



National Transportation Safety Board
Washington, D.C. 20594
Safety Recommendation

Date: March 18, 1993

In reply refer to: A-93-43 through -45

Mr. Joseph M. Del Balzo
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On June 18, 1992, a Cessna 207 airplane, N23CF, operated as an unscheduled domestic passenger flight by Hageland Aviation of Bethel, Alaska, experienced a total loss of engine oil pressure followed by total loss of engine power. The losses occurred while the airplane was climbing through 500 feet (above ground level and mean sea level) after takeoff from Quinhagak, Alaska. After a forced landing, the pilot and four passengers were not injured, but the airplane was substantially damaged. Postaccident inspection of the engine compartment revealed that a spin-on oil filter adapter, Cessna Aircraft Company P/N 1250922-1, had separated from the oil pump housing, allowing oil to flow out of the engine.

Metallurgical examination of the adapter at the Safety Board's materials laboratory disclosed that the adapter-to-oil pump threads (about 2-inch diameter) were severely worn along the thread crowns and that many thread fragments had separated from the adapter. Further, examination of several thread crowns containing pre-existing fractures showed that damaged adapter threads had been grit blasted and then installed in the airplane. The Safety Board has been unable to ascertain why this action was taken.

Spin-on adapters identified by P/N 1250922-1, -2, -3, -4, and -5 are manufactured by Cessna as part of a Cessna accessory kit to replace the factory-installed integral oil screen on Teledyne Continental Motor (TCM) O-470, IO-470, TSIO-470, O-520, IO-520, and GTSIO-520 series engines. The accessory kit, also known as a "full flow" engine oil filter system, is composed of a spin-on adapter and attaching canister-type oil filter that removes smaller particles from the engine oil than does the simple integral screen filter.

Cessna manufactures other full flow spin-on oil filter adapters that are similar in design to P/N 1250922. These adapters are identified by P/Ns 0450404-1 and -3, 0556004-1, 0556010-1, 0631333, 0631645, 0633324, 1250403-6, 1250417, and 1250921.

Cessna airplanes using spin-on adapters include models 150, A150, F150, FA150, 172, F172, 180, 182, A182, F182, 185, 188, 205, 206, P206, U206, 207, 210, P210, T210, 310 (from 1967 to 1974), 336, and 337. Other domestic airplane models using Cessna spin-on adapters include Aero Commander 200D, 500A, 500C, 500D and 685; Beech models 33, 35, 36, and 55 series; Bellanca 260, and Bellanca Viking 300; Navion Rangemaster and Ryan Navion (L-17); Piper PA-46 Malibu; and Wren 460.

Federal Aviation Administration (FAA) Supplemental Type Certificates (STC) for engine models TCM O-470, IO-470, TSIO-470, O-520, IO-520, and GTSIO-520 indicate that "a full flow oil filter may be used with these engines if the installation incorporates [a] filter bypass valve which opens between 12 and 16 psi. The oil filter [pump] housing is eligible for direct mounting of oil filter equipment having [a] maximum weight of 6 lb. and overhang moment of 25 in.-lb." All spin-on adapters manufactured by Cessna contain a bypass valve to allow the oil to circumvent the oil filter should the oil filter become clogged.

A review of FAA Service Difficulty Reports revealed that between August 29, 1985, and December 30, 1992, there were nine reported occurrences in which an adapter separated from the oil pump housing, resulting in loss of engine oil. All nine separations occurred on Cessna airplanes powered by TCM IO-470, and IO-520 series engines that had been modified by the installation of Cessna spin-on adapters. In two of the nine cases, the engine seized during flight, causing the airplane to crash. Two injuries were reported in one of these cases, and a serious injury was reported in the other. Adapter thread damage was observed and specifically mentioned in seven of the reported occurrences.

The failure of Cessna spin-on oil filter adapters in some Beech Aircraft Corporation airplanes was the subject of General Aviation Airworthiness Alert Advisory Circular (AC) 43-16, issued by the FAA in July 1992. The AC states that Beech models 33, 35, and 36 series airplanes powered by TCM IO-470 and IO-520 series engines "modified by the installation of a Cessna spin-on adapter (P/N 1250922)" have made forced landings due to loss of engine oil. In each case, the cause of the oil loss was traced to the failure of the aluminum threads on the adapter. According to the AC, neither Beech nor TCM approves the installation of a Cessna spin-on adapter. The AC further recommends that Beech airplanes modified with such spin-on adapters be frequently inspected for evidence of oil leaks.

Cessna believes the spin-on adapters are adequately designed and should provide trouble-free use if the threads are undamaged and if the adapters are installed in accordance with instructions in the Cessna service manuals. These manuals state that the adapter nut is to be tightened against the oil pump housing to a preload torque range between 50 to 60 ft.-lb. using a Cessna wrench adapter P/N SE709, or with a wrench manufactured from a 0.5-inch AISI 4130 steel plate.

Spin-on adapters are prone to thread damage if they are not installed according to the manufacturer instructions. Torque applied to the adapter nut by pliers, wrench, or channel lock cannot be measured and could result in an over- or undertorqued nut. Overtorque can deform and strip the threads located on the aluminum adapter, whereas undertorque can cause the adapter to lose the preload torque. Both conditions can lead to oil leaking from the engine.

The Safety Board is concerned that airplanes with Cessna spin-on oil filter adapters may be operating with undetected adapter thread damage or improper torque relative to the adapter nut. Thus, the Board believes that the FAA should require operators to inspect the adapter-to-oil pump threads for damage and to discard adapters containing thread damage. The inspection should occur during the next 100-hour or annual inspection, or major engine overhaul, whichever occurs first. Further, operators should be required to verify, by use of a torque wrench, that the adapter nut has been tightened to within the preload torque value range specified in the Cessna service manual. Torque verification should be made any time the adapter nut is tightened against the oil pump housing.

Movement or rotation of the adapter nut relative to the adapter or oil pump housing could affect the preload torque. Inspections of the spin-on adapters could be aided by measures to alert personnel of the possible movement or rotation of the nut since the previous engine inspection; such measures would also emphasize the need for a preload torque check or corrective action. Although the adapter nut is secured to the adapter by safety wires, this safety feature does not provide an indication of movement of the adapter nut. Further, neither the adapter nor the nut contain reference marks that could be used to indicate movement. However, torque paint or putty--if applied between the adapter, nut, and oil pump housing after tightening the adapter nut to the oil pump housing--could be a useful measure in later inspections. Breaks and misalignment in the torque paint or putty observed during periodic inspections would indicate movement of components from their originally installed position. Thus, the Safety Board believes that operators should apply torque paint or putty between the adapter, nut, and oil pump housing each time the adapter nut is tightened to the oil pump housing with the proper preload torque value range, and that periodic inspections of the integrity and alignment of the paint/putty should be made to verify that the assembly has not rotated from the as-assembled position. Inspection, at the minimum, should occur after each time the oil filter is changed.


The Safety Board believes that action should be taken to minimize the potential for separation of spin-on adapters that could result in the loss of engine oil and power during flight and loss of property, serious injury, or death.

Therefore, The National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an airworthiness directive to operators of airplanes equipped with engines that use Cessna Aircraft Company spin-on type oil filter adapter P/N 1250922, or any spin-on adapter of similar design, to require:

- Inspection of the adapter-to-oil pump threads for damage and removal of adapters containing thread damage. This inspection should occur during the next 100-hour or annual inspection, or major engine overhaul, whichever occurs first. (Class II, Priority Action) (A-93-43)
- Verification each time the adapter nut is tightened to the oil pump housing, by use of a torque wrench, that the adapter nut has been tightened to within the preload torque value range specified in the Cessna service manual. Application of torque paint or putty between the adapter, nut, and oil pump housing should follow verification of the preload torque. (Class II, Priority Action) (A-93-44)
- Periodic inspection of the integrity of the torque paint or putty each time the oil filter is changed. If the torque paint or putty is broken or misaligned, reinspect the adapter-to-oil pump threads for damage, verify proper torque to the nut, and reapply torque paint or putty as described in Safety Recommendations A-93-43 and 44. (Class II, Priority Action) (A-93-45)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in these recommendations.



By: Carl W. Vogt
Chairman