Case study american air flight

Business

Case Study Analysis Activity Title: Name: Date: Cause(s) of Accident The probable cause to the crash of American Airlines Flight 191 is the asymmetrical stall and the ensuing roll of the aircraft due to the UN-commanded retraction of the left wing outboard leading edge slats and the loss of stall warning and slat disagreement indication systems, resulting from maintenance-induced damage leading to the separation of the number one engine and pylon assembly at a critical point during take-off.

Contributing to the cause of the accident were the vulnerability of the design of the Holon attach points to maintenance damage; the vulnerability of the design of the leading edge slat system to the damage which produced asymmetry; deficiencies In FAA surveillance and reporting systems which failed to detect and prevent the use of improper maintenance procedures; deficiencies in the practices and communications among the operators, the manufacturer, and the FAA which failed to determine and disseminate the particulars regarding previous maintenance damage incidents; and the intolerance of prescribed operational procedures to this unique emergency. “

Through numerous simulations of the accident, the ANTS determined that it would have been possible for a flight crew to recover the airplane in a situation like that encountered by the crew of Flight 191, IF the crew had been fully aware of the situation and IF the crew had followed a very specific course of corrective action. In the case of Flight 191, no one had ever anticipated such a complex series of failures and procedures to handle the situation had never been developed. Also, because of the failure of the stall warning and slat disagreement Indicators, It Is likely that the ere was never fully aware of the situation, at least until it was too late to save the airplane.

The ANTS strongly disagreed with McDonnell Douglas' assessment that the probability of engine detachment and subsequent system failure was extremely low for the DC-10. Finally, in the opinion of the ANTS, the crew of Flight 191 flew the aircraft in accordance with prescribed emergency procedures. Structural and Mechanical Factors The pylon is attached to left wing using Spherical ball Joints in three a forward bulkhead which is attached to structure in the wing forward of the front spar. Another spherical Joint behind the forward bulkhead transmits thrust loads from pylon structure Into a thrust link which In turn Is connected through another spherical Joint to structure on the lower surface of the wing.

The third attachment point is a spherical joint in the pylon aft bulkhead which attaches to a clevis mounted on ten unawareness AT ten wing.

I née pylons Toward Dullness Ana portions flange from the pylon oft bulkhead either remained with the separated No. 1 pylon or were scattered along the runway. (See figures 2 and 3.) The No. 1 pylon's aft clevis attach assembly and portions of the pylon aft bulkhead, wing thrust angle assembly and thrust link, and pylon forward bulkhead attach assembly remained with the wing bolts which held the bulkhead upper plates were missing.

The upper 12 inches of the pylon forward bulkhead was bent forward about and most of the forward plate were bent forward an additional 10′ to 15′.

The aft plate was broken below the thrust fitting connection, and a large piece of the upper left corner was missing. The design of the leading edge slat system did not include positive mechanical cocking devices to prevent movement of the slats by external loads following a failure of the primary

controls. Charismatically leading edge slat condition. At the time of DC-II certification, the structural separation of an engine pylon was not considered.

Thus, multiple failures of other systems resulting from this single event were not considered. Contributing Factors As stated above if the flight crew was trained in these types of failures, the accident may have never happened.

Again, if the flight recorders did not fail the warning old have activated and the pilots could have responded, before it was too late. The aircraft was equipped with a Fairchild Model A-100 C. V. serial No 2935.

However upon investigation the recordings were incomplete because of loss of electrical power during aircraft rotation. Also damaged was the flight data recorder (DOFF) serial number 2298. Even though the unit suffered structural damage, with no evidence of fire or heat; the recorders tape was broken and spliced back together in two different places. IF recorded 50 seconds of data showing that the stabilizer trim setting for takeoff was 6. * nose-up and corrections for altitude and indicated airspeed were corrected.

After the investigation the Investigators final thoughts were American Airlines along with all DC-SIS’S of the same models made note of pylon attachment points during maintenance, and of the leading edge slat system which produced asymmetry.

Meaning, also known as asymmetric blade effect and asymmetric disc effect, is an aerodynamic phenomenon experienced by a moving propeller,[I] that is responsible for asymmetrical relocation of the propeller’s center of thrust

when aircraft is at a high angle of attack. There were deficiencies in the Fag’s surveillance and reporting systems in failure to detect improper maintenance procedures deficiencies in communication between the aircraft operators, McDonnell Douglas, and the FAA in failing to provide details of previous maintenance damage.

Finally that is mentioned above, a total crew failure and knowledge on how to cope with these particular set of unique emergencies and situations. The ANTS determined that the damage to the left wing engine pylon had occurred ruling an earlier engine change at ten American Alertness alert maintenance Tactical n Tulsa, Oklahoma on March 29 and 30, 1979. The evidence came from the flange, a critical part of the pylon assembly.

Investigation Board Findings The engine and pylon assembly separated either at or immediately after lift-off, the aft end of the pylon assembly began to separate in the forward flange of the aft bulkhead and the flight crew was committed to take-off.

The structural separation of the pylon was created by a complete failure of the forward flange of the aft bulkhead after its residual strength had been critically reduced by the fracture and subsequent service life. The overload fracture and fatigue on the pylon aft bulkheads upper flange were the only pre-existing damage on the bulkhead. The length of the overload fracture and fatigue cracking was about 13 inches. The fracture was caused by an upward movement of the aft end of the pylon which brought the upper flange and its fasteners into contact with the wing clevis.

The pylon to wing attach hardware was properly installed as all attachments. All electrical power to the number one aircraft generator bus was lost after the pylon separated.

The captain’s flight director instrument, the stall warning system, and the Gate disagreement warning light systems were rendered inoperative. Power to these buses was never restored. The No.

1 hydraulic system was lost when the pylon separated capability throughout the flight. Except for spoiler panels No. 2 Hydraulic systems No. 2 and No. 3 operated at their lull and No. 4 on each wing, all flight controls were operating.

The hydraulic lines and follow-up cables of the drive actuator for the left wings severed box separation of the pylon ‘ and the left wings right slats retracted during climb out. The-retraction of the slats caused an asymmetric stall.

During the investigation, the development of the DC-II maintenance program and the inspection requirements for the wing pylons. The program guidelines were embodied in the “ Airline manufacturer Maintenance Program Planning Document, The document was formulated by a working group composed of representatives of user air carriers, McDonnell-Douglas, and one or more FAA observers. The document was then submitted to the FAA’ Maintenance Review Board where FAA observers and engineers met to evaluate the proposals. The review board issued a report which prescribed the minimum work programs of each operator by TTS FAA principal maintenance inspector

to maintenance program for DC-II operators end required a : view of tilt: specific assure conformance with the program.

Recommendations As a result of this accident, the National Transportation Safety Board Issue immediately an emergency Airworthiness Directive 10 inspect all pylon attach points on all DC-II aircraft by approved inspection methods. (Class 1 Urgent Action) (A 13 41) Issue a telegraphic Alertness's Delectate to require a pylon assembly NAS been removed and reinstalled for damage to immediate inspection of all DC-10 aircraft in which an engine the wing-mounted pylon aft bulkhead, including its forward flange and the attaching spar web and fasteners. Require removal of any sealant which may hide a crack in the flange area and employ eddy-current or other approved techniques to ensure detection of such damage. Class l, Urgent Action) (A-79-45) z Issue a Maintenance Alert Bulletin directing FAA Maintenance pa inspectors 10 contact -their assigned carriers and advise them to immediately discontinue the practice of lowering and raising the pylon with the engine still attached. Carriers should adhere to the procedure recommended by the Douglas Aircraft Company Service Bulletin which includes removing the engine from the pylon before removing the pylon from the wing.

(Class 1 Urgent Action) (A-79-06) Issue maintenance Alert Bulletin to US certificated air: carriers, and notify States that have . Regulatory responsibilities over foreign air carriers operating DC-II aircraft, 10 require appropriate structural inspections of the engine pylons following severe side loads. Class 1 Urgent Action) (A-19-52) engine failures involving significant imbalance con Outcomes Three days after the American Airlines Flight 191

accident the FAA Western region sued a telegraphic AD which required visual inspection of the inside flange of each wing engine pylon aft bulkhead for cracks and inspection or replacement of the bolts at the forward and aft ends of each wing to pylon thrust link assemblies. On May 29, 1979, the AD was ‘ amended to require further inspections of AD was again amended telegraphically to require reinsertion of certain Model DC-10 series aircraft which had undergone engine and pylon removal and installation. As a result of the inspections required by the amended AD, the FAA was informed of the, existence of racks in the wing pylon assemblies of mounting assemblies.

Therefore, on June 6, 1979, the Administrator issued the following Emergency Order of Suspension.