



**UK
AIRPROX
BOARD**

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**Analysis of
Airprox in UK Airspace**

**Report Number 37
January 2021 – December 2021**

A joint Civil Aviation Authority / Military Aviation Authority service

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Thirty-Seventh Report by the UK Airprox Board

Analysis of Airprox in UK Airspace
(January 2021 to December 2021)

Compiled by Director UK Airprox Board for

The Chief Executive Officer
UK Civil Aviation Authority

and

The Director
UK Military Aviation Authority

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INTRODUCTION

In 2021 the UK Airprox Board (UKAB) assessed 253 Airprox, of which 172 were piloted aircraft-to-aircraft events with 81 involving UA/Other. 2021 saw a full return to previous years' historic levels, indeed, apart from a slow start due to Covid restrictions, the numbers following the General Aviation Sports and Recreational (GA) return to flying on 31 Mar 2021 met or exceeded previous years. We are still in a transitory period, where statistical projections still require manipulation in order to eliminate the effect of the pandemic. Indeed, once this has been done, we are witnessing a consolidated increase of 10% year-on-year for Airprox, giving an estimate of 212 aircraft-to-aircraft events in 2022.

The granularity which can now be achieved is continuing to provide an essential and consistent view of the factors which underpin the reasons behind Airprox and this is what I shall concentrate on in the majority of this report. It is only by directly focussing and targeting specific communities and by tackling their specific behaviours that we can begin to impact the instances of Airprox, mitigate Mid Air Collision (MAC) and contribute to augmenting Air Safety for all.

As with the approach adopted last year, this report will cover in detail the 5 weakest performing barriers and examine the observed behaviours behind them in an effort to identify areas where interventions can be more effectively focussed to better mitigate against MAC and enhance air safety. I will, of course, present appropriate statistics, but these need to be taken in the context of the time; care must be taken not to draw inaccurate or incomplete conclusions, and comparisons with previous years should not be made apart from in specific and focussed areas.

Suffice it to say, now more than ever, we need to focus on the 'Why' and the 'So What' as opposed to just the 'What' and 'How many' and my observations from this Airprox year reinforce those of my last report in the identification of the areas in which we can make the most difference. It is by identifying the weakest barriers, understanding the reasons for their poor performance and by targeting positive outreach action in these areas where we will be able to make the most difference. That said, it relies on the communities understanding their own cultural tapestry, it is for them to ensure that there are appropriate mechanisms and measures in place to effect change. They may be a flying club, an airfield, the military, a commercial operating authority or an individual General Aviation pilot, but the responsibility to exercise the privilege of operating in unregulated airspace and the ability to enjoy the freedoms it gives depends on individual and collective responsibility to continually strive to augment air safety and help to maintain a safe environment that can be enjoyed by all.

The weakest areas still reside in Electronic Conspicuity (EC) which is captured in the **Electronic Warning Systems barrier**, communication, planning and execution which is captured in the **Tactical Planning and Execution barrier**, situational awareness which is captured in the **Ground Elements Situational Awareness barrier** and the **Flight Elements Situational Awareness barrier** and finally the **See and Avoid barrier**. Within these barriers, the most common Contributory Factors (CF) are incompatibility of EWS; planning and communication; generic, late or no situational awareness, and; the monitoring of other aircraft. There is still a welcome focus within the CAA on promoting EC and a common approach will certainly improve situational awareness in both ground and air elements. The current funding initiative is in place until 31st March 2023.

[Electronic conspicuity devices | Civil Aviation Authority \(caa.co.uk\)](https://www.caa.co.uk/electronic-conspicuity-devices)

Where there is a technical element to the performance of the barriers (primarily the **Flight Elements Electronic Warning Systems barrier**), it is increased adoption of EC, an understanding of how to use the equipment, but most importantly an acknowledgement that there needs to be a consistency in approach which promotes compatibility of equipment which operate to agreed standards. Where there is a significant human aspect affecting the performance of the barrier, it can be addressed through firstly recognising and accepting the observations, the will to learn from the actions of others,

a commitment to training, a sense of personal responsibility with respect to threat and error management and an appreciation of the effects of poor currency and recency.

HEADLINE FIGURES AND HISTORIC DATA

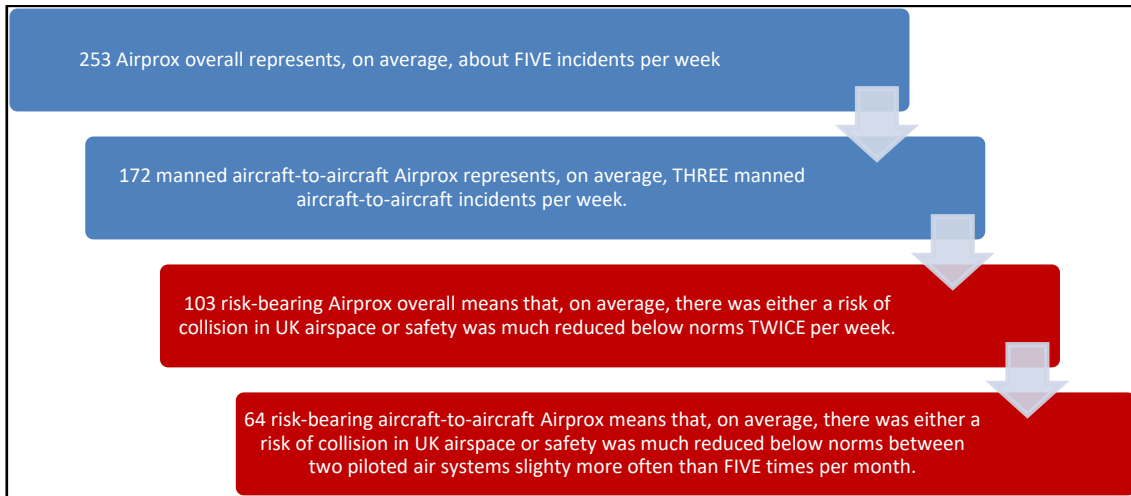


Table 1: All Airprox 2011 – 2021 by Risk Category

All Airprox 2011 - 2021												
RISK	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	10yr AVERAGE
A	23	18	22	28	41	51	45	65	60	17	43	39
B	36	27	43	68	66	72	82	96	86	41	60	64
C	88	97	72	86	78	104	111	120	147	73	118	101
D	2	5	9	9	12	11	12	5	11	3	6	8
E	12	14	26	33	20	27	22	33	24	29	26	25
Risk Bearing	59	45	65	96	107	123	127	161	146	58	103	103
% Risk Bearing	37%	28%	38%	43%	49%	46%	47%	50%	45%	36%	41%	42%
Total	161	161	172	224	217	265	272	319	328	163	253	237

As previously stated, once the anomalous activities of 2020 and the first three months of 2021 have been discounted and figures adjusted, there has been a steady and worrying 10% year-on-year rise in Airprox. As also predicted in last year’s report, the incidents of UA/Other observations and confirmed interactions has begun to plateau. Another pleasing factor is the increase in reporting of Airprox by the RPAS community – their action, appreciation and increased understanding of the value

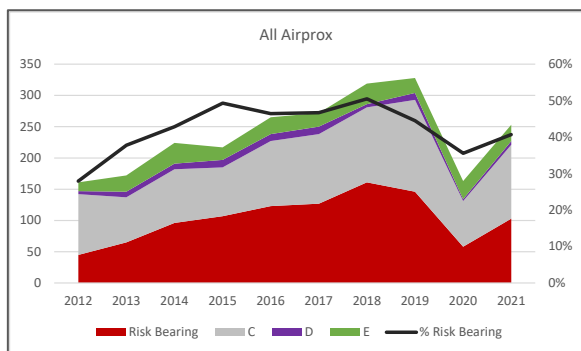


Figure 1: All Airprox 2012 – 2021 by Risk Category

added by submitting such reports is encouraging as it allows us to conduct a full evaluation process and learn as much as possible from events which otherwise go unreported as in ALL cases the piloted aircraft did not see the UA. The community making the most observations of encounters with UA/Other is still the Commercial Air Transport (large carriers) (CAT) category. I believe that the reasons for this remain related to the stages of flight in which they observe the UA/Other which is predominantly in the departure or landing phase; a phase typically characterised by high workload and high rates of climb/descent which tend to

precipitate a fleeting encounter whereby it is impossible for the pilots to manoeuvre effectively. This results in an event which, by its very nature, holds a risk of collision. As a result, and in order to gain a better appreciation of Airprox and the associated risk of collision, it is useful to think about the 2 areas (aircraft-to-aircraft encounters and UA/Other encounters) separately.

Table 2: All aircraft-to-aircraft Airprox 2012 – 2021 by Risk Category

All Aircraft to Aircraft Airprox 2011 - 2020												
RISK	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	10yr AVERAGE
A	23	18	22	25	27	17	13	20	18	8	22	19
B	36	27	43	64	52	41	49	50	50	32	42	45
C	88	96	72	85	75	79	75	80	106	51	80	80
D	1	1	9	6	5	8	5	2	6	2	5	5
E	11	13	26	33	18	25	20	29	23	25	23	24
Risk Bearing	59	45	65	89	79	58	62	70	68	40	64	64
% Risk Bearing	37%	29%	38%	42%	45%	34%	38%	39%	33%	34%	37%	37%
Ac-Ac Total	159	155	172	213	177	170	162	181	203	118	172	172

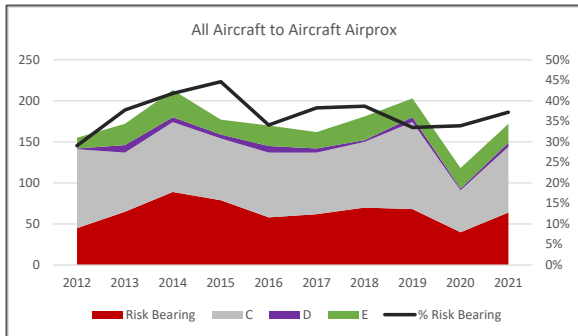


Figure 2: All Airprox 2012 – 2021 by Risk Category

As can be seen in Table 2 and Figure 2, the reported numbers and the associated proportion of risk bearing occurrences have remained largely constant over the last 10 years, notwithstanding the sharp drop experienced as a direct result of the Covid 19 pandemic in 2020. In fact, the percentage risk bearing for 2021 is at the current 10-year average of 37%. However, this does represent a proportional increase over the last 2 years in this category of event. What is more interesting is the sector mix composition of risk bearing events where it is evident that the GA

Sports and Recreational communities are experiencing a steady rise in the proportion of risk bearing Airprox, and the other significant area, (those involving military aircraft) are experiencing a marked and welcome decline. This will be explored further in the coming sections.

Turning specifically to Airprox involving UA/Other, I have included the 10-year picture to explicitly demonstrate the surge which occurred in 2014 as the small drone recreational market took off.

Table 3: Airprox Involving UA/OTHER 2011 – 2021 by Risk Category

Airprox Involving UA/OTHER 2011-2021												
RISK	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	10yr AVERAGE
A	0	0	0	3	14	34	32	45	42	9	21	20
B	0	0	0	4	14	31	33	46	36	9	18	19
C	0	1	0	1	3	25	36	40	41	22	38	21
D	1	4	0	3	7	3	7	3	5	1	1	3
E	1	1	0	0	2	2	2	4	1	4	3	2
Risk Bearing	0	0	0	7	28	65	65	91	78	18	39	39
% Risk Bearing	0%	0%	0%	64%	70%	68%	59%	66%	62%	40%	48%	48%
Total	2	6	0	11	40	95	110	138	125	45	81	65

Following the initial increase in reported Airprox involving UA/Other, the picture began to stabilise with the introduction of regulation and registration. The increased and continued focus on this area remains critical as commercial entities begin to exploit technological advances, opening up new opportunities

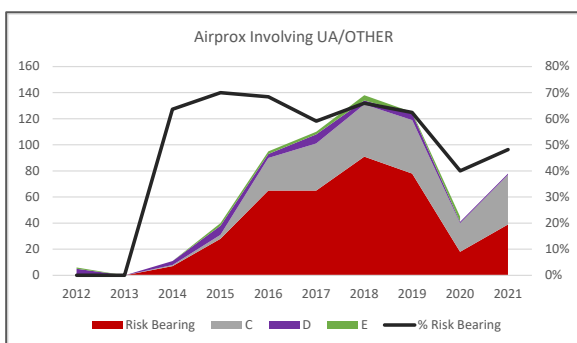


Figure 3: All Airprox 2012 – 2021 by Risk Category

which will take larger drones more into the realms of Class G Airspace. Airprox observations have reinforced the concern over interactions in the below 500ft height band, where neither the Flyer (sub 400ft), nor the piloted aircraft (military or otherwise similarly exempt) need to gain permission for or are required to promulgate their activities. The continued potential for an increased risk picture in this area is of concern; however, the biggest area for potential risk lies in the development of BVLOS (Beyond Visual Line-Of-Sight) capabilities which will undoubtedly see RPAS venturing into Class G

airspace above 500ft agl, and almost certainly in the 0-3000ft altitude band, which is where the majority of all Airprox occur. That said, I am pleased that there is continued evidence of RPAS operators taking responsibility to report Airprox. This means that we have an opportunity to thoroughly examine the event, trace the other aircraft, build the picture and fully discuss and evaluate the circumstances surrounding the occurrence. This has led to some interesting insights into UA/Other Airprox and raised some uncomfortable observations with regard to the performance of the safety barriers and how those performance deficiencies can be mitigated or removed. Please see the [UA/Other](#) section for analysis.

SECTOR MIX 2012-2021

Airprox vary by sector. They vary by risk distribution, airspace and altitude and each of them requires specific examination to best understand the Airprox landscape. There are 7 sectors of interest: General Aviation (including Sports and Recreational and PPL/CPL training), Civil Commercial (including air taxis, and commercial rotary); Commercial Air Transport (primarily large air carriers); Military (including Foreign military); Emergency Services (covering air ambulance, fire, police and coastguard); Unknown aircraft (although the aircraft in this category could not be traced, their descriptions are almost exclusively descriptions of general aviation light aircraft) and finally, UA/Other.

For the purposes of this report, these sectors will be abbreviated as follows: GA, Civ_Comm, CAT, Mil, Emerg-Servs, Unk ac and UA/OTHER

This section presents the data in graphical and diagrammatic form and describes Airprox in terms of sector mix, altitude, airspace and risk. It describes the ‘what’ and makes no attempt to divine the ‘why’ at this point in the report. Observations and insights as to the ‘why’ will be explored in the Safety Barriers and CF sections.

The sector populations are important: Civ_Comm, Emerg Servs and Mil sectors are professional pilots operating in primarily Class G airspace; The CAT sector represents professional pilots, primarily operating in Controlled Airspace and GA and Unk ac (including untraced) sector represent pilots flying primarily for recreational purposes, operating in class G airspace and flying the most diverse set of air vehicles including gliders, lighter-than-air vehicles, microlights and light aircraft of myriad configurations. Figure 4 below depicts these sector interactions from 2012. The areas of interest are any mix which involves GA aircraft, specifically GA-GA, and any involving Military aircraft.

Figure 4: All Airprox 2012 – 2021 by SECTOR MIX

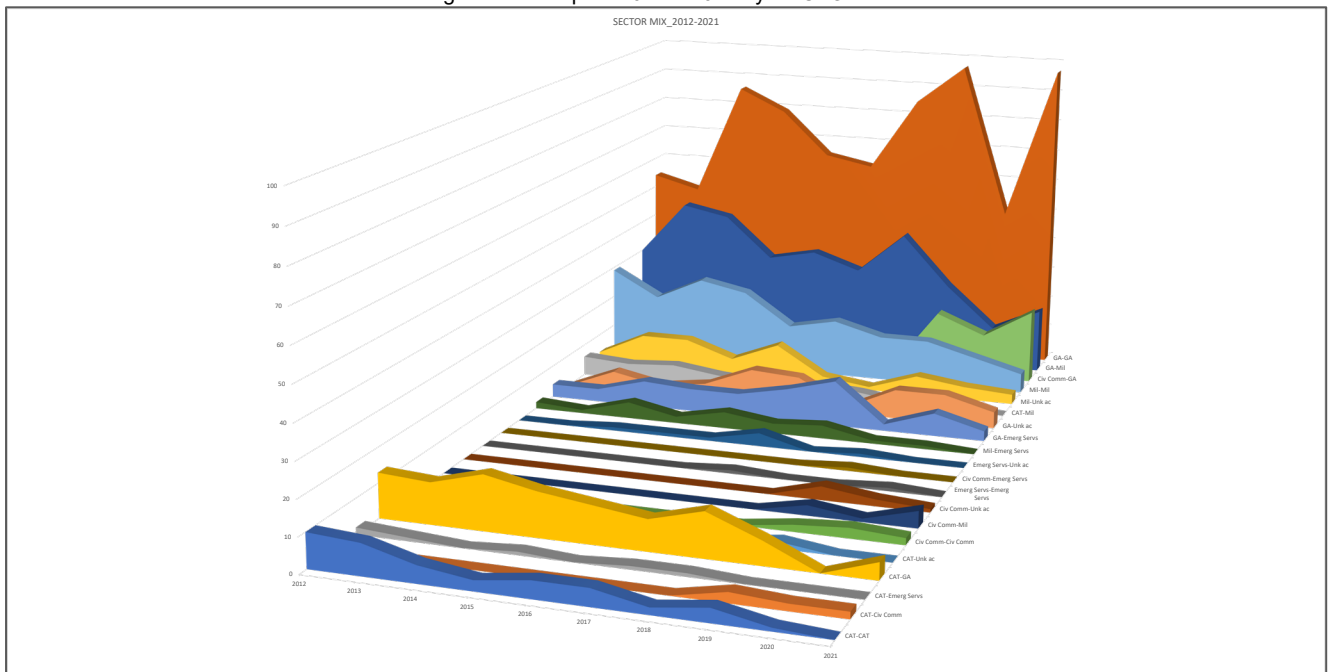


Figure 5 shows the Sector mix interaction as a percentage of the 1723 aircraft-to-aircraft occurrences reported since 2012. (Note the small numbers of Emergency Services and Civ_Comm reflect their recent inclusion in a specific category where previously they would have been captured in either CAT or GA.) It is striking that only 18% of the chart shows non-GA sector interactions. This ratio is reflected in the 2020 distributions as well.

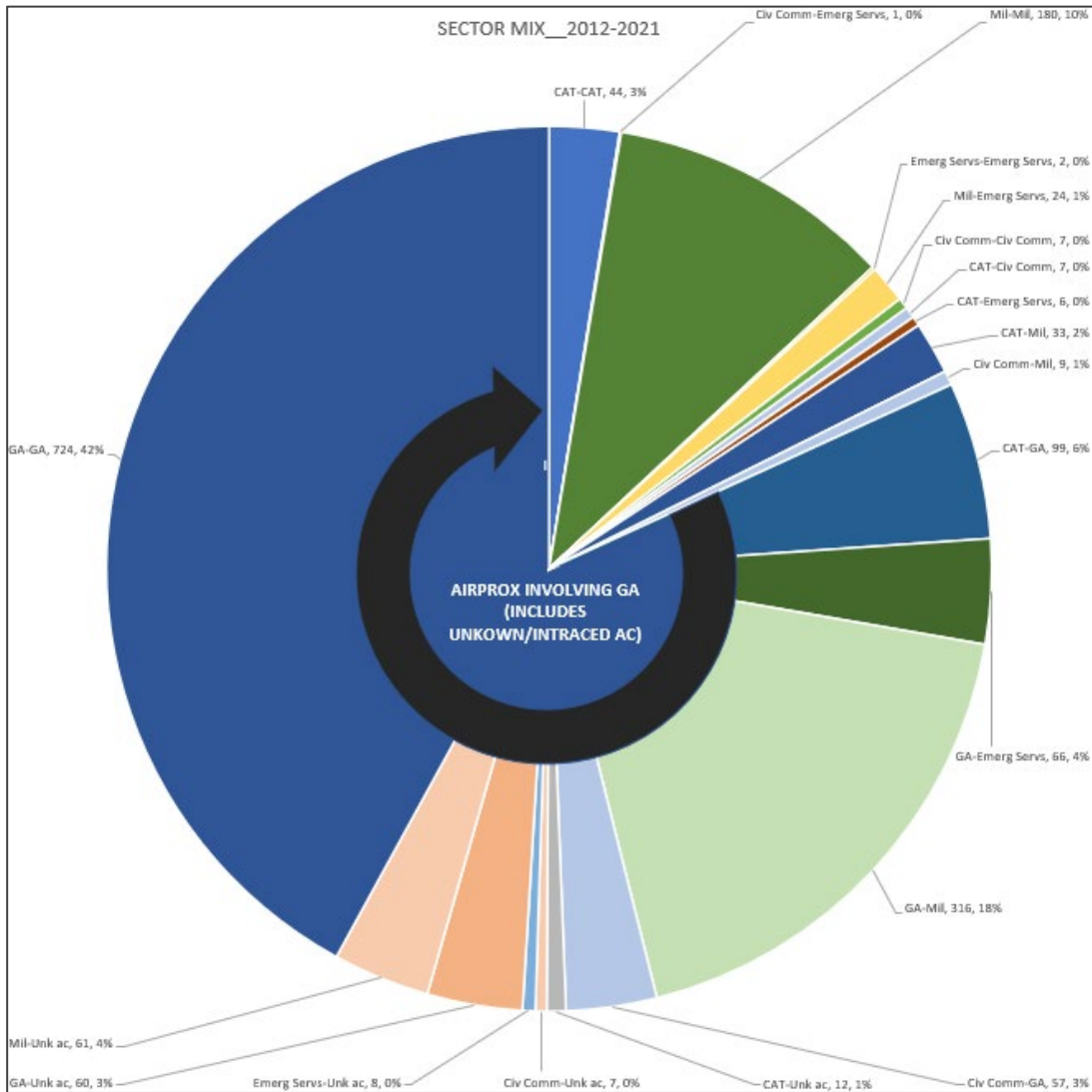


Figure 5: All Airprox 2012 – 2021 by SECTOR MIX

Understanding this picture is important as it describes the significant influence of the GA Sports and Recreational community on the Airprox landscape and emphasises the importance and value of the sectorised approach to understanding Airprox.

2012-2021
 82% of aircraft-to-aircraft events involved a GA Sports and Recreational light aircraft (This number includes Unknown_Untraced aircraft where the description fitted this category)

Also, it is useful to think about the percentage of risk bearing Airprox, in terms of overall percentage, and percentages of risk bearing of those involving GA, Mil and CAT_Civ_Comm.

Risk Bearing Trends

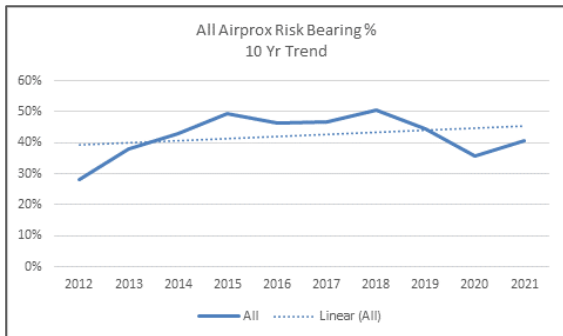


Figure 6: All Airprox Risk Bearing % 2012-2021

As previously mentioned, the percentage risk bearing figures for 2021 have reached the 10-year average and the overall linear trend indicates a gradual rise in the percentage of risk bearing Airprox. It should be noted that those involving UA/Other are included in this graphic and one could consider this a misleading influence, as the majority of UA/Other encounters are with the CAT and Civ_Comm sectors which carry an elevated proportion of events which are determined to be risk bearing.

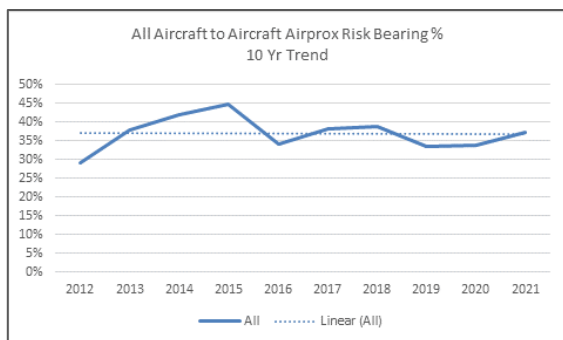


Figure 7: All Aircraft-to-Aircraft Airprox Risk Bearing % 2012-2021

When looking at aircraft-to-aircraft only – Figure 7 – the picture seems to be more positive and shows a constant linear trend over 10 years; however, it is useful to consider the sector distribution: Fig 8 depicts the risk bearing percentage by sector of all aircraft-to-aircraft Airprox.

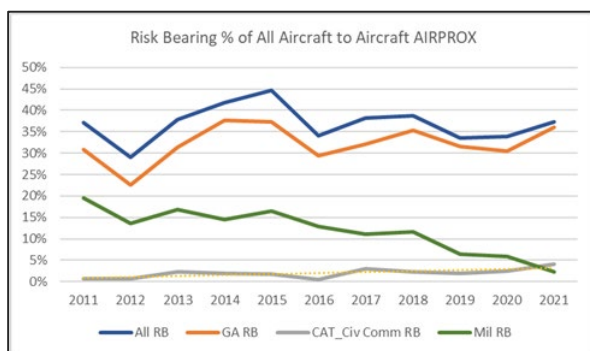


Figure 8: All Aircraft-to-Aircraft Airprox Risk Bearing % by sector 2012-2021

In 2021 risk bearing Airprox involving Military aircraft represented 2% of all aircraft-to-aircraft Airprox and risk bearing Airprox involving GA aircraft represented 36% of all aircraft-to-aircraft Airprox. The steady decline in those risk bearing events involving Military aircraft is encouraging and can be considered as evidence of a consistently improving risk picture as a result of a mature and effective SMS.

The final graphs and charts in this section – Figures 9 and 10 – show the *sector risk bearing percentage* of all risk bearing aircraft-to-aircraft Airprox. It can be seen that the GA Sports and Recreational community represented just over 78% of all risk bearing aircraft-to-aircraft in 2012 this has steadily increased over the years to 90% in 2020 and a staggering 97% in 2021. For the military sector, 46% of risk bearing aircraft-to-aircraft Airprox involved military aircraft in 2012, vice only 18% in 2020 and now only 6% in 2021. Note – the percentage totals per year do not add up to 100%. Although seemingly incongruent, this is because (at least) 2 aircraft are involved in a single Airprox event and when those Airprox involve the mixing of sectors, the instance will be counted in the figures for each sector.

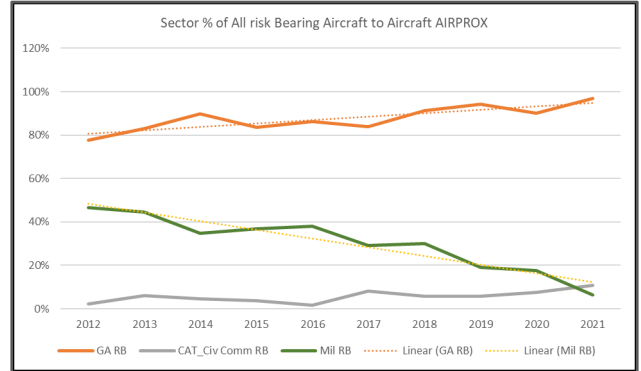
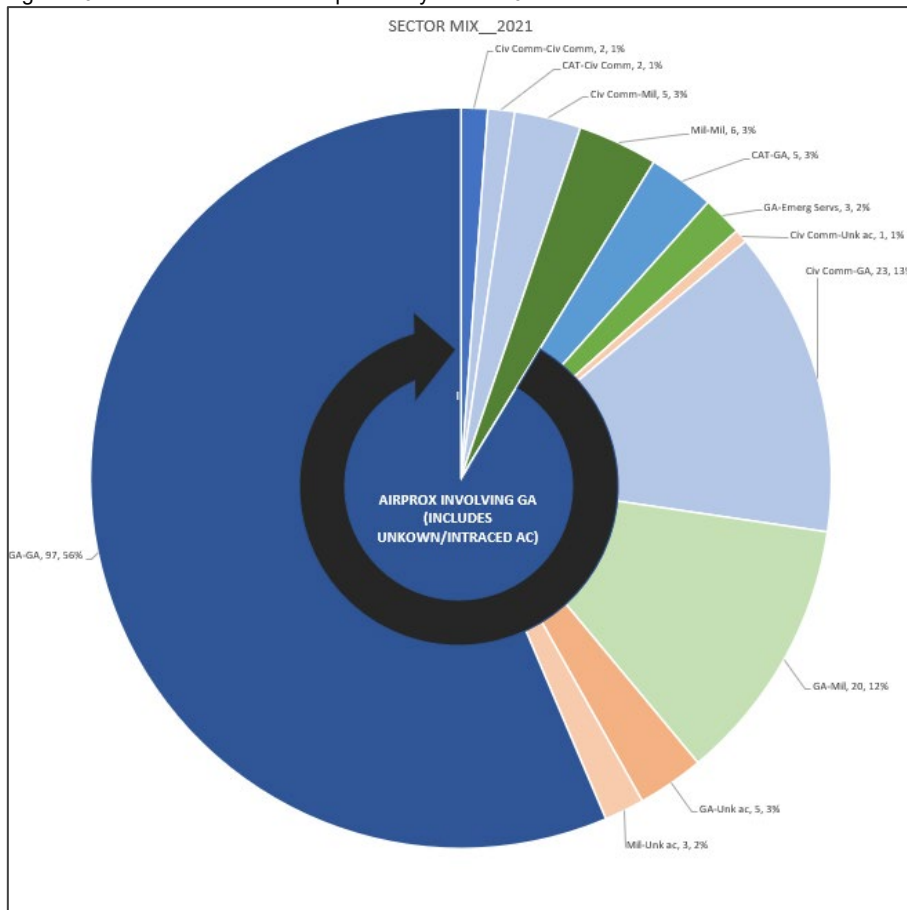


Figure 9: All Aircraft-to-Aircraft Airprox Risk Bearing % by sector 2012–2021

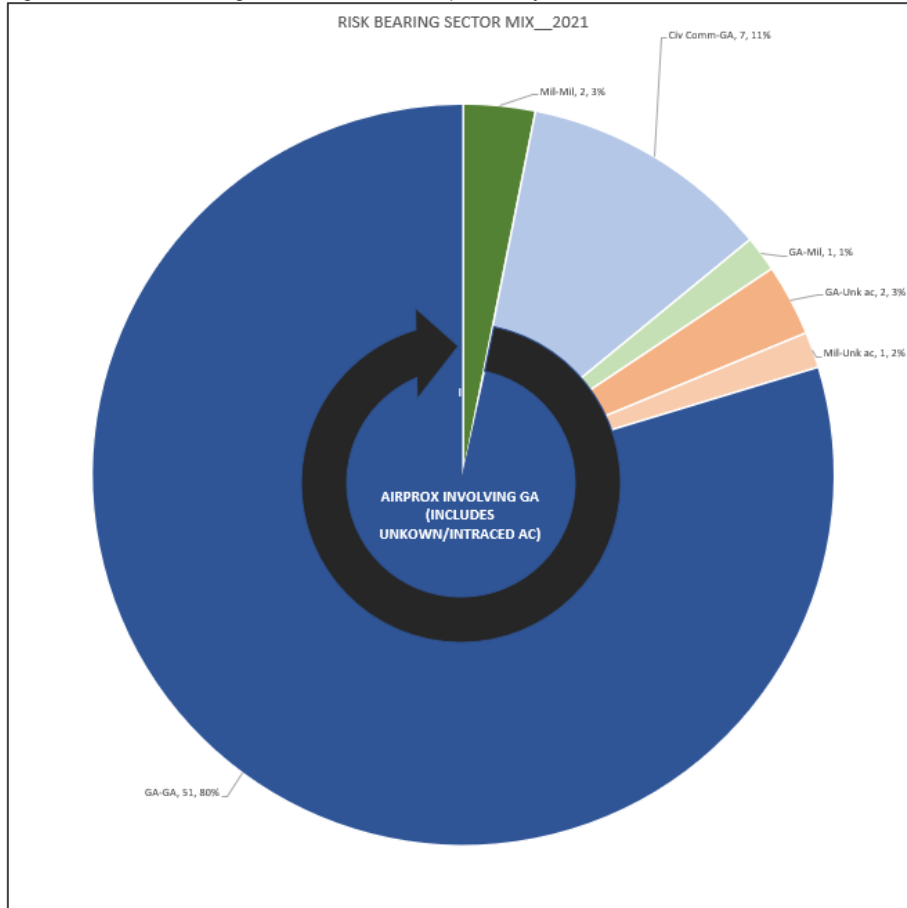
In 2021 - 92% of aircraft-to-aircraft events involved a GA Sports and Recreational light aircraft (This number includes Unknown_Untraced aircraft where the description fitted this category)

Figure 10: All Aircraft-to-Aircraft Airprox % by sector 2021



In 2021 - 97% of all risk bearing aircraft-to-aircraft events involved a GA Sports and Recreational light aircraft (This number includes Unknown_Untraced aircraft where the description fitted this category)

Figure 11: All risk bearing Aircraft to Aircraft Airprox % by sector 2021



ALTITUDE, AIRSPACE AND RISK – 2021 Overview

The following collection of charts depicts airspace, altitude and risk combinations for 2021. 92% of all aircraft-to-aircraft Airprox involved either the GA community or unknown/untraced aircraft, most of these occurred in Class G airspace below 3000.

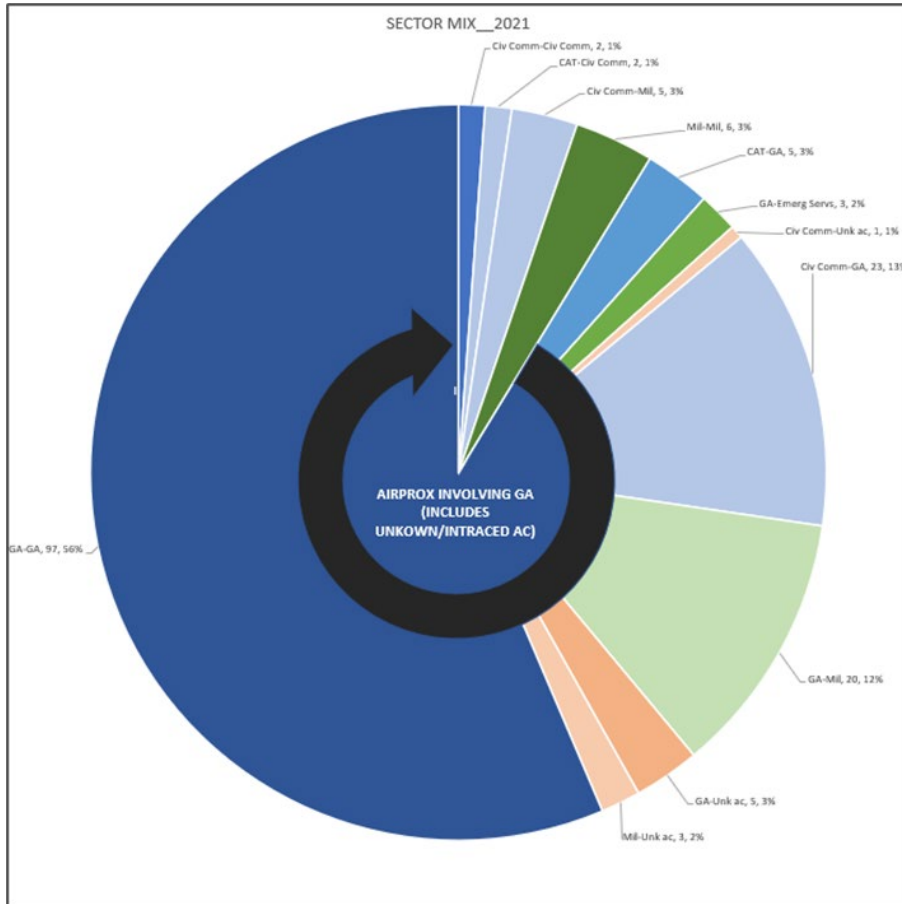


Figure 12: All Aircraft-to-Aircraft Airprox % by sector 2021

In 2021 – 92% of aircraft-to-aircraft events involved a GA Sports and Recreational light aircraft (This number includes Unknown_Untraced aircraft where the description fitted this category)

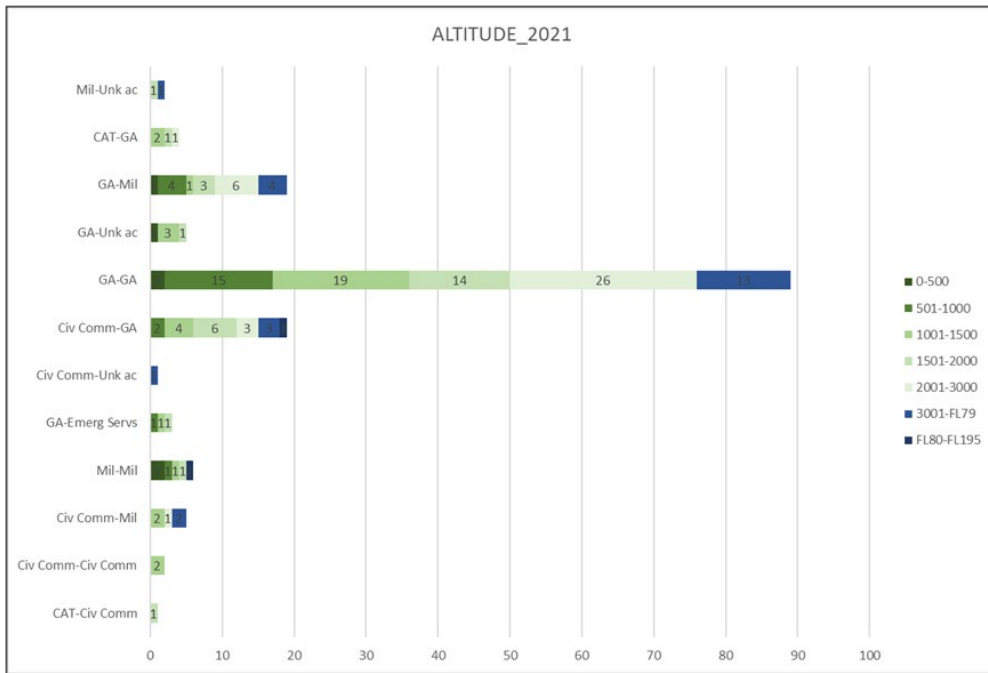


Figure 13: All Aircraft-to-Aircraft Airprox by Sector and Altitude 2021

In 2021 – 76% of all events and 83% of all aircraft-to-aircraft events took place at or below 3000ft altitude.

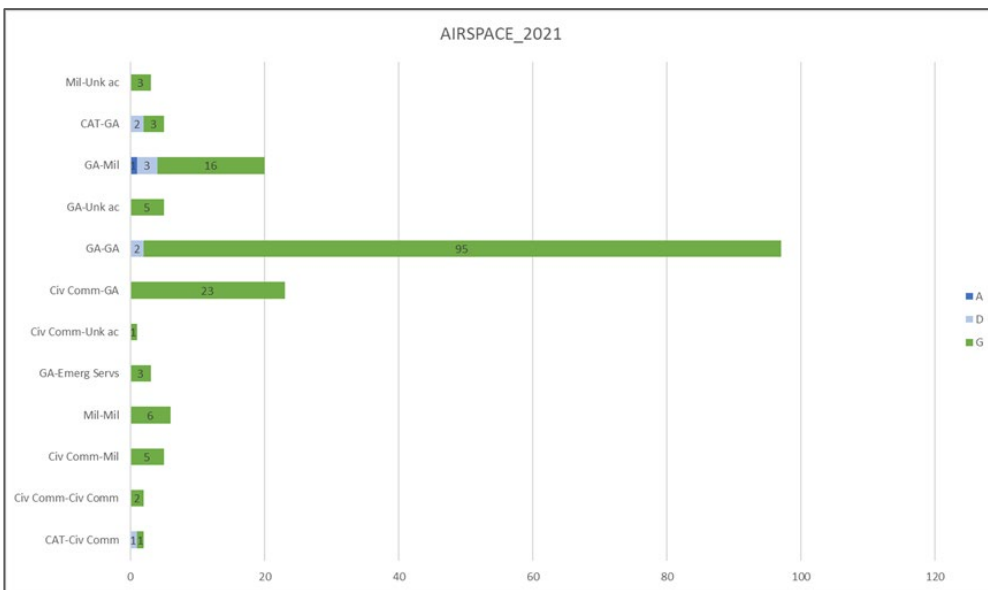


Figure 14: All Aircraft-to-Aircraft Airprox by sector and Airspace 2021

In 2021 – 76% of all events and 95% of all aircraft-to-aircraft events took place in Class G Airspace

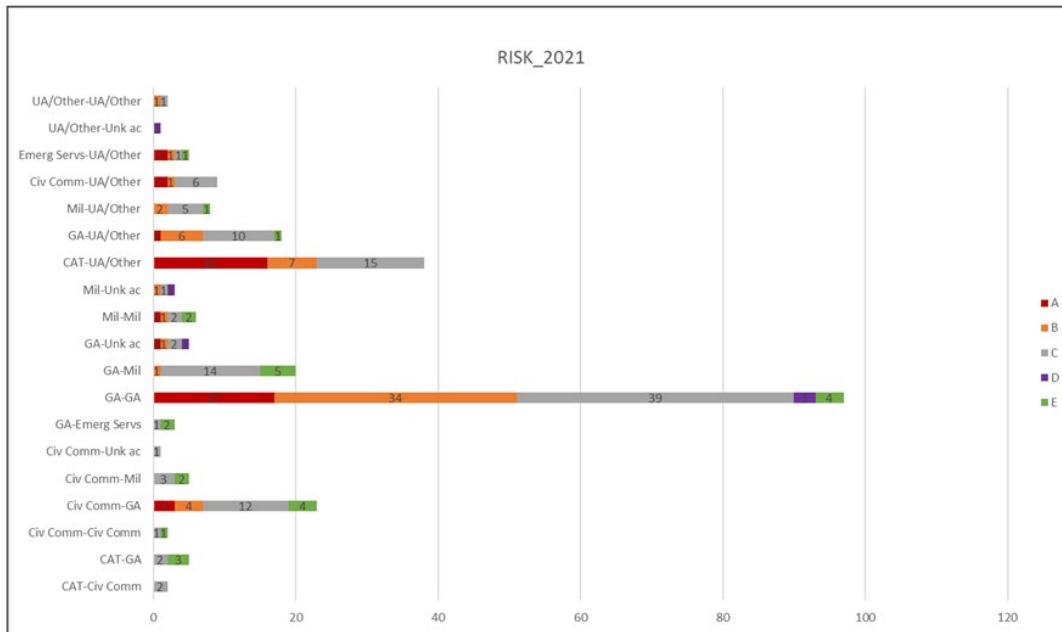


Figure 15: All Aircraft-to-Aircraft Airprox by sector and Risk 2021

We have already seen that 97% of all risk bearing Airprox occur in the GA Sports and Recreational community, but it is useful to have a graphical breakdown of the specifics. The above chart clearly shows the sector mix distributions, and the levels of risk for each sector combination. Tables 4 and 5 provide links to all aircraft-to-aircraft risk bearing events.

In 2021 – **21 out of 22** Category A aircraft-to-aircraft Airprox involved GA Sports and Recreational light aircraft.

Airprox No	Year	Alt Block	Risk Category	Sector Mix
2021003	2021	1001-1500	A	Mil-Mil
2021029	2021	2001-3000	A	GA-GA
2021032	2021	0-500	A	GA-GA
2021045	2021	501-1000	A	GA-GA
2021051	2021	3001-FL79	A	GA-GA
2021054	2021	3001-FL79	A	GA-GA
2021059	2021	1001-1500	A	GA-GA
2021061	2021	1001-1500	A	GA-GA
2021062	2021	3001-FL79	A	GA-GA
2021067	2021	501-1000	A	GA-GA
2021080	2021	0-500	A	GA-GA
2021082	2021	1001-1500	A	GA-Unk ac
2021090	2021	3001-FL79	A	GA-GA
2021114	2021	2001-3000	A	GA-GA
2021120	2021	501-1000	A	GA-GA
2021122	2021	#N/A	A	Civ Comm-GA
2021146	2021	501-1000	A	Civ Comm-GA
2021177	2021	1501-2000	A	GA-GA
2021197	2021	1501-2000	A	GA-GA
2021208	2021	#N/A	A	GA-GA
2021218	2021	#N/A	A	GA-GA
2021220	2021	1501-2000	A	Civ Comm-GA

Table 4: Category A Aircraft-to-aircraft Events

In 2021 – There was **one** Category A aircraft to aircraft Airprox involving Military aircraft.

In 2021 – **39** out of 42 Category B aircraft-to-aircraft Airprox involved GA Sports and Recreational light aircraft.

Airprox No	Year	Alt Block	Risk Category	Sector Mix
2021025	2021	3001-FL79	B	GA-Mil
2021028	2021	2001-3000	B	GA-GA
2021037	2021	501-1000	B	GA-GA
2021038	2021	1001-1500	B	GA-GA
2021043	2021	2001-3000	B	GA-GA
2021053	2021	1001-1500	B	GA-GA
2021060	2021	3001-FL79	B	GA-GA
2021063	2021	501-1000	B	GA-GA
2021064	2021	3001-FL79	B	GA-GA
2021065	2021	1001-1500	B	Civ Comm-GA
2021069	2021	1001-1500	B	GA-Unk ac
2021083	2021	1501-2000	B	GA-GA
2021085	2021	3001-FL79	B	Mil-Unk ac
2021104	2021	1501-2000	B	GA-GA
2021113	2021	501-1000	B	GA-GA
2021117	2021	1001-1500	B	GA-GA
2021124	2021	1001-1500	B	GA-GA
2021126	2021	1501-2000	B	GA-GA
2021129	2021	3001-FL79	B	GA-GA
2021133	2021	2001-3000	B	GA-GA
2021136	2021	1501-2000	B	GA-GA
2021145	2021	#N/A	B	GA-GA
2021147	2021	2001-3000	B	GA-GA
2021152	2021	501-1000	B	Civ Comm-GA
2021153	2021	2001-3000	B	GA-GA
2021157	2021	2001-3000	B	GA-GA
2021165	2021	1001-1500	B	GA-GA
2021166	2021	1001-1500	B	GA-GA
2021169	2021	2001-3000	B	GA-GA
2021173	2021	2001-3000	B	GA-GA
2021182	2021	2001-3000	B	GA-GA
2021184	2021	3001-FL79	B	GA-GA
2021194	2021	1501-2000	B	Civ Comm-GA
2021199	2021	501-1000	B	GA-GA
2021201	2021	1501-2000	B	Civ Comm-GA
2021206	2021	2001-3000	B	GA-GA
2021211	2021	2001-3000	B	GA-GA
2021234	2021	1001-1500	B	GA-GA
2021237	2021	501-1000	B	Mil-Mil
2021241	2021	1001-1500	B	GA-GA
2021246	2021	1001-1500	B	GA-GA
2021251	2021	1001-1500	B	GA-GA

Table 5: Category B Aircraft-to-aircraft Events

In 2021 – There were **3** Category B aircraft-to-aircraft Airprox involving Military aircraft.

ATZ and MATZ Airprox

In terms of numbers, those instances occurring within an ATZ or MATZ has remained relatively constant. Commensurate with the return to flying post-Covid, the numbers reported in 2021 have increased which is consistent with the observed upturn since 2017. Most of these events involve the GA Sports and Recreational sector. The top 5 CF associated with these Airprox are shown in Table 6 and links to those occurring in 2021, including the risk and sector mix, are in Table 7 for ease of reference.

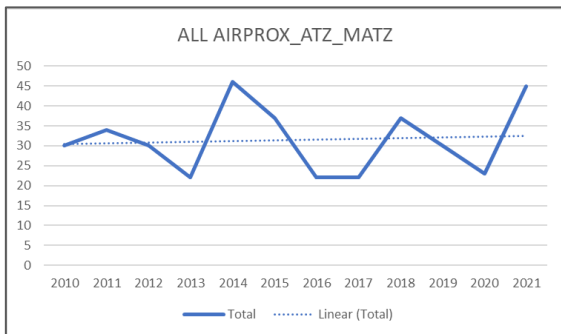


Figure 16: All Aircraft-to-Aircraft Airprox in ATZ_MATZ 2021

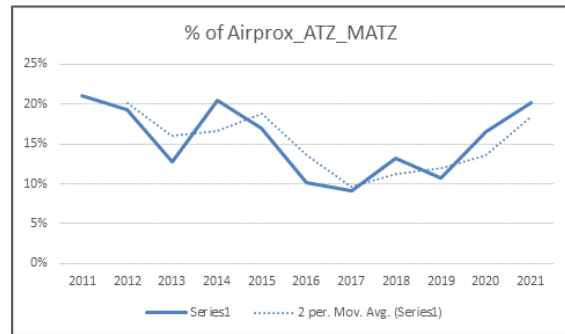


Figure 17: % of All Aircraft-to-Aircraft Airprox in ATZ_MATZ 2021

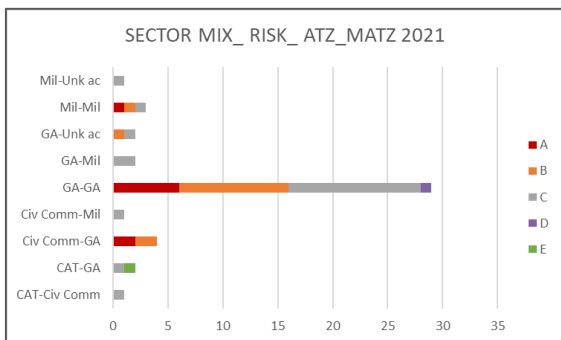


Figure 18: Risk Profile of Aircraft-to-Aircraft Airprox in ATZ_MATZ 2021

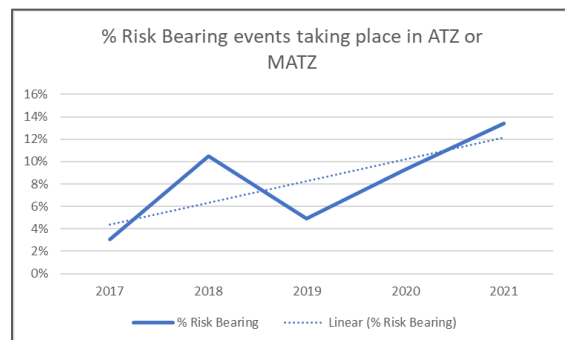


Figure 19: 5-year trend for Aircraft-to-Aircraft Airprox in ATZ_MATZ

Barrier	CF
Tactical planning and Execution	Did not conform with established pattern of Traffic
Situational Awareness	No, Late or generic Situational Awareness
	Did not assimilate traffic information
	Did not request further information
See and Avoid	Effective non-sighting

Table 6: ATZ_MATZ top 5 CF

Airprox No	Year	Alt Block	Risk Category	Sector Mix
2021003	2021	1001-1500	A	Mil-Mil
2021038	2021	1001-1500	B	GA-GA
2021045	2021	501-1000	A	GA-GA
2021061	2021	1001-1500	A	GA-GA
2021063	2021	501-1000	B	GA-GA
2021065	2021	1001-1500	B	Civ Comm-GA
2021067	2021	501-1000	A	GA-GA
2021069	2021	1001-1500	B	GA-Unk ac
2021080	2021	0-500	A	GA-GA
2021117	2021	1001-1500	B	GA-GA
2021120	2021	501-1000	A	GA-GA
2021122	2021	#N/A	A	Civ Comm-GA
2021124	2021	1001-1500	B	GA-GA
2021145	2021	#N/A	B	GA-GA
2021146	2021	501-1000	A	Civ Comm-GA
2021152	2021	501-1000	B	Civ Comm-GA
2021166	2021	1001-1500	B	GA-GA
2021199	2021	501-1000	B	GA-GA
2021208	2021	#N/A	A	GA-GA
2021234	2021	1001-1500	B	GA-GA
2021237	2021	501-1000	B	Mil-Mil
2021241	2021	1001-1500	B	GA-GA
2021246	2021	1001-1500	B	GA-GA

Table 7: All Aircraft-to-aircraft Risk Bearing Airprox in ATZ/MATZ - 2021

You will note that there is minimal emphasis on the See and Avoid barrier for obvious reasons – the Controlled airspace environment is known and regulated. ANSPs conform to traffic separation minima, and it is their responsibility to control the traffic in such a manner as to not compromise these minima – See and Avoid is effectively redundant and appropriately so.

In stark contrast to the barrier diagram for Controlled Airspace, with that of Uncontrolled Airspace – i.e., Class G airspace – the emphasis is almost entirely with the Flight Elements, with 75% of the barrier influence resting in this area. See and Avoid and Situational Awareness are paramount for the Flight Elements and are complemented with Electronic Warning Systems (in the form of EC) and the communication, planning and the execution aspects which are contained in the Tactical Planning and Execution barrier.

Only 25% of the picture comes from the Ground Elements and is captured primarily in the Situational Awareness barrier. In Airprox barrier methodology, the only way to augment the Ground Elements Situational Awareness is through communication and the use of an appropriate level of Service and through the use of EC – which for the Ground Elements refers directly to transponding traffic which can be verified and identified on radar displays.

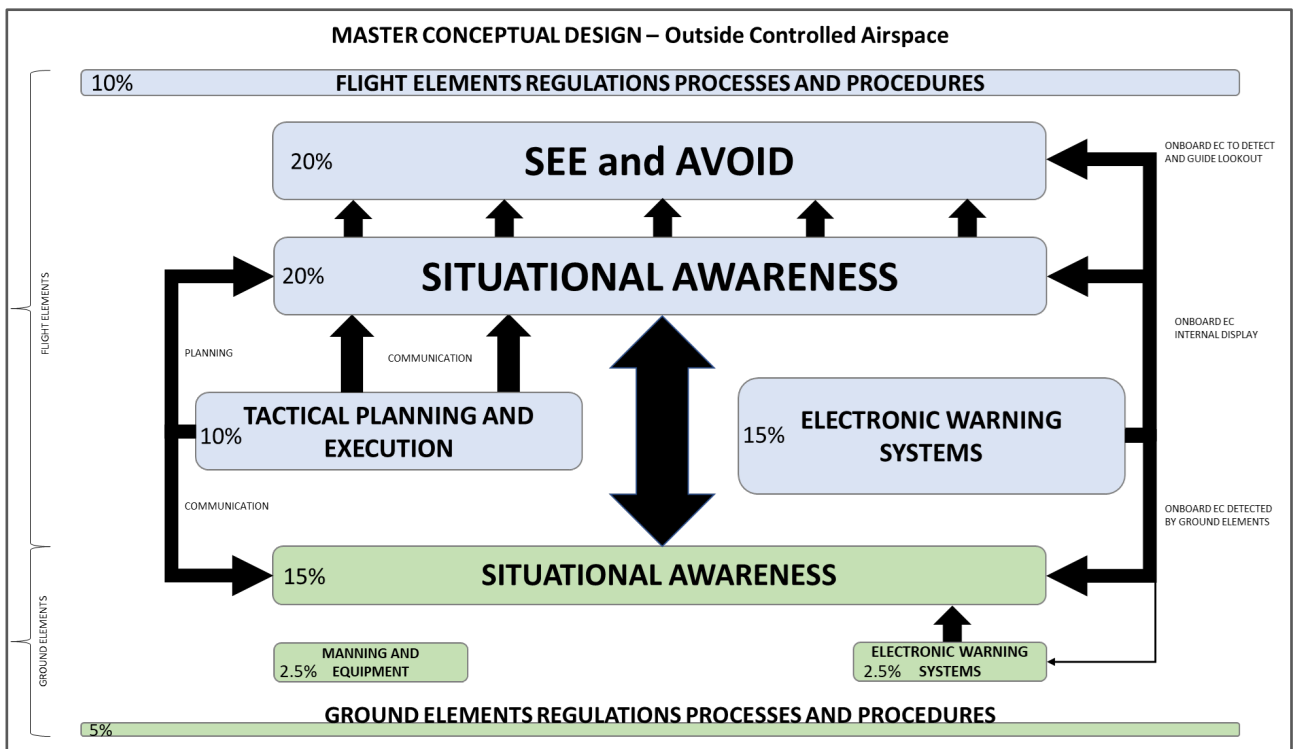


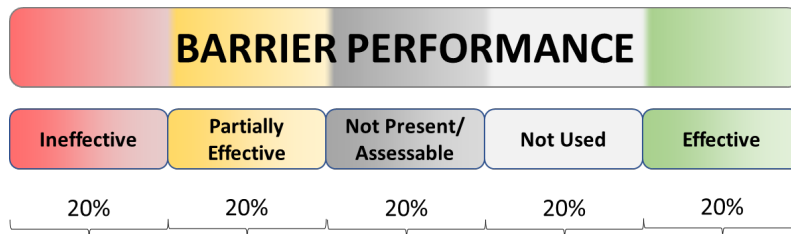
Figure 21: Schematic representation of top-level barrier interactions UNCONTROLLED AIRSPACE

The specific weightings are shown in each diagram and help us to focus on appropriate areas where potentially minimum action will have a proportionately significant effect.

The majority of Airprox take place in Uncontrolled Class G Airspace. As such it is the diagrammatic representation in Fig 21 that I shall take forward and further develop. The following section uses colour to bring each barrier to life and uses the percentage performance distributions in representative proportions dependent on the risk being discussed at the time. This is a development of the concept and a way of illustrating the barrier interactions. As with last year, I will compare risk bearing performance with Category E barrier performance and will introduce the Category C events. Category C events are important because they qualify those occurrences where safety has indeed been degraded but where there has not been an actual risk of collision. By comparing the performance of the barriers for these categories I will show that the principle of See and Avoid is the overriding factor

in MAC mitigation. I will also show that the effectiveness of See and Avoid can be enhanced most effectively by focussing effort on promoting the use of compatible EC equipment, carrying a transponder, communicating with an appropriate ANSP whilst engaging the best service possible. As further mitigation, adopting a considerate, defensive and responsible attitude whilst flying will strengthen the Tactical Planning and Execution barrier and as long as the rules, regulations and procedures have been followed.

Colouring metric with consistent ordering from left to right:



Each following diagram of this type has accurate barrier colouration and accurate barrier proportion where the GA Sports and Recreational community is used as the example Sector Mix unless otherwise stated.

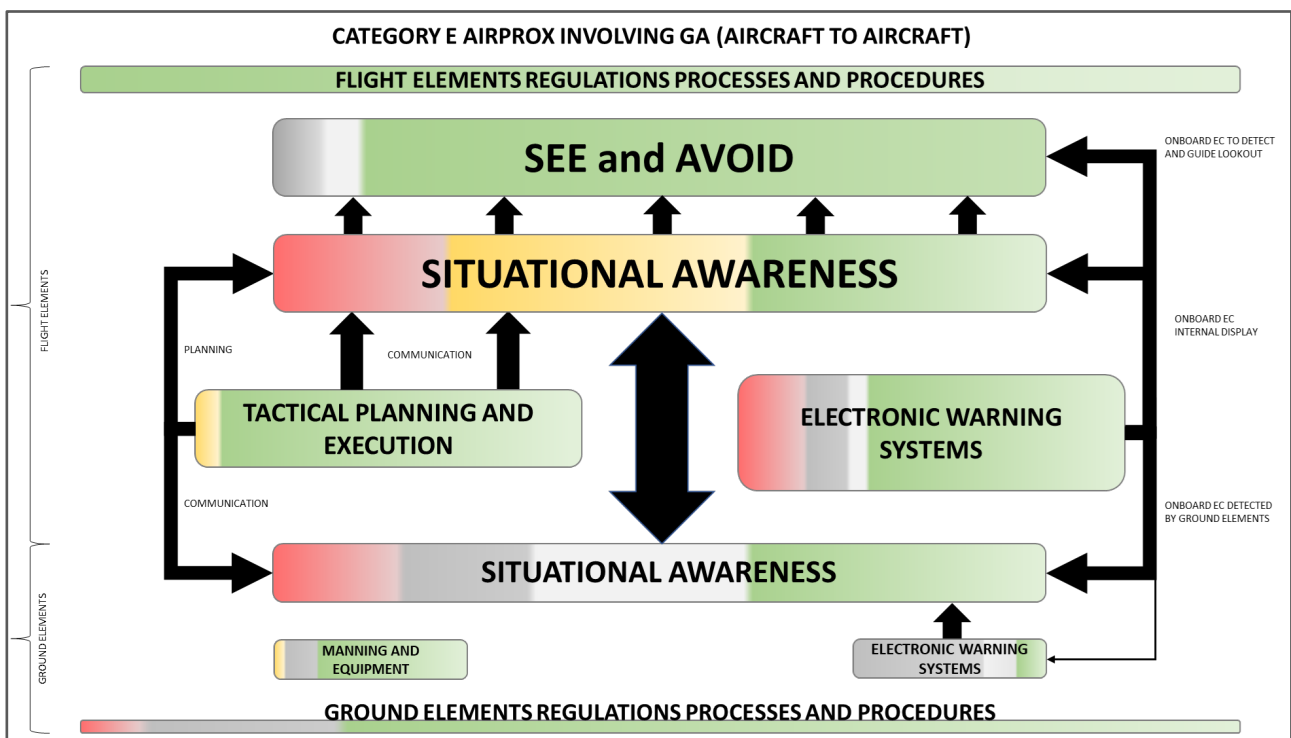


Figure 22: Schematic representation of top-level barrier interactions Category E_GA_UNCONTROLLED AIRSPACE

For Category E Airprox:

Figure 22 above depicts a category E event. This is an event in which the Board has determined that there was no degradation of safety and normal safety parameters have been met. Category E events are useful because we are able to collect information detailing the perspectives of the individuals, facts and the circumstances from an event which would otherwise not be available to us. If we then look at the performance of the barriers over the set of category E events, we can then show what an uneventful flight looks like and use it as a baseline comparator for Airprox where safety is degraded and indeed where one is risk bearing.

The main thing to take away from examining Figure 22 is the fragility of the Flight Elements Situational Awareness barrier. As previously discussed, once airborne, this barrier can only be augmented through the use of an appropriate ANSP and the use of an appropriate service (captured in the Tactical Planning and Execution barrier). The green portion of the Tactical Planning barrier tells us that, in all likelihood, the pilots had planned and executed their sortie effectively and that they were talking with an appropriate agency for the vast majority of the time. However, the white portion of the Ground Elements Situational Awareness barrier tells us that there is still a large percentage of flights who only choose a Basic Service – i.e., the barrier is engaged through communication, but it is Not Used as the pilot(s) are only in receipt of a service where ATC is not required to monitor. Where the barrier is green, this represents occasions where a Traffic Service (or higher) is in play or ATC happens to be actively involved in communicating with one or both of the aircraft at the time of the Airprox.

Electronic Warning Systems are employed 84% of the time and are effective for the majority of the time. This significantly enhances Flight Elements Situational Awareness and directly influences the See and Avoid barrier. With See and Avoid being the primary method of avoiding Airprox, it is essential that any and all levers are employed to strengthen this barrier.

For Category E Airprox, the EWS barrier is Effective (Green) 67%, Not Present in either aircraft (Grey) only 11%, Not Used in 5% and fitted but Ineffective (Red) in only 17% of the total aircraft to aircraft occurrences.

For Category E Airprox, the Ground Elements Situational Awareness barrier is Effective (Green) 39%, Not Used (Basic Service) or Not Present at all.45% of the time and Ineffective only 16% of the time.

For Category E Airprox, the Flight Elements Situational Awareness barrier is Effective (Green) 39%, Partially Effective 39% or Ineffective 22% of the time.

For risk bearing Airprox, the picture is markedly different:

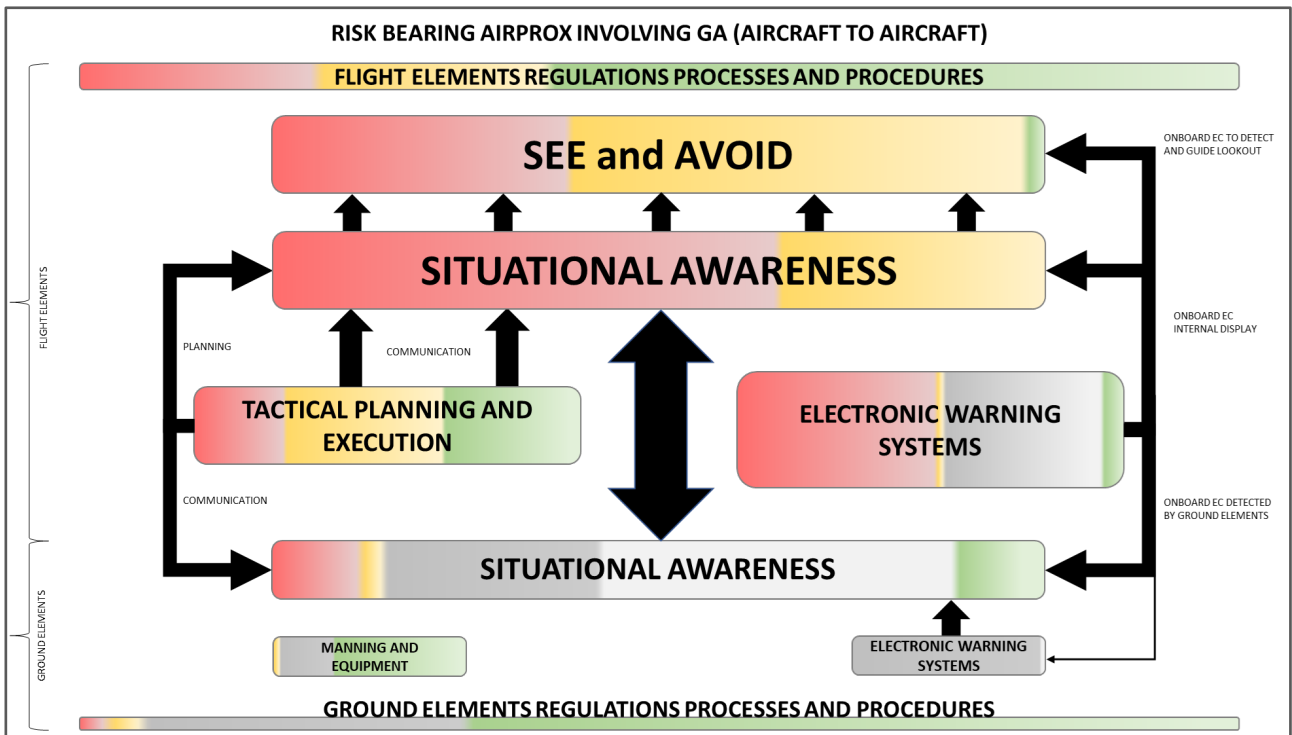


Figure 23: Schematic representation of top-level barrier interactions Risk Bearing_GA_UNCONTROLLED AIRSPACE

The changes in the performance of all the Flight Elements barriers together with that of the Ground Elements Situational Awareness barrier is evident. The poor performance of the Electronic Warning Systems barrier through either non-fitment, or incompatibility of EC equipment, combined with poor planning and execution and the proportion of the time when ATC was not engaged at all, or Not Used (Basic Service) means that the Flight Elements Situational Awareness barrier is NEVER effective. With little or no chance of any external influence to guide the pilot to look out, it is purely the quality of an individual’s lookout or indeed luck which caused the outcome to be an Airprox and not a MAC.

For risk bearing Airprox, the EWS barrier is Effective (Green) only 6%, Not Present in either aircraft (Grey) for 37%, Not Used 3%, Partially Effective 2% and fitted in at least one aircraft but Ineffective (Red) 52% of the time.

For risk bearing Airprox, the Ground Elements Situational Awareness barrier is Effective (Green) 12%, Not Used (Basic Service) 45% or Not Present at all 29%, Partially Effective 3% and Ineffective 11% of the time.

For risk bearing Airprox, the Flight Elements Situational Awareness barrier is NEVER EFFECTIVE

Category C Airprox represent those times where Safety has been degraded, but where there has been no risk of collision. The main changes in the barrier performances of these set of occurrences is evidence of an increase in the Effectiveness of the Electronic Warning System barrier, an associated increase in the performance of the Flight Elements Situational awareness barrier, a marked reduction in the proportion of time that pilots are not communicating at all with an ANSP and a resultant and significant increase in the performance of the See and Avoid barrier. Of course, it could just be that pilots who have category C Airprox conduct a better lookout or are better served by the ‘application of the big sky theory’. However, it is more likely to be as a result of increases in performance of the other critical barriers and their combined influence on the critical See and Avoid barrier.

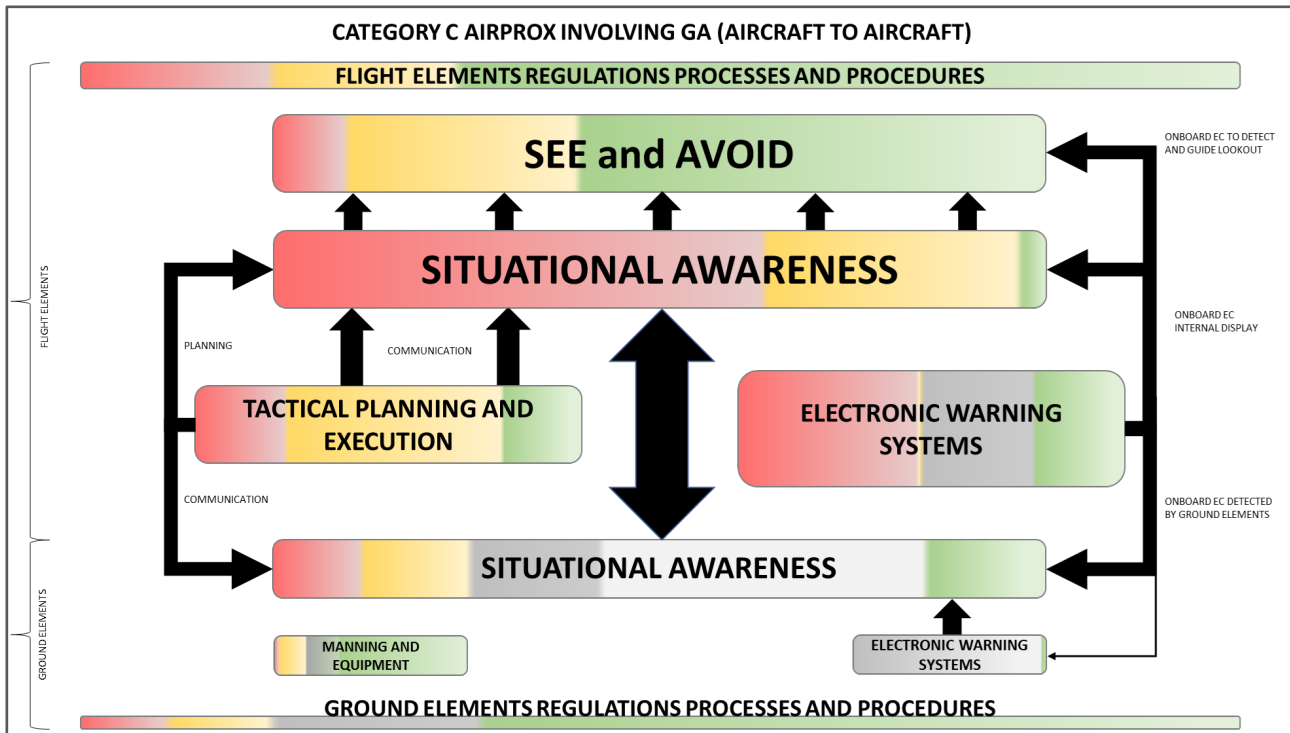


Figure 24: Schematic representation of top-level barrier interactions Category C_GA_UNCONTROLLED AIRSPACE

For Category C Airprox, the EWS barrier is Effective (Green) 24%, Not present in either aircraft (Grey) for 31%, Partially Effective 1% and fitted in at least one aircraft but Ineffective (Red) 44% of the time.

For Category C Airprox, the Ground Element Situational Awareness barrier is Effective (Green) only 15%, Not Present in either aircraft (Grey) for 17%, Not Used 40%, Partially Effective 14% and Ineffective (Red) 14% of the time.

For Category C Airprox, the Flight Elements Situational Awareness barrier is Effective (Green) only 14%, Partially Effective 32% and Ineffective (Red) 64% of the time.

In my last report I introduced the concept of barrier interactions and I demonstrated those interactions by plotting the effectiveness of one barrier against another. Book 36, 2020 annual report can be found at this link: <https://www.airproxboard.org.uk/media/oahp00s3/bluebook36.pdf>

BARRIERS AND CONTRIBUTORY FACTORS BY SECTOR

Having looked at barrier interactions in a slightly different way, scaling the relative influences of each on Airprox outcomes and having used colour to represent the collective performance of the barriers for GA Sports and Recreational instances, it is still useful to examine specific performance of the barriers as individual entities and to draw out the top five Contributory Factors which have influenced those performances. It is important to remember that Contributory Factors are generally only assigned when the barrier has been compromised, so these Contributory Factors indicate areas for individuals, clubs, operating authorities, or responsible bodies to consider when assessing what it is that they can do to improve either individual or collective performance and help to inform risk mitigation strategies and develop regulation.

We will look at the barriers and top 5 Contributory Factors for Airprox involving the GA Sports and Recreational community, those involving the military community and those where the RPAS flyer reported the Airprox.

Before looking at each of the sectors it is useful to summarise the key points associated with the five worst performing barriers:

Ground Elements – Situational Awareness

The Ground Elements Situational Awareness barrier is a two-pronged barrier based upon the relationship between an ANS provider (controller/FISO/AGO) and the pilot. For the barrier to be fully effective the controller themselves *must* have situational awareness about the two aircraft involved in the Airprox. For a large number of Airprox, the type of service provided either did not require the ANS provider to monitor the aircraft on radar (Basic Service), was not using a radar, or was not required to integrate the traffic in the visual circuit (FISO/AGO). In these circumstances the Board normally assesses the barrier as 'not used'. Furthermore, even when providing a service whereby the controller was required to give Traffic Information, if the controller has no knowledge of the conflicting aircraft, Traffic Information cannot be provided; an example of this might be a glider not displaying on the radar. Finally, the controller must be able to pass on the associated information to the pilot.

Flight Elements Situational Awareness

The Flight Elements Situational Awareness barrier describes all elements of situational awareness available within the cockpit, be that controller-derived from listening-out on a frequency or from EC equipment. The Board may also be of the view that a pilot should have generic situational awareness derived from planning documents: e.g. gliders should be expected near a glider site marked on a chart.

Tactical Planning and Execution Barrier

The Tactical Planning and Execution barrier involves both pre-flight and in-flight planning, plan adaptation, communication and execution and it is available to be used in all Airprox environments. It also forms a fundamental and intrinsic part of Threat and Error Management and should be diligently undertaken prior to every flight. This barrier is primarily concerned with doing everything possible on the ground to release capacity in the air which then enables accurate and effective execution of the task and comprehensive communication with ground agencies and other air users. As such it should be the easiest barrier for pilots to address. It is, however, the barrier most susceptible to human performance driven errors – especially those rooted in inexperience.

Electronic Warning Systems Barrier

The Electronic Warning Systems barrier is available for use in all Airprox and indeed forms a key element in the safety barrier system. Like the Tactical Planning and Execution barrier, it contributes to both the Ground and Flight Elements Situational Awareness barrier, but also contributes to the See and Avoid barrier (through guiding visual acquisition) and additionally to the Ground Elements Electronic Warning Systems barrier. This barrier is slightly different from the others in that it is independent to a very large degree of Human Factors: a system is either fitted (appropriately) or it is not. Of course, its efficacy also depends on the geometry of the Airprox and the familiarity of the user with their equipment (amongst other factors), however, these factors feature less than the presence of EC equipment or its compatibility.

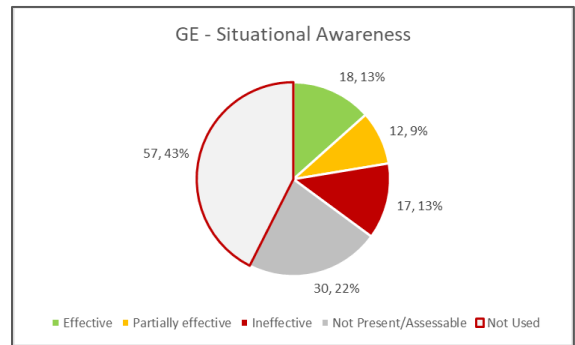
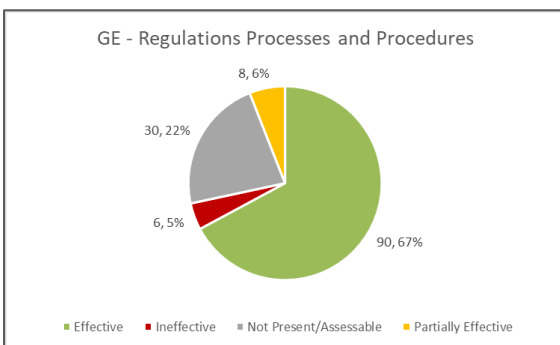
See and Avoid Barrier

The See and Avoid barrier, according to the conceptual model presented at Figure 21, can be considered to be the last barrier to a serious Airprox – however, it should be noted that barrier interactions are rarely consecutive in nature and any one of them can be in play at any one time. Additionally, the influence of this barrier overrides the performance of any of the others.

Where the See and Avoid barrier was **Fully Effective**, the result of the encounter was either a category C, D or E event in 96% of those Airprox

AIRPROX INVOLVING GA SPORTS AND RECREATIONAL AIRCRAFT_A/B/C

GROUND ELEMENTS

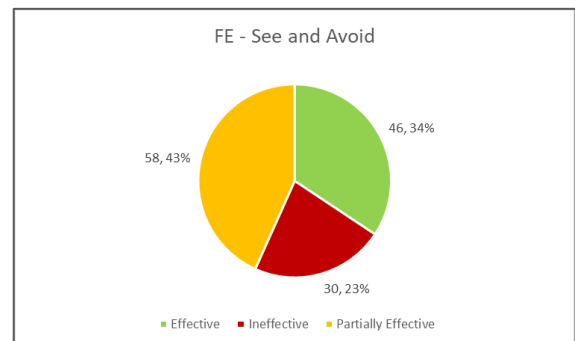
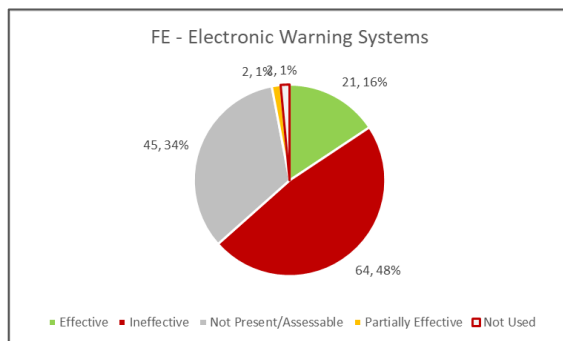
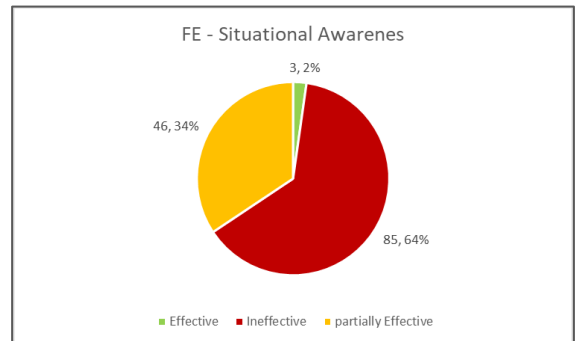
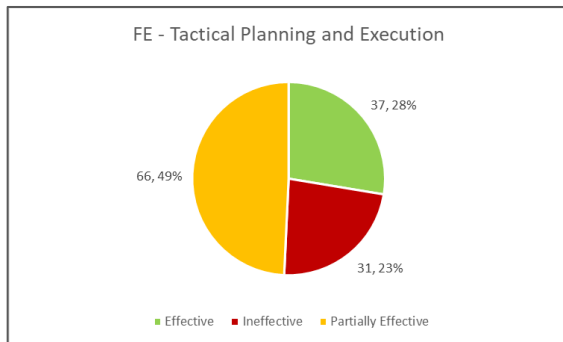


Key Points:

These Barriers were not engaged at all on 30 occasions (22% of the time). This is because neither aircraft was communicating with an ANSP. Where the Regulations, Processes and Procedures barrier was engaged, it was largely effective, however, it is also evident that the Situational Awareness barrier was Not Used 43% of the time, meaning that either an aircraft was in receipt of only a Basic Service, or the aircraft was in a circuit environment with an AGO or AFISO. On 78% of occasions, there was an opportunity for the Ground Elements to play a positive role in the interaction, but they were denied the ability to do so by the Flight Elements 65% of the time. This has a direct impact on the Flight Element Situational Awareness barrier and is evidenced by its particularly poor performance in Category A/B/C Airprox.

Taking an appropriate service from an ANSP will markedly increase the performance of the Ground Elements and will directly affect the performance of the Flight Elements Situational Awareness barrier.

FLIGHT ELEMENTS



Key points to be elicited from this set of pie charts is that 98% of the time the Flight Elements have only partial or no situational awareness of the evolving scenario and we must look to the Tactical Planning and Execution barrier and the Electronic Warning systems barrier to understand why this is the case. The main observations for this barrier are here:

FLIGHT ELEMENTS SITUATIONAL AWARENESS - AIRPROX INVOLVING GA SPORTS And RECREATIONAL_A/B/C
Situational Awareness and Sensory Events-Pilot had no, late or only generic, Situational Awareness
Understanding/Comprehension-Pilot did not assimilate conflict information
Lack of Communication-Pilot did not request additional information
Lack of Action-Pilot flew close enough to cause concern despite Situational Awareness
Monitoring of Communications

Table 8: Flight Elements Situational Awareness – Airprox involving GA Sports and Recreational aircraft

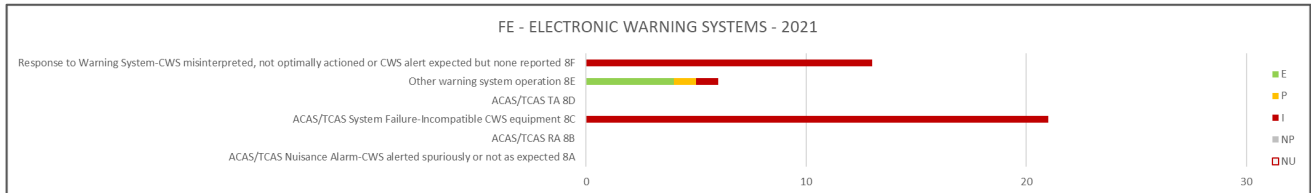
The Board evaluations determine that the Tactical Planning and Execution barrier was only effective 28% of the time. The Contributory Factors for this barrier are key here and we will see that they are related in essence to threat and error management. This covers checking NOTAMs, planning the route to avoid areas of active airspace (e.g., avoiding overflying gliding sites) recognising personal limitations in terms of currency and recency and finally in the communication plan for the flight.

For the Tactical Planning and Execution barrier the following are the Contributory Factors areas which are important to address by all communities:

TACTICAL PLANING AND EXECUTION – AIRPROX INVOLVING GA SPORTS And RECREATIONAL_A/B/C
Action Performed Incorrectly (Incorrect or ineffective execution)
Communications by Flight Crew with ANS (Pilot did not communicate with appropriate ATS provider)
Accuracy of Communication (Ineffective communication of intentions)
Insufficient Decision/Plan (Inadequate plan adaption)
Monitoring of Other Aircraft (Did not avoid/conform with the pattern of traffic already formed)

Table 9: Tactical Planning and Execution barrier – Airprox involving GA Sports and Recreational aircraft

Finally, the EWS barrier is either not present or is ineffective 82% of the time. With no equipment fitted the barrier is totally redundant, with incompatible EC fitted it is just as useless. If there is one key take-away from the work of the UKAB it is this area and this specific point. Furthermore, and as a secondary but equally influential factor, is training in the interpretation of the information available from the interactions of compatible equipment. This is the second most prevalent reason for the failure of the EWS barrier.

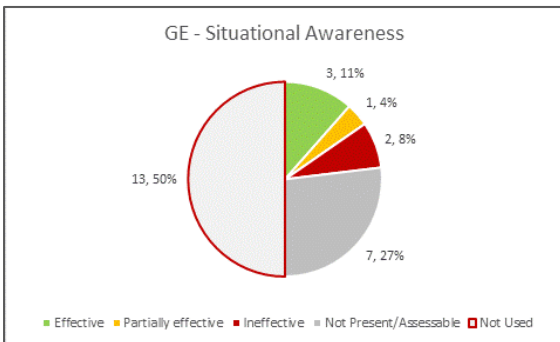


Take every opportunity to augment Situational Awareness: Plan, revise, communicate, fit and understand your EC equipment. Preparation will increase capacity and all of the above will contribute to your ability to concentrate on a robust and accurate LOOKOUT which is ultimately the key to a safe and successful flight in Class G Airspace.

AIRPROX INVOLVING GLIDERS_A/B/C

The main subsector within GA Sport and Recreational aircraft is those Airprox involving Gliders. Here there are specific challenges which highlight areas of concern with the integration of powered and non-powered aircraft into the same minimally regulated portion of airspace that is characterised by Class G operations.

GROUND ELEMENTS

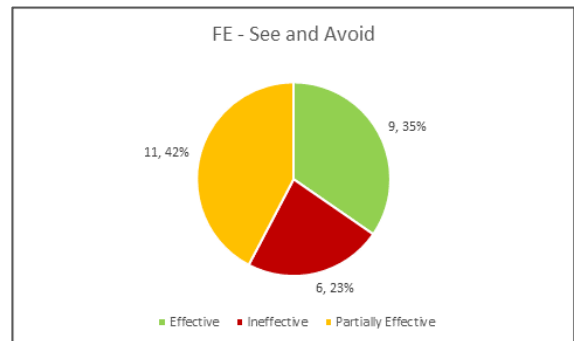
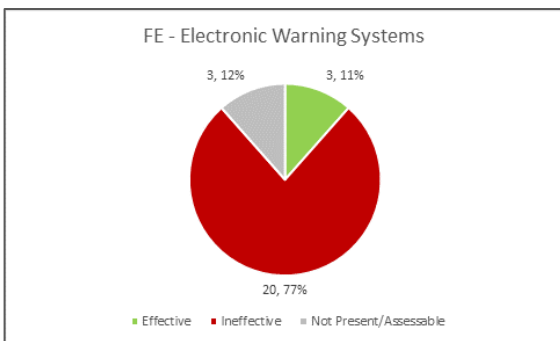
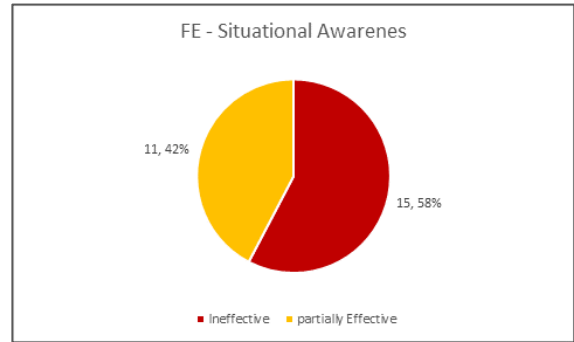
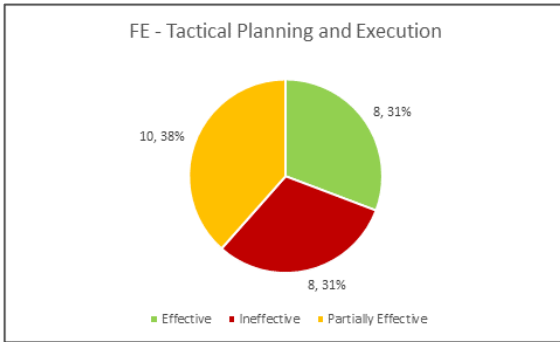


For Airprox involving Gliders the Ground Elements are only engaged in an active way 23% of the time, with only a Basic service being provided on 50% of the occasions (primarily by the pilot of the powered aircraft). It is acknowledged that radio licences are not compulsory in the gliding community, and the efforts taken by the BGA in promoting the benefits of obtaining one are noted and welcome.

There is little else to comment on with regard to the Ground Elements for Airprox involving Gliders apart from noting that the majority of gliders do not carry transponders will only appear as primary returns with no information on ATC radar equipment, if installed.

FLIGHT ELEMENTS

There are, however, a number of significant differences when one examines the Flight Elements, either in the performance of the barriers or, where the performances seem similar, in the contributory factors underpinning them:



There seems little difference in the performance of the Tactical Planning and Execution barrier, however the Contributory Factors are markedly different – for Airprox involving GA Sports and Recreational aircraft (which would also have included gliders) the most frequent were ‘action performed incorrectly’ and ‘communications with an appropriate ATS’.

For Airprox involving Gliders, the top 5 Contributory Factors are:

TACTICAL PLANING AND EXECUTION – AIRPROX INVOLVING GLIDERS_A/B/C
Insufficient Decision/Plan-Inadequate plan adaption
Communications by Flight Crew with ANS-Pilot did not request appropriate ATS service or communicate with appropriate provider
Aircraft Navigation-Flew through promulgated and active airspace
Airspace Infringement
Action Performed Incorrectly-Incorrect or ineffective execution

Table 10: Tactical Planning and Execution barrier – Airprox involving Gliders

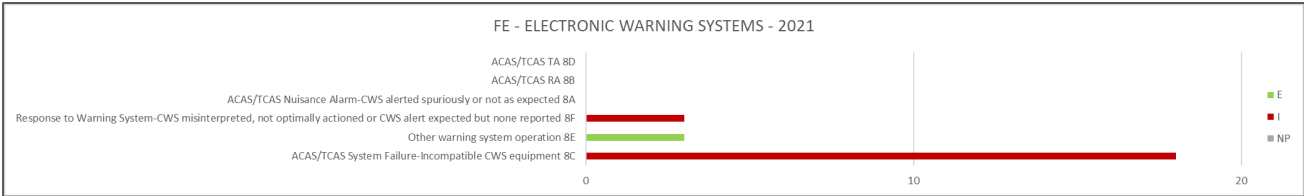
Not only are the Contributory Factors different (apart from the communication piece) but it is an observed fact from the Board deliberations that the degradation in this barrier with poor planning and the resultant actions of flying through promulgated and active airspace *and* having an Airprox are normally the actions of the powered aircraft’s pilot.

The Situational Awareness barrier is NEVER effective – this is normally only observed with risk bearing Airprox, not with Airprox categorised A to C. The only other way to positively influence the Situational Awareness barrier is through EC as captured in the Electronic Warning Systems barrier. For the See and Avoid barrier it is the accuracy and quality of lookout and lookout complemented by cues from the installed EC equipment (if fitted). It seems logical then that the performance of the Electronic Warning Systems barrier is important and intrinsically linked to Situational Awareness and the See and Avoid barrier.

Strikingly, for the subset of Airprox in the GA Sports and Recreational sector which involve gliders, the Electronic Warning Systems barrier is Ineffective 77% of the time, Not Present 12% of the time

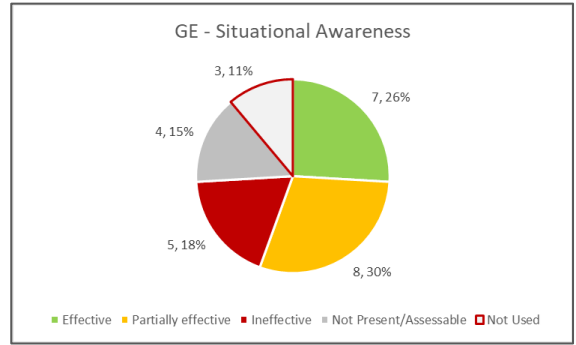
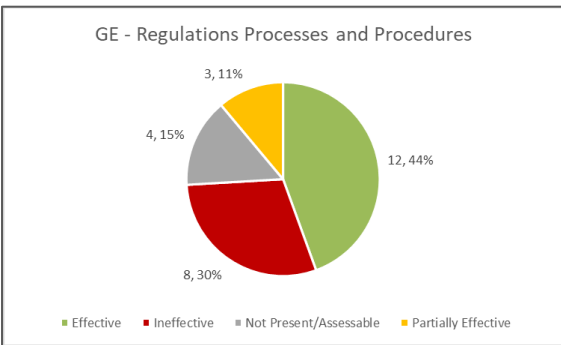
and Effective only 11 % of the time. Where the barrier is Ineffective it is as a result of incompatibility of electronic compatibility equipment in 87% of the occasions.

EC equipment which responds and reacts only to transponding traffic will NOT be effective with Gliders as the majority of them do not have transponders and, if they are fitted, they are usually turned OFF



AIRPROX INVOLVING MILITARY AIRCRAFT_A/B/C

GROUND ELEMENTS



For Airprox involving military aircraft we can see a markedly different distribution of the performance of these 2 barriers. Note the percentage of time that the Barrier is not engaged at all – only 15%. This means that 85% of the time one or both of the aircraft were engaged with ANSPs. Additionally, the Not Used barrier is only captured on 11% of the occasions. This means that the ANSPs involved were offering a service greater than that of a Basic Service. With Airprox, it is the case that we collect information when something strays from normal operations – it is crucial that the correct conclusions are drawn as it would be easy to conclude that the performance of the Ground Elements Situational Awareness barrier is ‘not as bad’ when the barrier is not used (as in Airprox involving GA). The Regulations Processes and Procedures barrier seems to perform better, and the proportions of Partially Effective and Ineffective are smaller. This would be an incorrect conclusion as we will see when we look at the performance of the Flight Elements Situational Awareness barrier. What we are actually seeing here is really helpful as it highlights the main areas that compromise a barrier *when that barrier is engaged*. Note that there were only 27 Airprox involving Military aircraft, and this includes 3 which were reported by UA/Other but were fully evaluated.

GROUND ELEMENTS SITUATIONAL AWARENESS BARRIER – AIRPOX INVOLVING MILITARY_A/B/C
ANS Traffic Information Provision-TI not provided, inaccurate, inadequate, or late
Conflict Detection-Not Detected
Expectation/Assumption-Concerned by the proximity of the aircraft
ATM Coordination
Task Monitoring-Controller engaged in other tasks

Table 11: Ground Elements Situational Awareness – Airprox involving Military Aircraft

Furthermore, where this barrier was Ineffective or Partially Effective, in 70% of the cases, the Manning and Equipment barrier was also compromised due to Leadership and Supervision, Scheduling and OJT.

Airprox worthy of further study from the Ground Elements perspective are:

Airprox No	Year	Alt Block	Risk Category	Sector Mix
2021003	2021	1001-1500	A	Mil-Mil
2021202	2021	1001-1500	C	Civ Comm-Mil
2021008	2021	2001-3000	C	GA-Mil
2021023	2021	2001-3000	C	GA-Mil
2021093	2021	3001-FL79	C	GA-Mil
2021095	2021	501-1000	C	GA-Mil
2021135	2021	0-500	C	Mil-Unk ac
2021213	2021	1501-2000	C	GA-Mil
2021228	2021	2001-3000	C	GA-Mil

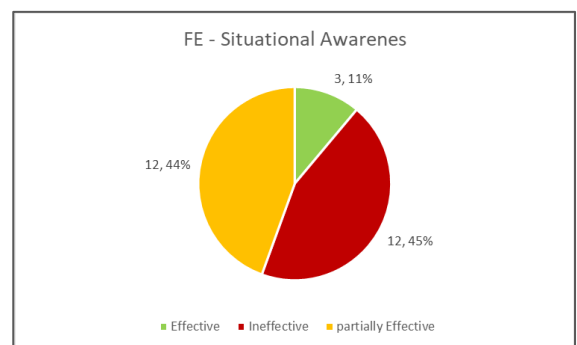
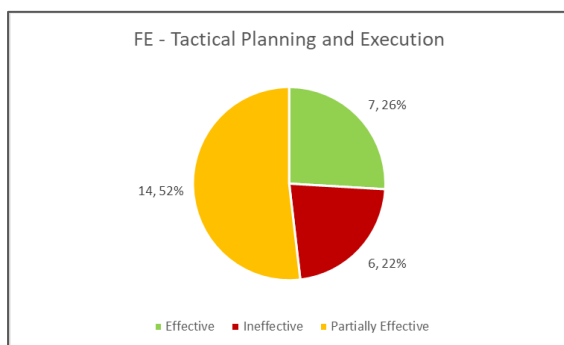
Table 8: Airprox involving Military Aircraft – worthy of study

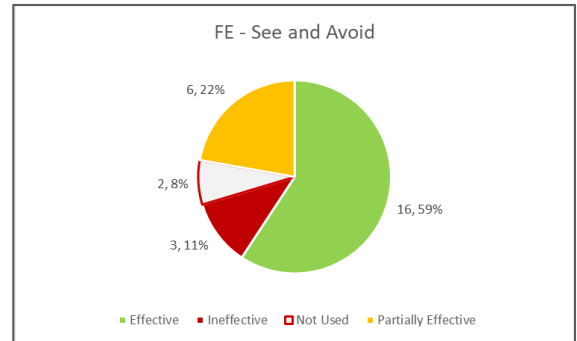
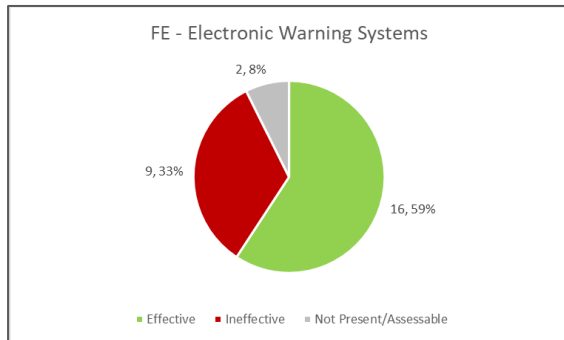
FLIGHT ELEMENTS

The first thing that jumps out here is the significant increase in an Effective barrier for the Situational Awareness, Electronic Warning Systems and, as a result the See and Avoid barrier. Where the Situational Awareness barrier was compromised it was for similar reasons to those Airprox involving GA Sports and Recreational aircraft – namely the assimilation, processing of and action taken once the information had been received.

FLIGHT ELEMENTS SITUATIONAL AWARENESS BARRIER – AIRPROX INVOLVING MILITARY AIRCRAFT
Situational Awareness and Sensory Events-Pilot had no, late or only generic, Situational Awareness
Lack of Action-Pilot flew close enough to cause concern despite Situational Awareness
Understanding/Comprehension-Pilot did not assimilate conflict information
Unnecessary Action-Pilot was concerned by the proximity of the other aircraft
Lack of Communication-Pilot did not request additional information

Table 12: Flight Elements Situational Awareness – Airprox involving Military Aircraft





Interestingly the Tactical Planning and Execution Barrier performs comparably to those Airprox involving GA Sports Recreational aircraft, but the reasons for the barrier compromise are different:

TACTICAL PLANING AND EXECUTION – AIRPROX INVOLVING MILITARY AIRCRAFT_A/B/C
Insufficient Decision/Plan-Inadequate plan adaption
Action Performed Incorrectly-Incorrect or ineffective execution
Pre-flight briefing and flight preparation
Monitoring of Environment-Did not avoid/conform with the pattern of traffic already formed
Accuracy of Communication-Ineffective communication of intentions

Table 13: Tactical Planning and Execution barrier – Airprox involving military aircraft

It is compromised by planning, preparation and execution. Communication figures only at number 5 where it is concerning accuracy rather than an appropriate ANSP. In Airprox involving GA Sports and Recreational aircraft, communication is 2nd and 3rd with ‘not communicating with an appropriate ANSP’ featuring as number 2. It is these changes in emphasis which are the most interesting. For military aircraft, the complexity of the sortie demands thorough planning – at all times. This planning could be to prepare for a Low-Level mission in the military low flying system, a circuits trip at an unfamiliar civilian airfield without ATC or encounters with conflicting traffic in the MATZ. This is not to say that it is the military aircraft which is necessarily collecting these contributory factors, it is simply to say that the normal complexity of a military flight can introduce an additional complexity: e.g. the Low flying System means that Military and other certain users are able to deconflict their sorties at the planning stage – the GA Sports and Recreational communities are not. The extreme (in comparison) performance of a military aircraft versus a standard GA Sports and Recreational aircraft (which could be anything ranging from a PA28 to a Glider to a paramotor) can induce an augmentation in the perception of risk or indeed actually increase the risk of collision. The differences in the way military pilots interact with military controllers, civilian pilots interact with military controllers and military pilots interact with civilian controllers induces yet another complexity where the subtle differences in roles and responsibilities and, in some cases, the differences in military-only regulation further complicates the matter.

Finally, when the Electronic Warning Systems barrier was Ineffective, it was always a mix of Military and GA Sports and Recreational aircraft where compatibility of equipment was a significant issue.

It should be noted that there were only 4 aircraft-to-aircraft risk bearing Airprox that involved Military aircraft. The majority of them were categorised as category C, where safety was degraded but there was no risk of collision. This distribution is directly related to the proportion of the time that the Situational Awareness barrier and the Electronic Warning System barrier was effective as this had a direct effect on the effectiveness of the See and Avoid barrier, meaning that conflicting aircraft (either sector) were seen with sufficient time to introduce deconfliction without the need for emergency or radical avoiding action. However, there are still areas which deserve focus, and these can be summarised here:

AIRPROX INVOLVING MILITARY AIRCRAFT	
GROUND ELEMENTS	FLIGHT ELEMENTS
ANS Traffic Information Provision-TI not provided, inaccurate, inadequate, or late	Lack of Action-Pilot flew close enough to cause concern despite Situational Awareness
Conflict Detection-Not Detected	Understanding/Comprehension-Pilot did not assimilate conflict information
Leadership and Supervision	Insufficient Decision/Plan-Inadequate plan adaption 6G
Staffing and Scheduling	Action Performed Incorrectly-Incorrect or ineffective execution
Instruction or Training	Incompatible CWS

Table 14: General Contributory Factors – Airprox involving Military Aircraft

AIRPROX Reported by RPAS (full Board evaluations)_A/B/C

The final bespoke section concerns the findings relating to interactions between RPAS and piloted vehicles. Although the numbers are small, these Airprox are significant because the RPAS flyer has reported the occurrence. This simply means that the UKAB Secretariat is able to trace the conflicting aircraft and the Board is therefore able to conduct a full evaluation of the event.

This is not the case with UA/Other Airprox where the non-piloted vehicle is untraceable. As with all sectorised Airprox, it is the differences in the barrier performances which are illuminating so it is useful to use the barrier conceptualisation diagram to illustrate the dynamics of the situation. For these cases I will also present the See and Avoid barrier qualified from both the perspective of the RPAS flyer and then the Piloted Vehicle.

It is clear that the Ground Elements play very little, if any, part in this type of Airprox leaving the Flight Elements with the only levers to mitigate against an occurrence.

We can also see that the Regulations, Processes and Procedures barrier performs well.

For the Tactical Planning and Execution barrier the main Contributory Factors to an Ineffective or only Partially Effective barrier are planning, preparation and plan adaption.

The Ground Elements are not able to add much, if any, value to RPAS Flyer operations

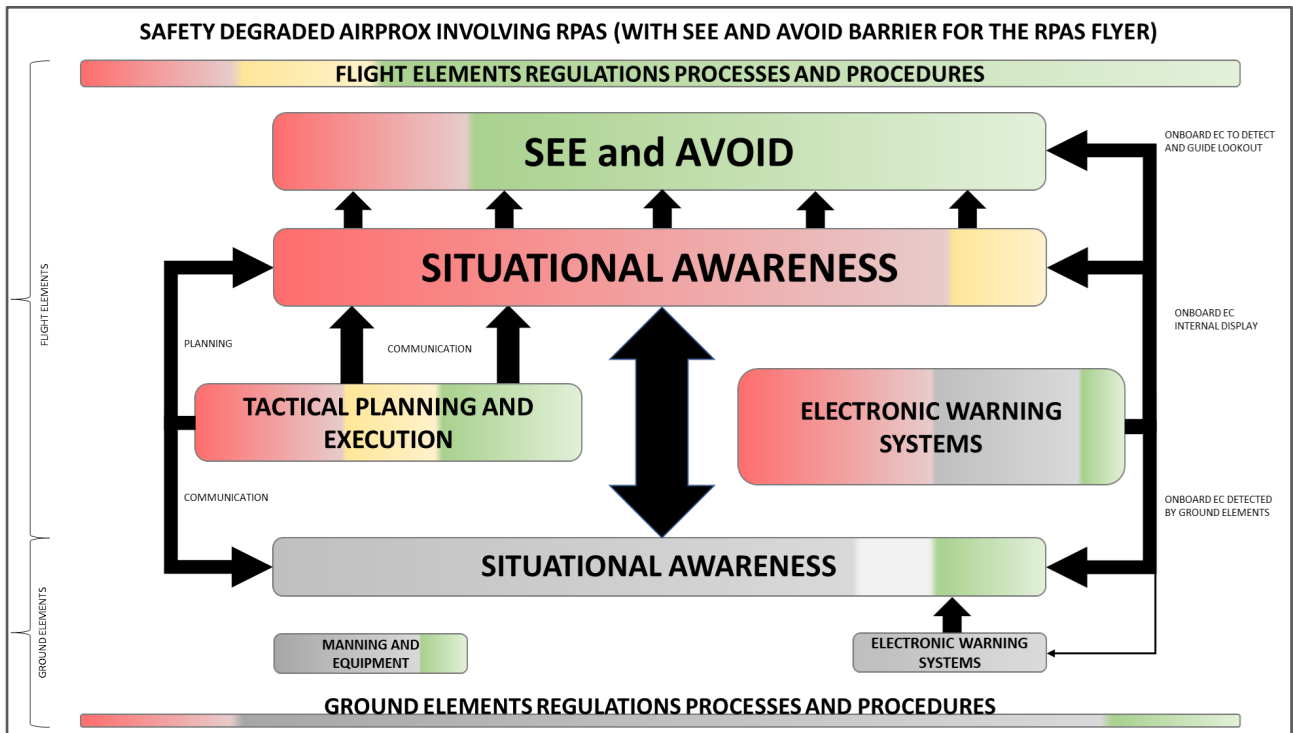


Figure 25: Schematic representation of top-level barrier interactions RPAS reported_A/B/C

On one occasion the RPAS was fitted with a form of EC which alerted the flyer (too late) to the presence of the approaching aircraft, but in all other cases it was either ineffective through incompatibility where a piece of equipment was fitted to the piloted aircraft and not fitted to the RPAS, or not fitted to either.

Situational Awareness was never Effective – being only Partially Effective once.

When all of these points are taken into consideration the feeds into the See and Avoid barrier are degraded significantly. However if one looks at Fig 25 the barrier performs really well. This is because on each and every occasion where this barrier was effective it was the RPAS Flyer who heard an aircraft in the vicinity and was able to acquire it visually and take action to avoid it.

Figure 26 has been constructed using the See and Avoid barrier information from the perspective of the piloted vehicle – the pilots involved NEVER saw the RPAS.

In all cases where the RPAS Flyer has reported the Airprox, the pilot in the piloted aircraft was NEVER aware of its presence.

Although the data set for these occurrences is incredibly small, consisting of only 8 Airprox, these 8 Airprox elicited 2 recommendations where the Board was seeking to improve the promulgation of planning information for RPAS activity. This concern has continued throughout 2022 and has elicited another recommendation concerning promulgation/coordination and communication. It is difficult to cater for all circumstances, but there is a nervousness surrounding the regulatory requirements as technological advances bring us ever closer to civilian BVLOS RPAS operations in Class G airspace. Although BVLOS RPAS will almost certainly have a larger visual cross section, they will still be significantly smaller than piloted aircraft, rendering this barrier more vulnerable than it already is. For the RPAS, the See and Avoid will be akin to a Sense and Avoid, yet Class G airspace does not require and the regulations do not support a known air traffic environment. Until this is the case there are no effective barrier mitigations to an Airprox with RPAS once airborne and those barriers which can be

employed by the Flight Elements on the ground i.e NOTAM information are either negated by the nature of the flight as it is not required or, where flyers are taking the initiative and promulgating their activity, they are doing so on a plethora of unregulated platforms where it is only by luck that a conscientious pilot conducting planning activity may stumble across something relevant.

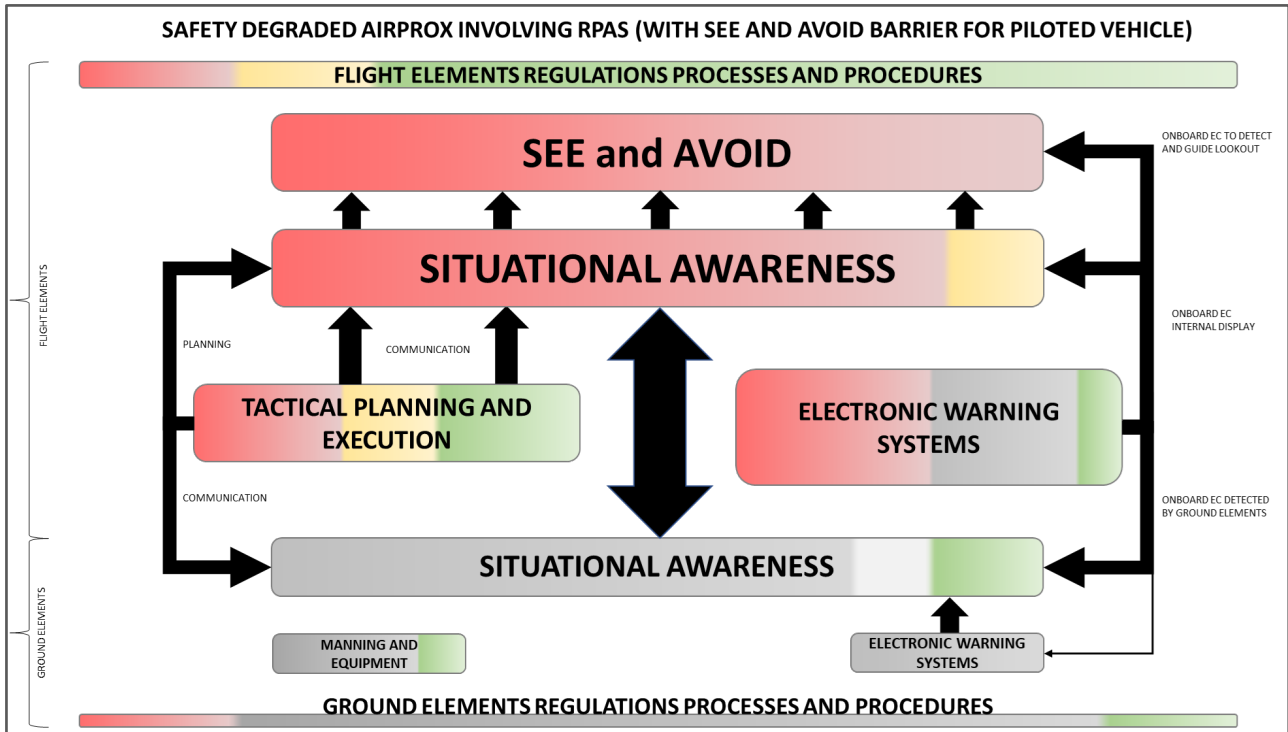


Figure 26: Schematic representation of top-level barrier interactions RPAS reported A/B/C See and Avoid from piloted vehicle

The table below provides links to the 8 Airprox where the Board was able to conduct a full evaluation:

Airprox No	Year	Alt Block	Risk Category	Sector Mix
2021012	2021	0-500	C	Mil-UA/Other
2021015	2021	0-500	C	Mil-UA/Other
2021035	2021	0-500	B	GA-UA/Other
2021057	2021	0-500	B	Mil-UA/Other
2021130	2021	501-1000	C	GA-UA/Other
2021156	2021	0-500	C	GA-UA/Other
2021203	2021	0-500	C	GA-UA/Other
2021205	2021	#N/A	C	GA-UA/Other

Table 15: Airprox involving Military Aircraft – worthy of study

Final Comments

This report has been compiled in such a way as to highlight the criticality of barrier interactions for all sectors. The dominance of the GA Sports and Recreational community in the Airprox landscape is worrying, but more worrying is the slow but steady rise of the proportions of risk bearing Airprox which involve that community. The Barrier performance and Contributory Factors allow us to focus in on certain areas, but the fact that the observations and the associated Contributory Factors are relatively constant and have remained so since 2018 indicates that more positive action needs to be taken by responsible bodies and individuals alike:

Airprox analysis has consistently highlighted the key areas:

- Compatibility of EC
- [Electronic conspicuity devices | Civil Aviation Authority \(caa.co.uk\)](#)
- Appropriate use of ATC services
- Planning including choice of routes, NOTAMs, Wx, etc
- Understanding of value and use of Basic Service, Listening Squawks, and responsibilities when flying VFR in Class D airspace and/or flying IFR in Class G
- Threat and Error Management in general
- Lack of familiarity with circuit procedures and/or services provided by and responsibilities of AGOs, FISOs and controllers
- Quality of lookout

Each community, each operating authority and each regulatory authority has a responsibility to act to change this Status Quo

Rachael Caston

Director UKAB

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ADDITIONAL INFORMATION

The following section is additional data comprising the following:

- A set of 5 charts for each sector where one can easily refer to the Sector mix, the altitude, the Airspace and the Risk distributions. These charts provide a quick access overview of the Airprox demographic:

UA/OTHER	CAT Civ Comm	GA Unk ac	Mil
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- A summary of [Safety Recommendations](#) (2021)
- The [2021 Airprox Catalogue](#) including Links to specific reports.

UA/OTHER SECTOR MIX

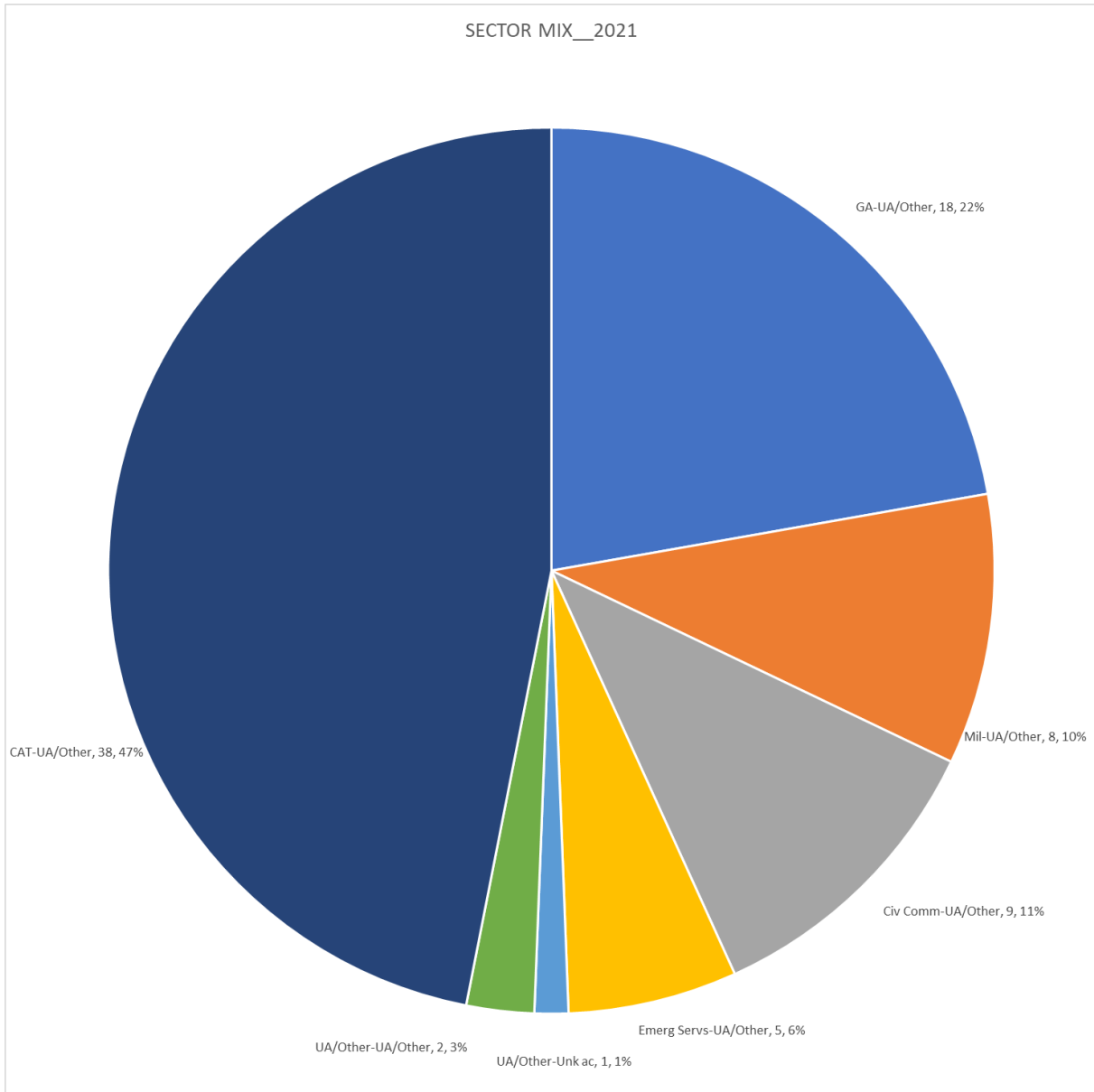


Figure 27: UA OTHER Sector Mix_2021

UA/OTHER SECTOR MIX_ALTITUDE

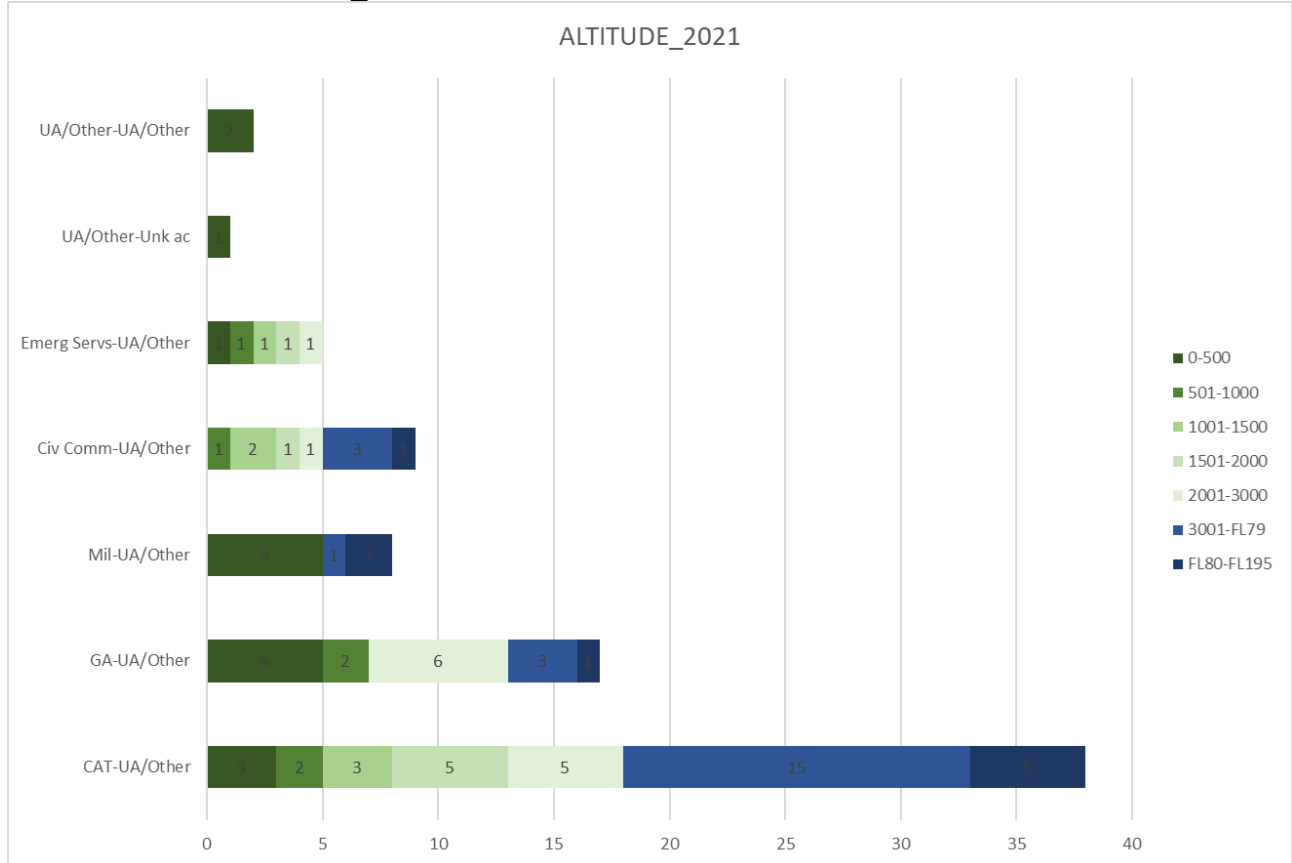


Figure 28: UA/Other Sector Mix_Altitude_2021

UA/OTHER SECTOR MIX_AIRSPACE

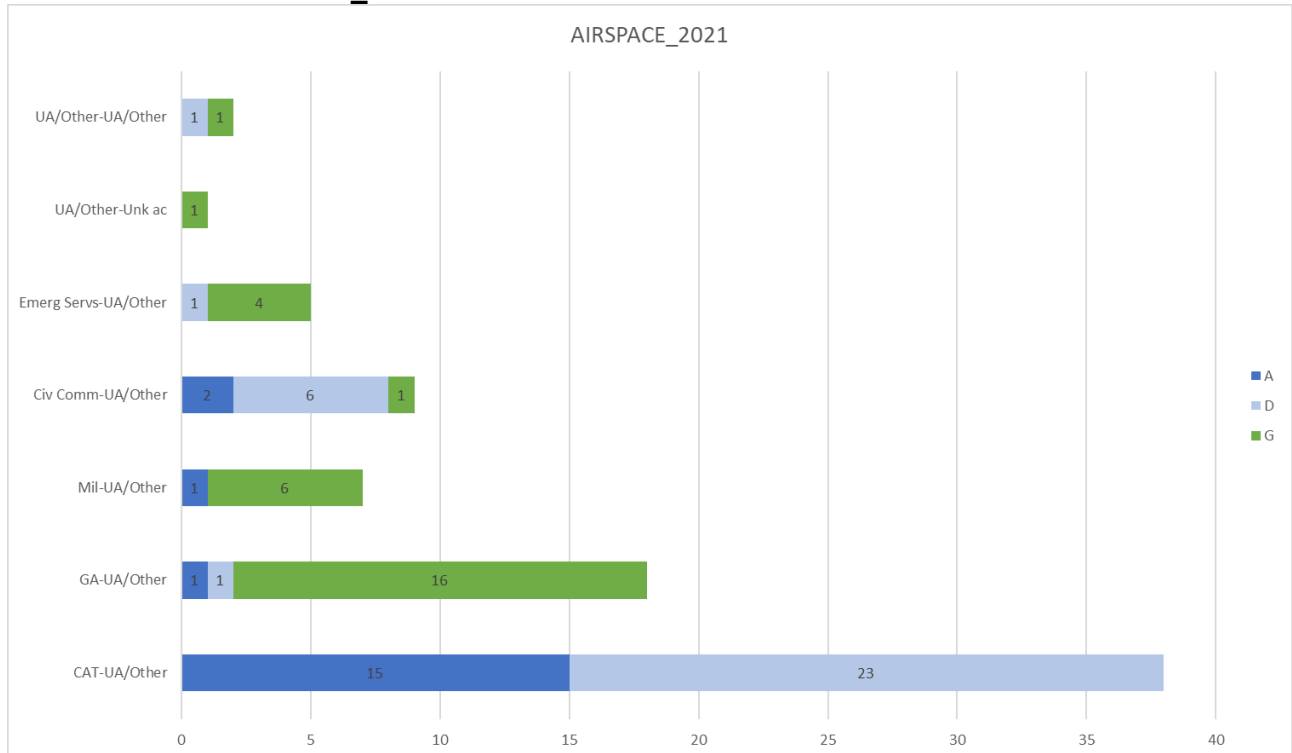


Figure 29: UA/OTHER Sector Mix_Airspace_2021

UA/OTHER SECTOR MIX_ALTITUDE_RISK BEARING

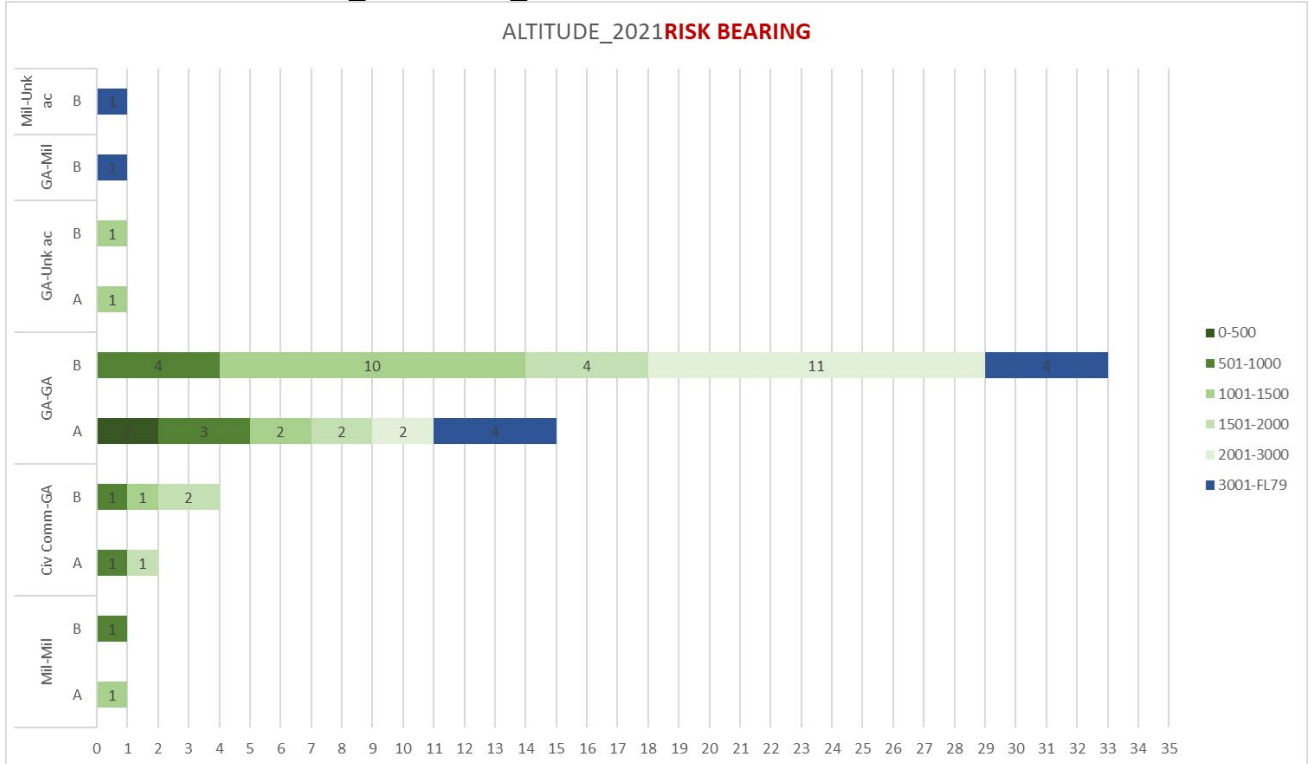


Figure 30: UA/OTHER Sector Mix_Altitude_Risk Bearing_2021

UA/OTHER SECTOR MIX_RISK

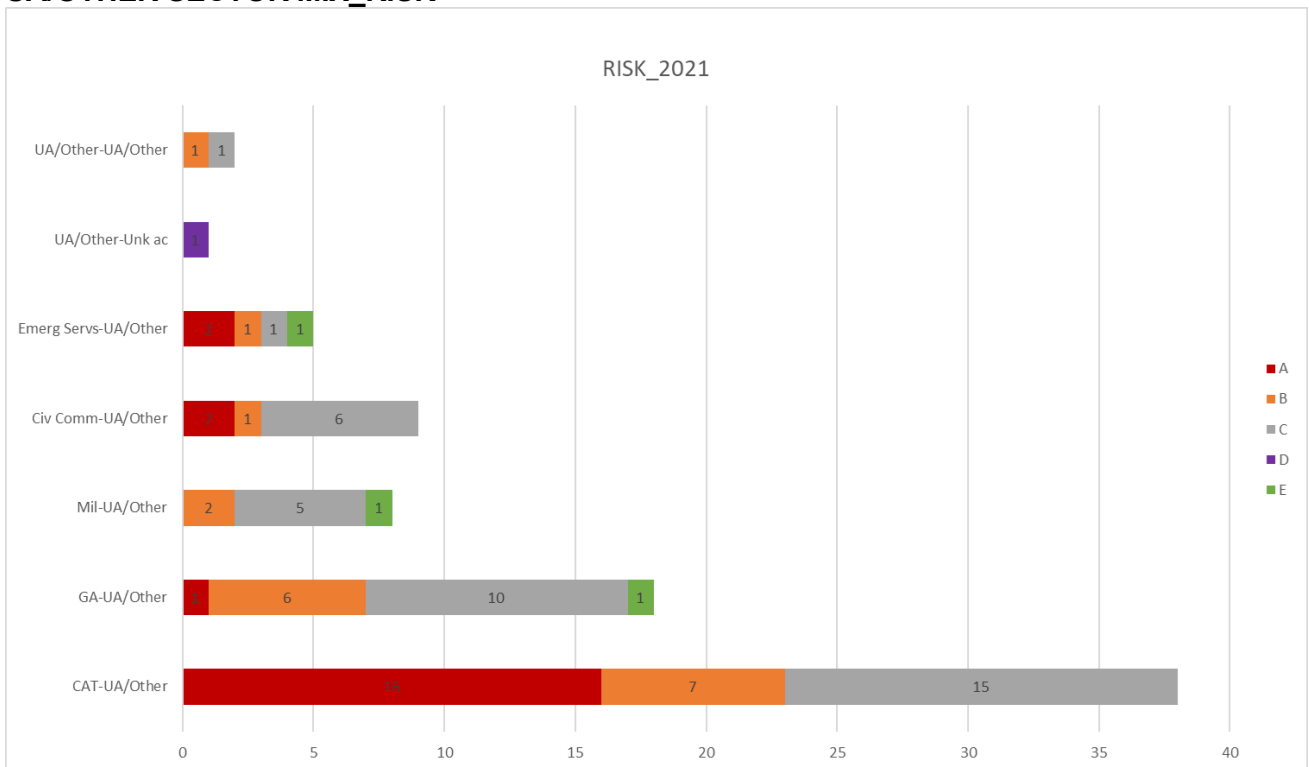


Figure 31: UA/OTHER Sector Mix_Risk_2021

CAT_CIV COMM SECTOR MIX

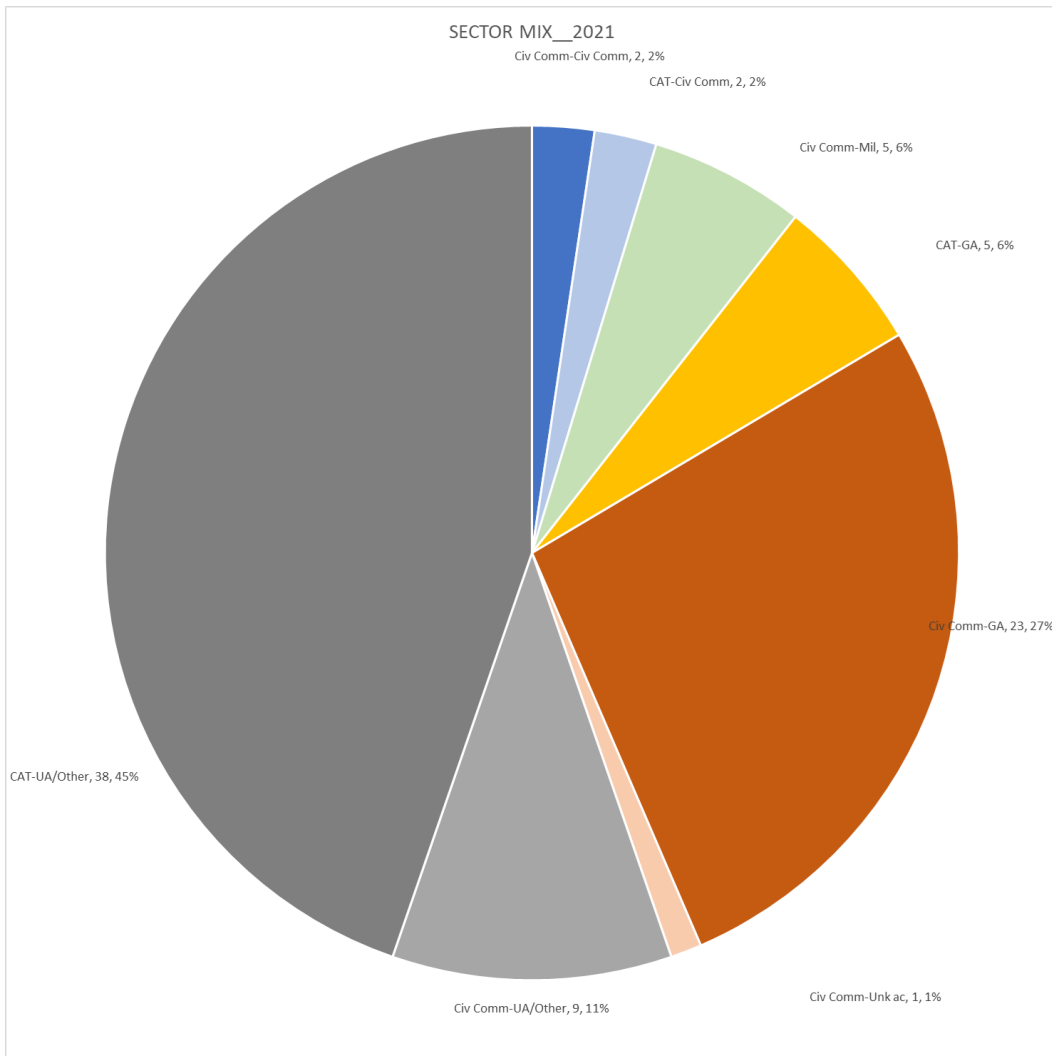


Figure 32: CAT_Civ Comm Sector Mix_2021

CAT_Civ Comm SECTOR MIX_ALTITUDE

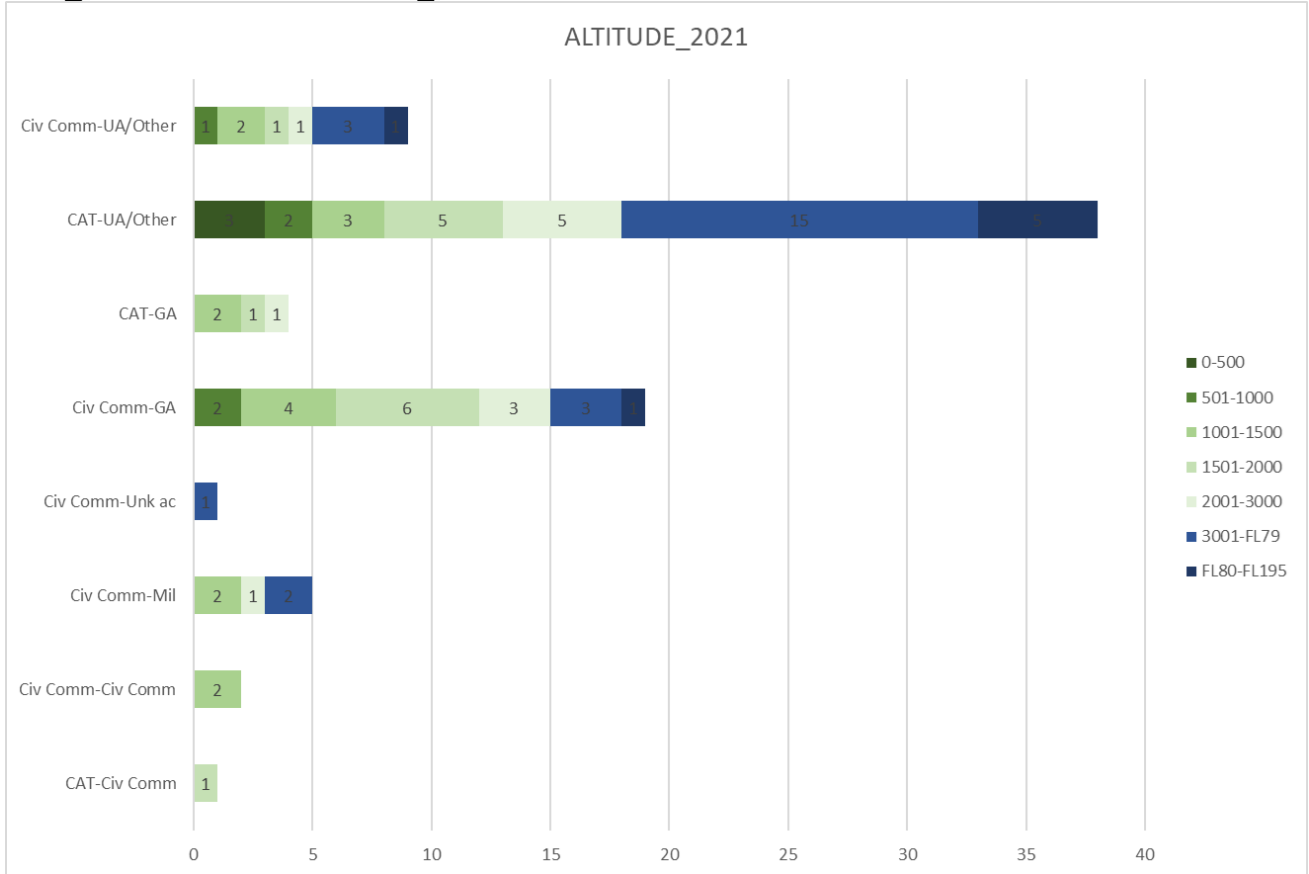


Figure 33: CAT-Civ Comm Sector Mix_Altitude_2021

CAT_Civ Comm SECTOR MIX_AIRSPACE

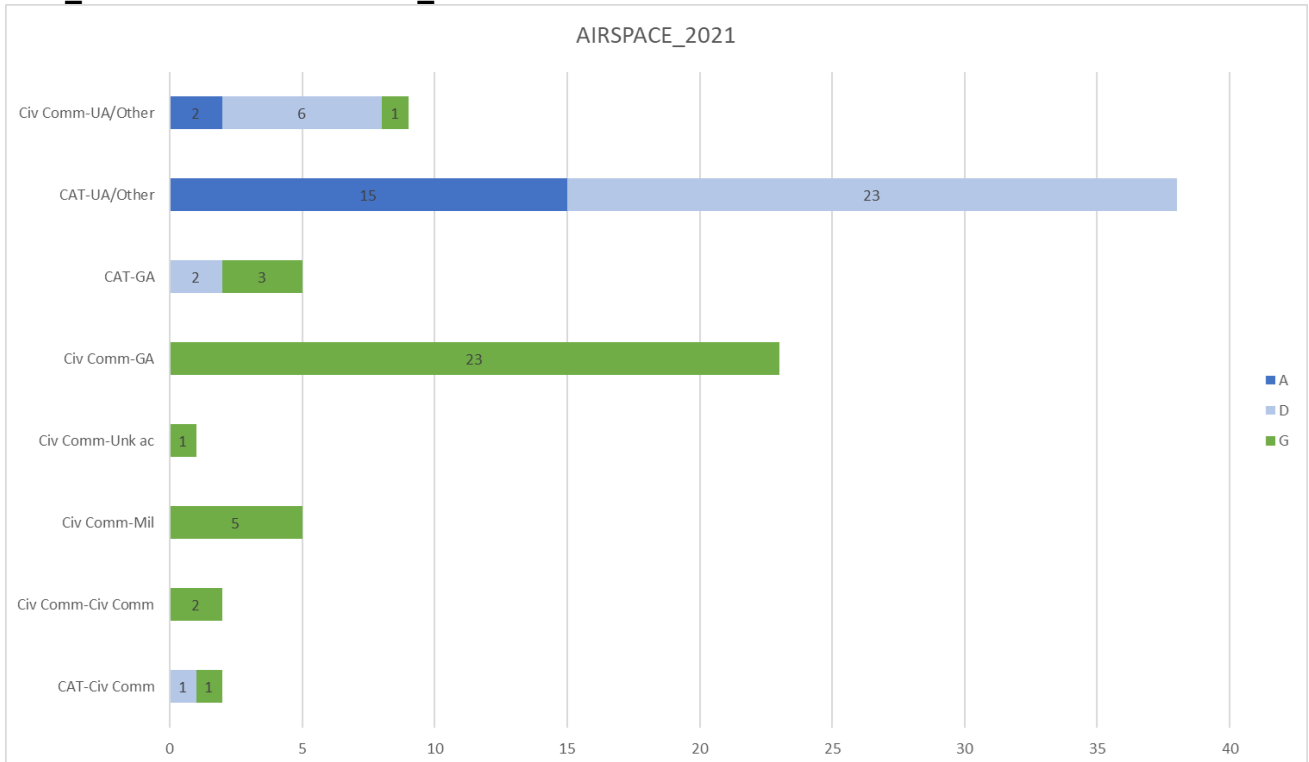


Figure 34: CAT-Civ Comm Sector Mix_Airspace_2021

CAT_Civ Comm SECTOR MIX_ ALTITUDE_RISK BEARING

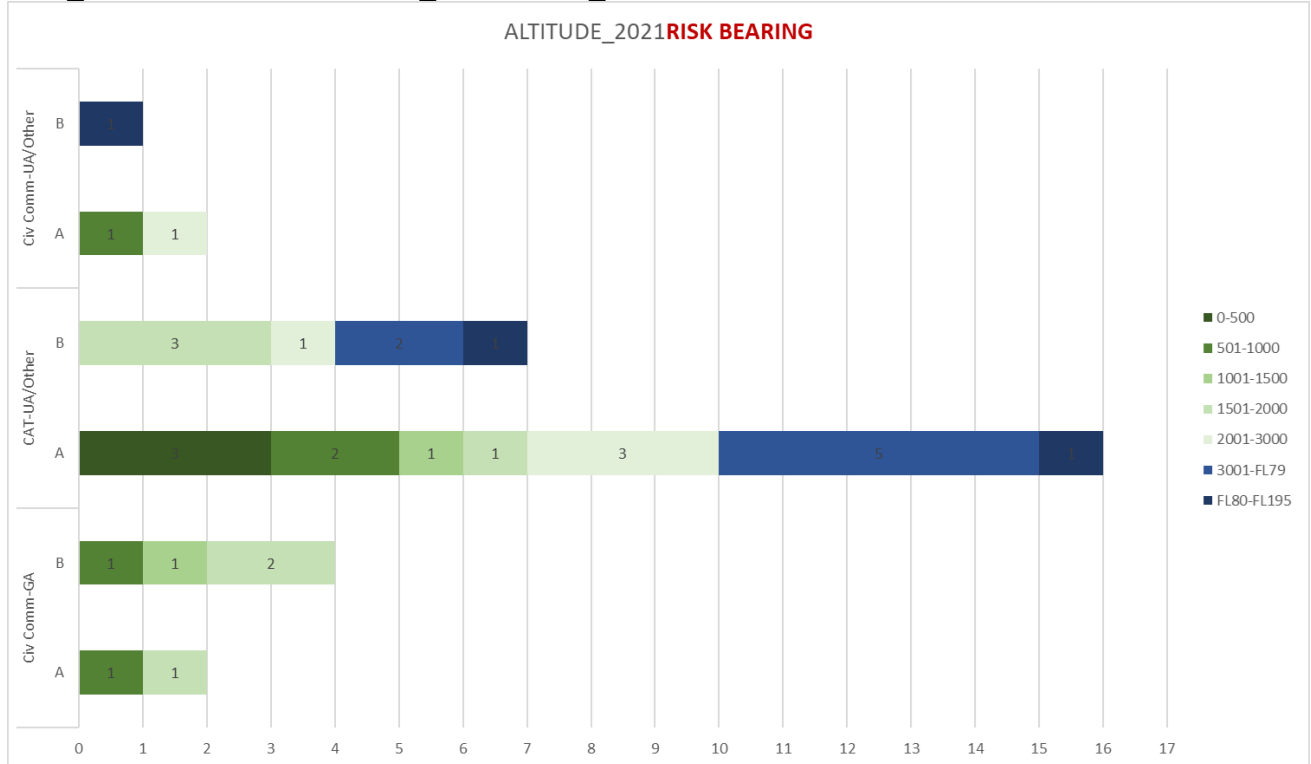


Figure 35: CAT_Civ Comm Sector Mix_Altitude_Risk Bearing_2021

CAT_Civ Comm SECTOR MIX_ RISK

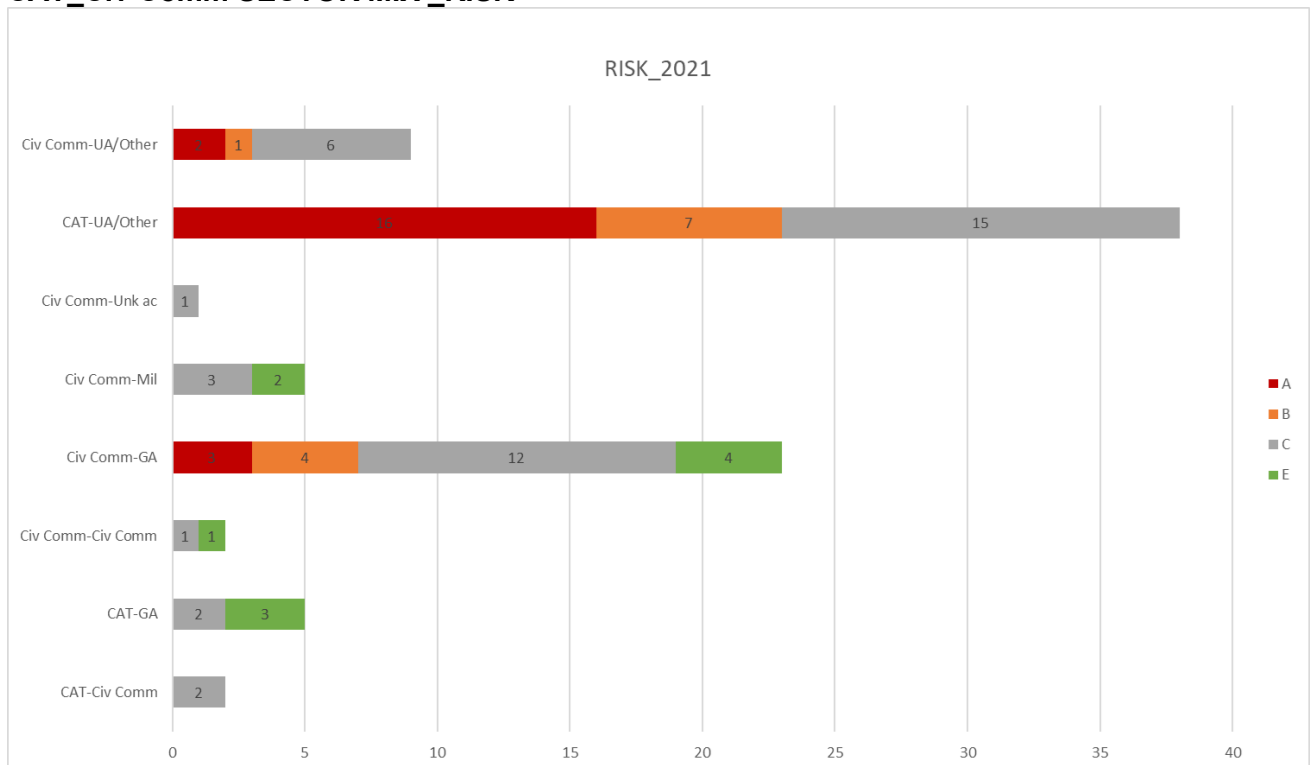


Figure 36: CAT_Civ Comm Sector Mix_ Risk Bearing_2021

GA (Sports and Recreational – including Unknown/Untraced) SECTOR MIX

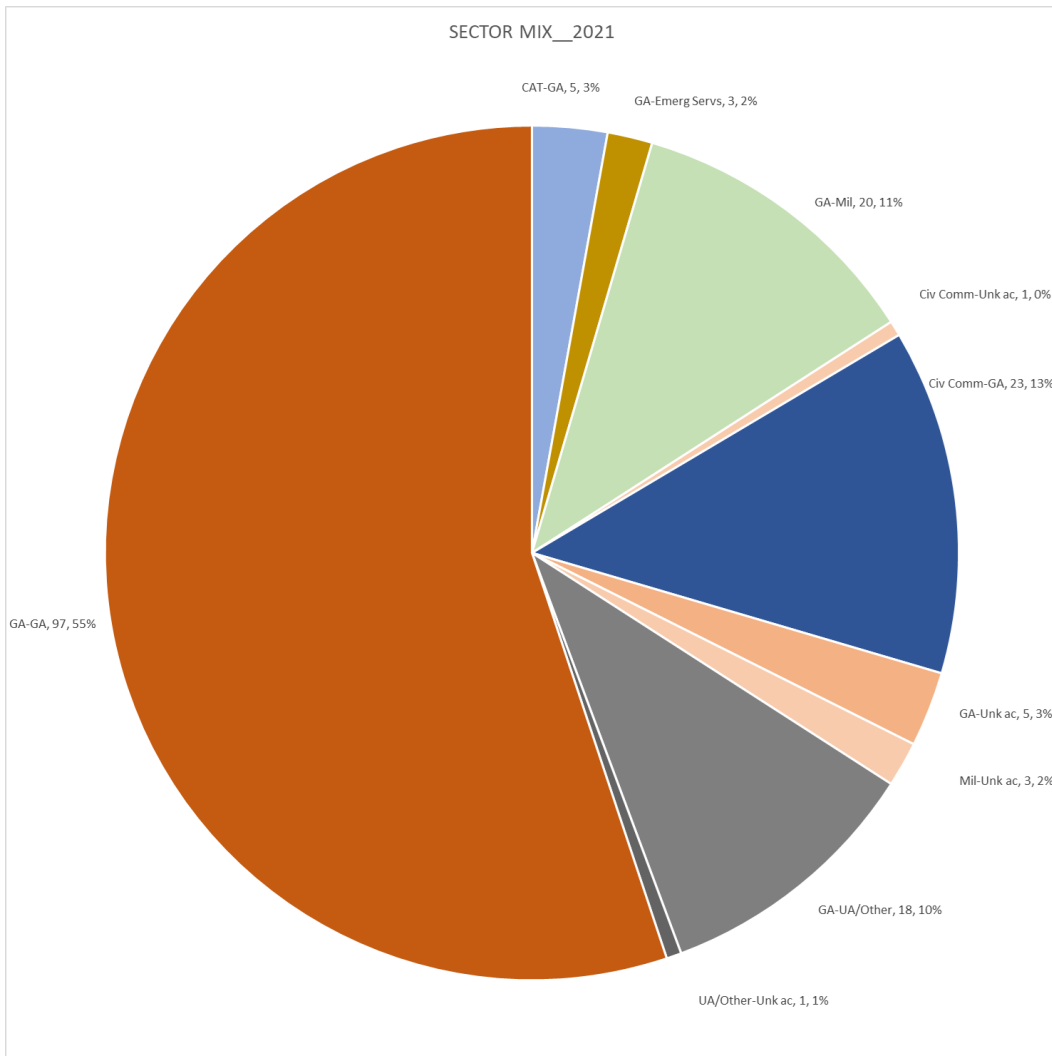


Figure 37: GA_Unk ac Sector Mix_2021

GA_Unk ac SECTOR MIX_ALTIUDE

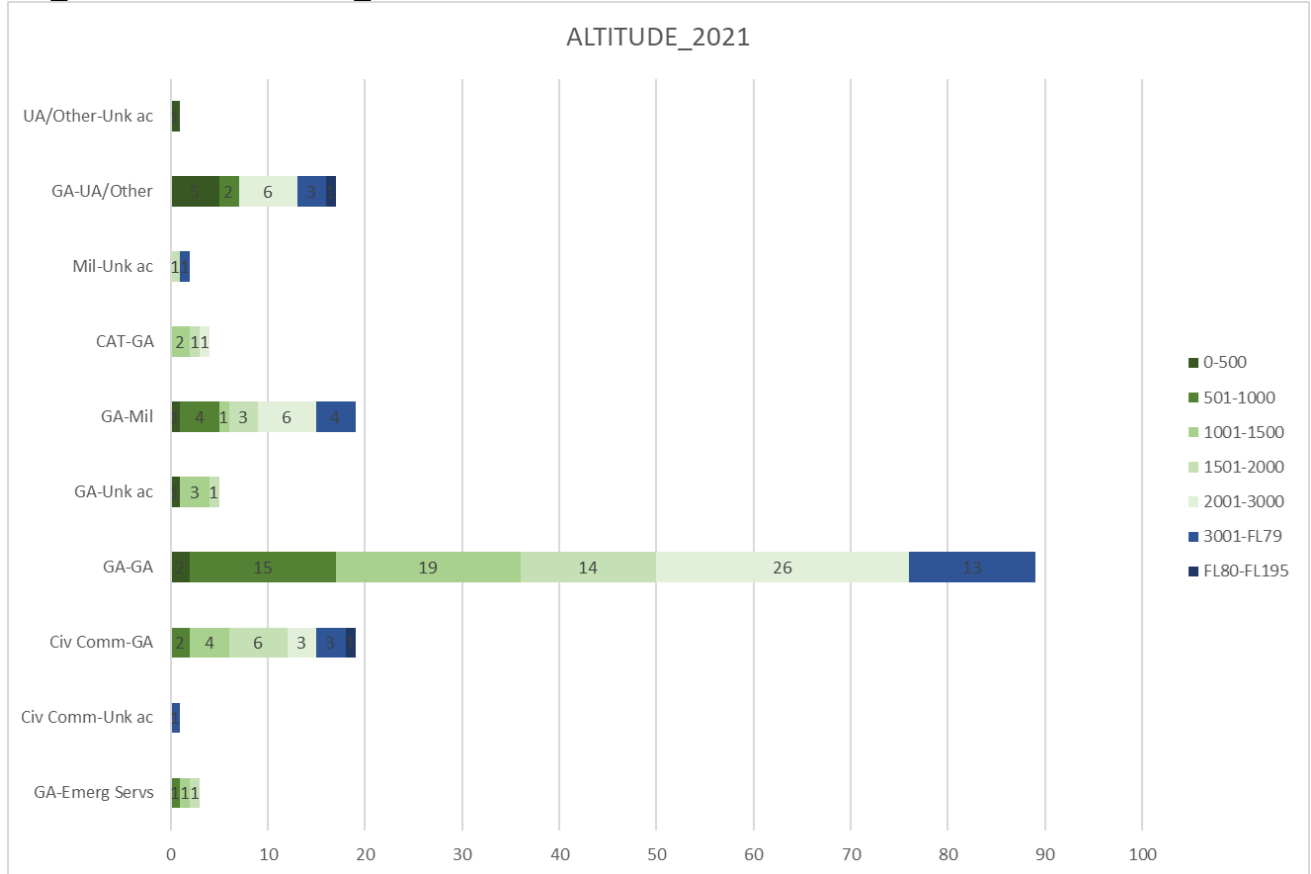


Figure 38: GA Sector Mix_Altitude_2021

GA_Unk ac SECTOR MIX_AIRSPACE

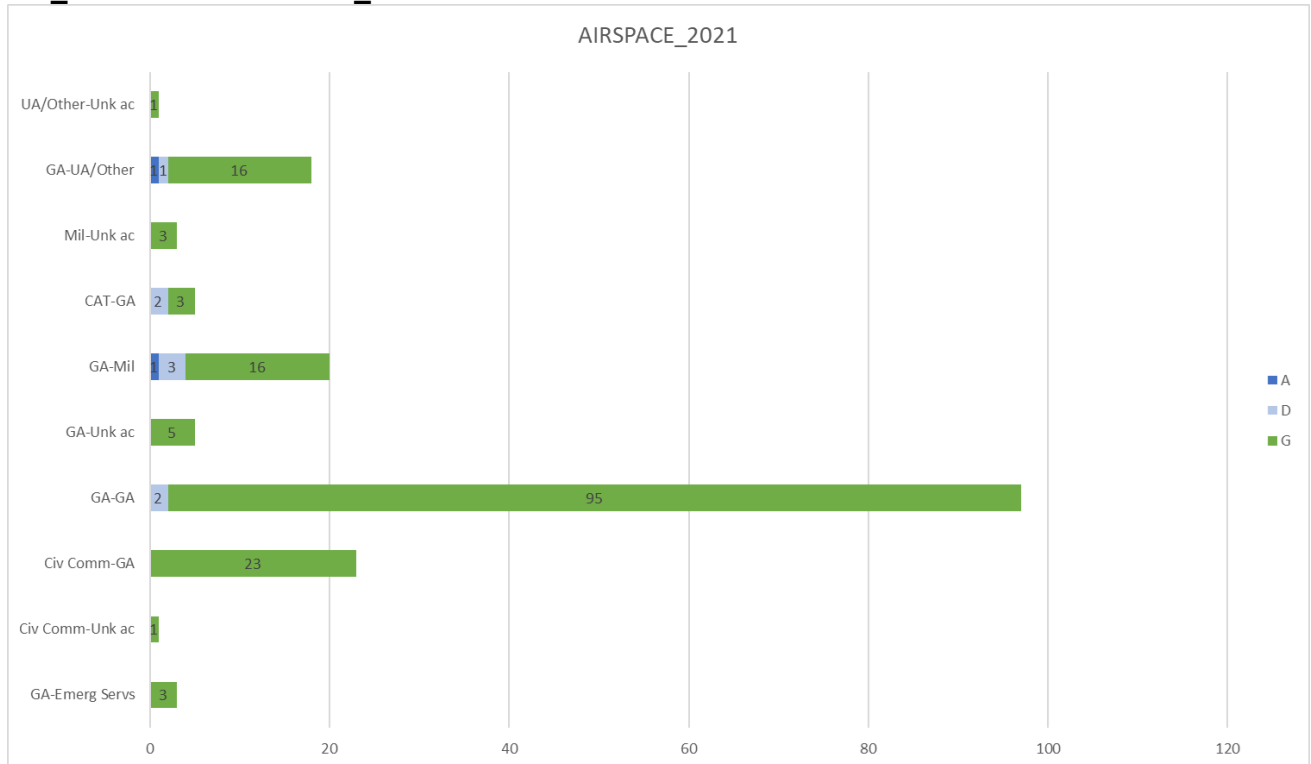


Figure 39: GA Sector Mix_Airspace_2021

GA_Unk ac SECTOR MIX_ALTITUDE_RISK BEARING

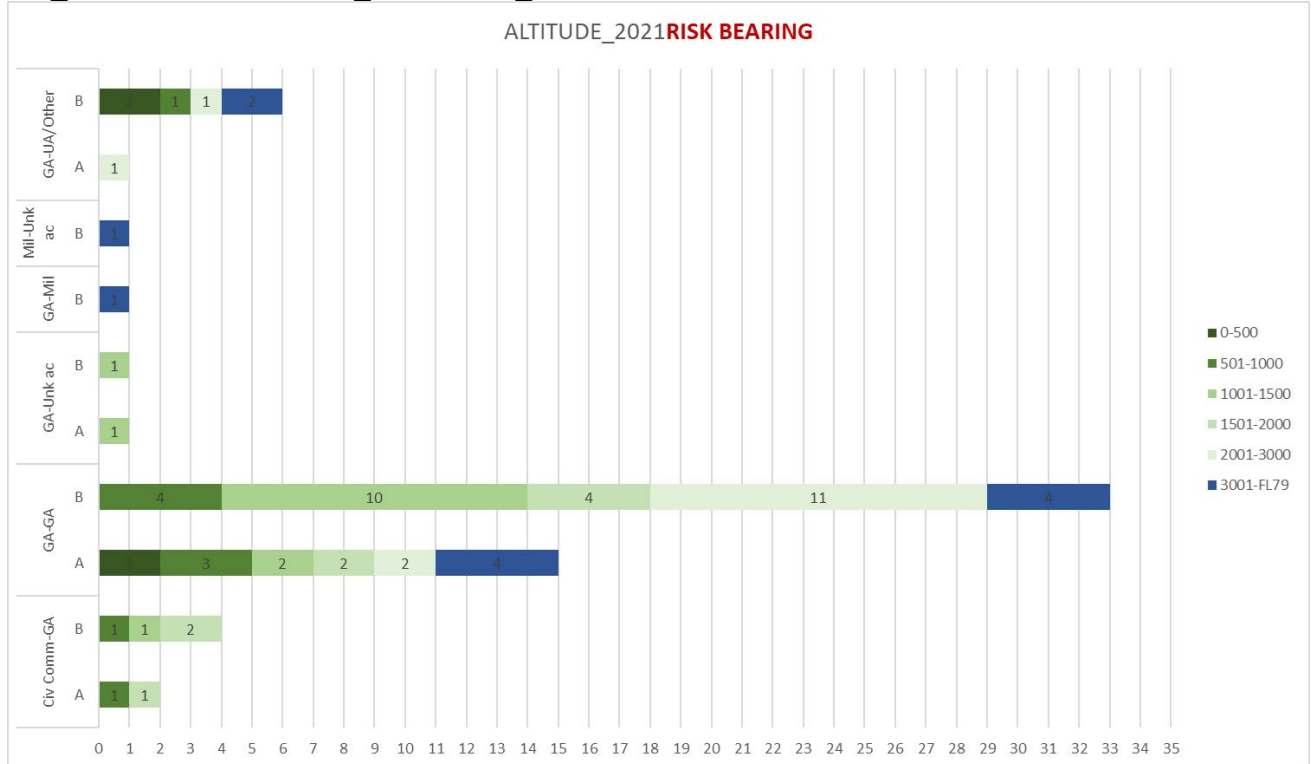


Figure 40: CAT_Civ Comm Sector Mix_Altitude_Risk Bearing_2021

GA_Unk ac SECTOR MIX_RISK

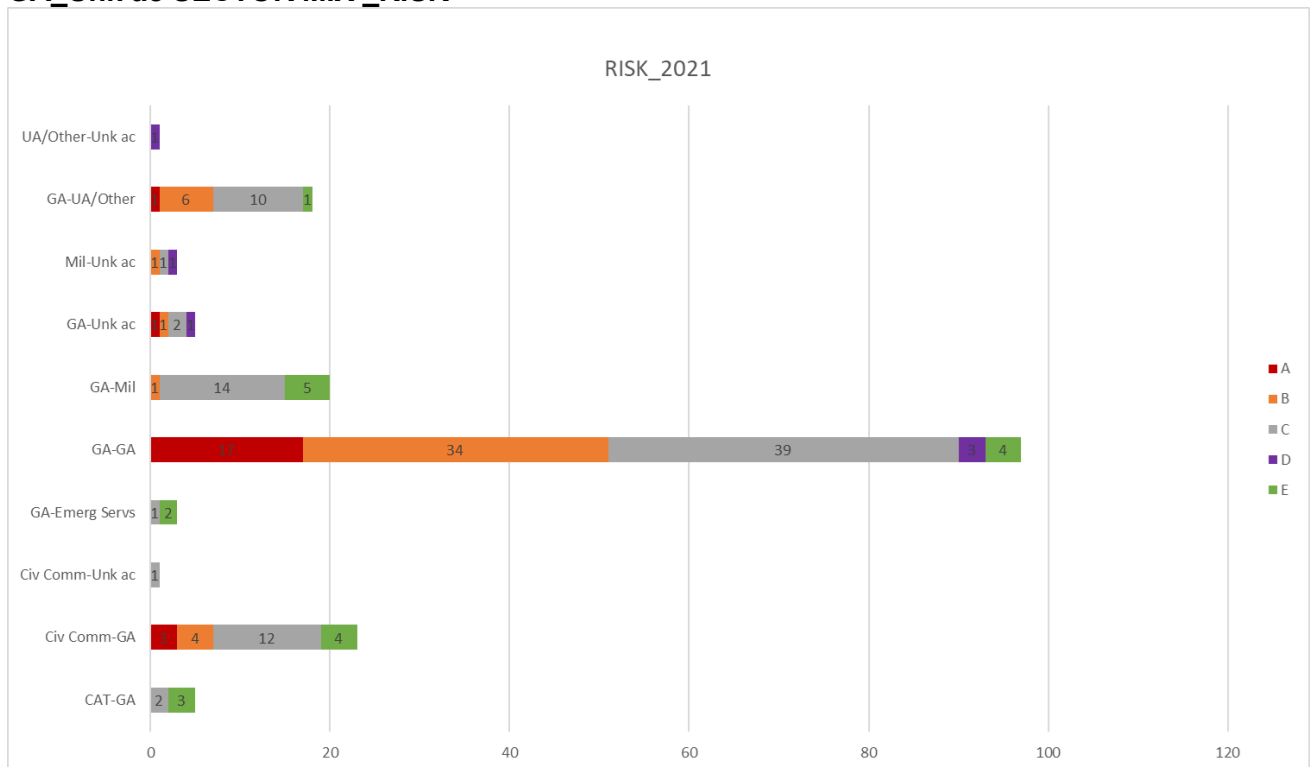


Figure 41: GA Sector Mix_Risk_2021

MILITARY SECTOR MIX

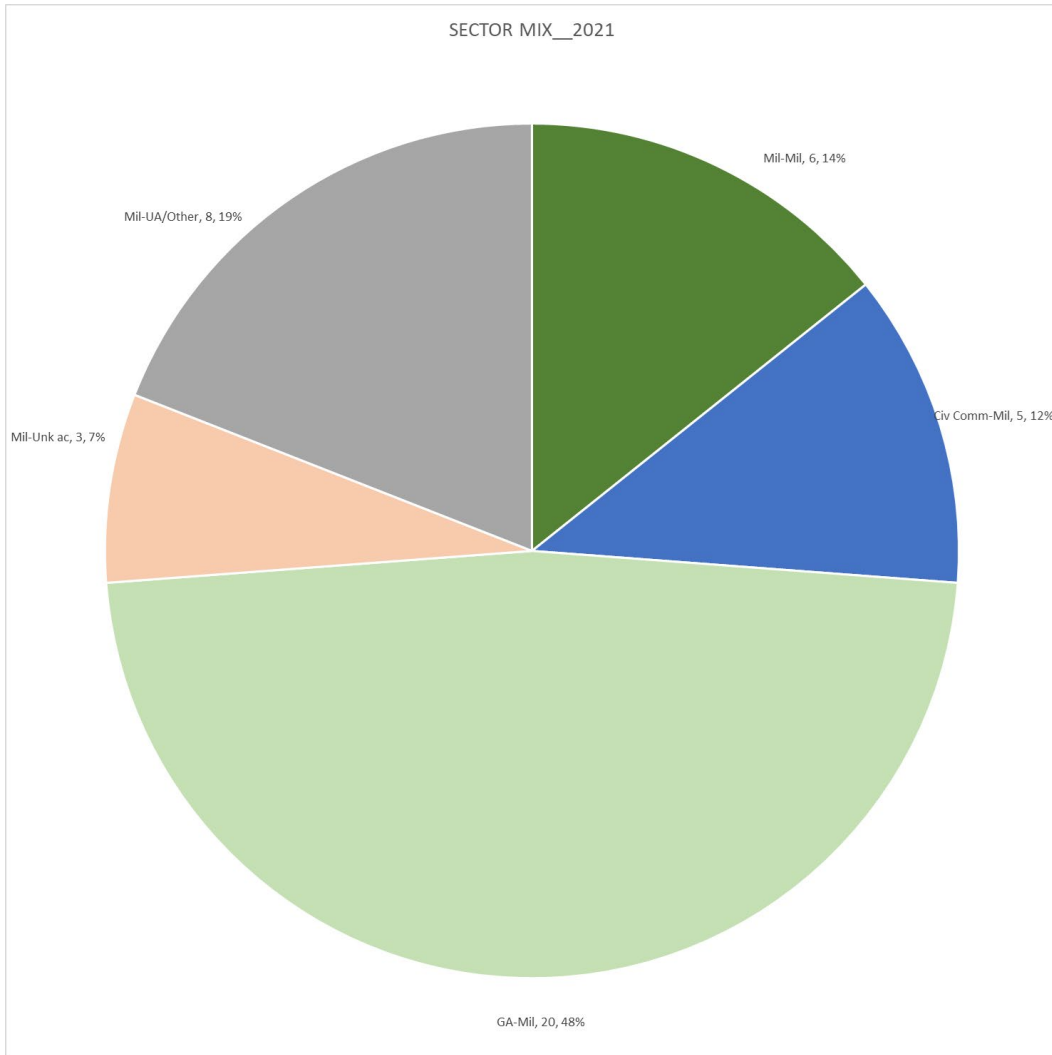


Figure 42: Mil Sector Mix_2021

MILITARY SECTOR MIX_ALTITUDE

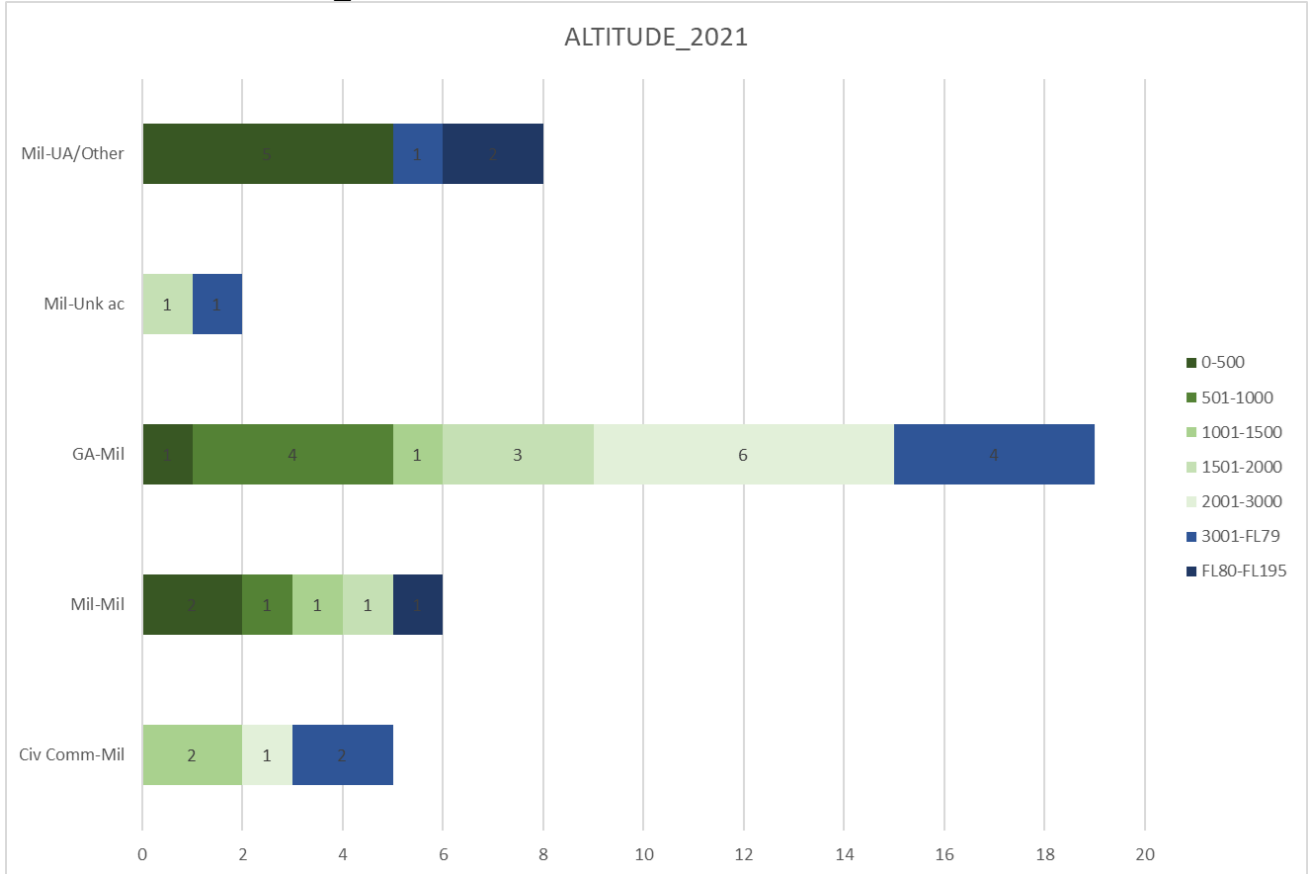


Figure 43: GA Sector Mix_Altitude_2021

MILITARY SECTOR MIX_AIRSPACE

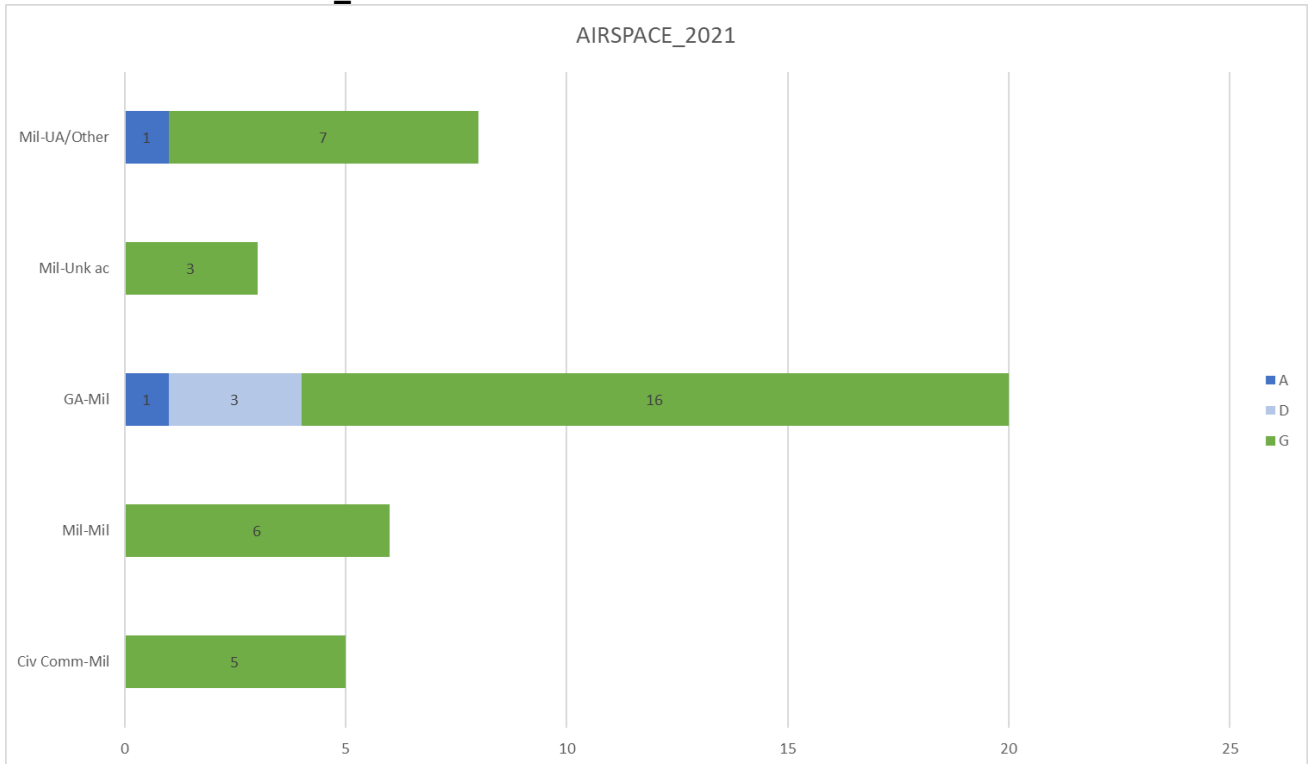


Figure 44: Mil Sector Mix_Altitude_2021

MILITARY SECTOR MIX_AIRSPACE_ALTITUDE_RISK BEARING

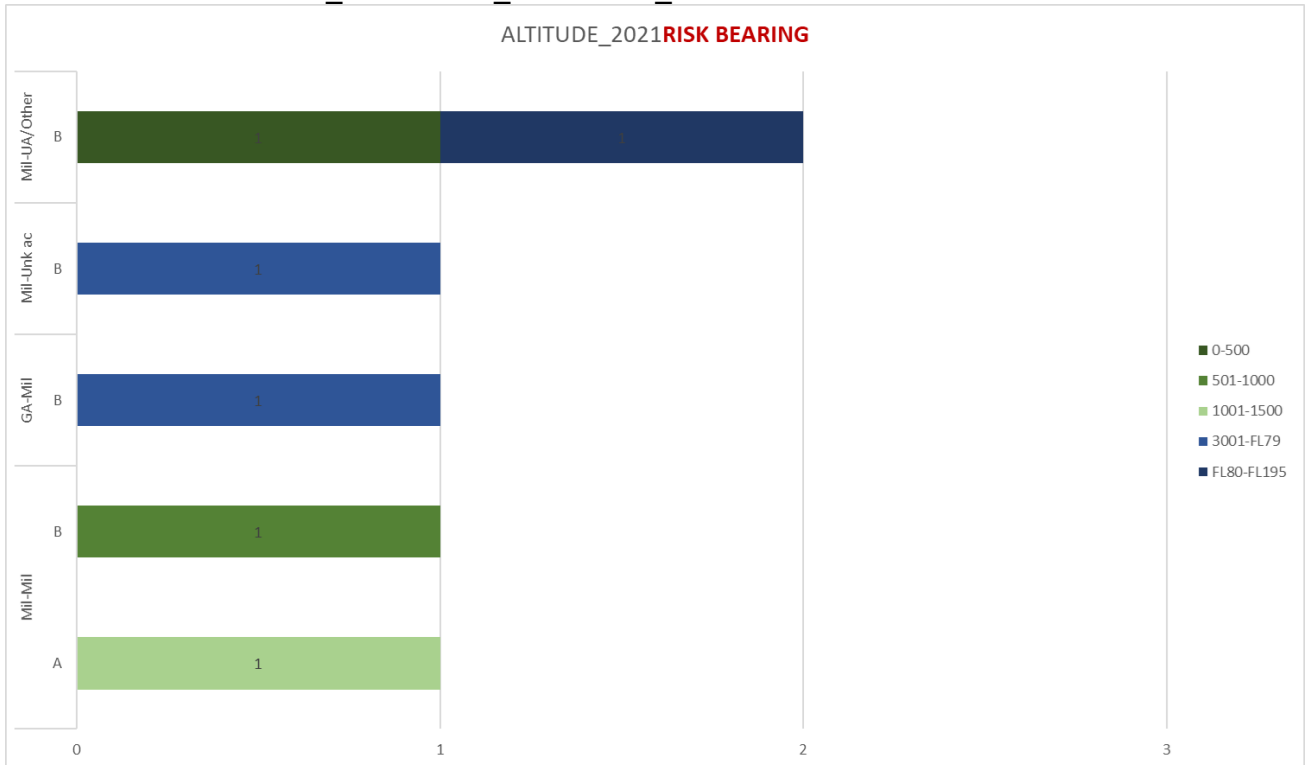


Figure 45: Mil Sector Mix_Altitude_Risk Bearing_2021

MILITARY SECTOR MIX_RISK

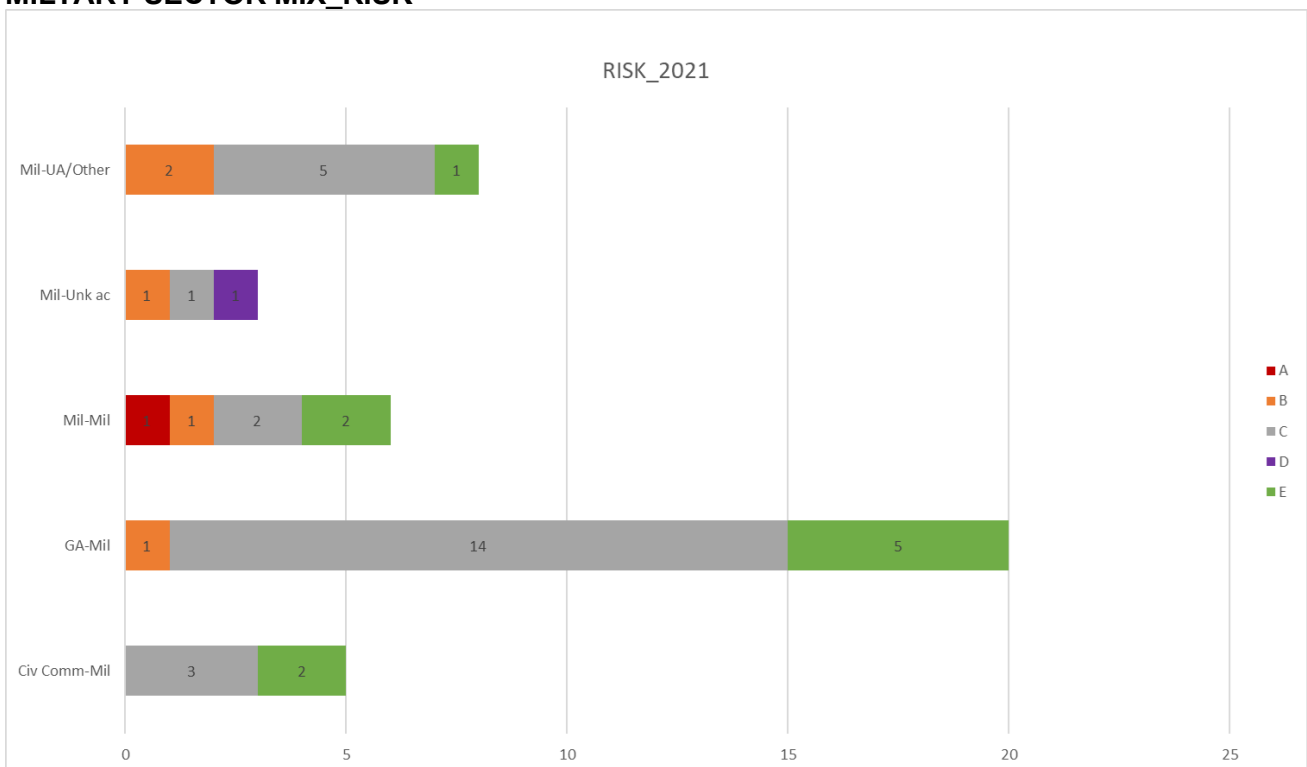


Figure 46: Mil Sector Mix_Risk_2021

UKAB 2021 SAFETY RECOMMENDATIONS

ACCEPTED		PARTIALLY ACCEPTED	REJECTED
Airprox	Recommendation	Comments	
2021057	The Drone and Model Aircraft Code, Point 3 currently states 'Always look and listen out for other aircraft that may be flying below 120m (400ft), such as air ambulances and police helicopters.' The CAA should consider adding 'military low-flying aircraft' to this paragraph.	The CAA has modified the Drone Code accordingly	
2021121	That the MAA and CAA review conflicting Rules of the Air regulations with respect to formations of aircraft; specifically, Avoidance of Collisions within MAA RA2307 paragraph 9 and (UK) SERA.3210 Right-of-way.	<p>The CAA accepts this safety recommendation from the UK Airprox Board (UKAB), and we note the Board's conclusion that "each pilot was expecting the other to give way because each was operating to a different, and incompatible, regulation."</p> <p>The CAA considers that common, internationally harmonised, Rules of the Air are an essential foundation for the maintenance of aviation safety. It is important to note that the provision within the Standardised European Rules of the Air (SERA) highlighted by the UKAB originates from ICAO Annex 2 'Rules of the Air', and maintains the long-standing UK position on rights-of-way that existed prior to the implementation of SERA. Moreover, the CAA agrees with the Board's analysis that SERA.3210(b) does not infer that single aircraft should give way to formations of aircraft.</p> <p>The CAA has determined that it would be inappropriate to step away from our internationally harmonised position. We are considering the development of guidance material advising pilots to consider that formations of aircraft may be less manoeuvrable than single aircraft, when applying the right-of-way and determining how best to avert collision.</p>	

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ACCEPTED		PARTIALLY ACCEPTED	REJECTED
Airprox	Recommendation	Comments	
2021121	That the MAA and CAA review conflicting Rules of the Air regulations with respect to formations of aircraft; specifically, Avoidance of Collisions within MAA RA2307 paragraph 9 and (UK) SERA.3210 Right-of-way.	<p>The MAA appreciate that harmonization of SERA and RA 2307 may appear desirable, but the MAA view is that aircraft flying in formation are limited in their manoeuvrability due to the requirement for all aircraft to remain in close formation to maintain safe separation from the other aircraft in that formation.</p> <p>The MAA believes that the most appropriate resolution is to maintain SERA and RA 2307 as they are and to work with the CAA to develop guidance material for both civil and military aircrew. This guidance material should advise civil pilots to consider that formations of military aircraft may be less manoeuvrable than single aircraft, when applying the right-of-way; and to warn military pilots that civilian traffic might not give way to military formations so they should plan their deconfliction accordingly.</p>	
2021156	The CAA considers highlighting the utility of monitoring relevant air communication frequencies to all drone operators, either through training syllabi or other appropriate media.	<p>Many GA users within uncontrolled airspace are unlikely to make use of VHF equipment to transmit position reports when not required; and</p> <p>That it is not reasonable to expect a recreational UAS operator to understand radio telephony phraseology without training, which in this instance would be disproportionate (in the Open category of operation) and may, in fact, distract them from the operation of the UAS, and obscure the sound of any approaching aircraft, thereby reducing their situational awareness.</p> <p>The CAA will recommend to providers of UAS flight control software to UAS Operators, that they incorporate other relevant hazards to UAS operators (such as microlight activity, glider sites, unlicensed airfields etc.) within their software; and</p> <p>The CAA will review open category training material, AMC and guidance material, and website information to ensure this is captured.</p> <p>The UKAB will consider the CAA's invitation to submit a recommendation to the Department for Transport in respect of the UKAB view on the right electronic conspicuity strategy for the UK in order to assist MAC avoidance within class G airspace.</p>	

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2021248	The CAA reviews whether the Centralised Aviation Data Service (CADS) procedures, (Ref: UK IAIP ENR 1.10) generate the publication of sufficiently detailed information about operations below 500ft to enable other airspace users to accurately determine where the activity is taking place.	The CAA has agreed that pipeline/powerline inspection operators should use CADS but is reluctant to change the conditions of the permission issued to these operators. However, the CAA has agreed, with the assistance of MAMC(LF), to: highlight the location of existing information within the IAIP to commercial operators and emphasise that the system should be used on all inspection flights, and; review training material and website information to ensure this is current and accessible, and; engage with the pipeline/powerline operators to remind them of the need to display dedicated secondary surveillance radar (SSR) code, 0036, when conducting pipeline/powerline operations.
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ACCEPTED		PARTIALLY ACCEPTED	REJECTED
Airprox	Recommendation	Comments	
2021202	The MAA re-examines the safety implications at military airfields of aircraft operating in the visual circuit on QFE.	Under Consideration	

AIRPROX CATALOGUE 2021

The table below is an abbreviated form of the 2021 Airprox Index that is available on the UKAB Website - Individual reports can also be accessed using the hyperlinks within the table.

Airprox No	Risk Category	Aircraft 1 Type	Aircraft 2 Type	Sector Mix
2021001	E	OTHER (Quadcopter Drone)	OTHER - Military (A400)	Mil-UA/Other
2021002	C	AIRBUS - A319	UNKNOWN (RPAS)	CAT-UA/Other
2021003	A	OTHER - Military (Tutor)	OTHER - Military (Tutor)	Mil-Mil
2021005	C	DIAMOND - DA42	DIAMOND - DA40	GA-GA
2021006	E	SIKORSKY - S92	SIKORSKY - S92	Civ Comm-Civ Comm
2021007	C	DIAMOND - DA40	UNKNOWN (Object)	GA-UA/Other
2021008	C	AGUSTA BELL - AB139	OTHER - Military (F35)	GA-Mil
2021009	E	SIKORSKY - S92	CESSNA - 152	Civ Comm-GA
2021010	A	AIRBUS - A330	UNKNOWN (Object)	CAT-UA/Other
2021011	C	OTHER - Military (Wildcat)	UNKNOWN (RPAS)	Mil-UA/Other
2021012	C	OTHER (RPAS)	OTHER - Military (Wildcat)	Mil-UA/Other
2021013	C	OTHER - Military (Wildcat)	DIAMOND - DA42	GA-Mil
2021014	C	PIPER - PA28	DIAMOND - DA40	GA-GA
2021015	C	OTHER - Military (RPAS)	OTHER - Military (Chinook)	Mil-UA/Other
2021016	E	OTHER (AW169)	CIRRUS - SR22	GA-Emerg Servs
2021017	C	OTHER - Military (BAE146)	UNKNOWN (Object)	Mil-UA/Other
2021018	C	OTHER (Skyranger Swift)	PARTENAVIA - P68	Civ Comm-GA
2021019	C	BOEING - 787	UNKNOWN (RPAS)	CAT-UA/Other
2021020	C	PARTENAVIA - P68	CESSNA - 172	Civ Comm-GA
2021021	C	CESSNA - F406	UNKNOWN (Balloon)	Civ Comm-UA/Other
2021022	C	BOEING - 787	UNKNOWN (Object)	CAT-UA/Other
2021023	C	OTHER - Military (C17)	DIAMOND - DA40	GA-Mil
2021024	E	AGUSTA (AW139)	SCHEMPP HIRTH - VENTUS2CT	Civ Comm-GA
2021025	B	SCHEMPP HIRTH	OTHER - Military (F15)	GA-Mil
2021026	C	EUROCOPTER - EC135	UNKNOWN (RPAS)	Emerg Servs-UA/Other
2021027	B	SOCATA - TB10	UNKNOWN (RPAS)	GA-UA/Other
2021028	B	PIPER - PA28	OTHER (MTOsport autogyro)	GA-GA
2021029	A	CESSNA - 152	BOLKOW - BO209	GA-GA
2021030	C	AIRBUS - A319	UNKNOWN (RPAS)	CAT-UA/Other
2021031	A	MD HELICOPTER - 902	UNKNOWN (RPAS)	Emerg Servs-UA/Other
2021032	A	SCHLEICHER - ASK13	SCHEIBE - SF25	GA-GA
2021033	E	EMBRAER - EMB145	ROBINSON - R22	CAT-GA
2021034	C	PIPER - PA28	CESSNA - 182	GA-GA
2021035	B	OTHER (RPAS)	AVIONS ROBIN - DR400	GA-UA/Other
2021036	C	PIPER - PA28	PIPER - PA28	GA-GA
2021037	B	PIPER - PA28	ZENAIR - CH601	GA-GA
2021038	B	PIPER - PA28	PIPER - PA28	GA-GA
2021039	C	SCOTTISH AVIATION - BULLDOG	AMERICAN AVIATION - AA5	GA-GA
2021040	E	OTHER (EC175)	GROB - G115 - D	Civ Comm-GA
2021041	C	PIPER - PA28	UNKNOWN (Balloon)	GA-UA/Other
2021042	E	OTHER (RPAS)	SCOTTISH AVIATION - PIONEER	GA-UA/Other
2021043	B	DIAMOND - DA40	CESSNA - 182	GA-GA
2021044	C	CESSNA - 172	EUROPA	GA-GA
2021045	A	PIPER - PA28	VANS - RV6	GA-GA
2021046	C	SCHEMPP HIRTH - DISCUS A	PIPER - PA28	GA-GA
2021047	B	GRUMMAN - AA5	UNKNOWN (Object)	GA-UA/Other
2021048	C	GLASER DIRKS - DG100	DIAMOND - DA40	GA-GA
2021049	B	PIPER - PA28	UNKNOWN (RPAS)	GA-UA/Other

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2021050	C	PZL BIELSKO - SZD51	PIPER - PA28	GA-GA
2021051	A	NORTH AMERICAN - HARVARD	EXTRA - 300 - L	GA-GA
2021052	C	SCHEMPP HIRTH - DISCUS A	PIPER - PA28	GA-GA
2021053	B	OTHER (AW109SP)	CESSNA - 152	GA-GA
2021054	A	OTHER (Paraglider)	GLASFLUGEL - 303	GA-GA
2021055	A	ATR - ATR72	UNKNOWN (Object)	CAT-UA/Other
2021056	D	PIPER - PA28	BAC - JET PROVOST	GA-GA
2021057	B	OTHER (DJI Mavic 2 RPAS)	OTHER - Military (Texan II)	Mil-UA/Other
2021058	C	PIPER - PA28	SLINGSBY - T67	GA-GA
2021059	A	CESSNA - 150	PIPER - PA28	GA-GA
2021060	B	GLASER DIRKS - DG808	DIAMOND (DA62)	GA-GA
2021061	A	PIPER - L21	SLINGSBY - T67	GA-GA
2021062	A	CESSNA - 208	OTHER (Skyranger)	GA-GA
2021063	B	VANS - RV7	CESSNA - 208	GA-GA
2021064	B	SCHLEICHER - ASW19	CIRRUS - SR22	GA-GA
2021065	B	DIAMOND - DA42	OTHER (Sky Arrow)	Civ Comm-GA
2021066	B	AIRBUS - A319	UNKNOWN (Object)	CAT-UA/Other
2021067	A	CESSNA - 152	EUROPA - EUROPA	GA-GA
2021068	C	GROB - G115	CIRRUS - SR22	GA-GA
2021069	B	CESSNA - 152	UNKNOWN	GA-Unk ac
2021070	C	PIPER - PA28	UNKNOWN	GA-Unk ac
2021071	A	BEECH - 200	UNKNOWN (Balloon)	Civ Comm-UA/Other
2021072	E	SCHEMPP HIRTH - CIRRUS	STEARMAN - 75	GA-GA
2021073	C	CESSNA - 152	SOCATA - TB20	GA-GA
2021074	A	BERIEVA - BE200	UNKNOWN (RPAS)	Civ Comm-UA/Other
2021075	C	AIRBUS (A220)	UNKNOWN (RPAS)	CAT-UA/Other
2021076	E	OTHER - Military (Prefect)	OTHER - Military (Hawk)	Mil-Mil
2021077	A	BOEING - 737	UNKNOWN (RPAS)	CAT-UA/Other
2021078	A	BOEING - 757	UNKNOWN (RPAS)	CAT-UA/Other
2021079	C	EVEKTOR AEROTECHNIK - EV97	PARTENAVIA - P68	Civ Comm-GA
2021080	A	PIPER - PA28	AVIONS ROBIN - HR100	GA-GA
2021081	E	OTHER - Military (Chinook)	OTHER (Skyranger)	GA-Mil
2021082	A	OTHER (Canopy Suspended)	UNKNOWN	GA-Unk ac
2021083	B	PIPER - PA28	EXTRA - 300	GA-GA
2021084	E	CESSNA - 208	OTHER - Military (Prefect)	GA-Mil
2021085	B	OTHER - Military (Prefect)	OTHER (Paramotor)	Mil-Unk ac
2021086	C	OTHER (Cabri G2)	OTHER (Just Escapade)	GA-GA
2021087	C	SCHLEICHER - ASW19	PIPER - PA28	GA-GA
2021088	C	CESSNA - 172	PIPER - PA32	GA-GA
2021089	C	SCHLEICHER - ASK21	CESSNA - 182	GA-GA
2021090	A	PIPER - PA28	CESSNA - 152	GA-GA
2021091	C	OTHER (RPAS)	UNKNOWN (RPAS)	UA/Other-UA/Other
2021092	C	PARTENAVIA - P68	PIPER - PA38	Civ Comm-GA
2021093	C	AIRBUS - A400M (Atlas)	PIPER - PA28	GA-Mil
2021094	C	CESSNA - 152	DIAMOND - HK36	GA-GA
2021095	C	OTHER - Military (Hawk formation)	ROBINSON - R44	GA-Mil
2021096	E	EXTRA - 300 - 200	SUPERMARINE - SPITFIRE	GA-GA
2021097	D	CESSNA - 140	SUPERMARINE - SPITFIRE	GA-GA
2021098	D	CESSNA - 140	NORTH AMERICAN - HARVARD	GA-GA
2021099	E	SAAB - 340	CESSNA - 172	CAT-GA
2021100	C	SCHEMPP HIRTH - JANUS	AEROSPATIALE - AS355	GA-GA
2021101	C	OTHER (EC175)	PITTS (M12)	Civ Comm-GA
2021102	C	CESSNA - 208	UNKNOWN (Object)	GA-UA/Other
2021103	C	SCHEMPP HIRTH - DUO DISCUS	BELL - 407	GA-GA
2021104	B	SUPERMARINE - SPITFIRE - IX	PIPER - PA34	GA-GA

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2021105	C	EVEKTOR AEROTECHNIK - EV97	CESSNA - 177	GA-GA
2021106	A	EMBRAER - ERJ175 - NO SERIES EXISTS	UNKNOWN (Balloon)	CAT-UA/Other
2021107	C	CESSNA - 152	CASA - 1 131	GA-GA
2021108	B	CESSNA - 525	UNKNOWN (Object)	Civ Comm-UA/Other
2021109	C	OTHER (CZAW SportCruiser)	UNKNOWN (RPAS)	GA-UA/Other
2021110	C	CESSNA - 680	UNKNOWN (RPAS)	Civ Comm-UA/Other
2021111	C	BEECH - 200	UNKNOWN (RPAS)	Civ Comm-UA/Other
2021112	C	OTHER (Cabri G2)	SCOTTISH AVIATION - BULLDOG	GA-GA
2021113	B	PIPER - PA32	SUPERMARINE - SPITFIRE	GA-GA
2021114	A	SCHLEICHER (ASG29)	DIAMOND - DA40	GA-GA
2021115	C	SUPERMARINE - SPITFIRE	EXTRA - 300 - 200	GA-GA
2021116	B	OTHER (RPAS)	UNKNOWN (RPAS)	UA/Other-UA/Other
2021117	B	CESSNA - 152	RUTAN - VARIEZE	GA-GA
2021118	C	OTHER - Military (Voyager)	ROLLADEN SCHNEIDER - LS4	GA-Mil
2021119	C	CIRRUS - SR22	DIAMOND - DA40	GA-GA
2021120	A	SOCATA - TB10	PIPER - PA28	GA-GA
2021121	C	Prefect formation	CESSNA - 208	Civ Comm-Mil
2021122	A	EUROCOPTER - EC155	AGUSTA - A109	Civ Comm-GA
2021123	C	ROBINSON - R44	PIPER - PA28	GA-GA
2021124	B	GROB - G109	CESSNA - 172	GA-GA
2021125	E	EUROCOPTER (EC175)	ROCKWELL - 114	Civ Comm-GA
2021126	B	YAKOVLEV - YAK52	PIPER - PA28	GA-GA
2021127	C	PARTENAVIA - P68	VANS - RV9	Civ Comm-GA
2021128	C	PIPER - PA28	PIPER - PA28	GA-GA
2021129	B	DIAMOND - DA42	SCHEMPP HIRTH - DUO DISCUS	GA-GA
2021130	C	OTHER (RPAS)	ROBINSON - R44	GA-UA/Other
2021131	C	PIPER - PA28	CHAMPION - 8KCAB	GA-GA
2021132	C	OTHER - Military (Defender)	SUPERMARINE - SPITFIRE	GA-Mil
2021133	B	SCHLEICHER - ASK21	PIPER - PA28	GA-GA
2021134	C	AIRBUS - A321	UNKNOWN (RPAS)	CAT-UA/Other
2021135	C	OTHER - Military (Typhoon)	UNKNOWN	Mil-Unk ac
2021136	B	PZL BIELSKO - SZD51	PIPER - PA28	GA-GA
2021137	C	OTHER (Canopy suspended)	SIKORSKY - S76	Civ Comm-GA
2021138	A	AIRBUS - A320	UNKNOWN (RPAS)	CAT-UA/Other
2021139	C	SCHLEICHER - ASK21	OTHER - Military (Prefect)	GA-Mil
2021140	C	BOEING - 737	UNKNOWN (Object)	CAT-UA/Other
2021141	C	DE HAVILLAND - DHC6	PIPER - PA28	Civ Comm-GA
2021142	C	DIAMOND - DA42	CESSNA - 208	Civ Comm-GA
2021143	C	EMBRAER - EMB500	SCHLEICHER - K8	Civ Comm-GA
2021144	E	OTHER - Military (Hawk T1)	PIPER - PA28	GA-Mil
2021145	B	DIAMOND - DA40	CESSNA - 150	GA-GA
2021146	A	ROBINSON - R22	BELL - 206	Civ Comm-GA
2021147	B	CESSNA - 152	PIPER - PA28	GA-GA
2021148	C	PIPER - J3	OTHER - Military (Prefect)	GA-Mil
2021149	C	PEGASUS QUIK	UNKNOWN (RPAS)	GA-UA/Other
2021150	E	EMBRAER - ERJ190	PIPER - PA28	CAT-GA
2021151	C	DASSAULT - MYSTERE FALCON20	UNKNOWN (RPAS)	Civ Comm-UA/Other
2021152	B	PIPER - PA18	ROBINSON - R44	Civ Comm-GA
2021153	B	CESSNA - 152	PIPER - PA28	GA-GA
2021154	B	CESSNA - 182	UNKNOWN (RPAS)	GA-UA/Other
2021155	C	AIRBUS - A320	UNKNOWN (Object)	CAT-UA/Other
2021156	C	OTHER (RPAS)	JABIRU - J430	GA-UA/Other
2021157	B	AGUSTA - A109	CESSNA - 182	GA-GA
2021158	A	AIRBUS - A320	UNKNOWN (RPAS)	CAT-UA/Other

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2021159	C	PIPER - PA28	CESSNA - 152	GA-GA
2021160	C	OTHER	CESSNA - 152	GA-GA
2021161	C	PARTENAVIA - P68	PIPER - PA28	Civ Comm-GA
2021162	A	BOEING - 737	UNKNOWN (RPAS)	CAT-UA/Other
2021163	E	OTHER (AW189)	VANS - RV7	GA-Emerg Servs
2021164	E	PIPER - PA28	CESSNA - 152	GA-GA
2021165	B	CESSNA - 152	BAC - JET PROVOST	GA-GA
2021166	B	CESSNA - 152	PIPER - PA28	GA-GA
2021167	C	DE HAVILLAND - DHC6	OTHER (AW189)	CAT-Civ Comm
2021168	A	BOEING - 737	Toy balloon	CAT-UA/Other
2021169	B	PIPER - PA28	GROB - G109	GA-GA
2021170	D	OTHER - Military (C130 Hercules)	UNKNOWN (Light aircraft)	Mil-Unk ac
2021171	A	BOEING - 737	UNKNOWN (RPAS)	CAT-UA/Other
2021172	C	CESSNA - F406	UNKNOWN	Civ Comm-Unk ac
2021173	B	EVEKTOR AEROTECHNIK - EV97	PIPER - PA28	GA-GA
2021174	C	PIPER - PA28	CURTISS WRIGHT (Hawk)	GA-GA
2021175	C	DIAMOND - DA42	DE HAVILLAND - DH82	GA-GA
2021176	A	AIRBUS - A319	UNKNOWN (Balloon)	CAT-UA/Other
2021177	A	SCHEIBE - SF25	SCHLEICHER - ASK13	GA-GA
2021178	C	CESSNA - 152	CESSNA - 208	GA-GA
2021179	C	BOEING - 737	UNKNOWN (Object)	CAT-UA/Other
2021180	A	BOEING - 737	UNKNOWN (Object)	CAT-UA/Other
2021181	C	SCHLEICHER (ASG29)	BEECH - 55	GA-GA
2021182	B	DIAMOND - DA40	MORANE SAULNIER - MS890	GA-GA
2021183	A	CESSNA - 180	UNKNOWN (RPAS)	GA-UA/Other
2021184	B	CESSNA - 182	DIAMOND - DA40	GA-GA
2021185	E	OTHER - Military (BAE146)	PIPER - PA28	GA-Mil
2021186	E	OTHER - Military (Prefect)	SCHLEICHER - ASK21	GA-Mil
2021187	C	BAE - JETSTREAM4100	PARTENAVIA - P68	CAT-Civ Comm
2021188	E	AVIONS ROBIN - DR400	ROBINSON - R44	GA-GA
2021189	C	PIPER - PA28	DE HAVILLAND - DHC1	GA-GA
2021190	C	OTHER (MTO Gyroplane)	OTHER (Eurofox)	GA-GA
2021191	E	AGUSTA BELL - AB139	OTHER - Military (Typhoon)	Civ Comm-Mil
2021192	C	VANS - RV7	PARTENAVIA - P68	Civ Comm-GA
2021193	C	OTHER - Military (Hawk T2)	PIPER - PA28	GA-Mil
2021194	B	CESSNA - 150	PARTENAVIA - P68	Civ Comm-GA
2021195	B	AIRBUS - A319	UNKNOWN (Object)	CAT-UA/Other
2021196	A	AIRBUS - A320	UNKNOWN (RPAS)	CAT-UA/Other
2021197	A	PIPER - PA25	CESSNA - 172	GA-GA
2021198	C	OTHER - Military (Hawk)	UNKNOWN (Object)	Mil-UA/Other
2021199	B	COMCO IKARUS - IKARUS C42	TECNAM - P2002	GA-GA
2021200	C	PIPER - PA28	UNKNOWN (RPAS)	GA-UA/Other
2021201	B	PARTENAVIA - P68	CESSNA - 172	Civ Comm-GA
2021202	C	OTHER - Military (Hawk T2)	BEECH - 200	Civ Comm-Mil
2021203	C	OTHER (RPAS)	OTHER (Skyranger Swift)	GA-UA/Other
2021204	A	AGUSTA - A109	UNKNOWN (RPAS)	Emerg Servs-UA/Other
2021205	C	OTHER (Hang glider)	OTHER (Model)	GA-UA/Other
2021206	B	CESSNA - 182	CESSNA - 208	GA-GA
2021207	B	DE HAVILLAND - DHC8 - 400 - 402	UNKNOWN (RPAS)	CAT-UA/Other
2021208	A	CESSNA - 152	CHAMPION - 8KCAB	GA-GA
2021210	D	OTHER (RPAS)	UNKNOWN	UA/Other-Unk ac
2021211	B	SCHEMPP HIRTH - CIRBUS	EUROPA - EUROPA	GA-GA
2021212	C	CESSNA - 182	BOLKOW - BO209	GA-GA
2021213	C	OTHER - Military (Tutor)	PIPER - PA28	GA-Mil
2021214	A	AIRBUS - A320	UNKNOWN (RPAS)	CAT-UA/Other

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2021215	B	BOEING - 737	UNKNOWN (RPAS)	CAT-UA/Other
2021216	C	BOEING - 737	UNKNOWN (Balloon)	CAT-UA/Other
2021217	C	SIKORSKY - S92	OTHER - Military (C12 Huron)	Civ Comm-Mil
2021218	A	ROBINSON - R22	VANS - RV6	GA-GA
2021219	B	AIRBUS - A319	UNKNOWN (RPAS)	CAT-UA/Other
2021220	A	SUPERMARINE - SPITFIRE - TIX	CESSNA - 340 - A	Civ Comm-GA
2021221	B	SAAB - 340 - B	UNKNOWN (Object)	CAT-UA/Other
2021222	C	BOEING - 737	UNKNOWN (RPAS)	CAT-UA/Other
2021223	C	PARTENAVIA - P68	UNKNOWN	GA-Unk ac
2021224	A	AIRBUS - A320	UNKNOWN (RPAS)	CAT-UA/Other
2021225	C	OTHER (Folland Gnat)	AVIONS ROBIN - DR400	GA-GA
2021226	B	EUROCOPTER (EC145)	UNKNOWN (RPAS)	Emerg Servs-UA/Other
2021227	C	OTHER - Military (Tutor)	OTHER - Military (Prefect)	Mil-Mil
2021228	C	OTHER - Military (Voyager)	SCOTTISH AVIATION - BULLDOG	GA-Mil
2021229	E	EUROCOPTER - EC135	UNKNOWN (Object)	Emerg Servs-UA/Other
2021230	C	PIPER - PA28	PIPER - PA28	GA-GA
2021231	C	OTHER - Military (Prefect)	OTHER - Military (Tutor)	Mil-Mil
2021232	B	OTHER - Military (F15)	UNKNOWN (Balloon)	Mil-UA/Other
2021233	C	OTHER - Military (Chinook)	OTHER (HPH Shark)	GA-Mil
2021234	B	CESSNA - 172	PIPER - PA28	GA-GA
2021235	C	MBB - BK117 (EC145)	AGUSTA - A109	GA-Emerg Servs
2021236	D	OTHER (Paraglider)	UNKNOWN	GA-Unk ac
2021237	B	OTHER - Military (Typhoon)	OTHER - Military (Typhoon)	Mil-Mil
2021238	C	BAE - JETSTREAM4100	UNKNOWN (RPAS)	CAT-UA/Other
2021239	C	OTHER - Military (Apache)	CESSNA - 150	GA-Mil
2021240	C	AGUSTA - A109	UNKNOWN (RPAS)	Civ Comm-UA/Other
2021241	B	SOCATA - TB10	PIPER - PA28	GA-GA
2021242	E	BAE - AVRO146RJ - 100 - 70	OTHER - Military (Hawk T1)	Mil-Mil
2021243	C	AIRBUS - A319	UNKNOWN (RPAS)	CAT-UA/Other
2021244	C	ATR - ATR42	PIPER - PA28	CAT-GA
2021245	E	CESSNA - 404	OTHER - Military (E3)	Civ Comm-Mil
2021246	B	CESSNA - 152	OTHER (PS-28 Cruiser)	GA-GA
2021247	C	BOEING - 737	UNKNOWN (Object)	Civ Comm-UA/Other
2021248	C	ROBINSON - R44	AEROSPATIALE - AS355	Civ Comm-Civ Comm
2021249	C	AIRBUS - A320	UNKNOWN (Object)	CAT-UA/Other
2021250	C	BOEING - 787	UNKNOWN (RPAS)	CAT-UA/Other
2021251	B	CESSNA - 152	DIAMOND - DA42	GA-GA
2021252	B	OTHER (Ozone Mantra)	UNKNOWN (RPAS)	GA-UA/Other
2021253	B	AIRBUS - A320	UNKNOWN (RPAS)	CAT-UA/Other
2021254	A	AIRBUS - A320	UNKNOWN (Object)	CAT-UA/Other
2021255	C	AIRBUS - A320	PIPER - PA34	CAT-GA