Continued Airworthiness Notification

Subject: Preventing Carbon Monoxide Poisoning in Piston Engine Aircraft

Date: 19 August 2021

For the attention of: Aircraft Operators

Applicability:
All piston engine aircraft have the potential for Carbon Monoxide (CO) poisoning from cracked exhaust units and unserviceable heat exchange assemblies. This situation can be further exacerbated by the CO gas penetrating through an unsealed firewall and can go unnoticed through the fitment of inadequate or inappropriate CO detection units.

Purpose:
This Continued Airworthiness Notification (CAN) is to inform operators and aircraft engineers of the dangers of potential CO poisoning via leaking exhaust collectors, heater muffs and openings in engine firewalls. Whilst audible/visual CO detectors are not mandated by CAAT, they are available for personal awareness of CO.

Recommendations:
Operators should conduct thorough visual inspections of exhaust collectors and heat exchange units, with the intention of identifying potential CO poisoning points/cracks. Whilst the internal condition and thickness of exhaust components is difficult to determine visually, if the component exhibits signs of thinning, cracking, bulging or any exhaust leakage the section should be removed and replaced with a new or serviceable/repaired item.

Pilots may consider wearing personal CO detectors. As not all aircraft are required to have CO detectors fitted, small electronic personal devices are readily available. If the aircraft is only fitted with a placard type CO indicator, the operator should ensure the placard is placed in the field of view of the pilot, is regularly checked to ensure that the placard is not time expired and that the indicator is not faded from ultraviolet exposure or contamination.

CO Spot Detectors are limited by the following issues:
- Lack of attention getting capability
- Frequent replacement requirement - every 3 months
- Do not show the level of CO
- Some can revert back to their original colour when exposed to fresh air

Finally, operators should be aware of the cumulative effect of CO. Exhaust tail pipes are designed for forward flight with the dispersion of exhaust gases rearwards. Lengthy engine run-ups and taxi periods with tail or cross winds can draw the exhaust into the cabin. Pilots should ensure adequate fresh air ventilation is available to them and that the aircraft is directed into the wind.

Reference:
AWB 02-064 Issue 3 – 3 August 2021 - Preventing Carbon Monoxide Poisoning in Piston Engine Aircraft

Should you have any questions, please contact
CAAT Airworthiness and Aircraft Engineering Department
Email: airworthiness@caat.or.th

Airworthiness Bulletin

AWB 02-064 Issue 3 – 3 August 2021

Preventing Carbon Monoxide Poisoning in Piston Engine Aircraft

An Airworthiness Bulletin is an advisory document that alerts, educates and makes recommendations about airworthiness matters. Recommendations in this bulletin are not mandatory.

1. Effectivity

Crew and passengers in piston engine aircraft have the potential for Carbon Monoxide (CO) poisoning from cracked exhaust units and unserviceable heat exchange assemblies. This situation can be further exacerbated by unsealed penetration through firewall and can go unnoticed through the fitment of inadequate or inappropriate CO detection units.

2. Purpose

To advise owners, operators and aircraft engineers of the dangers of potential CO poisoning via leaking exhaust collectors, heater muffs and openings in engine firewalls. Whilst audible/visual CO detectors are not mandated, they are available for personal awareness of CO.

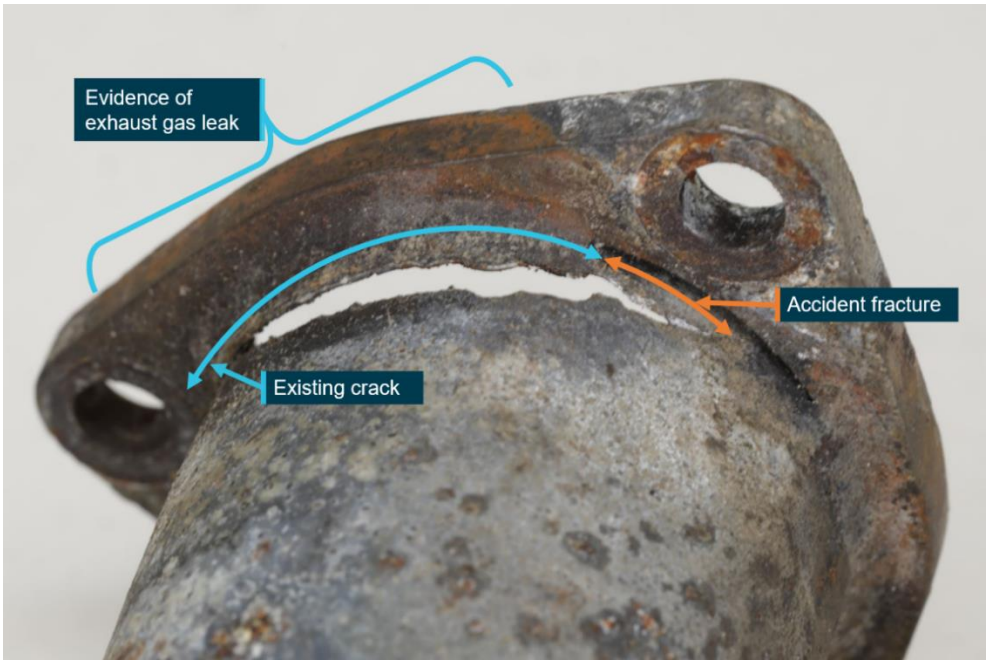

Figure 1

Engine exhaust unit potential to leak CO into the aircraft cabin. Image provided by Australian Transport Safety Bureau.

3. Background

A recent aviation incident investigation by the Australian Transport Safety Bureau (ATSB) has revealed that several of the occupants of the incident aircraft had elevated levels of Carbon Monoxide (CO) within their blood samples. The detailed investigation of the aircraft has revealed three main factors to be considered relating to CO.

Firstly, the exhaust collector assemblies on piston powered aircraft are a known source of CO. Manufacturer's instructions for continued airworthiness (ICA) require regular inspection of exhaust pipe collectors and heat exchangers. Their useable life is centred on an "on condition" maintenance inspection philosophy and as such requires increased vigilance with ageing exhaust components.

Secondly, the CO potentially enters the cabin either via heating ducting, open voids in the engine firewall or open doors and windows. Whilst the latter two are unavoidable, the firewall integrity, heating ducting and control valves need to be inspected to ensure correct operation and sealing. Modifications and access panels installed within firewalls for maintenance must be re sealed and secured correctly following all maintenance actions.

Finally, the fitment of placards designed to change colour when exposed to CO may not necessarily provide adequate warning to the pilot and passengers of the elevated levels of CO within the cabin. More modern devices which include audible and improved visual warnings are more suited to detect and warn cabin occupants of the elevated levels of CO.

Figure 2

Engine firewall openings that may be required to be opened for maintenance and repairs must be correctly fastened and sealed prior to flight thus preventing CO from entering the cabin.

It should be noted that CO is produced by incomplete combustion of fuel. CO is odourless and tasteless. For more information on these effects refer to UK CAA Carbon Monoxide in General Aviation landing page.

Additional information related to Carbon Monoxide can be obtained from *The United States report DOT/FAA/AR-09/49 on Detection and Prevention of Carbon Monoxide Exposure in General Aviation Aircraft*. This report provides information in relation to the symptoms resulting from various exposure levels of CO in Table 1.

4. Recommendations

The Civil Aviation Safety Authority recommends that when LAME/AMEs conduct visual inspections of exhaust collectors and heat exchange units, that a thorough inspection is conducted with the view of finding potential CO poisoning points/cracks. Whilst the internal condition and thickness of exhaust components is difficult to determine visually, if the component exhibits signs of thinning, cracking, bulging or any exhaust leakage the section should be removed and replaced with a new or serviceable/repaired item.

An ideal maintenance program would involve exhaust system replacement at engine change or at a predetermined interval gained from operating experience. To operate these items to a point of failure is not considered appropriate, the maintenance repair organisation or CAMO can instigate a periodic CO detection functional test during which the CO level in the cabin is measured. Quantitative CO must be used and the CO level entering the cabin must be less than 1 part in 20000 parts of air (equivalent to 50 parts per million).

Additionally, any modification or reduction in the length of the tail pipe/exhaust system must be conducted with original equipment manufacturer approval or local Australian CASR Part 21 approval.

Approved modifications that include access panels and attachments to firewalls must be re-sealed following all disturbances to prevent CO entering the cabin. Heating ducts and on/off valves should function correctly, particularly in the off position to allow the pilot to stop the flow of contaminated air entering the cockpit. If an access panel on the engine firewall is opened/removed during maintenance/servicing for gaining access, ensure that the access panel seals/gaskets and hardware are reinstalled correctly to prevent the flow of gases and flammable fluids entering the cockpit and cabin.

CASA strongly recommends pilots wear personal CO detectors. As not all aircraft are required to have CO detectors fitted, small electronic personal devices are readily available at affordable prices. These devices allow for continual monitoring of CO levels with audible and visual warnings when escalated CO levels are detected.

Figure 3

Electronic CO detector devices available for personal use.

Aircraft certified and hard-wired products are also available that can be installed by approved maintenance repair organisations. Reliance on only the visual CO indicator placard, that changes colour in the presence of CO, is considered suboptimal.

If the aircraft is only fitted with the placard type CO indicator, the operator should ensure the placard is placed in the field of view of the pilot, is regularly checked to ensure that the placard is not time expired and that the indicator is not faded from ultraviolet exposure or contamination.

CO Spot Detectors are limited by the following issues:

- Lack attention getting capability
- Frequent replacement every 3 months
- Do not show the level of CO
- Some can revert back to their original colour when exposed to fresh air

The UK CAA has published information on Carbon Monoxide Detectors. The Clued Up Passive or Active article explains the physiological effects of Carbon Monoxide poisoning.

Finally, operators of piston engine aircraft should be aware of the cumulative effect of CO. Exhaust tail pipes are designed for forward flight with the dispersion of exhaust gases rearwards. Lengthy engine run up's and taxi periods with tail or cross winds can draw the exhaust into the cabin. Pilots should ensure adequate fresh air ventilation is available to them and that the aircraft is directed into the wind.

5. Reporting

All defects found when examining exhaust sections ducting, heat exchangers and firewall assemblies should be submitted to CASA via the Defect Reporting system.

6. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link email address:

AirworthinessBulletin@casa.gov.au

or in writing, to:

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National Operations and Standards Division
Civil Aviation Safety Authority GPO Box 2005, Canberra, ACT, 2601