

Log 1936



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

**Date:** January 9, 1987

**In reply refer to:** A-86-135

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

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During the period 1978 through 1985, the National Transportation Safety Board investigated 18 accidents stemming from aircraft misfueling as enumerated in the attached aircraft misfueling accident summary. Fourteen of the accidents occurred during the critical takeoff initial climb and four occurred during the climb to cruise altitude. In all cases except one, the aircraft were light, twin-engine, piston-powered airplanes that had been misfueled with jet fuel instead of the required aviation gasoline (Avgas). As a result, 15 people were killed and 6 were injured seriously. Additionally, according to reports from the Federal Aviation Administration's (FAA) National Safety Data Branch, there were five aircraft misfueling incidents recorded during the period 1980 through 1986 involving four twin-engine, piston-powered airplanes, and a helicopter.

In recent years, the Safety Board has issued several safety recommendations to prevent misfueling accidents. For example, in Safety Recommendations A-82-140 and -141, the Board recommended that the General Aviation Manufacturers Association (GAMA):

A-82-140

Convene a meeting of representatives of the aviation and petroleum industries to examine the practicality of standardizing and modifying nozzles and tank openings throughout the aviation fuel distribution system from the refinery to the airplane so that jet fuel cannot be inadvertently delivered to tanks intended for the containment of aviation gasoline (Avgas).

and

A-82-141

Coordinate the action by the aviation fuel distribution industry to implement measures in the distribution system that will positively prevent the inadvertent fueling of reciprocating engine-powered aircraft with jet fuel.

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As a result, the subject of aircraft misfueling was given considerable attention by government and industry, and the efforts of a joint aircraft misfueling task force resulted in several significant remedial actions designed to prevent misfueling. Color-coded aircraft safe fueling decals specifying the correct fuel for particular aircraft were made available; Service Bulletins were issued by the respective manufacturers recommending that exterior logos, decals, lettering, or markings containing such words as "Turbo," "Turbocharged," or "Turbopowered" be covered, painted, or removed; and fuel port restrictor kits were developed by Shaw Aero Devices, Incorporated, for installation on most piston-powered aircraft. Installation of the kit, which essentially consists of a fuel port adapter insert and a new fuel cap, reduces the diameter of the fuel filler port, and precludes insertion of the larger-diameter jet fuel nozzles. Since January 1, 1985, the reduced-diameter fuel ports have been incorporated on most newly manufactured airplanes as an integral part of the design. Safety Recommendations A-82-140 and -141 were classified as "Closed—Acceptable Action" on November 5, 1982, and December 4, 1985, respectively.

On January 22, 1986, GAMA petitioned the FAA to require installation of anti-misfueling hardware such as the fuel port restrictors in "high risk" airplanes. The petition was published in the Federal Register on May 27, 1986, for public comment. However, none of these misfueling prevention aids, which may be used by a majority of the general aviation fleet, has been made mandatory by the FAA and many owners/operators have not installed the fuel port restrictors developed by Shaw or an equivalent device developed by the respective airplane manufacturer. The Shaw fuel filler port restrictor kits are relatively inexpensive, approximately \$35 each, and are approved by the FAA for installation without the use of special skills or tools by the holder of a pilot certificate.

Remarks taken from several misfueling accident reports which exemplify typical misfueling circumstances include: "The lineman had inadvertently used the Jet-A fuel truck which was identical to the Avgas truck except for a decal, approximately 4 inches by 16 inches, which identified the type of fuel. When he went to refuel N89PB prior to the accident flight, he went to the parking space where the Avgas truck was normally parked, but on that occasion, the Jet-A fuel truck was there"; "The line attendant who serviced the aircraft mistook it for a King Air. The pilot requested that all four tanks be topped off. The line attendant added 110 gallons of Jet-A fuel"; "Refueling of the aircraft with jet fuel immediately prior to the accident was accomplished by an experienced lineman who had completed the General Aviation Manufacturers Association's lineman training video tape program. The aircraft and fuel trucks were marked in standard fashion with appropriate placards"; "The FBO personnel misunderstood the pilot's request and refueled the aircraft with Jet-A instead of aviation grade gasoline"; "The truck containing Jet-A fuel looked similar to the one with 100LL Avgas, but was properly designated with fuel grade markings"; and "Aircraft refueled March 8, 1981, with 100LL Avgas and March 20, 1981, with Jet-A fuel by the same individual."

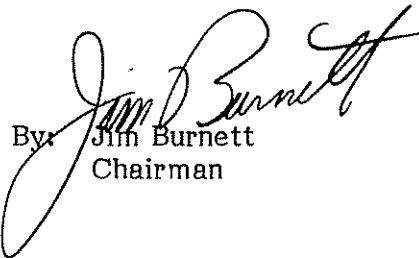
In recent years, the frequency of misfueling with jet fuel has increased significantly. For example, during the period 1964 through 1977, only 5 accidents of this kind occurred as compared to 18 such occurrences during the 1978 through 1985 period. Consequently, despite past government and industry efforts to prevent them, the continuance of incidents and catastrophic accidents involving misfueling is of considerable concern, particularly in view of the increased use of light, twin-engine, piston-powered airplanes in corporate/executive and air taxi passenger operations.

All of the accidents and incidents (see attachment) except one could have been prevented if a fuel filler port restrictor had been installed in the aircraft to preclude the misfueling occurrence (the exception was file No. 3-3978, a case where the Avgas truck itself had been filled with jet fuel). Some of the airplanes involved, such as the Piper PA-31 Navajo, resembled their jet-prop counterparts, i.e., the Piper PA-31 Cheyenne. Moreover, 19 of the 23 misfueling occurrences in the attached summary involved only three basic groups of airplanes: the Piper PA-31 series (the airplanes that are misfueled most often); the Gulfstream Commander 500/600/700 series; and the Cessna 300/400 series. When pre-1978 misfueling occurrences are considered, the Piper (Aerostar) 600/700 series airplanes also appear to be at risk. Consequently, the Safety Board believes that most of the misfueling accidents would be prevented if fuel filler port restrictors were installed in these airplanes.

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

Issue an Airworthiness Directive applicable to piston-powered Piper PA-31 series; Piper (Aerostar) 600/700 series; Gulfstream Commander 500/600/700 series; and Cessna 300/400 series airplanes requiring that fuel port restrictors, such as those manufactured by Shaw Aero Devices, Incorporated, or the respective aircraft manufacturer, be installed to prevent misfueling. (Class II, Priority Action) (A-86-135)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER AND NALL, Members, concurred in this recommendation.

  
By: Jim Burnett  
Chairman

**AIRCRAFT MISFUELING SUMMARY  
U.S. GENERAL AVIATION**

**Accidents  
1978 Through 1985**

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
933	2/6/85	Lynchburg, Virginia	Piper PA-31- 350 N3528U; substantial damage		1		Positioning

As the gear was retracting after takeoff, the aircraft began to lose power. The pilot could detect no yaw to either side. When the aircraft was about 50 feet off the ground, the tower informed the pilot that vapor or smoke was trailing from the left engine. The pilot acknowledged that he had a problem. The pilot then planned and executed a forced landing into trees at the departure end of the runway 21 at Lynchburg Municipal Airport. Examination of the wreckage by an FAA representative revealed large quantities of jet fuel throughout the fuel system of the aircraft. Refueling of the aircraft immediately prior to the accident was accomplished by an experienced lineman who had completed the General Aviation Manufacturers Association's lineman training video tape program. The aircraft and fuel trucks were marked in standard fashion with appropriate placards.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
2503	9/7/84	Naples, Florida	Cessna 402C N89PB; destroyed	1	2	3	Air Taxi, Scheduled, Domestic, Passenger

Shortly after takeoff, both engines lost power and a wheels up landing was made in an open field. The aircraft was destroyed by impact and fire. An investigation revealed that the aircraft had been refueled with Jet-A fuel rather than 100 low lead Avgas. The lineman had inadvertently used the Jet-A fuel truck which was identical to the Avgas truck except for a decal, approximately 4" by 16", which identified the type of fuel. The lineman stated that his training consisted of approximately 30 minutes of reading the company maintenance manual on how to refuel the different company aircraft, then was given on-the-job training for a brief time. When he went to refuel N89PB prior to the accident flight, he went to the parking space where the Avgas truck was normally parked, but on that occasion, the Jet-A fuel truck was there.

<sup>1/</sup> F-Fatal; S-Serious; M/N-Minor/None.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <u>1/</u>	
2474	6/20/84	Cincinnati, Ohio	Cessna 340A N5345J; destroyed	4			Personal

Pilot requested fuel from FBO but failed to make it clear what type he wanted. The FBO personnel misunderstood the pilot's request and refueled the aircraft with "Jet A" instead of aviation grade gasoline. The pilot did not monitor the refueling process and failed to recognize the wrong fuel as stated on fuel receipt. The pilot did not realize the improper fuel on his preflight of the aircraft. The aircraft departed and shortly thereafter the pilot radioed that he was returning to the airport because of a serious problem. Witnesses near the accident site stated that the aircraft was in a left bank (about 45° bank angle) before impact in a densely wooded area.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <u>1/</u>	
6004	1/9/84	St. Louis, Missouri	Douglas DC-3C CGSCA; substantial Damage	1	1		Positioning

After landing, the pilot-in-command placed a refueling order to fill the aircraft's two 210 gallon main tanks for a return flight to Toronto, Ontario, Canada. After the cargo was unloaded and the aircraft was refueled, the aircrew aborted the first two attempts to takeoff due to slow aircraft performance. Engine run-ups were performed after each abort and reportedly, the engines checked normal. After the second aborted takeoff, the aircrew called the FBO and requested that the refueler be asked what type of fuel was added. The response was "100LL Avgas." On the third attempt to depart, the aircraft took off, but both engines lost power as the landing gear was retracted. The flightcrew selected a highway on which to land. However, the left wing hit a utility pole, then the aircraft went through a fence and hit a highway embankment. Investigation revealed that Jet-A fuel had been added to the aircraft rather than 100LL fuel. The truck containing Jet-A fuel looked similar to the one with 100LL Avgas, but was properly designated with fuel grade markings.

1/ F-Fatal; S-Serious; M/N-Minor/None.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
677	1/2/83	Monterey, California	Cessna 340 A N1947E; destroyed		4		Personal

The aircraft began to lose power at about 400 feet above ground level after takeoff and the pilot elected to land along the shoreline in the ocean. The aircraft ditched about 100 yards off shore. All four occupants were able to exit through the airstair door and received only minor injuries. The aircraft sank after about 5 minutes. It was not recovered from the 27 foot deep water. Two occupants swam ashore and two were rescued by the Coast Guard. The line attendant who served the aircraft mistook it for a King Air. The pilot requested that all four tanks be topped off. The line attendant added 110 gallons of Jet A fuel.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
1267	5/2/82	Midland, Texas	Piper PA-31- 350, N70TT; substantial damage		1		Business

During a business flight, the aircraft's engines quit. The pilot attempted a gear-up emergency landing in a residential area. The aircraft impacted one pickup and two cars during the landing. Investigation revealed the aircraft had been mistakenly fueled with Jet-A fuel.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
2970	4/18/82	San Antonio, Texas	Piper PA-31- 350, N3580D; destroyed	3			Corporate/Executive

The pilot was trying to land after both engines failed during takeoff after the aircraft was refueled with jet fuel instead of gasoline. The weather was IFR with fog, low ceiling, and rain. The aircraft collided with trees during a forced landing and was destroyed by fire after impact.

<sup>1/</sup> F-Fatal; S-Serious; M/N-Minor/None.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-0333	4/26/81	Houston, Texas	Piper PA-31 N124EA; substantial damage	1		9	Air Taxi, Scheduled, Domestic, Passenger

Refueled with Jet-A.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-1019	3/23/81	Roanoke, Virginia	Aerostar 601P N3641U; destroyed	1			Corporate/Executive

Aircraft refueled on March 8, 1981, with 100LL and on March 20, 1981, with Jet-A by same individual on overtime due to supervisor illness.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-0340	1/28/81	Pontiac, Michigan	Piper PA-31P N222EB; substantial damage			6	Corporate/Executive

Outboard wing tanks serviced with jet fuel. Maneuvered to avoid tree and two power lines. Struck rock pile covered with snow.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-010-7	1/26/81	Palacios, Texas	Aero Commander N703SA; destroyed			4	Corporate/Executive

Serviced with Jet-A fuel; hit power line.

<sup>1/</sup> F-Fatal; S-Serious; M/N-Minor/None.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
3-3594	11/25/80	Fairhope, Alabama	Cessna 402B N7628Q; substantial damage		4		Corporate/Executive

Turbine fuel used to refuel aircraft.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
3-2576	8/2/80	Emeryville, California	Aerocommander 680FLP N27VF; substantial damage		7		Corporate/Executive

Center tank refueled with Jet-A; landed in tidal mud flats in bay.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
3-3754	2/29/80	Moab, Utah	Piper PA-31 N3540T; substantial damage		5		Air Taxi Scheduled, Domestic, Passenger

Refueled with mix of 100 gallons gasoline and either Jet-A or Jet-B turbine fuel.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
3-3978	12/20/78	Dallas, Texas	Piper PA-31 N27604; destroyed	4	3		Air Taxi Scheduled, Domestic, Passenger

A 100LL fuel truck with Jet A used to refuel aircraft; fuel farm tank vent covers improperly marked.

<sup>1/</sup> F-Fatal; S-Serious; M/N-Minor/None.



<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-1162	5/27/78	Chula Vista, California	Rockwell International 500-S, N2300 H; substantial damage			3	Personal/Pleasure

Refueled with 65 gallons Jet-A.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-3384	4/18/78	Anchorage, Alaska	Piper PA-34 N44356; substantial damage			4	Air Taxi - Passenger

Aircraft serviced with wrong fuel, JP-1.

<u>NTSB File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
3-1312	3/31/78	Salisbury, Maryland	Aero Commander 500B N313UT; destroyed			5	Corporate/Executive

Kerosene mixed with 100LL. Turning back to airport, left throttle at idle, carburetor heat on, crashed 1/2 mile short.

Incidents  
1980 Through 1985

<u>FAA File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N<sup>1/</sup></u>	
NSDB <sup>2/</sup>	4/17/86	Schenectady, New York	Cessna 421C N98455			None	Air Taxi-Ferry

Surging of engine with high cylinder head temperature after takeoff, returned, aircraft fueled with Jet-A.

<sup>1/</sup> F-Fatal; S-Serious; M/N-Minor/None.  
<sup>2/</sup> National Safety Data Branch.

<u>FAA File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
NSDB <sup>2/</sup>	8/1/85	Milton, New York	Piper PA-31- 350, N684JJ	None			Air Taxi-Passenger

Rough engines and high CHT on climb, aircraft had been fueled with jet fuel, engines to be changed.

<u>FAA File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
NSDB <sup>2/</sup>	11/16/83	Cut Bank, Montana	Cessna T310Q N8164Q	None			Business

Engines overheated on takeoff, returned, aircraft had been fueled with Jet-A fuel, pilot failed to check fuel slip.

<u>FAA File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
NSDB <sup>2/</sup>	10/25/81	Salt Lake City, Utah	Piper PA-31- 350, N66871	None			Air Taxi, Scheduled, Domestic, Passenger

High engine temperature on takeoff, linecrew fueled aircraft with jet fuel, then drained and put in Avgas without flushing.

<u>FAA File</u>	<u>Date</u>	<u>Location</u>	<u>Aircraft Data</u>	<u>Injuries</u>			<u>Flight Purpose</u>
				<u>F</u>	<u>S</u>	<u>M/N</u> <sup>1/</sup>	
NSDB <sup>2/</sup>	4/10/81	Redwood Falls, Minnesota	Bell 47D1 N4251A	None			Training

Forced off airport, landing due to jet fuel being put in the aircraft.

<sup>1/</sup> F-Fatal; S-Serious; M/N-Minor/None.  
<sup>2/</sup> National Safety Data Branch.