

WE ARE CaVD-PACE

New treatments and diagnostic measures for cardiovascular evaluation of pilots and ATCOs

Our mission is to help AMEs, AeMCs, aero-medical assessors, pilots and ATCOs to understand the regulatory cardiovascular requirements, to be able to recognize and to classify symptoms suspicious for a cardiovascular origin, to see the risk levels of defined cardiovascular diseases for fitness, to undertake the defined duties and to know in which cases a general practitioner, a specialist and/or an AME/AeMC has to be involved.

This should contribute to improved aviation safety for everyone.



CHEST PAIN

When is chest pain of significance for pilots and ATCOs?

Many conditions can lead to chest pain. Chest pain and its risk can range from harmless to severe. Assessment should consider pain severity, recurrence of pain with exertion, age, cardiovascular risk factors, medical history, and other health aspects. The key concern is ruling out coronary artery disease (CAD), which may cause myocardial infarction.

A CAD diagnosis does not automatically make a pilot or ATCO unfit.



MYOCARDIAL INFARCTION

Atherosclerosis and coronary artery plaque

Most myocardial infarctions (MI) occur when a coronary plaque ruptures causing thrombus formation, coronary artery occlusion and blockage of blood flow to the heart muscle. Risk of rupture depends on plaque stability (stable vs, unstable). Risk of MI is therefore not only related to the severity of narrowing of the coronary artery but also to plaque composition.

Coronary artery plaques are formed by build up of atherosclerosis over many years. In general: the more cardiovascular risk factors, the higher the risk.



MYOCARDIAL ISCHAEMIA

Causes and consequences

- Myocardial ischaemia is a lack of blood flow (and oxygen) to the heart muscle, usually caused by atherosclerotic coronary plaques narrowing the coronary arteries which increases the risk of myocardial infarction.
- Quantification of myocardial ischaemia can be determined by functional cardiac imaging tests.
- Myocardial ischaemia may be asymptomatic or can cause chest pain, particularly at exertion (angina pectoris).
- Treatment is by medication and/or invasive intervention (percutaneous coronary intervention = PCI or coronary artery bypass surgery = CABG).



HOW TO ANALYSE CORONARY ARTERY PLAQUES

Imaging methods for the analysis of coronary artery plaques

Coronary computed tomography angiography (CCTA) or invasive coronary angiography (catheter-based angiography; ICA) allow to characterise the coronary plaques and to classify them into stable or unstable plaques. When performing ICA, optical coherence tomography (OCT) and intravascular ultrasound (IVUS) are particularly useful for differentiation of the plaque.

CCTA is often used as primary method to assess the coronary arteries. It allows to exclude coronary artery disease (CAD) or to determine the severity of CAD.



CARDIAC IMAGING TESTS

Cardiac imaging tests are differentiated into anatomical and functional tests

These tests are used to determine abnormalities of the heart, especially of the different aspects of coronary artery disease (CAD). Coronary computed tomography angiography (CCTA) and invasive coronary angiography (ICA) are anatomical tests which can visualize coronary narrowing at high resolution and reliably rule out significant CAD.

The functional tests, that are used to demonstrate myocardial ischaemia, are: stress echocardiography, stress cardiac magnetic resonance imaging (MRI), nuclear medicine methods like single-photon emission tomography (SPECT) and positron emission tomography (PET); also exercise ECG, but this last method has a lower validity.



WHEN INVASIVE INTERVENTION IN CORONARY ARTERY DISEASE?

Invasive interventions in coronary artery disease (CAD) are percutaneous coronary intervention = PCI and coronary artery bypass surgery = CABG

The primary goal of therapy in persons with CAD is to relieve symptoms, delay or prevent progression of CAD, and decrease the risk of major adverse cardiovascular events. This may be achieved with optimal medical therapy alone. If not, PCI or CABG have to be considered. For the decision to perform a revascularisation in addition to medical therapy, a differentiated approach is mandatory, for which a cardiologist must be involved. One of several clear prognostic indications for revascularisation is a stenosis greater than 50% in the left main coronary artery.



CORONARY ARTERY DISEASE AND FITNESS OF PILOTS/ ATCOs

Coronary artery disease (CAD) has many manifestations with different risks

The risks for a sudden or subtle incapacitation in presence of an acute CAD situation (myocardial infarction or unstable angina) are often high, and therefore pilots and ATCOs are considered unfit in the acute phase. For the reissuance of a restricted - or potentially unrestricted - medical certificate, the following points should be considered: results of the cardiological examinations, e.g. invasive coronary angiography; a revascularisation procedure; long term follow-up CAD data; the overall cardiovascular situation; class of pilot or ATCO medical certificate; and type of operational activities.

The regulatory requirements for fitness consider these points!



CARDIOVASCULAR RISK

The role of cardiovascular (CV) risk factors

Atherosclerosis (plaque buildup or fatty deposits in the arteries) cause coronary artery disease, result in peripheral artery disease or in stroke. The risk for severe atherosclerosis is individually different. CV risk factors play a role for the formation of atherosclerosis; the more risk factors are present, the higher the risk. The most important CV risk factors are smoking, family history, lipid abnormalities, high blood pressure, obesity and diabetes. Except family history these risk factors can be mitigated by lifestyle measures and/or medication. AME can calculate the CV risk by using specific risk charts (SCORE2, SCORE2-OP and SCORE2-Diabetes) as described in the European Society of Cardiology-Guidelines. For pilots or ATCOs presenting with several of the CV risk factors mentioned above, a cardiovascular examination should be considered.



MICROVASCULAR DYSFUNCTION

Coronary microvascular dysfunction (CMD) is an important cardiac condition

Chest pain in patients without narrowing of the coronary arteries disease (obstructive CAD) can be caused by CMD. CMD has an increased risk for mortality and major adverse cardiac events. It should be considered if symptoms persist after diagnostic testing has ruled out obstructive CAD. CMD patients are diagnosed as angina with non-obstructed coronary arteries (ANOCA), or ischaemia with non-obstructed coronary arteries (INOCA). ANOCA/INOCA may be caused by impairment of myocardial perfusion.

Specific diagnostic examinations are used to evaluate CMD and different medication concepts are used for its treatment.



SHORTNESS OF BREATH

Causes of difficulty breathing (dyspnoea)

Dyspnoea is a common symptom of many diseases. It can be present only during physical exertion or already at rest. Acute dyspnoea occurs suddenly and is typical for an asthma attack or pulmonary embolism, but can occur in many other diseases. Chronic dyspnoea develops slowly, over weeks or months; it can be caused among others by a chronic lung disease or heart failure, or just by obesity, bad physical condition, status after transient illness like influenza. Acute dyspnoea requires immediate medical support. If chronic dyspnoea is present, in which its cause is not clear, it is advised to see the general practitioner or AME.

For the assessment of fitness of pilots or ATCOs, the presence of dyspnoea requires a clear medical diagnosis.



SYMPTOMS OF ATRIAL FIBRILLATION

How to notice possible atrial fibrillation (AF)?

AF is the most common fast irregular heart rhythm, its prevalence increases with age. 90% of AF patients describe symptoms with variable severity. There may be cardiac-specific symptoms such as irregular heart beat (palpitation), and non-specific symptoms including shortness of breath, fatigue, chest pain, dizziness, poor exercise capacity, fainting, anxiety, depressed mood, disordered sleep. But AF can also be completely asymptomatic. The presence or absence of symptoms is not related to incident stroke, systemic embolism, or mortality.

In case of suspected AF, pilots and ATCOs should be examined by a physician to verify or exclude this form of arrhythmia.



SCREENING FOR ATRIAL FIBRILLATION

The use of different screening tools for atrial fibrillation (AF)

The easiest way to screen for AF is pulse palpation to detect an irregular heart beat. Depending on frequency and duration of episodes, different ECG-based devices including 12-lead ECG, Holter (long-term) ECG, external or implantable loop or event recording, or tele-ECG can be used. Wearable devices including smart watches, smart phones, patches, textiles etc. are emerging on the market and can be divided into ECG-based and non-ECG-based devices, most of them working with photoplethysmography.

To establish the diagnosis of AF, an ECG is needed reviewed by a physician.



DIAGNOSTIC EVALUATION OF NEW ATRIAL FIBRILLATION

Diagnostic tests for individuals with newly detected atrial fibrillation (AF)

For all patients, medical history including family history is important to identify risk factors and/or comorbidities needing active treatment. A 12-lead ECG is warranted to confirm rhythm, determine ventricular rate, and look for signs of structural heart disease, conduction defects, or ischaemia. Blood tests should be carried out to detect any concomitant conditions that may exacerbate AF or increase the risk of bleeding and/or thromboembolism. An echocardiogram is recommended in the initial work-up. Other investigations will depend on individualised assessment and the planned treatment strategy.



AERO-MEDICAL FITNESS WITH ATRIAL FIBRILLATION

Criteria concerning fitness of pilots and ATCOs with atrial fibrillation (AF)

Important criteria for aero-medical fitness of pilots and ATCOs with AF are the number of AF episodes (single or recurrent), the overall cardiac situation, the amount of cardiovascular risk factors including the risk of stroke, the need for anticoagulation, and the symptomatology during AF episodes.

In many cases the continuation of pilot or ATCO duties is possible after referral to, or consultation with the licensing authority.



TREATMENT OF ATRIAL FIBRILLATION

Treatment options of atrial fibrillation (AF) for pilots and ATCOs

Treatment of AF is complex and should focus on several targets. Comorbidities and risk factors causing or facilitating AF should be treated. The need for anticoagulation to prevent stroke depends on the physician's assessment. In recurrent AF, symptoms can be reduced and sinus rhythm maintained by antiarrhythmic drugs or catheter ablation. As antiarrhythmic drugs are often associated with adverse effects not compatible with flying, catheter ablation can be recommended in many cases as the treatment of choice.

After successful treatment, return to pilot or ATCO duties is possible in most cases.



IRREGULAR HEARTBEAT

Is irregular heartbeat always a sign of atrial fibrillation (AF)?

Irregular heartbeat is an important sign of AF. But there are also other reasons for irregular heartbeat for example detected by wearable devices. It can also be caused by supraventricular or ventricular premature complexes/contractions (PAC or PVC), atrial flutter with irregular conduction, or heart blocks. Particularly in young people, an arrhythmia of a normal sinus rhythm can even be caused by respiration with an increase during inspiration and a decrease during expiration. Therefore, the cause of an irregular heartbeat should be clarified, preferably by an ECG.

An irregular heartbeat detected by wearable devices is not always indicative of AF. It can also be caused by other types of rhythm disturbances and should preferably be examined by an ECG.



FITNESS AFTER CATHETER ABLATION

Fitness of pilots and ATCOs after catheter ablation of arrhythmias

Catheter ablation is the treatment of choice for several arrhythmias including atrial fibrillation, atrial flutter, AV nodal reentrant tachycardias, accessory pathways, premature atrial complexes and atrial tachycardias, premature ventricular complexes and ventricular tachycardias etc. Healing of an ablation lesion takes about 2 months, short- and especially long-term success are variable depending on the type of arrhythmia. After catheter ablation, pilots and ATCOs are unfit for at least two months. They should then usually be restricted for a variable period of time, depending on flying class, cause of arrhythmia, ablation techniques, symptoms prior to ablation etc. The medical assessor of the licensing authority should be involved in the aero-medical assessment.

After catheter ablation, pilots and ATCOs are temporarily unfit; an individualised fitness assessment with tailored limitations should follow.



FITNESS AFTER CARDIAC PACEMAKER IMPLANTATION

When and under which pre-conditions can pilots and ATCOs perform their duties after cardiac pacemaker (PM) implantation?

After PM implantation, pilots and ATCOs are unfit for at least 3 months. With involvement of the licensing authority, they can then perform their duties, if there is no other disqualifying condition, if they are not fully PM dependent, if a bipolar lead system was used with sensing programmed in bipolar mode, and if they undergo regular follow-up examinations with PM checks at least every 12 months. In certain cases, imposing of limitations may be appropriate. Pilots and ATCOs may resume operational duties not earlier than 3 months following PM implantation, provided that all applicable preconditions are satisfied. In specific cases, the medical assessor of the licensing authority may impose restrictions on the exercise of privileges.



CONDUCTION SYSTEM PACING AND LEADLESS PACING

Can pilots and ATCOs perform their duties with conduction system pacing (CSP) or leadless pacing (LP)?

CSP includes His bundle pacing and left bundle branch pacing. It provides a more physiological ventricular pacing than right apical pacing. Requirements and preconditions for aero-medical fitness do not differ from right apical pacing.

LP has been developed to overcome complications with transvenous leads and subcutaneous pockets. Except requirements for lead configuration, preconditions for aero-medical fitness are the same as for conventional pacing with transvenous leads.

Preconditions of CSP and LP for aero-medical fitness do not differ from conventional right apical pacing with transvenous leads.



HEART BLOCK, BUNDLE BRANCH BLOCK, AND FASCICULAR BLOCK

Fitness of pilots and ATCOs with conduction disturbances

Pilots and ATCOs with first degree atrioventricular (AV) block or second degree AV block type Mobitz 1 are usually fit to perform their duties. Second degree AV block type Mobitz 2, and third degree AV block require full cardiological examination and are often not compatible with flying. Left and right bundle branch block require cardiological evaluation. Left anterior fascicular block is usually compatible with flying.

Certification of pilots and ATCOs with heart block, bundle branch block, or fascicular block shall be determined on a case-by-case basis, according to the type and clinical significance of the conduction disturbance. In the higher risk situations the medical assessor of the licensing authority should be involved in the aero-medical assessment.



SYNCOPE (“Fainting”)

Syncope is a temporary loss of consciousness due to a fall in blood pressure and consequent loss of blood flow to the brain

The most common form of syncope is reflex (vasovagal) syncope. Another form is orthostatic syncope, which occurs upon standing from a seated or supine position. A less common but more serious form is syncope of cardiac origin, which requires a thorough cardiological evaluation. In pilots and ATCOs, syncope is most often of the vasovagal type, caused by an exaggerated autonomic response that leads to a sudden drop in blood pressure and heart rate, resulting in transient loss of consciousness. It can for instance occur when viewing a needle during a blood test.

In risk assessment, recurrent vasovagal syncope should be evaluated differently from a single isolated episode.



SYNCOPE IN PILOTS AND ATCOs

How to assess the aero-medical fitness of pilots and ATCOs after a syncope?

The cause of syncope shall be evaluated, giving due weight to the applicant's history of the event and its circumstances in addition to the indicated diagnostic tests.

In case of a single episode of vasovagal syncope which can be explained, and which is unlikely to occur during performing aviation duties, a fit assessment of pilots/ATCOs may be considered. Applicants with a history of recurrent vasovagal syncope should be assessed as unfit. A fit assessment may be considered after a 6-month period without recurrence, provided cardiological evaluation and neurological evaluation, if indicated, are satisfactory.



HEART FAILURE

What does heart failure mean for pilots and ATCOs?

Heart failure describes the inability of the heart to pump enough blood to meet the body's needs. It can develop when the heart muscle is weakened or stiff, and it is usually a chronic and progressive disease. Typical symptoms include shortness of breath, fatigue, and swelling of the ankles. Diagnosis requires not only symptoms but also evidence from echocardiography, ECG, and laboratory tests.

A confirmed diagnosis of heart failure in pilots or ATCOs always requires aero-medical assessment, because even mild disease may adversely affect flight safety.



HEART FAILURE

Can heart failure be treated successfully?

Modern treatment with four classes of drugs (ACE inhibitors/ ARNI, beta-blockers, mineralocorticoid antagonists, SGLT2 inhibitors) significantly improves survival and quality of life. Additional options include device therapy like cardiac resynchronisation therapy (CRT) without or with cardioverter defibrillator (CRT-D) or left ventricular assist devices, and in selected cases heart transplantation. Even if cardiac function improves, treatment must be continued to prevent relapse.

Most cases of heart failure in pilots and ATCOs are incompatible with unrestricted medical fitness due to the need for ongoing therapy and the risk of relapse.



HEART FAILURE

Can pilots and ATCOs with heart failure ever be assessed fit to resume their aviation duties?

Pilots and ATCOs with symptomatic heart failure (NYHA II–IV), with reduced ejection fraction, or with device therapy must be assessed unfit to fly. In very mild and asymptomatic cases, a return to duties may be considered only after full stabilization and under strict cardiological follow-up.

For pilots and ATCOs, any heart failure represents a significant risk, and only carefully selected, mild cases may be compatible with limited duties.



CONGENITAL HEART DISEASE

What does congenital heart disease (CHD) mean for pilots and ATCOs?

CHD are structural heart defects present from birth. They range from very simple anomalies without symptoms to complex malformations with severe physiological consequences. In the general population, people with CHD are more likely to suffer from arrhythmias, chest pain, or hospitalizations. At high altitude, the lower oxygen pressure may further increase the associated risks.

For pilots, even mild congenital heart conditions warrant thorough evaluation, since the physiological demands of flight may unmask risks not evident at ground level.



CONGENITAL HEART DISEASE

Why are arrhythmias (rhythm disturbances) a concern in congenital heart disease (CHD)?

Adults with CHD have a high risk of developing arrhythmias, sometimes earlier than the general population. These may be related to the heart defect itself, surgical scars, or remodelling of the heart. Common are atrial tachycardias, intraatrial reentrant tachycardia, and atrial flutter, which can lead to rapid heart rates, hemodynamic compromise, and even sudden cardiac death.

For pilots and ATCOs, any CHD condition associated with significant arrhythmia risk is incompatible with operational duties, except for some bradycardias under pacemaker protection.



CONGENITAL HEART DISEASE

Can pilots and ATCOs with congenital heart disease (CHD) ever be assessed fit to fly or fit for ATC?

Simple congenital heart defects, especially if surgically corrected in childhood and without residual impairment, may be compatible with full or limited aviation duties. These include conditions such as bicuspid aortic valve, small septal defects, or a patent foramen ovale. In contrast, complex CHD, cyanotic conditions, Eisenmenger syndrome, or arrhythmia-prone conditions are generally incompatible with fitness of pilots and ATCOs.

For pilots and ATCOs, only simple, fully repaired congenital heart defects without residual risk can be accepted, while all complex or cyanotic cases usually lead to permanent unfitness.



MYOCARDIAL DISEASE

What does myocardial disease mean for pilots and ATCOs?

Myocardial diseases are conditions that directly affect the heart muscle. They include inflammatory causes such as myocarditis, genetic conditions such as hypertrophic cardiomyopathy, and infiltrative or restrictive cardiomyopathies. These diseases can impair heart function, trigger arrhythmias, or cause sudden cardiac death. Modern imaging, especially cardiac magnetic resonance imaging (MRI), is essential for diagnosis and risk assessment.

For pilots and ATCOs, any confirmed myocardial disease requires temporary unfitness until full clarification, because even mild forms may carry an unpredictable risk.



MYOCARDIAL DISEASE

What risks are associated with hypertrophic cardiomyopathy (HCM)?

HCM is a genetic disease of the heart muscle, often inherited. It may cause obstruction of blood flow, angina, arrhythmias, and sudden cardiac death, especially in younger individuals. Family history and genetic testing are important for risk stratification. Modern treatments, including medication and in some cases invasive therapies, have improved outcomes but do not eliminate the risk completely.

For pilots and ATCOs, HCM is a high-risk condition and usually incompatible with flying or ATC duties, except in mild and well-controlled cases.



MYOCARDIAL DISEASE

Why are restrictive cardiomyopathies so critical?

Restrictive cardiomyopathies (RCM) are rare but severe diseases where the heart muscle becomes stiff and filling of the heart is restricted. They are often caused by infiltrative or storage diseases such as amyloidosis, sarcoidosis, or hemochromatosis. RCM is associated with poor prognosis and a high risk of arrhythmia and conduction block. Diagnosis often requires magnetic resonance imaging (MRI), genetic testing, or biopsy to identify the exact cause.

For pilots and ATCOs, any significant RCM is incompatible with operational duties due to the risk of arrhythmias and severe physical limitation.



PERICARDITIS & ENDOCARDITIS

What do these diseases mean for pilots and ATCOs?

Pericarditis (inflammation of the heart sac) and endocarditis (infection of the inner heart lining or valves) are serious conditions that can lead to arrhythmias, heart failure, embolism, or compression of the heart due to inflammation fluid (tamponade). These conditions often require hospitalisation and intensive treatment. Non-inflammatory diseases of the pericardium and endocardium are very rare. As pericarditis and myocarditis often overlap and/or are combined, a new category “inflammatory myopericardial syndrome” (IMPS) recently has been defined.

For pilots and ATCOs, a diagnosis of pericarditis, IMPS or endocarditis always requires temporary unfitness, as the risk of sudden incapacitation is high.



PERICARDITIS

How does pericarditis affect aircrew fitness?

Pericarditis as well as inflammatory myopericardial syndrome (IMPS) present with chest pain and may be confirmed by ECG, echocardiography or cardiac magnetic resonance imaging (MRI). Complications include recurrent pericarditis or IMPS, pericardial tamponade, or restriction of heart filling. Treatment consists of anti-inflammatory medication and colchicine for several weeks. Recurrence occurs in up to 30% of cases.

For pilots and ATCOs, pericarditis and IMPS require at least several weeks of unfitness, and unrestricted return to operational duties is only possible after several months without recurrence.



ENDOCARDITIS

Why is endocarditis a critical condition?

Endocarditis is an infection of the heart valves or lining, diagnosed with clinical criteria, blood cultures and imaging according to the modified Duke criteria. Complications include persistent infection, embolism, arrhythmias, severe valve damage and heart failure. Treatment requires prolonged intravenous antibiotics and close monitoring for complications.

For pilots and ATCOs, endocarditis is incompatible with operational duties until treatment is completed, complications are excluded, and heart function is stable.



COVID-19 AND LONG COVID SYNDROME

Criteria concerning fitness of pilots and ATCOs

When having symptomatic COVID-19 disease, pilots and ATCOs are unfit. The situation with persistence of symptoms over months or even longer is labelled long COVID syndrome and its clinical manifestation is diverse. Applicants with symptoms suspicious for long COVID syndrome shall undergo an extended medical evaluation. If relevant symptoms such as myo- and/or pericarditis are present, pilots and ATCOs are unfit. Applicants who have recovered fully or partly from COVID-19 can be assessed fit without or with restriction. COVID-19 vaccination is safe and, like with any vaccine, side effects might occur but are usually not significant. Very rare side effects are myo- and/or pericarditis.



ATCOs – MEDICAL RISKS

Medical safety risk may be different for ATCOs compared to pilots

The majority of ATCOs work in an ATC team with monitoring and support (except Single Person Operations - SPO). The safety impact of incapacitating events is more severe in SPO than in ATC teamwork. Tower Controllers, Approach Controllers, and Area Controllers have different tasks and work environments which may lead to different stress and workload levels but may also have consequences concerning the sensitivity for electromagnetic interference (EMI) of cardiological devices, such as implantable cardioverter defibrillators (ICD).



CARDIOVASCULAR SAFETY RISK OF ATCOs

The differences between the various ATCO roles may lead to different considerations regarding fitness for the job in relation to safety and application of risk mitigating restrictions. It is e.g. considered that Tower and Approach Controllers may be exposed to more radiofrequency pulses and electromagnetic radiation than Area Controllers. Therefore, the fitness of Area Controllers needing an EMI-sensitive cardiological device may be considered in defined cases while this may not be considered for the other ATCO functions.

Acceptability of the risk requires careful consideration taking the work and environmental characteristics of ATCOs into account.



INCAPACITATION RISK

Cardiovascular safety risk evaluation for pilots and ATCOs

The CaVD-PACE matrix provides guidance to systematically estimate and document the risk during the period of validity of the medical certificate. To measure the safety impact of cardiovascular events, probability and severity (impact on flight safety) levels of each potential incapacitation event have to be defined.

Acceptability of the risk requires careful consideration taking into account the type of operation for which the risk is assessed (class 1 single pilot, multi-pilot, class 2, LAPL, ATC positions).



Cardiovascular safety risk evaluation for pilots and ATCOs

Step 1: Identify any actual or potential cardiological incapacitation event related to the diagnosis.

Step 2: Determine the annual probability of each potential medical event or condition identified in step 1.

Step 3: Determine the severity (effect on flight safety) for each potential event that was identified in step 1.

Step 4: Determine initial baseline risk level. Expected output is to determine whether the risk is acceptable or not (risk level green or red in CaVD-PACE matrix - see card 42).



Cardiovascular safety risk evaluation for pilots and ATCOs (continued)

Step 5: Identify risk mitigation strategies (restrictions) when risk level in CaVD-PACE matrix is orange or yellow.

Step 6: Re-apply the risk assessment matrix process considering the mitigation strategies identified in step 5 and re-determine the resulting risk level.

Step 7: Take decision and follow-up. Discuss the results of the aero-medical cardiovascular health assessment with the applicant.

Risk is estimated by considering the highest risk level of the potential incapacitating events of each condition.



Cardiovascular safety risk evaluation for pilots and ATCOs: CaVD-PACE matrix

CaVD-PACE MATRIX		Catastrophic - A	Hazardous - B	Major - C	Minor - D	Negligible - E
Cardiovascular risk assessment		May cause catastrophic event	may cause flight safety critical event	May compromise flight safety	Reduced effectiveness and capacity to adapt to operational requirements	Minimal impact on flight safety
	Frequency of a single event per year	Total incapacitation	Severe incapacitation	Major decrement on performance	Minor to moderate performance compromise, may continue duties	Minimal impact on performance
5 Frequent	>99%	5A	5B	5C	5D	5E
4 Probable	60 -99%	4A	4B	4C	4D	4E
3 Occasional	10 -60%	3A	3B	3C	3D	3E
2 Remote	1 - 10%	2A	2B	2C	2D	2E
1 Improbable	<1%	1A	1B	1C	1D	1E
Frequency is given for the occurrence of one single event per year irrespective of occurrence while being on duty or not. Frequency of >99% means that at least one event per year is expected to occur. Occasional means a 10-60% risk of occurrence of one event per year, etc.						
	Risk unacceptable				* Operational limitations as listed in MED.B.001, ATCO.MED.B.001 and applicable AMCs. Personal risk factors could be close follow-up by cardiologist, treatment, prevention, etc. Formalised risk reduction is documented and required in the certificate.	
	Risk unacceptable, but may in some cases be acceptable after thorough review and specific mitigation(s).*					
	Risk may be acceptable - requires operational and/or personal risk mitigation*					
	Risk acceptable					

