



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Log 1918

Date: March 19, 1987

In reply refer to: A-87-22 through A-87-24

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D. C. 20591

The nose compartment baggage doors in Piper PA-34 Seneca airplanes have a history of opening inflight. Since 1974, such occurrences have resulted in 10 reported accidents or incidents (see attachment). Additionally, the discovery of baggage door conditions that did or could cause such a hazard resulted in 34 Service Difficulty Reports (SDRs) being submitted to the Federal Aviation Administration (FAA) ¹/. Several of the reports refer to delamination of the door, cracking of the fiberglass in the area of the door hinge, and faulty door latching/locking mechanisms. Also, in several cases, the baggage door, or the contents from the baggage compartment, struck and damaged the propeller, windshield, or empennage after separating from the airplane inflight. The National Transportation Safety Board is concerned that similar circumstances may have been a factor in some catastrophic Seneca accidents where the probable cause included the finding "design stress limits of aircraft-exceeded," as well as in certain other fatal Seneca accidents that have occurred for "undetermined reasons."

Many of the unwanted baggage door openings in Seneca airplanes take place at low speed during takeoff, particularly at liftoff, or at approach speeds when the landing gear is extended. They probably result from the combined effects of vibration, flexure of the fiberglass nose compartment, and/or the aerodynamic pressure distribution produced on or around the baggage door. In such instances, the airplane is often damaged as the result of the door tearing away, debris striking a propeller, or an overrun during an aborted takeoff. Nevertheless, most such occurrences are classified as incidents and may merely result in the filing of an SDR.

If, however, the nose baggage door opens at high cruise/descent speeds and/or in turbulence, the situation is more hazardous. Items in the baggage compartment that are unsecured might thrash about against the baggage door in turbulence and cause it to open. Substantial changes in magnitude and direction of the aerodynamic pressure acting on the door as a unique or combined result of the increased airspeed, pilot-induced maneuvers,

¹/ Approximately one-third of the SDRs (11) resulted from inflight opening of PA-34 nose compartment baggage doors, but the occurrences were never officially or separately reported as incidents.

airplane sideslip, or gusts, may also cause it to open. If the door does open, it acts as a small airfoil, is free to flail up and down about its upper hinge, and sheds a strong vortex that is likely to impinge on the empennage and adversely affect pitch control of the aircraft. Unsecured items in the baggage compartment, as well as the door itself, if it tears away, are also likely to strike the airplane's propeller, windshield, and empennage, and may result in or induce catastrophic structural damage or overload.

The specific mechanical faults associated with the door itself that allow such unwanted openings often relate to delamination, inadequate latching/locking, inadequate rigging, or inadequate maintenance. However, the Safety Board believes that the design of the baggage door's latching/locking mechanism has proven to be physically fragile, maintenance-intensive, and operationally inadequate and, therefore, should be modified to substantially improve the door's mechanical reliability and safety. An effort should also be made to provide for double failure protection through secondary locking devices.

On September 20, 1979, the Piper Aircraft Corporation issued Service Bulletin No. 633A, "Forward Baggage Door Inspection and Modification" applicable to PA-34-200 and PA-34-200T Seneca airplanes. On October 3, 1980, Piper issued a revision, Service Bulletin 633B, dealing with the same subject. These bulletins were the subject of Airworthiness Directives (AD) 79-23-01 and 81-10-03, respectively, which were issued "to prevent the possible inflight opening of the forward baggage door, with resulting pilot distraction and possible structural damage to the aircraft."

Service Bulletin 633A is divided into three parts:

Part I, "Preflight and Postflight Inspection";

Part II, "Inspection and Rigging Checks" (at 25 hour time-in-service intervals until Part III has been accomplished);

and

Part III, "Modification," forward push rod and latch/lock mechanisms (at the next regularly scheduled progressive, 100-hour or annual inspection, but not to exceed 100 hours of operation).

Service Bulletin 633B incorporated an additional part for safety wiring of the latch mechanism roll pin: Part IV, "Roll Pin Safety" (to be accomplished within the next 10 hours of operation).

Airworthiness Directive 79-23-01 indicates that after compliance with Part III, compliance with Parts I and II is no longer required. Airworthiness Directive 81-10-03 required compliance with part IV of Service Bulletin 633B. Parts III and IV were to have been accomplished within 150 hours and 25 hours time-in-service, respectively, after the effective dates of the ADs. However, since 1980, 5 of the aforementioned accidents or incidents occurred and 10 of the SDRs were filed despite evidence, in a substantial number of cases, of compliance with the airworthiness directives. Moreover, three of the occurrences involved Seneca Model PA-34-220T airplanes (introduced in 1981), in which the baggage door modifications had been installed during manufacture. The following comments from reports of these occurrences are instructive:

Safety wire broke, roll pin fell out and door handle was lost in flight;

Forward baggage door came open in flight, no lock washer installed under nut of doorlock;

Found baggage door rod broken, lock failed in flight;

Nose baggage door opened on rotation, baggage fell out, damaged 2 left propeller blades;

Baggage door lock mechanism defective, door can open in flight;

Front baggage door came open during takeoff run, pilot unable to stop aircraft, ran off departure end.

As a result of these and other inflight cases of nose baggage doors opening in Seneca airplanes, the Parts III and IV modifications, particularly those relating to the lock mechanism, appear to have been inadequate. As a result, the Safety Board believes that the FAA should again make Parts I and II mandatory until more substantial improvements are incorporated in the nose baggage door latching/locking mechanisms. Additionally, the FAA should also require the use of tiedown straps or nets to secure any baggage or other items carried in the nose baggage compartment during flight.

The Safety Board believes that the inflight opening of nose compartment baggage doors in Piper Seneca and other airplanes can be alleviated or prevented by design changes to make the baggage door "failsafe." Aerodynamic forces acting on a door that is ajar, for example, should stabilize the door's position or tend to close the door rather than open it further. The FAA and each of the respective airplane manufacturers should attempt to accomplish this design safety objective in connection with the certification of new airplanes and in conjunction with related design modification efforts. Moreover, the FAA should also encourage aviation after-market suppliers, designers, and manufacturers to develop and design such failsafe baggage doors for installation in accordance with the supplemental type certification process.

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

Issue an Airworthiness Directive applicable to all Piper Seneca Model PA-34 series airplanes requiring compliance with Piper Service Bulletin No. 633B, Part I, "Preflight and Postflight Inspection," relating to the forward baggage door, specifically mandating the use of tiedown straps or nets to secure any baggage or other items carried in the nose baggage compartment during flight; and Part II, "Inspection and Rigging Checks," except that these checks need be performed only during annual or 100-hour inspections rather than at 25-hour intervals. These requirements should remain effective until substantial design improvements have been incorporated in the nose baggage door latching/locking mechanisms, as outlined in the succeeding recommendation. (Class II, Priority Action) (A-87-22)

Require the Piper Aircraft Corporation to develop an appropriate design modification that will substantially improve the mechanical reliability and safety of existing Piper PA-34 nose baggage doors. An effort should be made to develop a more positive, reliable locking mechanism and provide for double failure protection through secondary locking devices.

The design of a completely new baggage door should also be considered for incorporation on newly manufactured Senecas. The new design, through appropriate location of door hinges and/or stabilizing aerodynamic pressures, should ensure that no degradation of flight control occurs as a result of the door opening (becoming ajar) inflight. (Class II, Priority Action) (A-87-23)

Encourage, by direct letter or general advisory, aviation aftermarket suppliers, designers, manufacturers, and holders of existing supplemental type certificates to design and develop nose compartment baggage doors with improved safety characteristics for the Piper Seneca and other airplanes. The improved doors should incorporate highly reliable latching/locking mechanisms and be failsafe; that is, no degradation of flight control should occur even if the door should become unlatched (ajar) inflight. (Class Priority Action) (A-87-24)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER and NALL, Members, concurred in these recommendations.


by: Jim Burnett
Chairman

ATTACHMENT

PIPER PA-34 SENECA AIRPLANE ACCIDENTS AND INCIDENTS
INVOLVING INFLIGHT OPENING OF NOSE COMPARTMENT BAGGAGE DOORS

1974 Through 1986

<u>Date</u>	<u>Location</u>	<u>Registration No.</u>	<u>Classification</u>
8/2/74	Washington, D.C.	N1067U	Incident*
9/19/75	Boston, MA.	N56121	Incident*
4/24/78	Indianapolis, IN.	N9053K	Incident**
11/19/78	Cape Haitian, HA.	N31725	Incident**
8/13/79	Hickory, N.C.	N55321	Incident**
7/10/80	Albert Lea, MN.	N7021C	Accident*
10/2/80	Ypsilanti, MI.	N15445	Incident**
8/17/82	O'Neill, NE.	N8107D	Incident**
12/2/82	Palo Alto, CA.	N8292Y	Accident*
12/28/83	Westfield, MA.	N2119D	Incident**

NOTE-There were also 11 SDRs submitted during the above period as a result of inflight opening of PA-34 nose compartment baggage doors, but the occurrences were never officially or separately reported as incidents.

* Documented in NTSB Accident/Incident Files.

** Documented in FAA Accident/Incident Data System.