



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Washington, DC

July 26, 2022

Factual Report

Maintenance Records

A. ACCIDENT

Location: Hilo, Hawaii
Date: November 6, 2020
Time: 16:00 Pacific Standard Time
NTSB #: ANC21LA006

B. FACTUAL INFORMATION

1.0 The Type Certificate Data Sheet (TCDS)

The Federal Aviation Administration (FAA) Type Certificate Data Sheet (TCDS) A78EU prescribes conditions and limitations under which the product for which the Type Certificate (TC) was issued meets the airworthiness requirements of the Federal Aviation Regulations. According to the document, Pilatus Aircraft Ltd is the holder of the TC.

1.1 Aircraft Information

Pilatus Aircraft Ltd. manufactured the airplane, model PC-12/47E, serial number 2003, and a Standard Certificate of Airworthiness was issued on April 15, 2020. The FAA issued a Special Airworthiness Certificate on October 28, 2020, for flight from North Las Vegas, Nevada KVG T to Gold Coast, Australia YBCG.

According to the Aircraft Bill of Sale, dated April 30, 2020 Bank of Utah, owner trustee, purchased the aircraft under a trust agreement.

The airplane was equipped with a Pratt & Whitney Canada (P&WC) PT6E-67XP engine and a Hartzell Propeller.

Table 1 - Engine and Propeller Information¹

	Engine
Manufacturer	Pratt & Whitney Canada
Model Number	PT6E-67XP
Serial Number	PCE-HP0004
Time Since New	47.0 Hours
Cycles Since New	31 Cycles
	Propeller
Manufacturer	Hartzell
Model Number	HC-E5A-31A/NC10245B
Serial Number	SA517

1.2 Engine and Propeller Description

The accident airplane, Pilatus Aircraft Ltd., model PC-12/47E was powered by a P&WC PT6E-67XP turbo propeller engine and a Hartzell constant speed 5-bladed propeller. The PT6E-67XP utilizes two independent turbine sections. One is a single-stage compressor turbine that drives a multi-stage compressor while the other is a

¹ Engine and propeller times and cycles are from P&W Engine Condition Monitoring program as no logbooks were recovered.

two-stage free power turbine that drives the propeller shaft (Np) through the reduction gearbox.

According to the FAA's TCDS E26NE, revision 20, dated September 8, 2021, the PT6E-67XP has the following static ratings:

- 1200 shaft horsepower (SHP) at maximum continuous and takeoff (5 minute) at sea level.
- 181 pounds of jet thrust at maximum continuous and takeoff (5 minutes) at sea level.
- 1272 equivalent SHP maximum continuous and takeoff (5 minute) at sea level.
- 900 SHP maximum reverse.
- 1544°F (840°C) maximum permissible turbine interstage temperature for maximum continuous.
- 1562°F (850°C) maximum permissible turbine interstage temperature for takeoff.

The engine ratings are based on static sea level condition 29.92 inches of mercury (in Hg) pressure, compressor intake screen installed, no external accessory loads and no air-bleed. These ratings are available up to compressor inlet air (dry) temperatures of 122°F (50°C) maximum continuous and 111°F (44°C) takeoff. Fuel pump, fuel control unit, ignition system without power source, propeller governor and fuel heater are included as standard equipment as shown in the approved Parts List. The PT6E-67XP model includes an Engine and Propeller Electronic Control System (EPECS) and associated hardware.

According to the FAA's TCDS P20NE, revision 11 dated January 27, 2021, the Hartzell constant speed propeller with aluminum propeller hub model HC-E5A-31 and a five bladed feather-able and reversable composite model NC10245B has a maximum continuous and takeoff horsepower rating of 1200 SHP at a maximum rotational speed of 1700 revolutions per minute. Hartzell propeller model HC-E5A-31() is controlled by an integrated electronic system which is part of the engine type design. Propeller model HC-E5A-31() complies with the propeller airworthiness requirements when used only with the P&WC PT6E-67XP series engine, whose electronic software is written based on inputs from Hartzell's dynamic simulation models.

1.3 Special Airworthiness Certificate

On October 28, 2020, the FAA issued a Special Airworthiness Certificate for N400PW for flight from North Las Vegas, Nevada (KVG T) to Gold Coast Australia (YBCG).

In addition, the FAA Nevada Flight Standards District Office issued Special Flight Permit with additional Operations Limitations. From the 26 limitations listed, the following are noted.

The Special Airworthiness Certificate is not valid unless the aircraft has been inspected by an appropriately rated mechanic or repair station and determined to be capable of safe flight for the proposed ferry flight and the inspection recorded in the aircraft logbook.

The aircraft must conform to the auxiliary fuel system and other temporary system installations described on FAA Form 337 dated October 28, 2020.

- Maximum takeoff weight must not exceed 10,935 pounds.
- Maximum quantity of fuel carried in auxiliary (ferry tanks) must not exceed 160 gallons / 1,072 pounds.
- Center of gravity limits must not exceed (fwd) 233 inches and (aft) 238.8 inches.
- Use of autopilot (if installed) while in overweight condition is prohibited.
- Weather conditions with moderate to severe turbulence should be avoided.
- Ferry fuel shall be used as soon as practical during the flight.
- During the first leg of the flight the operation of the ferry fuel system shall be checked for proper operation.
- Navigation equipment aboard for the delivery flight must be adequate for accurate navigation from departure point through fuel stops to delivery destination.
- Any AD pertinent to this make and model of aircraft requiring accomplishment prior to further flight, or any for which the time limit has been reached or exceeded, must be complied with before the ferry flight is initiated.
- Aircraft must have a service check inspection every 30 days, by an appropriately rated mechanic, and a logbook entry made indicating the results of the inspection.

1.4 Major Alterations and Supplemental Type Certificate (STC)

According to the records on file with the FAA. The following major alterations are noted.

June 09, 2020 - Pilatus Business Aircraft, LTD installed Bose Headset Jacks PN 971-71-93-508 at seat positions 3, 4, 5, and 6. Installed a cabin chime amp PN MSM500-00 under cockpit floor panel 11AZ. Installed a crew call button annunciator switch PN LED-EM-11-HA1-E2LG9.

June 9, 2020 - Pilatus Business Aircraft, LTD - Installation of Auxiliary Fuel Tanks Provisions - Modified the fuel system by installing a fuel fitting PN AN827-10D,

check valve PN 869A-10TT, fuel line assemblies PN 2X-2000-30-0002, a fuel line bracket PN 2X-2000-32-0003 in the left wing in accordance with Pilatus drawings 2X-2000-30-0003, 12-1305-32-0005, and a fitting elbow feed through PN AN837-10D in accordance with Pilatus drawing 2X-2000-30-0002, drawing 2X-2000-30-0003 and drawing 2X-2000-61-0000. The fitting through the fuselage was capped and the fuel lines leak checked.

June 9, 2020 - Pilatus Business Aircraft, LTD installed an In-Flight Entertainment System in accordance with STC SA04153AT.

October 28, 2020 - Flight Contract Services, Inc. modified the aircraft fuel system by installing two auxiliary aluminum 120 gallon ferry fuel tanks in the cabin and connected to the factory installed ferry fuel supply fitting in the left wing root area. Number one tank located station 255 limited to 100 gallons and number two tank located at station 275 limited to 60 gallons. The tanks were electrically grounded and mounted on ½ inch plywood pallets. Pallets secured with four 2,000 pound straps secured to eight points of the cargo tie down rings located in the existing seat rails. The ferry fuel system was connected to the existing factory installed AN832-10D bulkhead fitting in the left-wing root area. The ½ inch, FLEXTRAL J3-8 fuel line, connects the fuel tanks to a ½ inch on off in-line ball valve for each tank, then to the fuselage bulkhead fitting and through a one-way check valve to the main fuel supply line to the header tank and back to the tanks through the crossflow line. Placards and operating instructions are secured to the tanks and valves. According to the 337 form, fuel feed is directly to the left fuel tank².

According to pilot interviews on the initial positioning flight from North Las Vegas Airport to Santa Maria, CA. Airport they could not transfer any fuel from the ferry tanks to the main fuel tank. Gateway Air Center along with assistance from Flight Contract Services further modified the auxiliary fuel system by installing two 30 psi transfer pumps to provide enough fuel pressure to overcome the check valve.

1.5 Weight and Balance

Temporary aircraft weight and balance for the installed ferry equipment on file with the FAA was reviewed. The following is noted.

Basic weight and balance prior to modification.

Weight:	6,678.50
Arm:	234.17
Moment:	1,563,881.35

Post modification including fuel plus 100 gallons in auxiliary fuel tank No.1 and 60 gallons in auxiliary fuel tank No.2. See next page -

² The installed fuel feed provision routed directly into the main fuel delivery line to the engine.

Weight: 11,119.50
Arm: 236.29
Moment: 2,627,371.07

1.6 Aircraft Flight Logs

Logbooks could not be recovered for review.

1.7 Record of Conversation

On July 12, 2022, beginning at about 11:00 EDT, Mr. Fred Sorenson, the mechanic that installed the auxiliary ferry fuel system agreed to speak via telephone with NTSB investigators John Flynn and myself and to have notes taken, which follow. These notes are not a verbatim transcript.

After introductions were completed and a brief explanation about the NTSB investigative role, Mr. Sorenson was asked what FAA certificates he has. To start, I have an Airframe & Powerplant (A&P) certificate with Inspection Authorization (IA). I have an Air Transport Pilot with multi engine, single engine C, Commercial with type ratings. I have a Flight Instructor Certificate, and a Ground Instructor Certificate.

With the IA certificate do you attend the periodic IA seminars, or do you send your work to the local FAA FSDO? He stated he does the FAA online training and I go to the FAA seminars and submit my currency such as the 337's and annual inspections I do that maintains my currency. He submits to the FAA FSDO.

Asked to describe his aviation background regarding maintenance, Mr. Sorenson said that he grew up rebuilding old airplanes. He remembered starting off rebuilding a 1936 Orion and, in the garage, we always had old airplanes and I helped my dad restore antiques. I worked towards my A&P certificate in 1978.

I had my own aircraft that I did maintenance on. He started the ferry business in 1974 and we were doing our own fuel tank installations since 1974.

When asked how many Pilatus aircraft he has installed ferry tanks on, Mr. Sorenson said this was the first one that we actually tanked.

Asked if he makes the fuel tanks or purchases them, he said that he has them made. These tanks were built by a company in California. We use the Coast Guard welding procedures, and they are built to the Coast Guard fuel tank codes. We normally put what code they are built to on the 337's. They are pressured checked and leak checked.

Mr. Sorenson was asked to describe the installation of the ferry system for the Pilatus? This was the first Pilatus. I have been involved in discussions on the Pilatus and normally the installation is to the return line to the fuel tank. This was the first Pilatus that they had added a fitting that went through the fuselage into the cabin. So, the actual connection of the ferry system was removing their AN924 cap and hooking up a fuel selector manifold made up of two valves and then to the ferry tanks. There was a check valve, relief valve and a breather valve on top of the tanks so the pressurization would push the fuel into the ferry plumbing. That was on the first try.

We tanked the airplane, and they flew the airplane to California and the ferry system was not transferring. So, we went to California and with discussions with Pilatus that they had a one-way check valve. We knew they had a check valve in the system. We didn't know what the cracking pressure was on the check valve. Neither did they. Pilatus had to go back and research what the cracking pressure was. It was in excess of 15psi. Which meant that the 6.5 to 7 psi pressurization wasn't going to do it. So, we installed two 24-volt fuel pumps.

Asked what type of pumps were installed he responded they were a pump system we had built up to do Cessna Caravans and we also had it installed in a turbo Commander as a backup system that went around the world pole to pole. They are two 30 psi pumps.

Asked if they are built to a technical standard order (TSO) standard he responded, no. They are not aircraft pumps, they are high-capacity industrial pumps. They were mounted in a pelican case.

After installing the additional pumps, we actually made sure they transferred fuel on the ground, and we had finished up at about 5:00 in the evening. The pilots were thinking about departing but after having a discussion regarding everything that had transpired today why not go to the hotel and get a good night's rest. Do your flight in the morning.

Asked how the pumps were connected electrically, he said we connected them to the 24-volt main bus. They had an inline circuit breaker. Switches to operate the pumps were built into the side of the pump case.

Asked if a weight and balance was done for the installation he said yes. How about an updated one after the pumps were added? I'm sure that we did because the pumps weigh five pounds. Each or total. No, total.

Did you have to provide the pilots any additional operating instructions? We had a discussion with them, and we did change the operating instructions. Can you provide us those instructions? I believe I can. I think I have the whole package. I need to check. If you do, great. If not, let us know. He added that our modification was

done while we were on the Phone with Pilatus discussing the change and the discussion on the check valve. We were talking with the engineering group at Pilatus as they were the ones that had to track down the cracking pressure.

The special flight permit the Las Vegas FSDO issued had additional limitations and requirements as stated in FAA form 337 dated October 22, 2021. The FAA file we obtained does not contain a 337 dated October 22, 2021. Everything is dated October 28th. Is there another 337 that is dated October 22, 2021, that didn't make it into the FAA file? Or was sent and the FAA doesn't, have it? I would have to go back and look at that. I do not know off the top of my head. I know that on the operating limitations, you have look at block three and what the actual date that the FAA signed block three. What happens, especially with this new airworthiness certification portal is that we put everything in as far in advance as we can. Then we try to match up what the final date of the inspection is going to be. Between the DAR's³ and the FAA offices. Right now, I have an airplane in Hawaii that needs to come back and the 337's are dated June 18th. We hope to get the ferry permit tomorrow. That is the process we have to go through, and the dates are mix and match.

Was there any concern if air got introduced into system? We did talk about the fact that when you are using the ferry system. It is the same thing when you are using any turbine airplane, such as King Airs if we are anywhere close to worrying about air getting into the system to always have the ignitors on. That's our procedure, we discussed that with them.

Asked if Mr. Sorenson talked to the pilots since, he said no.

You mentioned that you talked to Pilatus. Do you know who you talked to? Two names come to mind that he talked two. Asked if it was Pilatus in Colorado or Switzerland, he said it was actually both of them. The discussion covered the check valve pressure and what was required to get that open from the ferry system? Yes, and we told them what we were going to do to offset that. And they said that is their preference to always put pumps in it. He added, you did not tell anybody that!

When you talked about air in the system and having the ignitors on was that anytime the ferry system was running you wanted them to turn the ignitors on? Or just when you transition from the ferry system back to the regular system? We put a clear line in the feed system to the pumps to the fitting so they could monitor. Primarily when you get down low with the ferry system. If you need to get all the way down. They had plenty of fuel, not like they were on their longest leg. During our discussions, you do not need to run them dry. Having the ignitors on when you get down low. We ran into this problem with the King Air 200 with a pressure feed system, transfer system and found that ferry pilots were trying to purge the ferry tanks

³ Designated Airworthiness Representative

before they pulled them out when they arrived at the destination. So, they let it run and it is transferring into the main tank and not directly to the engine. When you are in a descent and you pull the power back, both engines flame out. We talked to Beechcraft about that, and they said there is no way it does that! We have had two instances of where air did backup and they did flame out. Fortunately, as soon as the ignitors were turned on, they came back up to power as they never completely spooled down, they relit. I had that discussion with them to make sure if you are going to run them down low to turn the ignitors on.

What airplane had that issue? King Air, same engines. He added we always have a discussion with the ferry pilots, my own pilots, and myself. We try and put a clear line in so they can see if the fuel tank is empty turn the pumps off.

It was my understanding they were done with one tank when this one quit. Just from reading or hearing stories that were put on the internet.

Asked if he has done any other Pilatus ferry systems since this one? He responded, no. This was your one and only Pilatus ferry system? Yes. He added that we do have to go get one in South Africa, but we are not going to tank it. Just clarify, you ferry airplanes and only tank them when you need to. Correct. I started Flight Contract Service in 1974 as my dad and I and another guy were buying airplanes over in Japan that were coming off training for the airlines and we were ferrying them back to the mainland. I've probably done 576 little airplanes across the ocean. The primary business is that we are an aircraft delivering business. We deliver everything from singles to heavy jets. We're working on a 767 project right now. Also, in the process of tanking a 727 that will be used for research. We do the whole gambit.

We just delivered a Bonanza over to Amsterdam with a ferry tank installed. I've been doing the installations since 1974. We've delivered over a thousand airplanes. We have had three go into the water that were engine failures. They were not on the ferry system as they were long after using the ferry system fuel when the engines quit. That's our history. Fortunately, everybody got out.

The one thing I want to say about the Pilatus, just for safety factor. When we tanked the airplane, we positioned the tanks to the aft limit of the CG because we did not want to block the emergency exit. They asked us to move them up, and I said no. You are within CG, and I am not moving the tanks forward and that is the way they got out of the airplane (emergency exit).

Conversation concluded at about 11:30 AM EDT.

Submitted by:
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