HORVÁTH

Survey Report

Interoperability of e-Conspicuity systems for GA

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Online general survey – Scope and general data

- Online survey was conducted for end-users from April 4th 2023 to May 7th 2023
- Focus was on existing, deployed electronic conspicuity systems in General Aviation (drones added)
- The survey asked for e-conspicuity system usage, satisfaction regarding conspicuity, needs and constraints
- Distribution was done by EASA (social media), pilot associations, aircraft owners and pilots within Europe
- The survey was anonymous
- Multiple selections were possible for used aircraft and used e-conspicuity systems

Remark: Mode A/C transponders are no longer in general use. They were replaced by Mode S devices, which must be used by certain user groups (by regulation) and specified airspaces. The questions for Mode C transponder were asked nevertheless, as there are still some exceptions for the use of Mode C.

Online general survey – Overview of results

- 2.133 Participants
- 61% (1.300) answered in German, 39% (833) in English
- 93% VFR (1.975), 7% IFR (158)
- Most used aircrafts: Single Engine Piston, Glider, Motor glider, Ultralight
- 22% (463) do not use any e-conspicuity system

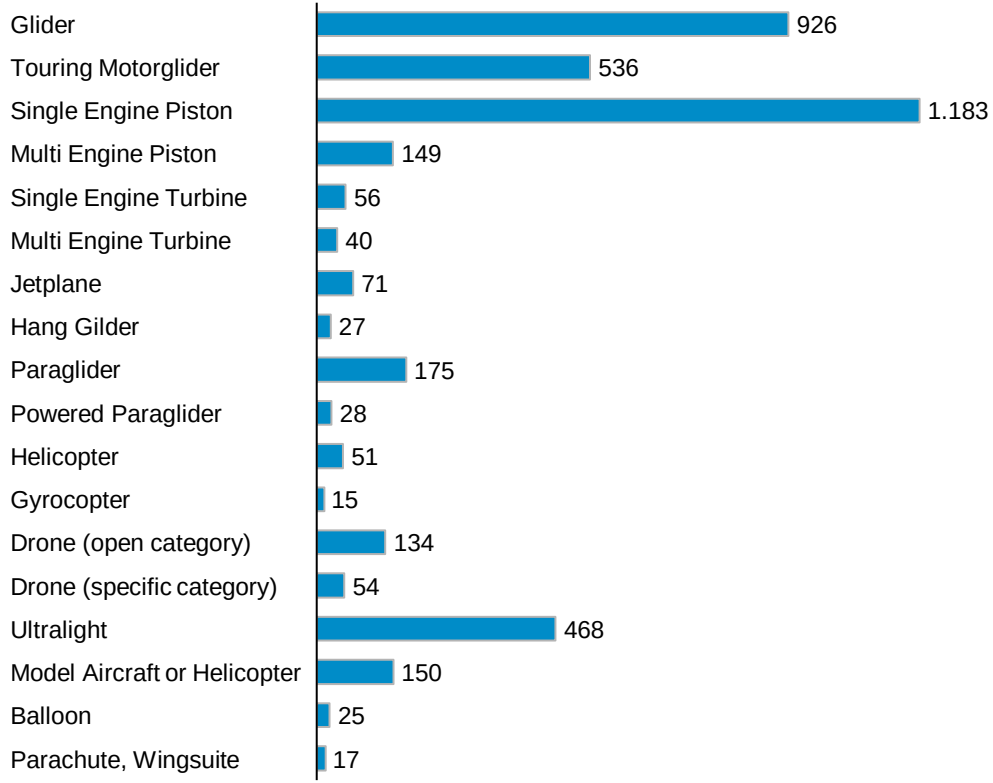
Online general survey – Overview of results

- Pilots, clubs and rentals are not well informed about e-conspicuity (an information deficit was pointed out in the comments of the survey)
- Many of the users of e-conspicuity systems seem to not have the technical background how their systems technically work; they are just using it
- In “closed” user groups, like glider pilots, the usage of a group-adapted e-conspicuity system, like FLARM, leads to an illusory feeling of complete safety
- Some user groups like parachute jumpers, paragliders and wingsuit jumpers do not need to see other aircrafts as the they cannot react to traffic warnings and cannot install heavy or fixed devices
- Networking and merging of information from existing systems is evaluated as necessary by 94% of the participants
- Air to air is regarded as the most important connection type

Online general survey – Overview of results

- 91% of all participants state that the EC systems should be used in all airspaces
- 72% think the use will be helpful for Flight Information Service (e.g. status of special airspace)
- Additional information (airspace data, weather, etc.) is seen as a nice benefit, but should not distract from pilot's tasks
- If there is the possibility of additional information the participants would like to see real-time airspace and airport data, weather and NOTAMs
- The safety gain for the usage of EC systems is assessed as 8.7 of 10

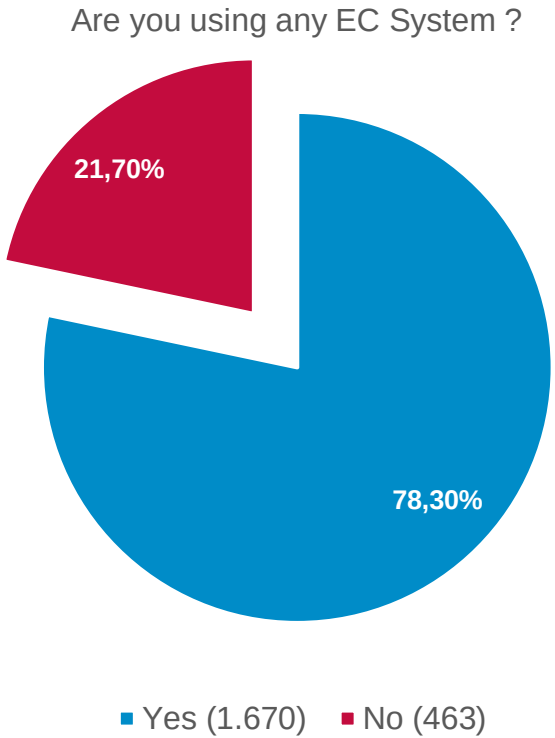
General survey analysis – Who participated?



Comment

- Multiple selection of used aircrafts was possible

General survey analysis – No e-conspicuity system used



Comment

- 86% of the participants, who are not using an EC system (the 463 participants with “No” as answer), would like to have one
- 53,5% of them would like to have a mobile solution
- Main reasons for not using an EC system:
  - Costs (39%)
  - Technical issues (20%)
  - Not necessary (15%)
  - Privacy (5%)
- Other reasons (22%):
  - Lack of information
  - No harmonised solution available in EU (equipage, interoperability)
  - Not available in rental aircrafts

General survey analysis – No e-conspicuity system used

Some Comments for not using EC systems…

"Aircraft is owned by our club, to expensive"

"The products are not complete, and those that are at the market are too expensive, and why do we need it when other aircrafts don't need it…"

"On UAS multiple requirements between French and EASA regulations difficult to implement"

"Never thought about it"

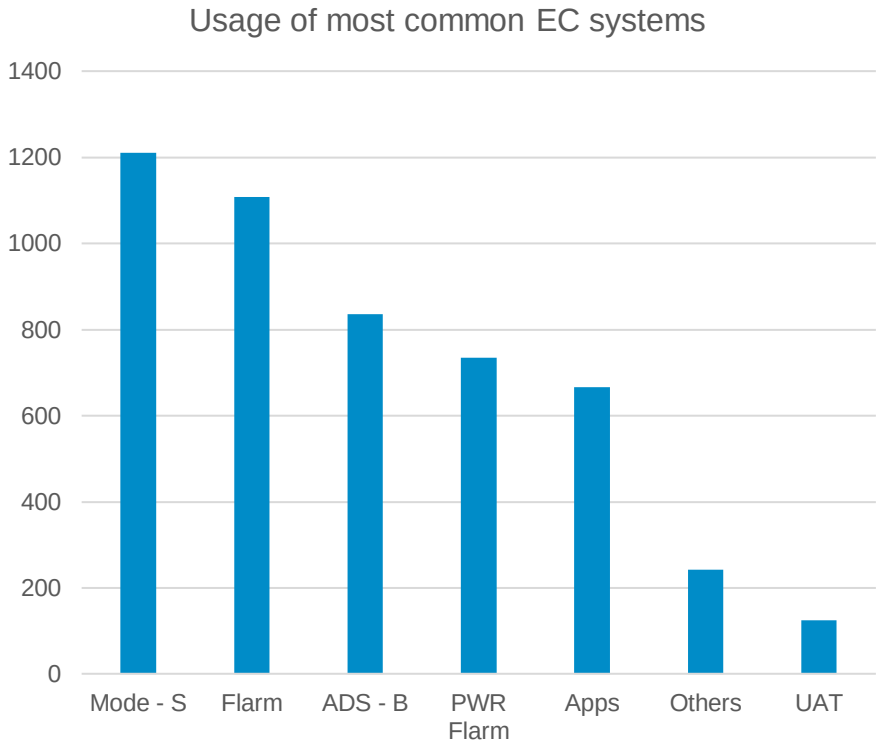
"Unclear which system is best/should be used"

"Another device/system to care about... No! "

„Currently no affordable, easily installed, system on the market that is compatible (in a single device) with all types of traffic and makes it visible and communicates with it (ADSB, Mode-C, FLARM, etc.)."

"No harmonised solution available (equipage, interoperability)"

General survey analysis – Usage of EC-Systems



Comment

- Preferred Apps: 1. SafeSky 2. SkyDemon 3. ForeFlight 4. XCSoar 5. Pilotaware
- Most mentioned other systems:
  - Haubenblitzer (flash lights)
  - Pilot Aware (also with MLAT for Mode S)
  - Skydemon in combination with Pilot Aware
  - FANET (+)
  - FLARM Data on Navigation System
  - OGN
  - See and avoid + radio !!

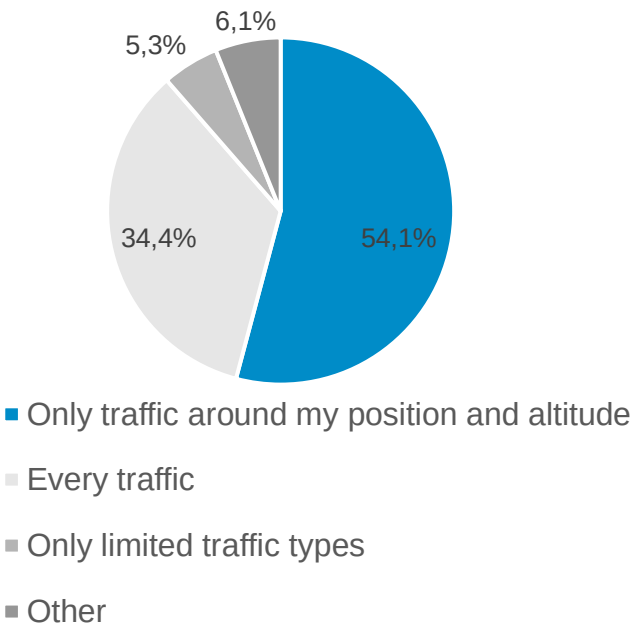
The systems and apps have been listed here as they were named in the survey by the participants.

General survey analysis – Illusion of the complete traffic picture?

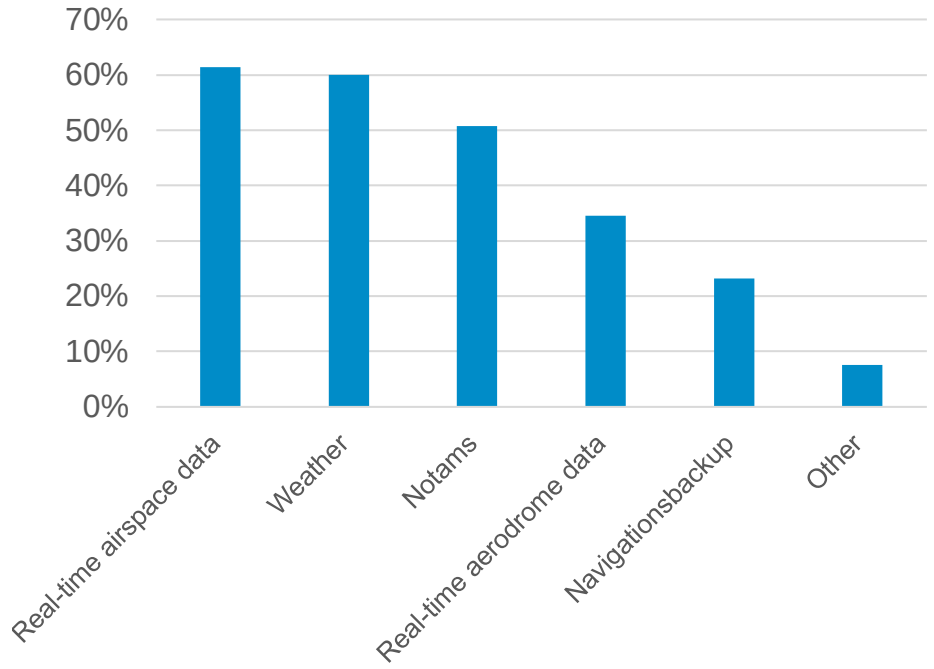
- 11,5% of all participants think, they can see every traffic
- Most of these are glider pilots
- Mentioned reasons for not seeing every traffic (with EC-systems):
  - 47% of the participants think, that there are still too many aircraft without an EC system
  - 37% of the participants think, that the systems are not networking
- There should be the possibility to filter the presented traffic according to the needs of the corresponding user group
- The most pilots only want to see the traffic in their direct vicinity for collision avoidance, but also 34% want to see all traffic for strategic planning

Needs and constraints of end-user groups – Displayed data

Traffic to be displayed



Desired additional information uplink



General survey analysis – Compilated comments on the traffic to be displayed (Question 40)

Only the potential conflicting traffic should be displayed, dependent on:

- Closure rate
- Type of aircraft (own and conflicting aircraft)
- Predictability of trajectory
- Tactical significance (Hotspots, thermals with gliders, etc.)

The displayed traffic should be filterable (altitude band, type, etc.) and not distract the pilot

As stated before, pilots of some aircraft types (Paragliders, Hang gliders, etc.) do not want a traffic display, but want to be seen from surrounding traffic

General survey analysis – Compilated comments on benefits to Flight Information Service (FIS) (Question 41)

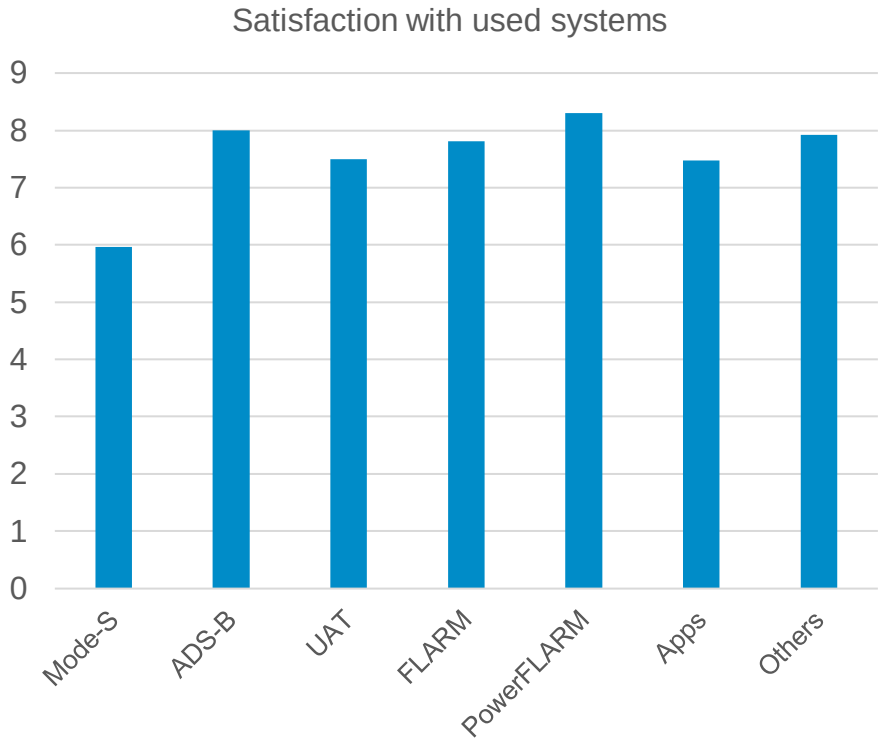
E-Conspicuity could be a benefit to air traffic services in several points:

- Relief from FIS due to non-necessary registration and deregistration
- Relief of FIS due to correct traffic information instead of inaccurate radio messages
- More efficient FIS
- Possibility of monitoring gilder traffic instead of only high frequented zones of gliders
- Drones and model-airplanes traffic could also be visible for FIS

Despite better traffic monitoring, it could be too much information for ATC.

Another interesting outcome is that most of the participants want to have a FLARM receiver as a mandatory item for IFR in airspace E/F/G.

General survey analysis – Satisfaction with used systems



Comment

- The user satisfaction with regard to e-conspicuity is low with Mode-C and Mode-S transponders (Mode C not mentioned here anymore) due to several reasons (obligation for fitting, costs, power consumption, mostly no display of traffic data, original use only for surveillance…)
- Mode A/C transponders are no longer in use. They were replaced by Mode S devices, which must be used by certain user groups (by regulation) and for the use of specified airspaces
- The usage of FLARM systems, Apps and in most cases of ADS-B is voluntary
- The satisfaction with the used device rises with newer systems, better network and a wide distribution within the respondent group

General survey analysis – Used system and satisfaction

Comments for …

FLARM: very good for gliders / low range / you can't see every traffic / due to a faulty installation, the system can only work with limited functionality / affordable / no interoperability with ADS-B / until 100 – 120 kts good limited functionality / low transmission power (positive for battery usage)

ADS-B: works good / too expensive / should be mandatory / you can't see every traffic / combination with other system like FLARM could be better / further information would be great (weather)

SafeSky: only sufficient reception up to about 3000 ft AGL / LTE coverage mostly poor / Not all traffic can be seen / Good for anticollision / cheap

UAT: Mandatory like in USA (people who use ADS-B) / not available in EU / FIS and TIS would be good for EU

PowerFLARM: same as FLARM / better range / combination with ADS-B

Haubenblitzer: good in mountains and under cloud-streets (Wolkenstraßen)

General survey analysis – Compilated comments on Mode C Systems for e-conspicuity

- Not in use anymore
- No position data
- Only for ATC and in RADAR coverage
- No traffic displayed
- Expensive
- Large and heavy, too much power consumption
- Completely outdated
- No peer to peer communication

General survey analysis – Compilated comments on Mode S Systems for e-conspicuity

- No displayed traffic, no collision warning
- No big improvement to Mode C
- Only usable with FIS
- Not compatible with systems like FLARM
- High power consumption
- In General Aviation not usable as Air-to-Air system
- The conversion to Mode S was expensive and did not even begin to bring what would have been possible at the time in terms of electronic conspicuity

General survey analysis – Compilated comments on ADS-B Systems for e-conspicuity

- Too expensive
- Reliable and big progress in terms of electronic conspicuity
- Much better than Mode C / S
- ADS-B with SIL=0 should be displayed
- Should be mandatory and standard
- Good in combination with FLARM devices
- Should have additional information (weather, NOTAMs, etc.)

General survey analysis – Compilated comments on FLARM Systems for e-conspicuity

- Only useful if every aircraft is equipped
- Not or only very limited usable in Commercial Aviation due to restrictions
- Low range, often reception problems, antenna position very critical
- Affordable
- Proprietary solution, needs to be opened
- Works fine only for gliders, nearly all gliders are equipped
- Able to predict curved trajectories

General survey analysis – Compilated comments on Power-FLARM Systems for e-conspicuity

- Same as FLARM
- Includes FLARM (In and Out), ADS-B (In) and Mode-S (In)
- Works effectively in SEP
- Antenna placement is critical, but much better range than FLARM
- Hardware problems, cheap hardware
- Expensive
- Also processes signals with SIL=0

General survey analysis – Compilated comments on UAT Systems for e-conspicuity

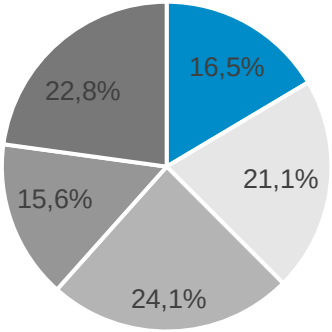
- No warnings for Mode C and S
- Only few aircraft are equipped in Europe
- You can get weather in the cockpit, but not in Europe
- Not useful in Europe
- In USA undoubtedly the best solution
- Military frequencies must be released for UAT usage in Europe

General survey analysis – Compilated comments on Apps for e-conspicuity

- Requires cellular network, coverage problems
- Problems at higher speeds and altitudes
- Small, cheap, portable
- Latency
- Not every traffic is covered
- Unreliable
- Integration with navigation Apps possible
- High battery consumption on mobile devices
- Increases situational awareness
- Great distraction potential
- Many different sources are combined

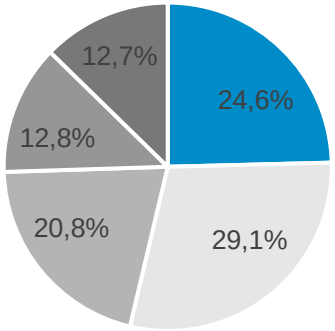
Needs and constraints of end-user groups – Costs

Acceptable costs for a full functional system



- Up to €100 (e.g. use of apps)
- Up to 500 €
- Up to 1.000€
- More than 1.000€
- I already have a system.

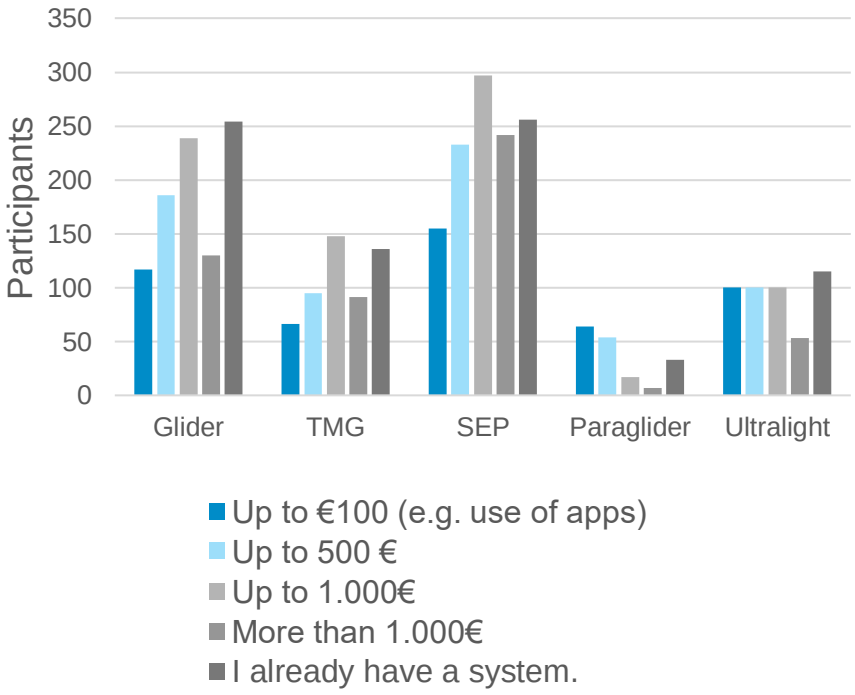
Acceptable costs for existing system upgrade



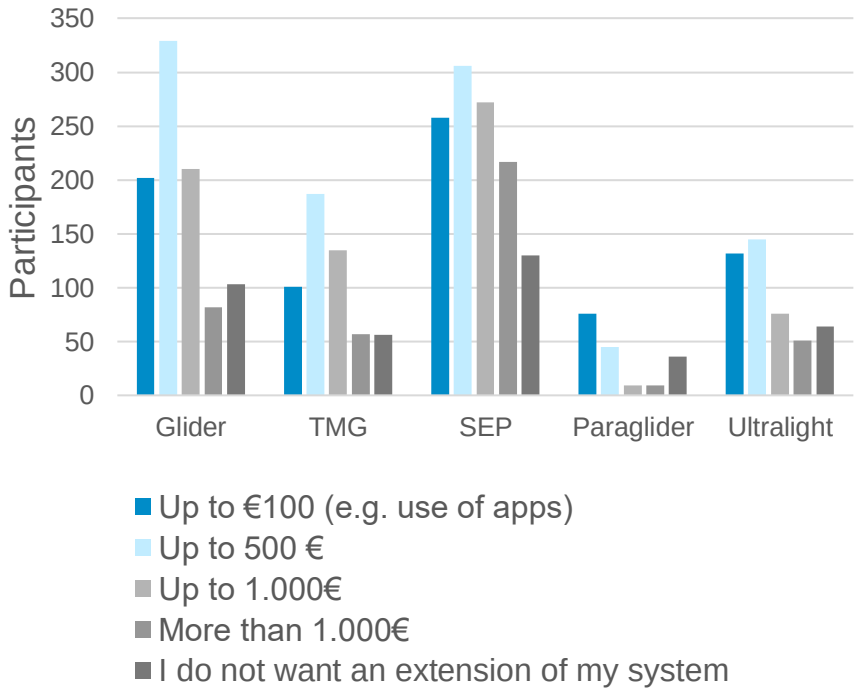
- Up to €100 (e.g. use of apps)
- Up to 500 €
- Up to 1.000€
- More than 1.000€
- I do not want an extension of my system

Needs and constraints of end-user groups – Costs

Acceptable costs for a full functional system



Acceptable costs for existing system upgrade

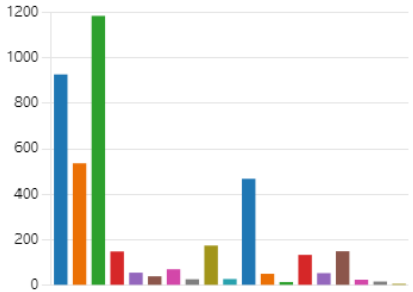


The numbering of the questions listed in the following chapter results from the structure in the electronic question system MS-Forms. The questions presented in the chapter are structured according to subject area.

List of questions – Participants

1. What category of aircraft do you fly? (multiple answers possible)

Glider	926
TMG (Touring motor glider)	536
Single Engine Piston	1183
Multi Engine Piston	149
Single Engine Turbine	56
Multi Engine Turbine	40
Jet Airplane	71
Hang Glider	27
Paraglider	175
Powered paraglider	28
Ultralight	468
Helicopter	51
Gyrocopter	15
Drone (open category)	134
Drone (specific category)	54
Model aircraft or helicopter	150
Balloon	25
Parachute, wingsuit	17
Other	7



2. What is the majority of your flights?

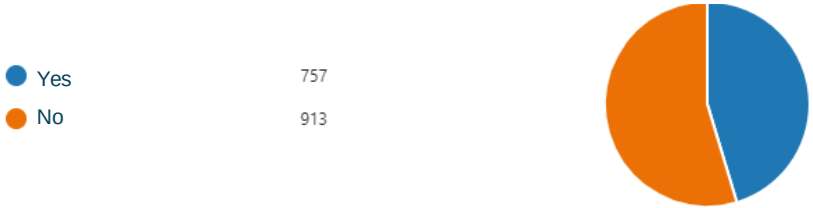
IFR	158
VFR	1975

3. Do you currently use electronic conspicuity or collision warning systems?

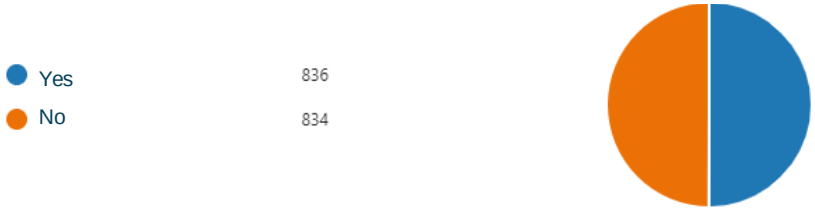
Yes	1670
No	463

List of questions – Used systems

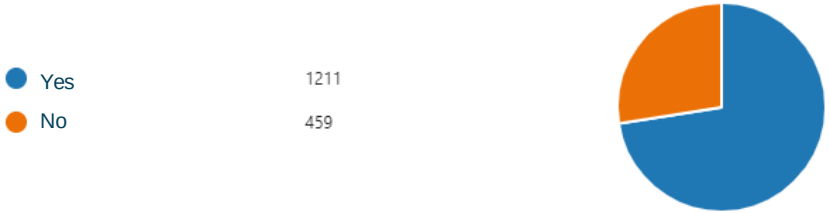
4. Are you using a Mode C transponder?



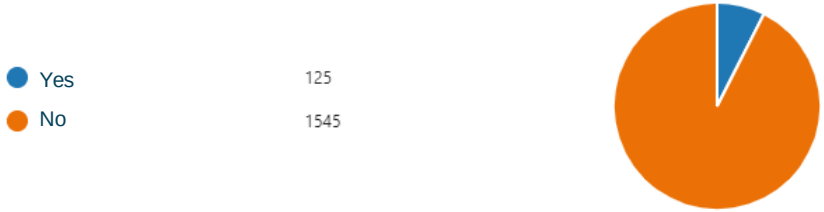
10. Are you using an ADS-B system?



7. Are you using a Mode S transponder?

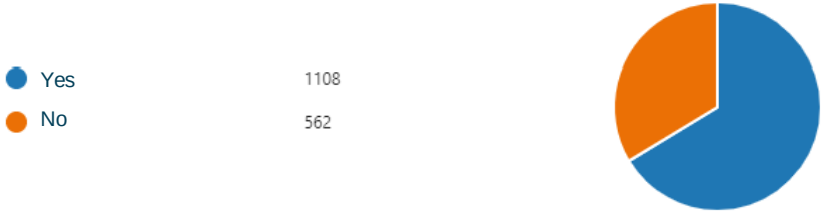


13. Are you using an UAT system?

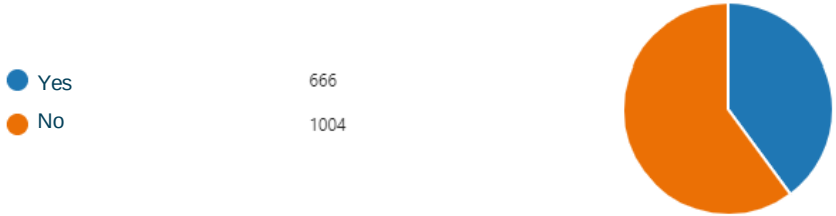


List of questions – Used systems

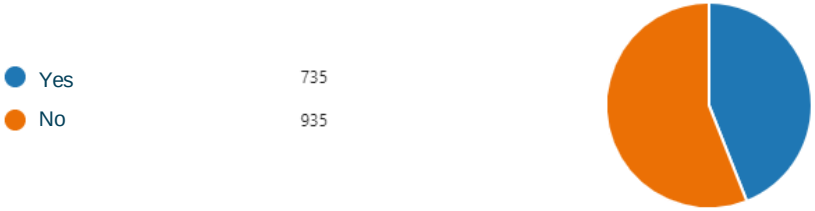
16. Are you using a FLARM system ? (PowerFLARM is inquired in the next question)



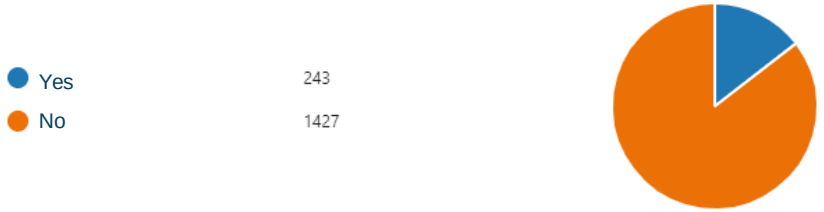
22. Are you using mobile Apps for electronic conspicuity / collision warning?



19. Are you using a PowerFLARM system?



26. Are you using an as-yet unnamed electronic conspicuity or collision warning system?



List of questions – Used Apps

16. Are you using a FLARM system ? (PowerFLARM is inquired in the next question)

666

Answers

Newest Answers

"SafeSky"

Highest answer response: 29% Safe Sky

List of questions – Used systems

39. What is your preferred conspicuity or collision warning system on the market or in development that meets your needs?

1726

Answers

Newest Answers

"FLARM / ADS L"

"SafeSky"

"Im not sure, I would prefer some open standard such as "low power ads-b". ...

Highest answer response: 17% ADS-B

List of questions – Used other systems

27. What system do you use for electronic conspicuity or collision warning?

243

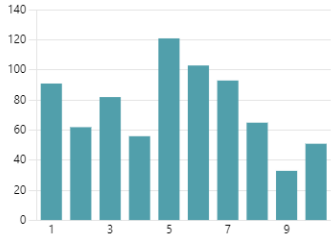
Answers

Highest answer response: 9% Pilot Aware

List of questions – Satisfaction with used system in terms of electronic conspicuity

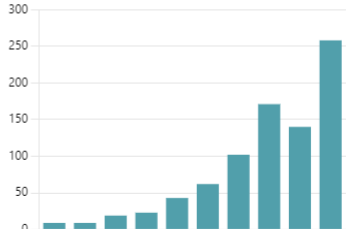
5. How high was/is your satisfaction with the Mode C transponder in terms of electronic conspicuity and collision warning?

5.13
Average rating



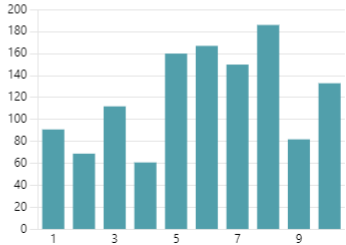
11. How high was/is your satisfaction with the ADS-B system in terms of electronic conspicuity and collision warning?

8.00
Average rating



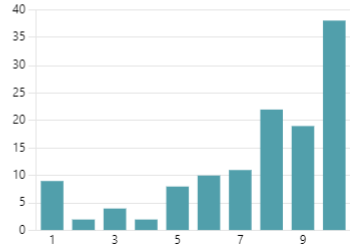
8. How high was/is your satisfaction with the Mode S transponder in terms of electronic conspicuity and collision warning?

5.96
Average rating



14. How high was/is your satisfaction with the UAT system in terms of electronic conspicuity and collision warning?

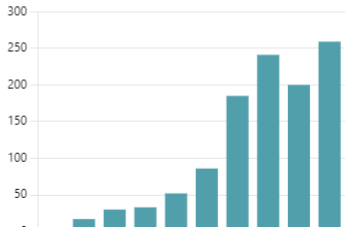
7.50
Average rating



List of questions – Satisfaction with used system in terms of electronic conspicuity

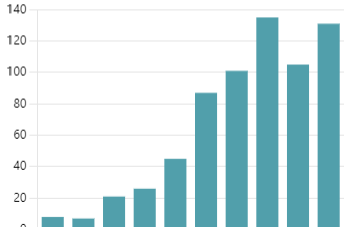
17. How high was/is your satisfaction with the FLARM system in terms of electronic conspicuity and collision warning?

7.81
Average rating



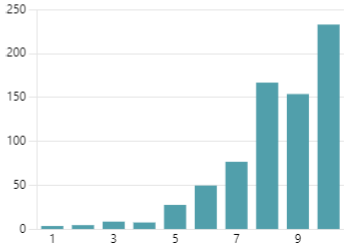
24. How high was/is your satisfaction with the used apps in terms of electronic conspicuity and collision warning?

7.47
Average rating



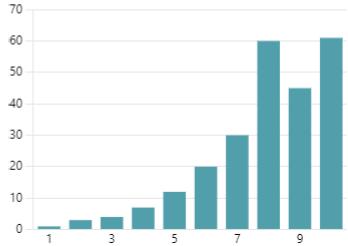
20. How high was/is your satisfaction with the PowerFLARM system in terms of electronic conspicuity and collision warning?

8.30
Average rating



28. How high was/is your satisfaction with the device/system in terms of electronic conspicuity and collision warning?

7.95
Average rating



List of questions – Visibility of traffic

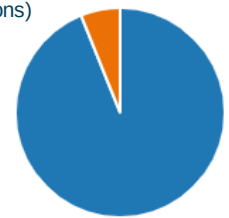
30. Do you believe you were alerted to TOTAL surrounding air traffic during flight by your system in use?

Yes	191
No	1479

32. Do you think that networking and merging information from existing systems will improve your traffic awareness?

(Networking can be done with ground stations as well as by on-board systems, e.g. FLARM, apps, trackers, or relay functions)

Yes	1389
No	90



31. In your opinion, why isn't all the air traffic visible? (Multiple answers possible)

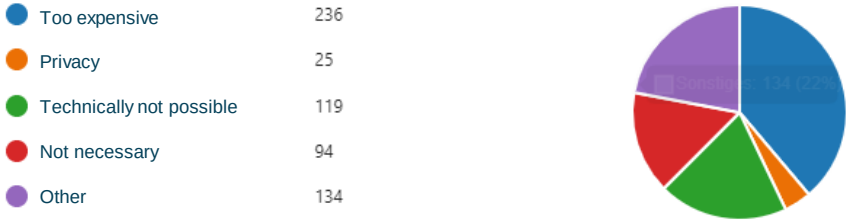
My system only sends out and/or does not display traffic.	162
I believe there are still many participants without such a system.	1282
The existing systems work side by side but are not networked.	993
I am not sure.	48
Other	225

40. When using a conspicuity / collision warning device, which air traffic is important for you to see and which is optional?

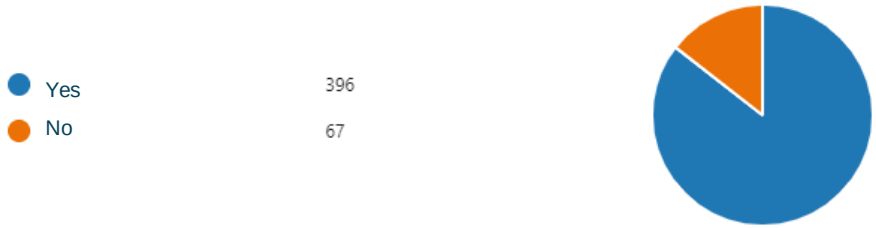
I need to see every surrounding traffic	734
I need only the traffic at and around my position and altitude	1154
I need only limited types of traffic displayed (e.g., only gliders / no commercial jets…)	114
Other	131

List of questions – Questions for participants not using a system 1

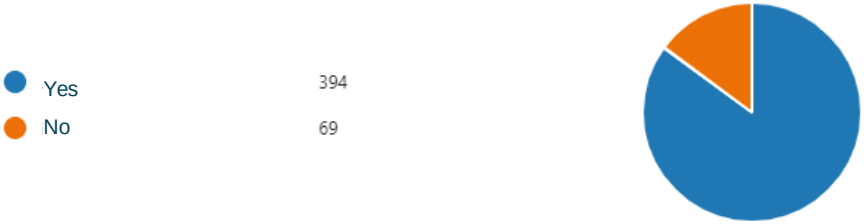
33. Why don't you currently use a system



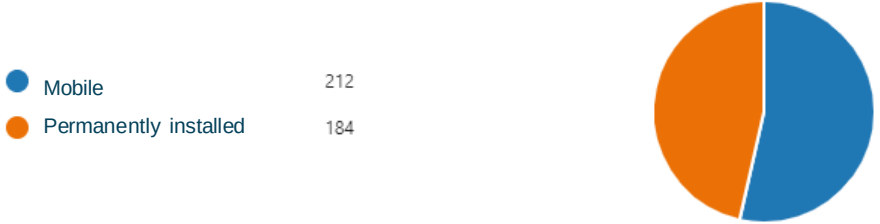
35. Would you like to have such a system in your aircraft?



34. Have you ever heard about electronic conspicuity or collision warning systems or have you seen such a system use?



36. Should your preferred system be mobile or permanently installed??

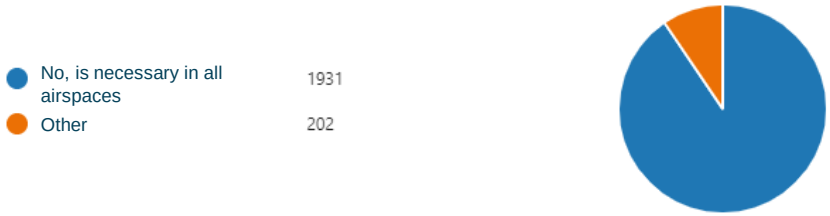


List of questions – Questions for participants not using a system 2

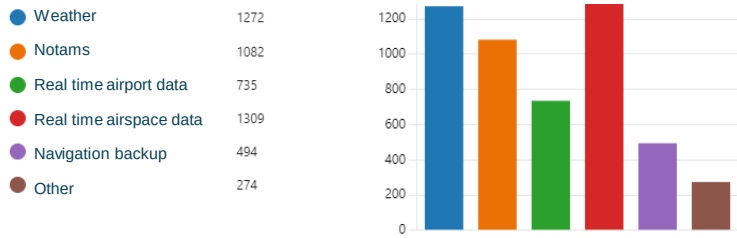
37. Do you think that an air-to-air connection is sufficient or that an air-to-ground connection and networking is also necessary?

List of questions – General questions, additional benefits

38. Do you think that the use of conspicuity or collision warning systems is only useful in certain airspaces?



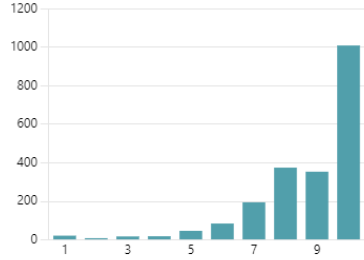
42. What additional functions / information would you like to see fromsuch a system in addition to the display of air traffic?



41. Do you believe that electronic conspicuity or collision warning devices will have a benefit to air traffic service?

43. What do you think is the safety gain in the "see and be seen" principle by using a conspicuity / collision warning device?

8.70
Average rating



List of questions – Costs

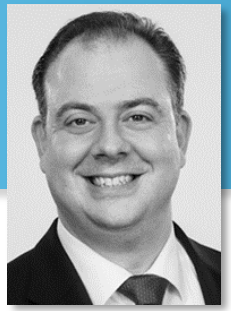
44. How much money would you spend for a full system with additional functions such as weather, Notams, airspaces?

Up to 100 € (e.g., use of apps)	351
Up to 500 €	449
Up to 1.000 €	514
More than 1.000 €	332
I already have a system	487

45. If you already have a system, how much money would you spend for an upgrade of your system to achieve interoperability with other systems and to get additional benefits like weather, airports, Notams, etc.?

Up to 100 € (e.g., use of apps)	525
Up to 500 €	620
Up to 1.000 €	443
More than 1.000 €	274
I don't want an upgrade of my system	271

Contacts



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