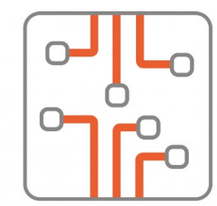
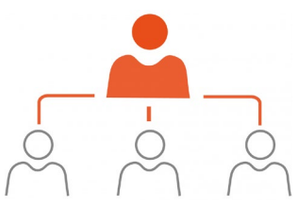
BEA

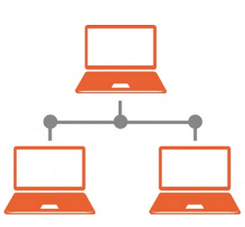
ACTIVITY REPORT 2022









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MESSAGE FROM THE DIRECTOR

This year marks the tenth time that I have addressed the readers of the BEA's annual activity report to outline the overall context and the work accomplished. In 2014, my first contribution mentioned that the annual number of air passengers in the world had just passed the 3 billion mark. In 2019, the year before the COVID pandemic, it exceeded 4.5 billion, and there is every reason to believe that, after the three years of difficulties linked to this pandemic, and despite the current geopolitical situation, this figure will be exceeded again in 2023.

The BEA's activity in 2022 has already been strongly marked by this upturn in traffic: the number of investigations opened and foreign notifications is on the increase, returning to the level of the "pre-COVID" years. International activities, as part of the work of various institutions such as ICAO, the European Union and others, are resuming their operations, adopting new working methods, combining teleconference meetings and "face-to-face" meetings, in the search for a compromise between the need to reduce operating costs and the need to maintain direct relations.

As far as commercial air transport in France is concerned, the BEA's resources were engaged in an accident linked to a hard landing, as well as in an unusual series of accidents and serious incidents linked to go-arounds and runway excursions: although none of these events resulted in personal injury, the succession of several events of a similar nature deserves particular attention.

In general aviation, the trends already noted in previous years are confirmed: the activity hardly seems to have been affected by the COVID pandemic. The numbers of accidents and victims remain fairly stable overall, but the trends vary from year to year between the different types of activity: up for microlights, down for aeroplanes.

The BEA published a slightly lower number of reports than the number of investigations it opened, which logically led to a slight increase in the number of investigations in progress.

In this context, the BEA has maintained its capacity to process all the events for which it was notified, without accumulating excessive delays. But it has to be said that this balance is rather fragile. If the number of investigations to be opened increases because of the rise in traffic, or if a major event occurs, it will then be necessary to review the organisation of the work. This could lead to adjustments in the investigation policy. As part of the preparatory work linked to the definition of its strategic plan for the next five years, the BEA has already launched discussions on this subject. We will be sure to provide regular updates on their progress in future activity reports.

In conclusion, I would like to thank all BEA staff for their engagement in our work in 2022, and tell them how proud I am to have been at the helm of the BEA for almost ten years: they themselves can be proud of the work they have accomplished.

Rémi Jouty

1. OVERVIEW OF ACCIDENTS, INVESTIGATIONS INITIATED IN 2022 BY THE BEA

Accident to the Jodel D140 registered F-BMFV on 26 February 2022 at Saint Roch Mayères mountain landing area.

1.1 GENERAL CONTEXT

The obligations of the Member States of the European Union in terms of Civil Aviation safety investigations are defined in Regulation No. 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation.

The general principle of this regulation is that every accident or serious incident in the field of civil aviation shall be the subject of a safety investigation in the Member State in which the accident or serious incident occurred. This requirement applies to all manned and unmanned aircraft (drones), except those listed in Annex I of Regulation (EU) No. 1139/2019 (the aircraft listed in this Annex are mainly non-certificated aircraft: microlights, "historic" aircraft, etc.).

Exemptions are however provided for: "the responsible safety investigation authority may decide, taking into account the expected lessons to be drawn for the improvement of aviation safety, not to initiate a safety investigation when an accident or serious incident concerns an unmanned aircraft for which a certificate or declaration is not required [...] or concerns a manned aircraft with a maximum take-off mass less than or equal to 2 250 kg, and where no person has been fatally or seriously injured."

Furthermore, Annex 13 of the International Civil Aviation Organization (ICAO) specifies that, when a safety investigation is conducted by a State (usually the State of Occurrence), the State of the Operator, the State of Registry and the State of Manufacture of the aircraft involved are invited to participate in this investigation, by naming an accredited representative (ACCREP).

In France, the BEA is the authority responsible for safety investigations. Its procedures stipulate that, in addition to the investigations it has an obligation to conduct in accordance with the European regulations, when its resources allow, it also investigates the following events:

- reported incidents; which are of particular interest for safety;
- fatal accidents involving aircraft listed in Annex I of Regulation (EU) No. 1139/2019;
- accidents involving aircraft weighing less than 2,250 kg, including those where no person was fatally or seriously injured;
- serious incidents and accidents involving drones, including those for which a declaration or a certificate is not required, when these have resulted in significant consequences for other aircraft or for third parties on the ground.

These criteria are assessed at the time of notification. Subsequent developments, in particular the death of an occupant of an aircraft covered by Annex I of Regulation (EU) No. 1139/2019 in the following days, generally do not lead to a reconsideration of the initial decision, mainly because the factual information required for the investigation has not been collected or preserved.

1.2 ACCIDENT DATA AND INVESTIGATIONS OPENED

The BEA receives several thousand notifications every year, mainly by telephone and/or e-mail. The incoming flow of these notifications is processed as follows:

- the operational duty investigator carries out an initial filtering process to select the events likely to meet the criteria for opening an investigation, which will be presented to the daily review;
- during this review, the events selected are studied collectively by investigators to decide on their classification (accident, serious incident or incident) and their treatment (investigation, collection of additional information, recording in a database or closure without further action).

In 2022, almost 1,200 occurrences were studied during the daily reviews.

1.2.1 ACCIDENTS IN FRANCE IN 2022

The data in the table below mainly comes from two sources:

- investigations conducted by the BEA;
- information provided by Field Investigators with respect to "Annex I" aircraft accidents that are not the subject of a BEA investigation.

Accident to the Diamond DA42 registered F-HIMY on 16 June 2022 at Courchevel.

Accidents in France in 2022				
	Number of accidents[1]		Number of injured people	
	Total	of which fatal	fatal	serious
COMMERCIAL AIR TRANSPORT				
Aeroplanes	4	0	0	0
Helicopters	2	1	2	0
Balloons	2	0	0	2
Commercial Air Transport TOTAL	**8**	**1**	**2**	**2**
AERIAL WORK / SPECIALISED ACTIVITY[2]				
Aeroplanes	4	1	1	0
Helicopters	2	0	0	2
Microlights	4	1	1	0
Aerial Work / Specialised Activity TOTAL	**10**	**2**	**2**	**2**
GENERAL AVIATION				
Aeroplanes	77	9	20	3
Helicopters	9	1	2	3
Gliders	16	2	3	1
Microlights[3]	101	24	32	21
General Aviation TOTAL	**203**	**36**	**57**	**28**
TOTAL	**221**	**39**	**61**	**32**

Note: no accident or serious incident involving a drone was reported to the BEA in 2022.

Overall, the number of accidents recorded in France in 2022 (all types of activity and categories of aircraft included) is identical to that in 2021. The number of fatal accidents and the number of victims rose slightly (by 8 % and 7 % respectively). The number of serious injuries fell sharply (-36 %), although it is not possible to explain this phenomenon in light of other accident characteristics.

More information about accidents in France in 2022

Fatal accidents involving an aircraft operated in commercial air transport:

- Only one was recorded. This concerned the accident to the Airbus EC130 registered 3A-MVT and operated by Monacair on 25 November 2022 at La Trinité (Alpes-Maritimes). The pilot and the passenger died when the helicopter collided with the terrain.

1. The number of accidents recorded may differ from the number of damaged aircraft or aircraft involved in accidents, in particular because an accident may involve several aircraft.
2. Accidents occurring during the aerial activities listed under GM1 SPO.GEN.005 associated with Regulation (EU) No. 965/2012 are counted under the "Aerial work/Specialised activity" heading even if the flights involved do not formally meet the requirements of PART SPO of this Regulation.
3. Local microlight flights for remuneration are included in the "General aviation" category.

Non-fatal accidents involving an helicopter operated in the scope of commercial air transport:

- Only one was recorded, which only resulted in material damage. This occurred during the hard landing of the Airbus EC135 registered F-GMHJ and operated par SAF Hélicoptères on 29 March 2022 at Les Deux Alpes (Isère).

Non-fatal accidents involving an aeroplane operated in commercial air transport: four were recorded:

- Three accidents involved a high-capacity aeroplane:
  - two of them occurred during the landing phase: the hard landing of the Boeing 737 registered F-GZHA and operated by Transavia on 01 October 2022 at Nantes-Atlantique (Loire-Atlantique) and the overrun of the Boeing 737 registered EC-NLS and operated by Swiftair on 24 September 2022 at Montpellier-Méditerranée (Hérault);
  - the third accident occurred during the taxiing phase to the Boeing 737 registered TF-BBM and operated by Bluebird Cargo on 20 November 2022 at Paris-Charles de Gaulle (Val-d'Oise).
- One accident involved a low-capacity aeroplane at the end of a sightseeing flight: this occurred during a runway veer-off of the Jodel D140 registered F-BLKK and operated by Aérocime on 20 April 2022 at Megève mountain airfield (Savoie).

These accidents only resulted in material damage.

Accidents involving a balloon operated in the scope of a commercial air transport flight meeting the requirements of Subpart ADD of Regulation (EU) No. 2018/395:

- Two accidents of this type were recorded in 2022, each resulting in injuries to a passenger. The first accident involved a tethered balloon: this occurred during the untimely take-off of the Ultramagic M105 registered F-GYFR and operated by Air Pegasus Montgolfières on 13 August 2022 at Bondy (Seine-Saint-Denis). The second accident occurred during a hard landing at the end of a sightseeing flight to the Cameron A300 registered F-HHLC and operated by France Montgolfières at Le Liège (Indre-et-Loire).

Fatal accidents involving an aircraft operated in aerial work / specialised activity:

- Two were recorded: the first accident occurred during the collision with the surface of the water of the paramotor identified 36UU on 25 June 2022 at Savines-le-Lac (Hautes-Alpes) and the second accident occurred during the collision with the ground of the Robin DR300 registered F-BTBC on 12 July 2022 at Revel (Haute-Garonne).

Non-fatal accidents involving an aircraft operated in aerial work / specialised activity:

- Three accidents resulting in material damage were recorded. These occurred during glider towing operations. These accidents are listed in the table above, in the category corresponding to the aircraft that sustained the most important consequences (glider or tug aeroplane/microlight).
- Of the other accidents recorded, two events involved injuries to operators on the ground during sling load operations (one occurred to the Airbus AS350 registered F-GJRP on 06 July 2022 at La Vieille lighthouse (Finistère) and the other occurred to the Airbus AS350 registered F-OMAB on 14 December 2022 at Ilet à Malheur (La Réunion)), and three aeroplane accidents occurred during parachute dropping flights, two of which resulting from a loss of engine power.

Of the microlight accidents reported in general aviation, four occurred within the context of commercial sightseeing flights. The accident which occurred to the DTA Dynamic feeling 912 identified 77BIQ on 20 August 2022 at Meaux (Seine-et-Marne) resulted in the death of the pilot and passenger after a loss of control in initial climb.

A more detailed description of the types of accident in general aviation is included in paragraph 3.

1.2.2 INVESTIGATIONS OPENED BY THE BEA IN 2022

In 2022, the BEA opened 139 investigations, compared with 121 in 2021, i.e. a 16 % increase.

2022 was marked by the opening of 18 investigations involving aircraft operated in the scope of commercial flights, 12 of which involving high-capacity aeroplanes.

Investigations opened by the BEA in 2022, by types of operation					
Event category	**Commercial Air Transport**	**General Aviation**	**Aerial Work**	**TOTAL**	***(Reminder of total in 2021)***
Accidents	8	108	7	**123**	*(107)*
Serious incidents	7	5	1	**13**	*(11)*
Incidents	3	0	0	**3**	*(3)*
TOTAL	**18**	**113**	**8**	**139**	*(121)*
(Reminder of total in 2021)	*(12)*	*(102)*	*(7)*	*(121)*	

Investigations opened by the BEA in 2022, by main categories of aircraft							
Event category	**Fixed-wing aircraft** **< 5,700 kg** *(Light aeroplanes, gliders and fixed-wing microlights)*	**Fixed-wing aircraft** **≥ 5,700 kg** *(High-capacity aeroplanes)*	**Rotary-wing aircraft** **< 3,180 kg** *(Light and ultralight helicopters, gyroplanes)*	**Rotary-wing aircraft** **≥ 3,180 kg** *(High-capacity helicopters)*	**Drones**	**Other** *(Balloons, paramotor and flex-wing microlights)*	**TOTAL**
Accidents	97	3	15	0	0	8	**123**
Serious incidents	7	6	0	0	0	0	**13**
Incidents	0	3	0	0	0	0	**3**
TOTAL	**104**	**12**	**15**	**0**	**0**	**0**	**139**

The number of investigations opened by the BEA indicated above is significantly fewer than the number of accidents, due in particular to the fact that "Annex I" non-fatal aircraft accidents are only investigated in certain specific cases.

More information about opened and delegated investigations

The table in paragraph 1.2.1. includes the accident to the Aura Aero Integral R registered F-WJMK on 12 April 2022 at Prat-Bonrepaux (Ariège), which resulted in the death of both occupants. This accident, which occurred during a test flight for civil type certification, is being investigated by the BEA-É (State Aviation Accident Investigation Authority), in coordination with the BEA. It is therefore not listed in the table of investigations opened by the BEA.

In addition, the fatal accident to the fixed-wing microlight identified 38AEA on 21 August 2022 at Bourg-Saint-Christophe (Ain) is not being investigated by the BEA: as the pilot had initially survived, a decision had been made not to open an investigation. When he died, the conditions for preserving factual data were no longer satisfied to allow for a change in the initial decision not to open an investigation.

With the exception of the occurrences mentioned above, all fatal civil aviation accidents which occurred in France in 2022 gave rise to the opening of an investigation by the BEA.

It should also be noted that in 2022, no investigation was delegated to the BEA by a foreign authority, and the BEA did not delegate any investigation concerning an event which occurred on French territory.

More information about investigations into incidents and serious incidents

In 2022, the BEA opened 16 investigations into incidents or serious incidents, including 9 investigations concerning high-capacity aeroplanes operated in commercial air transport (details of these investigations are given in paragraph 3.1.). The other incidents and serious incidents investigated included:

- the loss of separation between parachutists and the De Havilland DHC-6 registered F-OMYR and operated by Caire on 10 April 2022 during its approach to Saint-François AD (Guadeloupe);
- the temporary loss of control in cruise, in icing conditions, of the Cessna 340 registered N340YZ on 06 February 2022;
- the temporary loss of control of the Beech 90 registered F-HHAM on 23 May 2022 near Paris-Le Bourget after an ILS path acquisition problem;
- the temporary loss of control at low height of the Douglas DC3 registered F-AZTE on 09 July 2022 at Meaux (Seine-et-Marne) during a rehearsal for an air show;
- the rupture in flight of an aileron control cable fitted to the Cessna 172 registered F-OOOO on 18 February 2022 at Les Saintes (Guadeloupe).

More information about different investigation categories managed by the BEA

The BEA adapts its investigative resources and the type of report issued based on the perceived level of risk, the envisaged lessons to be learnt and the target public. On this basis, the BEA has established three categories for investigations and associated reports, based on the criteria detailed below.

The following table shows the breakdown of the investigations opened by the BEA in 2022 based on investigation categories.

Breakdown of the number of opened investigations, by category				
Investigation categories	**Category 1**	**Category 2**	**Category 3**	**TOTAL**
Investigations opened in 2022	2	81	56	**139**

The two category 1 investigations listed in this table concern the accidents involving the EC-NLS at Montpellier and the F-GZHA at Nantes, already mentioned in paragraph 1.2.1.

Classification criteria for investigations led by the BEA

Category 1 investigation

Investigation requiring several areas of organisational and/or systemic analysis and which leads to the writing of a report using the full structure proposed by ICAO Annex 13. Category 1 investigations generally give rise to safety recommendations. The accidents that systematically give rise to a category 1 investigation are those involving an aircraft operated under an air operator's certificate with a maximum certified take-off weight of more than:

- 5.7 t for an aeroplane, or
- 3.18 t for a helicopter,

during which:

- at least one person onboard is fatally injured, or
- an emergency evacuation is required and the aircraft is destroyed, or
- the aircraft is reported missing.

Category 2 investigation

This category is for investigations where the areas of in-depth examination and analysis are limited, giving rise to a "simplified report": the structure of these reports may differ from the template provided in ICAO Annex 13 in order to adapt to the circumstances of the occurrence and the priorities of the investigation. These investigations apply for all types of operations. They primarily aim to provide operational feedback, but can also lead to the issuing of safety recommendations.

Category 3 investigation

"Desktop" Investigation. During these investigations, information is mainly obtained through statements from the parties directly involved. This information is not generally validated by the BEA, and there is no development of an analysis, conclusions or lessons. With this investigation category, the BEA wants above all, to ensure that personal experience is shared throughout the community in question. This investigation category is generally reserved for light aircraft and types of occurrences which do not lead to serious bodily injury, based on past experience.

1.2.3 INVESTIGATIONS OPENED BY A FOREIGN BODY AND OFFICIALLY NOTIFIED TO THE BEA

Foreign investigations opened in 2022 about which the BEA has been officially notified							
Type of event	**Commercial Air Transport**	**General Aviation**	**Aerial Work**	**State aircraft**	**Other undetermined**	**TOTAL**	***(Reminder of total in 2021)***
Accidents	41	48	7	8	31	**135**	*98*
Serious incidents	83	10	4	1	9	**107**	*84*
Incidents	22	0	1	1	2	**26**	*21*
TOTAL	**146**	**58**	**12**	**10**	**42**	**268**	*203*
(Reminder of total in 2021)	*103*	*54*	*15*	*5*	*26*	*203*	

The number of occurrences for which, in compliance with the criteria of Annex 13, a foreign authority opened an investigation and notified the BEA, increased by 32 % in 2022, compared with 2021: with 268 notifications, 2022 marks a return to an activity similar to that recorded before the COVID-19 health crisis (270 notifications relating to foreign investigations in 2019).

For several years now, the BEA has adapted the allocation of its resources to foreign investigations based on the stakes associated with the reason for the proposed accredited representation. The classification criteria for foreign investigations for which the BEA appoints an accredited representative (ACCREP) are described below.

The participation of the ACCREP is:

- active for category 1 ACCREP cases (major event);
- active depending on the needs of the foreign authority for category 2 ACCREP cases;
- on standby, pending a request from the foreign authority for category 3 ACCREP cases: this category mainly includes events that occurred to aircraft of French design, for which no safety issues directly related to design characteristics have been identified at first sight.

Classification criteria for investigations opened by a foreign body and notified to the BEA

Category 1 accredited representations

These concern accidents or incidents to aeroplanes with a maximum take-off weight of more than 5.7 t where:

- at least one person on board is fatally injured (excluding injuries from natural causes), or
- an emergency evacuation is carried out and the aircraft is destroyed, or the aircraft is reported missing,

Or accidents and incidents to helicopters of more than 3.18 t where:

- at least one person on board is fatally injured (excluding injuries from natural causes), or
- an emergency evacuation is carried out and the aircraft is destroyed, or the aircraft is reported missing.

Category 3 accredited representations

These concern accidents and incidents to aeroplanes of less than 2.25 t:

- where the BEA, in theory, does not provide any added value during the investigation,
- without a clear link with the reason for accreditation,
- where there is no specific request from the authority in charge,
- which would be the subject of BEA Category 3 investigations,

Or accidents and incidents to aeroplanes of more than 2.25 t:

- where the BEA, in theory, does not provide any added value during the investigation,
- without a clear link with the reason for accreditation,
- where, in theory, there are no benefits or stakes for the advisor and/or the BEA,
- which would not give rise to the opening of a BEA investigation in France,
- where there is no specific request from the authority in charge,
- where there is no justified request from the advisor,

Or accidents and incidents to helicopters:

- without victim,
- where there is no specific request from the authority in charge,
- without a clear link with the reason for accreditation,
- where there is no justified request from the advisor,

Or accidents and incidents involving aircraft equipped with engines of French design or manufacture:

- if no component manufactured by the French manufacturer contributed to the occurrence,
- without a clear link with the reason for accreditation,
- where there is no justified request from the advisor.

Category 2 accredited representations

concern aircraft accidents and incidents that do not meet the criteria of category 1 and 3 ACCREP.

The following table shows the breakdown of the accredited representations of the BEA in 2022 based on commitment levels (ACCREP categories).

Breakdown of the number of ACCREP in 2022, by category				
ACCREP categories	**Category 1**	**Category 2**	**Category 3**	**TOTAL**
Investigations opened in 2022	2	165	101	**268**
Reminder for 2021	0	126	77	**203**

Category 1 accredited representations concern:

- the runway excursion of the Airbus A330-300 registered HL7525 and operated by Korean Air on 23 October 2022, during the landing at Cebu (Philippines): the aeroplane was substantially damaged during this accident;
- the collision with the surface of the water of the ATR 42-500 registered 5H-PWF operated by Precision Air on 06 November 2022 on approach to Bukoba (Tanzania), which resulted in the death of the19 occupants.

In addition, the Comorian authorities asked the French government and the BEA to provide assistance after a Cessna-208 collided with the surface of the water off the coast of Moheli. The Comorian authorities are in charge of the investigation. As the wreckage could not be located and the aircraft was not equipped with flight recorders such as a CVR or a FDR, the understanding of the circumstances that led to the accident will remain limited.

The distribution between categories of ACCREP cases can change depending on the requests of foreign safety investigation authorities.

1.2.4 GO-TEAMS

In the case of a particularly important occurrence (in France or abroad), the BEA sends a team of investigators to the site without delay. The size and composition of this "Go-Team" are defined on a case-by-case basis.

In 2022, 47 Go-Teams were dispatched in Metropolitan France and 2 in overseas territories. These teams were organised by the BEA within a few days, after checking that the factual aspects had been preserved: in one case, the preliminary work was carried out on site by a Field Investigator (see paragraph 1.2.5.) before the BEA team arrived.

In addition, 3 Go-Teams were sent abroad to the following countries:

- Philippines and Tanzania, within the context of the above-mentioned category 1 accredited representations;
- United Kingdom, following a serious incident (multiple electrical failures and loss of engine power) involving an ATR42-500 in climb from Aberdeen.

In all three cases, the BEA team was accompanied by technical advisors from Airbus or ATR.

1.2.5 FIELD INVESTIGATORS

The BEA frequently uses the services of Field Investigators, who are French civil aviation authority (DGAC) staff, mostly posted at the headquarters of the different Inter-Regional divisions, or in the French civil aviation safety directorate (DSAC) Delegations, and in overseas services. Some Field Investigators also come from the French Air Navigation Services Provider (DSNA).

These field investigators are trained by the BEA and have been approved by the BEA director in accordance with the provisions of the Code of Transport.

On request by the BEA and under its authority, they carry out the initial investigation actions (often on site) immediately after the accident and exclusively on French territory. They are mainly called on for general aviation occurrences, but sometimes they are also called on for commercial air transport occurrences, particularly in overseas territories.

According to the occurrence, BEA investigators will join them on-site, or not. In all cases, the rest of the investigation is carried out by BEA investigators.

One hundred and twenty-three Field Investigators are currently available. A tripartite service contract between the BEA, the DSAC and the DGAC Secretary General specifies the terms of their training, approval and use by the BEA. Maintaining the number and skills of Field Investigators is a major challenge for the BEA in order to ensure rapid and effective operations France-wide and all year round.

Nearly sixty operations by Field Investigators were recorded in 2022, of which 24 were coordinated with a BEA Go-Team.

Accident to the Robinson R44 registered F-HOHE on 19 February 2022 at Valojoulx

2. INVESTIGATIONS CLOSED, REPORTS PUBLISHED IN 2022

Accident to the Piper PA30 registered N8663Y on 12 August 2021 at Cannes.

2.1 INVESTIGATIONS CLOSED AND INVESTIGATION REPORTS PUBLISHED

European Regulation No. 996/2010 specifies that each safety investigation must be concluded with a report in a format suitable for the type of occurrence. The BEA has defined three investigation categories (refer to paragraph 1.2.2.).

In 2022, the BEA closed 129 investigations and published as many final reports, broken down as shown in the following table.

Number of investigations closed / reports published by the BEA in 2021				
	Category 1	Category 2	Category 3	Total
	(figures in brackets: reports with safety recommendations)			
Commercial air transport	**0**	**12***	**2**	**14***
	(0)	*(3)*	*(0)*	***(3)***
Aerial work/ Specialised activity	**0**	**6**	**0**	**6**
	(0)	*(0)*	*(0)*	***(0)***
General aviation	**0**	**69**	**41**	**110**
	(0)	*(4)*	*(0)*	***(4)***
Other	**0**	**0**	**0**	**0**
	(0)	*(0)*	*(0)*	***(0)***
Total	**0**	**87***	**43**	**130***
	(0)	*(7)*	*(0)*	***(7)***

** with a preliminary report on an investigation that is not yet closed*

Note: this table takes into account the publication of the preliminary report on the serious incident to the Airbus A320 registered 9H-EMU and operated by Airhub on 23 May 2022 near Paris-Charles de Gaulle (Val-d'Oise): this report contains six safety recommendations. The event was classified as category 2. It is described in paragraph 3.1.2. The investigation is still in progress and will be the subject of a final report at a later date.

The details of the reports including safety recommendations are given in paragraph 4.

Breakdown by report format

Category 1 investigations systematically give rise to ICAO format reports. Category 2 investigations are the subject of simplified investigation reports or ICAO format reports whilst category 3 investigations are systematically the subject of simplified reports, generally limited to the elements gathered from statements.

Number of final reports published, by report format				
Report format	**ICAO report**	**Simplified investigation report with analysis and conclusion**	**Simplified investigation report limited to statements**	**TOTAL**
Number of final reports published in 2022	4	82	43	**129**

2.2 MORE INFORMATION ABOUT THE BEA'S PRODUCTION

2.2.1 MORE INFORMATION ABOUT THE YEAR OF THE INVESTIGATIONS CLOSED AND THE STOCK OF INVESTIGATIONS

The BEA published 129 final reports in 2022 (compared with 140 in 2021 and 189 in 2020).

The following table indicates, for each category, the year of the investigations closed in 2022.

Year investigations were opened for all reports published by the BEA in 2022					
Investigation categories		**Category 1**	**Category 2**	**Category 3**	**Total**
Year of occurrence	2022	0	3	35	**38**
	2021	0	54	8	**62**
	2020	0	18	0	**18**
	Previous	0	11	0	**11**
Total		**0**	**86**	**43**	**129**

A total of 135 investigations were open on 31 December 2022. Of these investigations, 34 were more than one year old (compared with 38 in 2021 and 59 in 2020). The following table indicates, for each category, the age of these investigations.

Number of years since the BEA investigations were opened, on 31 December 2022				
	Category 1	**Category 2**	**Category 3**	**Total**
Less than one year	2	78	21	**101**
One to three years	0	33	0	**33**
More than three years	0	1	0	**1**
Total	**2**	**112**	**21**	**135**

2.2.2 MORE INFORMATION ABOUT THE "INVESTIGATIONS CLOSED IN LESS THAN ONE YEAR" PERFORMANCE INDICATOR

Regulation (EU) No. 996/2010 specifies that an investigation report should be published rapidly and, if possible, within twelve months of the date of the occurrence. For the BEA, this duration of twelve months for each investigation is thus a general objective and a monitoring indicator. This indicator is defined as the percentage of investigations closed within one year among the investigations opened the previous year.

In 2022, the global result of this indicator was 65 % (same as in 2021).

It can be seen that if a distinction is made between investigation categories (as defined in paragraph 1.2.2), the indicator varies substantially, as shown in the following table: the volume of factual items of information to be obtained, the time spent collecting and then analysing this information, the need to conduct complementary and potentially time-consuming work, and the duration of validation and consultation processes, may widely vary depending on these investigation categories. In addition, issuing recommendations (naturally more frequent

for category 2 investigations, and especially for category 1) is – except in the case of urgent recommendations - a demanding process with various validation phases, which may significantly extend the duration of investigations.

Breakdown of the "investigations closed in less than one year" indicator for 2022				
Investigation categories	**Category 1**	**Category 2**	**Category 3**	**Total**
Investigations opened in 2021	0	86	35	**121**
Closed in less than one year	0	44	35	**79**
2022 indicator	**-**	**51 %**	**100 %**	**65 %**

The BEA has set itself the target of closing 80 % of its investigations in less than one year. More precisely, this target is broken down as follows:

- 100 % of category 3 investigation reports should be published in less than one year. Most of these reports should be published in less than four months;
- 70 % of category 2 investigation reports should be published in less than one year. No category 2 investigation should take longer than two years (for information, the number of category 2 investigations lasting longer than two years was 7 as of 01 January 2023).

2.2.3 ANALYSIS OF THE BEA'S ACTIVITY

For the BEA, 2022 marked a return to a pre-COVID-19 activity. The number of new investigations increased. Moreover, the two major investigations (category 1 investigations) and the 17 investigations into commercial air transport accidents and incidents which were included in this number resulted in an increased engagement of resources. The same was observed in terms of international activity, with an increase in the number of ACCREPs, including two category 1 ACCREPs.

In 2022, for the first time in four years, the BEA published fewer final reports (129), compared with the new investigations it opened (139). However, it should be noted that:

- the BEA closed more category 2 investigations in 2022, compared with the number it opened.
- the increase in the number of investigations opened is mainly due to an increase in the number of category 3 investigations, which require limited resources to complete.

All in all, therefore, it can be considered that, despite an overall reduction in staff numbers, the BEA's capacity to handle a slightly increased incoming flow has been affected, but the situation remains under control for the time being.

In fact, the BEA's capacity to handle the incoming flow of investigations depends on the following factors:

- the number of investigators and support staff;
- the incoming flow and its characteristics (number of investigations opened during the year, number of accredited representations activated, reactivated or which remained active, complexity of all these investigations and accredited representations);
- the investigation policy, which defines the type of events to be investigated and the category of the investigation carried out for each of them: this policy may go beyond the regulatory requirements (the BEA's current investigation policy is summarised in paragraph 1.1.);
- the stock of investigations in progress for longer than one year, which may indicate an accumulated delay in processing the flow from previous years.

The figures for 2022 confirmed the analysis made last year, which showed a certain balance between these factors, allowing the stock of investigations to be improved on by further reducing the number of oldest investigations (-10 % of investigations of more than one year) and by maintaining constant production over the intermediate stock, as shown by the result of the 2022 indicator concerning the closure in less than one year of investigations opened in 2021 (identical to that of the previous year).

However, these figures indicate that this balance is somewhat fragile. While the BEA has been able to absorb the ups and downs of activity in the best possible conditions despite the high number and complexity of investigations opened during the year, it will have to keep a close eye on the air traffic (which practically returned to its pre-COVID-19 level and which tends to keep growing): if staff numbers continue to decrease, or if the number of major investigations substantially increases, the only available option will be to modify its investigation policy. However, given the regulatory constraints, modifying this policy could imply not to perform a certain number of investigations which are not compulsory, but useful to have an overall understanding of accidentology.

8th Accident Investigator Materials (AIM) meeting on 16 October 22 at the BEA.

3. GENERAL CONSIDERATIONS ON AIR SAFETY IN FRANCE IN 2022

Field Investigators' training day by the BEA in March 2023.

3.1 COMMERCIAL AIR TRANSPORT

3.1.1 COMMERCIAL AIR TRANSPORT ACCIDENTS

The three accidents involving high-capacity aeroplanes operated in commercial air transport were described in paragraph 1.2.1. These concerned the following occurrences:

- Hard landing of the Boeing 737 at Nantes-Atlantique. The RNP 21 approach (with LNAV/VNAV minima), conducted in adverse weather conditions by the co-pilot in line training, was stabilised until the flare, but the hard contact with the runway resulted in substantial damage to the aeroplane.
- Overrun of the Boeing 737 during landing at Montpellier-Méditerranée.
- Collision of the Boeing 737 with obstacles while taxiing from the parking area at Paris-Charles de Gaulle airport.

No French operator was involved in a commercial air transport accident abroad in 2022.

3.1.2 COMMERCIAL AIR TRANSPORT INCIDENTS AND SERIOUS INCIDENTS

Altimeter setting error during a Baro-VNAV approach, near-collision with the ground with no external visual references.

The most critical occurrence for 2022 in France definitely concerned the ground proximity event involving the Airbus A320 registered 9H-EMU and operated by AirHub on 23 May 2022 during an RNP approach with LNAV/VNAV minima to runway 27R at Paris-Charles de Gaulle (Val-d'Oise). Due to an error in the QNH value that the controller gave to the crew, the final approach was flown with an erroneous altimeter setting of 10 hPa (higher than the QNH of the day) and therefore nearly 280 ft below the nominal approach path. The error was not detected by either the crew or the air traffic controllers. The crew aborted the approach after reaching their operational minima (published minima plus 50 ft, as required by the operator's procedures) without acquiring visual references of the runway and with the runway approach lights OFF. During the go-around, the lowest point recorded by the aeroplane's radar altimeters was 6 ft. At this stage of the investigation, the following points can already be noted:

- the event occurred in the by-design inhibition zone of the EGPWS;
- the Minimum Safe Altitude Warning (MSAW) and the associated controller procedures did not allow the crew to be warned quickly enough.

This serious incident is reminiscent of another serious incident that occurred under the same conditions in October 2021, involving a Bombardier CRJ 1000 operated by Hop!, during an approach of the same type (RNP) to Nantes-Atlantique (Loire-Atlantique), following a QNH read-back error by the crew.

These two serious incidents, among others, are a reminder of the lack of robustness of Baro-VNAV approaches to QNH errors. Furthermore, the altitude-distance checks that crews are required to carry out as part of the procedures associated with this type of approach do not allow them to detect this type of error.

The serious incident at Paris-Charles de Gaulle gave rise to the publication of a preliminary report containing six safety recommendations addressed to the air operator and air navigation services.

Non-stabilised approach, overrun on landing

On 20 October 2022, the Embraer 145 registered F-HYOG and operated by Amelia overran runway 25 at Paris-Orly at the end of the ILS approach carried out by the crew. The aeroplane was not damaged. The initial information gathered showed that the approach was undertaken in very adverse weather conditions and was not stabilised, with no crew decision to abort it.

These observations are similar to those concerning the accident to the Boeing 737 at Montpellier, mentioned as part of the accidents above.

Malfunction of an airspeed/barometer system in flight, altitude deviation not detected

On 12 January 2022, the Cessna 525 registered F-HGPH and operated by Valljet experienced a malfunction in an airspeed/barometer system at the end of the climb from Le Bourget (Seine-Saint-Denis) bound for Geneva (Switzerland). This malfunction caused the aeroplane to fly in cruise at a flight level different from that authorised

by the air traffic controller, without the crew or the controller being fully aware of it. This altitude deviation resulted in a loss of separation with an Embraer 170 operated by HOP! in cruise at FL280.

This serious incident is reminiscent of two serious incidents which occurred in 2010 (near-collision between an Airbus A318 and a Pilatus PC 12) and in 2020 (proximity of a Cessna 525A to the ground in controlled flight), both following the failure of an airspeed/barometer system.

In each of these three investigations, the BEA observed the absence or lack of knowledge of emergency procedures, both on board or on the ground. For all these serious incidents, the BEA found a hypothesis confirmation bias in ground-air communications, i.e. between the aeroplane crew and the controllers with whom they were in contact.

In addition, the BEA stresses the exceptional criticality of this type of malfunction, which not only generates a threat by causing an altitude deviation, but also simultaneously removes the main recovery barriers against the risks of collision between aircraft and with the terrain, since the wrong altitude indication read by the crew and used by the autopilot is also the one displayed on the controller's radar screen, and the one used by certain systems, such as the TCAS or STCA (collision prevention) or the MSAW (terrain proximity).

In addition to this criticality, the BEA draws the attention of regulators to the involvement of aircraft covered by different certification standards and/or operated in different environments: regarding the risk of mid-air collision, some aircraft subject to less stringent requirements considered as acceptable (e.g. those covered by CS23 or equivalent and/or operated within a non-commercial context) are exposed to the same risk as aircraft subject to higher requirements (e.g. those covered by CS25 or equivalent and/or operated within a non-commercial context).

Other commercial air transport incidents and serious incidents investigated

The other commercial air transport incidents and serious incidents investigated by the BEA in 2022 included:

- Two occurrences of dual input in go-arounds resulting in the desynchronisation of the right and left control linkages:
  - the first incident involved a Boeing B777-300ER on approach to Paris Charles-de-Gaulle;
  - the second incident involved an ATR 72-600 during the landing at Hiva-Oa Atuona (Polynésie française) after wind shear.
- The loss of visual references by the crew of an Airbus A320 during a night visual approach at Pointe-à-Pitre (Guadeloupe), which resulted in the MSAW alarm being triggered during the base leg and the aircraft being offset in relation to the centreline on final approach. The approach was aborted.
- The landing clearance given to an Airbus A320 at Bordeaux without the crew or the controller having detected the presence of a DR400 on the runway.

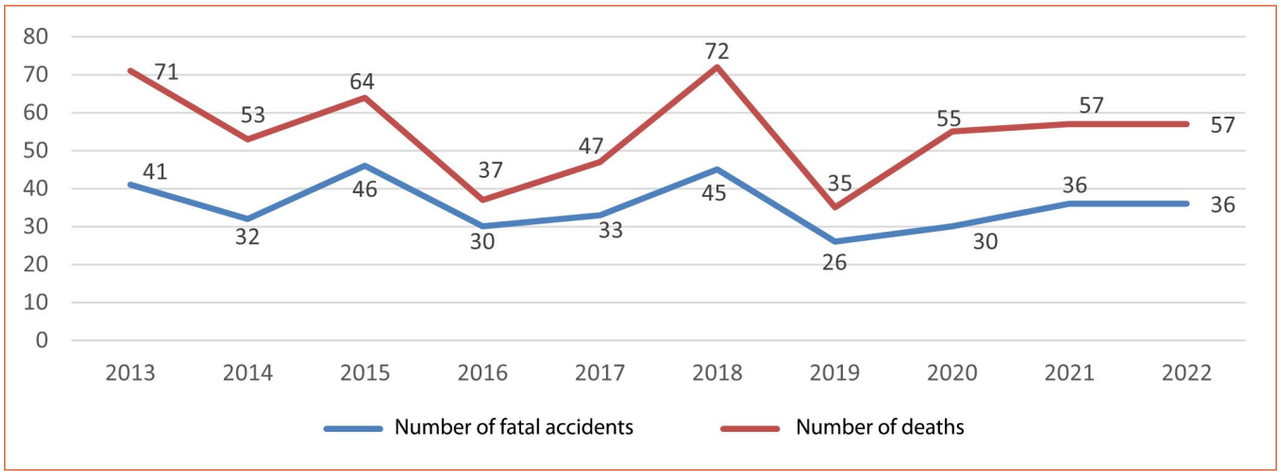
3.2 GENERAL AVIATION

3.2.1 OVERVIEW FOR ALL TYPES OF GENERAL AVIATION ACTIVITIES

The numbers of fatal general aviation accidents and associated victims observed in 2022 were strictly identical to those observed in 2021. These accident indicators, which are usually subject to substantial annual variations, have therefore stabilised, at least temporarily, slightly above the average for the past 10 years.

Behind these overall figures for general aviation, we can see:

- a reduction in the number of fatal accidents (-30 %) and victims (-20 %) for aeroplanes (see paragraph 3.2.2.), compared with the previous year;
- an increase in the number of fatal accidents (+26 %) and victims (+23 %) for microlights (see paragraph 3.2.3.);
- a relatively stable small number of fatal accidents involving gliders (two accidents in 2022, same as in 2021) and helicopters (one accident in 2022 compared with two in 2021);
- the absence of fatal balloon accidents (same as in 2021).

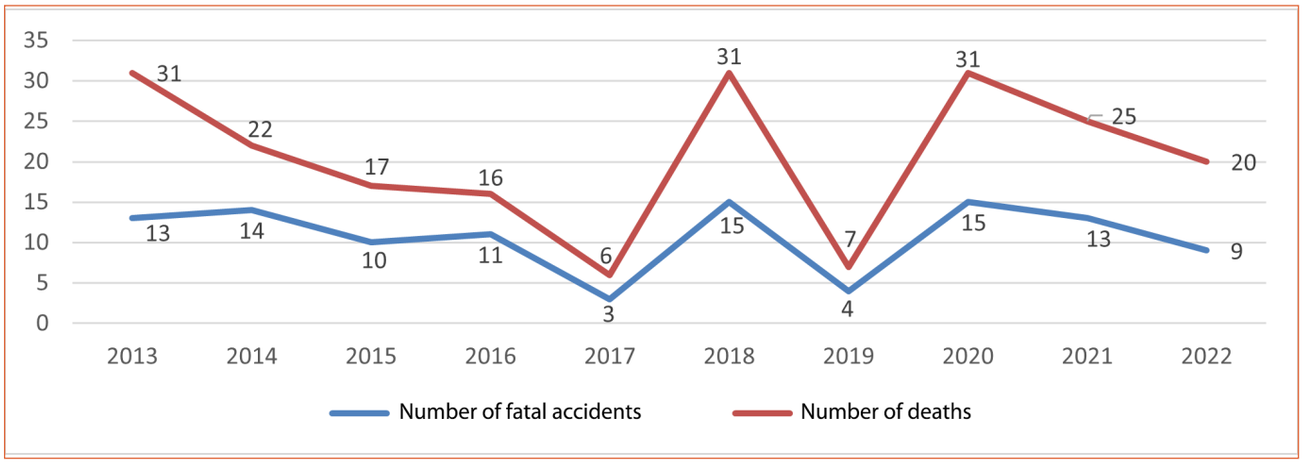


Variation in fatal general aviation accidents (all aircraft categories) over the 2013- 2022 period

3.2.2 OVERVIEW FOR GENERAL AVIATION - AEROPLANES

The numbers of fatal general aviation accidents involving aeroplanes and associated victims decreased for the second year in a row, after a peak in 2020. With nine fatal accidents and twenty deaths, 2022 is slightly below the average for the past 10 years.

It should be noted that one of these accidents is being investigated by the BEA-É (in collaboration with the BEA).



Variation in fatal general aviation accidents (aeroplanes only) over the 2013-2022 period

The analysis of fatal accidents involving aeroplanes that were investigated in 2022 did not reveal any particularly different topics compared with those of the previous years. Regarding the eight accidents mentioned above, the following characteristics can be highlighted:

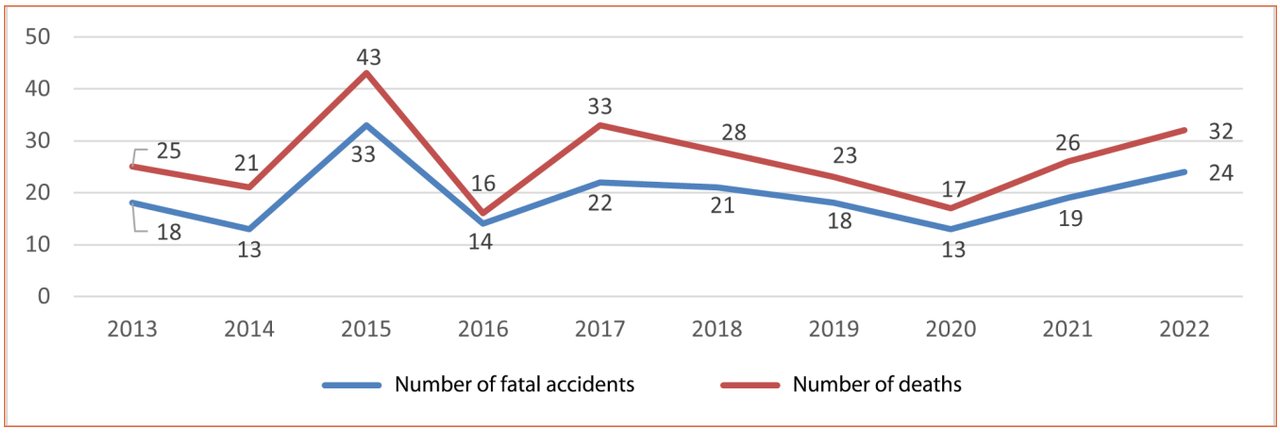
- four accidents occurred during or very soon after take-off;
- three accidents occurred during operations in mountainous regions;
- three accidents suggest a loss of control due to flying on the backside of the power curve.

It should also be noted that, in 2022, almost all the fatal accidents involving aeroplanes occurred in a context other than personal pleasure flights:

- three flights with paying passengers on board (one introductory flight, one shared-cost flight, and one flight the context of which has not been determined at this stage);
- one club excursion;
- one mountain introductory dual flight with a student in PPL training;
- and a first flight after major repairs.

3.2.3 OVERVIEW FOR GENERAL AVIATION - MICROLIGHTS

Contrary to aeroplanes, the number of fatal accidents involving microlights (24) and associated victims (32) rose for the second year in a row. These results put 2022 well above the average figure for the last 10-year period.



Variation in fatal general aviation accidents (microlights only) over the 2013-2022 period

Based on the initial information collected and analysed for the 24 fatal accidents involving microlights that were investigated, it was noted that there were:

- at least fifteen losses of control in flight (six of which could be associated with particular aerological conditions and two with a loss of external visual references in marginal weather conditions) and six possible technical malfunctions (two of which could have rendered the microlight uncontrollable);
- four instruction flights, three of which in dual flight.

These 24 fatal accidents can be broken down by type of microlight as follows:

- 15 accidents involving fixed-wing microlights;
- 3 accidents involving paramotors;
- 4 accidents involving gyroplanes;
- 2 accidents involving flex-wing microlights.

Accident and fatal accident rates per type of microlight based on the fleet size

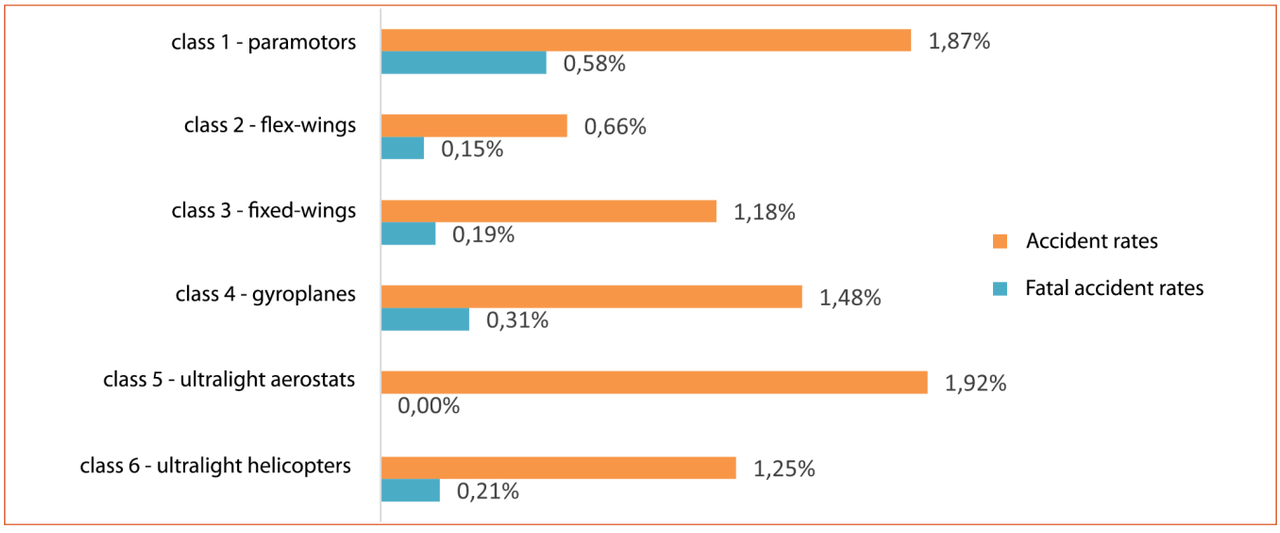
Every six months, the DSAC sends the BEA an extract from the French microlight identification database. For each type of microlight, the BEA counted, for the last three years (2020, 2021 and 2022):

- the number of accidents;
- the number of fatal accidents;
- the number of microlights with a valid identification card on 15 December of the year in question (automatic export date of the database each year).

The annual average over this period is as follows:

- class 1 - paramotors: 11 accidents (3 of which were fatal) for 572 aircraft identified;
- class 2 - flex-wing microlights: 10 accidents (2 of which were fatal) for 1,524 aircraft identified;
- class 3 - fixed-wing microlights: 63 accidents (10 of which were fatal) for 5,351 aircraft identified;
- class 4 - gyroplanes: 13 accidents (3 of which were fatal) for 859 aircraft identified;
- class 5 - ultralight aerostats: less than one accident (non-fatal) for 17 aircraft identified;
- class 6 - ultralight helicopters: 2 accidents (> 1 of which were fatal) for 160 aircraft identified.

In the absence of activity data (flight hours or number of movements), comparing this information gives an idea of the accident and fatal accident rates based on the assumed operational fleet, for each type of microlight and for the 2020-2022 period.



Accident / fatal accident rates (2020-2022) per type of microlight based on the French fleet size

4. SAFETY RECOMMENDATIONS

Accident to the Bell 47 registered F-GKTR on 07 April 2023 at Sainte-Marthe.

4.1 GENERAL CONTEXT

According to the ICAO, a safety recommendation is a proposal made by an investigation authority on the basis of information gathered from an investigation or a study, in order to prevent accidents or incidents.

The BEA sends most of its recommendations either to the civil aviation authority of a State or to the European Aviation Safety Agency (EASA). Some recommendations may also be sent to operators or manufacturers. They must relate to the measures to be taken to prevent occurrences which would arise in similar circumstances.

Follow-up of safety recommendations

The provisions of Regulation (EU) No. 996/2010 require, for Member States, that recipients of safety recommendations acknowledge receipt and inform the issuing authority, responsible for investigations, of the measures taken or under consideration.

This response must be addressed to the issuing authority within 90 days of receipt of the Safety Recommendation letter.

The investigation authority then has 60 days to inform the recipient of the Safety Recommendation if it considers its response as adequate or, if it disagrees with the response, to give reasons.

2022, year of the implementation of the ECCAIRS-SRIS 2.0 repository

After a year of transition following the introduction by the European Commission of the support software for the European Central Repository (ECR) pertaining to occurrence data, known as ECCAIRS 2.0, and with a view to further developing its capabilities, the ECCAIRS-SRIS 2.0 repository dedicated to safety recommendations is the subject of ongoing coordination between the working group dedicated to safety recommendations (WG6) of the European Network of Civil Aviation Safety Investigation Authorities (ENCASIA) (see paragraph 6.3.2.) and the EASA team responsible for technical support to this new repository.

As a result of these coordination efforts, the new safety recommendations repository was used in 2022, and is now considered satisfactory by users.

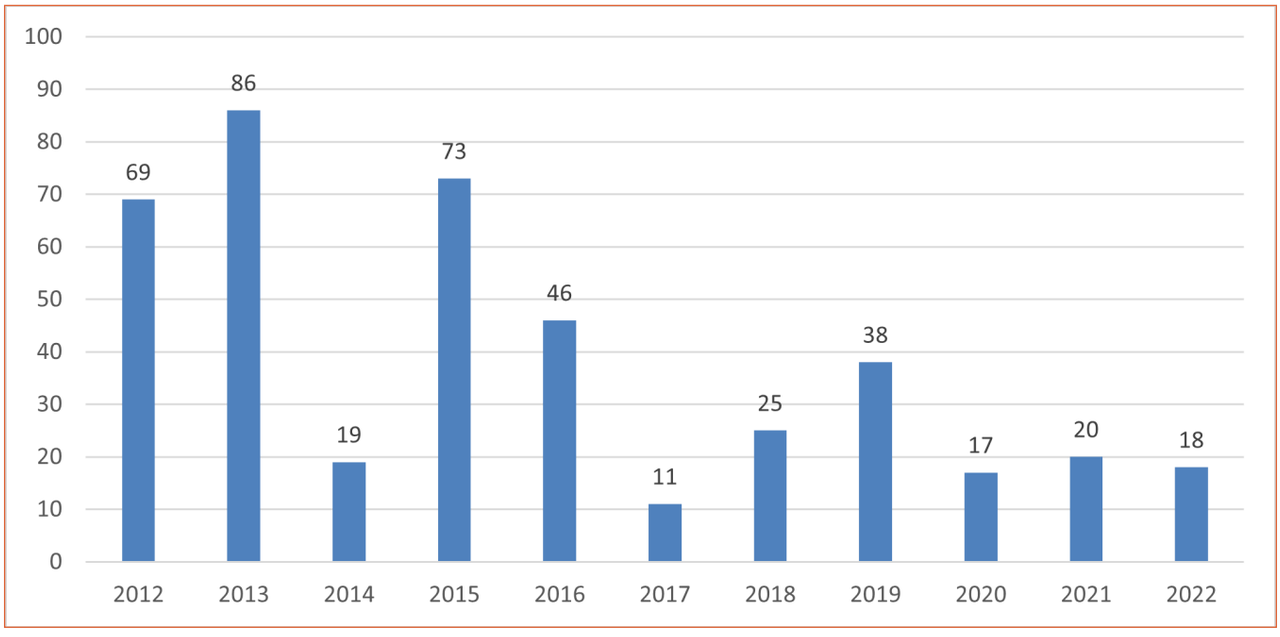
During the year, the BEA also migrated the 825 safety recommendations it had issued before 2021 to the new ECCAIRS-SRIS 2.0 repository.

This transfer required a great deal of preparation and internal coordination, which the BEA has been carrying out for over two years now, with a view to having all this archived data available in the new ECCAIRS-SRIS 2.0 system.

This new repository also enables the publication of information pertaining to safety recommendations on the European Commission's "Public SRIS" portal.

4.2. SAFETY RECOMMENDATIONS ISSUED

The BEA issued 18 recommendations in 2022.



Breakdown by aircraft category

All the recommendations issued in 2022 were made within the context of accident or incident investigations (the BEA can also issue recommendations in the context of safety studies, but this was not the case this year). The breakdown by category of aircraft involved in investigations that gave rise to recommendations is as follows:

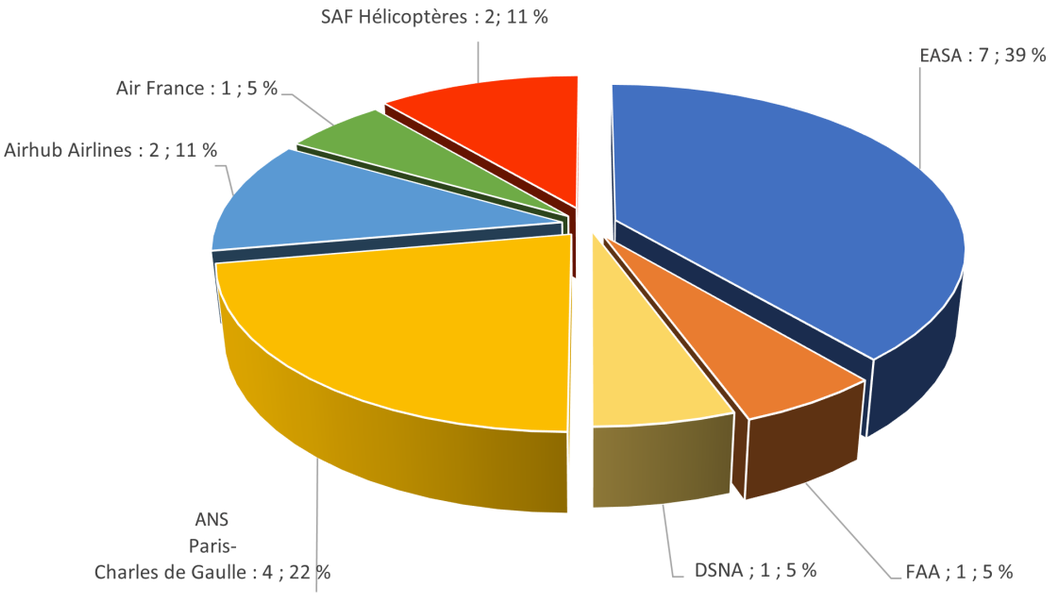
Aircraft category	Safety recommendations issued
Fixed-wing < 5,700 kg	5
Fixed-wing ≥ 5,700 kg	9
Rotary wing < 3,180 kg	4
Rotary wing ≥ 3,180 kg	0
UAS[1]	0
Other	0

Breakdown by recipient

In 2022, seven entities received safety recommendations, which represented a relatively considerable diversity.

The air navigation services at Paris-Charles de Gaulle and EASA were the main recipients of recommendations, representing 61 % of the total issued.

1. Unmanned Aircraft System.

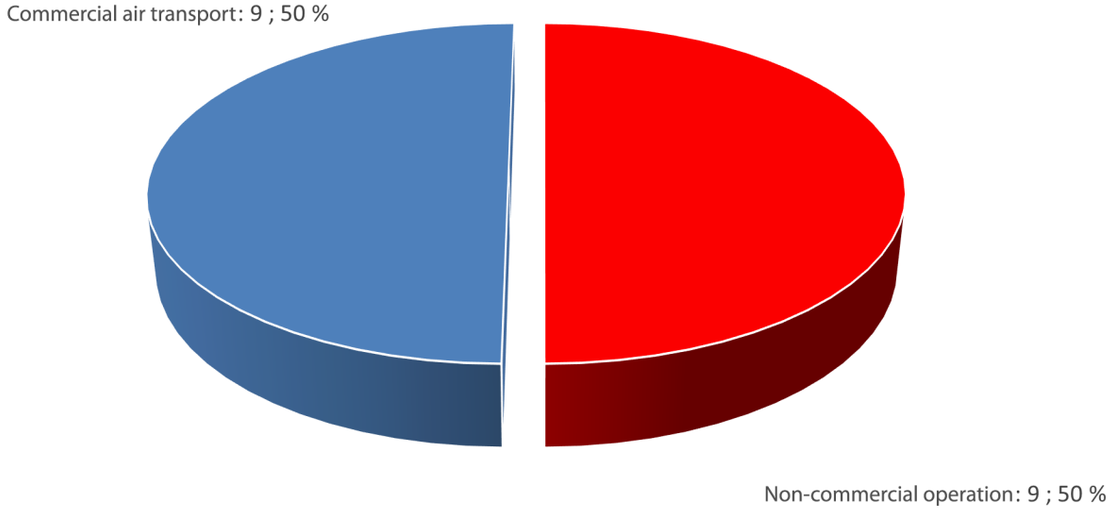


Recipients of recommendations

Note: For each recipient, the graph gives the total number of recommendations issued and the percentage of the total number of recommendations issued by the BEA.

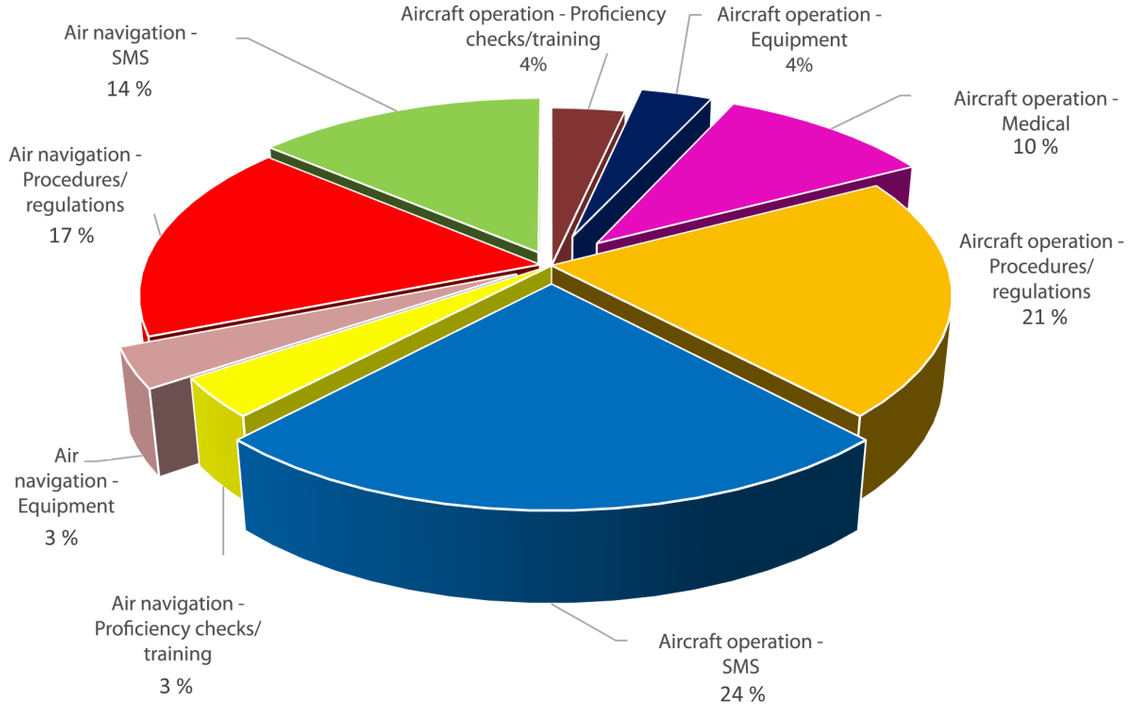
Breakdown by type of operation

In 2022, the recommendations issued by the BEA were broken down equally between commercial air transport and non-commercial aviation. No recommendations were issued in connection with investigations of aircraft operated for aerial work.



Breakdown of recommendations by theme

The breakdown of recommendations issued in 2022 by theme includes nine areas in which safety actions were recommended. The breakdown is as follows:



Breakdown of recommendations by theme

Note: Several safety themes can be associated with a single recommendation

Review of BEA investigation reports published in 2022 including safety recommendations

Seven reports published in 2022 contained safety recommendations. All these reports followed category 2 investigations. They concerned the following occurrences:

- Serious incident to the Cessna 525A registered N222NF on 14 August 2020 near Le Bourget (Seine-Saint-Denis): simultaneous fault on a PFD screen and one of the two air data systems during take-off, turn around and emergency landing. The BEA issued three recommendations, respectively to:
  - the U.S. Federal Aviation Administration (FAA) regarding an update to the Cessna Citation 525 flight manual concerning inconsistencies in air data information;
  - EASA, regarding the implementation of the recommendation issued by the BEA in 2010 on the subject of flight manuals, not limiting itself to the specific case of the Pilatus PC-12;
  - DSNA, to ensure that all air traffic controllers have a correct knowledge of how the altimeter information on their screens is obtained.
- Accident to the Cirrus SR22 registered N918SE on 28 September 2020 at La Chevillotte (Doubs): non-stabilised approach, loss of control during missed approach, collision with ground then fire. The BEA issued two safety recommendations to EASA, the first of which was to amend the "Preventing Hypoxia" brochure to include information about the effects and consequences of altitude hypoxia on the management of the flight, and the second to take into account the use of pulse oximeter limits.
- Accident to the Airbus EC135 registered F-HJAF on 08 December 2020 at Bonvillard (Savoie): collision with vegetation during an instruction flight in helicopter hoist operations, at night. The BEA issued two recommendations to the operator concerning risk analysis and the need to define the operational limits of the different types of flights carried out - in particular mountain rescue flights.
- Incident to the Airbus A330 registered F-GZCJ operated by Air France on 31 December 2020 en route: fuel leak en route, diversion, both engines kept in operation up to taxiing to parking area. The BEA issued one recommendation to the operator to continue its actions to make the safety culture evolve towards stricter compliance with in-flight procedures.
- Accident to the Airbus AS350B registered F-GIBM on 07 March 2021 at Touques (Calvados): collision with a tree during take-off from a helicopter landing site. The BEA issued two safety recommendations to EASA:
  - one recommendation concerning the introduction of a safety margin on Helicopter Landing Sites (HLS) and training in use of confined areas;
  - one recommendation that the physiological consequences of ageing should be addressed during renewal medical examinations, in particular by means of a contrast sensitivity assessment test.
- Accident to the Boeing 737 registered SE-RPE operated by Norwegian Air Sweden on 25 July 2021 en route to Nice: turbulence en route, severe injury to a cabin crew member, emergency landing at destination. The BEA issued two recommendations to EASA aimed at promoting the presentation of meteorological information on air traffic control screens and improving the meteorological information provided on board.
- Incident to the Airbus A320 registered 9H-EMU operated by AirHub on 23 May 2022 near Paris-Charles de Gaulle airport (Val-d'Oise): incorrect QNH information, RNP approach with LNAV/VNAV minima conducted below the descent profile, near CFIT, go-around performed at low height before the runway without visual references, second approach performed below descent profile. The BEA issued six safety recommendations to:

- the Paris-Charles de Gaulle Air Traffic Services, concerning the importance of the QNH for approaches using the Baro-VNAV function, the implementation of an associated procedure, the importance of checking that the information read back by flight crews is correct and the strict use of the standard phraseology in case of a MSAW;
- the operator, concerning the importance of the QNH setting for approaches using the Baro-VNAV function and the implementation of a procedure to mitigate the risks of an incorrect QNH setting affecting both altimeters during approaches using the Baro-VNAV function.

4.3 RESPONSES TO SAFETY RECOMMENDATIONS

As regards the follow-up to the 18 recommendations issued by the BEA in 2022:

- eight recommendations received a favourable response and were closed by the recipient;
- seven recommendations received a response from the recipient indicating that action was under way;
- three recommendations are still awaiting a response from the recipient.

4.4 PERFORMANCE INDICATOR FOR SAFETY RECOMMENDATIONS

The BEA has established a recommendation performance indicator based on a qualitative evaluation of the appropriateness of the action envisaged or actually taken by the recipient in comparison with the action expected by the BEA.

For each recommendation issued, the BEA recommendations board (COREC) will assign a performance indicator (between 0 and 1):

- either when it decides to close the follow-up;
- or when receiving the final response from the recipient.

The recommendation general performance indicator is then determined by calculating the mean value of the indicators of each recommendation evaluated.

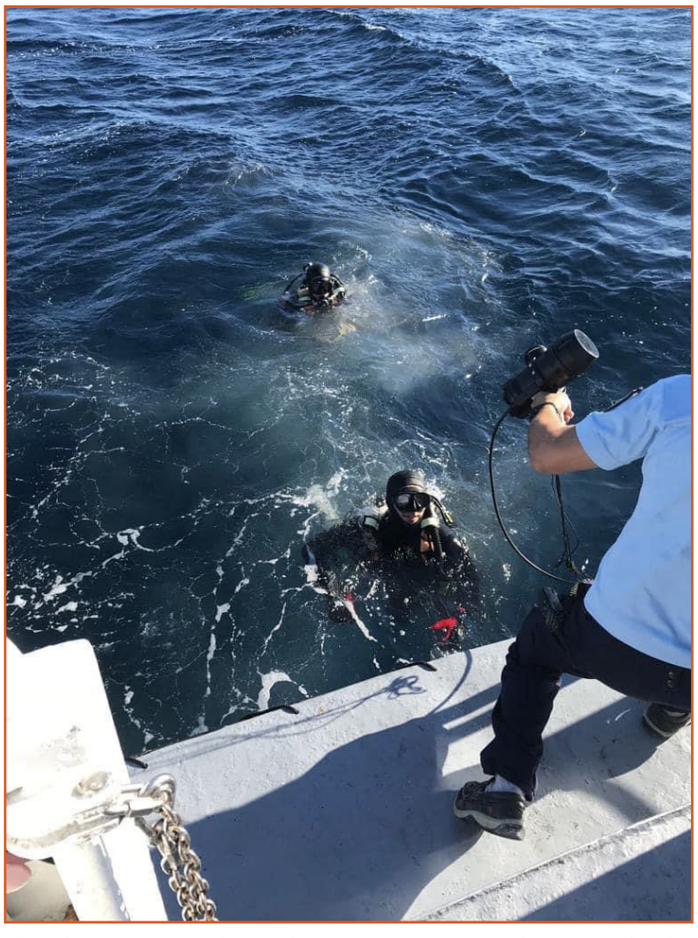
In 2022, the BEA closed the follow-up to 17 recommendations and the overall value of the indicator was 0.98, compared with 0.77 the previous year. The following table shows the breakdown of the appropriateness of the responses to these recommendations, by main recipient:

Appropriateness of responses to the BEA's recommendations in 2022, by main recipients

Recipients	Level
EASA	1
DGAC	1
DSNA	0.94
FAA	1
French Gliding Federation (FFVP)	1
Air France	1
Royal Air Maroc	1
Airhub Airlines	1

The sharp increase in the appropriateness of the responses can be explained by the desire of the recipients of recommendations and the BEA to keep a recommendation open and to continue discussions about the corrective actions to be taken, for as long as the response has not been considered satisfactory by the BEA.

Thus, behind this improvement in the appropriateness of the responses, there was a growing volume of safety recommendations where the responses were initially assessed as "inadequate" or "partially adequate" by the BEA, which led to the recipients working on improving the corrective actions set out in their replies.



BEA taking part, on 09 September 2022, in a test carried out in Antibes by the CNING (Centre National d'Instruction Nautique de la Gendarmerie) and the Gendarmerie on a device designed to locate transmitters attached to flight recorders.

5. ACTIVITY OF THE LABORATORY ENGINEERING DEPARTMENT

Laboratory of the flight recorders & avionic systems section.

5.1 OVERVIEW OF ENGINEERING DEPARTMENT ACTIVITY IN 2022

The volume of activity of the Engineering Department in 2022 was higher than in 2021, with a total of 525 examinations (all types) versus 445 in 2021.

Complex or highly technical work within the Engineering Department included the following:

- End of research work into the cause of a fire that broke out during a flight on the Piper PA28 registered HB-PNP on 23 July 2020 at Basel-Mulhouse.
- End of drafting work on the *Carburettor icing* study. The summary report is scheduled for publication in the first half of 2023.
- Completion of the "General aviation performance measurements" study, based on the analysis of test flights carried out on a Pilatus PC-7 belonging to the DGA-EV.

5.2 WORK BY PESA (FLIGHT RECORDERS AND AVIONIC SYSTEMS SECTION)

5.2.1 FLIGHT RECORDERS

In 2022, 33 voice recordings (CVR) and 67 flight data recordings (FDR) were read out at the BEA, representing a total of 100 recordings. This level is higher than that of the previous year (73 recordings in 2021).

	BEA investigation	BEA ACCREP	Technical assistance	Total
CVR recordings read out at the BEA	7	21	5	**33**
FDR recordings read out at the BEA	17	44	6	**67**

Most of these recordings concerned investigations in which the BEA participated as an accredited representative, or work carried out as part of the provision of technical assistance to third-party countries.

5.2.2 AVIONICS SYSTEMS

	BEA investigation	BEA ACCREP	Technical assistance	Total
Computers*	62	64	10	**136**
Laptops/Smartphones	19	2	1	**22**
Photo/video recordings	20	8	0	**28**

In 2022, the BEA's avionics lab read out 136 computers*, and carried out work on photo and video recordings as well as on laptops and smartphones. With a total of 186 examinations, the number of examinations carried out by the avionics lab increased (173 in 2021, 161 in 2020).

**The term "computer" groups various types of avionics and Global Navigation Satellite System (GNSS) equipment.*

5.2.3 ATM RECORDINGS

In 2022, 73 occurrences led to work on Air Traffic Management (ATM) data, based on radar data or Air Traffic Control (ATC) exchanges, including 5 examinations of data from Flight Radar 24 Live Tracking systems. This type of work related essentially to investigations led by the BEA.

ATM work by type of investigation was split as follows:

	BEA investigation	BEA ACCREP	Technical assistance	Total
Number of events	65	8	0	**73**

5.2.4 PESA DEVELOPMENT WORK

For many years now, PESA has been involved in development work aimed at adapting to the new technologies of aircraft in service and their equipment, as well as improving the quality and speed of its expert examinations.

This work is often carried out internally by the section's investigators, some of whom have experience in research and development, often in collaboration with research bodies or manufacturers. It should be noted that the BEA - and the PESA in particular - welcomes a number of trainee students each year, who find it an ideal place to put into practice the theoretical skills they have acquired during their studies.

Developments in audio analysis

In terms of audio analysis, the development work has made it possible to integrate an initial version of an automatic transcription system into the working environment of the laboratory investigators while minimising the impact of the introduction of these technologies on the working methodology. These tools provide support for the task of analysing audio recordings (CVRs and ATC recordings) as part of the investigations, by breaking down the speech sequences chronologically and providing automatic conversion of speech (in French and English) into a written version, which can then be checked and edited by the laboratory investigators.

There has also been work in collaboration with the LISIC[1] of the ULCO (Littoral Côte d'Opale university), which identified and evaluated several promising techniques for improving speech intelligibility in CVR recordings. This study led to the development of a prototype and several publications in scientific conferences.

Developments in flight recorders

As FDR specialists have to deal with an increasing number of recorded parameters (several thousand for the Airbus A350), a Boolean analysis module was developed. It is used to detect changes in the state of parameters encoded on a few bits, over a given time range. In just a few moments, it is possible to check whether parameters such as engaged modes, system failures and faults have or have not been activated/triggered during a phase of flight. This eliminates the need to display all the Boolean parameters in order to check their state.

Developments in the Avionics Lab

The study, already mentioned in previous years and aimed at better quantifying the impact of an X-ray examination on the integrity of data stored in memories, made further progress. This study evaluates the damage rate as a function of the power of the X-ray source, the distance from this source and the use of filters inserted between the emission source and the memory. On the basis of this work, the BEA has been able to adapt its procedures, in order to carry out X-ray examinations of memory components, in complete safety with regard to data integrity. The results, as well as precise measurements of radiation levels under different configurations, are discussed in particular within the framework of ANADEF[2] in which the BEA participates in several working groups.

In the avionics lab, the use of Cellebrite software for examining phones and tablets has become widespread. This software enables investigators to extract data from portable devices without impairing their content, and to analyse this data with increased precision and traceability.

Developments in aeroplane performance

In order to develop its aeroplane performance analysis and calculation capabilities, the section developed methods for estimating an aeroplane's aerodynamic coefficients based on its geometry. These methods are currently being validated using a 3D scan of an ISAE-SUPAERO aeroplane (Partenavia P68), as well as the 3D scan of a Cessna 208, provided by the U.S. National Transportation Safety Board (NTSB).

1. Signal and Image IT Laboratory.
2. European "Failure Analysis" scientific association.

Developments in image and video processing

The tools developed by the BEA several years ago can be used, in particular, to reconstruct trajectories from various videos recorded during the flight. In 2022, these tools were enhanced with new calibration methods that extend the extraction capacity of an aeroplane's attitude using recordings from ground-based remote surveillance cameras or on-board 360° cameras.

Moreover, in terms of Geographic Information Systems (GIS), two modules were developed in QGIS[3] for the generation of weather animations and for flight path analysis, providing data fusion solutions (audio, avionics, FDR), in a new working environment, through the installation of a dedicated server and an increased number of users.

5.3 WORK BY PSEM (STRUCTURE, EQUIPMENT AND ENGINES SECTION)

5.3.1 EXAMINATIONS CARRIED OUT

In 2022, 166 examinations were carried out, representing an increase in the volume of activity compared with 2021 (when there were 146 examinations).

The examinations performed can be broken down as follows:

	BEA investigation	BEA ACCREP	Technical assistance	Total
Wreckage examinations	44	7	0	**51**
Engine and propeller examinations	14	1	0	**15**
Fluid examinations	12	1	0	**13**
Equipment examinations	49	38	0	**87**

5.3.2 DEVELOPMENT OF THE PSEM

Organisation of the AIM meeting

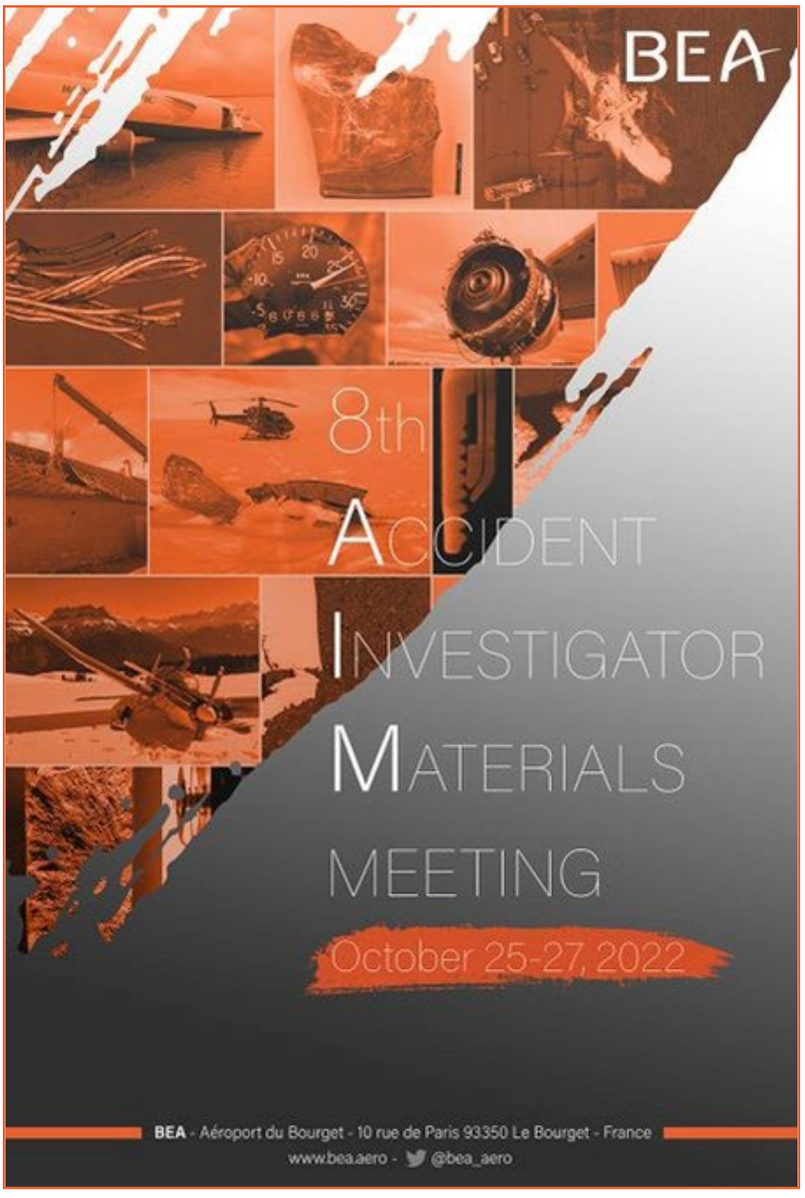
The annual AIM (Accident Investigator Materials) meeting was organised from 25 to 27 October 2022 at the BEA. Initially scheduled for spring 2020, this meeting had been postponed several times due to the health crisis. AIM is a forum for exchanges between investigators specialising in materials from the investigation authorities of different countries. The three-day AIM meeting brought together experts from the following safety investigation authorities:

- AAIB (UK)
- ATSB (Australia)
- CIAIAC (Spain)
- DSB (Netherlands)
- NTSB (USA)
- SA AIB (Saudi Arabia)
- BST TSB (Canada)
- TTSB (Taiwan)

3. Software used for flight path analysis.

Based on part or engine failure analysis activities as well as field activities on an accident site, the following themes, among the topics presented, are worth mentioning:

- BEA study of carburettor icing on piston engines;
- bridge failure investigations by the NTSB and TTSB;
- new propulsion technologies (electric and hybrid) by the French Aerospace Research Centre (ONERA).



6. INTERNATIONAL ACTIVITIES, TRAINING ACTIONS AND INSTITUTIONAL RELATIONSHIPS

BEA taking part in the "Air Transport University" training course organised by ENAC in Madrid in October 2022.

The BEA undertakes many activities on the European and international scene: communication activities through its participation in international conferences, the setting up of cooperation agreements with foreign investigation authorities, organising training seminars in France and abroad and participating in working groups in international organisations (in particular the European Union, the European Civil Aviation Conference (ECAC) and ICAO).

6.1 COMMUNICATION ACTIVITIES IN PROFESSIONAL FIELD

Every year, the BEA participates in many conferences and expert meetings. This allows the BEA not only to spread safety messages based on investigations that it has led or participated in, but also to make its investigation expertise more widely known abroad. This renown and the keeping of close contact with its counterparts are essential for the success of its work during investigations abroad.

A large number of international conferences had been cancelled due to the health situation at the start of the pandemic, but most of them were finally able to take place in 2022, either face-to-face or in hybrid mode (i.e. partly face-to-face and partly remote).

The most noteworthy international conferences and meetings attended by the BEA in 2022 were:

- The GA-ASI[1]: at this seminar for international general aviation investigators, held in Wichita (USA), two BEA investigators presented the investigation topics associated with *the myths and realities of piston engine icing* and the accident to a Socata TB20 during a GNSS approach without training.

- The Fifth International Accident Investigation Forum: this tri-annual forum, held in Singapore, brings together investigators from around the world. Two BEA investigators were present and gave presentations respectively on:

  - the work of the AIGP chaired by a BEA agent (see paragraph 6.3.1.) on the reasons why certain investigation reports are not published;

  - the need to rely on structured methodologies to organise, map out and share the analysis directions taken by an investigation team in a context where investigations are becoming increasingly complex (not only because of the type and quantity of information collected, but also because of the need to analyse systemic and organisational issues). This presentation was an opportunity to explain the different analysis methods used at the BEA.

- The ESASI[2]: a seminar chaired by a BEA agent is usually held every year. After a period of interruption due to the health crisis, it was finally organised in April 2022 in Budapest, in conjunction with the ACC meeting (see paragraph 6.3.3.). It provided an opportunity to present the investigation work regarding the incident to the Airbus A350 registered F-HREV operated by French Bee on 04 February 2020 at Paris-Orly (Val-de-Marne).

It should also be noted that the BEA hosted and organised the AIM (Accident Investigators on Materials) meeting, described in paragraph 5.3.2.

6.2 COLLABORATION WITH FOREIGN INVESTIGATION ORGANISATIONS

Through its experience and know-how, the BEA is recognised as one of the most important safety investigation authorities. As such, it is regularly consulted by many States for assistance relating to the correct implementation of the standards and practices recommended by the ICAO. It is in this context that the BEA regularly signs Declarations of Intent for Cooperation in investigations into civil aviation accidents, with foreign investigation authorities: in total, 59 Declarations of Intent for Cooperation are currently in force.

In particular, these cooperation agreements propose assistance, within the bounds of reasonable limits, in case of a major investigation. One of the main outcomes of this cooperation is the provision of technical assistance by the PSEM and PESA sections of the Engineering Department (this technical assistance activity is described in paragraph 5).

1. General Aviation Air Safety Investigator.
2. European Society of Air Safety Investigators.

Because of the health crisis, the signing of Declarations of Intent and Cooperation planned for 2021 with several foreign countries was postponed until 2022. Five of them could finally be signed

- the declaration regarding Gabon replaced a previous agreement rendered obsolete by the independence of the safety investigation authority;
- three declarations concerning the safety investigation authorities of the Comoros, Brazil and Rwanda;
- the intergovernmental agreement with the Principality of Andorra, which provides for the delegation of safety investigations to the BEA in the event of an occurrence in Andorra: this arrangement is part of a more general agreement between France and the Principality of Andorra, which also sets out the delegation of air navigation services.

6.3 PARTICIPATION IN THE WORK OF INTERNATIONAL ORGANISATIONS

6.3.1 ICAO

The BEA plays an active role in several of the ICAO's groups of experts. The operation of some of these groups was impacted by the health situation, although, generally, activity continued albeit to a lesser extent:

- Accident Investigation Group Panel (AIGP): the BEA chairs this group of experts, which is mandated to study amendments to Annex 13 and to investigation manuals. As the AIGP plenary session could not be held in Montreal because of the COVID-19 restrictions still in force, it was finally held face-to-face at the ICAO regional office in Paris. Moreover, the activity of the AIGP WG[3], which, for the majority, had adopted video conferences as a working method some time back – was able to resume normal operation. Among the working groups in which the BEA is particularly engaged, there are those that it chairs, i.e.:
  - The WG24, which was formed at Canada's request following the accident of flight PS752 in Tehran on 08 January 2020, to examine the provisions of Annex 13 in the event of an accident linked to an act of unlawful interference and/or in the event of a conflict of interest in the investigation process, when such investigation is conducted by a State responsible, for example, for a missile launch. The WG24 met in The Hague (Netherlands) in November 2022, which included a visit to the site of reconstruction of the wreckage of the Boeing 777 flight MH 17, destroyed in flight by a missile strike on 17 July 2014.
  - The WG20, which is responsible for analysing the reasons why some investigation authorities do not make all final investigation reports public after accidents involving commercial air transport aeroplanes.
  - The WG14, which is responsible for proposing standards for Annex 13 and for drafting SRGC[4] for the ICAO investigator's manual.
  - The WG25, which deals with providing information to air accident victims and their families.
- Flight Recorder Specific Working Group (FLIREC-SWG): this group of experts is responsible for proposing amendments to ICAO Annex 6, particularly with respect to the carrying of flight recorders, the location of aeroplanes in distress and the retrieval of flight data. This group operated exclusively by video conference in 2022.
- Occurrence Validation Study Group (OVSG): this group reviews accidents and incidents which occurred the previous year to establish statistics per occurrence category. This group's operation was not impacted by the pandemic, and the BEA was able to continue to contribute remotely to the establishment of the central repository of accidents and incidents used by the ICAO to establish general statistics regarding global aviation safety.
- ICAO's GADSS-AG Working Group: the aim of this group is to update the actions to be taken as part of the GADSS[5] concept, particularly taking into account the lessons learnt from the accident of flight AF 447 (over the Atlantic on 01 June 2009) and the disappearance of flight MH 370 (over the Indian Ocean on 08 March 2014). This group operated by video conferences in 2022, which enabled it to continue drafting a manual including guidelines for the implementation of the standards and recommended practices as regards the four core elements of the GADSS:

3. Working Groups.
4. Safety Recommendation of Global Concern.
5. Global Aeronautical Distress Safety System.

- the tracking of aeroplanes;
- the location of aeroplanes in distress;
- the precise location of an accident site;
- the rapid retrieval of data from flight recorders.

❍ ICAO's RASG-EUR[6]: under the umbrella of this group, the BEA is involved in the EASPG[7], which brings together 52 European States and whose work particularly focuses on developing methods and implementing shared tools for occurrence reporting and data analysis. One meeting of the group was held "face-to-face" at the ICAO regional office in Paris in 2022, and another "remotely". It should be noted that the EASPG usually also offers an opportunity to strengthen relations with authorities in Eastern European countries (Russia, Georgia, Ukraine, etc.), but the conflict situation in Ukraine affected some of these relations in 2022.

In addition, the ICAO's regional offices organise meetings or workshops for regional investigators in some regions of the world. France is involved in facilitating cooperation between investigators in the South Pacific and Asia (APAC-AIG) and North, Central America and Caribbean (NACC-AIG) regions, which include overseas departments and territories. France actively participated in "remote" meetings held in 2022.

Moreover, of the ICAO-validated auditors in the field of civil aviation safety investigations, one is a BEA staff member. As such, this staff member became part of an ICAO team to carry out an audit of the investigation authorities of two foreign States in 2022.

6.3.2 EUROPEAN UNION

Regulation (EU) No. 996/2010 created the ENCASIA network to coordinate the work and share the experiences of the various investigation authorities in the European Union (as well as members of the European Economic Area (EEA). The BEA's Director took the chairmanship of ENCASIA in 2017, for a term of six years[8].

In the context of ENCASIA's work, the BEA remains a key player in the various permanent working groups. The BEA is very involved in the following working groups:

❍ Promotion of mutual support between all European investigation authorities, the main aim of which is to guarantee that all air transport accidents, wherever they occur throughout Europe, are the subject of a suitable investigation and that lessons are learnt and shared to avoid any repeat occurrences. The ENCASIA Mutual Support System (EMSS) is one example of the BEA's extensive involvement in a medium to long-term project.

❍ WG4 (logistical aspects and training), which in particular organised an ENCASIA workshop on relations between security investigation authorities and judicial authorities on 16 and 17 November 2022. This initiative brought together around sixty people from investigation and judicial authorities in various European countries to discuss a number of topics, such as access to data, the proportionality test, protection of sensitive data, etc.

❍ WG5[9], which in 2022 sent questionnaires to the thirty ENCASIA member investigation authorities and analysed the detailed responses. It is also making preparations to conduct a full cycle of visits aimed at preparing the various investigation authorities for the management of a major accident in Europe.

❍ WG6 (Safety Recommendations), which is heavily involved in developing the new version of the European ECCAIRS 2.0 repository. It notably comprises a module concerning safety recommendations: the monitoring of these developments is deemed particularly important by the ENCASIA to ensure the sustained availability of safety lessons (see paragraph 4.1.).

6.3.3 ECAC

The Group of Investigation Authorities (ACC), bringing together the 44 Member States of the ECAC[10], is a forum for sharing feedback. It enables the BEA to give an update on its investigations in progress to its European

6. Regional Aviation Safety Group – Europe.
7. European Aviation System Planning Group.
8. See ENCASIA's annual activity report.
9. Peer Reviews.
10. European Civil Aviation Conference

counterparts. Two meetings were held in 2022: a face-to-face meeting in Budapest in April, and a remote meeting in October. These meetings were an opportunity for the BEA not only to summarise the position of a selection of investigations, but also to present the activities of the AIGP and the progress of ENCASIA's work (see paragraphs 6.3.1. and 6.3.2. above).

6.3.4 EASA

EASA's role is to ensure safety and environmental protection in civil aviation in Europe. Every year, it organises many events (seminars, meetings, etc.) in which the BEA regularly participates. For 2022, these included:

- A high-level conference on drones.
- The annual EASA-CASIA meeting between the European SIAs[11] and EASA[12], aiming to improve the coordination of safety investigations, discuss the events of the past year, review the follow-up of safety recommendations issued by the investigation authorities, and circulate information from EASA to the European SIAs.
- The annual EASA air safety conference, devoted in 2022 to safety in ATM[13].
- An ECCAIRS Steering committee, whose role is to validate developments to the ECCAIRS 2.0 repository. This event is organised each year by the European Commission.
- The annual meeting between EASA and the FAA.

6.3.5 EUROCAE[14]

EUROCAE is a European organisation that publishes reference documents on specifications for onboard systems. EUROCAE works in close coordination with the RTCA[15], its American counterpart, in many fields. EUROCAE and RTCA documents are written by representatives of the aeronautical community.

The work of EUROCAE involving flight recorders was not affected by the pandemic: meetings of the working groups the BEA participates in were held by video conference in 2022.

A particular mention can be given to WG-118, created in 2020, which reviews the specifications concerning flight recorders (ED-112A) and light flight recorders (ED-155) and is planning to develop new specifications for the recordings of UAS and RPAS[16]. Several BEA investigators actively take part in the working groups and were able to attend all of the scheduled video conferences.

6.4 INVESTIGATOR TRAINING ORGANISED BY THE BEA AND BEA PARTICIPATION IN ENAC TRAINING

The investigator training organised by the BEA generally comprises each year:

- Two identical two-week training sessions covering "Basic Investigation Techniques". These courses are mainly intended for investigators recently recruited by the BEA and for Field Investigators (FI). Two places are systematically reserved in each session for the air transport gendarmes (GTA) and, subject to availability, places are offered to French-speaking foreign investigators. Both sessions were held normally in 2022: three foreign investigators (from Benin and Mauritania) attended the October training course.
- One advanced training course for commercial air transport investigators: this two-week, Phase 3A course given in English, is intended for experienced investigators. It was organised as normal in 2022 for 14 participants, namely:
  - six BEA investigators;
  - five investigators from foreign countries (Israel, Mozambique, Pakistan, United Kingdom);
  - three industry (Dassault) and airline (HOP!, Volotea) investigators.

11. Safety Investigation Authorities
13. European Aviation Safety Agency
13. Air Traffic Management
14. EURopean Organisation for Civil Aviation Equipment
15. Radio Technical Committee for Aeronautics
16. Remotely Piloted Aircraft Systems

In common with the previous sessions, the marked variety of participants gave rise to some particularly fruitful discussions, enhancing the training experience for all of the investigators.

The Phase 3A training course is co-organised with the École Nationale de l'Aviation Civile (ENAC), with which the BEA signed a framework agreement, stipulating that specific agreements can be made to define joint actions. This training is the subject of specific agreement No. 1 regarding the collaboration to be set up for commercial air transport training. Under the framework agreement, participants other than BEA investigators now pay for this training.

Furthermore, each year, the BEA participates in different training courses provided at the ENAC in the form of safety investigation information modules:

- ENAC Engineers' Course (IENAC-major OPS-2nd year): two half-days per year.
- ENAC Engineers' Apprenticeship Course (IENAC-APPR-2nd year): two half-days per year
- Control Engineers' Course (MCTA - Air Traffic Control and Management): two half-days per year;
- Higher Technicians' Course (GSEA): two half-days per year;
- MS-MSA Master (Safety Management in Aviation): one day per year;
- MS-AM Master (Airport Management): one half-day per year;
- MS-ASAA Master (Aviation Safety / Aircraft Airworthiness): one half-day per year.
- NAVIG training course (Aircraft Airworthiness): one half-day per year.

All of these courses were delivered face-to-face in 2022.

Institutional relationships
Work to ensure coordination between the BEA and the Civil Defence Services in the scope of aviation accidents

The context

In March 2016, feedback following an exercise performed at an airport highlighted the need to update the specific ORSEC airport provisions (DSOA) and the specific SATER provisions (DSO-SATER) pertaining to aviation accidents. Indeed, during this exercise, it was noted that an emergency organisation plan had failed to take into account the mission and actions of the BEA in the system diagram.

The examination of around 50 plans pertaining to the DSOA and DSO-SATER specific provisions sent to the BEA confirmed this finding at national level and showed their high degree of variability due to regional and local specificities.

This documentation work highlighted the need for a systemic way of updating and amending plans, while taking into account the prefectorial authority's steering action and local variabilities.

To guarantee the relevance of the amendment actions proposed and the update of the emergency plans and their consistency at national level, a series of actions was carried out in coordination with the DSNA's search and rescue department (DSR-SAR) (tasked with keeping track of updates to DSOAs and DOS-SATERs), the French general directorate for civil defence and crisis management (DGSCGC) (which is responsible for coordinating the updating of emergency plans by the prefectorial authorities), and the ARCC Lyon, the national nerve centre for search and 3D coordination during search operations following an air accident.

As a result of these actions, Interdepartmental Letter INTK1701919J, issued on 30 January 2017 and co-signed by the office of the Secretary of State for Transport, the Sea and Fisheries, and the Home Office, asks prefects to amend their ORSEC and SATER systems pertaining to aviation accidents by incorporating the mission and actions of the BEA.

Actions carried out since 2021

The preliminary BEA-DGSCGC agreement, updated on 18 May 2021, acknowledges the BEA's position within the SATER body directing search and rescue operations. It specifies the framework of the interactions between the authorities and organisations present or involved in these measures. These interactions are divided into four topics.

BEA-DGSCGC coordination

The COVID-19 pandemic period meant that from 2020, the two annual coordination meetings, organised alternately at the DGSCGC and the BEA were postponed. (It should be noted, however, that a meeting was finally organised in January 2023.)

Update of the ORSEC airport and SATER measures

The DSOAs and DSO-SATERs must be updated by the prefectures every five years. Since 2017, the BEA has helped to update and amend, in coordination with the ARCC Lyon and the DSR/SAR department, along with the relevant services, 50 SATER plans out of the 101 national departments. It should also be noted that a (Mediterranean) SAMAR plan update, for which the BEA was consulted, was carried out in 2021. In the same way, the BEA has reviewed 29 DSOAs since 2018. However, the activity dropped substantially in 2020 and 2021 due to the pandemic.

Participation in DSOA and DSO-SATER exercises

The BEA was invited to take part in different types of exercises organised by the prefects in the departments concerned ("management" and "field" exercises). Firstly, these exercises enabled the

BEA to test the prefecture's notification system, to establish the right communication channel, in particular with the operations control division and, when necessary, to take part locally in some phases of the exercise.

Participation in interdepartmental SAR meetings (RIM-SAR)

Since 2018 and in pursuance of the 2017 interdepartmental letter, the BEA has been fully associated with the annual RIM-SAR meeting organised by the DSR-SAR department. The meeting brings together the different stakeholders involved in the SATER, SAMAR and ORSEC measures (authorities, civil and military organisations, etc.). This meeting takes stock of the activities carried out the previous year, and of the problems encountered by the SAR service stakeholders, with the aim of identifying solutions through direct communication in order to optimise the current system.

Interface in the context of assistance with safety investigations and participation in working groups

In some safety investigations, the investigator-in-charge was confronted with issues regarding the location of aircraft involved in accidents, equipped or not with an emergency locator transmitter (ELT), as well as specificities regarding the deployment of air assets. The light shed on SAR lessons by these safety investigations contributed to a reflection and action process at both local and national level. Thus, the BEA systematically receives reports on search and rescue operations issued by the ARCC Lyon, and received invitations to join working groups coordinated by the DSR-SAR department.

Moreover, the BEA was invited to co-host, alongside the DSR/SAR department and the ARCC Lyon, a SAR webinar organised by the DGSCGC in September 2022. This webinar reached more than 120 services in mainland France and the French overseas territories.

Meaning of abbreviations and acronyms

ORSEC:	*Civil defence emergency management*
DSOA:	*Specific ORSEC airport provisions*
DSO-SATER:	*Specific ORSEC provisions devoted to air-land rescue*
SAMAR:	*Air-sea rescue*
DSNA-SAR:	*Search and Rescue department of the French air navigation service provider*
RIM-SAR:	*Interdepartmental Search And Rescue meeting*
ARCC:	*Aeronautical Rescue Coordination Centre*

Agreement between the BEA, the BEA-TT and the BEA-RI

In 2022, an agreement was signed between the BEA, the BEA-TT (Land transport accident investigation authority) and the BEA-RI (Industrial risks investigation authority) to make the BEA doctor available.

The aim of this agreement is to enable the BEA-TT and BEA-RI to have a "nominated doctor" within the meaning of the French Transport Code to contribute to their technical investigations as regards medical aspects.

In 2022, this resulted in an initial request from the BEA-TT for help with a fatal accident involving a light vehicle and in the sharing of experience with the BEA-RI concerning certain pressurised equipment (floatation systems) at an accident site.

7. COMMUNICATION ACTIONS

Signing of a partnership agreement between the BEA and the National Air and Space Museum of France located at Le Bourget, in April 2023.

7.1 RELATIONS WITH THE FAMILIES OF VICTIMS

In compliance with European Regulation No. 996/2010, before publishing its findings, the BEA sends the investigation report to families of victims who have requested to receive a copy. In the case of a particularly complex report, or when required by the circumstances, the BEA can also offer to hold a meeting with the family to present the investigation and its findings before they are published.

In 2022, three meetings with families of victims were organised prior to publication of the final investigation report. In addition, a meeting was organised to give families an update on an ongoing investigation.

7.2 PROMOTION OF THE BEA'S WORK

7.2.1 THE BEA'S WEBSITE

The BEA developed and launched a new version (V6) of its website. This version includes a number of changes designed to meet the expectations of web users and stakeholders. These developments are specifically designed to take into account the new means available to access the website: over 70 % of connections are now made from mobile platforms (67.8 % from a smartphone and 3.9 % from a tablet). While for the last several years the BEA website was adapted for consultation via these media, the investigation reports were still published in a single PDF format: in order to make accessing and reading the reports from the mobile version of the site easier, html versions ("online reports") are now available for all reports up to ten pages long.

This V6 also provides greater visibility of safety recommendations. Until now, these were only published in the investigation reports in which they were issued. They can now also be accessed via a specific tab. In addition to accessing the texts of the safety recommendations issued by the BEA, this tab allows you to consult the European Central Repository for Safety Recommendations in aviation, SRIS. This public repository makes it possible to consult the status of each recommendation as well as the exchanges between the investigating authority that issued it and the recipient. The BEA is currently working on a better way of integrating these exchanges so that they can be displayed directly on its site without the need for an external link.

V6 also brings new improvements in the following areas:

- simplified display of search engine results;
- new access to reports;
- better identification of foreign investigations;
- setting up "direct access".

7.2.2 TWITTER FEED

In 2022, BEA's Twitter feed reached cruise level with 24,000 subscribers, almost 10,000 more than the previous year. While this increase is certainly not an objective in itself, it does reflect the sustained interest of stakeholders in this channel for direct, "real-time" access to BEA's activities. While there are always peaks in subscriptions and unsubscriptions during media events, the overall trend is still one of growth.

As far as content is concerned, the Twitter feed is regularly enriched with new subjects in order to be more representative of the BEA's missions (training, industrial collaborations, international meetings, etc.).

7.2.3 COOPERATION WITH THE NATIONAL AIR AND SPACE MUSEUM OF FRANCE LOCATED AT LE BOURGET

The BEA's Communication Department is taking part in the ASTREOS project, initiated by the National Air and Space Museum of France, as part of the project to build a new exhibition hall opposite the BEA building by 2025. This area should be made up of several rooms covering, in particular:

- civil and commercial aviation from 1945;
- light aviation and aerial sport from 1945;
- the future of the aerospace industry.

The BEA, which was created in 1946, should be included as part of a historical overview, in the section entitled "in the aftermath of the Second World War". Its skills, mission and activities, past and present, will be described

in an interactive presentation. A joint study of the BEA's archives by the BEA and the Museum is currently under way to determine which items could be displayed to the public when the new hall opens.

In addition to the ASTREOS project, cooperation with the National Air and Space Museum of France is continuing through various joint communication operations and the BEA's future participation in events organised by the Museum, such as "Ciné-Tarmac" (planned for the summer of 2023 and which will include a screening of the film "Black Box" mentioned in the 2021 activity report) or the future Science Days.

Participation of the BEA in the 41st World Microlight Exhibition in Blois on 02 September 2022 to meet the key players in ultralight aviation: manufacturers, federations, engine manufacturers and pilots.

8. HUMAN RESOURCES & FINANCES

Training of ATR investigators in real conditions at Auch airport in April 2023.

8.1 PERSONNEL

8.1.1 STAFF ON 31 DECEMBER 2022

As of 31 December 2022, the BEA had 86 members of staff divided as follows:

BEA staff	Civil servants	Contractual employees	Workers	Total
Flight crew		2		**2**
Engineers	35	12		**47**
higher technicians	16			**16**
Technicians		1	4	**5**
Administrative staff	12	3	1	**16**
Total staff	**63**	**18**	**5**	**86**

Note: 4 apprentices and 123 field investigators, 86 based in metropolitan France and 37 based in France's overseas territories, should be added to the above staff figures. Trained by the BEA, fields investigators take action at its request, under its supervision and authority, generally as part of general aviation investigations. Most field investigators hold positions in DGAC departments, or to be more precise DSAC Inter Regional departments. They are covered by a service contract concluded between the BEA, the DSAC and the DGAC Secretary General.

8.1.2 REGIONAL BRANCHES

The majority of the BEA's staff work at the Le Bourget site but 11 staff members are based at the different regional branches (staffing on 31 December):

- Rennes: two investigators;
- Toulouse: three investigators and one member of IT staff;
- Aix-en-Provence: three investigators;
- Lyon: two investigators.

Regional branches enable the BEA to ensure a better-distributed presence in Metropolitan France, and specifically:

- in regions where there is a high level of recreational general aviation activity;
- near the main aeronautical manufacturers.

They are housed in premises made available by the DSAC as part of the service contract between the BEA, the DSAC and the DGAC Secretary General already mentioned above (see paragraph 8.1.1).

8.1.3 PERSONNEL TRAINING

The BEA spends on average 10 % of its annual operating budget on professional training in order to guarantee a high level of skills for its personnel in various areas, vital for its activity.

The 2022 training programme had therefore been defined based on an initial budget of €230,000 of commitment authorisations (CA) and payment appropriations (PA).

In total, the budget committed for professional training was €220,155 of CA, and the PA used amounted to €201,234 for BEA agents. These figures are relatively stable compared with 2021.

Concerning flight training, the initiative to enable staff who are type rated on passenger planes to periodically undertake commercial air transport flights as a co-pilot, which had been launched in 2016 and suspended

in 2020, was resumed: a staff member has the possibility to fly one week per month as a co-pilot on the A320 within the framework of an agreement signed with an airline. This initiative gives the agents major experience in flying commercial air transport flights, which is necessary for carrying out some complex investigations in this specific area and for strengthening the credibility of the BEA in the eyes of air operators involved in an accident.

8.1.4 WORKING FROM HOME

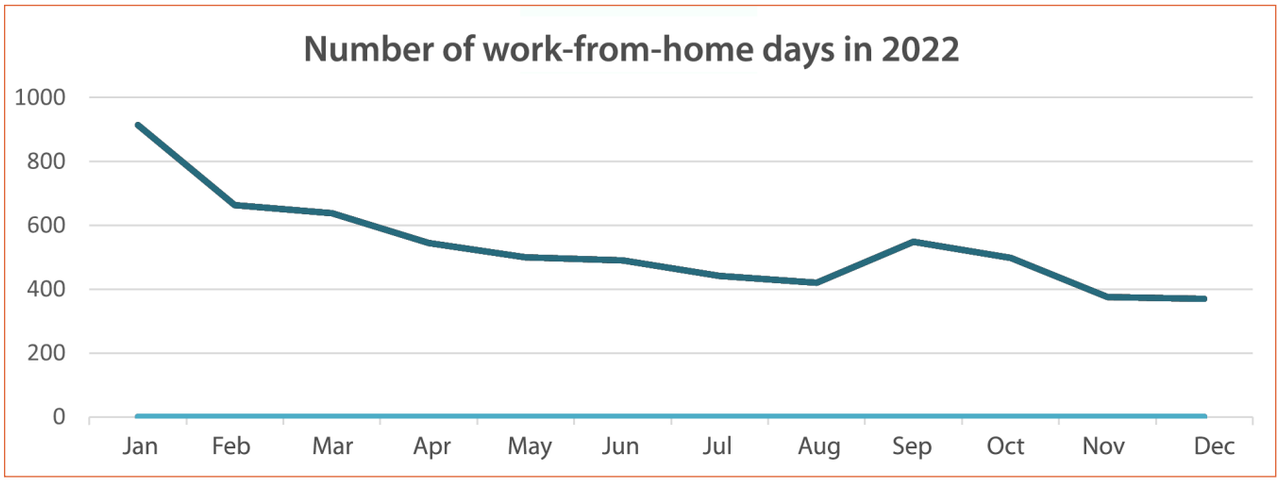
The BEA introduced the concept of working from home a few years ago within the framework of agreements between certain staff and HR. The practice became a lot more common in 2020 and 2021 due to the health situation and the recurrence of lockdown and mandatory or recommended working-from-home periods. During these periods, the framework for working from home was generally no longer set by agreements, but by government directives.

In 2022, of the 86 members of staff on 31 December 2022, there were:

- three members of staff doing work that could not be done from home;
- eighty-three members of staff doing work that could partially be done from home.

The total number of working-from-home days was 6,405, which represented an average of 74.5 days per member of staff or 77.2 days per member of staff able to do some of their work from home.

The following graph shows the monthly trend in the total number of days worked from home for all staff concerned in 2022. The data of this graph must be interpreted with caution (for example, the fact that staff often take holidays through the summer or over the festive periods, translates to a decrease in the number of days worked from home). As for 2021, however, it shows a downward trend throughout the year. Compared to 2021, a 30 % drop could be observed in the number of days worked from home in 2022, probably due to the end of the acute health crisis in France caused by the COVID-19 pandemic.



8.2 BUDGET

8.2.1 ALLOCATIONS

The BEA budget was set in the initial finance law at €3.75 million in commitment authorisations (CA) and payment appropriations (PA).

Resources were supplemented by:

- carry over of CA appropriated in 2021: €1.33 million in CA;
- carry over from 2021 to 2022: €0.27 million in PA;
- carry over of product allocations from 2021 to 2022; €0.034 million in CA and PA;
- derived product allocations in 2022: €0.010 million in CA and in PA (these allocations were from the sale of vehicles and various moveable assets).

In the end, the budget available for the year was therefore:

- €5.13 million in CA;
- €4.07 million in PA.

8.2.2 EXPENDITURE FOR THE PERIOD

Expenditure for the period is broken down by service in the table below.

Services	Operation		Investment	
	CA (€)	PA (€)	CA (€)	PA (€)
Logistics	854,755	854,062	1,907,240	781,455
Travel	410,396	410,396		
Communication	101,104	78,849		
Training of BEA staff	220,155	201,234		
Engineering	254,157	258,623	881,135	879,926
Information Technology	432,081	277,061	22,800	16,200
Investigation support	4,889	4,889		
Total (€)	**2,277,537**	**2,085,114**	**2,811,175**	**1,677,581**

Note: the amount paid by the BEA to the Apprentice Training Centres to train their apprentices is included in the table above in the row corresponding to the department in which they are working, and not in the "training" row

The BEA's total consumption was therefore:

- €5.09 million in CA;
- €3.76 million in PA;

which represents a consumption ratio of:

- 99 % of available CA;
- 92 % of available PA.

Operating expenses:

The operating budget for 2022 was €2.29 million in CA and PA.

After two years considerably affected by the health crisis, 2022 saw a return to sustained activity at the BEA in terms of air safety investigations. The strong recovery in commercial air transport led to several fatal accidents abroad, requiring a team of investigators to be sent to accident sites and travel to locations where parts or equipment were being examined and appraised.

As a result, business travel expenses rose sharply compared with 2021. In terms of travel, the BEA noted a sharp increase in air fares (around 25 %) compared with 2019, as well as a more restrictive pricing policy on the part of airlines, which leads to additional costs when staff members have to travel with hold luggage.

The annual training plan was implemented on a nominal basis for professional training. The difference between CA and PA can particularly be explained by the six-month delay imposed by service providers to book flight simulator training courses, due to high demand from airlines.

Investment:

2022 was a major investment year for the BEA. Feedback on the investigation into the accident to the Airbus A380 registered F-HPJE operated by Air France on 30 September 2017 in cruise over Greenland confirmed that

it would be in the BEA's interest to equip itself with an improved materials and wreckage analysis laboratory, especially capable of examining larger parts. In 2021, it was therefore decided to create such a laboratory in the building's former car garage, which was unused since vehicle maintenance had been outsourced. The study was entrusted to an architect and planning permission was granted in June 2022 by the Prefect of Seine-Saint-Denis, following a favourable opinion from the Bâtiments de France architect.

Work began at the end of November 2022 and is scheduled for completion in June 2023.

The laboratory will be equipped with the latest generation of analysis equipment, including a tomograph for the three-dimensional examination of large mechanical parts, the acquisition of which has been funded from the 2022 budget.

In 2022, €1,900,000 were therefore spent on building the materials laboratory and €880,000 on acquiring the tomograph.

8.3 COMPUTERISED UNION ELECTIONS

As is the case every four years, BEA staff were invited to vote from 01 to 08 December 2022 to elect their representatives, who sit alongside the administration's representatives on the joint administrative committees (CAP) for civil servants, on the joint advisory committees (CCP) for contractual employees, as well as on the social committees.

As part of the general roll-out of electronic voting promoted by the French Administration and Civil Service Directorate General (DGAFP), the Ministry used electronic voting for the first time for the 2022 union elections, and the BEA adopted the process led by the Ministry. Voting was open 24 hours a day from any computer connected to the Internet.

In addition, the law of 06 August 2019[1] relating to the transformation of the civil service modified the architecture, operation and powers of the social dialogue bodies: from 2023, the technical committees and the occupational health, safety and working conditions committee (CHSCT) will be merged into an Administrative Social Committee (CSA) in charge of all collective issues. At the BEA, the CSA also includes a specialised committee to deal with hygiene, health and safety issues.

The results of the election of the BEA Special CSA, for 88 registered staff members (including 2 apprentices) and 43 voters including 2 blank votes, are as follows:

	Number of votes		Result
CFDT Civil Aviation	19	46.34 %	2 representative seats and 2 substitute seats allocated
FO	14	34.15 %	2 representative seats and 2 substitute seats allocated
FNEE-CGT	7	17.07 %	No seats allocated
Alliance du trèfle (EFA-CGC, CFTC-FAE, SNISPV)	1	2.44 %	No seats allocated
FSU	0	0.00 %	No seats allocated

1. Version in force on 01 January 2022.

8.4 TRANSPORT OF WRECKAGE

The BEA ensures the independent transport, from the accident sites to the Le Bourget premises, of all general aviation wreckage or parts of wreckage requiring further examination, in particular to determine whether mechanical or structural failures may have caused the accident.

The transport logistics chain is therefore an integral part of the department's operational activity. Over 2022, this represented 85 mission days for the transport unit and 71,000 km travelled.

Work by the IT section

After several years of understaffing, during which it focused mainly on systems maintenance and machine renewal, the IT section was able to start work again on a number of structural projects aimed at improving efficiency, reducing operating costs and enhancing system security.

These projects included the following:

- Roll-out of Office 365: the migration from Zimbra to Outlook, which had been planned for the end of 2021, was completed at the beginning of January 2022. All staff received training in January. Numerous adjustments were then necessary throughout the year. This work enabled all staff to familiarise themselves with the tool and all its functions for internal and external communications;
- Fibre-optic project: the appointment of a service provider for the installation at the Le Bourget premises and Rennes, Toulouse, Aix-en-Provence and Lyon branches made it possible to launch the work in late 2022. Several branches are already equipped. From 2023, in addition to outward communication, these measures will provide a private internal broadband network (200 Mbit/s from the branches and 1 Gbit/s from Le Bourget premises via fibre optics).
- Installation of a tape drive enabling all BEA's data (around twenty TeraBytes) to be backed up offline.
- Implementation of a GLPI Purchasing tool: this tool can now be used to centralise purchase requests (whatever the purchase's legal form: purchase order, contract awarded under the adapted procedure (MAPA), invitation to tender, etc.). In particular, this tool enables the Secretary General's department (Purchasing and Contracts Division) to organise purchases and monitor procedures.

In addition to these major projects, the IT section was particularly involved in the preparations for the major work requiring the relocation of all of the BEA's workshops, as well as a large amount of equipment and offices.

Accident to the Boeing 737 registered EC-NLS operated by Swiftair on 24 September 2022 at Montpellier.
Accident to the Boeing 737 registered F-GZHA operated by Transavia on 01 October 2022 at Nantes.
Serious incident to the Embraer EMB145 registered F-HYOG operated by Amelia on 20 October 2022 at Orly.

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