Log 2293

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: January 28, 1992

In reply refer to: A-92-1 through -4

Honorable Barry L. Harris
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On September 20, 1990, a Boeing 707-321, N320MJ, operated by Omega Air, Inc., under the provisions of 14 Code of Federal Regulations (CFR) 91 as a ferry flight, crashed on takeoff from Pinal Airpark, Marana, Arizona. Evidence found at the scene indicated the airplane was airborne less than 6 seconds before its right wing struck the ground and the airplane crashed. The captain of the three-man crew sustained fatal injuries. The first officer and flight engineer received serious injuries, and the airplane was destroyed.

The Safety Board's investigation did not reveal fundamental anomalies in the airplane's structure or powerplants. Investigators determined that all four engines probably operated within normal range during the attempted takeoff.

The investigation identified a number of deficiencies in flight crew planning and performance and Federal Aviation Administration (FAA) oversight of the operations that contributed to the cause of this accident. Evidence found at the accident site indicated that the rudder trim was misset to approximately 79% of full deflection. Subsequent simulator flight tests showed that the misset rudder trim combined with inadequate flight attitude reference instrumentation in the cockpit may have compromised the flying pilot's ability to properly control the airplane after lift off.

The Safety Boards's investigation determined that the accident airplane was one of a number of B-707 and B-720 airplanes purchased by the United States Air Force (USAF) for their engines and engine pylons as part of a USAF and manufacturer "donor program" contract. That contract, with Boeing Military Company of Wichita, provided for the delivery of Pratt & Whitney JT3D engines on Boeing airframes from commercial sources, both foreign and domestic. Omega Air, Inc., and other operators and brokers had ferried a number of these airplanes to Davis Monthan Air Force Base (AFB), Arizona in recent years. It was determined that other B-707 airplanes also had arrived at Davis Monthan AFB in a stripped condition. Interviews with personnel at Davis Monthan AFB indicated that previous airplanes arrived "without fuel quantity gauges." These airplanes had carried Special Airworthiness Permits issued by Designated Airworthiness Representatives (DARs.) The Safety Board learned that third-party parts brokers had previously contracted to take

avionics and instrumentation from these airplanes prior to the last leg of ferry flights. These airplanes had flown at least one leg of their final flights over populated areas with various amounts of essential cockpit instrumentation removed.

Approximately 50 indicators and annunciators had been removed from the pilots' instrument panels of the accident airplane prior to the attempted flight. As a result, the pilots' instrument panels contained only two airspeed indicators, an altimeter and a standby attitude indicator. Engine Exhaust Pressure Ratio (EPR) gauges were attached to the glare shield by masking tape. There was no standby magnetic compass ("wet compass") or "mechanical cockpit checklist"[1] on board. A checklist card, listing start, taxi and shutdown procedures was found at the accident site. This checklist directed flight crewmembers to a mechanical checklist for before-takeoff and landing procedures. Investigators found an airplane flight manual (AFM) with these before-takeoff items listed, however that manual was secured in personal luggage when found at the crash site. Interviews of surviving flight crewmembers revealed that the before-takeoff checklist was "probably done from memory." In addition to the misset rudder, an item possibly overlooked in the before-takeoff sequence was the fastening of the captain's shoulder harness.

No records were found to indicate the airplane's takeoff gross weight. However, calculations made after the accident show that the amount of equipment removed, the minimum fuel load and the absence of passengers or cargo resulted in a takeoff weight approximately 35,000 pounds below the minimum weight for which takeoff performance charts were provided. Safety Board and manufacturer's performance engineers replicated the estimated weight and balance and cockpit instrument displays present in the accident airplane for tests in an engineering flight simulator. The rudder trim was set to correspond to that which was found in the accident airplane. Boeing Company and Safety Board pilots "flew" approximately 60 takeoff attempts. The pilots were able to maintain directional control with nose wheel steering and nominal rudder forces during the takeoff roll. However, as the airplane was rotated to the normal takeoff pitch-up attitude, the visual horizon was lost from the pilot's view. In many cases, the rudder deflection resulted in a right roll which was not perceived by the pilot and wing-tip "strike" occurred within a few seconds of "liftoff." The pilots generally agreed that, in the absence of external visual reference, their training and experience prompted them to return to a practiced scan pattern of the primary attitude instruments.[2] Without these instruments, they found that information was insufficient to maintain proper airplane control. Both Boeing and Safety Board pilots reported that they became disoriented in the initial rotation phase of the takeoffs as they attempted to refer to missing indicators. The location of the battery-bus

[1] A mechanical checklist is typically a lighted box-shaped annunciator, listing the procedural items, each with a toggle or similar switch to indicate completion.

[2] Horizontal Situation Indicator and Attitude Directional Indicator, as primary attitude instrument references.

Standby Gyro Horizon, at the lower left of the center engine instrument cluster, was not included in the normal scan pattern and thus was not used by the simulator pilots to reestablish a wings level attitude.

The Safety Board reviewed the qualifications of the DAR who had inspected the accident airplane and found that he had been employed by the FAA for more than 20 years in various positions dealing with original airworthiness certification. He was not required to, and did not, possess an FAA Aircraft and Powerplant Mechanic Certificate. He stated that he had no work experience in large airplane maintenance or in returning airplanes to service following major maintenance.

The investigation determined that the FAA DAR inspected the airplane after the removal of instrumentation and issued a Special Airworthiness Permit for the ferry flight, without consideration of the adequacy of the remaining cockpit flight instrumentation and equipment. In fact, when questioned after the accident, the DAR could not recall what instrumentation was installed in the airplane at the time he inspected it. Safety Board investigators were also unable to ascertain from the DAR what flight instruments or equipment he considered essential for ferrying airplanes of this type. The DAR stated that he was the final judge and followed his own guidelines, since none are provided in regulations or other directives. The Safety Board investigation revealed no specific guidance to DARs in the issuance of Special Flight Permits under FAA Order 8000.62.[3] Furthermore, the DAR apparently accepted the airplane's weight and balance as adequate without questioning the availability or importance of accurate records or performance data.

The Safety Board is also concerned that the DAR had not reviewed the maintenance records or verified the mechanics' credentials prior to issuing the Special Airworthiness Permit for the ferry flight. The investigation also revealed that extensive maintenance had been conducted by contracted individuals who held no FAA mechanics' certificates.

The Safety Board believes that Advisory Circular 183-33 and FAA Order 8000.62, which define DAR qualification criteria and selection procedures, are so broadly interpreted that persons who do not meet the specialized experience and certificate requirements for issuing Recurrent Airworthiness Certificates and Special Flight Permits following maintenance may be appointed and authorized to perform maintenance functions. Paragraph 24.a.(1)(C) provides that persons with 5 years experience as a Designated Manufacturing Inspection Representative (DMIR) or an FAA Manufacturing Inspector may be authorized to issue Recurrent Airworthiness Certificates. The Safety Board does not believe that such experience is qualifying for performing that DAR function, a situation that is evident from this investigation.

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[3] FAA Order 8000.62 "Designated Airworthiness Representatives Qualification Criteria, Selection, and Appointment Procedures," AWS-200, 10/1/85

Safety Board investigators found that, although the specific operation required a DAR familiar with maintenance operations and return-to-service requirements, this DAR did not possess the background experience to assess adequately the airplane's condition. Furthermore, when interviewed, the DAR did not appear to recognize the critical importance of the maintenance actions performed on the airplane.

The Safety Board also believes that this DAR's appointment was not in accordance with FAA Order 8000.57, which provides for the appointment of former FAA Manufacturing or Maintenance Inspectors as DARs. This order specifically states that, in part, "appointments for former FAA Inspectors must necessarily be limited to similar functions, on products of similar type and complexity, to those satisfactorily performed while in the employ of the FAA." As far as Safety Board investigators could determine, there were no limitations on the functions that this DAR was authorized to perform.

Additionally, it was determined that this DAR often conducted his activity outside the geographical area of his managing office without requesting and receiving, in writing, permission to do so, as required by FAA Order 8000.63. The Safety Board believes that this unauthorized activity seriously restricted the ability of the managing office to monitor and evaluate the DAR's activity, as required by the same Order.

As a result of interviews with the DAR, Safety Board investigators learned that he did not consider cockpit instrumentation aboard the airplane to be an important factor in the issuance of a Special Airworthiness Permit.

The Safety Board was unable to find any reference to minimum cockpit instrumentation requirements in Federal Aviation Regulations for the issuance of Special Airworthiness Permits. The Safety Board is concerned that without special training in flight operations, performance and instrumentation of multiengined turbojet airplanes, DARs and other FAA inspectors may not be capable of adequately assessing the airworthiness of such airplanes. The Safety Board believes that such guidance is critically needed when issuing Special Airworthiness Permits for large multiengine turbojet airplanes. The Safety Board believes that the FAA should correct this lack of guidance and require DARs and other inspectors to consider attitude reference instrumentation to be a critical airworthiness component and, at a minimum, to provide an attitude indicator which can be included in the scan of the flying pilot irrespective of the weather conditions anticipated during flight.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Conduct an interdisciplinary study, which includes flight operations and human performance specialists, to develop minimum instrumentation requirements for the issuance of Special Airworthiness Permits for ferry flight of large turbojet airplanes. Consideration should be given to the unique requirements of airplanes equipped with electronic flight information systems (EFIS), flight

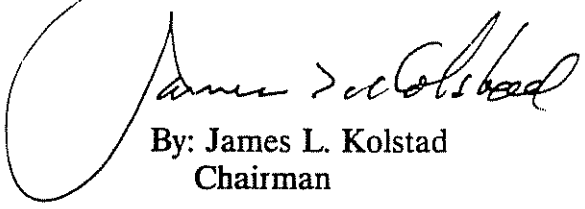
management computers and "fly-by-wire" systems. (Class II, Priority Action) (A-92-1)

Promulgate a standard of minimum acceptable cockpit instrumentation for large turbojet airplane ferry permits and disseminate this guidance to Principal Operations and Maintenance Inspectors for use in their issuance of Special Airworthiness Permits and in their oversight of activities of Designated Airworthiness Representatives. (Class II, Priority Action) (A-92-2)

Review the training, oversight, and supervision of Designated Airworthiness Representatives (DARs) by all the managing offices to ensure that DARs perform only functions for which they are qualified by training and experience; that appropriate limitations are specified on DAR appointments; and that the managing offices are monitoring and evaluating DAR activity in accordance with FAA Order 8000.63. (Class II, Priority Action) (A-92-3)

Revise FAA Order 8000.62 and Advisory Circular 183-33A to eliminate the practice of allowing experience gained in one area of the certification process to be considered as qualification for performing certification functions that clearly require experience in another certification or maintenance process. (Class II, Priority Action) (A-92-4)

Chairman KOLSTAD, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT, concurred in these recommendations.



By: James L. Kolstad
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

DCA90MA055

Brief of Accident

File No. - 2144 | 09/20/90 | MARANA, AZ | A/C Reg. No. N320MJ | Time (Lcl) - 0707 MST

----Basic Information----

Type Operating Certificate - NONE (GENERAL AVIATION)

Type of Operation - FERRY
Flight Conducted Under - 14 CFR 91
Accident Occurred During - TAKEOFF

Aircraft Damage
DESTROYED
Fire
ON GROUND

	Injuries			
	Fatal	Serious	Minor	None
Crew	1	2	0	0
Pass	0	0	0	0

----Aircraft Information----

Make/Model - BOEING 707-321B
Landing Gear - TRICYCLE--RETRACTABLE
Max Gross Wt - 320000
No. of Seats - 3

Eng Make/Model - P&W JT3D-3
Number Engines - 4
Engine Type - TURBOFAN
Rated Power - 18000 Lbs.

ELT Installed/Activated - NO/UNK/NA
Stall Warning System - YES

----Environment/Operations Information----

Weather Data
Wx Briefing - FSS
Method - TELEPHONE
Completeness - WEATHER NOT PERTINENT
Basic Weather - VMC
Wind Dir/Speed - CALM
Visibility - 40.00 SM
Lowest Sky/Clouds - 7000 FT SCATTERED
Lowest Ceiling - NONE
Obstructions to Vision - NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
TUCSON, AZ

ATC/Airspace
Type of Flight Plan - VFR
Type of Clearance - NONE
Type Apch/Lndg - NONE

Airport Proximity
ON AIRPORT

Airport Data
PINAL AIRPARK
Runway Ident - 12
Runway Lth/Wid - 6280/150
Runway Surface - ASPHALT
Runway Status - DRY

----Personnel Information----

Pilot-In-Command
Certificate(s)/Rating(s)
AIRLINE TRANSPORT
SE LAND, ME LAND

Instrument Rating(s) - AIRPLANE

Age - 60
Biennial Flight Review
Current - YES
Months Since - 15
Aircraft Type - 707

Medical Certificate - NON-VALID MEDICAL

Flight Time (Hours)

Total	13192	Last 24 Hrs	0
Make/Model	4000	Last 30 Days	14
Instrument	UNK/NR	Last 90 Days	14
Multiengine	12102		

----Narrative----

WITNESSES RPRTD 1ST ATMT TO TKOF WAS ABORTED AFTER ACFT SWERVED LEFT AND RGT. ON 2ND TRY, ACFT LIFTED OFF ABT HALFWAY DWN RWY. AFTER LIFTOFF, IT ROLLED RGT, RGT WING HIT GND AND ACFT CRASHED. INV REVEALED RUDDER TRIM WAS 7.9 TO 8.3 UNITS (79% TO 83%) NOSE RGT. SIMULATOR TESTS WITH THAT SETTING RESULTED IN CONSISTENT RGT WING COLLISIONS WITH GND AFTER LIFT OFF. CREW'S CHECKLIST REFERRED TO MECH CHECKLIST FOR CRITICAL ITEMS TO CHECK BFR TKOF. MECH CHECKLIST AND 50 OF 54 FLT INST HAD BEEN REMOVED FM ACFT, LEAVING 2 AIRSPEED INDCRS, ALTIMETER AND STBY GYRO HORIZON. IN 60 SIMULATED TKOFS IN THIS CONFIGURATION, THERE WAS EVIDENCE OF INSUFFICIENT ATTITUDINAL REF TO RECOGNIZE ROLLING OF ACFT BFR SUFFICIENT ALT WAS ATTAINED. FAA'S DESIGNATED AIRWORTHINESS REP (DAR) HAD INSPD ACFT 3 DAYS BFR AND ISSUED FERRY PERMIT. HE LACKED FAA MECH CERT AND EXPERIENCE WITH LARGE ACFT. FAA ORDER 8000.62 AND AC 183.33 LACKED SPEC GUIDANCE FOR SELECTION, TRNG AND OVERSIGHT OF DAR ACTIVITY. ALSO, LACK OF GUIDANCE CONCERNING MIN EQUIP LIST. PLT NOT CURRENT OR MED QUALIFIED TO FLY ACFT.

File No. - 2144 | 09/20/90 | MARANA, AZ | A/C Reg. No. N320MJ | Time (Lcl) - 0707 MST

Occurrence #1 - LOSS OF CONTROL - IN FLIGHT
Phase of Operation - TAKEOFF - INITIAL CLIMB
Finding(s)
1. PREFLIGHT PLANNING/PREPARATION - INADEQUATE - PILOT IN COMMAND
2. OPERATION WITH KNOWN DEFICIENCIES IN EQUIPMENT - PERFORMED - PILOT IN COMMAND
3. CHECKLIST - NOT USED - PILOT IN COMMAND
4. LACK OF RECENT EXPERIENCE IN TYPE OF AIRCRAFT - PILOT IN COMMAND
5. LACK OF RECENT EXPERIENCE IN TYPE OPERATION - PILOT IN COMMAND
6. INADEQUATE SURVEILLANCE OF OPERATION - FAA(ORGANIZATION)
7. INSUFFICIENT STANDARDS/REQUIREMENTS - FAA(ORGANIZATION)

Occurrence #2 - IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation - TAKEOFF - INITIAL CLIMB
Finding(s)
8. TERRAIN CONDITION - GROUND

----Probable Cause----

The National Transportation Safety Board determines that the probable cause(s) of this accident was: IMPROPER PREFLIGHT PLANNING/PREPARATION BY THE PILOT, AND HIS FAILURE TO USE A CHECKLIST. FACTORS RELATED TO THE ACCIDENT WERE: THE FAA'S INADEQUATE SURVEILLANCE OF THE OPERATION, THE FAA'S INSUFFICIENT STANDARDS/REQUIREMENTS, THE PILOT'S OPERATION OF THE AIRCRAFT WITH KNOWN DEFICIENCES, AND HIS LACK OF RECENT EXPERIENCE IN THE TYPE OF AIRCRAFT.