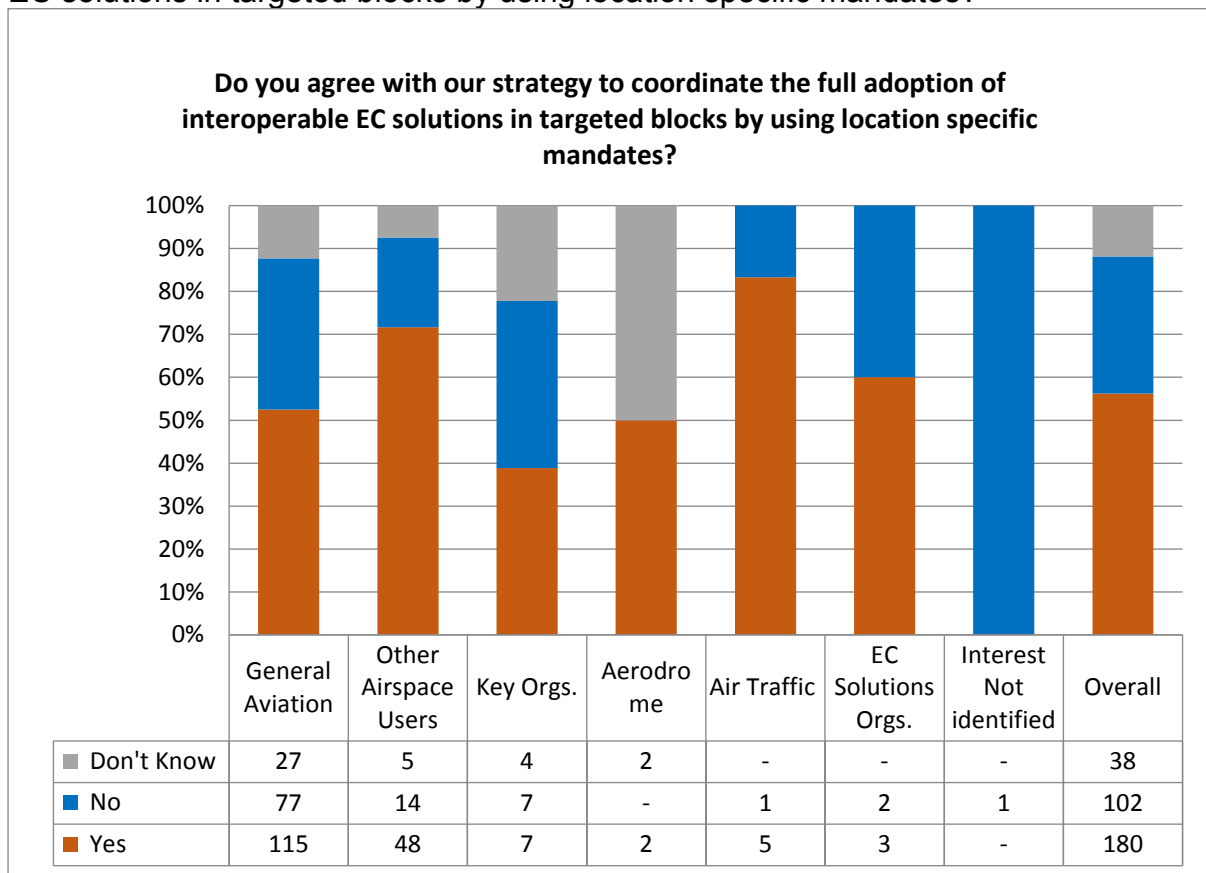
Q1 Should the CAA act to coordinate the adoption of interoperable EC solutions in targeted blocks of airspace?



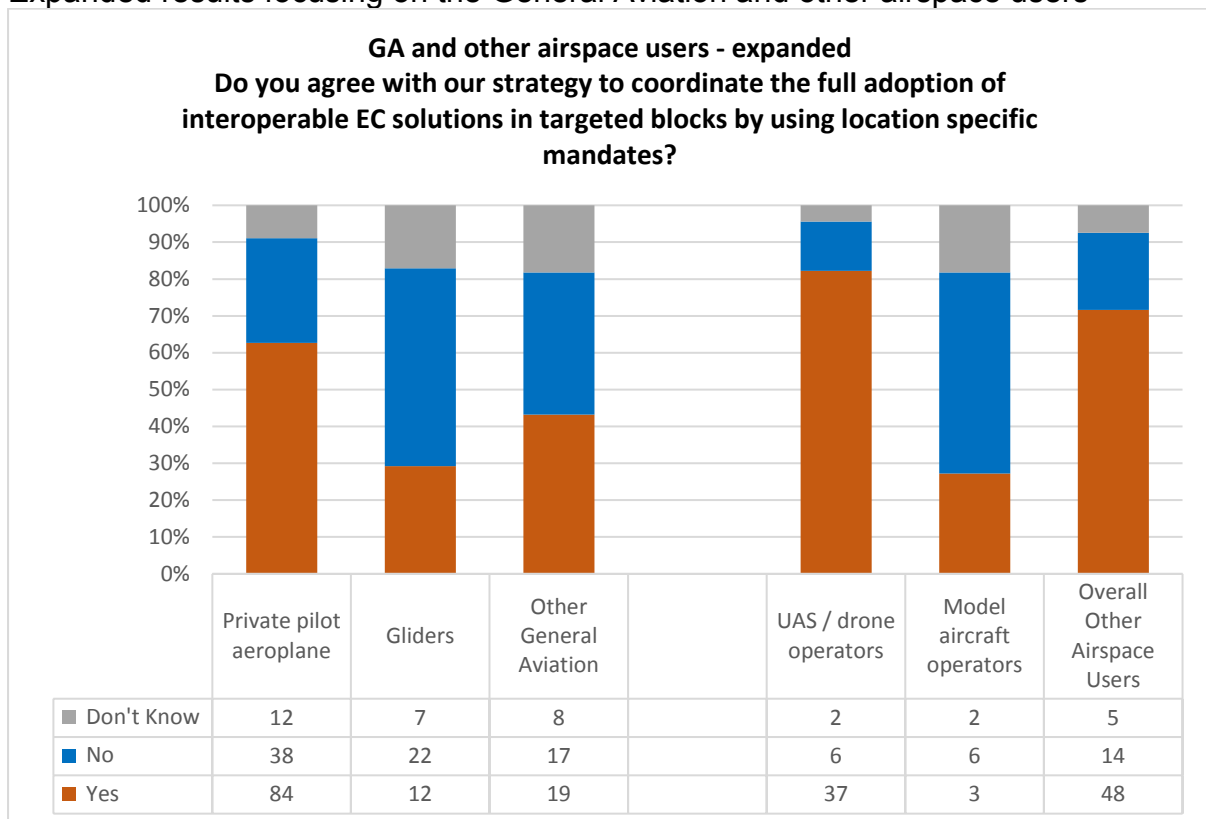
Expanded results focusing on General Aviation and other airspace users



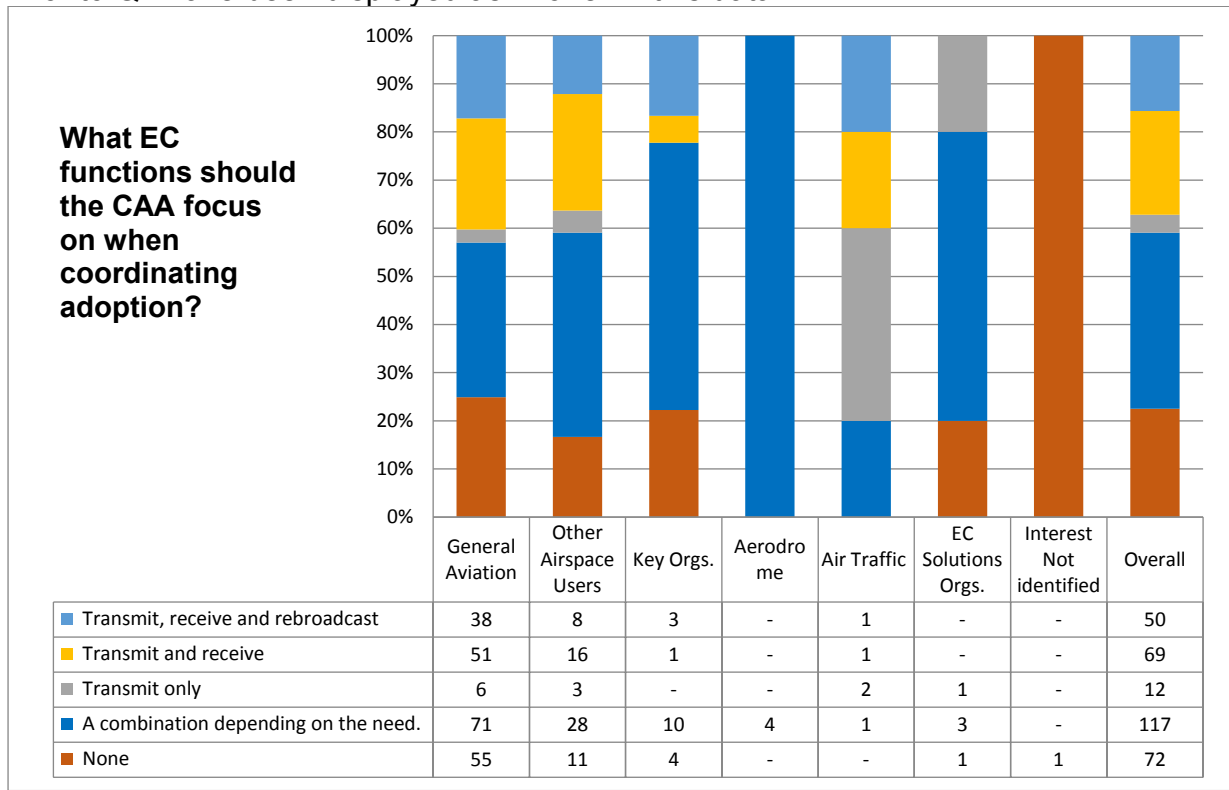
Q2 Do you agree with our strategy to coordinate the full adoption of interoperable EC solutions in targeted blocks by using location specific mandates?



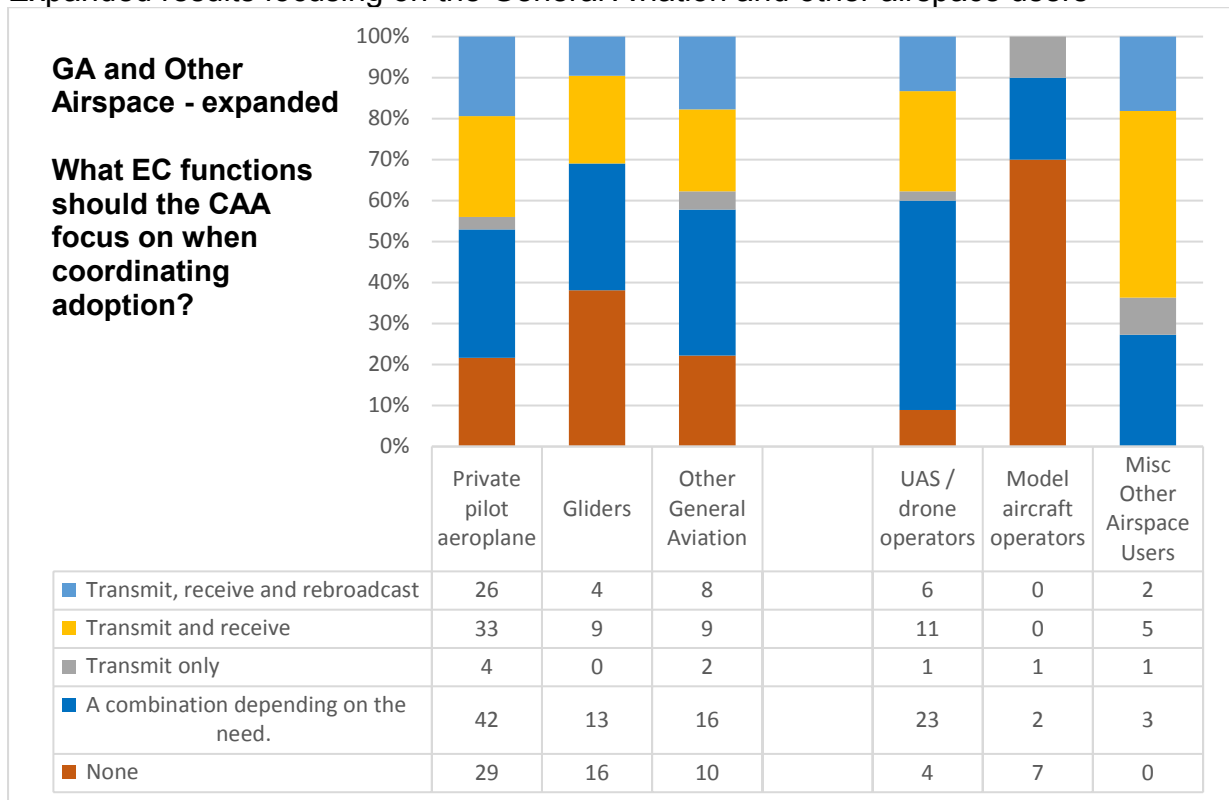
Expanded results focusing on the General Aviation and other airspace users



Q3 What EC functions should the CAA focus on when coordinating adoption?
 Note, there was not a “None” option for this question, but those who responded as “No” to Q1 have been displayed as “None” in this data.

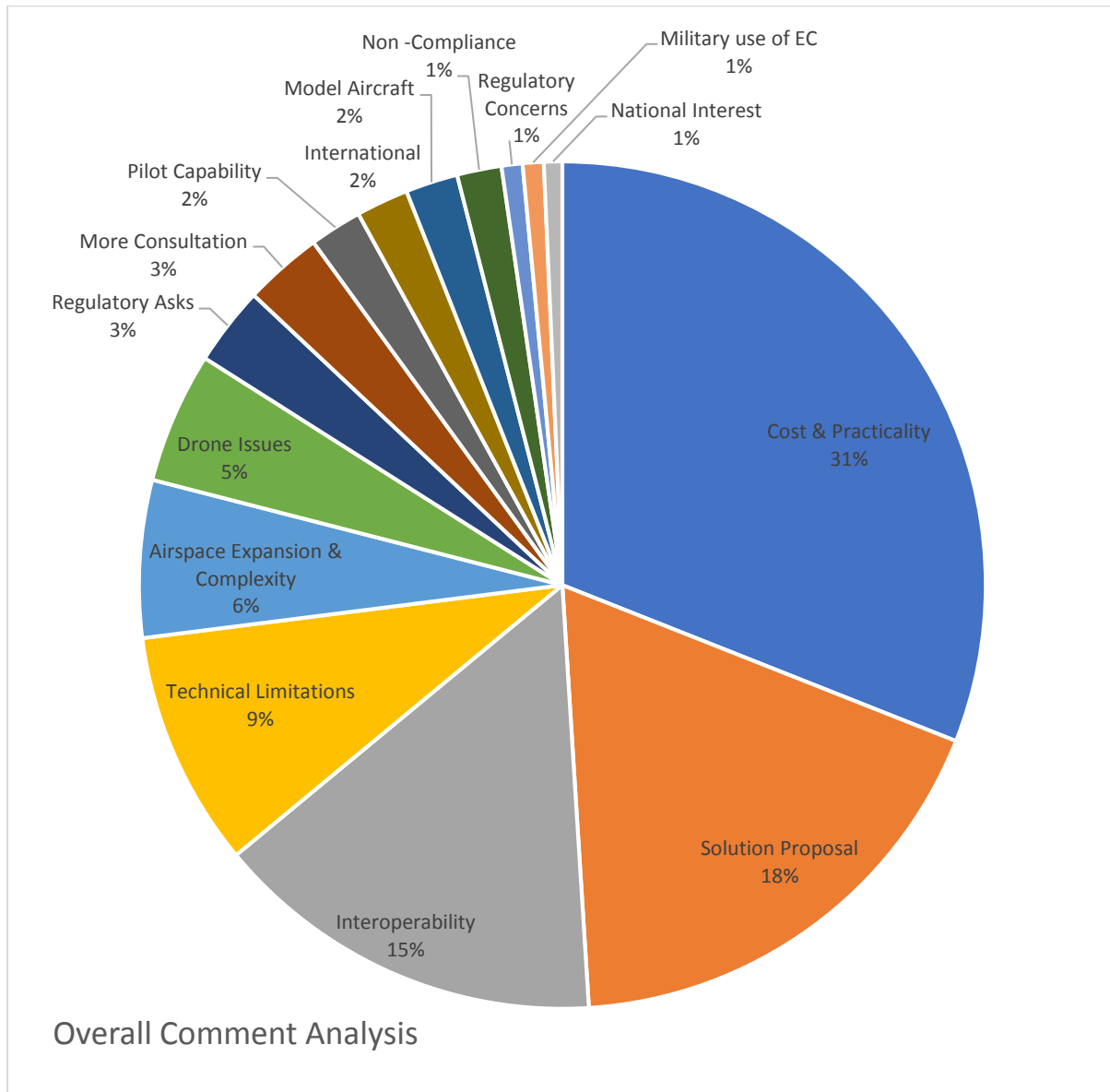


Expanded results focusing on the General Aviation and other airspace users



Comments

The three free text questions (Q4 – Q6) elicited a considerable number of responses. From the 327 responses to the call for evidence, in the initial analysis 751 specific themes covering asks and concerns, have been identified. These themes have been grouped for ease of consumption. Percentages represent the proportion of themes grouped under this heading.



Concerns - Cost & Practicality (31%)

The most prominent theme was about the cost and practicality of EC requirements including specific practical concerns for all categories of General Aviation (GA), wider funding concerns and querying value delivered for the outlay. These refer to the cost burden of introducing mandatory requirements beyond existing equipment levels and issues surrounding power consumption, size, weight and installation, particularly for the lightest categories of aviation. Other comments in this group referred to prior investments made within the GA community, specifically earlier CAA requirements to add Mode-S transponders and the widespread adoption of useful but non-certified EC

solutions (See section “Mentions of Technology”). Some commented that further expenditure on EC would not deliver value to GA, but would enable more complex drone operations and hence the costs should not fall onto GA.

Asks - Solution Proposals (18%)

The second most prominent theme related to solution proposals. This included requests to make EC mandatory, although this covered different mandatory levels and technology options. Within this group were a variety of suggestions of both technology and procedural approaches that should be considered in developing EC policy. Also included in this group were requests for “no change” to be an option.

Concerns – Interoperability (15%)

The next most common concerns were about interoperability of the available EC solution. At present there are several existing systems in place. To be workable, everything transmitting needs to be conspicuous to the relevant people and systems receiving.

Concerns – Technical Limitations (9%)

Concerns were raised about the technical limitations of solutions. The concerns related to the available frequency capacity, specific points against ADS-B as a solution, the potential longevity of a solution, reliability of signals in relation to jamming, issues of simultaneous transmission of Mode S and ADS-B and installation issues around portable equipment.

Concern – Airspace Expansion and Complexity (6%)

Concerns were raised about the impact on GA’s access to airspace. This included the expansion of controlled airspace and, the complexity of airspace. There was a view that the proposals are too focused on the requirements of Commercial Air Transport (CAT).

Asks – Drone Issues (5%)

There was a grouping of themes around drones. Within this, there were two significant groups, the first highlighting the potential benefits EC could unlock in permitting drone operations to expand. The second was looking for measures to ensure separation of drones from manned flight. A specific point was made about drone operations over cities and the interaction with helicopter emergency services aircraft.

Asks – Regulatory (3%)

There were a number of requests in relation to regulation and the regulatory process. Most significant is the call for urgent action by the CAA. However, there are also requests for due process to be observed, including exercises of cost/benefit analysis, regulatory impact assessment and a safety case. There are pleas both for a light touch regulatory approach and clarification on scope.

Asks – More Consultation (3%)

There is a theme calling for more consultation. A large number called directly for a full public consultation prior to any requirements being mandated. Additionally, there were requests for an opportunity to query assumptions that mandating EC will bring about improvements in safety.

Concerns – Pilot Capability (2%)

Several themes related to pilot capability, specifically the human factors and workload that EC data may introduce. This included comments about over reliance on technology and degradation of lookout.

Asks – International (2%)

A collection of themes commented on the international dimension of EC. This included calls for international standards and agreement and learning from experience other regulators may have gained in introducing EC.

Asks – Model Aircraft (2%)

A few themes concentrated on matters related to model aircraft and included requests that the practical needs for model aircraft are included in any requirements and the possibility of ground-based fixed position equipment is considered.

Concerns – Non-compliance (2%)

This group of concerns focused on a point that EC requirements will not tackle determined malicious operations and it will not be practical to enforce compliance on drones.

Concerns – Regulatory (1%)

Several comments raised concerns about the CAA being biased to a solution and this being a conflict of interest. Also included in this group is a concern about the unintended consequences of requiring EC.

Concerns – Military use of EC (1%)

Concerns were raised that the military may choose not to comply which would undermine the whole approach. Others voiced concerns that the EC data might provide data that could be of use to individual and state actors hostile to the UK.

Asks – National Interest (1%)

There were comments that reflected the wider benefits to the UK that would arise from EC, including the improved ability to enforce regulations.

Analysis of Asks and Concern Themes by Sector

Ask or Concern	General Aviation	Other Airspace Users	Key Orgs.	Aerodrome	Air Traffic	EC Solutions Orgs.	Not Identified	Overall
Cost & Practicality	34%	31%	17%	17%	35%	17%	0%	31%
Solution Proposal	16%	20%	19%	0%	25%	33%	50%	18%
Interoperability	17%	3%	23%	33%	5%	17%	0%	15%
Technical Limitations	10%	2%	12%	0%	5%	0%	0%	9%
Airspace Expansion & Complexity	6%	3%	4%	17%	20%	8%	0%	6%
Drone Issues	2%	14%	9%	33%	5%	0%	0%	5%
Regulatory Asks	3%	2%	6%	0%	5%	0%	25%	3%
More Consultation	3%	1%	2%	0%	0%	8%	0%	3%
Pilot Capability	3%	0%	4%	0%	0%	0%	0%	2%
International	2%	2%	0%	0%	0%	8%	0%	2%
Model Aircraft	0%	9%	0%	0%	0%	0%	0%	2%
Non - Compliance	1%	6%	0%	0%	0%	0%	0%	2%
Regulatory Concerns	2%	0%	1%	0%	0%	0%	0%	1%
Military use of EC	0%	4%	0%	0%	0%	0%	0%	1%
National Interest	0%	2%	2%	0%	0%	8%	0%	1%

Evidence

From the 327 responses to the call for evidence, in the initial analysis 170 specific themes covering thoughts on the evidence to be considered have been identified. Percentages represent the proportion of themes grouped under this heading.

Existing Data (37%)

Make use of existing sources of data, such as airproxes (where EC assisted in avoiding a collision), infringements, drone misuse and independent sources such as the British Gliding Association (BGA) Ladder gliding competition data.

Stakeholder Survey (19%)

Additional to trials, the full range of stakeholders should be surveyed, to discover current equipment levels, potential increases in demand and the views on proposals. This would include GA membership organisations.

International Experience (17%)

Seek out the views and experience of other European countries and the USA.

Trial Data (11%)

The CAA trial data collected should include size and type of aircraft, speed, position, interference, traffic volumes, density and other physical characteristics.

Technical Analysis (6%)

Broad technical analysis should be undertaken using the data collected. This would include potential for congestion of frequencies, issues of security and analysis of the cost and benefits.

Risk Analysis (6%)

Evidence should include the quantification of risk reductions from the use of EC.

Previous Trials (3%)

The evidence gathered in the CAA trial should be viewed alongside that gathered from previous trials.

Mentions of Technology

Within the comments made by respondents to the call for evidence, there were many mentions of specific technologies. The top eight technologies mentioned were FLARM, ADS-B, PilotAware, OGN, Mode S, TCAS, SkyEcho and SkyDemon. The respondents mentioning these technologies are analysed below:

Group	Number of Responses	FLARM	ADS-B	PilotAware	OGN	Mode S	TCAS	SkyEcho	SkyDemon
Overall	327	63 19%	62 19%	39 12%	15 5%	14 4%	5 2%	5 2%	5 2%
GA PPL(A)	135	22	34	22	7	9	2	4	4
GA Gliders	42	26	9	6	6	1	0	0	0
GA Microlights	24	5	7	8	1	0	0	0	0
GA Others	21	3	3	1	0	2	1	1	1
Other Airspace Drones	45	1	1	0	1	0	0	0	0
Other Airspace Models	13	0	0	0	0	0	0	0	0
Other Airspace Other	11	1	2	0	0	0	1	0	0
Key Orgs.	18	2	1	2	0	1	1	0	0
Aerodromes	4	1	0	0	0	1	0	0	0
Air Traffic	6	1	2	0	0	0	0	0	0
EC Solution Orgs.	4	1	3	0	0	0	0	0	0
Not Identified	3	0	0	0	0	0	0	0	0

Share the Air

The presentations given at the “Share the Air” conference highlighted that airspace is a finite and national resource. Currently, traffic deconfliction in uncontrolled airspace is managed primarily through lookout, air traffic services and a mix of temporary and permanent segregation based on prohibitions or restrictions for a location and height. The key points made were:

- Demand on this finite resource is growing continually.
- New entrants, such as unmanned aircraft systems, are now using uncontrolled airspace and will continue to do so, with operations growing on average by 25% per year.
- We expect other new entrants such as electronic vertical take-off and landing aircraft to start serious operations by around 2023 to make demands on both controlled and uncontrolled airspace.
- We expect to see the introduction of space flight in the UK in the near future, leading to requests on both controlled and uncontrolled airspace.
- An increase in requests for controlled airspace through airspace changes which impacts the current size of uncontrolled airspace.

At the conference a session was devoted to electronic conspicuity. **The following 4 discussion areas were presented by CAA:**

Draft Problem Statements

- Safety: Can we continue to rely on segregation as the key safety mitigation for innovative UAS operators? Request for temporary danger areas from unmanned aircraft system operators is up by around 200% impacting on other users of that airspace.
- Safety: Can we continue to rely on see and avoid as the key safety mitigation for uncontrolled airspace? Will this provide the same high safety standard with these increasing numbers? 2018 saw 319 reported airprox, 138 of were reported as involving Drones Corresponding numbers for drones in 2017 were – 272 (112 reported drone involvement)
- Efficiency: Can we continue to provide efficient access to uncontrolled airspace for the users that want to use it?

The CAA believes electronic conspicuity is a key mitigation to the above. It could enable further integration of unmanned aircraft systems without segregation as the main safety mitigation and could enable increased numbers in areas of airspace making use of the resource more efficiently.

Draft Guiding Principles

Based on the feedback from the call for evidence, CAA believes:

- There is general support for this work, some uncertainty around the CAA's role.
- Our approach needs to recognise different available technologies.
- Our approach needs to be flexible to meet local demand.
- There is some uncertainty about mandating location specific areas.
- GA is a diverse group and we need to recognise their differing needs.
- UAS cannot see and avoid, UAS need the capability to sense and avoid.
- Continued segregation is unsustainable.
- We will continue to require research, help from industry and an agile strategy.

Draft Vision

- We are working towards a fully coherent solution to realise the maximum number of benefits.
- The first step us developing our strategy (based largely on the call for evidence feedback and feedback we have to date) is to test whether multiple systems could be used, however, in our view the core of such a solution is ADS-B.
- Equally, in our view we need to start with targeted blocks of airspace based on evidence gathered about the risks and potential benefits.
- A system utilising different technologies is dependent on interoperability, there are many ways to achieve this – our work will explore this.

Draft Challenges

- How we define interoperability
- Frequency saturation – we need confirmation of 1090MHz ability to support future demands in the short, medium and long term.
- We need a methodology for identifying key volumes of airspace that should be considered for adoption.
- Understand and set appropriate system level cost of ground and air infrastructure required for integration.
- Availability of sufficient aircraft addresses to be allocated to additional aircraft in uncontrolled airspace.

The following questions were asked:

- What do you think of guiding principles?
- What do you think of our vision?
- What do you think of the potential challenges?
- What have we missed?
- Tell us your feedback on engagement?

Responses to Share the Air questions

Feedback against “What do you think of guiding principles?”

The approach should be to collaborate before mandate, be proportionate to risk, be agile, and recognise the diversity of general aviation. Different technology options should be considered, the UAS sense and avoid point is well founded and technology should offer backwards compatibility. Current segregation in airspace is unsustainable. Either the CAA should lead, or the CAA should just set the framework and allow others to lead.

Feedback against “What do you think of our vision?”

There was concern that the vision CAA presented was unclear and perhaps providing mixed messages around ADS-B. Although an important technology, the vision should not be restricted to ADS-B; there were concerns that solutions should provide international compatibility, the vision should reference quality of EC data, consider the successors to ADS-B, support technical innovation and look at alternatives to electronic conspicuity.

The vision should articulate that airspace should be open and fully integrated to maximise access. Additionally, it should emphasise a risk-based approach, with incremental delivery, feature light-touch regulation and require minimal air traffic management. The vision should look to enable activity, both those conducted now and those enabled by technological development, such as Beyond Visual Line of Sight (BVLOS) UAS operations. Further, the vision should emphasise the benefits both to airspace users and the wider public on the ground. Primarily, these are safety benefits within increasingly crowded airspace, but also environmental benefits and improving access to airspace. It should consider data privacy and security.

Feedback against “What do you think of the potential challenges?”

Technology will be a major challenge and will need to address spectrum concerns. A range of technologies and innovations should be considered along with necessary levels of integrity required. The landing and take-off phases of flight for emergency operations helicopters needs to be considered.

The human factors challenge must be considered in the use of EC data, taking the perspectives of all stakeholders, covering overload, potential false confidence, issues related to congestion at low level and the reality that people will not always read safety information such as NOTAMs (Notice to Airmen). Where systems supporting EC are not fully automatic, ease of use should be a high priority.

EC will undoubtedly come at a cost. There will be challenge on how to meet those costs. Associated to this, there are challenges to enabling EC for existing aircraft and flights where there is no electrical system.

The demands of introducing EC and the associated airspace change will create a resource challenge for the CAA. The CAA must make full use of the trials, determine what EC is expected to do and where, and ensure EC is consistent and aligned with airspace modernisation. Military exemptions are expected and the limit of these must be agreed. Regulation changes will need to incorporate UAS into rules of the air and ensure there is a realistic capability for enforcement.

A significant challenge will be bringing along aviation stakeholders that do not feel they receive a direct benefit from EC. This will involve the balancing of commercial and recreational needs, for example explaining why this is a benefit to ballooning.

A key challenge is enabling more complex unmanned flight but without placing insurmountable barriers on existing flight applications.

Feedback against “What have we missed?”

Design of airspace must be considered and improved with all flight activities being considered, not just powered manned aviation and UAS, for example model aircraft and parachuting. Environmental issues such as noise and radio wave emissions should be included. The CAA ought to seek out and learn from experiences of introducing EC in other countries. Further consideration should be given to whether a trial is the right way to proceed and what happens at the end of that trial.

Feedback against “Tell us your feedback on engagement?”

The most diverse range of comments arose in relation to CAA’s engagement; these can be seen together as two clear themes.

- **Communication**

On CAA communications to date, conflicting views were expressed that communications have been both satisfactory and poor. Interestingly, the UAS and GA communities both felt CAA communications were better to the other community than to their own. The Airspace Modernisation Strategy and the problem that EC is looking to fix was not understood and there is a need to clarify what is meant by interoperability.

To improve communications the CAA should be clear, less complex and try to make communications more two-way. CAA communications should aim to reach a wider audience to get representation from the general public, not just people that are already engaged in the subjects of aviation regulation. Views of interested parties outside the UK should be sought. The CAA should articulate a roadmap and separate the journey from the endgame.

A number of thoughts were articulated in relation to extending communication channels. These included gaining an understanding of the demographics to make best use of new media, having a focal point website for EC, education programmes, visits or targeted communications to GA operation groups (flying clubs etc.), use of public relations and adding EC material to all existing CAA communications, for example on posting pilot licences.

- **Wider benefits**

Many views queried the benefit of EC to their own sector of aviation. They were concerned about the expansion of controlled airspace and view that EC measures are only about facilitating UAS. CAA was urged to articulate the benefits to all, including the significance of risk.

Conclusions

It remains the CAA's intention to bring forward proposals to require EC where its use reduces the likelihood of mid-air collisions and where such mid-air collisions are a serious risk to those people either engaged in flying or on the ground. EC is viewed as a means to enable the UK to take advantage of the opportunities that might be presented by new technologies, but at the same time allow the volume of commercial air transport to increase efficiency and recreational aviation to continue to enjoy the activities they favour.

There is an appetite within the aviation community to engage with EC. However, this is qualified by a desire for any EC solution to be practical and deliver value to the users. Whilst the transmit, receive and re-broadcast approach to EC to internationally accepted standards should offer the greatest safety benefits to users, it is noted that a flexible approach is needed appropriate to the circumstances of particular categories of aviation.

A key principle for EC to be effective, is that each aircraft should be conspicuous to all other relevant airspace users. It is acknowledged that there are several non-certified EC solutions in operation providing active assistance in collision avoidance. The CAA does not wish to see any existing solutions becoming prematurely obsolete. However, there is a need for interoperability, so that all airborne solutions provide a satisfactory level of conspicuity both to other aircraft and ground-based services with a legitimate interest in flight safety

Next Steps

The CAA has announced its intention to facilitate a proof of concepts trial during the first half of 2020. Part of the trial will look to develop the feedback gathered via the call for evidence and Share the Air Conference. The outputs of the trial will be analysed, and conclusions published.

The precise details of the scope and objectives of the trial are being developed at the date of this report and will be published separately. However, the broad expectation is that the trial will be conducted in a small area of uncontrolled airspace, well covered by existing surveillance capabilities. The trial is expected to include a broad selection of recreational aviation, BVLOS UAS and military. EC for the trial will be derived from CAP1391 and non-certified equipment of manufacturers, subject to performance capability against requirements, in conjunction with installed certified EC equipment.

The objectives are likely to:

- Assess the interoperable feasibility of non-certified technologies.
- Confirm the performance and reliability of the various non-certified technologies,
- Determine the interoperability of the non-certified equipment with certified.

The CAA's ongoing technical work into performance requirements and the trial outputs will inform a comprehensive framework of EC requirements, which will underpin our recommended strategy to Government. We fully expect the comprehensive framework of EC requirements will be subject to a full public consultation.