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C I V I L A E R O N A U T I C S B O A R D
ACCIDENT INVESTIGATION REPORT

Adopted: November 13, 1952 Released: November 17, 1952

CURTISS C-46, N 79096 - MIAMI INTERNATIONAL AIRPORT,
MIAMI, FLORIDA, AUGUST 4, 1952

The Accident

At approximately 2430 EST,1/ August 4, 1952, a Curtiss C-46, N 79096, registered in the name of R. Paul Weesner, Miami Springs, Florida, while on a ferry flight from Burbank, California, to Miami, Florida, crashed on the Miami International Airport. Two nonrevenue passengers and the crew of two lost their lives, and the aircraft was damaged beyond economical repair.

History of the Flight

N 79096 departed Burbank, California, at 1729, August 3, 1952, on a nonstop ferry flight to San Antonio, Texas. The aircraft, piloted by Douglas T. Bell, Chief Pilot of Resort Airlines, arrived at its destination at 2345 following an uneventful flight VFR direct. Two minor discrepancies were reported by the pilot on arrival at San Antonio; that the hydraulic system cycled every one minute and 20 seconds, and that the left engine dropped 100 RPM's on the left magneto. These discrepancies were corrected by Slick Airways' maintenance crew at San Antonio, and at 1653, August 4, the aircraft departed for Miami, Florida, nonstop on a VFR flight plan to cruise at 10,000 feet. The crew on this flight consisted of Captain Robert E. Smith and Copilot John N. Goodman. Two

1/ All times referred to herein are Eastern Standard and based on the 24-hour clock.

nonrevenue passengers boarded the plane at San Antonio for the flight to Miami. The cabin of the aircraft contained no passenger seats. This equipment was to have been installed at Miami prior to placing the aircraft in service. The cockpit was equipped to accommodate a crew of three. One safety belt had been installed to accommodate one person riding in the cabin; however, no approved type seat was provided.

The aircraft and engine log covering the flight from San Antonio to Miami, as well as a mutilated flight plan and log sheet recovered from the wreckage, indicated that the flight was made at an altitude of 10,000 feet. All entries in the flight plan and log sheet covering check points between San Antonio and Miami were completed up to and including Cross City, Florida, the last check point before reaching Miami. The last entry gave the estimated time of arrival at Miami as 2324. The estimated and actual time over the various check points along the route as reflected in the flight log indicated that the flight had progressed very nearly as estimated. On the recovered aircraft and engine log covering the San Antonio-Miami flight under heading entitled "Difficulties Noted During Flight," there was found this entry, "EXCESSIVE PLAY ON ELE." The log sheet had been signed by both the captain and the copilot.

At approximately 2317 the Miami tower operator received a broken radio transmission from which he was unable to identify either the aircraft or the nature of the call. An attempt to establish contact was unsuccessful until the following message was received: "Miami tower - NAN 79096 requesting emergency landing." Two-way contact was established and at approximately 2318 the flight was cleared to land on Runway 27L (preferential runway for calm wind) and the pilot was advised that if

this runway was not satisfactory any runway was available. In the next transmission, the pilot advised the tower that the elevator control linkage was broken and he would attempt to bring the aircraft in, using trim tabs only. His position was given as high over the west boundary of the airport at an altitude estimated by the tower operator as 3,000 feet.

Since the use of Runway 9R would permit an approach to be made over very thinly populated areas, it was suggested to the pilot that if it was satisfactory with him, Runway 9R be used. The pilot advised the tower that the change of runways was satisfactory. The area was cleared of all traffic while the aircraft made a circuit of the field, letting down slowly with a wide approach to a long final. As the aircraft neared the approach end of the runway, it appeared to tower personnel to be lined up properly. The following is quoted from testimony of the tower operator: "As the aircraft neared the approach end of the runway and at an altitude of approximately 150 feet, the nose of the aircraft appeared to come up slightly, then drop about the same degree below the horizon. This was repeated several times, each time the maneuver becoming more violent, with the last pull-up very steep. At an altitude of approximately 150 feet the aircraft appeared to fall off slightly on the left wing, the nose dropped, and the aircraft struck the ground almost vertically." The fire which followed the crash was quickly extinguished by the airport fire-fighting equipment, the crews of which had been alerted and were in standby position prior to the crash.

Investigation

Runway 9R on the Miami International Airport, on which the landing was attempted, is 8,400 feet in length. The aircraft came to rest in an

inverted position on the seeded area approximately 100 feet north of the runway and 2,400 feet past the approach end. The landing gear was found in the fully extended position and the wing flaps down approximately four degrees. No evidence was found of the aircraft making contact with the ground prior to final impact.

The radio message received from the aircraft shortly before it arrived in the vicinity of the airport, to the effect that the elevator control linkage was broken, immediately suggested an examination of that area of the fuselage containing the elevator bellcrank, elevator push-pull tube, and elevator control cables. For purposes of assembly and inspection of the elevator controls at this point, there has been provided on the bottom of the fuselage, aft of the tail wheel well, a removable plate with dimensions approximately one foot square. With the fuselage in the inverted position, this inspection plate was removed.

It was found that the forked end of the push-pull tube was disconnected from its point of attachment on the elevator bellcrank and the connecting bolt was missing, thereby rendering the elevator control completely inoperative. (See Appendix A.) It is of particular significance that a 5/16-inch bolt, washer, and nut of the same specifications as required in the assembly of this connection were found lying separate and loose in the tail of the aircraft.

It was also found that the bolt attaching the down elevator dual control cables to the bottom end of the elevator bellcrank not only was not safetied but the castellated shear nut was found with only a few threads remaining engaged. No evidence was found to indicate that either this bolt or the missing one in the elevator push-pull tube connection had

ever been properly tightened and safetied. (See Appendix A also.) Investigation failed to reveal any other evidence of failure or malfunctioning of the aircraft or its components. However, subsequent to the accident, investigation revealed additional evidence of both poor workmanship and inspection during the modification of the aircraft. Although the elevators had received no external damage as a result of the crash, it became necessary during salvage of these parts to remove a portion of the skin for internal examination. As a result, it was found that in 44 instances in the left elevator and 20 in the right, the rivets securing the leading edge counterweight reinforcement doublers to the skin and internal structure were improperly driven. This was evidenced by the fact that in many of these instances scarcely any head had been formed on the driven end of the rivet, and in the remaining cases the head on the driven end had not been developed sufficiently to properly secure the surfaces involved.

Under a written agreement entered into June 16, 1952, between Mr. W. R. Boyd, representing the owner of the aircraft and Mr. K. T. MacKinzie, representing Slick Airways, Inc., the latter, for a consideration, was to complete all work required for certification of the aircraft for passenger operations, the aircraft having been previously operating in Nicaragua under Nicaraguan registration. The work under this agreement was to include, among other things, compliance with all applicable Airworthiness Directives through 52-10-1, modification of the tail (this included the installation of a new type bellcrank and push-pull tube which involved removal of the old type and installation of the new type), modification of the fuel system, painting the aircraft exterior, etc., but was not to include modification of radio installation, instrument panel or installation of passenger seats.

Slick Airways, Inc., holds approved repair station Certificate No. 4030, with ratings for instruments and metal propellers, but holds no rating for aircraft. It also holds Type Certificate No. 772, which contains the CAA approved technical data detailing the specifications for the conversion of Curtiss C-46A, D, E, and F military models to aircraft eligible for certification in normal categories.

The Civil Aeronautics Administration "Repair and Alteration Form," ACA-337, covering the work on aircraft N 79096 was certified by the supervising mechanic July 30, 1952, and on August 1, 1952, a certificate of airworthiness was issued on behalf of the Civil Aeronautics Administration by Mr. Sherwood, a Slick employee, D.A.M.I. (Designated Aircraft Maintenance Inspector) No. 6335.2/ All work on the aircraft was performed and the airworthiness certificate issued at the Slick Airways' Burbank, California, base.

The Miami weather, which at 2346 was scattered clouds at 10,000 and 25,000 feet, visibility 10 miles, and wind north 2, is not considered a contributing factor in this accident. The fact that there was practically a full moon and 10 miles visibility at the time of the accident made the landing approach and subsequent movements of the aircraft prior to the crash clearly visible to tower personnel and numerous witnesses on the ground.

2/ A Designated Aircraft Maintenance Inspector is an individual whom the Civil Aeronautics Administration has selected as being qualified and has clothed with certain authority to be exercised on its behalf.

The crew was properly certificated and qualified for the flight involved.

The aircraft, on departing San Antonio, Texas, without cabin seats or cabin load, was several thousand pounds below the allowable gross weight. No ballast was carried and none required to bring or maintain the center of gravity within allowable limits throughout the flight.

Analysis

No discussion seems necessary with respect to the aircraft's structure, powerplants and accessories, or to the rudder and ailerons and their related systems, since no evidence was found to indicate failure or malfunctioning of these items prior to impact. This analysis, therefore, will be concerned primarily with the elevators and the elevator control system.

Weather reports over the route and the flight log recovered from the wreckage indicate that the flight could be, and was made, VFR at 10,000 feet as far as Cross City, Florida, the last check point. From this point the flight continued VFR to Miami. The flight log found shows six intermediate check points along the route on which the ETA and ATA had all been entered, as well as the altitude, which in each instance was 10,000 feet. No entry appeared under "Remarks" concerning the condition of the elevator control system. For this reason, and the fact that eight communication stations en route and four stations off route reported no radio contacts with the flight, it is indicated that the separation of the elevator control system probably occurred after passing Cross City, the last check before Miami. The entry in the aircraft and engine log indicating excessive play in the elevator system does not show the time or the position of the flight when the entry was made. The fact that this entry, which was

hand printed, ended with the letters "ELE" may have been the writer's way of abbreviating the word "elevator" or it might also indicate that something unusual occurred at this point which interrupted completion of the entry.

In any event, when two-way radio communication was established with the flight at 2318, the Miami controller stated he was advised that the elevator control linkage was broken and longitudinal control was being maintained by the use of trim tabs only.

To all appearances, the aircraft was under control at the time it was first observed west of the airport at an estimated altitude of 3,000 feet, and later during the left descending turn around the field and the subsequent long, low final approach to Runway 9R. It is possible in this instance that elevator actuation by trim tab movement was insufficient to handle the aircraft at speeds encountered in the type of landing attempted. Recalling the fact that the wing flaps were found extended approximately four degrees suggests the possibility that the crew may have started the flaps down or were retracting them just prior to the oscillations of the aircraft which ended in the crash. There is also the possibility that the flap position may have been the result of impact forces. Any extension of the flaps at a critical period in the approach could conceivably disturb the stabilized condition to the extent that the control effected by trim tab movement would be insufficient. The bursts of power, reported by eyewitnesses to have occurred with each oscillation, undoubtedly were the result of an attempt by the pilot to maintain control.

Concerning the separation of the elevator push-pull tube from the bellcrank, the question naturally arises - just how could a properly

assembled control system become disconnected during flight. The answer is: It normally could not if correctly assembled and properly secured. Obviously, there must have been a connecting bolt in the elevator bellcrank assembly during the flight from Burbank, California, to a point somewhat west of the Miami Airport, where the entry concerning excessive play in the elevator control linkage was entered in the aircraft and engine log.

Following arrival at San Antonio, the aircraft was turned over to the Slick Airways maintenance crew where the work, as noted in the aircraft and engine maintenance log was accomplished. No work on the control system was indicated and none was performed. The inspection plate on the bottom of the fuselage, through which the down elevator control cables, elevator push-pull tube and elevator bellcrank are reached, was not removed. Furthermore, the aircraft, throughout its stopover period at San Antonio, was in the hands of Slick Airways maintenance personnel during which time no unauthorized person was permitted aboard the aircraft nor was any observed in the vicinity thereof. It would appear, therefore, that the conditions which existed at the time of the crash had their origin at the Slick Burbank Maintenance Base where all overhaul and modification work was performed.

There is no reason to doubt that the 5/16-inch bolt, nut, and washer found loose in the tail of the aircraft following the accident were the ones originally installed in the push-pull tube to bellcrank connection. Furthermore, no evidence was found to indicate that they had been safetied following assembly. This determination is further supported by the fact that the bolt and nut attaching the down elevator cable to the bottom end of the bellcrank also was not safetied when assembled, as will be noted by referring to Appendix A.

It is clear from the known facts that poor workmanship and inspection in connection with the overhaul and modification of this aircraft were the major contributing factors in the accident. The unsecured bolt connecting the elevator cables and the missing bolt from the push-pull tube, plus the 64 improperly driven or headed rivets found in the newly-fabricated elevators are ample evidence of such.

Concerning the overhaul, modification, and certification of N 79096, the aircraft involved, the Civil Air Regulations provide that major alterations or modifications to any aircraft, or any of its components, may be performed either by a certificated mechanic or by a certificated repair station. A certificated repair station, holding the appropriate ratings, may accomplish such alterations or modifications without detailed inspections or approvals by CAA of the actual workmanship, materials, or conformity to approved specifications. The issuance of an approved repair station certificate is predicated upon the acceptance of these responsibilities by the repair station. However, if similar alterations and modifications are accomplished by a certificated mechanic, such workmanship, materials, and conformance to previously approved specifications would be subject to detailed inspection and approval by the Civil Aeronautics Administration or its designated representatives.

Since the approved repair station certificate held by Slick Airways did not contain an aircraft rating, a major portion of the necessary modifications made to aircraft N 79096 was accomplished under the authority and responsibility of a certificated mechanic. Work so accomplished was, therefore, subject to inspection and approval by the Civil Aeronautics Administration or its designated representatives.

The Civil Air Regulations further provide that the Civil Aeronautics Administration shall issue an airworthiness certificate for an aircraft which, by inspection, has been found to conform to the appropriate Type Certificate and to be in an airworthy condition. In this instance, the inspection for airworthiness and the issuance of the airworthiness certificate was performed by D.A.M.I. No. 6335, as the authorized representative of the Civil Aeronautics Administration.

An examination was made of the overhaul, modification, and inspection procedures established by Slick Airways at its Burbank base. In theory, these procedures should have functioned satisfactorily during such overhaul and modification as was being performed in this instance. However, in practice they failed, as is evidenced by the known facts surrounding this accident.

The weakness apparently lies in the failure to provide proper tie-in procedures between workmen on different shifts on a particular job and between inspectors working different shifts on the same job. It is in this area, apparently, that the breakdown occurred, thus resulting in this aircraft being released and erroneously certificated as airworthy.

Circumstances surrounding this accident clearly indicated the necessity for strengthening the inspection procedure then in effect. To this end, on August 19, 1952, the Chief Inspector for Slick Airways issued the following memorandum to all inspectors and maintenance superintendents:

> "Effective immediately, on all future modifications and overhauls, the routine Inspection Forms shall not be signed off until all work has been completed by the Maintenance Department. At that time, all Inspection covers shall be opened and the aircraft shall be turned over to Inspection

for a period of four hours. This will eliminate any possible chance of areas being closed or reworked without Inspection's knowledge. As each area is completed, the Inspector will seal the Inspection cover with a decal and stamp same."

The Board has been advised that an accelerated inspection by the Civil Aeronautics Administration Air Carrier Safety Branch, Sixth Region, of the maintenance and flight operations of Slick Airways, Inc., was already under way prior to the occurrence of this accident. The Civil Aeronautics Administration also held several meetings with Slick Airways for the purpose of discussing results of this inspection survey, and is presently in the process of preparing a report concerning the operational and maintenance deficiencies found. The Board was further advised that these deficiencies, supported by specific examples, will be subject to such corrective action as is necessary.

Findings

On the basis of all available evidence, the Board finds that:

1. The aircraft and the crew were properly certificated for the flight undertaken.

2. The flight from San Antonio, Texas, to Cross City, Florida, was made VFR at 10,000 feet altitude, and continued VFR to Miami.

3. Weather was not considered a factor in this accident.

4. Total flight time on the aircraft since overhaul and modification was approximately 13 hours 27 minutes.

5. At 2318 the flight advised the Miami tower that the elevator control linkage was broken and elevators functioning by use of trim tabs only.

6. The aircraft became uncontrollable and crashed during an attempted landing on Runway 9R.

7. The push-pull tube was found disconnected from its point of attachment on the elevator bellcrank.

Probable Cause

The Board finds that the probable cause of this accident was failure of the elevator control system in flight, resulting in loss of control of the aircraft during landing. The failure of the elevator control system was the result of poor workmanship and inadequate inspection during overhaul and modification.

BY THE CIVIL AERONAUTICS BOARD:

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board received notification of the accident approximately midnight August 4, 1952, through the Miami Communications Station, Civil Aeronautics Administration. An investigation was immediately initiated in accordance with the provisions of Section 702(a)(2) of the Civil Aeronautics Act of 1938, as amended. Public hearings were held in connection with the investigation of this accident on August 19, 1952, at Miami, Florida, and August 28, 1952, at Burbank, California.

The Aircraft

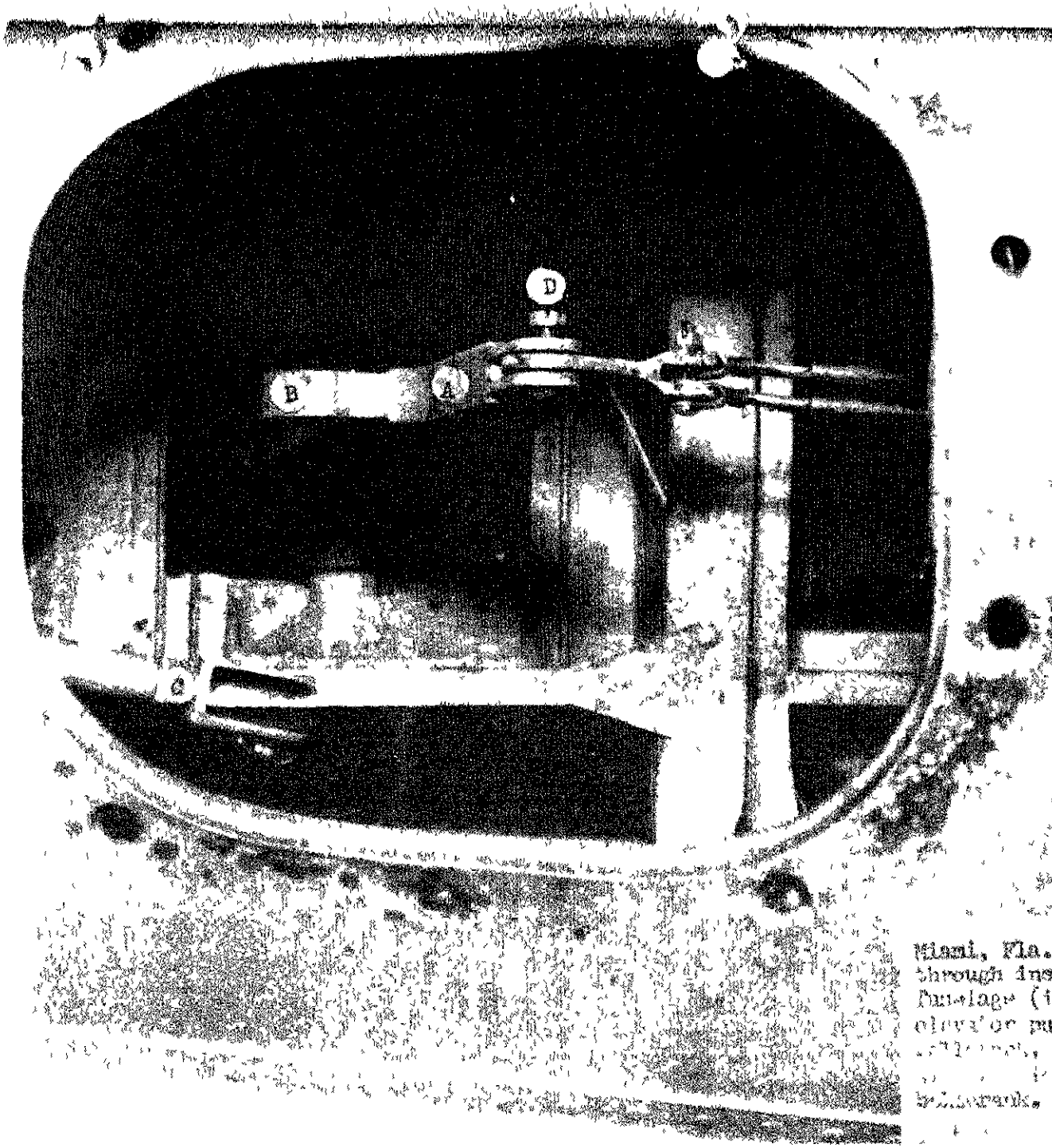
The aircraft, a C-46A, Serial No. 27038, N 79096, was equipped with two Pratt & Whitney R-2800-75 engines, with Curtiss electrically-operated full feathering propellers. The aircraft, after having been operated in Nicaragua, Central America, under lease to the Air Express Agency and under Nicaraguan registry, was returned to the United States; and on August 1, 1952, after overhaul and modification, a certificate of airworthiness was issued.

Flight Personnel

Captain Robert Edward Smith held air transport rating No. 411589, with a total accumulated time of 5,823 hours, of which 1,412 were at night. He had approximately 1,623 hours' time as pilot in the type of aircraft involved. Captain Smith received his training in the United States Air Force, beginning in 1942, remaining on active duty as a commissioned officer until January 1946. In August 1946 he was employed as pilot by the Nationwide Air Transport Service, Inc., and later served as vice president-general manager of this intrastate scheduled carrier. On April 1, 1951, Mr. Smith joined All American Airways, Inc., as vice

president-general manager and was subsequently elected president of this corporation in November 1951, which position he held at the time of the accident.

Copilot John Norman Goodman had been employed by Resort Airlines, Inc., since May 15, 1952, as first officer. He held a commercial pilot certificate and had qualified as first officer with Resort Airlines by completing a 54-hour period of training in their training school. From May 15 to July 21, 1952, he was on official leave from Resort Airlines, during which time several hundred hours' flight time were logged as copilot in Lockheed Lodestars, covering all phases of VFR and instrument flight conditions over practically all portions of the United States. In addition, he received one hour 30 minutes of flight time in a C-46, of which 30 minutes was consumed practicing night take-offs and landings. The final phase of his training consisted of six hours of company-operated Link trainer, covering different types of instrument procedures authorized by the Resort Airlines, Inc., by whom he was still employed. During this time he had satisfactorily completed an instrument course and a CAA flight check at the Airline Training School, Homestead, Florida.



B - Attach point of elevator push-pull tube to bellcrank.

C - Forked end of elevator push-pull tube.

D - Bolt connecting down elevator cable to bellcrank.

Appendix A

Miami, Fla., 8/4/42, C-46, #79096 - View through inspection opening bottom of fuselage (inverted), showing disconnected elevator push-pull tube, main elevator [illegible], to lower bell[illegible] attach point bellcrank.