

Case Study: Alaska Airlines Flight 261

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### Abstract

With many rapidly expanding airlines active in the air transportation system, it is entirely possible for one of them to expand beyond its capacity to operate safely. The accident of Alaska Airlines Flight 261 was the direct result of such a scenario, coupled with a lack of Federal oversight. While maintenance programs are designed to allow a company to adjust required maintenance intervals and to recommend changes to materials and tooling, there can be no substitute for placing safety ahead of profit. Management can assist employees by establishing a culture of safety and by ensuring that changes to maintenance procedures are made with full oversight and executive review.

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In the competitive environment of deregulation and rising fuel costs, an airline capable of satisfying its customers while maximizing load factors and minimizing maintenance costs greatly enhances its survivability. However, this reality has caused some air carriers to attempt to stretch manufacturer preventative maintenance cycles and sometimes even to use inferior parts or tools. Simultaneously, the desire to keep expensive aircraft in the air has even led company management to accept a lower standard of quality in the areas of system safety and maintenance practices. An example of the far-reaching effects of this kind of business model is the case of Alaska Airlines Flight 261.

### Background Information

#### *Alaska Airlines*

Since its founding in 1932, Alaska Airlines has demonstrated that it is the type of regional carrier that has the capacity to survive the airline environment of the early Twenty-first Century. Whether it is the difficult weather in Alaska and the Northwestern United States, a shift from charter to passenger service or a rapid expansion throughout the Eastern Pacific Rim, the company has proved that it can adapt to myriad new challenges. Alaska Airlines claims that its business strategy is characterized by a spirit of resourcefulness, a trait which helped lead the company to achieve an unprecedented 19 straight years of profitability, a three-fold growth of the company and a five-fold growth in its aircraft fleet within a quarter century (Alaska Airlines Historical Overview, 2005).

As a consequence of this rapid growth, however, Alaska Airlines was actually operating with a smaller number of personnel than other, more established, airlines of similar size. Despite the existence of federal regulations, which delineate required personnel for airline operation, the

company allowed its staff to fall below these standards. From June 1998 until January 2000, the Director of Line Maintenance and Director of Base Maintenance (two separate people) shared the duties of the Director of Maintenance position (vacant). The Director of Safety was concurrently filling the positions of Director of Quality Control and Director of Training and did not report directly to the company president (Aircraft Mechanics Fraternal Association [AMFA], 2002). The Director of Operations position was also vacant (National Transportation Safety Board [NTSB], 2002).

The Alaska Airlines maintenance program is operated with guidance provided by the MSG-3, a document created, improved and maintained by the aviation industry. The ultimate goal of this program is to ensure that the company complies with guidance provided by the manufacturer and the Federal Aviation Administration (FAA). Within the company, a Maintenance Review Board (MRB) and Reliability Analysis Program (RAP) convene regularly to discuss changes in the required servicing of aircraft. If the MRB or RAP determines that a change is required, they will each forward these recommendations to the FAA for review and approval. Aircraft manufacturers are then required to issue on-aircraft maintenance planning (OAMP) documents and task cards delineating specific tasks associated with maintaining the aircraft under the new parameters. There is no allowance for independent modifications of maintenance practices or for use of unapproved materials or tools (NTSB, 2002).

### *Mishap Aircraft*

Alaska Airlines Flight 261 was flown using a McDonnell Douglas MD-83, a derivative of the Douglas DC-9. This variant, sometimes referred to as a “Super 80,” has all the engineering benefits of a time-tested airframe coupled with the upgrades of more modern aircraft (i.e. glass cockpit). From its design and introduction in the mid 1960s until the merger of McDonnell

Douglas with Boeing in 1997, the DC-9 series was constantly in production. Boeing adapted the final variant of this aircraft and named it the Boeing 717, which is expected to cease production in 2006 (Wikipedia: McDonnell Douglas DC-9, 2005).

A significant feature of the DC-9 is the mechanical operation of the horizontal stabilizer on the aircraft's T-Tail. Pilots are able to control the elevator from the flight station using levers which control primary and secondary trim motors. The motors move a jacking gear assembly (also known as a jackscrew), controlling the aircraft's elevator and maintaining level flight. The DC-8, predecessor of the DC-9 series, had a similar horizontal stabilizer control system, although it also had a second jacking gear assembly (International Aviation Safety Association, 2005). In the absence of such redundancy, McDonnell Douglas intended that airline maintenance departments perform routine inspections and service the jackscrew of the DC-9 to prevent undetected failure. The "end-play" check was one such inspection, designed to show unusual wear in the jacking gear assembly. The jackscrew was also to be serviced with lubricating grease, to ease friction and wear on the jackscrew (AMFA, 2002).

### *Federal Oversight*

The FAA is directly responsible for actively monitoring the activities of airlines and for ensuring compliance with established regulations. Since October 1998, the oversight of maintenance programs at Alaska Airlines has primarily been achieved by means of the Air Transportation Oversight System (ATOS). However, the original installation of this program was hampered by a shortage of personnel at the Seattle Flight Standards District Office (FSDO), primarily responsible for ATOS at Alaska Airlines. As a result, less than half of ATOS required procedures were actually executed by the FAA between October 1998 and January 2000 (AMFA, 2002). In late 1999, Alaska Airlines actually complained to the FAA that it was

concerned that “diminished surveillance is imminent and the risk of incidents or accidents...is heightened” (NTSB, 2002, p.95).

## Synopsis of the Accident

### *Inspection Intervals*

In an effort to reduce the number of required aircraft inspections, Alaska Airlines attempted to achieve a comprehensive adjustment of service schedules. The manufacturer originally recommended lubrication of the jackscrew every 600 flight-hours and the “end-play” check every 3,600 flight-hours. Utilizing the MRB process and by obtaining FAA approval, the company gradually increased the limits for each maintenance procedure. By 1996, the MSG-3 OAMP had set new limits for the lubrication at eight months (which was approximately 2,550 flight-hours) and for the “end-play” check at 7,200 flight-hours (NTSB, 2002). However, by means of a series of waiver requests and by subjective interpretation of the limits, Alaska Airlines eventually allowed up to 9,550 flight-hours for the “end-play” check (International Aviation Safety Association, 2005).

### *Jackscrew Lubrication Grease*

As it expanded, Alaska Airlines encountered numerous types of grease used in lubrication on the many kinds of aircraft in their inventory. While the aircraft manufacturer intended that the jackscrew assembly be lubricated with MIL-G-81322 (e.g. Mobilgrease 28) grease, the company decided to use MIL-G-23827 (e.g. Aeroshell 33) instead. This was not done overtly, but the company’s apparent impatience with the manufacturer led to some subjective interpretations of statements (i.e. that these greases were interchangeable). Consequently, maintenance personnel began to use the new grease without properly routing the request through the company executive chain for approval. In addition, the FAA was not informed of the full

extent of their practices with the greases. In reality, the two types of grease are rated for different temperatures and react differently when in contact with water and each other (AMFA, 2002).

### *Tooling*

Alaska Airlines apparently did not wish to purchase tools to use during the “end-play” check of the horizontal stabilizer. Boeing had manufactured a particular tool for this procedure and the task card for performing the check indicated a list of acceptable substitutes. However, in early 2000, Alaska Airlines had only one such tool in its entire inventory. This tool had been manufactured by the company maintenance facility and did not meet Boeing’s standard for completing the test correctly. Consequently, use of this equipment may actually have misled a technician using it into believing that the established horizontal stabilizer “end-play” limits of 0.040 inches were being met (NTSB, 2002).

### *Inspection History*

When the mishap aircraft was brought into a required maintenance inspection on September 24, 1997, it was scheduled to receive a lubrication of the jackscrew assembly and “end-play” check. During performance of the latter, it was determined that the horizontal stabilizer had reached its maximum “end-play” limit of 0.040 inches. At first, the technician who performed the test attempted to prevent release of the aircraft back to flight status by recommending replacement of a part of the jackscrew assembly. The part was not in stock and should have been ordered, although it apparently was not. However, as the aircraft remained in maintenance for two extra days longer than scheduled, a shift supervisor eventually overrode the parts replacement recommendation. Instead, numerous additional “end-play” checks were conducted until the jackscrew assembly appeared to be operating within expected tolerances. The jackscrew was lubricated with Mobilgrease 28 at that time. The mishap aircraft returned for

scheduled horizontal stabilizer maintenance on June 26, 1998, January 13, 1999, and September 24, 1999. During each inspection, Aeroshell 33 was used as the lubricant on the jackscrew, although there were no further “end-play” checks performed before the accident occurred in January 2000 (NTSB, 2002).

John Liotine, a technician involved in the 1997 “end-play” check, informed the NTSB of this and additional maintenance malpractice issues prevalent at Alaska Airlines in October 1998 (NTSB, 2002). In June 2000, he was actually identified by Alaska Airlines as the person who had suggested jackscrew replacement, although at that time the company stated that he was incorrect in his recommendation (Shukovsky, 2000).

### *The Mishap Flight*

The mishap aircraft launched from Puerto Vallarta, Mexico, on January 31, 2000, enroute to San Francisco, California. The pilots first determined that there was a problem with control of the aircraft during the initial climb, when they were unable to use the primary or secondary trim. In such a scenario, a trim motor could have failed but a jammed stabilizer is also possible. While flying without stabilizer trim is not a serious matter, landing with a jammed stabilizer requires emergency landing procedures. However, the procedures used at that time were not clear on what specific actions should be taken to determine which failure had occurred. During the mishap flight, the pilots decided that the trim motors had failed and contacted Alaska Airlines Maintenance to ask for assistance in determining the best course of action (NTSB, 2002).

After consultation with the company, the Captain decided to divert the flight to Los Angeles, California. While enroute, the pilots discussed their concerns about landing with inoperative stabilizer trim. With no guidance to assist or prevent them, they made several attempts to regain control of the trim motor. The crew was eventually successful in getting the

horizontal trim motor to operate, but it was this same action that caused the motor to force the jackscrew assembly past its mechanical limits. The aircraft then proceeded into a steep dive, from which the crew was able to recover only after some difficulty. As they again proceeded toward Los Angeles International Airport, the final part of the jackscrew assembly that was still holding the horizontal stabilizer in place broke loose and the crew lost control for a second time. All 88 souls perished in the resulting inverted dive into the ocean (Wikipedia: Alaska Airlines Flight 261, 2005).

### System Safety Failures

While they were the last people in the procedural chain of errors that led to accident, the pilots of Flight 261 can be faulted for unnecessary in-flight troubleshooting while adequate landing and maintenance facilities were nearby. However, they should not have been placed in a situation where it was their responsibility to decide which malfunction (i.e. trim motor or jammed stabilizer) was more dangerous. Clearer emergency procedures in the event of a non-responsive horizontal stabilizer could manage this hazard, but pilot training is needed to emphasize that landing without stabilizer trim is both permissible and safe.

The FAA's inadequate oversight was directly involved in Alaska Airline's ability to stretch maintenance check intervals and change materials and tooling improperly. While manning of the FSDO might be blamed on greater budgetary restrictions, it is nevertheless true that even the airline knew ATOS was inadequately managed. If the FAA wishes to use such a system, it must properly enforce directives and provide proper inspection services. In addition, the procedures for adjusting check intervals or changing materials (i.e. tools, grease, etc.) should not be left solely at the discretion of the airline or the industry. The FAA should also have

required that Alaska Airlines be organized in compliance with federal regulations, emphasizing the danger of a safety culture created by management indifference.

Alaska Airlines should have created a clear chain of command for their maintenance department. Confusion surrounding the sharing of duties within the department made routing of concerns difficult and may even have led to a conflict of interest. Likewise, the lack of direct access for the Safety Director to company leadership may have prevented a free flow of safety concerns and policies. Clearly, another major factor in the mishap was the lack of supervision, especially with regards to how money should be saved. If employees felt the need to avoid notifying their entire chain of command concerning the changes of grease, lack of parts support or even the consequences of lengthening maintenance check intervals, there was definitely a problem with communication. In response to these issues, it would be beneficial for the company to institute an organizational change, specifically giving the Safety Director direct access to the company president. It would also be wise to require executive review of all attempts to cut costs at the expense of safety. The entire episode might have been avoided if the company had heeded the concerns of a senior technician who, previous to the mishap, informed the NTSB that the company was “seriously cutting down on aircraft inspections in order to get more flights out” (Wikipedia: Alaska Airlines Flight 261, 2005, ¶ 7).

Perhaps the most important experience that can be gained from Alaska Airlines Flight 261 is that rapid growth of an airline, coupled with cost-cutting concerns and a corporate culture that accepts gaps in management positions, can lead to conditions that facilitate unsafe acts. Oversight provided by the FAA must ensure that an ambitious company does not expand beyond its capacity to operate safely.

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