



Rolls-Royce

Engine Investigation

Allison
M250-C20B
Engine CAE 836362

MD 369E
Registration: N506PH



Model 250-C20B/J

**Paradise Helicopters
Hamakua, Hawaii**

A black ink signature of David Riser.

**David Riser
Senior Air Safety Investigator**

**Accident date: February 21, 2019
Investigation date: March 5-7, 2019
At Keystone: May 15, 2019
Report date: July 8, 2019**

Report Enclosures:

Report Narrative

Appendix A , Engine Run Logs

Appendix B , Engine Performance Charts

Appendix C, Photographs at Aircraft Recovery Location

Appendix D, Photographs Keystone Turbine Services

Appendix E, Selected Engine Records

Background Information:

On February 21, 2019, at approximately 0659 local time, an MD 369E helicopter, N506PH, was involved in an accident approximately 1 mile south-east of Kukuihaele, Hawaii. The helicopter was registered to K&S Helicopters and operated by Paradise Helicopters. Visual meteorological conditions prevailed in the area at the time of the accident and no flight plan was filed. The flight originated from Hilo International Airport, Hilo, Hawaii at approximately 0600 and was operating as a positioning flight.

The pilot reported that he was maneuvering to land at an off-airport pick up site. He started the approach to land and while in a descending turn to the right he saw the engine out light illuminate and heard an alarm activate. He noticed the exhaust gas temperature at about 909° C and the engine torque gauge indicated 0%. He established an autorotational descent and found a suitable landing area. During touchdown, the tail rotor assembly and left skid assembly broke away followed by the helicopter rolling to the left. The helicopter came to rest on its left side with the engine still running. The pilot shutdown the engine and exited through the front wind screen area with the help of witnesses. The helicopter sustained substantial damage to the fuselage and tail boom. The pilot and only occupant sustained serious injuries.

Airframe Observations:

The helicopter was positioned upright on a dolly. All main rotor blades had been removed. The tail boom was separated just forward of the tail rotor with the tail rotor gear box and tail rotor blades remaining attached. Both main landing gear skids were absent. The fuselage exhibited overall damage with the majority of the front wind screen and chin bubble plexi-glass being absent.

Engine Observations:

The engine remained in position and securely attached to the airframe. No visible impact damage was noted to the engine. A visual and tactile examination of all engine pneumatic, fuel and oil lines was conducted where all "B" nuts and associated fittings were found to be at least finger tight. Oil and fuel line interface connections between the engine and airframe were examined where all were found at least finger tight with no evidence of leakage. The power turbine governor was examined where collective movement resulted on correct movement at the governor. Rotation of the throttle was not possible due to control linkage damage beneath the right collective position. A vacuum check of the engine fuel system was conducted where the engine fuel system aft of the airframe fuel filter held specified vacuum for excess of two minutes. Impact damage to the airframe fuel filter drain fitting prohibited vacuum testing of the entire fuel system. (Fig1)

During examination fuel was noted both within the fuel pump filter bowl and approximately two tablespoons of fuel noted in the line at the fuel nozzle. The only noted anomaly was the compressor bleed valve which was stuck in the closed position and the poppet valve could not be manually actuated. (Fig 2)

Upon removal of the engine from the airframe both N1 and N2 drive trains were rotationally free and smooth. Examination of both upper and lower chip detectors revealed both to be void of material. The decision was then made to recover the engine to Keystone Turbine Services for run as received testing of the engine. (Fig 3)

Engine Information:

An Allison M250-C20B gas turbine engine, S/N CAE 836362, powered the helicopter. Engine records indicate the engine was installed on the airframe August 30, 2018 at 29230.0 ETT. The last recorded component change was installation of the bleed valve at 29702.0 ETT.

Manufacturer	Allison
Engine Model	250-C20B
Rating:	420 Shaft Horsepower
Serial Number	CAE 836362
Engine Total Hours	29796.5
Last 100-Hour Inspection	29796.5
Last 300-Hour inspection	29796.5

Component	Serial Number	Part Number	TSO	Total Time
Engine	CAE 836362	6887190	15899.3	29796.5
Gearbox	CAG 36630	6894171	6619.5	20504.6
Compressor	CAC 42331	6890550	2565.1	10954.0
Turbine	CAT 34592	23069745	1024.5	17155.2
Fuel Control	BR53842	23070606	1514.6	Unknown
Governor	BR42981	M250-10844	254.5	Unknown
Fuel Pump	T3758	6899253	2565.1	Unknown
Fuel Nozzle	AG72045	M250-10603	1891.8	Unknown
Bleed Valve	FF29669	23053176	94.5	Unknown

❖ All Times taken from engine log book records and do not include accident flight

Engine Investigation:

On May 15, 2019 "Run as Received" testing was conducted on the subject engine at Keystone Turbine Services Coatesville, PA. Testing was conducted to Rolls-Royce Overhaul specifications. Testing was conducted under the auspices of the NTSB IIC. The engine was removed from the container and placed onto an engine stand where preparation and pre run examination of the engine was conducted. (Fig 4)

Other than the bleed valve being stuck in the closed position which was discovered on the initial examination, nothing else was discovered which would preclude operational testing. Prior to the

initial start attempt the bleed valve was manually cycled to the open position to facilitate engine start.

The engine was then placed into the test cell where the engine started within specification time and temperature and stabilized at ground idle power. Following engine warm up and with vibration scans being within specification, the engine was accelerated to a flight idle power where the bleed valve, although reluctant to close was confirmed in the closed position. A power calibration of the engine was then conducted where the engine met specification at all points including take off power. The engine was then shut down normally.

For testing purposes a manually controlled OEM bleed valve was then installed on the engine in order to replicate the condition of the engine with bleed valve being in the closed position at a low power setting as reported at the initiation of the reported power loss. With the manually controlled bleed valve installed it was possible to replicate the power loss described by the pilot by keeping the bleed valve closed during power reduction where at approximately 78% N1 the engine would begin to surge and application of power at that point would only exacerbate the problem with N1 continuing to decrease. This test was replicated twice with the same results. Rolls-Royce performance engineers calculated the surge margin numbers where the predicted reduced surge margins reflected the replicated results.

Following the engine run testing, the failed bleed valve which log records indicate had been overhauled 94.5 hours prior to the accident flight was disassembled by technicians for inspection at the direction of the NTSB IIC. Inspection revealed all internal components to be PMA parts which during inspection by technicians revealed the poppet valve and bushing failed to meet tolerances. The poppet valve was also found to exhibit levels of corrosion where when coupled with tolerance deviations resulted in the valve not being able to cycle as designed. (Fig 5)

Summary of Findings:

- Run as received testing of the engine to Rolls-Royce overhaul test specification revealed the engine to meet all points of the specification.
- Operation of the engine at a reduced power setting with the bleed valve in the closed position resulted in decreased surge margins with subsequent engine surge and power loss.

Appendix A, Engine Run Logs

ROLLS-ROYCE MODEL 250 SERIES II NON-R DATA REDUCTION PROGRAM EDR 19034G - DATED 10 April 2018

MODEL => C008J	TEST CONFIGURATION => Accessory G.S. Only
OCC PROBE TYPE => 2306555 OCC Probe (New)	TURBINE ASSEMBLY => 23072052, 2307210A, 23072105, 23069745
UNITS => English	HPT DIAPHRAGM => Fixed (23071538, 23073800)

SERIAL NUMBERS	TEST SEQUENCE NUMBER => 1
ENGINE => CAE836362	TEST TYPE => FULL
COMPRESSOR => CAC42331	TEST DATE => 15-May-19
TURBINE => CAT34592	TEST TIME => 11:25 AM
GEARBOX => CAG36630	BY => Rick Marano
FUEL CONTROL =>	TEST STAND => 145
OCC =>	NUMBER OF DATA POINTS => 5

MEMO NUMBER => 020616RR	FUEL LHV => 18,642.0 BTU/lbm
ENGINE DISPENSATION =>	FUEL SPECIFIC GRAVITY => 0.797

NOTES => Accident Investigation
SG = .794 @ 69 °F

HIGH PRESSURE TURBINE FLOW AREAS (sq in)	LOW PRESSURE TURBINE FLOW AREAS (sq in)
STATOR 1 => Default	STATOR 3 => Default
ROTOR 1 => Default	ROTOR 3 => Default
STATOR 2 => Default	STATOR 4 => Default
ROTOR 2 => Default	ROTOR 4 => Default

INPUT DATA

AMBIENT TEMPERATURE (F)	64.15	64.22	64.83	64.74	64.78				
AMBIENT PRESSURE (in Hg(a))	29.19	29.19	29.19	29.18	29.18				
AVG EXH STATIC PRESSURE (in Hg(a))	29.37	29.32	29.37	29.34	29.35				
FUEL TEMPERATURE (F)	56.18	55.33	55.38	55.2	55.34				
TRUE FUEL FLOW (lbm/hr)	177.51	206.71	225.99	247.15	258.23				
GASIFIER SPEED, N1 (RPM)	47,456.02	49,549.18	50,874.44	52,246.9	52,854.83				
POWER TURBINE SPEED, N2 (RPM)	33,263.95	33,248.36	33,285.63	33,332.78	33,416.36				
OUTPUT SHAFT TORQUE (ft-lbf)	212.97	266.35	302.73	338.09	362.42				
TORQUE METER OIL PRESSURE (psi(g))	59.59	74.25	84.48	94.46	101.02				
GEARBOX CASE PRESSURE (in H2O(g))	9.72	10.87	10.46	9.81	10.3				
AVG COMP INLET TEMP (F)	66.33	66.28	67.67	67.04	67.14				
AVG COMP INLET PRESS (in Hg(a))	29.17	29.17	29.15	29.15	29.15				
OCC TEMPERATURE (F)	498.07	533.78	559.49	584.96	600.38				
OCC PRESSURE (in Hg(a))	165.87	181.3	192.17	201.77	209.09				
OBSERVED AIRFLOW (lbs/sec)	0.	0.	0.	0.	0.				
AVERAGE MGT (F)	1,193.96	1,288.24	1,353.19	1,421.32	1,442.83				

CALCULATED DATA

TMOP OUTPUT SHAFT TORQUE (ft-lbf)	216.03	269.14	306.26	342.42	366.2				
TMOP OUTPUT SHAFT POWER (hp)	247.25	307.9	350.75	392.72	421.05				
OBSERVED OUTPUT SHAFT POWER (hp)	243.75	304.7	346.71	387.76	416.7				
COMP DISCHARGE TEMPERATURE (F)	489.39	524.57	549.81	574.59	589.53				
COMP DISCHARGE PRESSURE (in Hg(a))	167.81	183.35	194.21	203.74	210.99				
COMPRESSOR PRESSURE RATIO	5.76	6.29	6.66	6.99	7.24				

CORRECTED DATA

CORRECTED FUEL FLOW (lbm/hr)	182.29	212.59	232.22	254.34	265.61				
CORRECTED OUTPUT SHAFT POWER (hp)	249.84	312.23	355.77	397.95	427.13				
CORRECTED SFC (lbm/hp-hr)	0.72961	0.68088	0.65271	0.63913	0.62186				
CORRECTED AIRFLOW (lbm/sec)	3.07	3.23	3.37	3.46	3.56				
THETA CORRECTED GASIFIER SPEED (RPM)	47124	49205	50455	51847	52445				
CORRECTED MGT (thermocouple) (F)	1,166.77	1,262.06	1,322.18	1,391.93	1,412.3				
CORRECTED COMP DISCHARGE TEMP (F)	476.11	511.19	533.85	559.64	574.22				
CORRECTED COMP DISCHARGE PRESS (in Hg(a))	172.34	188.13	199.33	209.14	216.56				
LP COMPRESSOR EFFICIENCY (%)	79.82%	78.27%	77.50%	75.85%	75.37%				
LP TURBINE EFFICIENCY (%)	87.38%	88.14%	88.06%	87.80%	87.96%				
HP TURBINE EFFICIENCY (%)	82.18%	82.17%	83.07%	83.45%	84.48%				
LP TURBINE FLOW CAPACITY (lbm/sec)	2.938	2.938	2.938	2.938	2.938				
HP TURBINE FLOW CAPACITY (lbm/sec)	1.107	1.107	1.107	1.107	1.107				

PREDICTED DATA

	TAKEOFF	NORM CRUISE	CRUISE A	CRUISE B	CRUISE C
SPEC MGT (F)	1490	1380			1261
SPEC OUTPUT SHAFT POWER (hp)	420	370	333	278	300
SPEC SFC (lbm/hp-hr)	0.650	0.650	0.665	0.709	0.689
PRED SHAFT PWR AT SPEC MGT (hp)	484	381			311
PRED SFC (lbm/hp-hr)	0.606	0.643	0.668	0.705	0.681
PERCENT DELTA FROM SPEC PWR (%)	15.2%	3.0%			3.7%
PERCENT DELTA FROM SPEC SFC (%)	-6.8%	-1.1%	0.5%	-0.6%	-1.2%
TORQUE METER OIL PRESSURE CALIBRATION	102.0 (psi(g))			420.00 (hp)	
TORQUE METER OIL PRESSURE PTS SPEC	101.3 (psi(g))		+/-	2.0 (psi(g))	

SECOND ORDER POLYNOMIAL CURVEFIT

	INTERCEPT [C]	1ST COEFF [B]	2ND COEFF [A]
CORR SHAFT PWR VS CORR MGT (English)	1.121870E+01	-2.020833E-01	3.487845E-04
CORR FUEL FLOW VS CORR MGT (English)	3.000766E+01	-3.533696E-02	1.422980E-04
CORR FUEL FLOW VS CORR SHAFT PWR (English)	5.385281E+01	5.368996E-01	-9.244465E-05
TMOP VS SHAFT PWR (English)	1.023174E+00	2.404565E-01	

PROGRAM MESSAGES

Note 2231: 23073352, 23073513, or 23073514 turbine unit used in thermodynamic model corrections and warping

Note 2238: Fixed Diaphragm HPT assembly used in thermodynamic model corrections and warping

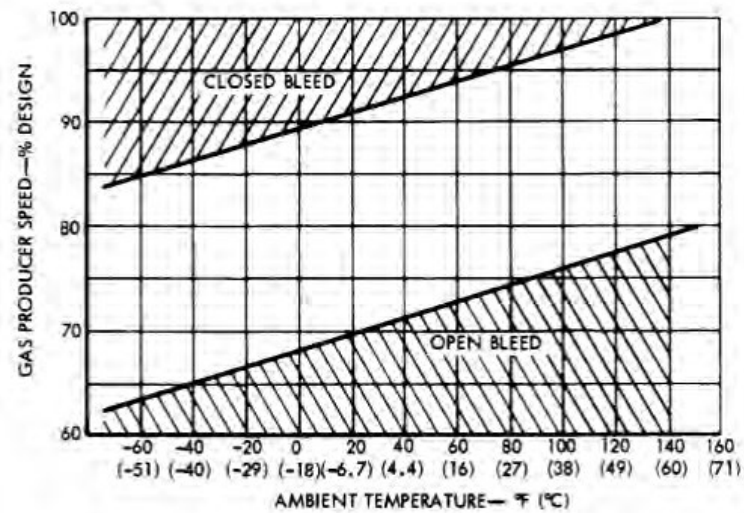
Warning 2312: Specific fuel consumption higher than maximum specification

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Engine Model	250-C20B											
Serial Number	CAE836362											
Work Order	020616RR											
Run Number	1											
Run Date	5/15/2019											
Customer	Rolls Royce											
Operator:	Rick Marano											
Assistant:	Ken Jenkins											
Oil Flow In CCs:	280											
Run Comments:												
Accident Investigation												
Date		5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019	5/15/2019
Time		11:34:23 AM	11:36:18 AM	11:40:07 AM	11:41:34 AM	12:58:53 PM	1:01:05 PM	1:04:17 PM	1:12:41 PM	1:14:53 PM	1:23:09 PM	1:24:07 PM
Setting		4th Power Point	5th Power Point	Oil Consumption	shutdown	start	Ground Idle	1st Power Point	start	Ground Idle	ground idle	shutdown
Run Time	HH:MM:SS	00:47:05	00:49:00	00:52:50	00:53:18	00:54:12	00:56:24	00:59:36	01:04:13	01:06:26	01:12:11	01:12:34
Start Time	Seconds	0.0	0.0	0.0	0.0	14.9	0.0	0.0	12.2	0.0	0.0	0.0
N1 RPM	RPM	52247	52855	48301	-1	30092	30427	48304	30174	30410	30382	-1
N1 PCT	%	102.5	103.7	94.8	0.0	59.0	59.7	94.8	59.2	59.7	59.6	0.0
N1 RPM Corrected	RPM	51847	52445	47908	0	0	0	47815	0	0	0	0
N2 RPM	RPM	33333	33416	33375	96	15041	20743	33310	15996	20299	20537	61
N2 PCT	%	100.1	100.4	100.3	0.2	49.2	62.3	100.1	51.5	61.0	61.7	0.0
Dyno Torque	FT-LBS	338.1	362.4	242.1	-1.8	1.3	19.1	241.4	1.9	20.4	19.0	14.6
Dyno Out Temp	°F	77.2	79.4	74.1	63.0	64.0	62.3	70.8	61.8	59.7	59.5	58.0
SHP Speed (tq. Meter)	RPM	6024	6039	6031	17	2718	3748	6020	2891	3668	3711	11
SHP (selected source)	HP	387.8	416.7	278.0	0.0	0.7	13.6	276.7	1.1	14.3	13.5	0.0
Engine Torq. Prs.	PSIG	94.5	101.0	67.8	-0.1	9.9	6.6	67.3	10.0	6.8	6.5	0.2
HP Corrected	HP	397.9	427.1	284.4	0.0	0.0	0.0	282.3	0.0	0.0	0.0	0.0
Fuel Temp	°F	55.2	55.3	55.8	59.0	67.3	67.2	63.7	60.6	60.6	60.3	62.1
Fuel Pressure	psi	16.5	19.2	23.5	26.3	24.4	26.0	21.8	22.6	25.3	26.4	25.7
Wf Observed	PPH	247.1	258.2	188.5	0.0	66.6	61.7	187.7	60.8	59.6	59.4	0.0
Wf Corrected	PPH	254.3	265.6	193.2	0.0	0.0	0.0	192.3	0.0	0.0	0.0	0.0
Wf 1 PPH		247	258	189	0	66	61	187	60	60	59	0
Wf 1	PPH	247.15	258.23	188.53	0.00	66.65	61.68	187.66	60.77	59.56	59.40	0.00
Wf 2	PPH	243.99	254.95	186.10	0.05	65.46	61.26	185.46	60.07	59.18	58.94	0.04
SFC Corrected	LBS/HP/HR	0.6391	0.6219	0.6794	0.0000	0.0000	0.0000	0.6812	0.0000	0.0000	0.0000	0.0000
CIP	" HGA	29.15	29.15	29.17	29.22	29.18	29.18	29.13	29.17	29.17	29.17	29.18
Exhaust Static Prs	" HGA	29.34	29.35	29.37	29.22	29.21	29.17	29.25	29.17	29.21	29.15	29.18
Baro	" HGA	29.18	29.18	29.19	29.22	29.19	29.19	29.16	29.19	29.18	29.19	29.19
Ambient Temp	°F	65	65	66	66	70	70	69	70	70	70	70
CIT	°F	67.0	67.1	67.5	69.1	73.1	72.9	69.7	73.9	74.0	74.4	74.5
CDT	°F	585.0	600.4	523.4	258.6	241.0	260.1	527.6	250.8	261.4	261.0	174.1
CDP	" Hg	172.6	179.9	147.1	-0.1	37.3	37.8	146.2	37.2	37.6	37.5	-0.2
max.GPTOT @START	°F	1486	1486	1486	1566	1128	980	1396	1145	940	939	939
GPTOT	°F	1421	1443	1212	778	970	954	1219	921	931	929	434
GPTOT Corrected	°F	1392	1412	1181	0	0	0	1181	0	0	0	0
Main Oil Pressure	psig	125.2	125.6	121.5	1.8	124.3	121.8	125.3	117.1	116.8	117.0	2.7
Scavenge Oil Pressure	psig	32.7	32.6	32.1	1.3	23.9	24.4	32.8	25.9	26.2	26.4	4.7
Oil In Temp	°F	173.3	174.8	182.7	173.9	93.0	110.7	152.8	169.8	175.2	168.4	167.1
Oil Out Temp	°F	259	262	249	221	117	139	214	201	198	192	186
Gear Box ST Prs	" H2O	9.81	10.30	10.70	0.00	2.41	2.62	11.91	2.18	2.70	3.09	0.36
Dyno Vibration	IPS	0.16	0.14	0.10	0.00	0.01	0.04	0.08	0.05	0.10	0.06	0.00
Compressor Vibration	IPS	0.35	0.35	0.35	0.00	0.08	0.11	0.44	0.10	0.09	0.09	0.00
Gearbox Vibration	IPS	0.21	0.20	0.19	0.00	0.13	0.09	0.20	0.15	0.12	0.10	0.00
Turbine Vibration	IPS	0.19	0.19	0.19	0.00	0.11	0.12	0.16	0.14	0.13	0.13	0.00
Decel Time	Seconds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accel Time	Seconds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anti Ice Line	°F	108.8	108.3	109.1	108.8	79.2	95.1	100.5	102.5	109.1	108.8	110.2
Comp Seal Vent Press	" Hg	4.4	4.6	4.0	-0.8	0.6	0.9	6.8	0.1	0.5	0.5	-0.7
Comments 1												
Comments 2												
Comments 3												

Appendix B, Engine Performance Charts

Compressor Bleed Control Valve
Figure 21



NOTE: THE LINES ON THE FIGURE REPRESENT NOMINAL SETTINGS AND ARE NOT INTENDED AS SPECIFIC LIMITS. THE EXACT OPERATING RANGE MAY VARY DUE TO VARIATIONS IN ENGINE AND AIRCRAFT INSTALLATIONS.

Compressor Bleed Control Valve Operation
Figure 22

Appendix C, Photographs at Aircraft Recovery Location

Fig 1



Helicopter at Recovery



Airframe Fuel Filter
[Return](#)

Fig 2



Engine as Recovered



Compressor Bleed Valve



Return

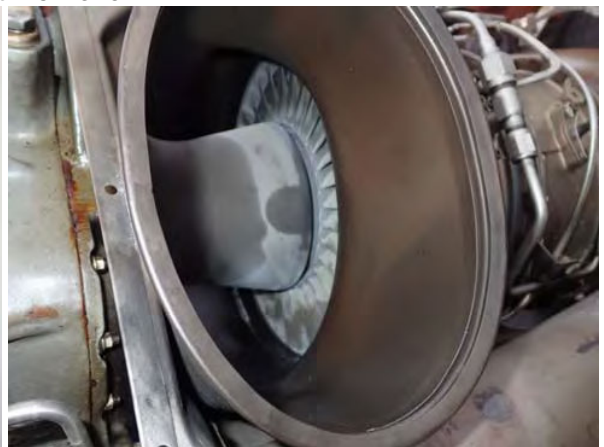
Fig 3



Engine at Removal



Compressor Inlet



Exhaust Collector / Stage 4 Turbine Wheel



Upper Chip Detector



Lower Chip Detector

[Return](#)

**Appendix D,
Photographs
Keystone Turbine Services
Coatesville, PA**

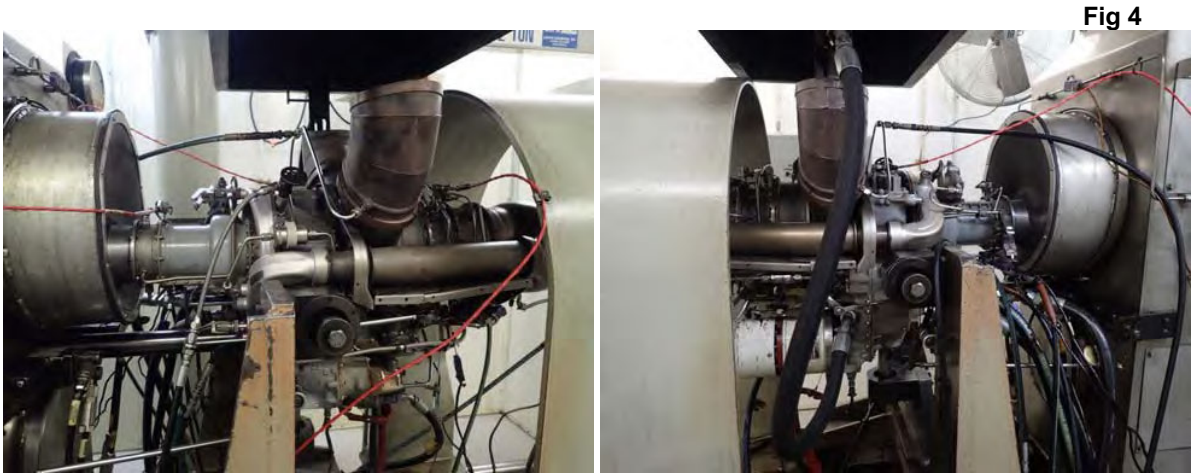


Fig 4

Engine in Test Cell

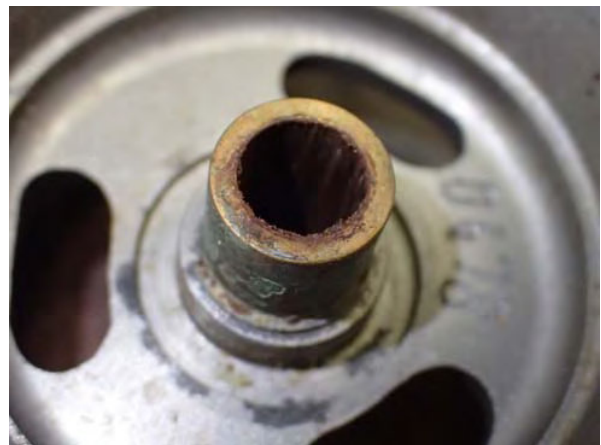


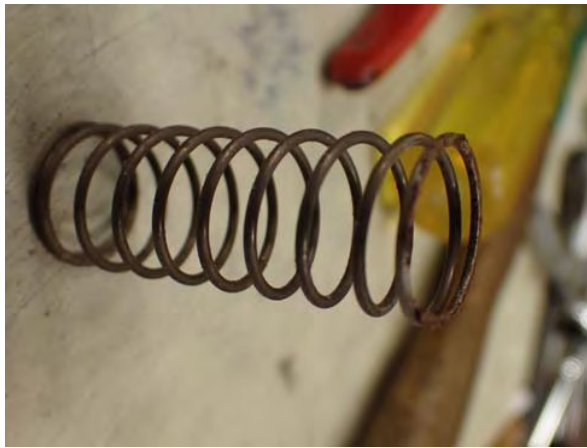
[Return](#)

Fig 5



Bleed Valve Disassembly





[Return](#)

Appendix E, Selected Engine Records

CERTIFICATE OF CONFORMANCE

Alison Gas Turbine Division certifies that the 350 Series Turboshaft Engine shipped herewith was manufactured in accordance with all applicable specifications, drawings and procedures. This certificate shall be of no force or effect upon expiration of the warranty provision applicable to this purchase order.

Engine Serial No. CAY-33632

Purchase Order No. _____

Quality Assurance Department

March 31, 1989
Date

UT 9538
(3-87)

[illegible]

Assembly Record Engine Accessories				Rolls-Royce			
			Part V/ Page No.		16		
Engine Serial Number		CAL-83682	Engine Model - 250 C20B				
Nomenclature	Part Number	Serial Number	Installed		Removed		Remarks
			Date	ENG TT WPT TSO	Date	ENG TT ENG TSO	
Paced Valve	22058176	FF27669	123-19	2110Z O D.O			
*							
*							
*							
*							
*							
*							
*							
*							
*							
*							
* (P.T.M.B.A.V.)							

* Installed at entry column no listed in Part V or Engine Accessory List

Paradise Helicopters, N506PH, M250-C20B,CAE 836362 --- February 21, 2019

N506PH ENGINE COMPONENT SCHEDULE													
ENGINE SERIAL # - CAE-836362													
SEE AIRFRAME COMPONENT WORKSHEET FOR AIRFRAME SPECIFIC INTERVALS													
				AIRFRAME HOURS		31226		HOOK HOURS		0		LAST UPDATE	
				ENGINE HOURS		29796.5		NEXT DUE IN		NEXT DUE @			
				ENGINE CYCLES		25363		HOURS		HOOK		CYCLES	
				RIN/TORQUE EVENTS		36104		108.2		N/A		2,306.0	
								DATE		HOURS		CYCLES	
								29994.7		N/A		27669	
PRINTED REPORTS FOR REFERENCE ONLY-DATA SUBJECT TO CHANGE-CONTACT MX CONTROL FOR CURRENT DATA													
ITEM	COMPONENT	PART NUMBER	SERIAL #	MAX HOURS	MAX CYCLES	SINCE OVERHAUL HOURS	CYCLES	INSTALLED @ ENGINE HOURS	CYCLES	REPLACE @ ENGINE HOURS	CYCLES	HOURS REMAINING	CYCLES REMAINING
1	Engine	290-C20B	CAE-836362	O/C		29,230.0	24,966	30,459.5	AIRFRAME				
2	Compressor	8899950	CAE-24231	3,500		1,998.6	1,293	29,230.0	24,966	30,731.4		534.6	
3	1st Stage Wheel	23057111	KR115454	O/C	30,000	5,502.1	4,401	29,230.0	24,966			52,585	25,202
4	2-3 Stage Wheel	23057112	KR71136	O/C	30,000	12,568.1	13,713	29,230.0	24,966			41,203	15,860
5	4th Stage Wheel	23057114	KR85651	O/C	30,000	5,502.1	4,401	29,230.0	24,966			52,585	25,202
6	5th Stage Wheel	23057115	KR44187	O/C	30,000	12,388.1	13,713	29,230.0	24,966			41,203	15,860
7	6th Stage Wheel	E-23057118	T860987	O/C	30,000	1,998.6	1,293	29,230.0	24,966			53,673	28,310
8	Impeller	23076838	KR122889	3,550	9,150	1,998.6	1,293	29,230.0	24,966	30,781.4	32,823	684.6	7,460
9	Tie Bolt	E8471259	PRQ-1043			1,998.6	1,293	29,230.0	24,966				
10	Turbine-Hall	23068745	CAT-34592	1,750		458.0	297	29,230.0	24,966	30,522.0		726.6	
11	Turbine-Clk	23068743	CAT-34592	3,500		458.0	297	29,230.0	24,966	32,272.0		2,476.6	
12	1st Stage Wheel	M250-10223	X652450	1,775	3,000	458.0	297	29,230.0	24,966	30,547.0	27,669	780.5	2,396
13	2nd Stage Wheel	23073854	X653778	1,775	3,000	458.0	297	29,230.0	24,966	30,547.0	27,669	780.5	2,396
14	3rd Stage Wheel	23065818	X641913	4,550	6,000	458.0	297	29,230.0	24,966	33,322.0	30,669	3,550.5	5,206
15	4th Stage Wheel	M250-10445	X659772	4,550	6,000	458.0	297	29,230.0	24,966	33,322.0	30,669	3,550.5	5,206
16	AD-2017-18-14	23069745	CAT-34592	1,775		458.0	297	29,230.0	24,966	30,547.0		750.5	
17	1st Stage Nozzle Shield	23073533	140-257	O/C		1,292.4	1,559	29,230.0	24,966				
18	2nd Stage Nozzle Diaphragm	E8851499	NSM	O/C		1,292.4	1,559	29,230.0	24,966				
19	Tie Bolt	23068265	NMB5554	O/C		3,030.9	5,894	29,230.0	24,966				
20	Gears	8894171	CAC-38630	O/C		8,053.0		29,230.0	24,966				
21	Fuel Nozzle	M250-10803	AG72049	2,500		1,324.3		29,230.0	24,966	29,504.7		109.2	
22	Fuel Control	23070906	BH33842	2,500		948.1		29,230.0	24,966	30,781.9		955.4	
23	Bleed Valve	23053176	PF29669	1,500		0.0		29,792.0	25,293	31,292.0		1,405.5	
24	Governor	M250-10844	BR42581	2,000		0.0		29,542.0	25,180	31,542.0		1,745.5	
25	Fuel Pump	6599253	T3758	4,000		1998.6		29,230.0	24,966	31,231.4		5,434.6	
ENGINE INSPECTIONS													
ITEM	Component Name	REFERENCE	INTERVAL	MX ACTIVITY	COMPLIED WITH	ENGINE TIME DUE	REMAINING HOURS						
1	150 Hour Engine Inspection		150	Inspection	29796.5	29948.5	150.0						
2	300 Hour Engine Inspection		300	Inspection	29796.5	30096.5	300.0						
3	Facet Airframe Svc Oil Filter		300	RETIRED	29796.5	30096.5	300.0						
4	Airframe Fuel Filter Element		300	RETIRED	29796.5	30096.5	300.0						
5	Engine Turbine Oil		300	RETIRED	29796.5	30096.5	300.0						
6	300 Hour Case Half Inspection		300	Inspection	29796.5	30096.5	300.0						
7	Fuel Nozzle Flow Check		300	Flow Check	29796.5	30096.5	300.0						
8	600 Hour Engine Inspection		600	Inspection	29542.0	32142.0	548.5						