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INVESTIGATION REPORT

# Accident to the Airbus AS 350 B3 registered F-GKMQ

on 7 January 2019
at Puylaurens (Tarn)[1]

[1] Locality of *"Le Galot"*.

| | |
|---|---|
| **Time** | Around 14:10[2] |
| **Operator** | Airplus Hélicoptères |
| **Type of flight** | Slung load transportation |
| **Persons on board** | Pilot |
| **Consequences and damage** | Pilot fatally injured, helicopter destroyed |

**This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in October 2020. As accurate as the translation may be, the original text in French is the work of reference.**

[2] Except where otherwise indicated, times in this report are local.

## Loss of control while setting down a slung load, collision with vegetation and then ground

### 1 - HISTORY OF THE FLIGHT

*Note: the history of the flight is based on statements, data from the engine data recorder "Brite Saver" and a video taken by a technician close to the accident site.*

As part of the construction of a tower designed to hold a relay antenna for a telephone operator, Airplus Helicoptères was responsible for lifting and positioning by sling, the six sections of the tower.

The pilot, a company employee, lifted and positioned the first two sections at the end of the morning at the controls of F-GKMQ[3]. This first step was carried out without a radio assistant on the ground[4]. Before the lunch break, he was joined by the company manager who would carry out this role of "helper" for the rest of the job. After the lunch break, the pilot took off from the loading zone[5], lifted and then positioned the third section above the structure. Technicians stabilized and fastened this section which the pilot released from the hook at the bottom of the sling before returning to land in the loading zone.

The pilot waited on board the helicopter with the rotor operating, for the third section to be completely assembled and then took off to allow the technicians, in the loading zone, to hook the fourth section to the sling. As the technicians on the structure had not completely finished fastening the third section, the pilot hovered for around five minutes with the suspended load.

[3] In the scope of this operation, a team on the ground or on the tower is required to attach the tower sections.

[4] Or "*helper*" (see § 2.8).

[5] Also called "*DZ*" (Drop Zone).

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Once the technicians were positioned and ready to receive the fourth section, the pilot at the controls of F-GKMQ moved the load towards the structure. He kept the helicopter in hover in order to position his load overhead the assembly and allow the technicians to put it in place more accurately. A first positioning pin was then attached to the first anchor point[6] of the element.

[6] Each section has three anchor points.

The two other pins were about to be fitted when the helicopter slightly descended and then suddenly climbed with the section, separating it from the rest of the structure. The pilot lost control of the helicopter which entered a roll, striking trees before the left side collided with the ground below the tower installation zone (see Figure 1).


Figure 1: F-GKMQ manoeuvring zone

## 2 - ADDITIONAL INFORMATION

### 2.1 Aircraft information

#### 2.1.1 General

F-GKMQ was equipped with an option installed under an STC[7] which proposed a window in the cockpit floor on the right side of the pilot's seat which allowed him to check the transported load. An optional external rear-view mirror could also be used to check the slung load.

[7] Supplemental Type Certificate: major modification to an aircraft with a type certificate, approved by a civil aviation authority.

### 2.1.2 Slinging system

The system is composed of a sling around 15 m long connecting the helicopter's top hook to a bottom hook installed under an STC. A shackle is then attached to this bottom hook, connecting three slings around 5 m long, each attached to a leg of the section being transported (see Figure 2).

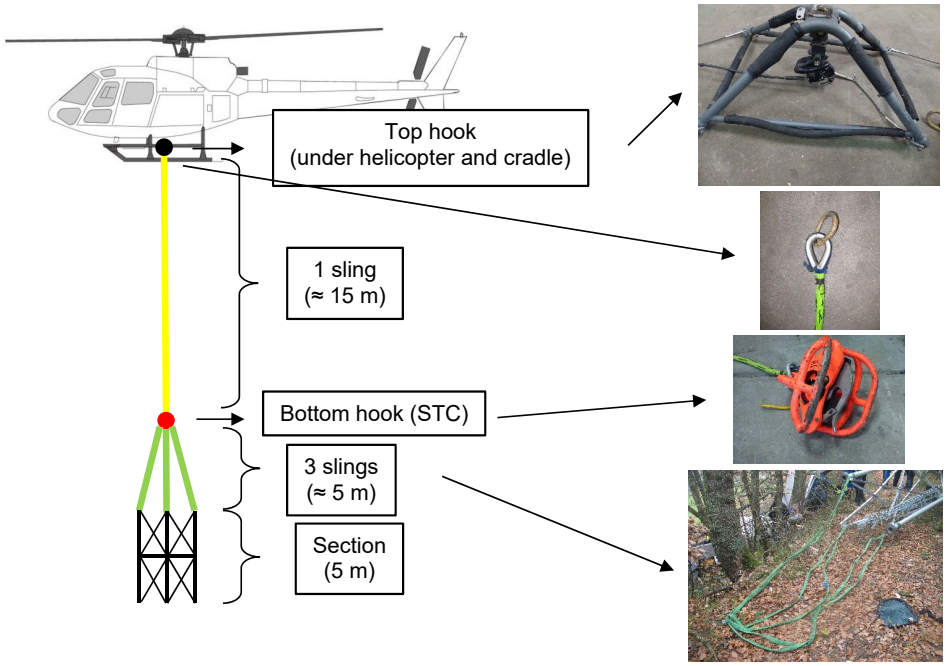



Figure 2: Diagram of slinging system

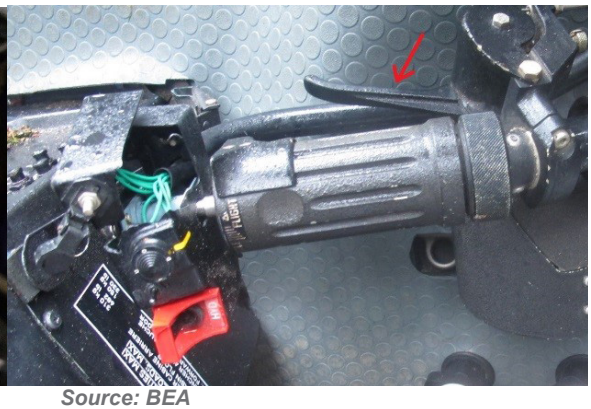
### 2.1.3 Hook controls

The pilot controls the opening of the hooks from the cockpit by means of the systems on the cyclic pitch stick and collective pitch lever. Once opened, the top or bottom hooks remain in the open position until closed again manually.

The opening of the top hook can be electrically controlled using the "*CARGO REL*" button on the cyclic pitch stick (see Figure 3) or mechanically, by pressing the lever on the collective pitch lever (see Figure 4).


*Source: BEA*

Figure 3: "CARGO REL"



*Source: BEA*

Figure 4: Release lever

The opening of the bottom hook can be electrically controlled by pushing a button using the "*LOW REL*" tab situated on the cyclic pitch stick (see Figure 5).

*Source: BEA*

Figure 5: "LOW REL"

The bottom hook can also be opened mechanically by a manual action on the hook (only accessible to ground agents).

## 2.2 Site and wreckage information

The wreckage was situated in a wooded area, below the zone where the tower was installed. It was resting on its left side.


*Source: BEA*

Figure 6: General view of wreckage

The fourth tower section was situated a few metres higher than the wreckage. The three slings were connected to its legs and joined to the shackle found disconnected from the bottom hook. An attachment pin was in position on one of the tower's legs.

The bottom hook was found under the wreckage in the closed position. The sling joining the bottom hook to the top hook was still connected to the bottom hook and was wrapped around the main rotor shaft. The top ring of the sling, found near the tower section, was not connected to the top hook. The latter was found closed and correctly attached to the helicopter by the cradle system.

The collective pitch twist grip was found in the "*FLIGHT*" position. The "*LOW REL*" control tab was found in the raised position, probably the consequence of the collision with the ground[(8)].

[(8)] The pilot usually works with the tab lowered. The tab has a flexible hinge.

The operation of the hooks was tested. The top hook mechanical and electrical release systems operated correctly.

The electrical power supply of the bottom hook release system is provided by the helicopter's electrical master box. Tests found that the fuse in the electrical master box protecting the bottom hook control system was damaged. Given the substantial damage to the front of the helicopter, in particular to the pedestal, the damage to this fuse was very probably caused by a short-circuit during the accident sequence. After being replaced, the bottom hook release system operated correctly. It is thus very probable that the bottom hook release system was operational during the occurrence.

The other examinations of the wreckage did not bring to light any anomaly prior to the accident:

- continuity of flight control linkages;
- no anomaly was found on the hydraulic system;
- the engine was producing power at the time of the impact with the ground.

### 2.3 Analysis of a video recording

Part of the sequence of the occurrence was filmed by a technician, present at the DZ, using a smartphone (see Figure 7). Trees in the foreground conceal the tower sections already installed and the technicians located there.

Figure 7: Image taken from sequence filmed by technician

The video recording shows the helicopter from the side (nose pointing left) hovering above the tower for around 20 s, the fourth section was stable and positioned above the tower at the end of the taut sling.

The helicopter then slightly tipped downwards and forwards losing height, causing the sling to slacken. The helicopter quickly regained height by moving forwards which drew the sling tight until the fourth section separated from the structure.

The helicopter rolled to the right until reaching a nose-up position while the load was raised and the sling was slightly slack. The load then fell, tightening the sling and dragging the helicopter towards the ground. The last visible images of F-GKMQ show the helicopter pointed towards the camera with a zero attitude and decreasing, and a bank angle of around 45° to the right.

During all of the sequence where the helicopter is visible, the load appears to be hooked to the sling.

## 2.4 Analysis of flight parameters

The helicopter was equipped with a FADEC[9] which controls the engine and a VEMD[10] used in flight as a piloting aid and on the ground for maintenance. F-GKMQ was also equipped with a "*Brite Saver*"[11] engine data recorder. These three computers recorded parameters which were downloaded and then analysed. The accident flight was recorded.

Figure 8 juxtaposes the altitude and the torque, NG[12] and NR[13] parameters taken from the Brite Saver and observed on the accident flight.

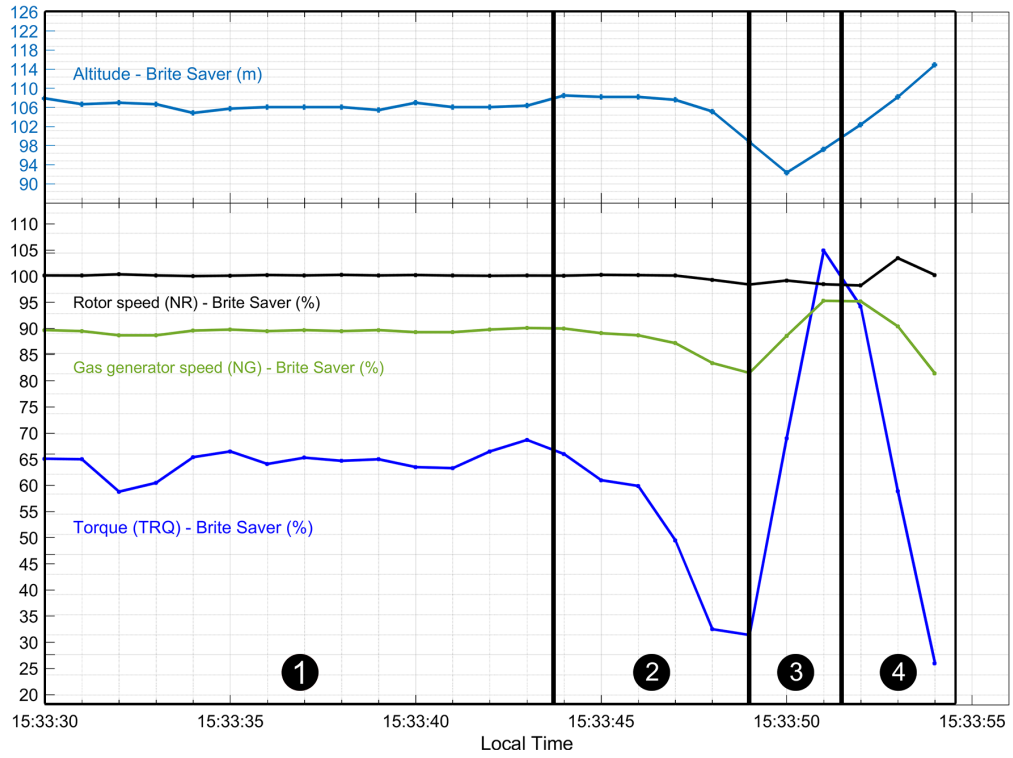
[9] Full Authority Digital Engine Control (electronic computer that regulates fuel flow).

[10] Vehicle and Engine Multifunction Display (engine and helicopter monitoring system).

[11] The Brite Saver records the parameters sampled at one point per second (the value of the parameter recorded is the average over one second).

[12] NG: gas generator rotation speed, reference at 100%: NG = 52,100 rpm.

[13] NR: main rotor rotation speed, reference at 100%: NR = 390 rpm.




*Source: BEA*

Figure 8: Evolution of certain parameters taken from the computers

The analysis of these parameters permits us to define four clear sequences during the accident flight:

- Sequence 1 corresponds to the nominal flight, during which the helicopter is in hover over the structure.
- Sequence 2 corresponds to a reduction in the engine rating during which a slight decrease in altitude is observed.
- Sequence 3 corresponds to an increase in the engine rating; the altitude progressively increases.
- Sequence 4 corresponds to a new reduction in the engine rating; it is during this phase that the helicopter has high and unusual variations in attitude.

These parameters were compared to those obtained in flight simulations and tests carried out by Airbus and Safran Helicopter Engines. This analysis showed that the helicopter and its systems were operating nominally at the time of the accident. Sequences 2 and 3 can thus very probably be explained by the collective pitch lever in the cockpit being progressively lowered (reduction in pitch) and then quickly raised (increase in pitch), which is consistent with the simulations carried out.

## 2.5 Pilot information

### 2.5.1 Experience and ratings

The 54-year-old pilot held a helicopter commercial pilot licence since 2008 by converting an A81 licence obtained in 2005. He had several type ratings, notably for the AS350 and EC130 ("*Écureuil*"), "*Lama*" and "*Alouette II*".

At the time of the accident, he had logged 3,160 flight hours on helicopters (of which 3,055 hours as pilot-in-command). In 2018, he had carried out 287 flight hours, almost all of them on the AS350.

He was a permanent member of staff at Airplus Hélicoptères since February 2017. Prior to this, the pilot had worked alone in a company which he had created in 2003 and sold to Airplus Hélicoptères in 2016. He carried out aerial work flights and local revenue flights with passengers, chiefly on "*Lamas*" and "*Alouettes*".

The pilot held several declarations of proficiency including a declaration for helicopter transportation and slung-load transportation (HESLO[14] 4 - long lines and construction given previous experience). He had obtained this declaration of proficiency in March 2016.

[14] Helicopter External Sling Load Operations Level four corresponds to advanced sling load activity, such as tower erecting, wire stringing, disassembly of masts and towers (AMC1 SPO.SPEC.HESLO.100).

All of his declarations of proficiency had been accepted by Airplus Hélicoptères in April 2017. He had lifted around 1,600 slung loads in 2018. The pilot exclusively used the window, without the help of the rear-view mirror, to carry out the external sling load operations. This technique requires the pilot to adopt a particular back posture as he must bend his head to the right to look through the floor, while extending the left arm to keep the hand positioned on the collective pitch lever.

The different statements gathered draw the portrait of a technically-skilled pilot for carrying out tricky and complex external sling load missions. The image conveyed by articles and reports in the local press published before the accident, praising his work, reinforce these statements. The pilot had vast experience in the setting up of towers. He had repeatedly worked over numerous years with the same clients who knew him well and acknowledged his expertise. According to close family and friends, the pilot had a certain bearing and could be perceived as a "*grumbler*" and as someone with "*character*".

The pilot had performed 18 flight hours for the company in December 2018 over 8 working days. The day of the accident, the pilot had just returned from a two-week holiday.

### 2.5.2 Medical and pathological information

The autopsy carried out on the pilot, supplemented by an anatomopathological examination, brought to light, in particular, a hepatic steatosis with fibrosis and a cardiac pathology which could result in episodes of dizziness, fainting or sudden death. The toxicological analyses revealed the presence of caffeine and cotinine. This latter substance is related to smoking[15].

[15] Smoking and excessive caffeine consumption can affect the cardiovascular system.

According to his partner and a doctor friend, the pilot had a good constitution and no health problems. The pilot's partner did indicate, however, that the pilot suffered from "*sciatica*". The pilot consulted a healer to treat his back problems. His medical file did not show any information linked to sciatica.

The pilot held a class 1 medical fitness certificate issued on 31 August 2018. The pilot's body mass index (BMI)[16] was 28.7 kg/m², characterizing excess weight. The successive certificates over the last five years indicated BMI between 25 and 31 along with blood pressure measurements regularly higher than 140 mmHg for the systolic pressure and 90 mmHg for the diastolic pressure. The alleged dates at which he had given up smoking differ from one medical fitness examination to another. On several occasions over the last few years, a "*White coat hypertension*"[17] or "*adrenergic blood pressure*" was noted in relation to a discrepancy between the blood pressure values[18] observed by the medical examiner and those on the medical certificates giving occasional blood pressure measurements spontaneously presented by the pilot at each medical fitness examination. His medical examination included an electrocardiogram but no recent biological screening.

[16] The pilot weighed 92 kg and was 1.79 m tall.

[17] High blood pressure in a medical setting and normal at home (ameli.fr).

[18] 145/90 or 160/100.

The information contained in the pilot's medical file, revealing the presence of cardiovascular risk factors (see § 2.6.1), was not of a nature to declare the pilot unfit.

Witnesses state that, following his examination on 31 August 2018, the pilot had told them that the medical examiner had asked him to consult a practitioner of his choice to conduct further examinations to include an exertion test and a scintigraphy. The pilot mentioned these examinations to colleagues during a flight safety day organised at the company at the end of October 2018. The pilot did not seem to understand why he had been asked to book these additional tests specifically at this examination, and witnesses stated that these examinations had appeared to upset him. There is no mention of these examinations in the pilot's medical file. In particular, no copy of the prescription was found.

The manager specified that the pilot got out of breath easily and established a link with the latter's smoking, which he estimated to be two packets of cigarettes per day.

A ramp agent who refuelled F-GKMQ at Rodez airport on 18 December 2018 indicated that that day the pilot had seemed a little tired and sat down as if it was difficult for him. From what he said, the agent understood that his back was hurting as if it was a sciatica. He explained that the pilot had told him that he did not know if it was sciatica or something else. The ramp agent remembered having seen him sit down for a few seconds which he never did. According to him, it was the first time that he had seen him so tired that he had to sit down. He added that the pilot was breathless when talking about his back problem, which had been going on for a while. He was dragging his feet a bit. The ramp agent specified that he saw the pilot as resilient to pain.

## 2.6 Medical references and standards

### 2.6.1 Cardiovascular risk factors

The French Cardiology Federation (FFC) states on its website[19] that except for heredity, gender and age factors, it is possible to take action with respect to many cardiovascular risk factors:

- Smoking: between the ages of 30 and 70, four in 10 cardiovascular deaths are caused by smoking.
- High blood pressure.
- Obesity and excess weight[20]. It is important to be vigilant if the waist circumference is greater than or equal to 88 cm in women or greater than or equal to 102 cm in men.
- Inactivity. Inactivity contributes to the onset or aggravation of a number of risk factors (high blood pressure, diabetes, excess weight, high cholesterol, etc.).
- Alcohol. More than three units per day for men and two for women raises cardiovascular risk.

[19] https://www.fedecardio.org/Je-m-informe/Reduire-le-risque-cardio-vasculaire/les-facteurs-de-risque-cardio-vasculaires

[20] Excessive weight is defined by a BMI of between 25 and 30 and obesity by a BMI greater than or equal to 30.

The risk factors are not add-ons, they are compounded by each other. Therefore, the association of several risk factors, even low level, can lead to a very high risk of cardiovascular disease.

### 2.6.2 Blood pressure

According to the website ameli.fr, high blood pressure is diagnosed when systolic blood pressure reaches 140 mmHg or more, or diastolic blood pressure reaches 90 mmHg or more. These measurements must also be observed on more than one occasion, during three successive appointments over a period of three to six months.

The thresholds used by the French health authorities to define high blood pressure are in line with the values specified by the World Health Organization (WHO).

Part MED.B.010 to annex IV to regulation (EU) No 1178/2011 "*Aircrew*"[21] indicates the following points about blood pressure:

> "*(c) Blood Pressure*
> *(1) Applicants' blood pressure shall be recorded at each examination.*
> *(2) Applicants whose blood pressure is not within normal limits shall be further assessed with regard to their cardiovascular condition and medication with a view to determining whether they are to be assessed as unfit in accordance with points (3) and (4).*
> *(3) Applicants for a class 1 medical certificate with any of the following medical conditions shall be assessed as unfit:*
> *(i) symptomatic hypotension;*
> *(ii) blood pressure at examination consistently exceeding 160 mmHg systolic or 95 mmHg diastolic, with or without treatment.*
> *(4) Applicants who have commenced the use of medication for the control of blood pressure shall be assessed as unfit until the absence of significant side effects has been established.*"

[21] European Commission Regulation of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew.

### 2.6.3 Cardiovascular risk factors in European regulations

All of the applicable European regulations[22] in the aeromedical field are contained in the document, *Easy Access Rules for Medical Requirements*[23].

In this document, the references to risk factors exclusively relate to the cardiovascular sphere. Furthermore, the additional medical examinations to be carried out following the medical fitness check frequently refer to the cardiovascular sphere.

Among the articles focusing on these aspects, it is possible to cite:

| Reference | Text |
|---|---|
| AMC1 MED.A.025 | (d) The AeMC[24], AME[25], GMP[26], or OHMP[27], should give advice to the applicant on treatment and preventive measures if, during the course of the examination, medical conditions or risk factors are identified which may endanger the medical fitness of the applicant in the future. |
| MED.A.040 | (e) The AME, AeMC [...] may require the applicant to undergo additional medical examinations and investigations when there is a clinical or epidemiological indication before the medical certificate is issued, revalidated or renewed. |

[22] Basic regulation, *Implementing Rules, Acceptable Means of Compliance, Guidance Material*.

[23] https://www.easa.europa.eu/sites/default/files/dfu/Easy_Access_Rules_for_Medical_Requirements.pdf

[24] Aeromedical Centre.

[25] Aeromedical Examiner.

[26] General Medical Practitioner.

[27] Occupational Health Medical Practitioner.

| | |
|---|---|
| AMC1 MED.B.010 | (b) General<br>(1) Cardiovascular risk factor assessment [...]<br>(ii) Applicants with an accumulation of risk factors (smoking, family history, lipid abnormalities, hypertension, etc.) should undergo a cardiovascular evaluation by the AeMC or AME, if necessary in consultation with the medical assessor of the licensing authority.<br>(2) Cardiovascular assessment<br>[...]<br>(ii) The extended cardiovascular assessment should be undertaken at an AeMC or may be delegated to a cardiologist.<br>(j) Blood pressure<br>(1) The diagnosis of hypertension should require cardiovascular evaluationto include potential vascular risk factors. |
| AMC2 MED.B.010 | (j) Blood pressure<br>(1) When the blood pressure at examination consistently exceeds 160 mmHg systolic and/or 95 mmHg diastolic, with or without treatment, the applicant should be assessed as unfit.<br>(2) The diagnosis of hypertension requires review of other potential vascular risk factors. |

| | |
|---|---|
| AMC2 MED.B.095 | CARDIOVASCULAR SYSTEM<br>(b) General<br>(1) Cardiovascular risk factor assessment<br>An accumulation of risk factors (smoking, family history, lipid abnormalities, hypertension, etc.) requires cardiovascular evaluation. |
| AMC5 MED.B.095 | METABOLIC AND ENDOCRINE SYSTEMS<br>(e) Aero-medical assessment by, or under the guidance of, the medical assessor of the licensing authority:<br>(1) A diabetology review at yearly intervals, including:<br>[...]<br>(iii) cardiovascular status. Exercise ECG at age 40, at 5-yearly intervals thereafter and on clinical indication, including an accumulation of risk factors. |

### 2.6.4 Cardiovascular risk scores

Using indicators, cardiologists have assessed the risk associated with the simultaneous presence of several of these factors in order to help practitioners and patients to interpret their influence. These scores can be used to estimate the probability of the occurrence of a fatal heart attack within the next 10 years. To read more, visit:

- QRISK®3-2018 (https://qrisk.org/three/);
- The Framingham risk score (https://ccs.ca/app/uploads/2020/12/FRS_fr_2017_fnl_greyscale.pdf);
- The SCORE method (https://www.ameli.fr/sites/default/files/Documents/4991/document/evaluation-risque-cardiovasculaire-10-ans_assurance-maladie.pdf).

### 2.6.5 Reassessment of medical fitness

The MED.A.020 section of Annex IV of the European Regulation mentioned in § 2.6.1 specifies that, in the case of a change to the pilot's state of health,

"*(a) Licence holders shall not exercise the privileges of their licence and related ratings or certificates at any time when they:*

*(1) | are aware of any decrease in their medical fitness which might render them unable to safely exercise those privileges;"*

### 2.6.6 Forms used during the medical fitness examination

Before the medical fitness examination, the pilot completes a medical certificate request form (see Figure 9). During the medical examination, the medical examiner completes a form detailing all the examinations carried out and their results (see Figure 10). The formats of these two forms are defined by the AMC[28] of the EASA[29] introduced in the annex[30] of the Executive Director Decision 2012/006/R (AMC1 ARA.MED.135 (b);(c)).

Information pertaining to cardiovascular risk factors (highlighted in red in the figures below) is distributed between these two forms. The risk factors are not summarised by way of an indicator, in particular of the type of those validated by cardiologists as indicated in § 2.6.1.

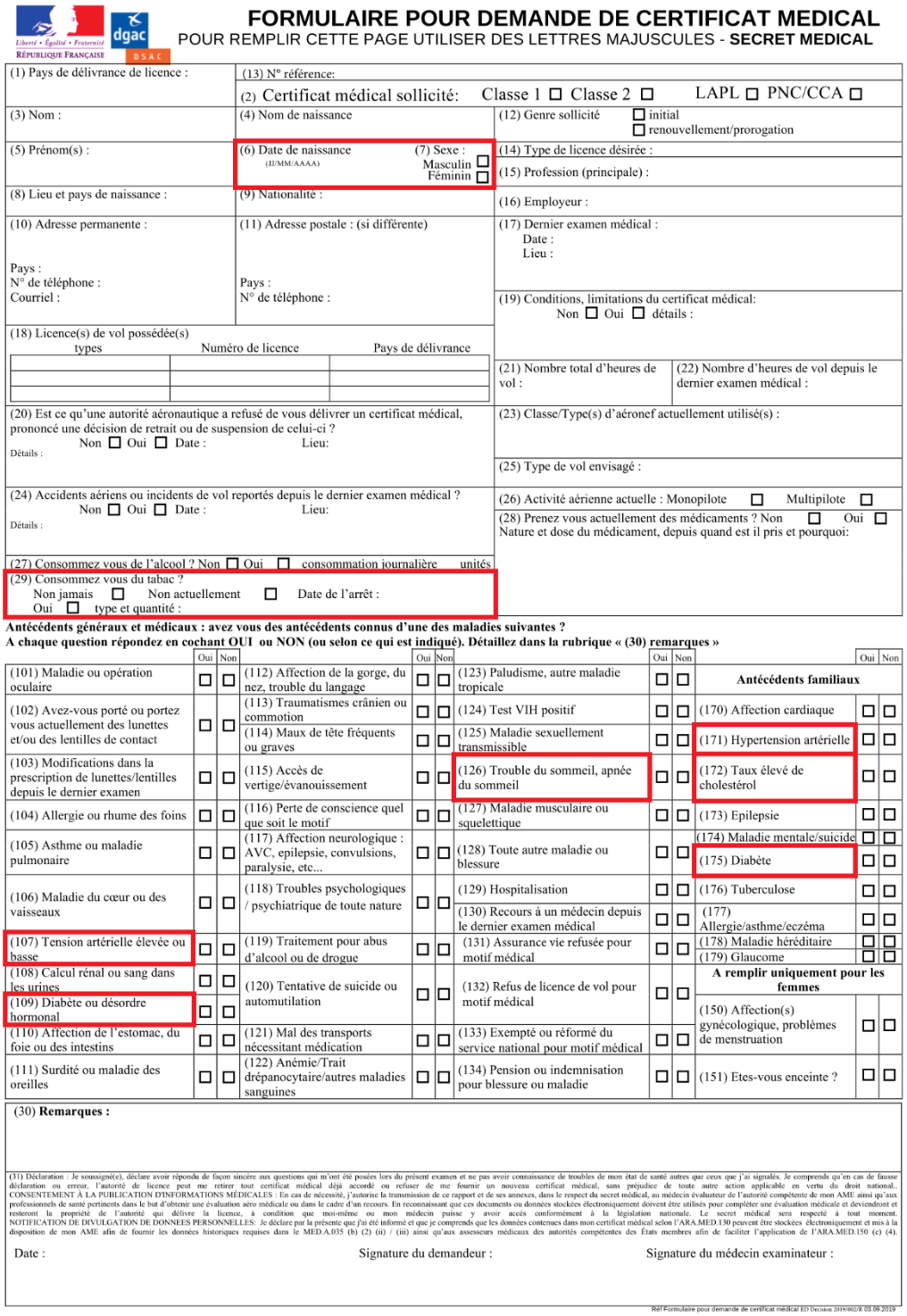
In addition to these forms, the national authorities can introduce additional documents to be completed in the form of summary sheets. These documents concern specific medical fields such as oto-rhino-laryngology and ophthalmology. The formats of these additional documents are proposed by the EASA guides[31] introduced in the annex of the Executive Director Decision 2012/006/R (GM1 ARA.MED.135 (b);(c)).

[28] Acceptable Means of Compliance.

[29] European Aviation Safety Agency.

[30] https://www.easa.europa.eu/sites/default/files/dfu/Annex%20to%20ED%20Decision%202012-006-R.pdf

[31] Guidance Materials (GM).



**FORMULAIRE POUR DEMANDE DE CERTIFICAT MEDICAL**

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| | | |
|---|---|---|
| (1) Pays de délivrance de licence : | (13) N° référence:<br>(2) Certificat médical sollicité: Classe 1 ☐ Classe 2 ☐ LAPL ☐ PNC/CCA ☐ | |
| (3) Nom : | (4) Nom de naissance | (12) Genre sollicité ☐ initial ☐ renouvellement/prorogation |
| (5) Prénom(s) : | (6) Date de naissance (JJ/MM/AAAA) (7) Sexe : Masculin ☐ Féminin ☐ | (14) Type de licence désirée :<br>(15) Profession (principale) : |
| (8) Lieu et pays de naissance : | (9) Nationalité : | (16) Employeur : |
| (10) Adresse permanente :<br>Pays :<br>N° de téléphone :<br>Courriel : | (11) Adresse postale : (si différente)<br>Pays :<br>N° de téléphone : | (17) Dernier examen médical :<br>Date :<br>Lieu : |
| | | (19) Conditions, limitations du certificat médical:<br>Non ☐ Oui ☐ détails : |
| (18) Licence(s) de vol possédée(s)<br>types / Numéro de licence / Pays de délivrance | | (21) Nombre total d'heures de vol : / (22) Nombre d'heures de vol depuis le dernier examen médical : |
| (20) Est ce qu'une autorité aéronautique a refusé de vous délivrer un certificat médical, prononcé une décision de retrait ou de suspension de celui-ci ?<br>Non ☐ Oui ☐ Date : Lieu:<br>Détails : | | (23) Classe/Type(s) d'aéronef actuellement utilisé(s) :<br>(25) Type de vol envisagé : |
| (24) Accidents aériens ou incidents de vol reportés depuis le dernier examen médical ?<br>Non ☐ Oui ☐ Date : Lieu:<br>Détails : | | (26) Activité aérienne actuelle : Monopilote ☐ Multipilote ☐<br>(28) Prenez vous actuellement des médicaments ? Non ☐ Oui ☐<br>Nature et dose du médicament, depuis quand est il pris et pourquoi: |
| (27) Consommez vous de l'alcool ? Non ☐ Oui ☐ consommation journalière unités<br>(29) Consommez vous du tabac ?<br>Non jamais ☐ Non actuellement ☐ Date de l'arrêt :<br>Oui ☐ type et quantité : | | |

**Antécédents généraux et médicaux : avez vous des antécédents connus d'une des maladies suivantes ?**
**A chaque question répondez en cochant OUI ou NON (ou selon ce qui est indiqué). Détaillez dans la rubrique « (30) remarques »**

| | Oui | Non | | Oui | Non | | Oui | Non | | Oui | Non |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (101) Maladie ou opération oculaire | ☐ | ☐ | (112) Affection de la gorge, du nez, trouble du langage | ☐ | ☐ | (123) Paludisme, autre maladie tropicale | ☐ | ☐ | **Antécédents familiaux** | | |
| (102) Avez-vous porté ou portez vous actuellement des lunettes et/ou des lentilles de contact | ☐ | ☐ | (113) Traumatismes crânien ou commotion | ☐ | ☐ | (124) Test VIH positif | ☐ | ☐ | (170) Affection cardiaque | ☐ | ☐ |
| | | | (114) Maux de tête fréquents ou graves | ☐ | ☐ | (125) Maladie sexuellement transmissible | ☐ | ☐ | (171) Hypertension artérielle | ☐ | ☐ |
| (103) Modifications dans la prescription de lunettes/lentilles depuis le dernier examen | ☐ | ☐ | (115) Accès de vertige/évanouissement | ☐ | ☐ | (126) Trouble du sommeil, apnée du sommeil | ☐ | ☐ | (172) Taux élevé de cholestérol | ☐ | ☐ |
| (104) Allergie ou rhume des foins | ☐ | ☐ | (116) Perte de conscience quel que soit le motif | ☐ | ☐ | (127) Maladie musculaire ou squelettique | ☐ | ☐ | (173) Epilepsie | ☐ | ☐ |
| (105) Asthme ou maladie pulmonaire | ☐ | ☐ | (117) Affection neurologique : AVC, epilepsie, convulsions, paralysie, etc... | ☐ | ☐ | (128) Toute autre maladie ou blessure | ☐ | ☐ | (174) Maladie mentale/suicide | ☐ | ☐ |
| | | | | | | | | | (175) Diabète | ☐ | ☐ |
| (106) Maladie du cœur ou des vaisseaux | ☐ | ☐ | (118) Troubles psychologiques / psychiatrique de toute nature | ☐ | ☐ | (129) Hospitalisation | ☐ | ☐ | (176) Tuberculose | ☐ | ☐ |
| | | | | | | (130) Recours à un médecin depuis le dernier examen médical | ☐ | ☐ | (177) Allergie/asthme/eczéma | ☐ | ☐ |
| (107) Tension artérielle élevée ou basse | ☐ | ☐ | (119) Traitement pour abus d'alcool ou de drogue | ☐ | ☐ | (131) Assurance vie refusée pour motif médical | ☐ | ☐ | (178) Maladie héréditaire | ☐ | ☐ |
| | | | | | | | | | (179) Glaucome | ☐ | ☐ |
| (108) Calcul rénal ou sang dans les urines | ☐ | ☐ | (120) Tentative de suicide ou automutilation | ☐ | ☐ | (132) Refus de licence de vol pour motif médical | ☐ | ☐ | **A remplir uniquement pour les femmes** | | |
| (109) Diabète ou désordre hormonal | ☐ | ☐ | | | | | | | (150) Affection(s) gynécologique, problèmes de menstruation | ☐ | ☐ |
| (110) Affection de l'estomac, du foie ou des intestins | ☐ | ☐ | (121) Mal des transports nécessitant médication | ☐ | ☐ | (133) Exempté ou réformé du service national pour motif médical | ☐ | ☐ | | | |
| (111) Surdité ou maladie des oreilles | ☐ | ☐ | (122) Anémie/Trait drépanocytaire/autres maladies sanguines | ☐ | ☐ | (134) Pension ou indemnisation pour blessure ou maladie | ☐ | ☐ | (151) Etes-vous enceinte ? | ☐ | ☐ |

(30) **Remarques :**

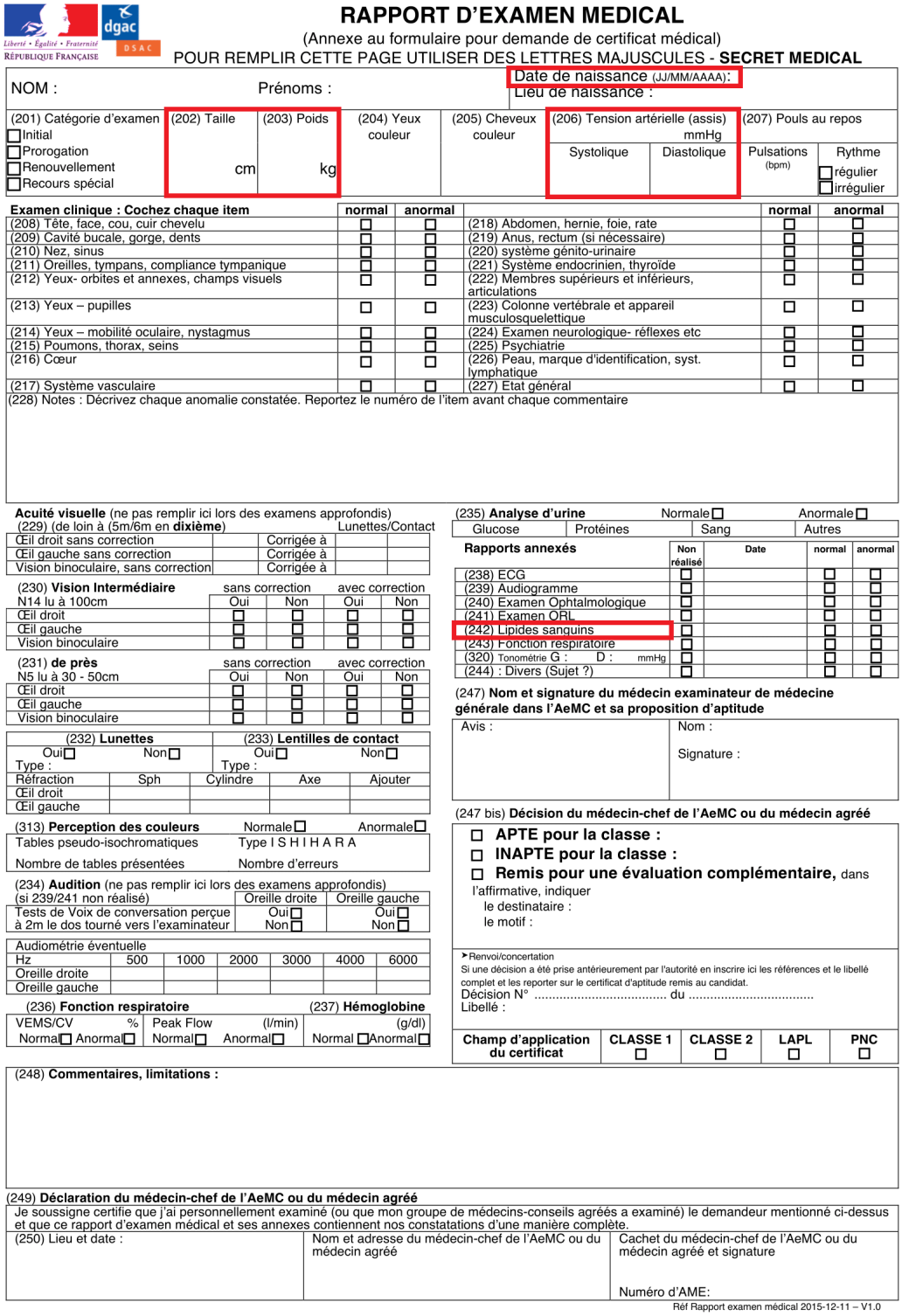
(31) Déclaration : Je soussigné(e), déclare avoir répondu de façon sincère aux questions qui m'ont été posées lors du présent examen et ne pas avoir connaissance de troubles de mon état de santé autres que ceux que j'ai signalés. Je comprends qu'en cas de fausse déclaration ou erreur, l'autorité de licence peut me retirer tout certificat médical déjà accordé ou refuser de me fournir un nouveau certificat médical, sans préjudice de toute autre action applicable en vertu du droit national.. CONSENTEMENT À LA PUBLICATION D'INFORMATIONS MÉDICALES : En cas de nécessité, j'autorise la transmission de ce rapport et de ses annexes, dans le respect du secret médical, au médecin évaluateur de l'autorité compétente de mon AME ainsi qu'aux professionels de santé pertinents dans le but d'obtenir une évaluation aéro médicale ou dans le cadre d'un recours. En reconnaissant que ces documents ou données stockées électroniquement doivent être utilisés pour compléter une évaluation médicale et deviendront et resteront la propriété de l'autorité qui délivre la licence, à condition que moi-même ou mon médecin puisse y avoir accès conformément à la législation nationale. Le secret médical sera respecté à tout moment. NOTIFICATION DE DIVULGATION DE DONNEES PERSONNELLES: Je déclare par la présente que j'ai été informé et que je comprends que les données contenues dans mon certificat médical selon l'ARA.MED.130 peuvent être stockées électroniquement et mis à la disposition de mon AME afin de fournir les données historiques requises dans le MED.A.035 (b) (2) (ii) / (iii) ainsi qu'aux assesseurs médicaux des autorités compétentes des États membres afin de faciliter l'application de l'ARA.MED.150 (c) (4).

Date : Signature du demandeur : Signature du médecin examinateur :

Réf Formulaire pour demande de certificat médical ED Decision 2019/002/R 03.06.2019

Figure 9: Medical certificate request form[32] (annotated by the BEA)

[32] This form can be found on pages 208 & 209 of the Easy Access Rules for Medical Requirements at https://www.easa.europa.eu/sites/default/files/dfu/Easy_Access_Rules_for_Medical_Requirements.pdf. The French form shown in this report can be downloaded online at https://www.ecologie.gouv.fr/sites/default/files/Formulaire_pour_demande_de_certificat_medical_aptitude.pdf



# RAPPORT D'EXAMEN MEDICAL

(Annexe au formulaire pour demande de certificat médical)

POUR REMPLIR CETTE PAGE UTILISER DES LETTRES MAJUSCULES - **SECRET MEDICAL**

NOM : Prénoms : Date de naissance (JJ/MM/AAAA): Lieu de naissance :

| (201) Catégorie d'examen | (202) Taille | (203) Poids | (204) Yeux couleur | (205) Cheveux couleur | (206) Tension artérielle (assis) mmHg | | (207) Pouls au repos | |
|---|---|---|---|---|---|---|---|---|
| ☐ Initial<br>☐ Prorogation<br>☐ Renouvellement<br>☐ Recours spécial | cm | kg | | | Systolique | Diastolique | Pulsations (bpm) | Rythme<br>☐ régulier<br>☐ irrégulier |

| Examen clinique : Cochez chaque item | normal | anormal | | normal | anormal |
|---|---|---|---|---|---|
| (208) Tête, face, cou, cuir chevelu | ☐ | ☐ | (218) Abdomen, hernie, foie, rate | ☐ | ☐ |
| (209) Cavité bucale, gorge, dents | ☐ | ☐ | (219) Anus, rectum (si nécessaire) | ☐ | ☐ |
| (210) Nez, sinus | ☐ | ☐ | (220) système génito-urinaire | ☐ | ☐ |
| (211) Oreilles, tympans, compliance tympanique | ☐ | ☐ | (221) Système endocrinien, thyroïde | ☐ | ☐ |
| (212) Yeux- orbites et annexes, champs visuels | ☐ | ☐ | (222) Membres supérieurs et inférieurs, articulations | ☐ | ☐ |
| (213) Yeux – pupilles | ☐ | ☐ | (223) Colonne vertébrale et appareil musculosquelettique | ☐ | ☐ |
| (214) Yeux – mobilité oculaire, nystagmus | ☐ | ☐ | (224) Examen neurologique- réflexes etc | ☐ | ☐ |
| (215) Poumons, thorax, seins | ☐ | ☐ | (225) Psychiatrie | ☐ | ☐ |
| (216) Cœur | ☐ | ☐ | (226) Peau, marque d'identification, syst. lymphatique | ☐ | ☐ |
| (217) Système vasculaire | ☐ | ☐ | (227) Etat général | ☐ | ☐ |

(228) Notes : Décrivez chaque anomalie constatée. Reportez le numéro de l'item avant chaque commentaire

**Acuité visuelle** (ne pas remplir ici lors des examens approfondis)

(229) (de loin à (5m/6m en **dixième**) Lunettes/Contact

| | | | | |
|---|---|---|---|---|
| Œil droit sans correction | | Corrigée à | | |
| Œil gauche sans correction | | Corrigée à | | |
| Vision binoculaire, sans correction | | Corrigée à | | |

| (230) **Vision Intermédiaire** N14 lu à 100cm | sans correction | | avec correction | |
|---|---|---|---|---|
| | Oui | Non | Oui | Non |
| Œil droit | ☐ | ☐ | ☐ | ☐ |
| Œil gauche | ☐ | ☐ | ☐ | ☐ |
| Vision binoculaire | ☐ | ☐ | ☐ | ☐ |

| (231) **de près** N5 lu à 30 - 50cm | sans correction | | avec correction | |
|---|---|---|---|---|
| | Oui | Non | Oui | Non |
| Œil droit | ☐ | ☐ | ☐ | ☐ |
| Œil gauche | ☐ | ☐ | ☐ | ☐ |
| Vision binoculaire | ☐ | ☐ | ☐ | ☐ |

| (232) **Lunettes** | | (233) **Lentilles de contact** | | | |
|---|---|---|---|---|---|
| Oui☐ Non☐ Type : | | Oui☐ Non☐ Type : | | | |
| Réfraction | Sph | Cylindre | Axe | Ajouter | |
| Œil droit | | | | | |
| Œil gauche | | | | | |

(313) **Perception des couleurs** Normale☐ Anormale☐

Tables pseudo-isochromatiques Type I S H I H A R A

Nombre de tables présentées Nombre d'erreurs

(234) **Audition** (ne pas remplir ici lors des examens approfondis)

| (si 239/241 non réalisé) | Oreille droite | Oreille gauche |
|---|---|---|
| Tests de Voix de conversation perçue à 2m le dos tourné vers l'examinateur | Oui☐ Non☐ | Oui☐ Non☐ |

| Audiométrie éventuelle | | | | | | |
|---|---|---|---|---|---|---|
| Hz | 500 | 1000 | 2000 | 3000 | 4000 | 6000 |
| Oreille droite | | | | | | |
| Oreille gauche | | | | | | |

| (236) **Fonction respiratoire** | | (237) **Hémoglobine** |
|---|---|---|
| VEMS/CV % Normal☐ Anormal☐ | Peak Flow (l/min) Normal☐ Anormal☐ | (g/dl) Normal ☐Anormal☐ |

(235) **Analyse d'urine** Normale☐ Anormale☐

| Glucose | Protéines | Sang | Autres |
|---|---|---|---|
| | | | |

| **Rapports annexés** | Non réalisé | Date | normal | anormal |
|---|---|---|---|---|
| (238) ECG | ☐ | | ☐ | ☐ |
| (239) Audiogramme | ☐ | | ☐ | ☐ |
| (240) Examen Ophtalmologique | ☐ | | ☐ | ☐ |
| (241) Examen ORL | ☐ | | ☐ | ☐ |
| (242) Lipides sanguins | ☐ | | ☐ | ☐ |
| (243) Fonction respiratoire | ☐ | | ☐ | ☐ |
| (320) Tonométrie G : D : mmHg | ☐ | | ☐ | ☐ |
| (244) : Divers (Sujet ?) | ☐ | | ☐ | ☐ |

(247) **Nom et signature du médecin examinateur de médecine générale dans l'AeMC et sa proposition d'aptitude**

| Avis : | Nom :<br>Signature : |
|---|---|

(247 bis) **Décision du médecin-chef de l'AeMC ou du médecin agréé**

☐ **APTE pour la classe :**
☐ **INAPTE pour la classe :**
☐ **Remis pour une évaluation complémentaire,** dans l'affirmative, indiquer
le destinataire :
le motif :

➤Renvoi/concertation
Si une décision a été prise antérieurement par l'autorité en inscrire ici les références et le libellé complet et les reporter sur le certificat d'aptitude remis au candidat.
Décision N° ..... du .....
Libellé :

| **Champ d'application du certificat** | **CLASSE 1** | **CLASSE 2** | **LAPL** | **PNC** |
|---|---|---|---|---|
| | ☐ | ☐ | ☐ | ☐ |

(248) **Commentaires, limitations :**

(249) **Déclaration du médecin-chef de l'AeMC ou du médecin agréé**

Je soussigne certifie que j'ai personnellement examiné (ou que mon groupe de médecins-conseils agréés a examiné) le demandeur mentionné ci-dessus et que ce rapport d'examen médical et ses annexes contiennent nos constatations d'une manière complète.

| (250) Lieu et date : | Nom et adresse du médecin-chef de l'AeMC ou du médecin agréé | Cachet du médecin-chef de l'AeMC ou du médecin agréé et signature<br>Numéro d'AME: |
|---|---|---|

Réf Rapport examen médical 2015-12-11 – V1.0

Figure 10: Medical report form[33] (annotated by the BEA)

[33] This form can be found on page 212 of the Easy Access Rules for Medical Requirements at https://www.easa.europa.eu/sites/default/files/dfu/Easy_Access_Rules_for_Medical_Requirements.pdf. The French form shown in this report can be downloaded online at https://www.ecologie.gouv.fr/sites/default/files/Formulaire%20pour%20rapport%20d%E2%80%99examen%20m%C3%A9dical_1.pdf

## 2.7 Meteorological information

The meteorological conditions estimated by Météo-France on the site at the time of the accident were the following:

- cloud cover between 1,200 ft and 1,800 ft;
- visibility greater than 10 km;
- wind from 280°, between 8 kt and 10 kt with gusts between 14 kt and 18 kt;
- temperature 2° C;
- slight turbulence.

During the external sling load operations preceding the accident (between 11:15 and 14:15), the estimated conditions on the site were similar.

## 2.8 Airplus Hélicoptères

Airplus Hélicoptères offers aerial work services, public transport services, business aviation services and sightseeing flights by helicopter. The aerial work falls within a number of domains, such as measurements and readings, aerial photography, aerial surveillance, transporting loads and fire fighting.

The company has several helicopters located at Bordeaux Mérignac (Gironde), Saint-Girons Antichan (Ariège) and Rodez Aveyron (Aveyron) airports.

The company published an operations manual comprising five sections. The last section (section E) specifically focuses on specialist operations.

*Description of normal procedures*

The load hooking, manoeuvring and drop zones are defined prior to carrying out the work. Emergency procedures are specified in the operations manual in the event of engine failure, specifying, in the event of a failure occurring during hover, that the helicopter should vacate the area to the right while the pilot holds the collective pitch. Ground personnel are warned that in this case, they must withdraw to the left and told that they must never stand under a load.

As a general rule, the pilot is assisted by a helper on the ground. The role of the helper is described in detail in the company's operations manual. The helper is in radio contact with the pilot, notably to assist him and guide him during the external sling load operations. The role of the helper is generally filled by an employee of Airplus Hélicoptères.

When the technicians present at the structure are ready, the helper tells the pilot that he can take off from the DZ. After take-off, the pilot hovers to check the parameters and to make sure there are no warnings. He then waits for the technicians to attach the load to the bottom hook, then sets the load vertically before lifting it. The pilot then flies the helicopter to the installation zone and positions the load overhead the structure. The helper gives guidance to help the pilot to position the load using short messages[34].

When the load is approximately 50 cm from the structure, the technicians turn it to align it correctly. Once the load is correctly aligned, the helper gives the order to the pilot to lower the load onto the structure. It is then temporarily held in place using metal pins before being permanently bolted to the structure. This operation generally lasts around a minute and a half. During this phase, the pilot very slightly lowers the helicopter (by approximately 50 cm) to slacken the sling[35].

[34] The messages provide an indication of movement associated with an indication of distance (e.g. "*Descend 1 m*" or "*50 cm to the left*").

[35] This enables an eventual tipping of the load to be countered if the load is incorrectly positioned, whilst ensuring that it is correctly locked.

When the technicians have finished attaching the element, the helper orders the pilot to release the load. The pilot then moves the helicopter sideways in relation to the structure, then descends by approximately three to four metres so that he can see the technicians through the helicopter door. The pilot controls the opening of the bottom hook and the three slings holding the load are released and drop down above the technicians. The pilot waits nearby for the technicians to attach a second set of slings, which were used to carry the previous element, to the bottom hook.

Lastly, the pilot returns to the DZ to release the slings to the hooking technician and lands to wait for the next element to be handled, without switching off the engine.

## 2.9 Statements

### 2.9.1 Company manager

**Context**

The expertise and experience of the pilot made him the manager's choice for this job which had been scheduled for five months.

At the end of a 15-day company shutdown for the end-of-year holidays, the manager contacted the pilot at around 20:00 the evening before the day of the accident to discuss the job. The pilot told him that he would check the weather conditions forecast for the next day and that he would contact the job site manager so that he could assign his technicians.

**Description of the occurrence**

The day of the occurrence, the pilot had agreed to contact the manager before taking off from Rodez airport so that the latter could leave Toulouse at the same time and meet up with him on the job site. The manager was to carry out the role of helper.

At 11:40, the pilot sent an SMS to the manager informing him that he had landed on the job site. The manager reminded him that he should have warned him before taking off, to which the pilot replied that he had forgotten. The manager then took to the road to join the job site. On arriving at the site at around 13:00, the manager saw that the pilot had already installed two sections without waiting for or informing him. He indicated to the pilot that this should not normally be done without a helper.

During lunch, the pilot and manager discussed how the start of the job had gone on. He told the manager that the first two parts of the tower had been installed without incident. However, the pilot had had to offer up one of the two sections a second time after an unsuccessful first attempt. He specified that he was hampered by gusts of wind. The manager indicated that the pilot was used to working in more difficult conditions. During the meal, the manager considered that the atmosphere was relaxed and that the pilot did not seem worried or tired.

At around 13:45, the manager returned to the helicopter and checked that the top hook and bottom hook release was operating correctly. During the helicopter startup, the manager informed the pilot of the presence of a tree just behind him. The pilot replied that he was aware of it and that he was not a novice.

Once the start-up procedure had been completed, the manager walked up to the tower installation zone in order to take up his position as helper. The pilot had not waited for him to get into position and had taken off quickly while he was still halfway there. The pilot did not carry out the stabilized hover parameter check and had had the load hooked on before flying towards the tower. The helper did not make any comments to the pilot about this.

The helper took up position outside the fence marking out the job site to have a better overall view. The third section was positioned and assembled normally.

While the three technicians on the tower were bolting the parts, the pilot asked the helper what they were doing. The helper replied that they had nearly finished and would be ready in two to three minutes, the time needed to climb the structure and to safety themselves. The pilot then took off without waiting for the helper's clearance and lifted the fourth section. A technician specified to the helper after the accident, that the load had been lifted quickly, the pilot had not paused for the section to right itself from its position on the ground.

As the technicians were not yet ready, the helper asked the pilot not to approach the structure. The pilot then held the helicopter in hover with the slung load for four to five minutes. The manager indicated that the company pilots never do this as this operation uses fuel unnecessarily. The helper told the pilot that next time he had to wait for the technicians to be ready.

The helper finally signalled to the pilot that he could approach the structure with the load. He guided him into position laterally and vertically. The technicians grabbed the load when it was about 50 cm above them and then turned it to line up the plates. The helper then gave the order to slightly descend. The section was resting on the lower element and was stable. The technicians started positioning the pins. The sling was slightly slack as is usually the case. According to the helper, the manoeuvre was controlled.

When the helicopter started losing height and then enter unusual attitudes, the helper asked the pilot what was happening; the latter did not reply. The helper gave the pilot the order to release the load three times. He did not see the load being released.

The manager indicated that he had already worked with the pilot on other job sites in this configuration (pilot manoeuvring the helicopter and manager acting as helper), without any notable problem.

### 2.9.2 Pilot's partner

The pilot and his partner had returned from their holidays the day before the accident at around 18:30. She specified that before leaving for their end-of-year holidays, the pilot seemed tired. She believed that the two-week holiday taken before the accident had allowed the pilot to have a good rest.

The day of the occurrence, he did not have any particular obligations for the evening.

When the pilot worked alone in his company, he did not have a fixed helper on the ground. The help and guiding were done by the job site technicians, a specific briefing being carried out in this case. The pilot had already carried out external sling load operations without a helper.

The pilot's partner indicated that the latter was stressed in connection with his work. She explained that this stress was linked to the rosters which regularly changed in the company. These modifications, sometimes made without a lot of prior warning, irritated the pilot. He had to regularly travel to the other bases or other aerodromes to pick up helicopters. These car journeys, which were sometimes long, tired him out and required him, from time to time, to stay overnight at a hotel. The pilot had informed the company manager that this organization did not suit him and it was planned that they meet to talk about these points.

The pilot's partner indicated that recurring events and a few episodes which had occurred in the company had annoyed the pilot and strained relations between him and the manager. She added that there had been altercations between the pilot and people he worked with. As a result of this particular atmosphere, the pilot had contacted another company which proposed the same type of helicopter work and was organizing leaving Airplus Hélicoptères.

### 2.10 Occurrences where there may have been a cardiovascular accident

For different reasons, it is often difficult to determine with certitude, to what extent medical factors contribute to the occurrence of civil aviation accidents or incidents.

The disorders which affect the cardiovascular sphere can go unnoticed and lead to a more or less marked incapacitation, or even death. In day-to-day life, a large proportion of these disorders, all the more so when there is no marked lesion of the heart muscle, can be reversed, in particular, with the use of defibrillators. In flight, the temporality of the attack and the non-existence of resuscitation equipment compromise the pilot's survival. During a fatal accident investigation, only a minority of heart disorders accompanied by a (macro- or microscopic) physical lesion of the heart can show the cardiovascular origin of pilot failure. Other incapacitating disorders (e.g. rhythm disorders) can only be suspected. The result is that all epidemiological approaches based on safety investigations largely underestimate the prevalence of cardiovascular disorders.

However, since 2000, in at least 51 investigations (of which 44 were fatal accidents involving light aircraft that caused the death of 57 people), based on the pilot's medical history or the examinations carried out within the scope of the investigations, the BEA noted the existence of cardiac pathologies in the pilot which might have caused an episode of dizziness or fainting. In at least 14 of these cases (including 12 fatal accidents), the scenario of a cardiovascular episode having directly triggered or contributed to the occurrence was considered to be the most probable (see table below).

| Occurrence | Description of the occurrence | Link to the BEA report | Note |
|---|---|---|---|
| Accident (fatal) to the Aviasud Albatros identified **28-SD** on 17 August 2001 at Champrond-en-Gâtine (Eure et Loir). | In-flight incapacitation of pilot, collision with ground on final. | *Information in database only.* | The autopsy of the pilot revealed that he had suffered a coronary thrombosis. |
| Accident (fatal) to the Piper PA22 registered **F-BHPE** on 13 February 2003 at Fontaine-Mâcon (Aube). | Loss of control, collision with ground. | https://www.bea.aero/docspa/2003/f-pe030213/htm/f-pe030213.html | The autopsy of the pilot revealed that he had suffered a coronary thrombosis during the flight prior to collision with the ground. |
| Accident to the Piper PA34 registered **HB-LLR** operated by Flugschule Basel AG on 15 May 2003 at Basel-Mulhouse airport (Haut Rhin). | Loss of control during take-off run, runway veer-off. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/lors-du-roulement-au-decollage-en-piste-16-de-laerodrome-de-bale-mulhouselavion-sort-latera/ | |
| Accident (fatal) to the Eurocopter SA 342 J registered **F-GEST** on 9 September 2005 at Albertville Général Pierre Delachenal aerodrome (Savoie). | Incapacitation of pilot, loss of control during a tight turn at low height, collision with ground. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/peu-de-temps-apres-un-vol-de-controle-de-la-voilure-dune-dizaine-minutes-le-pilote-accompagn/ | |

| Occurrence | Description of the occurrence | Link to the BEA report | Note |
|---|---|---|---|
| Accident (fatal) to the Schleicher ASK 14 registered **F-CEAY** on 10 June 2006 at Mas Saint-Chely (Lozère). | In-flight loss of control, collision with ground. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/le-pilote-decolle-de-laerodrome-de-florac-48-vers-11-h-45-les-usagers-de-laerodrome-ente/ | |
| Incident to the Airbus A321 registered **F-GTAH** operated by Air France on 31 January 2007 in descent to London Heathrow airport (UK) | Incapacitation of captain. | *Information in database only.* | Descending through FL150, the captain felt pains in his chest and left arm. He lost consciousness for around 15 seconds. The captain said that he had been suffering from moderate pains in the chest during the three days before the flight. |
| Accident (fatal) to the Robin DR400-120 registered **F-GHOJ** on 18 August 2008 at Pamiers - Les Pujols aerodrome (Ariège). | Incapacitation of pilot during landing, runway veer-off | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/incapacite-du-pilote-lors-de-latterrissage-sortie-laterale-de-piste/ | |
| Accident (fatal) to the Piper PA28 registered **F-GJCB** on 23 March 2009 at Toussus-le-Noble aerodrome (Yvelines). | Death of pilot after start-up. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/deces-du-pilote-apres-la-mise-en-route-1/ | |

| Occurrence | Description of the occurrence | Link to the BEA report | Note |
|---|---|---|---|
| Accident (fatal) to the Diamond DA40 registered **F-GZVE** on 19 September 2010 at Saint-Sauveur (Haute Saône) | Incapacitation of pilot, attempted emergency landing by passenger. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/incapacite-du-pilote-tentative-datterrisage-durgence-par-le-passager/ | The autopsy report for the pilot indicated the probable reason for the aeroplane accident to be a cardiovascular accident. Past history and the presence of ticlopidine detected by the toxicology tests confirmed an active cardiovascular pathology. |
| Accident (fatal) to the Avid Aircraft Inc identified **73JU** on 5 June 2014 at Albertville Général Pierre Delachenal aerodrome (Savoie). | Engine shut-down after take-off, incapacitation of pilot, loss of control, collision with ground, fire, in instruction | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/accident-du-avid-aircraft-inc-identifie-73-ju-le-05062014-a-albertville/ | |
| Accident (fatal) to the CARMAM JP 15-34 registered **F-CRJB** on 26 March 2016 at Seillans (Var). | Loss of control, collision with tree tops then terrain. | https://www.bea.aero/en/investigation-reports/notified-events/detail/accident-to-a-jp-15-34-registered-f-crjb-on-26-03-16-at-seillans-83/ | |
| Accident (fatal) to the ELA 07 identified **95AGD** on 21 June 2016 at Persan Beaumont (Val d'Oise). | Collision with ground during runway circuit, in solo instruction. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/accident-de-lautogire-ela07-identifie-95-agd-survenu-le-21062016-a-persan-beaumont-95/ | |

| Occurrence | Description of the occurrence | Link to the BEA report | Note |
|---|---|---|---|
| Accident (fatal) to the XL8 Bristell identified **44AXM** on 16 August 2016 at Guérande (Loire Atlantique). | Collision with ground. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/accident-du-xl8-bristell-identifie-44-axm-survenu-le-160816-a-guerande-44/ | |
| Accident (fatal) to the Rolladen Schneider LS4 registered **F-CADT** on 2 August 2018 at Thônes (Haute Savoie) | Collision with terrain. | https://www.bea.aero/les-enquetes/evenements-notifies/detail/event/accident-du-planeur-rolladen-schneider-ls4-immatricule-f-cadt-survenu-le-02082018-a-thones-74/ | |

## 3 - LESSONS AND CONCLUSION

### 3.1 Circumstances of job

On the day of the occurrence, the pilot had, on several occasions, breached the usual rules of the slung load transportation procedures practised at Airplus Hélicoptères.

The pilot had worked alone in the company he had set up for around 10 years before his company was bought out by Airplus Hélicoptères. The pilot's great independence, demonstrated by deviations from the company's recommended practices, can also be explained by him sticking to the practices he had learned when he was carrying out this type of work alone.

The areas of disagreement that he may have had with the manager as well as the altercations that he had reported to his partner may be interpreted as signs of a difficulty adapting to the practices of the new company in which he had been working for nearly two years. This complex acculturation finally resulted in the pilot taking steps to change employer.

It is in these particular circumstances that the pilot came back to work, on the day of the accident, after two weeks off work. Although the manager had not noted any particular tension, it is possible that the pilot's clear haste was a sign of a certain form of irritation.

### 3.2 Medical aspects

In terms of his state of health, the investigation revealed that the pilot had developed heart and liver problems in particular, which can be considered as risk factors not taken into account. Moreover, the pilot had not sought appropriate treatment for his sciatica-related discomfort. The discomfort experienced by the pilot was reported by the ramp agent from whom the pilot had been unable to hide the extent of his suffering. The investigation was unable to establish whether the pilot's failure to disclose these back problems to the aeromedical examiner was linked to a fear of having his licence temporarily suspended, which would have prevented him from doing his job.

These medical hypotheses point to the pilot's insufficient recognition of his state of health. Health professionals duly responded to his requests but the pilot had been reluctant to undergo further examinations, in particular those requested by the medical examiner. Furthermore, the pilot's family and close friends had not noted that he had any specific health problems. However, the pilot's aviation medial file contained several references to cardiovascular risk factors with respect to this over 50 year old male, such as blood pressure, BMI and smoking despite references to giving up smoking. The situation even seems to have been explained by the use of the expression "*white coat hypertension*".

The investigation was unable to determine if the accident could have been caused by an incapacitation of the pilot. In terms of the medical context of the occurrence, there may have been an incapacitation due to an episode of dizziness or fainting of cardiovascular origin associated with uncontrolled risk factors (as revealed by the anatomopathological examination of the heart), or an acute rheumatology problem associated with the posture adopted to look out of the window in the helicopter floor in an unexplained context of sciatica.

The investigation brought to light a clear difference between how the pilot was perceived, an experienced professional with a strong constitution, and the medical aspects and operating circumstances.

### 3.3 Scenario

When F-GKMQ was stabilized in hover in order to set down a slung load onto a structure being built, the helicopter suddenly lost height. The investigation was able to determine that this loss of height was caused by a lowering of the collective pitch lever in the cockpit, almost certainly initiated manually by the pilot. However, it was not possible to explain why the pilot made this input on the collective pitch lever.

Some possible hypotheses are:

- A sudden aerological disturbance (turbulence, gust of wind) that destabilised the pilot and prevented him from maintaining hover.
- An involuntary action of the pilot following an unexpected occurrence in the cockpit (fall of an object, presence of an insect).
- A temporary loss of control in maintaining hover as the possible consequence of:
  - physical fatigue from hovering with a load a few moments earlier (a manoeuvre known to be physically demanding and which had lasted several minutes) or
  - a sudden or disproportionate action (see § 3.1)
- a temporary incapacitation of the pilot (see § 3.2).

Immediately after this loss of height, the pilot pulled firmly on the collective pitch lever, which caused the helicopter to suddenly climb. This excessive increase in the helicopter's height caused tautness of the sling followed by separation of the load. The kinematics of the load between its separation and its fall suggests that it was not linked to the helicopter rolling to the right. This may have been initiated by the pilot.

The absence of personnel standing straight ahead meant that the load could be released safely. The helper told the pilot three times via radio to release the section after its separation. However, the section remained hooked to the sling throughout the sequence filmed. Given that all of the release hooks were operational at the time of the occurrence, it is likely that the pilot did not activate the release commands during this sequence.

After this, the pilot did not manage to regain control of the helicopter, which adopted an unusual attitude when the load fell back down, and until it collided with the ground.

The shackle connecting the three green slings and the top ring of the yellow sling were respectively found disconnected from the bottom hook and the top hook. This would suggest that these hooks were open prior to the collision with the ground. Therefore, it is possible that the pilot commanded release of the load after losing control of the helicopter. The fact that the two hooks were found in the closed position is probably the consequence of the impact or a rebound effect observed during other occurrences.

### 3.4 Safety lessons

The investigation was unable to prove that the F-GKMQ accident was caused by an in-flight incapacitation. Nevertheless, hypotheses calling into question the pilot's state of health were examined. The investigation brought to light that the pilot had been suffering from chronic back pain that he had not deemed necessary to mention to his doctors, and that he had been reluctant to undergo the further examinations recommended by the medical examiner. Observed in other accidents, this approach suggests that pilots can be reluctant to admit the reality of their health problems, or not be aware of the potential risks associated with their aviation activity. For these reasons, it is possible that despite the provisions of MED.A.020[(36)], pilots conceal the full details of their actual state of health from aeromedical examiners.

[(36)] Annex IV of the EU regulation "*Aircrew*".

In the report on the accident to the Rolladen Schneider LS4 registered F-CADT published in July 2019, the BEA specified that in accordance with paragraph MED.A.020, the reassessment of medical fitness between two regulatory examinations is incumbent upon the pilot. These provisions are inextricably linked to the periodic examination but aeromedical examiners stated that they are underused by pilots and operators.

It is clear from these elements that referrals to the MED.A.020 article by aeromedical examiners must occur within a more general context of health and prevention education at the centre of which the pilot must be positioned as a completely separate party.

## 4 - RECOMMENDATIONS

*Note: in accordance with the provisions of Article 17.3 of Regulation No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation in no case creates a presumption of fault or liability in an accident, serious incident or incident. The recipients of safety recommendations report to the issuing authority in charge of safety investigations, on the measures taken or being studied for their implementation, as provided for in Article 18 of the aforementioned regulation.*

### 4.1 Taking into account cardiovascular risk factors in the pilot's medical fitness evaluation

The medical fitness examination is perceived by a majority of crew members as an examination which might end their career. However, the aim of the examination is above all, to guard against the risks of flight safety being affected by health issues, and the harmful consequences of aviation activities on health. In terms of the prevention of cardiovascular risks, the difference between health standards and aeromedical standards creates a space in which the health of a pilot can deteriorate before he/she is declared unfit. In this space, steps can be taken to mitigate the risks of a deterioration in the pilot's health - and therefore the occurrence of health and air accidents - for pilots who meet the fitness criteria. The BEA proposes that the visibility of cardiovascular risk factors and the dialogue with the crew member's personal doctor(s) are developed in order to improve aviation safety by reinforcing the role of the medical fitness examination so that it becomes a lever for prevention.

The existence of cardiac pathologies in pilots likely to have caused episodes of dizziness and/or fainting has been detected in at least 51 occurrences investigated by the BEA since 2000, of which 44 fatal accidents caused the death of 57 people. The cardiovascular risk factors are the only risk factors taken into account under this denomination by the regulations that list the cases in which risk factors must be assessed. The importance that the regulations place on cardiovascular risk factors in the body of the text and notably their "*accumulation*", is not reflected in the forms filled in during fitness checks: the parameters used to define a cardiovascular risk factor are spread out between the medical certificate request forms and the medical examination report. Some other medical domains assessed during the examinations, such as ophthalmology and oto-rhino-laryngology, are notably the subject of specific annexes completed during the fitness examination. A brief presentation of the parameters which constitute cardiovascular risk factors, sometimes represented in the form of a score developed by cardiology specialists is likely to help the aeromedical examiner (AME) improve the evaluation of the risk during the actual examination and to improve the monitoring of the pilot from one examination to another well before any discussions about a possible decision declaring the person as unfit. As is the case for the other aforementioned medical domains, this brief presentation of the cardiovascular information about a pilot could supplement the actual medical examination report, without modifying its content defined in the MED section, by way of a specific annex.

Consequently, the BEA recommends that:

- **to help pilots and medical examiners assess the cardiovascular risk and, if necessary, to encourage the ordering of additional examinations and actions on risk factors before incapacitation thresholds are reached,**

  **the DGAC supplement the medical examination report by adding an annex specific to the cardiovascular risk summarizing the main factors to be assessed by the aeromedical examiners during the pilots' medical fitness examinations, as well as the results of the assessment of these factors.**
  **Recommendation FRAN-2020-010**

### 4.2 Coordination between medical fitness examiner and medical practitioner

The medical fitness examination is perceived by a majority of crew members as an examination which might end their career. However, the aim of the examination is above all, to guard against the risks of flight safety being affected by health issues, and the harmful consequences of aviation activities on health. In terms of the prevention of cardiovascular risks, the difference between health standards and aeromedical standards creates a space in which the health of a pilot can deteriorate before he/she is declared unfit. In this space, steps can be taken to mitigate the risks of a deterioration in the pilot's health - and therefore the occurrence of health and air accidents - for pilots who meet the fitness criteria. The BEA proposes that the visibility of cardiovascular risk factors and the dialogue with the crew member's personal doctor(s) are developed in order to improve aviation safety by reinforcing the role of the medical fitness examination so that it becomes a lever for prevention.

The investigation revealed that it was witnesses who reported that the AME had requested additional examinations to those of the medical fitness examination but there is no evidence that the pilot underwent these examinations. The regulations list the situations, which are numerous in the cardiovascular sphere, where the AME can or must ask an aeromedical centre (AeMC) or a specialist for their expert opinion. The medical examination report form has a section entitled "*comments, limitations*" which ensures the traceability of the examinations required by the AME and their follow-up. However, the use of this section for this purpose is left to the initiative of the AME. The regulations do not specify the way in which an AME might ask a medical practitioner for an opinion or examination. It is likely that formalizing the request would ensure that the AME receives the result(s) and that the pilot measures the health issues concerning him, which would be beneficial for both his own health and for the length of his professional working life.

Consequently, the BEA recommends that:

- **to encourage the effective completion of additional examinations which would make it possible to better understand the pilot's state of health and, where appropriate, to implement measures to reduce the risks of deterioration of his/her state of health before incapacitation thresholds are reached,**

  **the DGAC encourage the medical examiners to include in the medical examination report, the prescriptions for the medical examinations recommended to the pilot and to be carried out outside the fitness examination.**
  **Recommendation FRAN-2020-011**

  **the DGAC invite the medical examiners to accompany their prescriptions with an exchange in writing with the crew's personal physicians when additional medical examinations to the fitness examination are recommended and to keep these exchanges.**
  **Recommendation FRAN-2020-012**