CEN13LA359

Jonesboro, Arkansas

June 19, 2013

1620 CDT

Bell Helicopter 206 L-4; N467AE

NTSB ENGINE EXAMINATION

Examination Date: July 9, 2013

PARTICIPANTS IN THE EXAMINATION

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HISTORY OF FLIGHT

On June 19, 2013, at 1620 central daylight time, N467AE, a Bell 206L-4 helicopter, sustained substantial damage when it made a forced landing after a partial loss of engine power while on final approach to a helipad at the Jonesboro Municipal Airport (JBR), Jonesboro, Arkansas. The commercial pilot, flight nurse, and the paramedic were not injured. The helicopter was registered to a private entity and operated by Air Evac EMS, Incorporated, O'Fallon, Missouri. Visual meteorological conditions prevailed and a company visual flight rules flight plan was filed for the repositioning flight conducted under Title 14 Code of Federal Regulations Part 91. The flight originated from the Southeast Missouri Hospital in Cape Giradeau, Missouri, approximately 1534.

The pilot reported that the helicopter was approximately 80-100 feet above the ground at an airspeed of 40 knots when the engine lost power. He said the power loss was similar to the engine rolling back to flight idle. The pilot said he lowered the collective to conserve rotor RPM, so there would be enough engine power for a "sliding landing." The helicopter touched down at the edge of tall grass/dirt and bounced slightly before it came to rest upright on its skids. The helicopter's skids sustained damage and the tail boom was displaced downward so the stinger was resting on the ground.

According to operator, the helicopter and engine had accrued a total of 154.3 hours since new

ENGINE INFORMATION

Engine Manufacturer: Rolls-Royce
Engine Model Number: 250-C30P
Engine Serial Number: CAE896154

INITIAL EXAMINATION AS RECEIVED

The engine was shipped from the operator's facility in West Plaines, Missouri to Rolls-Royce facilities in Indianapolis, Indiana via crate and bonded shipment. Upon receipt the engine was immediately logged and placed in bonded/secure storage and was not opened. On July 9, 2013 at 0735 EDT, the crate was viewed by the NTSB and the above listed personnel as unopened; it was photographed and opened for examination. The sealed tags were numbered 922558 and 922591. No representative from the operator was present at the time of the examination. The examination revealed that the freewheeling unit had been removed and was not contained within the shipping crate.

Photo 1: Engine Shipping Crate as Received

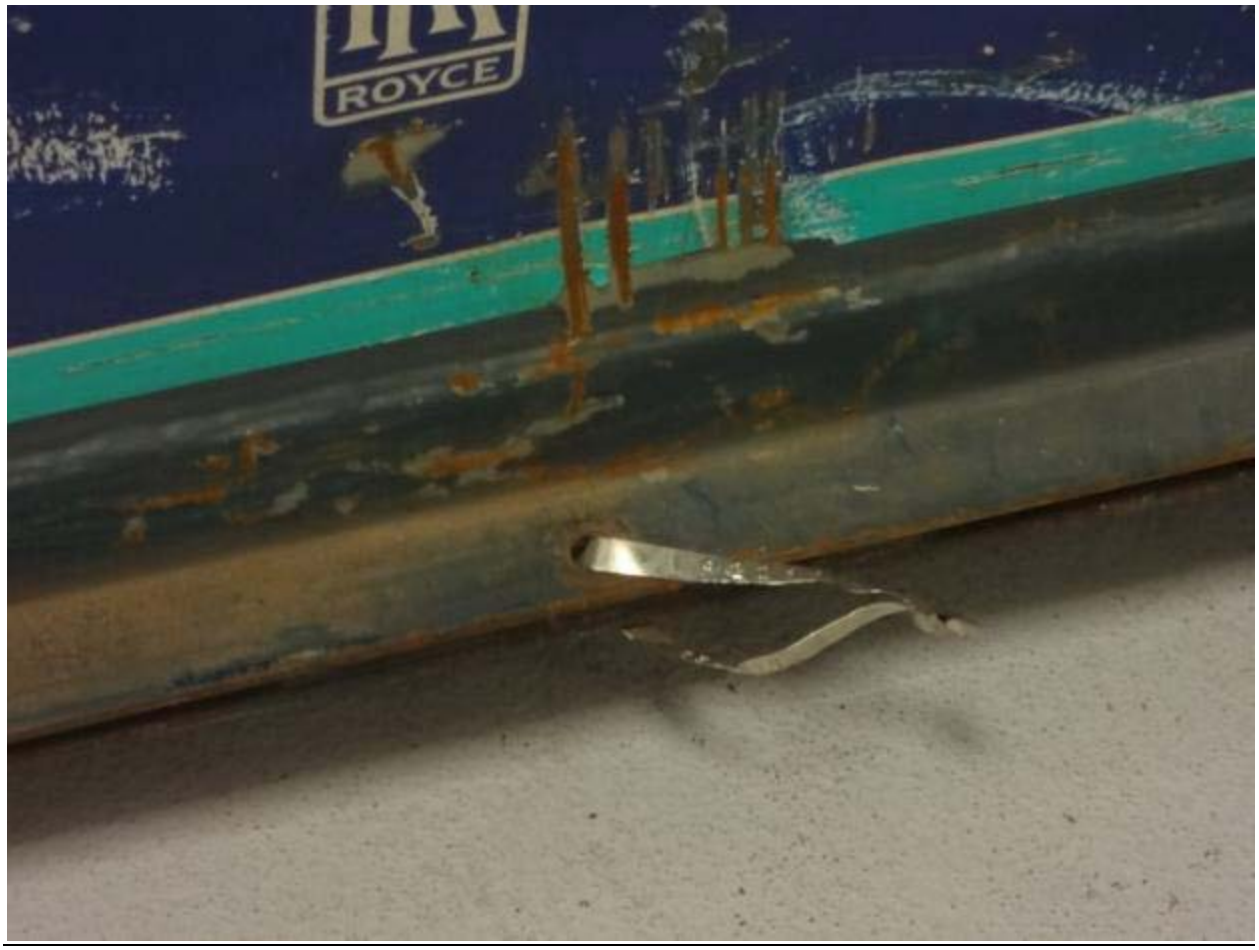

Photo 2: Seal Tag No. 922591

Photo 3: Engine Shipping Crate as Received

Photo 4: Seal Tag No. 922558

DETAILED EXAMINATION

Engine Overall

The engine was mounted on an engine test stand and the Serial Numbers were noted in the table below. Filter air was applied to the Pc filter at 50 psi and "SNOOP" leak detecting liquid was applied to all B-nuts and no leaks were detected. Examination did not reveal any abnormalities or malfunctions that could preclude an engine operation in the test cell. The engine was transported to Rolls-Royce Test Cell No. 147 and was mounted for the engine run.

Photo 5: Engine after Shipping Case Removal

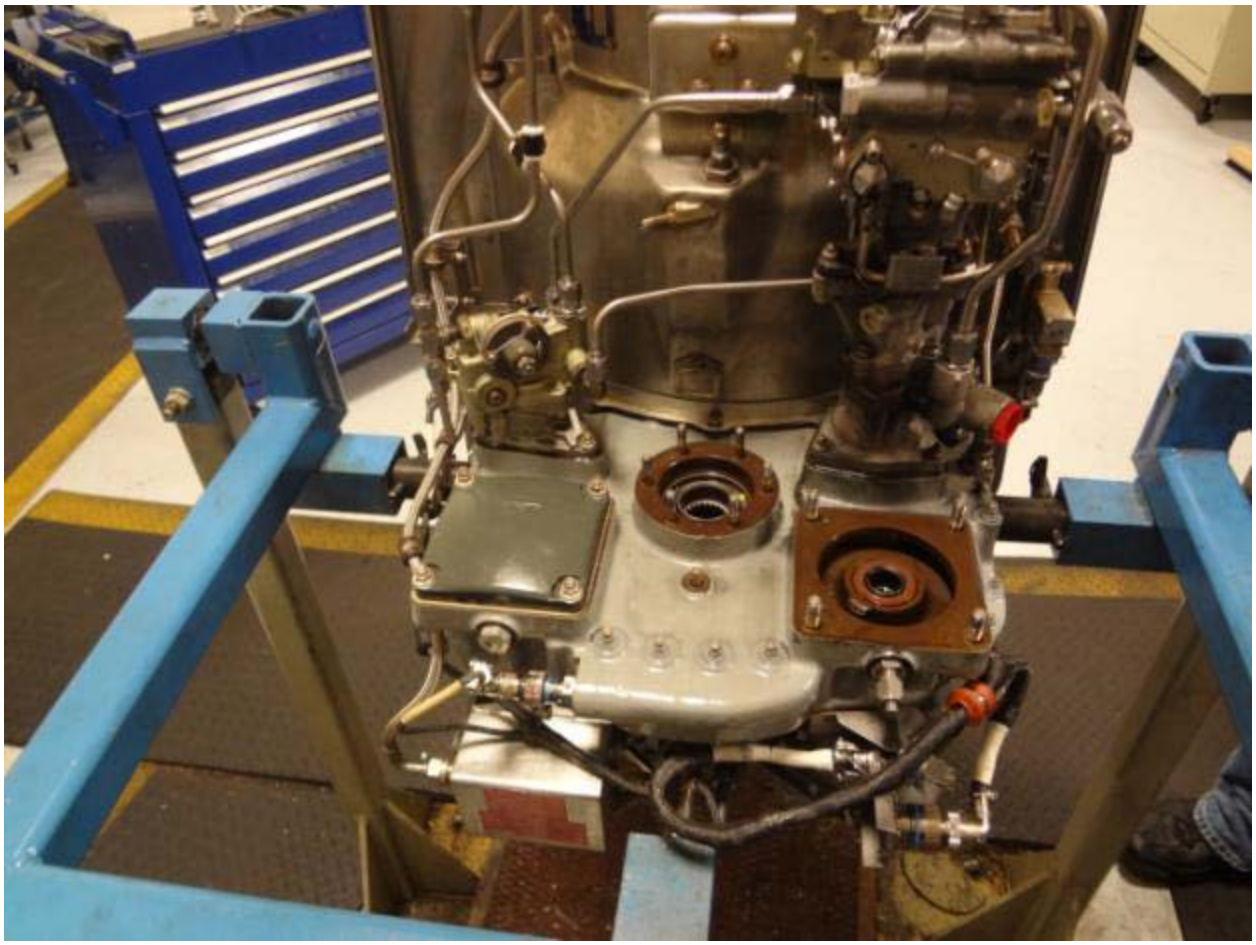

Photo 6: Rear Accessory Drive

Photo 7: Fourth Stage Turbine Blades as Viewed in Engine on Engine Stand

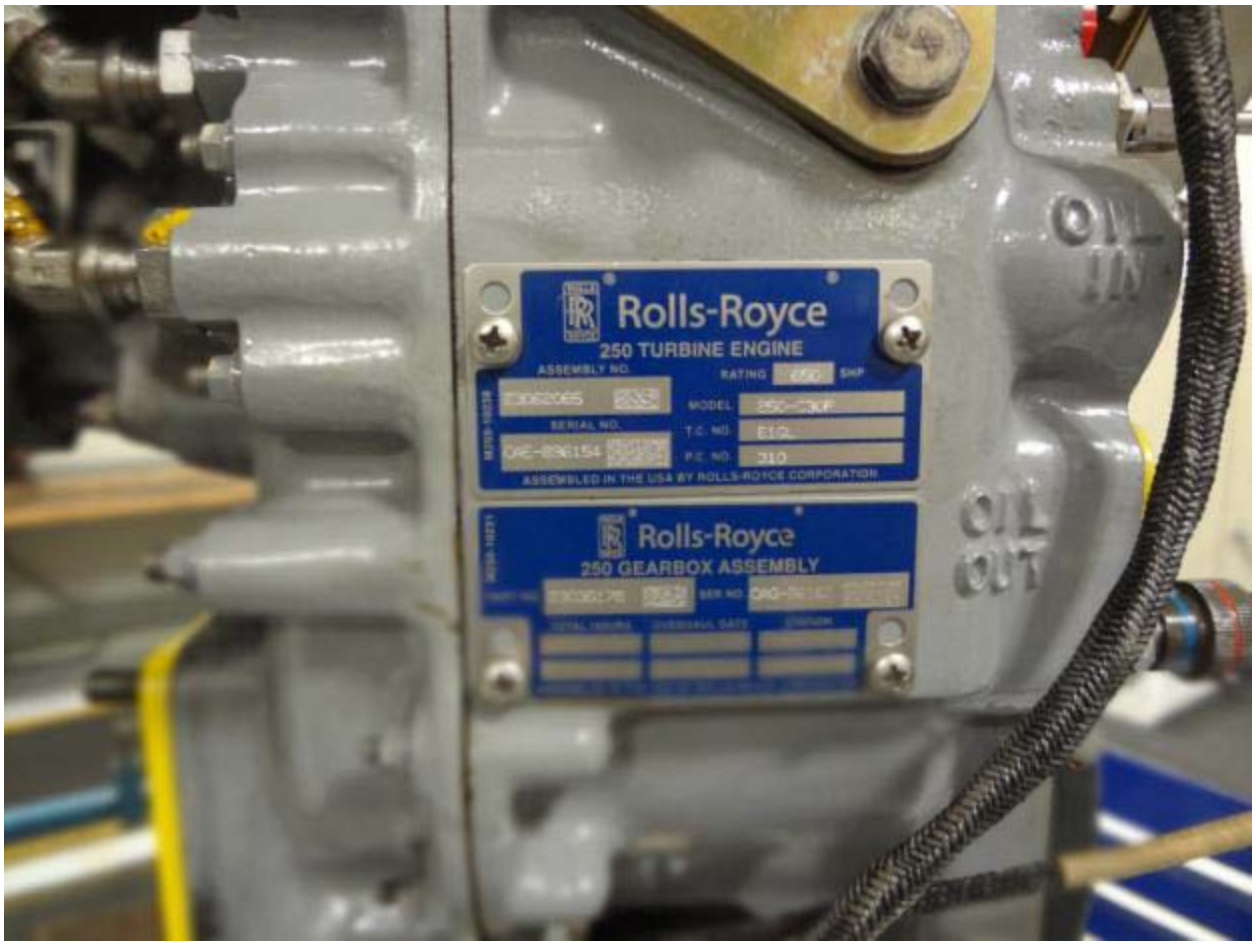

Photo 8: Engine Information

Component	Serial Number	Part Number	TSO (hrs)	Total Time (hrs)
Engine 250-C30P	CAE 896154	23062065	154.3	154.3
Gearbox	CAG 96163	23035178	154.3	154.3
Compressor	CAC 92402	23051643	154.3	154.3
Turbine	CAT 98789	23035128	154.3	154.3
FCU	HR60584	23087146	154.3	154.3
Fuel Pump	JG10AKW0410	23074706	154.3	154.3
Fuel Nozzle	VN1BRR1657	23077067	154.3	154.3
Bleed Valve	FF372338	23073353	154.3	154.3
Governor	HR49739	23086751	154.3	154.3

ENGINE RUN

The engine was mounted in Rolls-Royce test stand No. 147 and attached with test stand fuel lines. The engine run was accomplished per the Rolls-Royce 250-C30 series overhaul manual. The engine test cell had a recorded temperature of 81°F, the engine was started and operated at various power settings; however, when torque was at 95% the maximum fuel flow was recorded at 376 pounds per hour and was unable to be achieve maximum fuel flow, and the gearbox output speed began to decrease and did not achieve the output speed of 6016 rpm. The engine power was reduced to idle and then shut down to facilitate adjustment of the "max flow stop" on the fuel controller. The engine was restarted and again accelerated through various required power settings up to and including maximum takeoff power. The Bleed valve was verified closed within the normal range and no vibration exceedances were noted. The anti-ice was utilized and operated within a normal range. The governor check was accomplished and was normal in operation. Then engine was operated at about 78% torque and then decreased to flight idle (which is 100% power turbine speed, on the ground, flat pitch on the main rotor blades) then accelerated to takeoff power with no hesitation or abnormalities noted; this procedure was accomplished twice with similar results. The Engine was stabilized at ground idle for 1 minute then accelerated to the flight idle setting. The engine accelerated to takeoff power in 0.48 seconds. The test data correlates to 678.6 shaft horsepower, or 5.8% above rated power, at takeoff. For further test information reference Appendix A and Appendix B of this report.

Photo 9: Engine Mounted in Test Stand

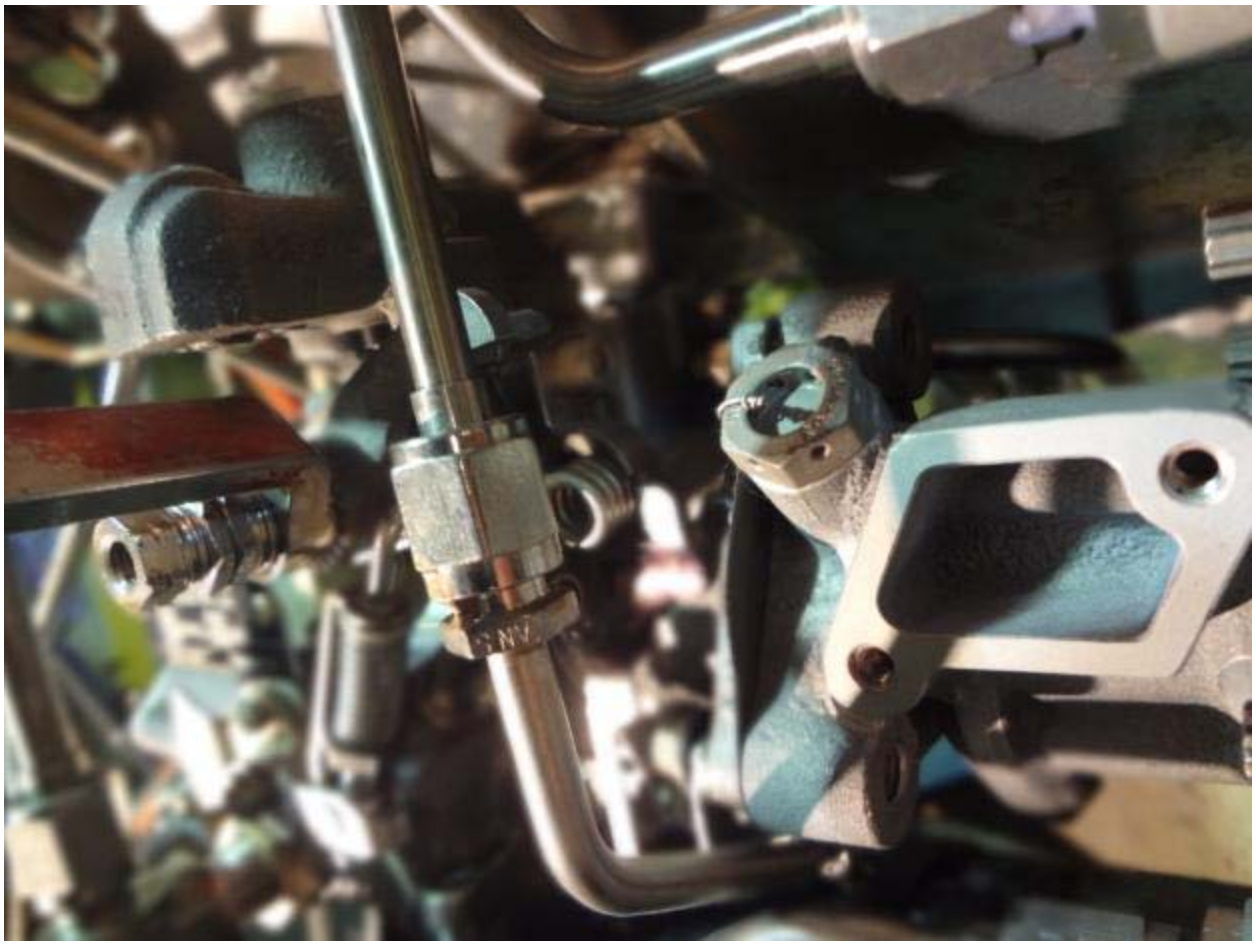

Photo 10: Max Flow Stop

SUMMARY

The engine examination and run did not reveal any abnormalities that would have precluded normal operation including the capability of producing power during the accident sequence. Although the initial test run indicated that the engine was not producing maximum gearbox output speed, Rolls-Royce indicated that the maximum fuel flow is set in the factory at the maximum setting and the operator is required to set the fuel flow for the specific aircraft type. In the case of the Bell 206 L-4 the initial setting appeared to be correct for the aircraft type. Therefore it is probable that the engine, at the time of the accident, did not rollback or operate at a sub-idle setting.

FUTURE ACTIVITES

None are planned at this time for this engine. The engine will be returned to the operator in West Plains, Missouri and kept with the accident helicopter in preparation for the release of the wreckage by the National Transportation Safety Board IIC.

Photo 11: Engine Crated for Shipment to Operator

Appendix Table of Contents

Appendix A – Engine Test Log photographed copy

Appendix B – Engine Test log scanned copy

Appendix A

Engine Test Log – Photograph Copy

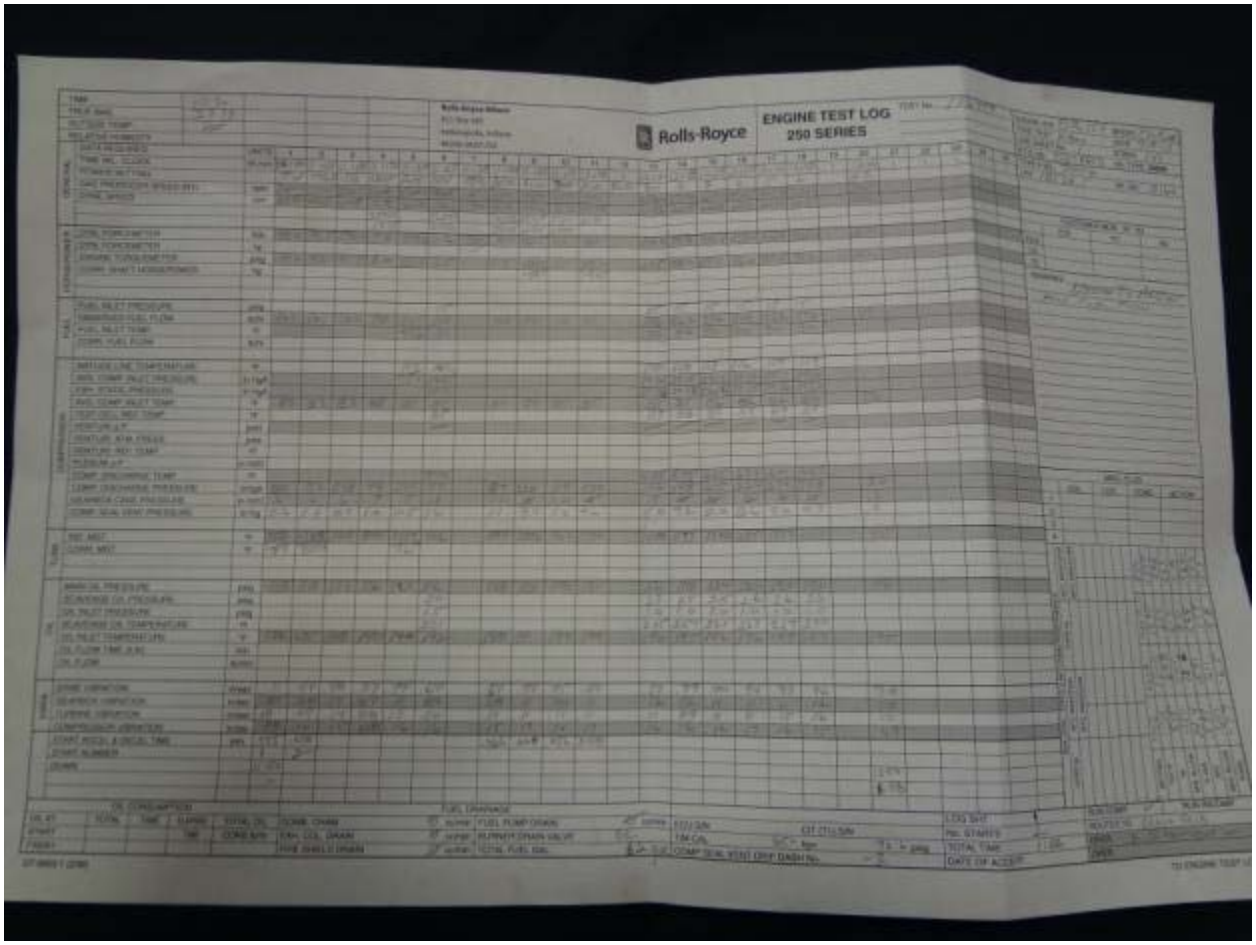

Photo 12: Engine Test Log Raw Test Data Numbers

Appendix B

Engine Test Log Copy (2 Pages)

TIME	10:30						**Rolls-Royce Allison**								
TRUE BAR.	29.33						P.O. Box 420								
OUTSIDE TEMP.	80°						Indianapolis, Indiana								
RELATIVE HUMIDITY							46206-0420 USA								

	DATA REQUIRED	UNITS	1	2	3	4	5	6	7	8	9	10	11	12
GENERAL	TIME MIL. CLOCK	hh:mm	10:40	11:04	11:08	11:12	11:20	11:25	11:38	11:44	11:50	11:59	12:08	:
	POWER SETTING		51/68	51/68	VIB.	Noise	A/I	GOV	18%	DECEL	Accel	DECEL	Accel	Power
	GAS PRODUCER SPEED (N1)	rpm	32527	32505	51417	SCAN	50053	Droop	of	35K	78%	35K	78%	
	DYNE SPEED	rpm	4326	4308	6009	F.I	6012	CK.	T/O	F.I	T/O	F.I	49/98	
						32704		36209		34186	49277	34311	6030	
						5475		6426		5964	6024	5970		
HORSEPOWER	DYN. FORCEMETER	ft/lb	33.4	32.5	590.0	7.8	517.8	11.6	460	7.0	460.5	4.6	460	
	DYN. FORCEMETER	hp												
	ENGINE TORQUEMETER	psig	5.0	5.2	95.5	1.0	84.0	2.5		1.5	109.0 / 74.5	1.5	108.6 / 745	
	CORR. SHAFT HORSEPOWER	hp												
FUEL	FUEL INLET PRESSURE	psig						15						
	OBSERVED FUEL FLOW	lb/hr	103	101	380	98	341	114		103	313	104	311	
	FUEL INLET TEMP.	ºF					346	84						
	CORR. FUEL FLOW	lb/hr												
COMPRESSOR	ANTI-ICE LINE TEMPERATURE	ºF					104	102						
	AVG. COMP. INLET PRESSURE	in HgA					154	1925						
	EXH. STATIC PRESSURE	in HgA						29.11						
	AVG. COMP. INLET TEMP.	ºF	82	82	83	83	83	84		84	84	85	85	
	TEST CELL REF. TEMP.	ºF						85						
	VENTURI Δ P	psid						—						
	VENTURI ATM. PRESS.	psia												
	VENTURI REF. TEMP.	ºF												
	PLENUM Δ P	in H2O												
	COMP. DISCHARGE TEMP.	ºF						370						
	COMP. DISCHARGE PRESSURE	inHgA	80	82	248	79	234	97		87	220	88	220	
	GEARBOX CASE PRESSURE	in H2O	.6	.6	.6	.7	.5	1.1		1.0	ø	1.0	ø	
	COMP. SEAL VENT PRESSURE	in Hg	2.6	1.4	10.0	1.0	10.5	1.6		1.1	9.0	1.2	9.6	
TURB.	IND. MGT	ºF	1333 / 919	1388 / 898	1409	895	1337 / 1365	916		897	1272	902	1220	
	CORR. MGT	ºF												
OIL	MAIN OIL PRESSURE	psig	118	118	122	116	120	116		118	120	118	120	
	SCAVENGE OIL PRESSURE	psig						20						
	OIL INLET PRESSURE	psig						1.5						
	SCAVENGE OIL TEMPERATURE	ºF						231						
	OIL INLET TEMPERATURE	ºF	126	175	188	190	190	192		198	191	197	198	
	OIL FLOW TIME (5 lb)	min												
	OIL FLOW	lb/min												
VIBRA.	DYNE VIBRATION	in/sec	.11	.44	.88	.33	.79	.69		.69	.74	.75	.84	
	GEARBOX VIBRATION	in/sec	.07	.06	.13	.07	.11	.09		.08	.11	.08	.11	
	TURBINE VIBRATION	in/sec	.10	.09	.17	.08	.13	.10		.11	.11	.11	.11	
	COMPRESSOR VIBRATION	in/sec	.08	.10	.15	.08	.16	.16		.15	.17	.14	.17	
	START ACCEL & DECEL TIME	min	.555	.438						.066	.048	.056	.048	
	START NUMBER		1	2										
	DOWN		11:50											
			:10											

OIL CONSUMPTION				
OIL AT:	TOTAL	TIME	ELAPSED	TOTAL OIL
START			TIME	CONS lb/hr
FINISH				

FUEL DRAINAGE			
COMB. CHAM	ø cc/min	FUEL PUMP DRAIN	ø
EXH. COL. DRAIN	ø cc/min	BURNER DRAIN VALVE	OK
FIRE SHIELD DRAIN	ø cc/min	TOTAL FUEL GAL.	6

Rolls-Royce

ENGINE TEST LOG
250 SERIES

TEST No. 106759

ENGINE S/N 896154 MODEL C30 P1/T2
TYPE TEST MEMO DATE 7-9-13
LOG SHEET No. 1 STAND 147
P.T.S. No. 827 REND OIL TYPE: 23699
TYPE FUEL JET A
LHV 18538.5 SP. GR. .8160

CUSTOMER MON. N1 N2

	COL.	N1	N2
IDLE			
CC			
TO			

REMARKS: NEEDED TO ADJUST MAX FUEL FLOW.

MAG. PLUG

	COL.	LOC.	COND.	ACTION
1				
2				
3				
4				

	13	14	15	16	17	18	19	20	21	22	23	24	25
	12	12:18	12:24	12:30	12:36	12:42	:	12:46	:	:	:	:	:
	1	2	3	4	5	6		G.I.					
	06	47348	48774	49629	50478	51563		32667					
	22	6015	6008	6021	6013	6011		4326					
	6	359.6	430.4	473.0	516.8	585.4		30.5					
	5	58.0	69.5	76.0	83.5	95.0		5.-					
		15	15	15	15	15							
	6	262	296	318	342	376		99					
	0	90	90	90	90	90							
	0	108	113	116	117	117							
	20	29.15	29.12	29.12	29.11	29.10							
	24	29.24	29.24	29.25	29.26	29.26							
	5	85	86	86	86	86		86					
	7	88	89	89	89	89							
		—	—	—	—	—							
	5	575	605	624	641	667							
	6	198	215	224	234	248		80					
		Ø	Ø	Ø	Ø	Ø		.2					
	0	7.2	8.0	8.6	9.0	9.7		.9					
	9	1173	1248	1295	1337	1414		903					
		118	120	120	120	120		116					
	3	25	25	26	26	26							
	0	1.0	1.0	1.0	1.0	1.0							
	5	257	261	263	267	270							
	6	195	196	196	197	197		195					
	3	.77	.90	.94	.93	.96		.38					
	2	.12	.11	.11	.11	.12		.08					
		.09	.11	.11	.15	.16		.10					
		.16	.16	.17	.16	.15		.09					
								1250					
								1.46					

SEA LEVEL - STATIC (UNITY RAM) PERFORMANCE

SETTING	CORR hp	SFC: MAX/CORR	WFC: MAX/CORR	CORR hp	SFC: MAX/CORR	WFC: MAX/CORR
TOT °F						
hp						
MIN. ALLOW						
% VAR.						
SFC						
MAX. ALLOW						
%VAR.						

	T/O	MAX C.T.	CLIA	CRUISE
TOT °F	1337	1295	1248	1174
hp	688	654	608	515
MIN. ALLOW	663	612	540	450
% VAR.	3.8	6.0	12.6	14.4
SFC	.562	.564	.571	.597
MAX. ALLOW	.582	.599	.611	.647
%VAR.	-1.5	-5.8	-6.9	-7.7

LOG SHT 1
No. STARTS 2
TOTAL TIME 1:56
DATE OF ACCEPT

RUN COMP. ✓ RUN INCOMP.
ROUTED TO CRASH CAB
OPER. [redacted]
OPER.

ECU S/N CIT (T1) S/N
T/M CAL 650 hp= 92.6 psig
COMP SEAL VENT ORIF DASH No. -3