DATA SUMMARY

LOCATION

Date and time	**Friday, 2 February 2007; 19:43 local time**[1]
Site	**En route, 40 NM from the Tenerife South VOR**

AIRCRAFT

Registration	**EC-IJO**
Type and model	**BEECHCRAFT 1900-D**
Operator	**NAYSA. Navegación y Servicios Aéreos Canarios**

Engines

Type and model	**PT6A-67D**
Number	**2**

CREW

	Pilot in command	First officer
Age	**33 years old**	**25 years old**
Licence	**Commercial pilot license**[2]	**Commercial pilot license**
Total flight hours	**6,000 h**	**660 h**
Flight hours on the type	**2,591 h**	**456 h**

INJURIES

	Fatal	Serious	Minor/None
Crew			**2**
Passengers			**13**
Third persons			

DAMAGE

Aircraft	**Right engine**
Third parties	**None**

FLIGHT DATA

Operation	**Commercial air transport – Scheduled – Domestic – Passenger**
Phase of flight	**En route**

REPORT

Date of approval	**26th September 2011**

[1] All times in this report are local. Local time and UTC coincide during the winter in this time zone.
[2] According to JAR-OPS (now EU-OPS) 1.960 a) (1) (i) the holder of a commercial pilot license can operate as captain under instrumental flight rules if the pilot has a minimum of 700 h total flight time on airplanes, of which 400 must have been as the pilot in command.

1. FACTUAL INFORMATION

1.1. History of the flight

The flight was conducting the sixth of a total of eight flights scheduled for the day between the various islands that comprise the archipelago of the Canary Islands.

This flight originated at Lanzarote Airport and was heading for the Tenerife South Airport. The aircraft was a Beechcraft 1900D, registration EC-IJO. The pilot flying was the first officer. Weather conditions were VMC (Visual Meteorological Conditions) and by the time of takeoff, 19:00, the sun had already set.

They took off from runway 03 on standard departure TENERIFE SUR DOS MIKE (TFS2M), as shown in Figure 1. When they reached the Fuerteventura (FTV) VOR (Very High Frequency Omni-Directional Range), ATC cleared them to proceed directly to the Las Palmas (LPC) VOR before clearing them to proceed directly to MERAN. They were at flight level FL100.

At 19:43, once past the coast of the island of Gran Canaria and still at FL100, the crew felt a strong explosion and noted how the airplane experienced uncommanded right yaws. From his seat in the cockpit, the first officer saw flames emerging from the exhaust nozzle of the number 2 engine and informed the captain of the fire. The captain, for his part, noted how the ITT (Inter Turbine Temperature) rose to 720 °C.

The crew decided to apply the "ENGINE FIRE OR FAILURE IN FLIGHT" emergency procedure and shut down the number 2 engine. The captain started the procedure by performing the first two of the four memory items:

1. **Condition Lever** ..... **FUEL CUTOFF**[3]
2. **Propeller Lever** ..... **FEATHER**

The first officer then declared the emergency to ATC (Tenerife South) and requested to proceed to the island of Gran Canaria, which was granted. From that moment on the captain took control of the aircraft (PF) and the first officer handled the communications and continued with the emergency procedure (PNF).

3. **Firewall Fuel Valve** ..... **PULL CLOSED**
4. **Fire Extinguisher, if required (*)** ..... **ACTUATE**
5. Eng AutoIgnition ..... OFF
6. Autofeather ..... OFF
7. Prop Sync ..... OFF

[3] The items shown in bold type are memory items.

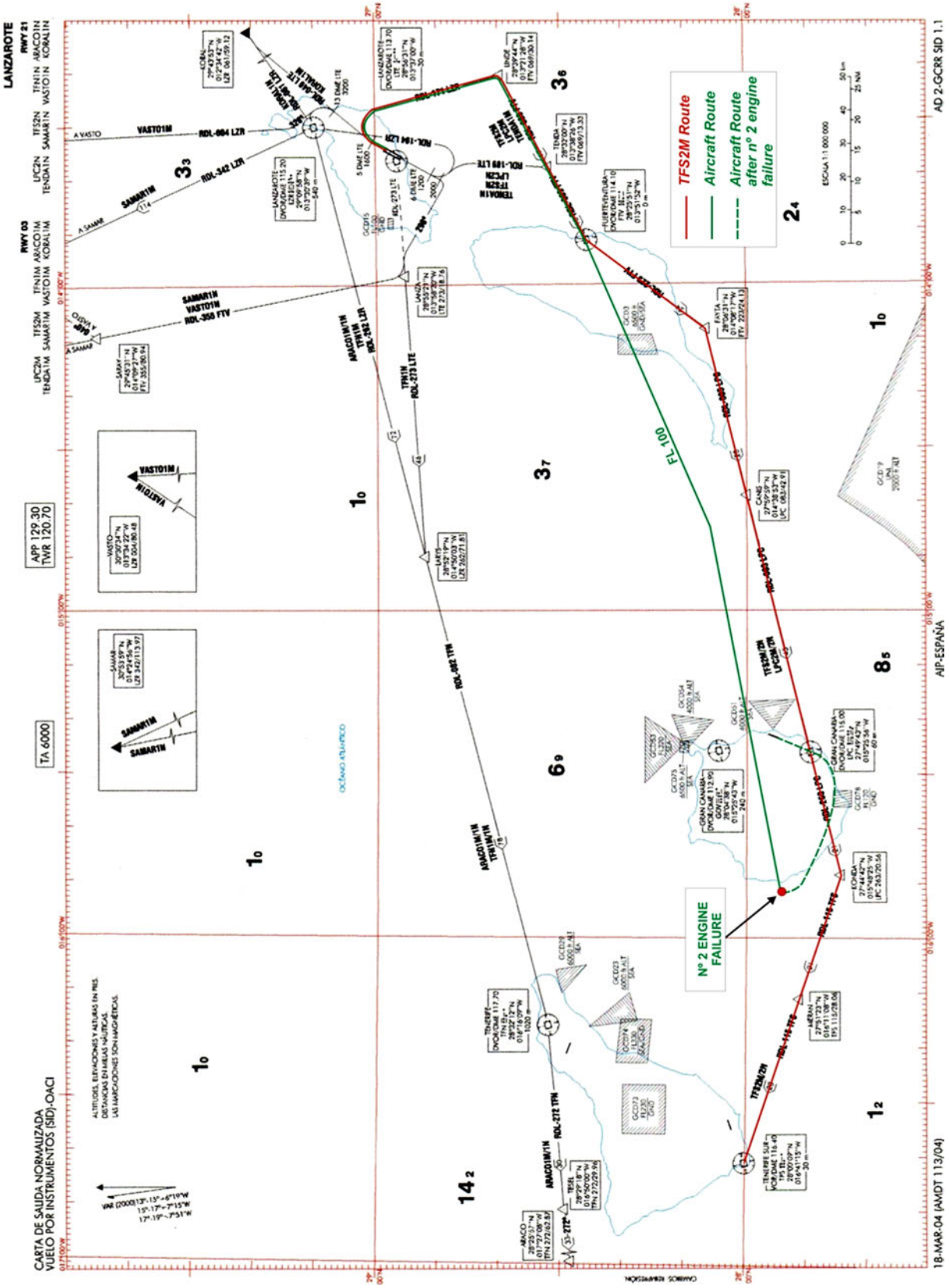


Figure 1. Aircraft flight path

8. Generator ..... OFF
9. Electrical Load ..... ENSURE WITHIN LIMITS
10. Bleed Air Valve ..... INST & ENVIR OFF

Once completed, they decided not to attempt to restart the engine in flight after concluding that the engine was damaged. The crew did not activate the fire extinguisher because the engine fire warning indication wasn't on and there were no signs of a fire.

The aircraft proceeded to the airport of Las Palmas de Gran Canaria and requested a visual approach, during which the aircraft requested on several occasions that the preceding traffic, a B-757, be diverted. ATC maintained the approach sequence until the landing. Before the aircraft landed on runway 03L, another aircraft, an A-320, was cleared to take off on runway 03R.

After landing on runway 03L, the aircraft exited the runway via taxiway S3 and notified ATC of the end of the emergency. They parked in front of the airport staff offices. The crew shut down the left engine and secured powered to the aircraft, which was vacated using the normal procedure.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total on aircraft	Third persons
Fatal				
Serious				
Minor				N/A
None	2	13	15	N/A
TOTAL	**2**	**13**	**15**	

1.3. Damage to aircraft

Once on the ground a preliminary check of the right engine revealed that it did not rotate. No other damage was noted.

1.4. Personnel information

1.4.1. *Pilot in command (CM-1), seated in the LH seat*

Gender, age: Male, 33

Nationality: Spanish

Type rating:	Beech 300/1900, IR
Total flight hours:	6,000 h
Flight hours on the type:	2,591 h
Hours in the last 90 days:	133:30 h
Hours in the last 30 days:	34:30 h
Hours in the last 7 days:	0 h
Hours in the last 24 h:	0 h
Last line check:	27/02/2006
Last proficiency check:	22/10/2006
Start of on-duty period:	13:15 on 02-02-07
Previous rest period:	7 days

He had been certified as a captain on 18/02/2006.

The company's training for pilots did not include flight simulator sessions, meaning that certain emergencies could not be duplicated in training or during line checks.

The last CRM training before the incident was in March 2005. The last CRM course shown in his training record took place four days following the incident.

1.4.2. *First officer (CM-2), seated in the RH seat*

Gender, age:	Male, 26
Nationality:	Spanish
Type rating:	Beech 300/1900, IR
Total flight hours:	660 h
Flight hours on the type:	456 (all as first officer)
Hours in the last 90 days:	163:25 h
Hours in the last 30 days:	59:35 h
Hours in the last 7 days:	13:45 h
Hours in the last 24 h:	0 h
Last line check:	1/05/2006
Last proficiency check:	17/12/2006

Start of on-duty period: 13:15 on 02-02-07

Previous rest period: 2 days

The CRM course shown in his training records was completed four days after the incident. The first officer reported having taken an initial CRM course upon joining the airline in December 2005.

1.5. Aircraft information

The Beechcraft 1900 is a 19-seat, pressurized, twin-engine turboprop airplane. It is designed primarily to be used as a commuter aircraft. The powerplant consists of two Pratt & Whitney PT6A-67D engines. The characteristics of the right engine, which had the fault, are as follows:

Model: PT6A-67D

S/N: 114109

Total time: 18,239 h

Total cycles: 29,180

The aircraft had a valid airworthiness certificate and had been maintained in accordance with the approved maintenance program. According to the data sheets of type certificate number A24CE, the minimum flight crew was one pilot[4].

1.5.1. *Power plant*

The aircraft had two PT6A-67D engines. The PT6A-67D engine is a turbine that drives a propeller through a two-stage gear reduction box. The engine consists of two major rotating assemblies. The first is the compressor and the compressor turbine (compressor section), and the second is the two power turbines and the power turbine shaft (turbine section). The two rotors are not connected and rotate in opposite directions. This design is referred to as a free-turbine engine. This turbine has six bearings to support the engine's rotation and minimize friction. The highest temperature is associated with the number 2 bearing, which is a roller bearing that has to with stand radial loads.

[4] According to JAR-OPS 1.940 (now EU-OPS), during IFR or nighttime operations, the operator shall ensure that: (1) For all turbo-propeller airplanes with a minimum approved passenger seating configuration of more than 9, and for all turbojet airplanes, the minimum flight crew is 2 pilots.

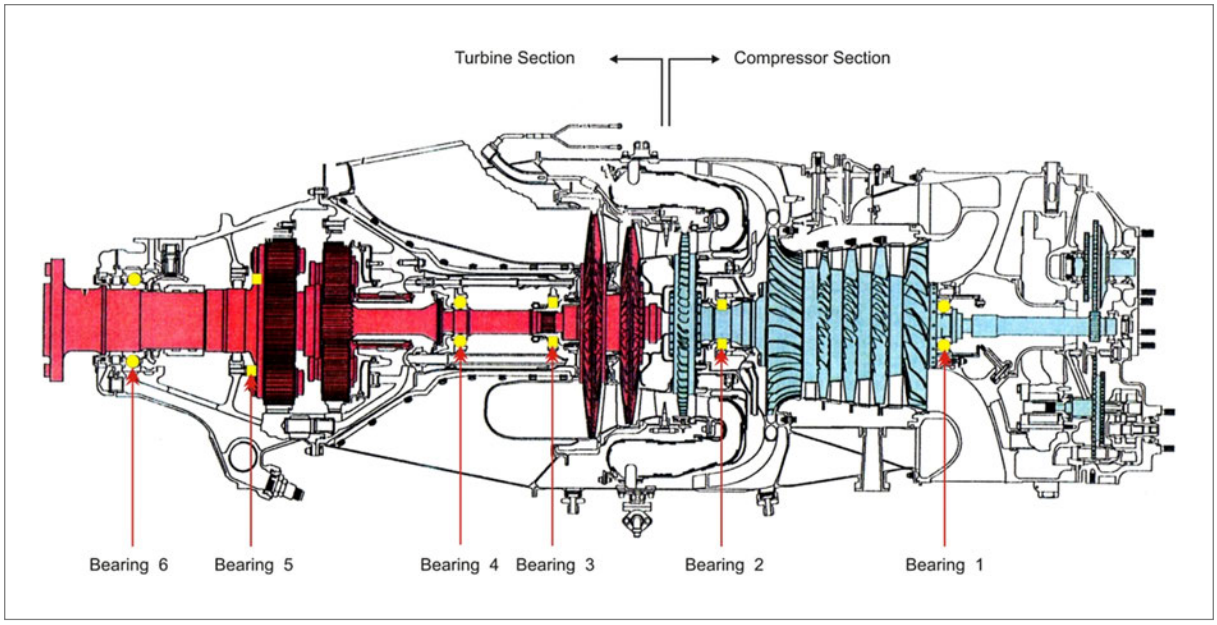


Figure 2. Diagram of the PT6A-67D engine

1.5.2. *Engine lubricating system*

The engine's lubricating system provides filtered oil to the engine to cool and lubricate certain components. It also supplies oil to the propeller governor, which controls the propeller pitch and speed, and to the torque measurement system.

The engine oil system consists of a pressure system, a scavenge system and a breather system. The oil lubricates and cools the bearings and carries any extraneous matter to the oil filter, where it is precluded from circulation. The oil tank is integrated into the engine air inlet casing. A chip detector is located in the reduction gear box to detect metal particles and warn of the metal contamination.

Pressure system

The oil draws from the oil tank through a gear type pump and is delivered to the oil filter and pressure regulating valve. At the filter outlet pressure oil separates into several parts. One directs oil to the number 1 bearing and to the accessory box through cored pasages and transfer tubes. The pressure and temperature sensors are housed in these internal passages.

Another pressurized line located in the bottom right hand side of the engine delivers oil to lubricate the number 2, 3 and 4 bearings, the reduction gear box, front accessories and then to the propeller and torque measurement system.

Scavenge system

The scavenge system consists of four gear type pumps mounted on two double elements. Two pumps are inside the accessory box, while the other two are mounted externally at the rear of the accessory gearbox.

The oil from the number 1 bearing returns to the accessory gearbox by gravity drain. The number 2 bearing scavenge is done through a tube mounted under the engine. At high power, a relief valve located on the line near the scavenge pump allows the air/oil from the bearing cavity to bleed into the accessory gearbox, preventing flooding of the number 2 bearing cavity.

The oil from the 1, 2, 3 and 4 bearings scavenge is driven to the accessory gearbox through the scavenge lines, as shown in the figure. From there it is routed to the fuel heater exchange, where it gives up its heat to the fuel.

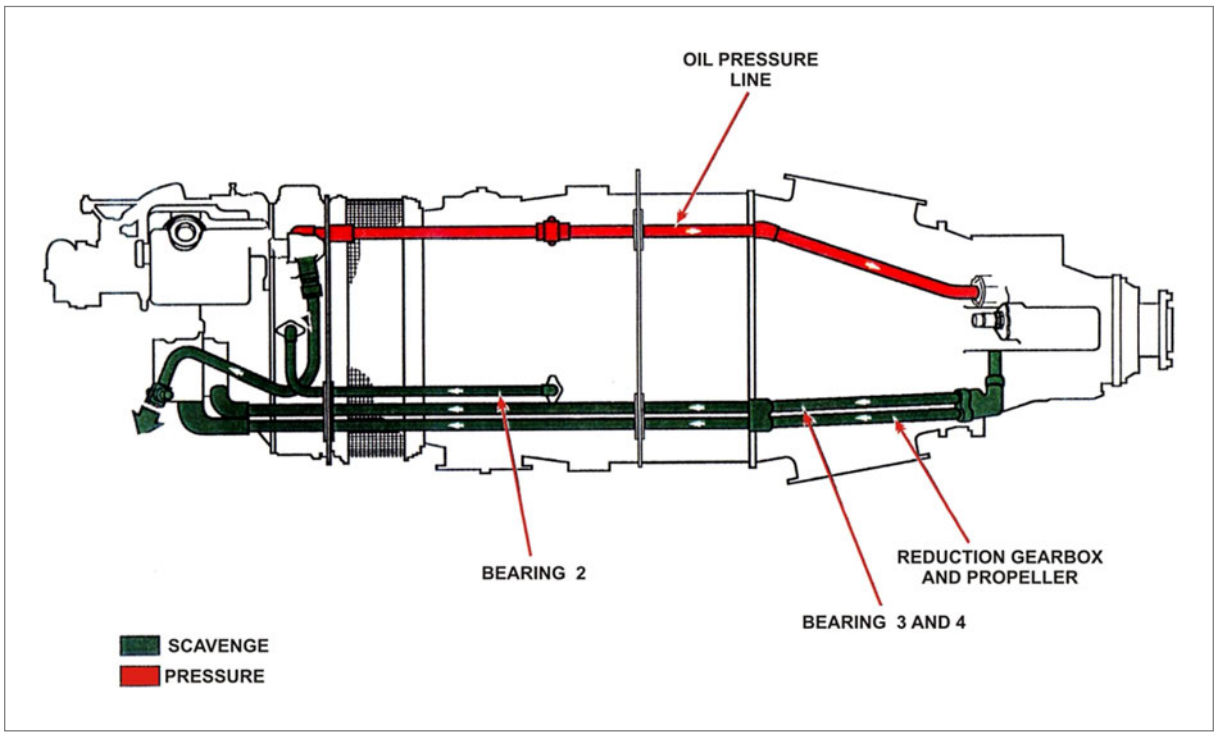


Figure 3. Engine lubrication system

1.5.3. *Periodic inspection of the engine lubrication system*

According to the Aircraft Maintenance Manual, the oil level in the engine has to be checked on each "daily or preflight aircraft inspection". If the oil level is below normal, it states to refill it.

The Maintenance Manual also specifies that the oil filter must be checked every 100 hours, which can be extended to 200 hours depending on the results of previous inspections. It states that any particles found in the main filter mesh must be removed. In any event, it states that any foreign elements found in the main oil filter or in the detector chip detector must be identified for a more in-depth analysis.

According to Service Bulletin 14001 TURBOPROP ENGINE APPROVED LISTING OF (SYNTHETIC) LUBRICATING OILS, the engine oil does not have to be changed after a specific time period since the manufacturer's experience has shown this not to be necessary. It warns operators, however, that they should be aware of the danger of oil contamination from extraneous matters such as hydraulic fluid, sand, etc.

The operator reported that the oil was checked every day and that the oil tank was refilled as necessary.

1.6. Meteorological information

The weather information provided in the 19:30 METAR for the airport in Las Palmas de Gran Canaria was as follows:

Surface winds:	From 20° at 14 kt
Visibility:	In excess of 10 km
Cloud cover and altitude:	1 to 2 eighth at 3,000 ft
Temperature:	16 °C
Dewpoint:	9 °C
QNH:	1,019 hPa.

1.7. Communications

When the emergency took place, at 19:43, the aircraft was in contact with Tenerife South approach. After declaring the emergency at 19:44:21, the crew requested to divert to Gran Canaria. The aircraft was transferred to Gran Canaria (feeder sector) and then to Gran Canaria Approach. The aircraft was finally transferred to the Las Palmas Tower (local controller).

Controllers at Gran Canaria Approach and ground control at the Las Palmas Tower also coordinated their activities.

For the approach to Las Palmas Airport, the sequence had a 757 first to land, followed by the Beechcraft 1900D that had declared the emergency.

While the aircraft in emergency was making the approach to runway 03L, there was another aircraft at the threshold of runway 03R awaiting takeoff clearance.

The chronological sequence of events was as follows:

At 19:44:51, the aircraft in emergency was transferred to Gran Canaria (feeder sector) and reported its emergency using the standard "MAYDAY, MAYDAY, MAYDAY" phraseology, adding that an engine had failed and requesting priority.

At 19:47:01 the aircraft was transferred to Gran Canaria Approach and requested a visual descent.

At 19:48:44, the 757 ahead of it was cleared by Gran Canaria Approach to do a visual approach to runway 03L.

At 19:49:41, Gran Canaria Approach informed the 757 to maintain a high airspeed.

At 19:50:44, the 757 was transferred to the Control Tower (local controller) frequency.

At 19:51:42, Gran Canaria Approach cleared the aircraft in emergency to fly direct to the Las Palmas VOR. The aircraft requested information regarding how many miles ahead the preceding aircraft (the 757) was, to which ATC replied 8.5 miles.

At 19:52:20, Gran Canaria Approach spoke with the local controller in the Tower to request that he inform the 757 to speed up, since there was an aircraft in emergency behind it, which the local controller did.

At 19:52:43, Gran Canaria Approach suggested to the Tower ground controller to remove the 757 from the approach sequence. The ground controller proposed that the 757 land on runway 03R, to which approach replied that the traffic in emergency was very close.

At 19:53:10, Gran Canaria Approach informed the traffic in emergency that the 757 was going to be removed from the sequence and cleared it to establish on final and descend to 3,000 ft. The aircraft reported it was 10 miles away from the field.

At 19:53:29, the local controller in the Tower informed Gran Canaria Approach that an aircraft was ready to take off on runway 03R.

At 19:53:34, the local controller in the Tower informed Gran Canaria Approach that the 757 would not be removed from the approach sequence, and that the traffic in emergency could be cleared. He also requested that Gran Canaria Approach confirm whether the traffic on runway 03R could be cleared for takeoff.

At 19:53:49, Gran Canaria Approach cleared the traffic in emergency to conduct a visual approach to runway 03L.

At 19:54:01, Gran Canaria Approach warned the local controller in the Tower that the runways had to be clear because the traffic in emergency was 5 miles away.

At 19:54:07, the aircraft in emergency requested that the preceding traffic (the 757) be removed from the sequence.

At 19:54:10, the local controller in the Tower authorized the 757 to land on runway 03L.

At 19:54:27, Gran Canaria Approach informed the ground controller in the Tower that the aircraft in emergency was requesting that the preceding traffic (757) be removed from the sequence. The Tower replied that it was already landing, that it was 2 miles away and asked whether the aircraft on the runway 03R threshold could be cleared to take off. Approach cautioned that the aircraft in emergency was very close to the airport. The ground controller replied that after the 757 landed, the aircraft at the runway 03R threshold could be cleared to take off since the aircraft in emergency was five and a half miles away and there was sufficient time. Finally, Gran Canaria Approach informed him that he could authorize the takeoff and that he was transferring to him the aircraft in emergency.

At 19:55:00, Gran Canaria Approach informed the aircraft in emergency that the 757 was landing and instructed it to contact the Control Tower.

At 19:55:15, the aircraft in emergency contacted the local controller in the Tower, and reported being in an emergency and 3 miles away. The Tower instructed the crew to continue with the approach.

At 19:55:30, the local controller cleared the aircraft located at the runway 03R threshold to take off.

At 19:55:46, the local controller instructed the 757 to clear the runway as soon as possible.

At 19:56:31, the local controller cleared the aircraft in emergency to land on runway 03L.

At 19:57:18, the local controller in the Tower informed Gran Canaria Approach that the aircraft in emergency had landed.

1.8. Aerodrome information

The airport of Las Palmas de Gran Canaria has two parallel, concrete runways, 03R/21L and 03L/21R, whose centerlines are separated by 200 m. Both runways are 3,100 m long and 45 m wide.

1.9. Flight recorders

The aircraft had cockpit and flight data recorders, both of which were recovered in good condition.

1.9.1. *Flight data recorder*

The flight data recorder was a FAIRCHILD F-1000 solid state model. It had a capacity to record 27 parameters for 100 hours.

According to the information on the flight data recorder, the right engine failed at 19:43:34, and twenty-eight seconds the propeller was feathered with the engine fully stopped.

At 19:55:52, the crew selected 17° flaps, and at 19:56:38, 35° flaps.

1.9.2. *Cockpit voice recorder*

The aircraft was equipped with a FAIRCHILD A100S solid-state voice recorder with a 30-minute capacity.

When investigators attempted to download the data from the recorder, they could not retrieve any information.

The CVR was sent to the manufacturer to check it for proper operation. The manufacturer did not detect any malfunction or fault in the equipment after running the relevant tests on a test bench.

Another A100A CVR was later installed on the same aircraft and tested, which yielded satisfactory results. The CVR wiring in the aircraft was also checked to verify that the signals were being correctly transmitted and that the wiring was properly shielded.

No malfunction could be detected either in the CVR itself or in the way it was installed on the aircraft.

During the investigation it was noted that as part of the cockpit flight preparation procedure, crews pressed the ERASE button on the CVR prior to commencing the next flight. While this was not in the procedure, company pilots reported that this was normally done prior to each flight.

1.10. Tests and research

1.10.1. *Engine inspection*

Description of damage

The engine was disassembled at Pratt & Whitney's facility in Germany (PWC CSC Europe GmbH). The disassembly showed that the compressor rotor had seized due to friction

between parts of the rotor and the stator. This damage resulted from the improper operation of the number 2 engine bearing, which was also badly damaged. Additionally, the number 2 bearing oil nozzle was partially clogged, meaning that the pattern and direction in which the oil was sprayed were not normal.

The no. 2 bearing oil nozzle strainer was not clogged. There was a small amount of burned oil in the no. 2 bearing housing. The main oil pump, the scavenge pumps and the accessory gear box were partially seized. Metal particles were found in the main oil tank and in the accessory gear box.

Figure 4. No. 2 bearing

Figure 5. No. 2 bearing oil nozzle and oil nozzlestrainer

The nos. 1, 3 and 4 bearings were found in perfect condition and did not show any signs of lacking lubrication. The chip detector in the reduction gear box was completely clean.

1.10.2. *Analysis of engine oil*

The oil was sampled to analyze its condition.

The physical-chemical analyses conducted on the engine oil showed normal values considering the degree of use. The oxidation values obtained were within the limits specified by the engine manufacturer.

The metals present in the oil, on the other hand, indicated wear of the engine's metallic pieces. The oil exhibited high levels of sediment of a carbonaceous nature and of unknown origins.

The oil analysis conducted by the manufacturer showed a high iron content, which is consistent with the wear on the no. 2 bearing.

1.10.3. *Service bulletins involving the no. 2 bearing oil nozzle*

The Pratt & Whitney service bulletins nos. 14346 and 14325R1 are included as Appendix 1. Both bulletins are category 8, meaning that compliance with them is optional.

The first, no. 14346, states that oil leaks can occur because the no. 2 bearing oil nozzle strainer is held in place by a retaining pin that oil can leak through the retaining pin hole. The bulletin suggests replacing the pin with a ring to hold the strainer in place. This Service Bulletin was modified in February 2009 to change its category from 8 to 6, i.e., of application when the sub-assembly is disassembled and access is available to necessary part. Afterwards, it was modified in May 2011 to clarify new oil nozzle was provided with an increased oil flow.

The second bulletin, no. 14325R1, informs that carbon deposits can form in the no. 2 bearing area due to elevated scavenge oil temperatures, and proposes a new seal to provide thermal shielding between the no. 2 bearing compartment and the compressor turbine. A no. 2 bearing oil nozzle with increased oil flow is also provided.

Pratt & Whitney was asked about the possibility of making these service bulletins mandatory. Pratt & Whitney replied that this was the third instance of an unscheduled engine disassembly involving the no. 2 bearing, and that given the total number of flight

hours of the PT6A-67D engine was in excess of 13 million, this amounted to an average of 4.3 million hours per event. As a result, Pratt & Whitney did not believe that a change in the category of the aforementioned service bulletins was warranted.

1.11. Organizational and management information

1.11.1. *Aircraft Flight Manual*

Part B of the Naysa Operations Manual includes the following information on handling emergencies involving problems with the powerplant:

> *"In every case involving a loss of power or an actual engine failure, the captain will be responsible for flying the airplane, re-starting the engine if possible and conducting an emergency landing if required. The first officer will handle the communications and the GPS equipment so as to proceed to the aerodrome or landing field that is most appropriate depending on the distance and winds aloft. The first officer will keep the captain informed at all times of the distances, times and deviations from the chosen route".*

The abnormal procedures section of the Aircraft Flight Manual has a procedure for an in-flight engine failure and a procedure for doing an approach and landing on a single engine.

ENGINE FIRE OR FAILURE IN FLIGHT

NOTE

When operating on the ITT limit, placing the Bleed Air Valves to ENVIR OFF will decrease ITT, thereby allowing the pilot to select a higher power setting on the operating engine. The cabin will depressurize anytime the Bleed Air Valves are moved to the ENVIR OFF position.

Affected Engine:

1. **Condition Lever** ..... **FUEL CUTOFF**
2. **Propeller Lever** ..... **FEATHER**
3. **Firewall Fuel Valve** ..... **PULL CLOSED**
4. **Fire Extinguisher, if required** ..... **ACTUATE**
5. Eng Auto Ignition ..... OFF
6. Autofeather ..... OFF
7. Prop Sync ..... OFF
8. Generator ..... OFF
9. Electrical Load ..... ENSURE WITHIN LIMITS
10. Bleed Air Valve ..... INST & ENVIR OFF

ONE-ENGINE-INOPERATIVE APPROACH AND LANDING

1. Approach Speed (V_{REF}) ..... CONFIRM
2. Fuel Balance ..... CHECK
3. Pressurization ..... CHECK
4. Bleed Air Valves ..... ENVIR OFF
5. Envir Mode Control ..... OFF
6. Blowers ..... HIGH

When it is Certain that the Field Can Be Reached:

7. Flaps ..... 17°
8. Landing Gear ..... DN
9. Lights ..... AS REQUIRED
10. Surface Deice (as required) ..... CYCLE
11. Propeller Lever ..... SET 1700 RPM
12. Airspeed ..... V_{REF} + 5 KNOTS

When it is Certain there is No Possibility of Go-around:

13. Flaps ..... DOWN
14. Airspeed ..... V_{REF}
15. Execute normal landing.

WARNING

Care must be exercised when using single-engine ground fine on surfaces with reduced traction.

Do not use reverse thrust with one engine inoperative.

The before-landing and normal landing checklists are included in the normal procedures.

BEFORE LANDING

1. Cabin Sign (if installed) ..... FSB
2. Approach Speeds ..... CONFIRM
3. Cockpit Door (curtain) ..... OPEN
4. Autofeather ..... ARM
5. Pressurization ..... CHECK
6. Flaps ..... 17°
7. Landing Gear ..... DN
8. Lights ..... AS REQUIRED

NOTE

Under low visibility conditions, landing and taxi lights should be left off due to light reflections.

9. Surface Deice ..... CYCLE, IF REQUIRED

NOTE

If crosswind landing is anticipated, determine Crosswind Component from Section V, PERFORMANCE. Immediately prior to touchdown, lower up-wind wing and align the fuselage with the runway by use of rudder. During rollout, hold aileron control into the wind and maintain directional control with rudder and brakes. Use propeller reverse as desired.

NORMAL LANDING

1. Flaps ..... 35°
2. Airspeed ..... V_{REF}
3. Yaw Damp ..... OFF
4. Power Levers ..... IDLE
5. Propeller Levers ..... FULL FORWARD

After Touchdown:

6. Power Levers ..... LIFT AND SELECT GROUND FINE
7. Brakes ..... AS REQUIRED

Neither the company's normal nor emergency procedures define the tasks sharing. The reference document for the execution of the procedures and checklists used by the company was the aircraft's AFM, approved by the FAA in October 1999.

1.12. Additional information

1.12.1. *Interviews with flight crew and company personnel*

1.12.1.1. Interview with the captain

As reported by the captain, it was on the sixth flight of the day that they had the problem involving the engine. They took off at 19:00 from Lanzarote en route to Tenerife South. The first officer was the pilot flying. The start of the flight was normal and without incidents. They flew the TFS2M departure, climbing to FL100.

ATC cleared them to proceed directly to MERAN and then to LPC. After flying over Las Palmas, he felt a strong explosion and the airplane shook. The ITT reading for the right engine rose to 720 °C, and he saw that engine flare up.

The captain concluded that the engine was on fire, so he started the relevant procedure and carried out the first two memory items:

1. Condition Lever ..... FUEL CUTOFF
2. Propeller Lever ..... FEATHER
3. Firewall Fuel Valve ..... PULL CLOSED
4. Fire Extinguisher, if required (*) ..... ACTUATE

The first officer did the third item and, since the fire seemed to have gone out, the crew decided jointly not to use the fire extinguisher, that is, they did not complete item 4.

From that moment on the captain took control of the aircraft as the pilot flying.

The first officer assumed the duties of the PNF and reported the emergency to ATC, after which he completed the emergency checklist (items 5 to 10):

5. Eng AutoIgnition ..... OFF
6. Autofeather ..... OFF
7. Prop Sync ..... OFF
8. Generator ..... OFF
9. Electrical Load ..... ENSURE WITHIN LIMITS
10. Bleed Air Valve ..... INST & ENVIR OFF

After finishing the procedure, they requested radar vectors to start the ILS approach to runway 03L. The first officer, at the captain's request, informed the passengers of the change in their destination.

The initial approach was done at a speed of 190 kt, and the final was done with 35° flaps.

Two other aircraft came into play during the approach: a B757, whose wake turbulence is categorized as heavy, and another aircraft that took off from runway 03R and which could have interfered with the aircraft in the event of a missed approach.

The aircraft left the runway via taxiway S3, almost at the end of the runway. Upon exiting they saw two emergency vehicles. The passengers were disembarked normally without any need for an evacuation.

The captain confirmed that he had held a landing briefing that included a single-engine approach and go around.

He also stated that there were no company instructions regarding protecting the CVR data in the event of an incident or accident.

1.12.1.2. Interview with first officer

The flight started normally with the first officer as the pilot flying. The flights are normally divided, with the first four being done by one pilot and the last four by the other.

After crossing Las Palmas, he felt several thuds over half second intervals and saw a flame streaming out of the engine nozzle. He immediately informed the captain that there was a fire in the number 2 engine. The captain told him that he was initiating the engine fire procedure while the first officer kept guard the number 1 engine.

At no time was there a fire indication nor did the MASTER WARNING turn on.

He reported the emergency to ATC and then completed the procedure. The crew did not attempt to re-start the engine in flight since both assumed it was damaged.

They isolated the cockpit by closing the cockpit door, which is normally open.

They then proceeded visually to Las Palmas. He does not recall whether they held an approach briefing or whether the turned off the environmental mode, since the procedure indicates performance of this step "as required". After landing they did not park in the usual area.

They exited the airplane normally after shutting it down.

He stated that the training in his opinion was fairly good, and that he was not aware of any procedure or instruction that required protecting the information in the flight recorders in the event of an incident or accident.

1.12.1.3. Interview with the operations manager

The operations manager stated that Naysa is an airline with a very limited number of flight destinations and with highly repetitive operations.

As regards training, there was no flight simulator on which to conduct refresher and training courses.

He also confirmed that there were no procedures in effect within the company that reminded crews to protect flight recorder data in the event of an incident or accident.

1.12.2. *Air traffic regulations involving emergencies*

According to Spain's air traffic regulations, any aircraft in an emergency situation is to be given priority over other aircraft. This condition is described in Chapter 4:

4.3.16. Emergency procedures.

4.3.16.1. General.

4.3.16.1.1. The diversity of circumstances involving each emergency situation precludes the establishment of detailed and exact procedures to follow. The procedures described herein are intended to provide general guidelines to air traffic services personnel. Air traffic facilities are expected to fully coordinate their activities Itis left to the judgment of said personnel the best way to handle emergency cases.

4.3.16.2. Priority.

4.3.16.2.1. An aircraft known or suspected to be in an emergency situation, even if it is suspected an act of unlawful interference, shall be given priority over other aircraft.

4.6.8. Emergencies, hazards and equipment failures.

4.6.8.1. Emergencies.

4.6.8.1.1. If an aircraft is or appears to be in an emergency situation, the radar controller shall provide any and all assistance as required. The procedures specified herein may vary depending on the situation.

1.12.3. *AENA's procedures in relation to flight emergencies*

According to the document «Actuación en emergencias» in force on the accident date, which included the engine failure procedure, it was necessary to clear the runway to maintain it safe and available (example: since 20 NM in final approach).

Also, in the Operational Manual of the ATS facility, section 6.7.1. EMERGENCIAS, it was mentioned the emergency manual and the aerodrome emergency plan. In the same way, it was included the aforementioned 4.3.16.2 paragraph from the Rules of the Air and Air Traffic Services.

2. ANALYSIS

2.1. Actions of the flight crew

During the sixth flight of the day, the Beechcraft 1900D aircraft, registration EC-IJO, experienced an in-flight engine failure. The crew initially identified the fault as an engine fire due to the flames they saw exiting from the exhaust nozzle, but they ruled out that possibility since the fire warning was not activated.

The pilot flying was the first officer, meaning that the procedure was started by the captain, who performed the first two memory items. As specified in Part B of the Operations Manual, whenever an emergency involving the loss of power or an engine failure occurs, the captain is responsible for flying the airplane. Consequently, the captain took the controls of the aircraft and the first officer performed the third memory item.

The engine fire/failure procedure was interrupted and the first officer reported the emergency to ATC using standard phraseology. It was then that he finished the rest of the procedure by completing the six (6) remaining items.

The tasks sharing used by the crew corresponds to that outlined in the Operations Manual, since in this case the pilot flying was the first officer, who was properly relieved as soon as the engine failure was identified, in keeping with company procedures.

This case involves an aircraft whose minimum crew complement is one pilot. The procedures in the AFM are designed with that condition in mind. Naysa used the

procedures contained in the AFM even though the aircraft was operating with two crewmembers, meaning that the procedures in use were not applicable to that circumstance. Neither the normal nor the abnormal procedures included a definition of the taskssharing among the crewmembers. This lack of guidance resulted in the engine fire or failure procedure being initiated by the captain and, before the memory items were completed, being continued by the first officer.

The normal tasks sharing in an emergency with a two-pilot crew has the pilot flying at the time of the emergency fly, navigate and comunicate while the pilot not flying combats the emergency. In this case, there was no clear definition of whose responsibility it was to carry out the emergency procedure; moreover, since the first officer is the crewmember assigned to report the emergency to ATC, the full execution of the procedure is delayed.

Given the crew's handling of the event, it is clear that a detailed definition is needed of the taskssharing, whether during an emergency or normal operations, involving an aircraft whose minimum crew complement is one pilot and which is being flown by two pilots. The procedures in the AFM, therefore, need to be adapted for two-pilot operations.

Along these lines, the indications included in Part B of the Operations Manual which refer to the tasks sharing in the event of a loss of power or engine failure are not in keeping with the most universally recognized principles[5], which define the priorities in the event of an emergency as flying, navigating, communicating and handling the emergency.

According to these publications, the pilot flying must fly the aircraft and ask the pilot not flying for whatever he needs in order to adjust the navigation instruments so that he can navigate. When the emergency is identified, the pilot flying should inform ATC of their intentions and their situation while the pilot not flying executes the emergency procedure when instructed to do so by the pilot flying.

Another aspect to consider is the execution of the approach. According to the information provided by the crew during the interviews, they were unclear as to whether or not a briefing was held that considered the approach and go around on a single engine.

The operations manager stated that crew training was not held in a flight simulator since no simulators for this type of aircraft were available. This meant that some emergencies could not be fully trained on, and that therefore the crew's response when such an emergency did take place may not be correct given the lack of training on it. The company's fleet currently consists of ATR-72 aircraft, for which a flight simulator

[5] FSF ALAR Briefing note 1.3. Golden Rules. Flight Safety Foundation.

does exist that allows for periodic training, in accordance with regulations, on emergencies such as an in-flight engine failure.

The crew also reported that prior to each flight, the ERASE button was pressed on the CVR to erase the contents from the previous flight even though this action was not in any procedure. This indicates that oral tradition prevailed over the documentation found in the Operations Manual, and that actions were therefore taken that deviated from procedure.

Nor was there a procedure to warn of the need to preserve the contents of the flight recorders in the event of an incident or accident. As a result, if the aircraft was energized for any reason, the information contained in them could be lost.

2.2. Actions of air traffic control

When the emergency occurred, the crew properly notified ATC of the event using the standard phraseology (MAYDAY repeated three times), the nature of the emergency and informing of their intention to divert to Las Palmas.

According to Spain's Air Traffic Regulations (RCA), aircraft in an emergency have priority over all other aircraft.

In this event, even though the aircraft requested that an aircraft categorized as heavy according to its wake turbulence classification (a 757) be removed from the landing sequence, said sequence was maintained without the incident aircraft being given priority. Moreover, another aircraft on a parallel runway, 03R, was cleared to take off, which interfered with the approaching aircraft.

An incident could have occurred during the landing of the 757 that might have forced said aircraft to remain on the runway, which in turn would have forced the incident aircraft to go around on a single engine.

If, on the other hand, the aircraft had been forced to go around, it could have interfered with the aircraft that had been cleared to take off from runway 03R shortly before.

The coordination of ATC was generally adequate, and the aircraft was quickly transferred from the Tenerife South sector to the Gran Canaria feeder sector, and subsequently to the Gran Canaria approach sector. It was then that the aircraft requested that the preceding traffic be removed from the approach sequence. Since said traffic was under the control of the Las Palmas Tower, it was that facility which should have instructed the 757 to abandon the approach.

The actions of the Las Palmas Tower were not in keeping with the instructions contained in the RCA with respect to the priority that should be given to an aircraft in an

emergency situation. Priority should have been given to the incident aircraft by removing the preceding traffic from the approach sequence and by not authorizing any takeoffs until the aircraft in emergency was confirmed to be safely on the ground.

2.3. Identification of engine failure

The carbon build-up that was noted in the oil nozzle for the no. 2 bearing indicates that rather that a build-up of particles, it was the remains of a layer that was growing inside the nozzle. The experience of Pratt & Whitney indicates that this was not a typical case of residue accumulation. The gradual formation of this layer resulted in a lack of lubrication to the no. 2 bearing, and possibly in the damage that was seen in this bearing.

The fact that no metal particles were found in the main oil filter, along with the good condition of the other bearings, rules out any problems with the main oil pump and with the scavenge pump.

The damage that was noted in the main and scavenge oil pumps is believed to have resulted from the failure of the number 2 bearing.

In conclusion, the damage to the number 2 bearing was indicative of a lack of lubrication, due possibly to a partial blockage present in the number 2 bearing oil nozzle. This resulted in a reduction in flow and in an abnormal spray pattern.

Later it was clarified that although in the beginning the formation of waste in the nozzle seem to be due to an increase of temperature inside the bearing housing (which lead to the issue of the SB 14325), the main cause of the burned deposits was the oil leakage through the nozzle pin hole and consequently the SB 14346 was issued later.

The SB 14346 modified the retaining ring of the oil nozzle to hold the strainer element and also, according to the May 2011 issue, the no. 2 bearing oil nozzle was provided with an increased oil flow. Pratt & Whitney informed that since issuance of SB 14346 there have been no reported nozzle blockage occurences associated with engines incorporating the new nozzle arrangement.

3. CONCLUSION

3.1. Findings

- The aircraft had a valid and in force airworthiness certificate.
- The flight crew was in possession of valid and in force flying licenses.
- There was a failure of the right engine during the sixth flight of the day.

- The engine failed due to an increase of the no. 2 bearing above its normal operating temperature caused by a lack of lubrication, which caused said bearing to fail.
- The no. 2 bearing was not being properly lubricated because the oil nozzle for said bearing was partially clogged.
- The crew identified the engine failure and secured the engine.
- The tasks sharing during the execution of the engine failure procedure was not clearly defined.
- The procedures in the Operations Manual did not define the tasks sharing in the event of an emergency.
- The Operations Manual also did not describe task sharing for normal procedures.
- The crew declared the emergency in accordance with standard procedures.
- There was another aircraft ahead of the incident aircraft that was interfering with the latter's maneuvers.
- The crew requested that the approach be cleared and that they be given priority.
- ATC decided to maintain the approach sequence and the Control Tower authorized a takeoff on a parallel runway before the incident aircraft landed.
- The crew reported that there was no procedure to preserve flight recorder data in the event of an incident or accident.
- The crews routinely pressed the CVR ERASE button as part of their flight preparations.

3.2. Causes

The most likely cause of the engine failure was the lack of lubrication to the no. 2 bearing caused by a partially clogged oil nozzle. The high temperatures reached in the area of the no. 2 bearing could have resulted in the formation of carbon deposits that led to the obstruction.

4. SAFETY RECOMMENDATIONS

REC 45/11. It is recommended that, in accordance with EU-OPS, NAYSA define a task sharing policy within its emergency procedures that clearly specifies who is responsible for flying, navigating, communicating and for executing the emergency procedure, and that it include guidelines for the proper coordination between the flight crew members in the event of an emergency so as to provide for the optimum use of available resources.

It is also necessary that proper task sharing be defined for the normal procedures that specify the functions of each flight crew member.

REC 46/11. It is recommended that NAYSA define a procedure for preserving flight data recorder in the event of an accident or incident, and that it transmit

precise instructions to its flight crews so that the information contained in the flight recorders is not lost.

REC 47/11. It is recommended that AENA updates the procedures included in the document "Actuación en emergencias" to give specific indications to the controllers about what separation should be provided to aircrafts in emergency with other aircrafts and references to the before mentioned document "Actuación en emergencias" were included in the operational manual of the ATS facilities.

APPENDIX 1

PRATT & WHITNEY SERVICE BULLETING

APPENDIX 1
Pratt & Whitney Service Bulleting

PRATT & WHITNEY CANADA

SERVICE BULLETIN

P&WC S.B. No. 14346

BULLETIN INDEX LOCATOR 72-30-04

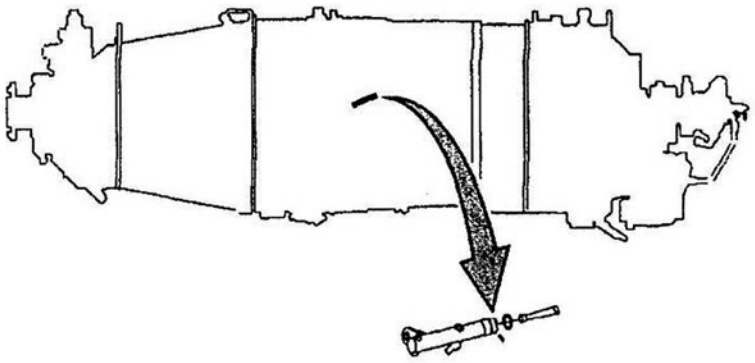
TURBOPROP ENGINE
NO. 2 BEARING OIL NOZZLE WITH RETAINING RING - INTRODUCTION OF

MODEL APPLICATION

PT6A-64, PT6A-66, PT6A-67, PT6A-67A, PT6A-67AF, PT6A-67AG, PT6A-67D, PT6A-67R, PT6A-67T

Compliance: CATEGORY 8

Summary: Oil leakage can occur in the area of the No. 2 bearing oil nozzle. The oil nozzle strainer element is held in place by a retaining pin and oil can leak through the retaining pin hole. The No. 2 bearing oil nozzle is replaced with one that uses a retaining ring to hold the strainer element in place.



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P&WC S.B. No. 14325R1

BULLETIN INDEX LOCATOR
72-30-04 / 72-50-01

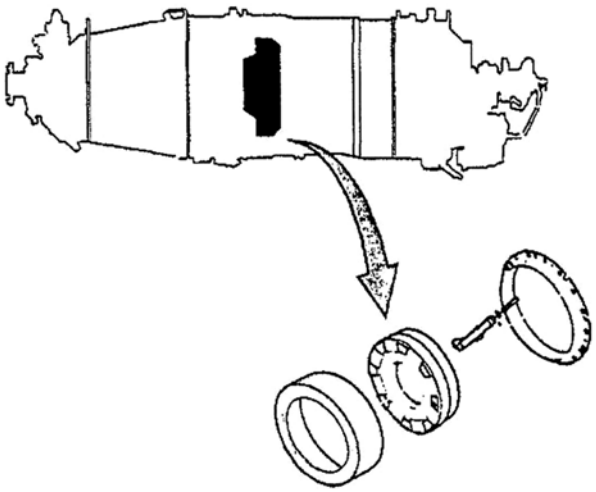
TURBOPROP ENGINE
COMPRESSOR TURBINE AIR SEAL AND NO. 2 BEARING OIL NOZZLE AND HOUSING COVER AND FLANGE - REPLACEMENT OF

MODEL APPLICATION

PT6A-67D

Compliance: CATEGORY 8

Summary: Carbon deposits can form in the No. 2 bearing area because the scavenge oil temperature can be higher than necessary. A redefined compressor turbine air seal is introduced to provide thermal shielding around the bearing compartment. Also, a No. 2 bearing oil nozzle is provided with an increased oil flow. A redefined bearing cover and flange is also introduced.



Apr 16/2001
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