



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 13, 2022

Group Chairman's Factual Report

Maintenance / Human Performance

DCA21FA174

A. ACCIDENT

Location: Honolulu, HI
Date: July 2, 2021
Time: 0145 Hawaii Standard Time,
1145 coordinated universal time (UTC)
Airplane: Boeing B737-275C, N810TA (S/N: 21116), Rhoades Aviation Inc., dba
Transair Flight 810

B. MAINTENANCE AND HUMAN PERFORMANCE GROUP

Group Chairman	Pocholo Cruz National Transportation Safety Board Washington, D.C.
Group Chairman	Dr. William Bramble National Transportation Safety Board Washington, D.C.
Group Member	Stephen Muse Federal Aviation Administration Honolulu, HI
Group Member	Dan Marcotte The Boeing Aircraft Company Seal Beach, CA
Group Member	Anthony DiCioccio Pratt and Whitney East Hartford, CT
Group Member	Ron Lenhart Rhoades Aviation, Inc. Honolulu, HI

C. DETAILS OF THE INVESTIGATION

Maintenance and Human Performance Investigators traveled to Honolulu, HI on July 3, 2021, to begin the investigation into the Rhoades Aviation Inc. dba Transair accident. The team documented all aspects of the Maintenance Organization and the maintenance of the accident airplane.

Maintenance and Human Performance Investigators returned to Honolulu, HI on September 20, 2021, to conduct interviews with Rhoades Aviation Inc. Maintenance and Federal Aviation Administration personnel.

D. FACTUAL INFORMATION

1.0 Air Carrier Certificate

On May 17, 2012, The Federal Aviation Administration (FAA), Western Pacific Region, issued Rhoades Aviation Inc. of 100 Iolana Place, Honolulu, Hawaii 96819, Certificate Number JRAA169N. The certificate holder was authorized to conduct operations under the business name Transair¹. See Attachment 1.

2.0 Operations Specifications (OpSpecs)²

Rhoades Aviation Inc. (RAI) dba Transair was authorized to conduct operations under 14 CFR Part 121 of the Federal Aviation Regulations, which included the standards, terms, conditions, and limitations contained in the FAA approved Operations Specifications (Parts D and E).

1. Per Section D072 of the OpSpecs, RAI was authorized to use a Continuous Airworthiness Maintenance Program (CAMP) to maintain the B737-200 Aircraft using General Maintenance Manual (GMM) B737-200 Aircraft Inspection Program (AIP), Task Card Manual, B737-200 Weight and Balance Manual (WBM).
2. Per Section D076 of the OpSpecs, RAI was authorized to use Short-Term Escalation Authorization. Limitations were limited to letter checks not to exceed 10% time in service. Airframe overhaul not to exceed 500 hours time-in-service.
3. Per Section D085 of the OpSpecs, RAI had five total Boeing 737-200 (including the accident airplane) in its fleet.

¹ For the purpose of the Maintenance/Human Performance Factual Report, the report will refer to Transair as Rhoades Aviation Inc. (RAI) due to the majority of the Operator's Manuals, documents and FAA correspondence being addressed to RAI.

² 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. Per Section D089 of the OpSpecs, RAI was authorized to use Maintenance Time Limitations specified in the RAI B737-200 Aircraft Inspection Program.
5. Per Section D091 of the OpSpecs, RAI was authorized to make arrangements with other persons (maintenance providers) to accomplish maintenance, preventative maintenance, or alterations for RAI.
6. According to Section D095 of the OpSpecs, RAI was authorized to use an approved Minimum Equipment List (MEL).
7. OpSpecs D485 (Aging Airplane Inspection and Records Review) policies and procedures had been incorporated into the maintenance and/or inspection programs for RAI.
8. Per section E096 of the OpSpecs, RAI was authorized for a Weight and Balance Program per the B737 Weight and Balance Manual, General Maintenance Manual Chapter 10.4. According to the document, the airplanes were to be individually weighed every 36 months.

3.0 Type Certificate Data Sheet (TCDS)

TCDS number A16WE applied to the accident airplane. The TCDS number for the engine was E2EA. The TCDS prescribed 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, The Boeing Company was the holder of the TC for the airplane and Pratt & Whitney was the holder of the TC for the engines.

4.0 Aircraft Information

The Boeing Company manufactured the accident airplane as a convertible (both Passenger and Cargo) and issued the Certificate of Airworthiness on October 10, 1975. The airplane was owned and operated by several different companies before it was sold to RAI on December 23, 2014. RAI registered the airplane with the FAA on January 23, 2015 and it was added to the RAI Operation Specifications on February 2, 2015. According to aircraft records, the airplane had accumulated 72,871.20 total hours with 69,446 total cycles prior to the accident.

The airplane was equipped with two Pratt and Whitney JT8D-9A Turbojet Engines and a Garrett Auxiliary Power Unit (APU). The Engines and APU had accumulated the following times at the time of the accident:

Table 1 - Engine and APU Information

	No.1 Engine	No.2 Engine	APU
Manufacturer	Pratt and Whitney	Pratt and Whitney	Garrett
Part Number	JT8D-9A	JT8D-9A	380428-1-14
Manufacture Date	6/24/1971	1/10/1968	07/19/72
Date Installed	10/28/19	9/20/19	09/07/06
Serial Number	674548	657227	P34894
Location of Engine / APU Installation	HNL	HNL	Transmile Sultan Abdul Aziz Shah Airport
Total Engine/APU Time	32,304.9	70,827.3	34,805.3
Total Engine/APU Cycles	33,670	101,368	N/A
Total Time of Airframe during Engine/APU installation	71,816.0	71,816.0	Unknown
Total Cycles of Airframe during Engine/APU installation	67,361	67,361	Unknown
Engine/APU Time Since Engine Shop Visit	1,055.2	1,055.2	6,922.1
Engine/APU Cycles Since Engine Shop Visit	2,085	2,085	Unknown

5.0 Continuous Aircraft Maintenance Program (CAMP)

According to the RAI B737-200 Aircraft Inspection Program (AIP), the AIP was based upon the FAA Boeing 737 Maintenance Review Board Report (MRBR) RD6-822980-MRBR, dated May 2007, the Boeing Maintenance Planning Document No. D6-17594, dated December 2009 Revision R, and the Pratt and Whitney JT8D Engine Shop Manual Document and other documents listed in Section 1.0.9 of the AIP.

RAI provided the investigative team the latest AIP Revision (Rev 2 dated October 31, 2014). As previously stated, the accident airplane was put on the RAI Operations Specifications on February 2, 2015, however the accident airplane was not included in the applicability section (Section 1.0.4) of the AIP.

The maintenance program consisted of the following:

1. Daily Checks: Intended to assure continuous serviceability of the aircraft not to exceed 36 calendar hours. The check is a walk around inspection which requires checks of the aircraft interior and exterior for obvious damage, leaks, proper operating equipment, security of attachments, operational checks of items that might ground the aircraft.
2. Weekly Checks: Incorporates everything in the Daily Checks and is accomplished weekly not to exceed 7 calendar days.

3. "1A" Check: Primary Inspection and is intended to disclose the general condition of the aircraft. The 1A Check was to be accomplished every 250 Flight Hours or 45 Days.
4. Multiple "A" Checks (2A, 3A, 4A, 5A, 6A): Multiple "A" checks are considered intermediate checks, which require a more extensive examination of the aircraft to determine its condition for assuring sustained airworthiness. These checks include selected operational checks, filter servicing, lubrication, and require opening of specific access door and panels.

Table 2 - Check Interval

CHECK	INTERVAL
2A	500 Flight Hours or 90 Days
3A	750 Flight Hours or 135 Days
4A	1,000 Flight Hours or 180 Days
5A	1,200 Flight Hours or 270 Days
6A	1,500 Flight Hours or 360 Days

5. "1C" Checks (2C, 3C, 4C, 5C, 6C): Requires a greater depth of structural inspections throughout the aircraft to ensure continued airworthiness. These checks also involve selected Non-Destructive Testing (NDT) inspections along with operational/functional checks and require the removal of access doors and panels to facilitate the inspection. Restoration of components, removal of life limited components.

Table 3 - Check Interval

CHECK	INTERVAL
1C	4,000 Flight Hours or 24 Months
2C	8,000 Flight Hours or 48 Months
3C	12,000 Flight Hours or 72 Months
4C	16,000 Flight Hours or 96 Months
5C	20,000 Flight Hours or 120 Months
6C	24,000 Flight Hours or 144 Months

6. Zonal Inspection Tasks: Tasks are consolidated of "1C" and in some cases multiple "C", visual inspections that check system components including associated wiring, tubing, ducting and structure for condition and security in areas of common access.
7. Out of Phase and other Instructions for Continued Airworthiness (ICAs): Company developed tasks, Supplemental Type Certificates (STCs), Airworthiness Directives (ADs), Service Bulletins (SBs) and Engineering Authorizations (EAs) which include Operational, Functional, General Visual Inspections, Detailed Inspections, Non-Destructive Testing Inspections (NDT), Restorations or other methods required by an ICA.

8. Engine Maintenance Program (Section 7.0 of the AIP): Engine Task requirements were developed using Boeing 737 MRBR D6-82980-MRBR dated May 2007, Pratt and Whitney Engine Manual (PN 820510-01), Pratt and Whitney Component Maintenance Manual (PN 779155), Pratt and Whitney Standard Practices Manual (PN 52A138) and Pratt and Whitney JT8D STD Maintenance Planning Guide (PN 820671).
9. All Engine Operational Requirement, Operational Limits, Period Inspections and Engine Shop Visits were built into the Rhoades Aviation Inc. Inspection Program.

The following is a listing of the previous inspections accomplished on airplane N810TA.

Table 4 - Maintenance Checks

CHECK	DATE	LOCATION	TOTAL TIME	TOTAL CYCLES
Daily	7/01/21	HNL	72,871.1	69,446
Weekly	06/26/21	HNL	72,853.1	69,410
1A	06/09/21	HNL	72,788.5	69,274
2A	04/25/21	Air Asia, Taiwan	72,662.1	69,030
3A	04/25/21	Air Asia, Taiwan	72,662.1	69,030
4A	04/25/21	Air Asia, Taiwan	72,662.1	69,030
5A	04/25/21	Air Asia, Taiwan	72,662.1	69,030
6A	04/25/21	Air Asia, Taiwan	72,662.1	69,030
1C	04/25/21	Air Asia, Taiwan	72,662.1	69,030
2C	04/25/21	Air Asia, Taiwan	72,662.1	69,030
3C	04/25/21	Air Asia, Taiwan	72,662.1	69,030
4C	02/07/15	Airod, Malaysia	69,927.0	63,805
5C	02/07/15	Airod, Malaysia	69,927.0	63,805
6C	02/07/15	Airod, Malaysia	69,927.0	63,805

6.0 General Maintenance Manual

According to FAR 121.133 (a), a certificate holder shall prepare and keep current a manual for use and guidance of flight, ground operations, and management personnel in conducting its operations.

Rhoades Aviation Inc. provided the most recent revision of the General Maintenance Manual dated February 25, 2014, Revision 2 (Original Revision March 20, 2013; Revision 1 May 13, 2013). The Director of Maintenance (DOM) was responsible for the quality and procedures related to the GMM. The DOM had the authority and responsibility to establish and modify the policies, procedures, instructions, and information associated with the GMM. Revision 2 contained the following GMM Bulletins:

- GMM Bulletin 15-1 4/20/2015 - MCO Completing Closing action
- GMM Bulletin 15-2 Rev 1 7/8/2015 - Changes to certain Chapter 7.0 Technical Services Sections

- GMM Bulletin 15-3 7/21/2015 – Short Term Escalation
- GMM Bulletin 15-4 7/23/2015 – Changes to Chapter 3.0 Monitoring and Control Section
- GMM Bulletin 16-1, 16-2 10/1/2016 – Aircraft Weight and Balance Tracking/Recording
- GMM Bulletin 16-3 12/07/2016 – MEL Extension Process Improvements

Since the GMM had not been revised since 2014, the investigative team found several inconsistencies/discrepancies with several GMM procedures. Such as references/procedures that no longer apply (Convair 640 maintenance and inspection procedures), inaccurate (RVSM reference even though no longer used by Rhoades Aviation Inc., MEL extension procedures) or out of date.

7.0 Minimum Equipment List (MEL)³

RAI was authorized to use an approved MEL on its B737 aircraft per its OpSpecs. The OpSpecs D095 with an effective date of July 13, 2018, allowed Rhoades Aviation Inc. to use a continuing authorization – single extension to approve a single, one-time extension to the repair interval for repair category B and C items, as specified in the FAA approved MEL, provided the responsible Certificate Holding District Office was notified within 24 hours of the extension approval. If an additional extension was required after the continuing authorization-single extension privilege had been exercised, it had to be approved by the FAA principal inspectors (PIs) prior to the expiration of the current extension time period. The certificate holder was not authorized to approve a single, one-time extension to the repair interval for repair category A and D items, as specified in the FAA-approved MEL. The Certificate Holding District Office had the authority to deny the use of the continuing authorization-single extension privilege if abuse was evident.

RAI GMM Bulletin 16-3 dated December 7, 2016, stated for the first and second MEL Extensions, the Chief Inspector or designee was allowed to approve the extensions as long as notification to the principal inspectors was provided within 24 hours of the extension. The bulletin stated that an additional extension (3 or more extensions) could be utilized, providing FAA approval was authorized for each extension. Per GMM MEL Extension procedures, Request Form: RAI MEL-E001 was to be completed, reviewed, and signed by both the Director of Maintenance and Chief Inspector, then forwarded to the Principal Maintenance Inspector for approval or rejection. If the request for approval was denied, the aircraft was not to be operated beyond the previous approved MEL extension deadlines.

A review of the most recent Rhoades Aviation Inc. MEL Deferred Item Log revealed that there were no open MEL items at the time of the accident.

³ 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.

8.0 Supplemental Type Certificate (STC)

Supplemental Type Certificates (STCs) supplied by air carrier, were reviewed. A total of 8 STCs were found in the maintenance records.

Table 5 - Supplemental Type Certificates

STC No:	Modification Description	Vendor	Date Accomplished
P-LSA93-149/D	Conversion from Passenger to Class "E" Cargo Compartment	Transmile	6/7/93
ST223CH	Installation of Stage 3 Hushkit (AV Aero Systems)	Transmile	5/19/04
ST 00389SE	Installation of Honeywell EGPWS	Transmile	10/10/02
SA297980	Installation of a Single Bendix TRA-67 Mode S Transponder	Transmile	12/9/04
SA92-69	Installation of Mode S Transponder and Collins TCAS II	Transmile	12/9/04
C-LSA98-327/D	Sundstrand DFDR Upgrade	Transmile	3/8/99
ST01114WI	Class "E" Lower Compartment Smoke Detection System	Rhoades Aviation	11/18/14
ST01904AT	Installation of Trimble 2101, I/O plus GPS- (Auto Pilot Coupled)	GenAero/RAI	9/8/16

9.0 Aircraft Logbooks

Aircraft Logbooks for the accident airplane were reviewed from January 1, 2020 thru July 1, 2021. The Table below show the engine logbook writeups from January 2021 - July 2021. See Attachment 2 for additional logbooks from January 2021 - July 2021.

Table 6 - Aircraft Logbook

DATE	LOGPAGE	DISCREPANCY	CORRECTIVE ACTION
1/4/2021	8226	#2 Engine Fuel Pressure and Dump valve leaking fuel beyond limits.	R&R and ops check per AMM 73-12-01 and Engine Run per AMM 71-09-100
1/9/2021	8227	#2 Engine LO Ignition INOP.	R&R #2 Ignition exciter per AMM 74-11-11. Ops check good IAW 74-00-00. Engine run IAW 71-09-100
1/19/2021	8242	#2 Engine oil qty is below 1.5 gallons during flight.	Added 2 quarts to #2 engine
2/10/2021	8482	#1 EPR Gauge INOP.	R&R #1 EPR Gauge IAW 737AMM 77-11-00 Ops check normal per AMM 77-11-00.
2/27/2021	9009	#2 Engine cowl valve light on with switch in OFF position.	Ground tested good could not duplicate error IAW AMM 75-11-00
4/25/2021	TNN	C Check (3C, 1C, 1A-6A)	
4/27/2021	9021	Found #2 Engine CSD Overserviced.	Drained and reserviced #2 Engine CSD IAW AMM 12-13-21.

4/27/2021	9022	LH Valve open light flicker in flight on Engine Anti-Ice. Switch in OFF position.	Performed ops check of #1 Engine Anti-Ice valve per 75-11-00. Could not duplicate. Ops Check Good.
5/3/2021	9032	#2 Engine Anti-Ice cowl valve open and right valve open light illuminates dim intermittently in flight.	Check and cleaned cannon plug on #2 Engine Anti-Ice valve per 20-60-01. Tested per AMM 75-11-11-401. All Ops normal. No faults noted.
5/6/2021	9040	Back-to-Back Compressor Stalls presumably from #1 Engine at 13,000 during cruise phase of flight.	Ran #1 Engine per 71-09-100. No faults noted could not duplicate
5/9/2021	9045	Before engine start duct pressure with APU valve open was 32 psi left and right side. During start with start valve open duct pressure dropped to 18 psi left and right side.	Per AMM 71-09-100, ran engine all pneumatic pressure normal. No faults noted, all parameters normal.
6/4/2021	8644	#1 EPR gauge knob slips when trying to adjust it.	MEL 77-01(02). Cleaned #1 Engine EPR indicator set knob ball locks, Operation checks good per AMM 77-11-00. Placard removed; MEL list updated.
6/14/2021	8670	#1 Engine fuel heat valve light illuminated after landing.	Cleaned and verified fuel heat valve electrical connector and ops check per IAW AMM 73-14-11. Normal.
6/16/2021	8677	#1 Engine fuel heat valve open. Flickers in flight.	Removed #1 Engine Fuel Heat Valve cannon plug, cleaned cannon plug connector, reinstalled cannon plug. Ops check good IAW BSPWM 20-60-01 and 20-60-06.
6/17/2021	8678	After #2 Engine Start Oil qty increased to 1.75. On taxi out qty decreased to 1.0. Power applied with no increase in qty needle flickered between 1.0 and 1.25.	Service #2 Engine to full indication IAW AMM 12-13-00.
6/23/2021	8697	#2 Thrust Reverser did not deploy on landing.	Deployed #2 T/R cleaned latches & latch switches, repeated deployment 4 times. Ops Check good IAW B737 AMM Ch 78-23-01.
6/25/2021	8853	#2 Reverser will not deploy.	Cleaned #2 Reverser Proximity Sensor. Ops check good IAW Boeing 737 AMM 78-36-01.
6/26/2021	8856	#2 TR did not deploy during landing in HNL.	Cleaned #2 Reverser proximity sensor IAW AMM 78-36-01. Ops Check good.

10.0 Service Difficulty Reports (SDR)⁴

According to the FAA SDR and RAI Database, there were three SDRs reported for the accident airplane. The most recent was reported to the FAA on January 30, 2019. The incident involved a No. 1 Engine fail at around 2000 feet. On final, the crew performed the engine failure/shutdown checklist (QRH). According to records, the No. 1 Engine Fuel Pump failed and was replaced. The second SDR was reported on April 8, 2018, where the No.1 Engine failed during takeoff, got 3 back firing before engine shutdown, QRH completed. Maintenance found a broken shaft in the fuel pump. The fuel pump was replaced and checked per 71-09-100. The third SDR was reported on February 29, 2016, where the airplane had fuel transfer issues (right fuel tank dumping fuel into the center tank) in flight. The airplane turned around and returned to the airport. Maintenance replaced the center tank one way check valve as they found the flapper spring was broken.

11.0 Aircraft Weight and Balance

Per the RAI OpSpecs, the airplanes were to be weighed every thirty-six (36) calendar months. The last actual weight and balance on the airplane was accomplished on April 19, 2021, in Taiwan by Air Asia. See Attachment 3.

The figures for last weight and balance are shown below:

Basic Empty Weight:	59,719.65 pounds
Arm:	654.63 inches
Moment:	39094013 lb-inches

12.0 Major Repairs and Major Alterations

RAI maintenance records show there were 9 major repairs and alterations to the accident airplane. Seven of the records were structural in nature with the other two being an escape rope installation and the removal of #1 ATC control panel. See Attachment 4.

13.0 Hard Time Components

Time Limit Component status for the airplane and the two installed powerplants and the APU were reviewed. RAI was tracking all the Time Limited Components from the accident airplane. For additional information see Attachment 5.

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 121.703.

14.0 Continuous Analysis and Surveillance System (CASS)⁵

According to RAI General Maintenance Manual, the primary function of the CASS program was to ensure that aircraft operated by RAI were airworthy, safe, reliable, and that the maintenance and inspection programs developed for maintaining the aircraft met or exceeded all regulatory requirements.

It was designed to confirm that the Maintenance and Inspection Program was being properly controlled and adhered to. The intent of the CASS was to ensure compliance; regardless of whether that program is carried out by RAI or by another party. CASS findings were also to be used to improve the quality of RAI programs.

CASS was a Safety Management System that is based on principles of system safety and analysis performed through the closed-loop, continuous cycle of surveillance, investigations, analysis, and corrective action permit Rhoades Aviation Inc. to refine its audit and data collection priorities through the risk assessment process. The system was designed to identify deficiencies, initiate collaborative discussions with the appropriate departments, and resolve issues.

RAI's CASS had four primary functional areas for its inspection, maintenance, preventive maintenance, and alterations programs.

1. Monitoring a maintenance program's effectiveness
2. Monitoring a maintenance program's performance (program execution)
3. Developing and implementing corrective action for maintenance program deficiencies identified during the surveillance, investigation, and analysis process.
4. Follow up to ensure corrective action was effective.

14 CFR 121.373(a) (b) requires CASS to accomplish surveillance and analysis of RAI's maintenance program from two perspectives: performance and effectiveness. RAI conducts the first two activities in the CASS (surveillance and analysis) in two different ways. The primary basis for one activity is audits, while the primary basis for the other is operational data collection and analysis. The results of these two types of surveillance and analysis feed into the third and fourth basic CASS activities (corrective action and follow-up).

Monthly CASS meetings (typically second Thursday of the month) were scheduled, and CASS findings were to be presented by the RAI Chief Inspector or

⁵ As established by 14 CFR Part 121.373, each certificate holder shall establish and maintain a system for the continuing analysis and surveillance of the performance and effectiveness of its inspection program and the program covering other maintenance, preventative maintenance, and alterations and for the correction of any deficiency in those programs, regardless of whether those programs are carried out by the certificate holder or by another person.

designee, who headed the CASS Program, at those meetings. RAI's FAA Principal inspectors were invited to attend each meeting. Data in the chief inspector's report were to be provided by CASS Board members. These data could come from several different sources as necessary, such as but not limited to:

1. Aircraft Log Sheets
2. Aircraft Inspection Reports
3. Mechanical Reliability Reports
4. Service Difficulty Reports
5. Aircraft/Engine Utilization Reports
6. Internal/External Audits
7. Pilot Reports
8. Delays and Cancellations
9. Unscheduled Engine Removals and In-Flight shutdowns.
10. Component Removal Report Repeat Discrepancy Alerts

A review of the last twelve-monthly CASS meeting reports was conducted. The reports listed issues from the fleet based on predetermined ATA thresholds set by RAI CASS program. RAI was unable to provide the process on how the ATA thresholds were set. In the last CASS Report reviewed, June 2021, RAI was tracking components with three failures in a month for the accident airplane. These issues were components associated with the #2 Fuel Quantity System, Traffic Collision Avoidance System (TCAS), #2 Thrust Reverser System and #1 Engine Fuel Heat Valve Light.

15.0 Maintenance Provider List

RAI provided the investigative team a Maintenance Provider List to review. The listing included all the approved repair stations/major vendors for the engines, airframe, and appliances. A separate list was provided to show the last times the vendors were audited. According to RAI GMM essential Maintenance Providers/Vendor audits were accomplished every 24 months. There were no discrepancies noted.

16.0 Airworthiness Directives (AD)⁶ and Service Bulletins (SB)

RAI provided AD and SB summaries for review. A review of AD and SB status lists for the airplane, powerplants and appliances was conducted. All ADs and SBs applicable to this airplane were implemented. Non-Mandatory/Reliability SBs were also tracked for the records of the airplane.

⁶ 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.

RAI Engine AD Status listings for both engines were incomplete. The RAI Engine Status listed only the repetitive AD requirements and did not list the status of all ADs effective to the Engines. Per RAI GMM 7.7.3 Item 11, RAI was to maintain a current Airworthiness Directive listing providing all applicable and non-applicable, and one time airworthiness directives on file. For additional information see Attachment 6.

17.0 Flight Data Recorder Maintenance

Maintenance Records indicate that a Flight Data Recorder Functional Test (Task Card 31-012-01-01) was accomplished on May 9, 2021, by AACO Incorporated, Seattle, WA. Per the report, there were four discrepancies noted. Rhoades Aviation Inc. was unable to locate records on how the discrepancies were rectified.

18.0 Manuals

RAI used the following manuals to maintain the airworthiness of its fleet and management of the maintenance department.

General Maintenance Manual (GMM) - The purpose of the RAI GMM was to provide information to maintenance personnel, contract maintenance, and flight personnel concerning the proper procedures, rules, and requirements to be followed by all personnel performing maintenance duties in accordance with the company approved Continuous Airworthiness Maintenance Program (CAMP).

Maintenance Training Manual (MTM) - The manual described RAI Maintenance Training Program policy, the program implementation process and the requirements regarding maintenance training records.

Aircraft Inspection Program (AIP) - The manual outlined RAI's program of scheduled maintenance and inspection for the B737 aircraft.

Minimum Equipment List (MEL) - List of equipment and instruments that may be inoperative on a specific aircraft.

Weight and Balance Control Manual (WBM) - The manual provided process and procedures for weighing RAI aircraft.

Manufacture Supplied Manuals - Aircraft/Engine Maintenance Manuals, Structural Repair Manuals, Overhaul Manuals, Wiring Manuals, Illustrated Parts Catalog, Corrosion Program Manual, Bulletins and Engine Manuals

19.0 Method of Record Keeping

As required by FAR 121.380, RAI was to retain pertinent aircraft records in paper and/or electronic media form. These records were maintained by the Records Department under the direct supervision of the Chief Inspector.

Aircraft maintenance records were kept in a secure fireproof location at RAI's primary base and any records incoming from sub-base or line locations were to be inventoried by the Aircraft Records department.

The Aircraft Records Department utilized a computerized system called "Computer Aircraft Log Manager" (CALM) to track hard time components, flight time, inspections, AD's, EA's, SB's and maintenance forecast. In addition, a Kardex File System is used to hold the overhaul/repair records, component change history, On-condition/Condition Monitored components and served as hard copy backup to CALM. Data on the CALM system was backed up every five (5) days.

According to the GMM, the maintenance records were to be retained for one year, except for the records of the last complete overhaul of each airframe, engine, appliances, and the life limited parts, the records were to be retained until the work was repeated or superseded by other work or sold.

There were no discrepancies noted in the RAI record keeping procedures.

20.0 Rhoades Aviation Inc. and Federal Aviation Administration Personnel Interviews

Interviews of RAI maintenance personnel and Federal Aviation Administration principal inspectors overseeing the certificate were conducted during the investigation. Transcripts of the interviews can be seen in the Attachment 7.

21.0 Federal Aviation Administration Letters of Investigation (LOI)

During the investigation, the NTSB was made aware of several FAA Letters of Investigation (LOI) still open against RAI prior to the accident. The open LOIs involved issues in the RAI's Operation Specifications, Aircraft Inspection Program, Manual Revisions and Process/Policies and Procedures. There had been numerous meetings/correspondence between the FAA and RAI but there had been limited movement to close some of the investigations.

22.0 N810TA Engine Shop Records

Both the No. 1 Engine (S/N 674548) and the No. 2 Engine (S/N 657227) were installed on the accident airplane on October 28, 2019, and September 20, 2019,

respectively. The last Engine Shop visits for both No. 1 (September 19, 2019) and No. 2 Engine (April 5, 2019) occurred at APECS Engine Center, Miami FL. Details of the work accomplished in the last Engine Shop visit can be seen in Attachment 8. Further Details on the engines can be found in the Powerplants Group Chairman Factual Report.

23.0 Maintenance Personnel Statements about the Accident Airplane

Investigators queried Rhoades personnel about current and past maintenance issues with the accident airplane. During a preflight inspection, the FO discovered hydraulic fluid on the right main landing gear and ground before departure, and he notified a mechanic and the captain. The mechanic and captain inspected the area, checked the hydraulic fluid reservoir, powered up the hydraulic interconnect, and decided there was no active leak. The spilled fluid and the inspection were not documented in the airplane's maintenance logbook. The captain told investigators he planned to write it up at the end of the crew's shift. The mechanic told investigators he deferred to the captain. For more information, see the Operations and Human Performance Group Factual Report.

The airplane underwent a routine daily check the day before the accident, and company records indicated that no discrepancies were identified. Mechanics who were on duty that day addressed two maintenance issues. They replaced two components on a malfunctioning left air conditioning pack and a GCU on the APU. Records for both repairs indicated "ops check good". The airplane had an open write-up for a faulty fuel quantity indication. Mechanics said they had previously swapped fuel quantity indicator gauges and changed an indicator power supply in the past, but they did not work on that issue the day before the accident. The DOM told investigators this problem could not be duplicated on the ground. No maintenance personnel interviewed by the NTSB were aware of any other open issues with the airplane.

With respect to past maintenance issues involving the airplane's engines, a lead mechanic recalled that the accident airplane had been written up for compressor stalls in flight on May 6, 2021. The captain of that flight had told him the crew was rapidly advancing the thrust levers from idle to MCT when the stalls occurred. The mechanic told investigators that he consulted the AMM and the Pratt and Whitney engine manual section 71-00-00/601 and inspected the engine. He recalled looking at the inlet for any damaged blades, bent blades, broken blades, nicks, [or] chips", checking the sense lines, and checking the PRBCs for loose fittings. He could not find anything. He told investigators that he did not arrange for a borescope inspection because he could not see any external damage. He ran the engine at 90 to 95% N2 (a value he chose based on his experience) and did not hear a "pop" sound, so he returned the airplane to service.

The same lead mechanic recalled a November 25, 2020, maintenance write-up

on the accident airplane that described "continuous" compressor stalls during an attempted takeoff. He found that a nose cowl acoustic liner had ripped off and become stuck in the air intake, preventing adequate airflow. He told investigators he replaced the nose cowl and ran the engine. It did not pop, so he returned it to service. The DOM said he was unaware of any compressor stalls occurring with the accident airplane's engines.

The DOM told investigators he was unaware of any flight crew reports involving high EGT indications from the accident airplane's engines. He said RAI had received an engine trend monitoring report for the airplane's engines two days before the accident that it indicated everything was normal. Asked whether he knew the engine's EGT margin at the time of the accident, he said no, they only received that information when the engine came out of a test cell. A previous RAI chief inspector (who stepped down from that position May 21, 2021) told investigators he recalled chronic write-ups for issues with EGT and fuel indications on the accident airplane, but he would have to refer to maintenance records to refresh his memory.

During the Maintenance/Human Performance group interview sessions, the DOM and the Assistant DOM were aware of an AMM Chapter 5 inspection concerning Engine Seizure/Engine Surge/Uncontained Failures; however, the two mechanics and two lead mechanics interviewed did not appear to be aware of this AMM Chapter 5 inspection.

24.0 Maintenance Organization and Staffing

RAI's maintenance organization was managed by the DOM. The DOM reported to the vice president of operations. The DOM had been with RAI for seven years, all of that time in the same position. He stated that the maintenance personnel he oversaw included an assistant director of maintenance (ADOM) and about 25 mechanics (some of whom held FAA A&P certificates and some of whom did not) reported to the DOM. Two mechanics held lead mechanic positions. They assigned tasks to other mechanics and monitored workflow. There were two overlapping 10-hour day shifts and there was one night shift. Each of the day shifts was staffed by three or four mechanics who held A&P certificates and two or three who did not. Most maintenance personnel worked in the daytime, but two certificated mechanics were on duty at night. The DOM hired all new mechanics. He stated that he had difficulty finding qualified applicants, despite running employment advertisements for four years. He said, however that maintenance staffing was adequate.

The ADOM supervised RAI's two lead mechanics and reported to the DOM. He began working for Transair in 2010, transitioned to RAI's certificate in 2013, and became the ADOM for RAI during the summer of 2019. The ADOM said that he and the DOM performed the maintenance control function described in the GMM, and that they received calls from the night mechanics. The ADOM said hiring mechanics was difficult, but maintenance staffing was adequate. He said RAI preferred

experienced A&P mechanics, and he added that experience working on the B737 was a plus. He interviewed prospective hires in the maintenance department.

The CI reported to the general manager. He had only recently been hired and began working for RAI two weeks before the accident. The previous CI had begun working for RAI as a mechanic in February 2019 and was appointed CI in July 2019. The previous CI said his job responsibilities included auditing inspection log sheets to ensure that required inspections were performed. He oversaw a records manager and records clerk (who were not AMTs) and a part-time NDT inspector (who was an AMT). He told investigators he did not have the staffing he thought he needed to effectively handle all of his job responsibilities. He believed he needed a CASS manager and an additional inspector. He said that in early 2021 he asked management to fill these positions, but the positions were not filled before he stepped down in May 2021 because the airline had difficulty attracting qualified applicants. He also stated that during his tenure he spent a substantial amount of time helping RAI respond to FAA letters about maintenance issues, and this had also made it difficult to attend to his core responsibilities. He said that he stepped down from the CI position because he became overwhelmed by his job responsibilities. He stated that a lead mechanic who was going to replace him as CI was unable to do so because the FAA had suspended that employee's inspection privileges because he completed a maintenance task without ensuring that a required inspection was performed and documented.

The lead mechanics worked four 10-hour day shifts per week. They were responsible for projecting future maintenance tasks, scheduling, and preparing for these tasks. They said they received a written turnover at the beginning of each shift. They reviewed airplane maintenance logbooks and MEL lists, determined priorities, discussed a plan of action with the line mechanics, and assigned individual mechanics to work specific items. One of the lead mechanics summarized his duties as making sure required maintenance tasks were completed "on time and correctly." One of the lead mechanics was asked who supervised the night mechanics and he said that they supervised themselves. He said that if they ran into trouble they would call the DOM or ADOM.

The ADOM told investigators that RAI's maintenance department did not do in-house avionics or component work. The DOM said the maintenance department did not perform borescope inspections. He stated, "If I have to have an engine borescoped, I bring somebody in for that, and Pratt and Whitney gives you a pretty good size interval for your borescopes. We tend to use the four year disk for the 6431, so that means, you know, basically we're taking these engines off every four years and we send them to the shop to have the (indiscernible) reapplied and everything else, and they [go] through a test cell at that time."

E. LIST OF ATTACHMENTS

Attachment 1 - Air Carrier Certificate

Attachment 2 - Aircraft Logbooks

Attachment 3 - Weight and Balance

Attachment 4 - Major Repairs and Major Alterations

Attachment 5 - Hard Time Components

Attachment 6 - Airworthiness Directives and Service Bulletins

Attachment 7 - Rhoades Aviation Inc. and Federal Aviation Administration Personnel
Interviews

Attachment 8 - Engine Shop Records

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