AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

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Mr. Richard Rodriguez
Investigator-In-Charge
Major Investigations Division
National Transportation Safety Board
AS-10, Room 5305
490 L'Enfant Plaza East, S.W.
Washington, DC 20594-2000

Dear Mr. Rodriguez:

In accordance with the Board's rules, the Air Line Pilots Association (ALPA) submits the following comments concerning the aircraft accident involving Alaska Airlines Flight 261, which occurred on January 31, 2000 off the coast of Port Hueneme, California.

On January 31, 2000, at approximately 1621 Pacific Standard Time, N963AS, a McDonnell Douglas MD-83, operating as Alaska Airlines Flight 261, crashed into the Pacific Ocean about 3 miles from Anacapa Island, California. All 83 passengers and 5 crewmembers were fatally injured. The flight, from Puerto Vallarta, Mexico, to Seattle, Washington, with an intermediate stop in San Francisco, California, was operating under Title 14 Code of Federal Regulations Part 121.

Accident Discussion

Given the apparent condition of the Acme nut at the beginning of the accident flight, this accident was inevitable and unavoidable. The attached submission contains ALPA's analysis of the facts surrounding the accident based upon information obtained through the NTSB's investigation. Also included are ALPA's suggested Safety Recommendations for the NTSB to consider.

The factual record indicates that had the accident not occurred on this particular flight, it would have occurred in the very near future. The condition of the jackscrew components was the result of years of mismanagement and poor oversight on the part of Alaska Airlines and the Federal Aviation Administration.

The following is a discussion of several key factors that were involved in this accident. These factors relate to issues involving flawed design and certification decisions by the FAA on the failed aircraft components, inadequate maintenance policies and practices as implemented and approved by Alaska Airlines and the FAA respectively. Other factors include the inappropriate or non-existent oversight by both Alaska Airlines and the Federal Aviation Administration.

Chronology of Failure Scenario

As the aircraft was climbing out from Puerta Vallarta, the autopilot was engaged by the flight crew at approximately 7,000'. Normal alternate trim was applied by the autopilot to the horizontal stabilizer as the aircraft continued its ascent. Unbeknownst to the crew, the condition of the Acme nut, a specific component integral to the horizontal stabilizer trim system, was worn to the point of failure due to years of a lack of lubrication.

During the climb, the threads on the horizontal stabilizer Acme nut, already worn to 10% of their original thickness, began to fail. At an altitude of approximately 23,500', the threads in the Acme nut failed completely and caused the Acme nut to jam, resulting in the horizontal stabilizer ceasing movement at a near-neutral position (~0.37° aircraft nose down). The horizontal stabilizer remained in this position for a majority of the flight. As the aircraft continued its climb on the autopilot, the alternate trim system was no longer able to function due to the jammed condition, and at ~29,000', the autopilot disconnected due to its inability to maintain a trim condition on the aircraft. The flightcrew leveled the aircraft temporarily at 29,000' for other traffic, and then continued their climb to their final cruising altitude of 31,000'.

Thirty minutes prior to the accident, the cockpit voice recorder begins with the flightcrew discussing their situation with Alaska Airlines. From the ensuing discussions between the flightcrew and company personnel, it was evident that all of the individuals involved initially believed that the malfunction they were experiencing were electrical in nature.

Approximately 11½ minutes prior to the accident, the aircraft experienced a severe pitchover, due to the unjamming of the horizontal stabilizer trim system. For the aircraft to behave in this way, the Acme nut would have to be beyond the full aircraft nose down trim position. This aircraft behavior surprised the flight crew and required approximately 1½ minutes to regain control of the aircraft. Although the flightcrew did regain partial control of the aircraft, the aircraft was still difficult to handle and required a large amount of backpressure on the control column to counter the pitch-down attitude.

Approximately 3½ minutes prior to the accident, the flightcrew made a comment that indicated that they now felt that the anomaly they were experiencing may be mechanical versus electrical.

Approximately 1½ minutes prior to the accident, a "thump" is heard on the CVR, and the crew begins to experience more difficulty controlling the aircraft over a matter of seconds. The aircraft violently pitched over, the flight crew experienced a negative 3 g's and the aircraft rolled inverted. At this point, the remaining components of the horizontal stabilizer assembly failed and the horizontal stabilizer went to a position that rendered the aircraft uncontrollable. The flightcrew was unable to recover from this inverted attitude.

Certification of DC-9 / MD-80

The initial models of the Douglas Aircraft Company, DC-9 were type certificated under the Civil Aeronautics Regulations, CAR 4b, dated December 31, 1953, including Amendments up to 4b-16 and certain special conditions. Application by McDonnell Douglas to build the MD-80 series required significant modifications to the design of the aircraft; therefore those significant aircraft modifications were required to meet the requirements of FAR Part 25. Since no significant changes were made to the trim system components and the system did not show an unsatisfactory service history, the certification basis for the trim system components on the MD-80 series aircraft remains CAR 4b.

This accident demonstrates that the FAA's consideration of the horizontal stabilizer trim system as a "structural element", despite the fact that the assembly consists of moving parts of the stabilizer trim system, is flawed. This type of classification would rely on inspection and maintenance alone to maintain the airworthiness of the components and preclude a catastrophic failure of a primary flight control system. This inappropriate classification allowed this critical, non-redundant flight control system to be approved without consideration of wear to the components. The FAA's interpretation of how this particular system should be characterized (structure versus system) led to a certification of an assembly that allowed a failure mode (i.e. total wear of the Acme nut threads) to present itself that rendered the aircraft uncontrollable. It is appropriate for a certification philosophy to assume that a proper maintenance and inspection program will maintain the type design. However, when the maintenance program fails or is inadequate, this protection is lost.

The design of the horizontal stabilizer jackscrew assembly presumably met established certification criteria in place at the time. However, these "structural" components were required to conform to Subpart C, Structure of CAR 4b. CAR 4b.201, Strength and Deformation, subpart (b) states that the *"structure shall be capable of supporting limit loads without suffering detrimental permanent deformations"*. CAR 4b.201(c) states, *"the structure shall be capable of supporting ultimate loads without failure"*. The factual record shows that these particular components do not appear to meet the requirements of CAR 4b.201(b) or (c).

As another example of a failure to comply with the applicable regulations, CAR 4b.270(b), Fail Safe Strength, goes on to state that *"...catastrophic failure or excessive structural deformation, which could adversely affect the flight characteristics of the airplane, are not probable after fatigue failure or obvious partial failure of a single principal structural element."* This particular system on the DC-9 / MD-80 series aircraft also does not appear to meet the requirements of CAR 4b.270(b).

Alaska Airlines Maintenance Program and Oversight

The NTSB's public hearing identified that the FAA's Maintenance Review Board (MRB) document is simply an acceptance of the Maintenance Steering Group (MSG) standards. The FAA does not get involved in the development process, but allows the industry group to totally direct and control these standards for maintenance programs. It is self-evident that the groups represented benefit from designing these programs to be as economical as possible. There was a shift in philosophy, with the development of MSG-3, to base scheduled inspections or scheduled maintenance on component failure rates. Any component failures that were "detectable by the flight crew" do not, under this new MSG-3 philosophy, require scheduled maintenance or inspections until such failures are detected. The NTSB Maintenance Records Factual Report also discusses this MSG-3 philosophy and describes the logic as a "from the top down" or "consequence of failure approach." The report also documents that MSG-3 addresses and emphasizes economic issues: *"Several of the potential impact areas that are examined are initial design, maintenance / ownership cost, and premature removal rates."* It is obvious that the FAA's MRB was not doing the reviewing which the name of the document implies, that the FAA was not a safety net in this process, and that the FAA's oversight is systemically deficient.

Between November 1966 and September 1991, Douglas issued several All Operators Letters related to lubrication intervals. Each AOL was in reference to a specific in-service incident related to inappropriate lubrication of the horizontal stabilizer jackscrew assembly. In each AOL, Douglas recommended that the lubrication interval be every 600 hours or sooner with the Douglas approved grease. At the time of the accident, the lubrication interval at Alaska Airlines for the horizontal stabilizer assembly was approximately 2550 hours. At no time was the McDonnell Douglas recommended lubrication interval extended by McDonnell Douglas. Therefore, Alaska Airlines extended their lubrication intervals based upon insufficient rationale for doing so and the FAA's oversight allowed these escalations to occur.

Continuing Airworthiness

The NTSB's Maintenance Records Group and the FAA's Special Inspection Team found deficiencies in the Maintenance & Engineering Department's organization, administration, and staffing. Many of these positions were not filled at Alaska Airlines at the time of the accident. This gravely impacted the safety of the company and was directly related to the inadequate oversight by the FAA for allowing such positions to remain unfilled.

There was not a full-time Director of Maintenance or Director of Safety at Alaska Airlines as required by FAR Part 119.65. The Director of Maintenance position had been vacant for almost two years at the time of the accident, and at the time of the accident the acting Director of Safety also had the responsibilities of two other positions, Director of Quality Control and Director of Training. Formal interviews conducted by the NTSB's Maintenance Records Group with several of Alaska Airline's management personnel and with several members of the FAA's Certificate Management Team (CMT) revealed that there was not a formal safety reporting system in effect prior to, or at the time of, the accident. Interviews indicated that there was no formal division of responsibilities between the part-time Director of Safety and the Director of Flight Safety.

Inadequate command, control, and responsibility within the Alaska Airlines maintenance organization were also discovered during the investigation. There were no written procedures for Production Control during heavy checks at the Oakland maintenance facility (violation of FAR 121.135). This lack of written procedures for heavy checks is an important factor in this accident and directly relates to management's reversal of the decision to replace the stabilizer jackscrew assembly during the C5 check of aircraft N963AS (accident aircraft) in September 1997 at the Oakland Maintenance Facility. The NTSB's Maintenance Records Group was unable to establish who had the authority to authorize this change to the planned replacement of the jackscrew assembly on aircraft N963AS.

Lubrication intervals at Alaska Airlines for the stabilizer jackscrew were escalated from an interval of 500 hours in 1987 to an interval of 8 months (approximately 2,550 hours) in 1996.

This was done in spite of the fact that the McDonnell Douglas recommended lubrication interval was consistently identified in several AOLs as 600 hours. The dramatic difference in the extended lubrication intervals used by Alaska and those recommended by the manufacturer had a significant effect on the overall wear of the jackscrew components.

As the lubrication intervals for the stabilizer jackscrew assembly were being escalated at Alaska Airlines, the inspection and endplay check intervals were not shortened in order to monitor the affects of the decreased frequency of lubrication. The opposite was actually being implemented. As the interval between lubrications increased from an interval of 500 hours in 1987 to an interval of 8 months (approximately 2550 hours) in 1996, the interval between inspections and endplay checks increased from 5000 hours in 1985 to 30 months (approximately 9950 hours) in 1996. Note the change from an hourly requirement to a calendar requirement. No special monitoring program or special inspections were established for the Reliability Analysis Program to monitor the affects of decreased lubrication on the MD-80 stabilizer jackscrew assembly.

The last required lubrication of the horizontal stabilizer jackscrew assembly on N963AS was documented on September 24, 1999, at SFO. At the time of this lubrication the task card for this procedure specified Aeroshell 33 as the grease to be used. The Alaska Airlines GMM, however, specified Mobilgrease 28. The Maintenance Records Group was not able to establish which type of grease was actually used for the lubrication. Mechanics interviewed indicated that the assembly was lubricated, and the task cards called for Aeroshell 33. Although the task card for this lubrication in 1999 indicated that Aeroshell 33 was used, the Materials Group found no visible Aeroshell 33 either on the Acme screw or the Acme nut. Nor did the Materials Group find any evidence of Aeroshell 33 in the Acme nut gimbal ring (which is also a component of the jackscrew assembly that would have required lubrication at that time). This indicates that either Mobilgrease 28 was used (contrary to the task card), or the component was not greased as the task card indicated.

The change to Aeroshell 33 from Mobilgrease 28 by Alaska Airlines was significant with respect to the lack of oversight on the part of the FAA and the failure to follow procedures on the part of Alaska Airlines. However, we must add here that the grease change, in and of itself, did not have any significant impact on the lubricating abilities or the wear characteristics of the components. In fact, the NTSB's Grease Group determined that Aeroshell 33 actually provided better friction characteristics than Mobilgrease 28 and mixtures of the two greases had little effect on the lubricating properties.

An effective Reliability Analysis Program (RAP) for the MD-80 might have prevented the catastrophic failure of the horizontal stabilizer jackscrew assembly. However, the RAP used by Alaska Airlines was ineffective. The FAA authorized its use for the MD-80, as part of Alaska's maintenance program under the guidelines of FAA Advisory Circular AC 120-17, "Maintenance Control by Reliability Methods." The objectives of the program are to improve airworthiness, reliability and cost effectiveness of the inspection, maintenance and overhaul programs for a particular aircraft. In view of the complexity and flexibility of such a program, it requires special attention by the FAA before approval is granted because every element of the program must be studied.

Investigation by the NTSB Maintenance Records Group disclosed that the Unscheduled Removal Alert report for 1999 (including a three-month rate per 1,000 unit hours, for components related to the stabilizer trim system) contained the removal of only two horizontal stabilizer jackscrews and support assemblies while there had actually been three assemblies removed and replaced. The third unit was removed in November 1999; however, a new unit was not installed until January 2000. Thus, the airplane check and component report were not completed until January 2000. Even though two removals occurred in November 1999, at no time before the accident did the component unscheduled removal rate trigger the alerting system, requiring an investigation. In spite of these three removals, Alaska Airlines did not submit to the FAA SDRs about these assemblies as required by federal regulation.

Alaska Airlines did not have an effective Continuous Analysis and Surveillance System (CASS) at the time of the accident. This is a violation of FAR 121.373. The regulation requires that "*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, preventive 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.*" Prior to the accident, the FAA never took any action against Alaska Airlines as a result of this failure to comply with the provisions of 121.373. Administration of the CASS system is a function of the Quality Assurance (QA) Department at Alaska Airlines. Interviews conducted with members of the FAA's CMT and with the former PMI for the airline indicated that the QA was not performing its required functions.

Performance of the endplay check of the horizontal stabilizer requires the use of a "restraining device" and a "dial indicator." Until the accident, Alaska Airlines had only one restraining fixture tool in its inventory, and this tool was located in OAK. Prior to the accident, there was no procedure in place to sign-out a measurement tool at the maintenance facilities. The tool was manufactured in-house by Alaska Airlines and did not meet either McDonnell Douglas or Boeing specifications.

On August 2, 2000 (6 months after the accident), Alaska Airlines reported a concern to the FAA that the restraining fixture tool used by Alaska Airlines and manufactured in-house may not be "an equivalent substitute" for the Boeing/McDonnell Douglas fixture as called for in the MD-80 Maintenance Manual. Among several potential areas of concern was the problem that these tools could bottom out during the check, thus yielding an erroneous measurement. Alaska Airlines then quarantined all the tools that were not manufactured by Boeing. The NTSB Systems Group performed a series of both laboratory and on-wing tests comparing the accuracy of endplay checks using authentic Boeing tools and Alaska clone tools. They discovered that the force output from the Alaska clone tools was so low that their use could lead to artificially low endplay readings, especially on MD-83s with their heavier tail structures (963 was an MD-83).

Corporate Culture

A poignant reflection of the corporate culture is revealed by the flightcrews conversation within the cockpit during the last thirty minutes of the flight. The crew commented to each other about the pressure placed on them by the company to continue to SFO, the planned destination, and about the failure of the dispatcher to get an instructor pilot on the radio to assist them. It appears that even the "A" flight attendant was aware of the culture when she made the statement (recorded by the CVR): *"So they're trying to put the pressure on you –"*. This provides some insight into the management culture that prevailed at Alaska Airlines.

It is apparent from a review of the factual data collected by the NTSB Accident Investigation Team, the FAA's Special Inspection of the airline, and the audit conducted by the Enders group, that the motivation for maximum income with minimum operational cost resulted in a high tolerance for risk with regard to safety. In a post-accident interview with the Director of Flight Safety at the time of the accident, he stated: *"The role of both maintenance control and dispatch was to push aircraft. Pilots determined if the aircraft was flyable. This was the philosophy and always has been."*

FAA Oversight

The Reliability Program establishes the important criteria for determining routine maintenance, overhauls, and inspections and must be initially linked to the manufacturer's recommended maintenance program and the MSG-2 document. Alaska did not incorporate the required maintenance and inspection data necessary from which to make these important and informed decisions. The FAA CMO failed to correct this problem over the many years that it was responsible for their regulatory oversight.

The implementation of ATOS could have been instrumental in uncovering deficiencies at Alaska Airlines if the Principal Inspectors involved had been honest and forthright about their concerns over Alaska's maintenance and inspection functions. The FAA implemented ATOS in the fall of 1998 in a major attempt to re-structure and significantly enhance its surveillance process of the top ten air carriers, of which Alaska Airlines was one.

The FAA's April 2000 (3 months after the accident) Special Inspection of Alaska Airlines conducted by the System Process Audit Program staff reported the significance of its findings. The report disclosed that 22 of its associated findings "had a HIGH criticality baseline." Of the breakdowns identified in Alaska's systems, 15 (27%) were uncovered in the Maintenance Program alone. The report also showed that if a hazard analysis were to have been conducted, it would have identified such areas as the abuse of the maintenance deferral system, ineffective quality control and assurance departments, vacant key management positions and aircraft released to service without proper documentation with the following consequences: use of non-airworthy aircraft in service, poor on-time performance, aircraft incidents and accidents.

The evidence clearly shows that in the years Alaska had been operating, fundamental and critical deficiencies in its systems, processes and procedures were allowed to exist. Many of these deficiencies should have been discovered by the CMO during its initial certification and approval of these activities. ATOS notwithstanding, any subsequent deviation from what was approved should have been detected through surveillance and corrected. The fact that these deficiencies have existed for so long explains why the carrier had developed a culture of non-compliance with regulatory standards and best practices, which the CMO allowed.

The PMI involved had spent eight years with the carrier over the period when Alaska Airlines had acquired the MD-80 until the accident. The PMI should have been intimately familiar with the Alaska's maintenance, inspection and engineering functions and its culture. Appropriate guidance was available to Principal Inspectors about growth and aircraft utilization rates from which to monitor the airline. Yet, in the case of Alaska, its systems were not able to adequately support the carrier's aggressive flight schedule. As summed up in the System Process Audit report, "*...there seems to be a basic lack of understanding regarding the complexity of operating an airline of this size*." The question is why were deficiencies not previously detected and corrected?

Title 49, Section 44702(b) of the US Code places primary responsibility to provide the public with the highest possible degree of safety on the air carrier. It is the responsibility of the FAA to promulgate and enforce adequate standards and regulations. As the subsequent special investigations conducted by the FAA showed, the CMO had the authority, responsibility and justification for suspending Alaska's operating certificate until such time as Alaska had corrected the systemic deficiencies in its operating systems and achieved compliance with regulatory standards. Had this been done long ago, this type of accident might not have occurred. In the Special Audit Team's report under the Surety Model, it proposed that, "*A plan needs to be developed to integrate effective controls and standardize all systems and manuals*." One of its proposed potential corrections was, "*Limit growth until all threats have been eliminated*." Clearly, had the CMO taken this action long ago, it could have achieved control over Alaska's operation and established systemic improvement. It chose not to do this, but instead only reacted to Alaska's demands.

ALPA concludes that the factors involved in the accident should be attributed to the following:

- Deterioration of the Acme nut threads was caused by a lack of lubrication to the Acme screw / nut assembly.

- The total failure of the Acme nut threads resulted in a total mechanical failure of the horizontal stabilizer system and the surrounding aircraft structure. These combined failures allowed the horizontal stabilizer to move to a position beyond full nose down trim that rendered the aircraft uncontrollable.

- The failure of the Alaska Airlines Maintenance and Engineering Department to properly conduct endplay measurements, to properly lubricate this jackscrew assembly and to establish reasonable inspection intervals based upon supportable data was directly causal to this accident.

- The FAA approved a type design for the stabilizer trim system that did not meet several of the applicable portions of both the original Civil Aeronautics Regulations (CAR) and the current FAR Part 25 requirements.

- This type design, along with the failure mode experienced on these components, does not provide adequate redundancy to preclude total mechanical failure of the stabilizer system.

- Organizational shortcomings that existed within the maintenance, engineering and flight operations departments at Alaska Airlines.

- The certification, inspection, and surveillance failures on the part of the Federal Aviation Administration (FAA) Certificate Management Office for Alaska Airlines allowed years of questionable corporate practices at the airline.

- The industry's Maintenance Steering Group Task Force failed to base maintenance recommendations (MSG-2 and MSG-3) for the horizontal stabilizer on established engineering data, thread wear rates, service history, manufacturer's service bulletins, and the FAA's Service Difficulty Reports (SDRs).

- The flawed certification philosophy of the trim system led to an inadequate Abnormal Procedures Checklist that failed to address all of the potential failure modes and risks of an inoperative or failed jackscrew.

Based upon the factual record and ALPA's analysis of those facts, ALPA offers the following Safety Recommendations:

1. The FAA must deploy its System Process Audit team to monitor the effectiveness of the ATOS program and other means of oversight to identify shortcomings, develop strategies for improved operator oversight and to improve the training and standardization of its inspector workforce.

2. The manufacturer must identify a more thorough and representative horizontal stabilizer endplay check procedure to accurately determine jackscrew component thread wear.

3. In conjunction with an improved endplay check procedure, the FAA and the operator must ensure that mechanics are properly trained in conducting such checks to preclude erroneous measurements.

4. The FAA must require the operators to record, retain and track all horizontal stabilizer endplay check measurements.

5. The FAA and the manufacturer must identify improved horizontal stabilizer jackscrew lubrication procedures to ensure that the Acme nut and screw threads receive a thorough amount of lubrication. Improved lubrication procedures must take into account accessibility, number of grease fittings, lubricant properties and lubrication intervals.

6. In conjunction with improved lubrication procedures, the FAA and the operator must ensure that mechanics are properly trained in conducting such lubrications to preclude inadequate lubrication of critical components.

7. The FAA and the operator must develop additional flightcrew training and guidance materials to address mechanical failures of critical aircraft systems and components.

8. The manufacturer must develop a mechanical system to preclude critical flight components (e.g. horizontal stabilizer, rudder, etc.) from reaching a position of which the flight crew would be unable to overcome the failure through other means.

9. The concept of Derivative Certifications should be revisited to ensure that when current regulations provide an increased level of safety to aircraft systems or components, that those new regulations are applied and enforced.

10. The FAA's concept of "structural element" should be revisited to ensure that the regulations in place related specifically to structural elements provide the highest level of safety.

11. Continuing Airworthiness programs must be monitored and compared with current certification requirements to identify possible areas of regulatory compliance deficiencies.

12. Operator management structures must be reviewed to ensure that the positions required by Federal Regulation are filled in compliance with the requirements mandated by the FAA.

13. The FAA must ensure that it assigns qualified airworthiness inspectors capable of evaluating, certificating and surveilling air carrier maintenance reliability analysis programs and continuous analysis and surveillance systems through actions, such as, improving present human resource staffing policies, inspector training curriculum, and certificate office management decisions regarding inspector assignments and supervision.

14. The FAA should take an aggressive stance and deploy the use of its expert CSET and System Process Audit teams to examine the status of critical air carrier systems where there is justification to ensure regulatory compliance, improve industry standardization, resolve deficiencies and clarify any regulatory misunderstandings about these systems on the part of certificate holders.

15. The FAA must review and improve its policies with respect to the Flight Standards Service tenure of its inspectors assigned to air carrier certificate management teams as well as its office supervisory staff to prevent improper relationships with their certificate holders and misconduct on the part of inspectors and managers.

16. To assist the industry in identifying maintenance trends, the FAA must strictly enforce the requirement for operators to submit Service Difficulty and Mechanical Interruption Reports.

ALPA appreciates the opportunity to have participated as a party to the investigation and hopes that the attached analysis, conclusions and safety recommendations will be of assistance as the NTSB concludes its investigation.

Sincerely,

Christopher W. Wolf /ak

Captain Christopher W. Wolf, Sr.
Air Line Pilots Association
ALPA Coordinator

Attachment

cc: Chairperson Marion Blakey
Member Carol Carmody
Member John Goglia
Member John Hammerschmidt
Member George Black
Mr. John Clarke
Mr. Tom Haueter
ALPA Accident Investigation Board