
Engine fire, Final Report of the Aircraft Accident Investigation Bureau concerning the incident of the airplane Airbus A321-111, HB-IOC on 20 February 2001 at Geneva Airport

Micro-summary: A Bang! in flight on this A321 turns out to be an engine fire.

Event Date: 2001-02-20 at 1130 UTC

Investigative Body: Aircraft Accident Investigation Bureau (AAIB), Switzerland

Investigative Body's Web Site: <http://www.bfu.admin.ch>

Note: Reprinted by kind permission of the AAIB.

Cautions:

1. Accident reports can be and sometimes are revised. Be sure to consult the investigative agency for the latest version before basing anything significant on content (e.g., thesis, research, etc).
 2. Readers are advised that each report is a glimpse of events at specific points in time. While broad themes permeate the causal events leading up to crashes, and we can learn from those, the specific regulatory and technological environments can and do change. ***Your company's flight operations manual is the final authority as to the safe operation of your aircraft!***
 3. Reports may or may not represent reality. Many many non-scientific factors go into an investigation, including the magnitude of the event, the experience of the investigator, the political climate, relationship with the regulatory authority, technological and recovery capabilities, etc. It is recommended that the reader review all reports analytically. Even a "bad" report can be a very useful launching point for learning.
 4. Contact us before reproducing or redistributing a report from this anthology. Individual countries have very differing views on copyright! We can advise you on the steps to follow.
-



Final Report of the Aircraft Accident Investigation Bureau

concerning the incident

of the airplane Airbus A321-111, HB-IOC
on 20 February 2001
at Geneva Airport

Ursache

Der Vorfall wurde verursacht durch das Versagen des Hauptlagers Nr. 4 des Triebwerks #2 und der daraus folgenden Beschädigungen der Turbinenschaufel-Enden der Hochdruckturbinen.

Aircraft Accident Investigation Bureau

FINAL REPORT

THIS REPORT HAS BEEN PREPARED FOR THE SINGLE PURPOSE OF ACCIDENT/INCIDENT PREVENTION. THE LEGAL ASSESSMENT OF ACCIDENT/INCIDENT CAUSES AND CIRCUMSTANCES IS NO CONCERN OF THE ACCIDENT INVESTIGATION (ARTICLE 24 OF THE AIR NAVIGATION LAW)

AIRCRAFT	Airbus A321-111	HB-IOC
-----------------	-----------------	--------

OPERATOR	Swissair, Schweiz. Luftfahrt AG, Postfach, 8058 Zürich
-----------------	--

OWNER	Flightlease AG, Postfach, 8058 Zürich
--------------	---------------------------------------

PILOTS	PIC: Swiss citizen, male, born 1954 COPI: Swiss citizen, male, born 1977
---------------	---

LICENCES	ATPL CH (PIC) and CPL CH (COPI)
-----------------	---------------------------------

FLIGHT EXPERIENCE (PIC)	Total	5731	In the previous 90 days	160
	On accident type	1368	In the previous 90 days	160

FLIGHT EXPERIENCE (COPI)	Total	670	In the previous 90 days	228
	On accident type	501	In the previous 90 days	228

PLACE	Geneva Airport
--------------	----------------

DATE AND TIME	20 February 2001 11:30 UTC approx
----------------------	-----------------------------------

TYPE OF FLIGHT	Commercial scheduled flight / SR 831
-----------------------	--------------------------------------

PHASE OF FLIGHT	Cruise and Approach
------------------------	---------------------

TYPE OF INCIDENT	Engine failure with fire in tailpipe
-------------------------	--------------------------------------

INJURIES TO PERSONS

	Crew	Passengers	Others
Fatal	---	---	---
Serious	---	---	---
Minor or none	7	85	

DAMAGE TO AIRCRAFT	RH Engine
---------------------------	-----------

OTHER DAMAGE	---
---------------------	-----

History of flight

During the flight from London Heathrow to Geneva after the climb to FL290 and establishing cruise conditions at 11:05 UTC a loud bang was heard by the flight and cabin crew. The cabin crew advised the cockpit crew by interphone of their observations. After checking all parameters, all seemed normal and the flight continued to Geneva.

During descent in to Geneva for a landing on runway 05, around 11:46 UTC the vibrations on the RH engine increased and fluctuated as well as the EGT of the RH engine.

A loss of engine power was felt, so that a corrective rudder input had to be given.

During the landing and flare phase, fire was observed by a crew in the proximity of the runway and TWR was advised. After landing, the warning light "ENG #2 OIL FILTER CLOGGED" came on. The crew shut down the RH engine.

Geneva Apron advised the crew that one engine is on fire and asks them if they can stop were they are, which means on the taxiway. The crew complied with the request.

The aircraft stopped on the taxiway. Both fire extinguisher bottles of the RH engine were discharged. The fire brigade arrived and cooled the RH engine. The fire has ceased, as no more fuel was injected due to the shut off of the engine.

After the extinguishing of the fire and the cooling down of the engines, the CDR decided to let the passengers disembark via the stairways on the taxiway.

Nobody was hurt during the disembarkation of the plane and the passengers remained calm.

Investigation

The ACC of Geneva informed the Swiss Federal Aircraft Accident Bureau about the incident.

An investigation according to ICAO Annex 13 was opened on the same day.

Findings

- All crew members held valid licences.
- The aircraft had no story of engine problems.
- During a night stop in Bruxelles from 08th to 09th February, the Maintenance found that the chip detector indicator on engine #2 popped out (SEQ 57). The check revealed "No metallic parts found.." and the indicator was repositioned. Follow-up was requested on log slip.
- On the third flight of 09 February, N2 vibrations of 2.2 were observed and reported in the log (SEQ 61). The vibrations were in limits and after a check of the engine inlet and outlet, the aircraft was released. Troubleshooting (TUTB) was informed.
- On 09 February, the fire loop "B" on engine #2 had a fault. The aircraft was released after a transfer to HIL i.a.w. MEL.
- On 20 February, the crew made the following entry after the flight from London Heathrow (LHR) to Geneva (GVA):
 - *" Subject: POWER PLANT; Strange vibrations on Eng. #2 starting at intermed. final (up to 4.6). During short final increase up to 9.0 units. After leaving the RWY ECAM warn Eng two filter glogged. No fire warning at all. Fire bottle #2 discharged as informed by APRON Eng two on fire."*

- On 20 February 2001, the flight SR 831 was from LHR to GVA with the F/O being PF.
- At 11.05, data recorded show, that on engine #2 a short drop of some power indications followed by a higher EGT for the remainder of the flight of approx 30°C.
- The vibrations VIB 2 on engine #2 raised during the T/O roll to 1.5 units. At power reduction for cruise, the vibrations increased to 2 units.
- At 11:05 during the incident in the engine #2, the vibrations VIB 2 on engine #2 dropped back to below 0.5 units.
- At 11:35 the aircraft was in descent and vibrations VIB 2 shortly peaked to 0.9 units. Thereafter, the vibrations VIB1 rose to 6.7 units and later on up to 9.0 units before the engine was shut down. The EGT had risen to 837°C.
- The aircraft was landed by the CDR, which took over control as the vibrations got stronger.
- The disrupted gas flow due to the damaged blades and heavily fluctuating pressure P3 let the flame move back into the exhaust zone, where unburned fuel from the not properly working engine was ignited and was visible as fire.
- The fire was in the exhaust zone, which is not protected by a fire warning.
- The fire went out after the unburned fuel was sparked off during after a few seconds.
- After landing the warning light "ENG #2 OIL FILTER CLOGGED" was lighted.
- Geneva Apron ordered the aircraft to stop at the taxiway and wait for the fire brigade.
- The fire brigade cooled the exhaust area after the crew had activated both fire extinguisher bottles (Agent #1 and Agent #2) on the engine #2.
- The agent #1 "DISCH" light was not illuminated after the activation of the two bottles.
- The aircraft was evacuated after the arrival of busses and stairs via the left forward and aft exit.
- The initial inspection of SR- Technics maintenance revealed, that the HP and LP rotors were seized together. Oil was drained for analysis and a boroscope inspection carried out.
- The engine was removed for investigation. Disassembly started with presence of BFU representative and confirmed a defective bearing No. 4.

Analysis

The incident was the result of the failure of Bearing No. 4 during the Flight from LHR to GVA. Despite the fact, that some days earlier, the engine #2 had showed a popped out chip detector indicator in BRU, there is no relation to the incident of 20 February 2001. The material removed after this incident has been analyzed and did not show Bearing material as used on Bearing No.4.

The first indication with a noticeable noise during cruise left some engine indications changed, but not so far out of the former values, that a clear analysis of the situation was possible to the crew. Also the cabin crew had realized the noise and has contacted the flight crew.

During the approach to Geneva, the situation changed, as through the change in power setting, the parameters of engine #2 started to change. After the reduction of power, there was the application of more power around 11:42 with the throttles retarded again. At 11:46 there was again power applied, and at this moment, the engine #2 shows a sharp increase in EGT, a loss of N1 and N2 together with remaining low P25 and P3.

The engine was only shut down on the ground, after the "ENG #2 OIL FILTER CLOGGED" warning light came on.

Through the crew of an aircraft holding short of runway 05, the Geneva Ground controller was advised, that flames were coming of the landing aircrafts engine #2. This information was transferred to the Geneva Apron controller, who instructed Swissair 831 to stop at the taxiway.

A distinct frequency 121.85 (Geneva Traffic) was assigned to Swissair 831 and the chief of the fire brigade to coordinate the actions.

After the activation of both fire extinguisher bottles by the crew and the cooling of the tailpipe by the fire brigade, the fire was out. This was mainly due to the starvation of the fuel in the tailpipe. The fire extinguishers were of no use, as their disposal of extinguishing agent was not in the area of the tailpipe.

As the fire was no real threat and was extinguished quickly, the CDR decided not to evacuate the aircraft via the slides and ordered disembarkation via stairs on the left side.

There was some confusion among the cabin crew members about the correct selection of the door slides, as the captain had briefed to disarm only the left slides and leave the right slides armed in case an emergency evacuation would become necessary. As some doors normally are never actuated and the command should be "Yellow selectors disarmed", One flight attendant (FA 3) was disturbed by the command:" ALL LH selectors in disarmed position" The Maitre de cabine corrected the instruction to this person.

Cause

The incident was caused by the failure of bearing No. 4 of the engine #2 with resulting damage to the HPT blade tips.

Berne, 10 May 2004

Aircraft Accident Investigation Bureau

This report has been prepared for the purpose of accident/incident prevention. The legal assessment of accident/incident causes and circumstances is no concern of the incident investigation (art. 24 of the air navigation law)

Appendix 1

Transcript



Abbreviations

TWR - Geneva Tower
GND - Geneva Ground
AMS - Geneva Apron
TFC - Geneva Traffic

831 - Swissair 831 A321 IFR flight EGLL - LSGG

GED/ 04/04/2001

Appendix 1

skyguide

Page no.1
Date: 20.FEB.2001

TRANSCRIPT SHEET

To Col.1	From Col.2	Time Col.3	Communications Col.4	Observations Col.5
-------------	---------------	---------------	-------------------------	-----------------------

Frequency 118.7 MHz: Geneva Tower, concerning SWR831 only

TWR	831	11:44:38	Geneva Tower bonjour, Swissair eight three one on VOR zero five.	
831	TWR	43	Bonjour Swissair eight three one, number one, report on short final.	
TWR	831	46	Okay, will do.	
831	TWR	11:45:36	Swissair eight three one cleared to land zero five, wind zero six zero degrees one one knots.	no reply
831	TWR	46	Swissair eight three one ?	
TWR	831	50	Heu, go ahead, Swissair eight three one.	
831	TWR	52	Swissair eight three one you are cleared to land zero five, wind zero six zero degrees one one knots.	
TWR	831	57	Cleared to land, Swissair eight three one.	
831	TWR	11:47:58	Swissair eight three one contact one two one seven five, au revoir.	
TWR	831	11:48:00	One two one seven five, Swissair eight three one, bye-bye.	

Frequency 121.9 MHz: Geneva Ground, comment about SWR831 only

GND	249	11:48:36	Vol d'Occitania ?	OJF249, F900, LSGG - LFPB
249	GND	38	Oui, je vous écoute.	
GND	249	39	Oui le, pour info, la, le... Swissair qui vient de se poser, il y avait des flammes qui sortaient du moteur droit à l'atterrissage !	
249	GND	46	Oui, bien reçu, on va les aviser.	
GND	249	50	XXXXX.	probably: "Okay"

Signature of
person in charge:


Appendix 1

skyguide

Page no.2
Date: 20.FEB.2001

TRANSCRIPT SHEET

To <u>Col.1</u>	From <u>Col.2</u>	Time <u>Col.3</u>	Communications <u>Col.4</u>	Observations <u>Col.5</u>
<u>Frequency 121.75 MHz: Geneva Apron, concerning SWR831 only</u>				
AMS	831	11:48:21	Apron bonjour, Swissair eight three one.	
831	AMS	23	Bonjour Swissair eight three one, taxi via the outer, strip number three to stand eight.	
AMS	831	29	Outer, strip three, stand eight, Swissair eight three one.	
831	AMS	50	Swissair eight three one for information: during the landing you had a big flame escaped from your right engine.	
AMS	831	57	Swissair eight three one thank you, that's copied. Heu, we had some more problems with our engine, so we will have a check XXXXX by our maintenance. XXXXX, can you see any fire, anything now ?	probably: "done" probably: "Do you heu..."
831	AMS	11:49:06	Yes, the fire brigade is coming... near to you from the left.	
AMS	831	10	Okay, thank you very much.	
831	AMS	18	Swissair eight three one can you ????? stop here, please ?	unreadable
AMS	831	21	Okay, we are stopping here, Swissair eight three one.	
AMS	831	27	And eight three one for information, heu we have the... number two engine, the engine on the right hand side is shut down now.	
831	AMS	33	Okay, thank you.	
AMS	831	48	Heu..., Swissair eight three one, heu is it still.... on fire, can you find that out for us, please ?	
831	AMS	53	Swissair eight three one could you cut... all engines, please ?	
AMS	831	11:50:40	And Swissair eight three one, we are shutting down now engine number one, now to.	
831	AMS	43	Thank you Sir.	
831	AMS	11:51:56	Swissair eight three one ?	

Signature of
person in charge:

Appendix 1

skyguide

Page no.3
Date: 20.FEB.2001

TRANSCRIPT SHEET

To <u>Col.1</u>	From <u>Col.2</u>	Time <u>Col.3</u>	Communications <u>Col.4</u>	Observations <u>Col.5</u>
AMS	831	11:52:00	Eight three one, go.	
831	AMS	01	Could you change the frequency on... one two one point eighty-five.	
AMS	831	06	Twenty-one eighty-five, Swissair eight three one.	

Frequency 121.85 MHz: Geneva Traffic

TFC	831	11:52:09	XXXXXX eight three one is on.	Probably: "And"
831	TFC	12	Heu India Oscar Charlie from Fire Chief Officer.	
TFC	831	15	Yes Sir, go ahead.	
831	TFC	17	Okay, heu we clean your engine, your right engine, we have some flames at the rear of the ... engine and we cool down now the engine. Heu, would you like please to disembark your aircraft ?	
TFC	831	29	Okay heu we are ... shut down the engine and have ????? both heu our fire agent. So heu, yes I think... we would like to heu... get the passengers out. Could you organise some stairs for us ?	unreadable
831	TFC	44	Okay, there is actually for myself no risk, and we will cool down and continue to cool down your engine. We will organise some stairs, but please on the right side of the aircraft; stay stand by to disembark by the slide.	
TFC	831	59	Okay, we will... keep the slide armed on the right hand side of the aircraft.	
831	TFC	11:53:04	Yes sure, and please, please stand by, just in case if we have a degradation of the situation.	
TFC	831	10	Okay, will do.	
831	TFC	43	Heu, India Oscar Charlie from Chief Fire Officer ?	
TFC	831	45	Yes, go ahead Sir.	
831	TFC	46	Yes Sir, we will organise the bus and the stairs and we will keep stand by with the appliances and the... and my guys.	
TFC	831	55	Okay, thank you very much Sir.	

Signature of
person in charge:


Appendix 1

skyguide

Page no.4
Date: 20.FEB.2001

TRANSCRIPT SHEET

<u>To</u> Col.1	<u>From</u> Col.2	<u>Time</u> Col.3	<u>Communications</u> Col.4	<u>Observations</u> Col.5
831	TFC	11:56:25	India Oscar Charlie from Chief Fire Officer ?	
TFC	831	29	Yes, go ahead.	
831	TFC	31	I just have a question. How are the passengers inside ? If you need a "psychologue", a psychological assistance or something like that ?	
TFC	831	38	Heu... at the moment it's okay, but heu... we will, we offered it to the passengers at the moment, nobody heu needs, but... we'll keep you informed.	
831	TFC	50	Okay.	
TCF	831	11:58:53	And Fire Chief from Oscar Charlie.	
831	TFC	11:59:10	Oscar Charlie, go ahead.	
TFC	831	11	Yes..., do you have an idea how long it will take for the stairs and the passenger bus to get here ?	
831	TFC	18	I think it will be done in two minutes, because the bus are present and we need... just to XXXXX the stairs.	probably: "have"
TFC	831	25	Okay, thank you very much.	
831	TFC	27	You're welcome.	
831	TFC	12:00:55	Oscar Charlie from Chief Fire Officer ?	
TFC	831	57	Yes, go ahead.	
831	TCF	59	Okay the stairs are XXXXX.	Probably: "present"
TFC	831	12:01:00	Okay, thank you very much, we have the slides disarmed and we are opening... the door now. We are, confirm we only have slides on, I mean heu stairs at the forward door ?	
831	TFC	10	Yea.	
TFC	831	11	XXXXX.	Probably: "Okay"

05/04/2001 / GED/sm
\\libdoc\ops\libenq\01\atirSignature of
person in charge:

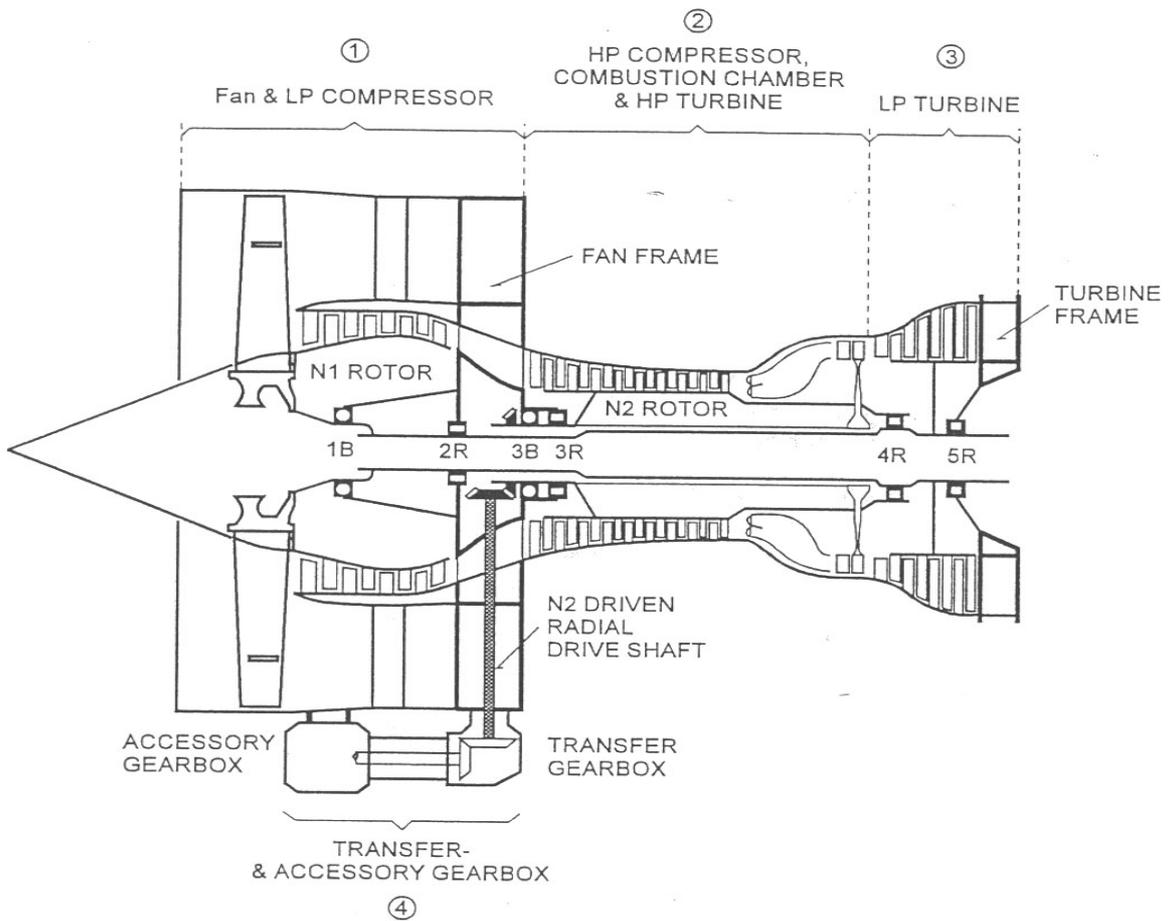

Appendix 2

Extract of IHB with Engine Layout and location of Bearing No. 4

IHB A319/A320/A321
INSTRUCTION HANDBOOK

ENGINE
General

ENGINE PRESENTATION



Appendix 3

Pictures of dismantled engine S/N 779172

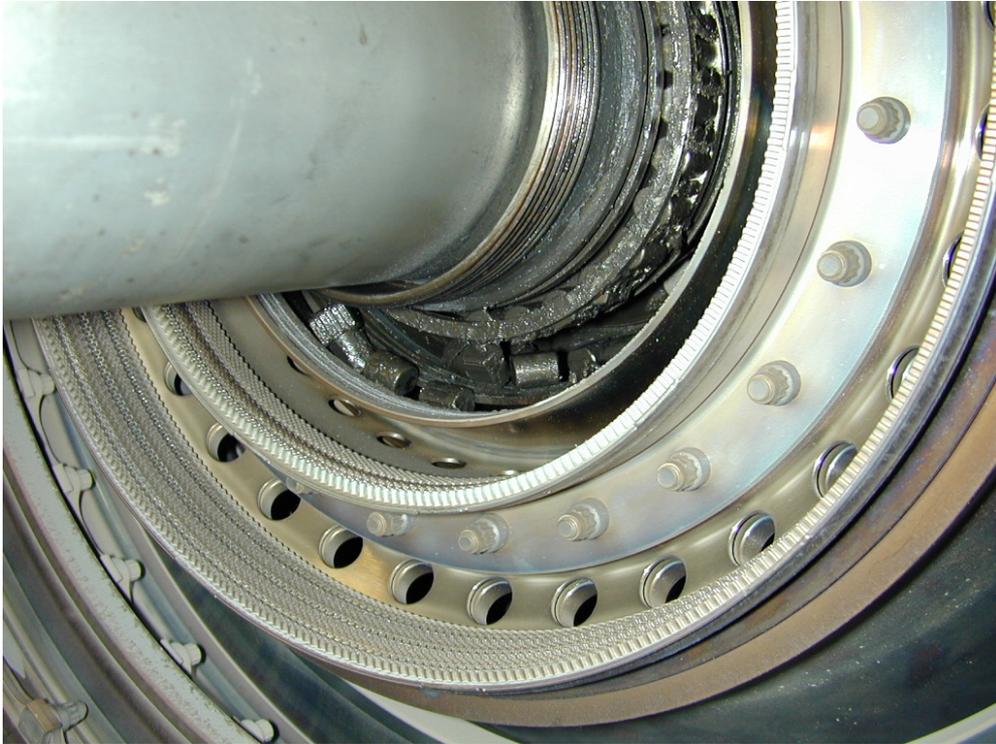


Fig. 1 Engine view Bearing 4

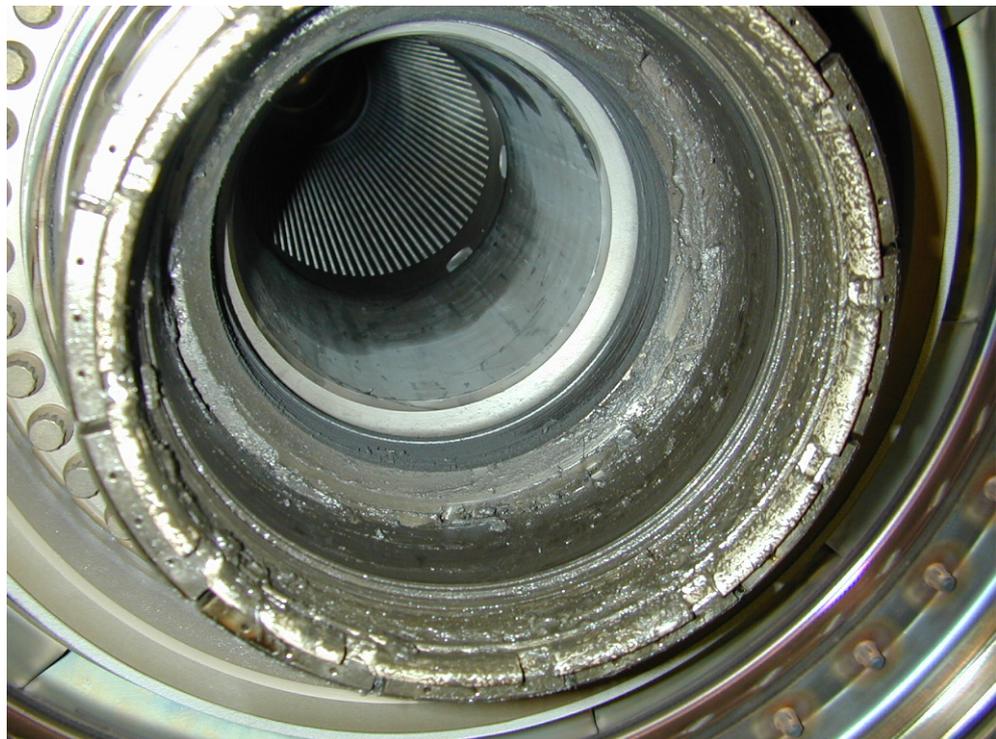


Fig. 2 Bearing No 4 Outer race



Fig. 3 Bearing No 4 Inner race



Fig. 4 Damaged blade tips



Fig. 5 Shroud



Fig. 6 Ring