NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

October 17, 2018

MAINTENANCE FACTUAL REPORT

NTSB No: ERA16FA311

A. ACCIDENT

Operator:	AAR Airlift Group, Inc.
Aircraft:	Sikorsky S-61N, Registration N805AR
Location:	Palm Bay, Florida
Date:	September 6, 2016
Time:	1340 Local Time

B. MAINTENANCE SPECIALIST

Gregory Borsari
National Transportation Safety Board
Washington, D.C.

LIST OF ACRONYMS

AD	Airworthiness Directive
BSB	Brunei
CAMP	Continuous Airworthiness Maintenance Program
ECL	Engine Condition Lever
FAA	Federal Aviation Administration
FCF	Functional Check Flight
FSDO	Flight Standards District Office

LIST OF ACRONYMS (cont.)

GOM	General Operations Manual
MEL	Minimum Equipment List
MLB	Melbourne, FL
NF	Power Turbine Speed
NG	Gas Generator Speed
NR	Main Rotor Speed
OAKN	Kandahar, Afghanistan
OASA	Pakita, Afghanistan
OpSpec	Operation Specification
PIC	Pilot in Command
SDR	Service Difficulty Report
STC	Supplemental Type Certificate
TC	Type Certificate

C. SUMMARY

On September 6, 2016, about 1340 eastern daylight time, a Sikorsky S-61N, N805AR, was destroyed when it impacted a field under unknown circumstances near Palm Bay, Florida. The airline transport pilot, commercial pilot, and maintenance crewmember were fatally injured. The helicopter was registered to EP Aviation LLC and operated by AAR Airlift Group for the post-maintenance flight conducted under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and a company flight plan was filed for the local flight that departed Melbourne International Airport (MLB), Melbourne, Florida, at 1324.

D. DETAILS OF INVESTIGATION

1.0 Air Carrier Certificate

On December 15, 2011, Federal Aviation Administration (FAA), Orlando Flight Standards District Office (FSDO), issued AAR Airlift Group, Inc. of 2301 Commerce Park Drive, Palm Bay, FL. 32905 Air Carrier Certificate Number 39LA907M.

2.0 Operations Specifications (OpSpecs)[1]

AAR Airlift Group, Inc. was authorized to conduct 14 CFR Part 135 On Demand Operations under of the code of Federal Aviation Regulations, which includes the standards, terms, conditions, and limitations contained in the FAA approved Operations Specifications (Parts D and E).

a) Per Section D072 of the OpSpecs, AAR Airlift Group, Inc. was authorized to use a Continuous Airworthiness Maintenance Program (CAMP), document number M2-MTX-1004 dated May 22, 2012, revision (00) to maintain the Sikorsky Helicopter model SK-61-N. The CAMP includes the General Maintenance Manual, Document M2-MTX-0001, revision (6), Continuing Analysis and Surveillance System Manual, Document M2-MTX-0002, revision (3) and the Maintenance/Inspection Training Program Part 135 Document M2-TNG-2000, revision (1).

b) Per section D085 of the OpSpecs, AAR Airlift Group, Inc. has 19 Sikorsky SK-61-N Helicopters, 2 Sikorsky SK-92-A Helicopters, 10 CASA Aviocar C-212 aircraft, 4 Bombardier DHC-8 aircraft, and 9 Aerospatiale SA330 Helicopters.

c) Per section D093 of the OpSpecs, AAR Airlift Group, Inc. was authorized to use Helicopter Night Vision Imagining System and Night Vision Goggles to perform Helicopter Night Vision Operations per Maintenance Documents S61004-4, revision (IR) and D205689-073C, revision (0) or ANVD-TM-ITI revision (1).

d) Per Section D095 of the OpSpecs, AAR Airlift Group, Inc. was authorized to use an approved Minimum Equipment List (MEL).

e) Per section E096 of the OpSpecs, AAR Airlift Group, Inc. was authorized for a Weight and Balance Control Procedures based on Actual Weights per 14 CFR 135.185(a) and the CAMP. According to the document, the aircraft are to be individually weighed every 36 months.

3.0 Type Certificate Data Sheet

The Type Certificate Data Sheet (1H15) prescribes conditions and limitations under which the product for which the Type Certificate (TC) was issued meets the airworthiness requirements of the Federal Aviation Regulations. According to the document Sikorsky Aircraft Corporation is the holder of the TC.

[1] Operations Specifications contains the authorizations, limitations, and certain procedures under which each kind of operation, if applicable, is to be conducted by the certificate holder.

4.0 Helicopter Information

The Sikorsky Aircraft Corporation manufactured the helicopter, serial number 61717 in 1974. AAR Airlift Group, Inc. leased the helicopter from EP Aviation LLC and placed it into service on February 20, 2009 with 35,724.4 total flight hours. The helicopter had 40,296.2 total flight hours with 109,600 total flight cycles as of August 29, 2016 (logbook sheet No. 046371).

The helicopter was equipped with two General Electric CT58-140-2 engines. The engines had accumulated the following operating times at the time of the accident:

	No.1 Engine	**No.2 Engine**
Manufacturer	General Electric	General Electric
Part Number	CT58-140-2	CT58-140-2
Manufacture Date	1974	1968
Date Installed	11/25/2015	1/26/2016
Serial Number	295122C	296010
Time Since Light Overhaul (Engine hours)	248.4	371.6
Total Cycles Since Light Overhaul (Engine cycles)	145	245
Time Since Overhaul (Engine hours)	708.9	4,520.2
Total Cycles Since Overhaul (Engine cycles)	423	2,683
Engine Total Time Hours	23,234.8	26,258.6
Engine Total Cycles	20,939	22,050
Location of Engine Installation	MLB	MLB
Total Time of Helicopter at engine installation (hours)	40,047.7	40,058.5

5.0 Continuous Airworthiness Maintenance Program (CAMP)

AAR Airlift Group, Inc. aircraft are maintained in accordance with their approved Continuous Airworthiness Maintenance Program (CAMP).

The CAMP is based on the Sikorsky Equalized Check and Maintenance Program (document SA 4047-13), manufacturer data, field experience and airworthiness requirements. Documents included;

- Manufactures Maintenance Manuals
- Service Bulletins

- Service Letter.
- Service Notes and/or Instructions
- Airworthiness Directives
- Aircraft Specifications and/or Type Certificate Data Sheets for the Aircraft and Engines.

The following is a listing of recent inspections accomplished on N805AR.

CHECK	DATE	LOCATION	TOTAL TIME	TOTAL CYCLES
Daily Check	9/4/2016	MLB	40,296.2	107,600
Periodic Safety Check	8/26/2016	MLB	40,296.2	107,600
100 Hour Engine Inspection No.1 Engine	8/26/2016	MLB	40,296.2	107,600
100 Hour Engine Inspection No.2 Engine	8/26/2016	MLB	40,296.2	107,600
300 Flight Hour	7/13/2016	MLB	40,221.0	107,421
600 flight Hour	12/25/2013	OAKN	39,747.3	106,298
1200 Flight Hour	1/2/2014	OAKN	39,754.4	106,314
2000 Flight Hour	11/7/2012	OASA	38,789.2	102,466
Periodic Phase 1	5/25/2016	MLB	40,194.8	107,381
Periodic Phase 2	7/11/2016	MLB	40,219.5	107,425
Periodic Phase 3	7/22/2016	MLB	40,238.0	107,481
Periodic Phase 4	8/4/2016	MLB	40,266.7	107,538
Periodic Phase 5	8/25/2016	MLB	40,296.2	107,600
600 Flight hour Lubrication	12/25/2013	OAKN	39,747.3	106,298
Major Inspection Phase 1	8/5/2004	BSB	32,830.8	UNK
Major Inspection Phase 2	8/16/2004	BSB	32,830.8	UNK
Major Inspection Phase 3	8/16/2004	BSB	32,830.8	UNK
Major Inspection Phase 4	8/16/2004	BSB	32,830.8	UNK
Major Inspection Phase 5	8/11/2004	BSB	32,830.8	UNK
Major Inspection Phase 6	8/13/2004	BSB	32,830.8	UNK
Major Inspection Phase 7	8/13/2004	BSB	32,830.8	UNK
S-61 Avionics Check	9/5/2015	MLB	39,968.0	106,832
Aircraft Weight & Balance	2/12/2015	MLB	39,928.6	106,770
2000 Flight Hour Fuel Sys	11/7/2012	OASA	38,789.2	102,466

Maintenance packages from the Periodic Phase 4 and Phase 5 as well as the 100-hour inspections on engines one and two recently completed were reviewed. The following work was noted.

- Visual inspection of each engine air inlet ducts.
- Visual inspection of each engine front frame, compressor blades and inlet guide vanes.
- Visual inspection of each engine power turbine blades.
- Borescope inspection of each engine first stage blades.
- Compressor wash each engine.
- Replaced collective primary servo.
- Replaced worn bracket and liner assemblies for fore and aft primary servo.
- Replaced primary manifold hydraulic line due to leak.
- Hydraulic filters inspected, cleaned, installed and serviced.
- Main gear box inspected.
- Drained and serviced main gear box transmission.

6.0 Supplemental Type Certificates (STC)[2]

Major Alterations and Supplemental Type Certificates (STCs) supplied by AAR Airlift Group, Inc. and the FAA were reviewed. There were 29 major alterations on file with the FAA. All major alterations were airframe related with one being related to the powerplants. An electrical engine chip detector system was installed for each engine, June 2005.

7.0 Airworthiness Directive (AD)[3]

AAR Airlift Group, Inc. provided an AD summary (airplane, powerplants and appliances) for review. There were 34 AD's of which two affected the engines. All AD's were either complied with or scheduled. The two engine AD's were AD 2004-15-22, number five bearing chip detector and AD 2013-05-17, 40-micron fuel filter. No discrepancies were found during the review.

8.0 Service Difficulty Reports (SDR)[4]

According to the FAA SDR Database, there were six SDRs submitted on the accident helicopter. Two of the reports were engine related.

March 5, 2013 – Immediately after takeoff at approximately 97 percent NG the number one NG began to fluctuate 3 – 4 percent. Noticed number 1 NF begins to fluctuate as well as number 1 fuel pressure

[2] The FAA issues Supplement Type Certificates, which authorize a major change or alteration to an aircraft, engine or component that has been built under an approved Type Certificate.
[3] Airworthiness Directive (AD) is a regulatory notice sent out by the FAA informing the operator of an action that must be taken for the aircraft to maintain its airworthiness status.
[4] A Service Difficulty Report (SDR) is a report of the occurrence or detection of each failure, malfunctions, or defects as required by 14 CFR 135.415.

and T5. Approximately 40 percent torques split was noted during landing with number 1 fuel control levers fully forward and only getting 90 percent NG. Removed and replace number one engine.

March 12, 2013 – After departure, fuel load was 2,800 LBS, T/O GW 17,594, and Temperature 12 Deg. When power change was made the number one engine torque oscillated 30 to 40 percent, fuel pressure oscillated 10 to 15 PSI and T5 temps oscillating 30 to 40 degrees. Removed and replaced the main fuel inlet hose assembly, part number SS40CF6F446000.

9.0 Minimum Equipment List (MEL)[5]

AAR Airlift Group, Inc. was authorized to use an approved MEL on its aircraft per its OpSpecs. At the time of the accident, there were no open MEL items.

10.0 Aircraft Flight Logs

Aircraft Flight Logs were reviewed from September 5, 2015 thru August 29, 2016. The subsequent aircraft flight logs were in the aircraft at the time of the accident and could not be reviewed. The review focused on the engines, rotor system, flight controls and fuel system.

The following work was noted:

Log No.	Date	Flight Hours	Flight Cycles	Discrepancy	Corrective Action
030288	11/04/2015	40,047.7	106,994	Both number one and two engines removed and replaced for AD 2015-20-09 reduction of life limited rotating parts	Installed repaired engine number one, part number CT58-140-2, serial number 295-122C. Installed repaired engine number two, part number CT58-140-2, serial number 295-237C
030152	Unknown	40,057.6	107,015	Both number one and two engines failed start attempts	Cleaned and serviced oil. Performed a fuel bleed on both engine one and two fuel controls. Checked good
030155	1/23/2016	40,057.6	107,015	Functional check flight (FCF) required for engine one and two topping check	FCF completed satisfactory
030157	1/25/2016	40,058.5	107,016	Number two engine failed two start attempts. Fuel pressure increased to about 200 PSI, when engine condition lever advanced there was no drop in fuel pressure. All other indications were normal and no climb in T5	Replaced number two engine, serial number installed 296-010

[5] The FAA approved Minimum Equipment List contains a list of equipment and instruments that may be inoperative on a specific aircraft for continuing flight beyond a terminal point.

Log No.	Date	Flight Hours	Flight Cycles	Discrepancy	Corrective Action
030196	4/8/2016	40,138.2	107,263	Functional check flight required for inflight controllability check. Negative force gradient check required in excess of 40 ft. lbs. to stop right turn	Removed and replaced negative force gradient springs in accordance with S-61N AMM 65-43-2
047284	7/6/2016	40,214.6	107,414	On departure, aft fuel bypass light illuminated	Removed and replaced both forward and aft airframe fuel filters in accordance with S61N maintenance manual 28-20-7 page 201.
047286	7/8/2016	40,217.4	107420	Static fuel leak dripping from weep hole aft of aft fuel tank	Removed and replaced drain cock defueling valve in accordance with S61N AMM 28-31-0 page 204-205. Ops check and leak check completed. No leaks noted.
046369	8/25/1016	40,296.2	107,600	Daily Check Due	Daily check completed which includes the following MGB tasks; Electrical chip detector inspect and test, MGB oil strainer visual inspect, service and inspect for security, damage, and leaks including lubrication lines.

11.0 Weight and Balance Summary

Per the AAR Airlift Group, Inc. OpSpecs, the aircraft were to be weighed every thirty-six (36) calendar months. The last actual weight and balance on N805AR was accomplished on February 2, 2015 in Melbourne, Florida. The figures from the last weight and balance are shown below:

Basic Empty Weight: 12,036.0
Arm: 259.52
Horizontal Moment: 3,123,582.7

AAR Airlift maintained a record of added and removed equipment with the calculated adjusted weight and balance figures. The latest entries for N805AR dated June 25, 2016 for the calculated weight and balance figures are shown below:

Basic Empty Weight: 12,359.1
Arm: 264.64
Horizontal Moment: 3,270,712.2

AAR Airlift provided an estimated weight in pounds for N805AR on the day of the accident, as shown below:

Item	Flight #1	Flight #2
Basic Weight (pounds)	12,359	12,359
Fuel (pounds) at start of day	3,670	3,670
Fuel burned, 0.8 hours (950 pounds per hour)	0 (1st flight)	(760)
Protective Diamond Plating (per mechanic estimate)	60	60
Water weight (Container + pallet + jack + tie down (estimated)	800	1,600
Pilot's weight (medical certificate)	280	280
Co-Pilot's weight (medical certificate)	240	240
Crew Chief (estimated)	200	200
Total Weight	**17,609**	**17,649**

Notes:

a) The water weight is an estimate as the actual calculation paperwork remained with the accident aircraft and destroyed by post-crash fire.
b) The water weight estimates are based on interviews of AAR Airlift employees who were involved in the water weighing process.
c) Weight of the water container came at the Pilot In Command's direction based on his weight calculations for each flight.
d) Maximum Allowable Gross Weight for the day of the accident was 19,500 pounds.

12.0 Major Repairs and Major Alterations

According to the FAA Airworthiness Report and AAR Airlift Group Inc records, there were no Major Repairs and approximately 29 Major Alterations on the accident helicopter. One Major Alteration affected the powerplants. On February 13, 1996, an electrical chip detector system was installed for each engine position.

13.0 Time Limit Components

Time Limit Component status for the airplane and the two installed powerplants were reviewed. The review included the most recent overhaul for the main gear box and the two, input free-wheel units.

The main gear box and the two, input free-wheel units were overhauled by HELI-ONE CANADA. The main gear box was overhauled on June 12, 2013. Both input free wheel units were overhauled on June 5, 2013.

Component	Part Number	Serial Number	Time Since New at Overhaul	Time Since Overhaul	Time Remaining to Overhaul
Main Gear Box	S6135-20600-046	A14-J-19-72-946	24,157.0	940.12	1559.88
Left Input Free-Wheel Unit	61074-35000-061	C144-00008	Unknown	940.12	309.88
Right Input Free-Wheel Unit	61074-35000-060	C144-00056	Unknown	940.12	309.88

The main gear box and the input free wheel units were overhauled in accordance with Sikorsky S61 Overhaul Manual SA4045-83 Revision 22, dated November 30, 2010.

New parts installed in the left input free wheel unit at overhaul:

Cam: PN S6135-20614-041, SN G121-01028.
Gear: PN S6135-20695-004, SN F124-00228.
Roller Retainer: PN S6135-20730-000, SN H125-00305.

New parts installed in the right input free wheel unit at overhaul:

Cam: PN S6135-20614-042, SN H120-00819.
Gear: PN S6135-20695-003, SN F124-00315.
Roller Retainer: PN S6135-20457-101, SN C125-00271.

The overhauled main gearbox was installed on June 23, 2013 at Kandahar, Afghanistan. The main gearbox with the input free wheel units were removed to facilitate helicopter relocation from Bagram, Afghanistan to Melbourne, Florida where the main gearbox was reinstalled on July 25, 2014. Time since overhaul when reinstalled, 569 hours.

14.0 Manuals

AAR Airlift Group, Inc. used the following manuals to maintain the airworthiness of its fleet and management of the maintenance department.

General Operations Manual (GOM) - The GOM contains policies, procedures and instructions for the performance of maintenance, preventive maintenance and alterations for AAR Airlift Group, Inc. operated aircraft that are type certified for a passenger seating configuration, excluding any pilot seat, of ten or more, as required by FAR 135.411(a)(2), and continuous airworthiness of the aircraft.

Continuous Airworthiness Maintenance Program (CAMP), The CAMP, document number M2-MTX-1004 dated May 22, 2012, revision (00) is used to maintain the Sikorsky Helicopter model SK-61-N. The CAMP includes the General Maintenance Manual, Document

M2-MTX-0001, revision (6). The CAMP includes routine inspection requirements, rotable overhaul limits, repetitive AD's and lubrication intervals.

Minimum Equipment List (MEL) – This manual provides information pertaining to the dispatch of aircraft with inoperative system(s) and references maintenance procedures relating to inoperative MEL items.

Manufacture Supplied Manuals - Aircraft/Engine Maintenance Manuals, Structural Repair Manuals, Overhaul Manuals, Wiring Manuals, Illustrated Parts Catalog, Service Bulletins, Engine Manuals and other FAA approved or accepted manuals to perform maintenance.

15.0 Method of Record Keeping

Per FAR Parts 43, 91 and 135, AAR Airlift Group, Inc., maintains records with the use of Aircraft Logs and the CAMP paperwork which includes the inspection program. Non-routine work is recorded and kept for the inspection program along with other aircraft work.

AAR Airlift Group Inc. also uses a computerized electronic tracking program called TRAX to assist in tracking:

a) Scheduled maintenance
b) Component/Equipment
c) Airworthiness Directives
d) Service Bulletins
e) Life Limited Components

Submitted by: Gregory Borsari
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Maintenance