

UNITED STATES OF AMERICA  
NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

**ABSTRACT OF AVIATION ACCIDENT REPORT  
ALASKA AIRLINES FLIGHT 261, MD-83, N963AS  
PACIFIC OCEAN ABOUT 2.7 MILES NORTH OF  
ANACAPA ISLAND, CALIFORNIA  
JANUARY 31, 2000  
NTSB/AAR-02/01**

Board Room and Conference Center  
National Transportation Safety Board  
429 L'Enfant Plaza, SW  
Washington, D.C.

Tuesday, December 10, 2002  
9:30 a.m.

National Transportation Safety Board

CAROL CARMODY, ACTING CHAIRMAN  
GEORGE W. BLACK, MEMBER  
JOHN HAMMERSCHMIDT, MEMBER  
JOHN L. GOGLIA, MEMBER

Staff

JOSEPH KOLLY  
JEFFREY GUZZETTI  
RICHARD RODRIGUEZ  
JOHN CLARK  
DANIEL CAMPPELL  
RON BATTOCCHI  
DR. DANIEL BOWER  
DR. JANA PRICE  
JOE EPPERSON  
KAREN BURY  
DR. VERNON S. ELLINGSTAD  
FRANK MCGILL  
DAVID IVEY  
ELAINE WEINSTEIN  
KRISTEN SEARS  
LORENDA WARD  
KEVIN RENZE

**EXECUTIVE COURT REPORTERS, INC.  
(301) 565-0064**

## P R O C E E D I N G S

9:30 a.m.

ACTING CHAIRMAN CARMODY: Good morning.  
Could we take our seats? Let's take our seats and  
close the door in the back, if you will, please.

I'm going to go ahead and begin since it is  
9:30 and we have a long day in front of us.

On January 31st, 2000, about 16:21 Pacific  
Standard Time, Alaska Airlines Flight 261, a McDonnell-  
Douglas MD-83, crashed into the Pacific Ocean about 2.7  
miles north of Anacapa Island, California. The  
airplane was completely destroyed. There were no  
survivors among the five crew and 83 passengers.

I'd like to extend a special welcome to the  
families of the victims who are here with us today as  
well as to all the other people who have come to  
observe the board meeting.

This is a sunshine meeting of the National  
Transportation Safety Board. That essentially means  
that federal agencies must conduct their business in  
the open, in the public. Therefore, board meetings are  
called sunshine meetings. While the public is invited  
today to observe the meeting, only the Board and the  
staff will be participating in the meeting.

A few weeks ago, the staff submitted for the

1 Board's consideration a Draft Accident Report of this  
2 accident. We've had several weeks to read it. I think  
3 most of us have read it numerous times, and we've had  
4 an opportunity to talk with the staff about it, but  
5 this is the first time we have met as a board to review  
6 and consider the report itself as well as the  
7 recommendations and the probable cause.

8           Because this document being considered is a  
9 draft, it does not necessarily reflect the views of the  
10 agency and it's not available to the public at this  
11 time. During today's meeting, you will observe the  
12 board members going through the draft section-by-  
13 section eliciting responses, asking questions of the  
14 staff. Once they have gone through the body of the  
15 Draft Accident Report, the board members will then  
16 consider conclusions, probable cause determination, and  
17 specific safety recommendations proposed in that  
18 report.

19           The board members will determine if they  
20 should approve the report, the draft, with editorial,  
21 analytical or factual corrections agreed to during the  
22 meeting or if it should be returned to the staff for  
23 revision. Such deliberations over a draft report can  
24 take anywhere from 90 minutes to the better part of a  
25 day. Sometimes all or part of a draft conclusion,

1 probable cause, or recommendation is revised or  
2 rejected by the members. That's because you're viewing  
3 our actual deliberations, our sunshine meeting.

4 About 30 minutes after the meeting, copies of  
5 abstracts containing the conclusions, probable causes,  
6 and recommendations will be available. It can be  
7 obtained from the Board's Public Affairs Office which  
8 is in Room 6201.

9 In the event of an emergency, such as a fire,  
10 the building alarm system will activate and a voice  
11 message will instruct persons to vacate the building.  
12 You should proceed to your nearest exit. There are  
13 emergency exits up front, to the left and right of the  
14 podium, and, of course, in the back of the room.

15 Also for your convenience, the restrooms and  
16 telephones are in the foyer in the back on your left as  
17 you exit.

18 To provide the appropriate meeting  
19 environment, I ask that you put your cell phones, your  
20 beepers, your pagers on silent. If you need to make a  
21 call, please leave the room to do so.

22 I'd like to introduce my fellow board members  
23 with me today. On my left, Member John Hammerschmidt.

24 He was the member on scene for this accident. On my  
25 right, Member John Goglia, and at the end, Member

1 George Black.

2 I will now move to the Managing Director who  
3 will introduce the staff.

4 Mr. Campbell?

5 MR. CAMPBELL: Good morning, Madam Chairman,  
6 Members of the Board.

7 With me at the front table, to my left, is  
8 Ron Battocchi, the agency's General Counsel, and  
9 proceeding to my right, John Clark, the Director of the  
10 Office of Aviation Safety, Richard Rodriguez, the  
11 Investigator-in-Charge in this accident, Jeff Guzzetti,  
12 who is the Chairman of the Systems Group, and Joseph  
13 Kolly, who is the Chairman of the Grease Group. Mr.  
14 Rodriguez, the Investigator-in-Charge, has the opening  
15 statement.

16 Thank you.

17 ACTING CHAIRMAN CARMODY: Please go ahead,  
18 Mr. Rodriguez.

19 MR. RODRIGUEZ: Good morning, Madam Chairman,  
20 Board Members, ladies and gentlemen.

21 My statement and staff presentations this  
22 morning summarizes the significant findings of this  
23 investigation, including the failure mode of the  
24 horizontal stabilizer jackscrew, the relative effects  
25 of lubrication and inspection of the jackscrew, the

1 Alaska Airlines Maintenance Program, and the FAA  
2 oversight of Alaska Airlines.

3 Alaska Airlines Flight 261 departed Puerto  
4 Vallarta at 1337. This profile shows various  
5 significant points during the flight. The flight  
6 operated normally until 23,400 feet when the horizontal  
7 stabilizer jammed. From this point on, the aircraft  
8 generally continued climbing in a series of climbs and  
9 level-offs until the autopilot disconnected at 28,557  
10 feet and 296 knots. During the next seven minutes, the  
11 aircraft began climbing at a much slower rate as the  
12 pilot was flying manually using up to 50 pounds of  
13 pulling force to maintain the climb attitude.

14 By 1400 hours, the aircraft had leveled at  
15 the assigned altitude of 31,000 feet, and for the next  
16 24 minutes, the aircraft was flown manually at 280  
17 knots with about 30 pounds of pulling force to maintain  
18 level flight. Then the crew accelerated to 301 knots  
19 and the pulling force was reduced to about 10 pounds.

20 About one hour and 15 minutes later, the  
21 autopilot was re-engaged and the crew contacted Company  
22 Dispatch and Maintenance Control in Seattle to discuss  
23 the stabilizer problem. During the next 17 minutes,  
24 the crew discussed operational details of diverting  
25 into Los Angeles with Dispatch and advised Los Angeles

1 Operations that they intended to land there.

2 At 16:08, a Los Angeles mechanic asked if the  
3 crew had tried the suitcase handles and the pickle  
4 switches and the captain responded, "Yeah. We tried  
5 everything together." One minute later, there was a  
6 click recorded on the CVR as the captain stated,  
7 "This'll click it off." During the next two seconds,  
8 the CVR recorded a clunk, the sound of two faint  
9 thumps, and a sound similar to the horizontal  
10 stabilizer in motion audible tone.

11 Following the autopilot disengagement, the  
12 horizontal stabilizer moved from the jammed position to  
13 full nose down and the aircraft pitched to nearly eight  
14 degrees nose down attitude. In the dive that lasted  
15 about 80 seconds, the air speed increased rapidly to  
16 353 knots which is 10 knots above the maximum allowable  
17 air speed, and the aircraft descended to between 23,000  
18 and 24,000 feet. Calculations indicate that a column  
19 force of a 130 to 140 pounds was required to recover  
20 from the dive.

21 At 16:11, the captain advised the controller,  
22 "We are at 24,000 feet, kind of stabilized." For the  
23 next several minutes, the crew discussed their problem  
24 with Los Angeles Maintenance, the cabin crew, and also  
25 advised the passengers that they had a control problem

1 and would be diverting into Los Angeles. During this  
2 time, the controller cleared Flight 261 to descend to  
3 17,000 feet and assigned them a heading of 280 degrees  
4 to remain out over the water.

5 As the aircraft was leveling off at  
6 approximately 18,000 feet, the air speed had decreased  
7 to 253 knots and the captain asked for slats extend and  
8 then shortly requested flaps 11 degrees. Once  
9 configured, the captain commented, "Actually, it's  
10 pretty stable right here, but we got to get down to a  
11 180." The captain ordered retraction of the flaps and  
12 slats and the air speed again began to increase from  
13 245 to 270 knots.

14 At 16:19:21, the cockpit voice recorder  
15 recorded the sound of faint thumps and the horizontal  
16 stabilizer moved for the second time since the initial  
17 jam during the climb-out. The captain asked if the  
18 first officer had felt the thump and he replied,  
19 "Yeah." The captain then expressed increased  
20 difficulty controlling the aircraft and asked for the  
21 slats and flaps to be extended again. At this time,  
22 the aircraft was at 17,900 feet. The air speed had  
23 increased to 270 knots and the nose attitude was plus  
24 two degrees.

25 At 16:19:36.6, an extremely loud noise was



1 recorded. Within the next few seconds, the vertical  
2 acceleration changed to -3 Gs. The aircraft pitched  
3 down at a rate of 25 degrees per second and began  
4 rolling to the left. The aircraft continued descending  
5 in the relatively uncontrolled inverted attitude to  
6 water impact.

7 At this time, I would like to show a brief  
8 animation of the aircraft final maneuver. As a  
9 courtesy to family members who may not wish to see the  
10 animation, I will pause briefly for them to be excused  
11 before beginning. The animation begins approximately  
12 25 seconds before the final dive.

13 (Pause)

14 MR. CAMPBELL: At the beginning of the  
15 animation, the crew is commenting on controllability  
16 and discussing damage. Then there are the faint thumps  
17 and the call for the slats and flaps and then the loud  
18 noise and the loss of control.

19 In order to more fully understand the  
20 conditions that the crew of this flight faced, we have  
21 prepared two additional presentations, the first begin  
22 Mr. Jeff Guzzetti, the Systems Group Chairman, who will  
23 describe the operation of the horizontal stabilizer  
24 jackscrew assembly and the failure sequence.

25 MR. GUZZETTI: Good morning, Madam Chairman

1 and Members of the Board.

2           The MD-80 is a twin-engine transport category  
3 airplane which the FAA certified in August 1980. The  
4 MD-80 was derived from earlier DC-9 series model  
5 airplanes and as a result much of the MD-80's  
6 structure, systems, components and installations are  
7 similar to the DC-9 which entered service back in  
8 December 1965.

9           Longitudinal trim control for the MD-80 is  
10 provided by the horizontal stabilizer. The tail  
11 surface is a critical flight control not only because  
12 it provides a constant aerodynamic balancing force that  
13 allows the airplane to maintain controlled flight but  
14 also because the movement of the stabilizer can be  
15 commanded to aid in controlling the airplane's pitch or  
16 up and down movement.

17           Staff has prepared a six-minute animation to  
18 show how the horizontal stabilizer operates and also to  
19 show the sequence of failures that occurred during the  
20 accident flight. So, if we can cue up that animation  
21 now, I'll narrate it, and while we're waiting, I'd like  
22 to thank Kevin Renze and Doug Brazy for producing this.

23           The horizontal stabilizer is mounted on top  
24 of the 18-foot high vertical stabilizer in a T-tail  
25 configuration. The horizontal stabilizer has a span of

1 about 40 feet and comprises a center box and a left  
2 and right outboard section. In this animation, only  
3 the left outboard section is shown. The leading edge  
4 of the horizontal stabilizer can be raised or lowered  
5 as the entire surface pivots about its hinge points.  
6 The stabilizer's normal limit of motion upward is 2.1  
7 degrees. This upward motion tends to pitch the  
8 airplane's nose down abbreviated by the letters AND.  
9 The normal limit of motion downward is 12.2 degrees  
10 which tends to pitch the airplane's nose up or ANU.

11 Here you see the stabilizer move throughout  
12 its full range of motion before returning back to its  
13 neutral or zero degree position. For the purposes of  
14 this presentation, the speed of the stabilizer shown  
15 here is twice that of actual operation. The horizontal  
16 stabilizer is connected to the vertical stabilizer by  
17 hinges at its aft spar and with a single jackscrew  
18 actuator assembly at its front spar near its leading  
19 edge.

20 The animation will now provide a cut-away  
21 view of the tail assembly so that you can view the  
22 actuating mechanism for the horizontal stabilizer. As  
23 the view shifts, let me take this time to inform you  
24 that movement of the stabilizer can be commanded either  
25 automatically by the autopilot or manually by the

1 flight crew. Any of these commands activates either  
2 the primary or alternate trim motor shown here in  
3 purple. The motors are connected to a gear box shown  
4 in black which is needed to rotate the acme screw shown  
5 in blue by applying a torque to a titanium torque tube  
6 that is held fixed inside the screw.

7 The upper end of the jackscrew assembly is  
8 attached to the horizontal stabilizer and the lower end  
9 is threaded through the acme nut shown in yellow which  
10 is attached to the vertical stabilizer. The jackscrew  
11 assembly also has upper and lower mechanical stops  
12 shown here in green attached to the screw to stop screw  
13 rotation in case of a malfunction of the normal  
14 electrical shut-off controls. The entire jackscrew  
15 assembly is covered by a tip fairing on top of the  
16 vertical stabilizer. This fairing is attached with  
17 brackets that I will mention later in this  
18 presentation.

19 As the animation shows the stabilizer moving  
20 toward its upper and lower limits of travel, you'll  
21 notice that the rotation of the screw through the non-  
22 moving nut causes the screw to translate upward and  
23 downward. This rotation between the case-hardened  
24 steel screw and the softer aluminum bronze nut  
25 gradually wears down the thickness of the nut threads.

1 It is important to note here that the acme nut is by  
2 design the wearing component in this system.  
3 Therefore, frequent lubrication is needed to minimize  
4 the rate of nut thread wear in order to maintain the  
5 expected wear rate of about 1,000ths of an inch per  
6 thousand flight hours.

7 Additionally, a periodic inspection procedure  
8 to monitor this wear is also required. This inspection  
9 is known as the end-play check, and if the wear exceeds  
10 40,000ths of an inch, then the jackscrew assembly is to  
11 be replaced. These maintenance and inspection  
12 requirements will be discussed in detail later in this  
13 meeting.

14 The animation will now depict the system  
15 operation and sequence of failures that occurred during  
16 the accident flight. Flight data recorder information  
17 indicated that the accident airplane's longitudinal  
18 trim control system was functioning normally during the  
19 airplane's descent and landing into Puerto Vallarta on  
20 the flight just before the accident flight. Later,  
21 while preparing for take-off from Puerto Vallarta, the  
22 accident flight crew had trimmed the airplane to a  
23 seven-degree airplane nose-up position as you see here.

24 As the airplane was climbing out after take-  
25 off, the horizontal stabilizer moved at the normal

1 primary trim motor rate of one-third of a degree per  
2 second from seven degrees to two degrees airplane nose  
3 up. Thereafter, as the airplane continued to climb  
4 through 6,200 feet, the stabilizer moved at the normal  
5 alternate trim motor rate of one-tenth of a degree per  
6 second from two degrees airplane nose up to 0.4 degrees  
7 airplane nose down. Operation of the alternate trim  
8 motor during this period is consistent with use of the  
9 autopilot. Again, for the purposes of this  
10 presentation, the alternate trim motor speed of the  
11 stabilizer shown here is twice that of actual  
12 operation.

13 As the airplane continued to climb through  
14 about 23,000 feet, the stabilizer stopped moving at the  
15 0.4 degree position. This cessation of stabilizer  
16 movement is consistent with the mechanical jam.  
17 Evidence suggests that this jam occurred due to the  
18 deteriorated condition of the acme nut threads that  
19 resulted from a lack of lubrication.

20 Two hours and 20 minutes after this jam  
21 occurred, immediately after the autopilot was  
22 disconnected by the flight crew with the activation of  
23 the primary trim, the stabilizer traveled from its  
24 jammed position to about the 3.1 degree airplane nose  
25 down position. Aircraft perform and kinematic analyses

1 indicate that the severely-worn threads of the acme nut  
2 stripped out at this point, allowing the acme screw to  
3 be pulled upward through the nut until the lower  
4 surface of the acme nut contacted the lower mechanical  
5 stop on the acme screw. The airplane entered the  
6 initial dive as the stabilizer moved. The lower  
7 mechanical stop and the torque tube that was connected  
8 to it was not designed to withstand the aerodynamic  
9 loads produced by the horizontal stabilizer.

10 About eight minutes later, after the airplane  
11 had recovered from the first dive, the torque tube and  
12 lower mechanical stop separated. The horizontal  
13 stabilizer moved upward from the 3.1 airplane nose down  
14 position to about a 3.6 airplane nose down position  
15 where it contacted the fairing brackets that were  
16 attached to the structure of the vertical stabilizer.  
17 These brackets were never designed to carry the tail  
18 loads. Several seconds after the horizontal stabilizer  
19 contacted the fairing brackets, the brackets failed,  
20 releasing the horizontal stabilizer. The resulting  
21 upward movement of the horizontal stabilizer's leading  
22 edge caused an uncontrollable downward pitching of the  
23 airplane from which recovery was not possible.

24 And that concludes my presentation.

25 ACTING CHAIRMAN CARMODY: Thank you, Mr.

1 Guzzetti.

2 MR. RODRIGUEZ: Our second presentation is by  
3 Mr. Joe Epperson, the Materials Group Chairman, who  
4 will describe recovery of the horizontal stabilizer  
5 jackscrew assembly and how it failed.

6 MR. EPPERSON: Good morning, ladies and  
7 gentlemen.

8 This morning, I will be giving you a brief  
9 description of some of the significant findings with  
10 respect to the metallurgical and mechanical behavior of  
11 the horizontal trim system.

12 As shown here, the jackscrew assembly was  
13 recovered from the ocean with the acme nut separated  
14 from the acme screw. At this point, the assembly had  
15 only received fresh water rinses and was still attached  
16 to the horizontal stabilizer. Acme nut thread remnants  
17 were found entwined around the center portion of the  
18 acme screw. This photograph shows a closer view of the  
19 acme nut thread remnants wrapped around the center  
20 portion of the acme screw in their recovered condition.

21 When examined shortly after recovery, no  
22 grease or lubricant was detected in the working area of  
23 the screw. Grease covered by sand from the ocean  
24 bottom was found on the lower end of the screw and an  
25 oily sheen was present on the upper end. Grease was



1 also found on the lower mechanical stop which had  
2 separated after the torque tube fractured at its lower  
3 end. The acme screw showed relatively minor wear and  
4 no evidence of abrasive wear.

5 The separated lower mechanical stop was  
6 recovered from within the vertical stabilizer structure  
7 and was partially covered by grease. The upper surface  
8 shown here after cleaning was damaged in several  
9 locations by contact with the lower end of the acme  
10 nut. These marks could have only been made after  
11 complete separation of the nut threads and the contact  
12 would induce offset loading and bending in the torque  
13 tube. Additional damage to the stop indicates that the  
14 screw rotated after the lower stop contacted the nut.

15 The acme nut was recovered separated from the  
16 jackscrew assembly but still attached in its original  
17 position in the vertical stabilizer. The threads on  
18 the interior of the nut were completely stripped and no  
19 grease was present inside the bore. However, red and  
20 green grease was found in various areas on the exterior  
21 of the nut and on surrounding structure. Additionally,  
22 the grease fitting passageway of the nut was found  
23 blocked by degraded grease containing wear particles  
24 and flakes from the acme nut.

25 This slide illustrates and compares the

1 internal threaded area of the accident nut on the right  
2 to that of a worn nut removed from service on the left.

3 The sections -- the nut has been sectioned  
4 longitudinally here. Significant thread material  
5 remained in the used nut while on the accident nut none  
6 remained.

7 When the jam between the acme screw and the  
8 acme nut released at the beginning of the initial dive,  
9 the acme screw pulled upward through the acme nut until  
10 it contacted the lower mechanical stop, creating the  
11 previously-mentioned offset loading. The torque tube  
12 subsequently fractured at its lower end as a result of  
13 low-cycle fatigue due to the continued flight loads.  
14 The fracture was not characteristic of a single event.

15 The dash line in the inserted image here  
16 depicts the extent of fatigue on a portion of the  
17 crack. Mechanical tests established that similar  
18 fractures could be produced in as few as 100 cycles by  
19 applications of very high cyclic stresses, similar to  
20 those experienced by the accident components.

21 In order to address issues related to thread  
22 wear and failure mechanism and to the load environment  
23 in which the grease operated, the Safety Board and  
24 Boeing initiated finite element studies to analyze the  
25 stress and deformation in the jackscrew under

1 operational loads. Two actual models containing all 32  
2 threads in the acme nut were analyzed to investigate  
3 load transfer between the screw and the nut and local  
4 3-dimensional analyses were performed to study the  
5 contact pressure, nut thread deformation, and the  
6 influence of nut thread wear.

7           Analysis of these models showed that the  
8 actual stress distribution within the nut was non-  
9 uniform and that in certain conditions, as few as four  
10 threads could be carrying as much as 90 percent of the  
11 load. As wear progressed on more highly-loaded  
12 threads, the loads would shift or move to less-worn  
13 threads. The results also highlighted that the local  
14 contact stresses and distribution did not change as the  
15 wear progressed to well beyond the operational wear  
16 limits on the acme nut thread.

17           The contact pressures for an extreme load  
18 condition of 8,000 pounds averaged 3 to 4,000 pounds  
19 per square inch over the contact area. At extreme wear  
20 levels, the non-uniform load transfer caused bending  
21 deformation under normal flight loads, consistent with  
22 the unique shape of the remnants. The non-uniform  
23 loading of the threads is also consistent with the  
24 incremental shearing of the threads and production of  
25 the thread remnants.

1           Fractured remnants comprising approximately  
2 75 percent of the acme nut threads were recovered from  
3 the working area of the screw. This view shows the end  
4 of one of these remnants. The remnants were sheared at  
5 the thread route and were less than 10 percent of their  
6 original thickness. They had multiple wear surfaces  
7 indicating multiple stages of wear and deformation  
8 resulting in the unique shape.

9           This slide illustrates the wear and  
10 deformation sequence as indicated by the shape of the  
11 remnants themselves. The first position shows a new  
12 condition with the remnant shape imposed upon a new  
13 thread. Wear would be expected to progress with a  
14 normal geometry up to Position 2. This corresponds to  
15 an approximately end play of 82,000ths of an inch.

16           As was just discussed, the finite element  
17 analyses indicated that beyond this level of wear, the  
18 thread would begin to experience large degrees of  
19 bending deformation. Position 3 shows the relative  
20 positions of the nut and screw after some deformation  
21 and additional wear. Position 4 shows the deformed and  
22 non-uniformly-worn thread remnants just before fracture  
23 and separation from the nut.

24           In conclusion, these are some of the findings  
25 that arose from the metallurgical investigation of the

1 jackscrew assembly and the overall investigation.  
2 There were no material defects or conditions that  
3 contributed to the wear nor were there any structural  
4 conditions, such as wobbling of the jackscrew, that  
5 would contribute to the wear.

6           Upon the recovery from the ocean, there was  
7 no lubrication in the working area of the acme screw.  
8 Furthermore, based on the presence of grease elsewhere  
9 on the recovered structure, the absence of lubrication  
10 on the screw cannot be explained by impact with the  
11 ocean, by exposure to seawater before recovery, or by  
12 the recovery and cleaning operations. Also, the lack  
13 of abrasive wear to the threads of the acme screw  
14 indicated that the jackscrew assembly grease had not  
15 been contaminated with abrasive particles.

16           The finite element analyses showed that local  
17 contact stresses and their distribution between the  
18 screw and the nut did not change as wear progressed  
19 beyond the operational limits of the acme nut. The  
20 wear was caused by sliding contact consistent with an  
21 unlubricated condition. The low-cycle fatigue crack in  
22 the torque tube was generated during the accident  
23 flight by unusual loading after complete loss of the  
24 acme nut threads.

25           This completes my presentation on

1 metallurgical findings.

2 Thank you.

3 MR. RODRIGUEZ: Our examination of the failed  
4 threads of the acme nut led to an immediate effort to  
5 ensure that there were no other jackscrews in the fleet  
6 that were about to fail. On February 9th, the day  
7 after the jackscrew was recovered, Alaska Airlines  
8 Maintenance Department and Boeing independently took  
9 steps to inspect all DC-9, MD-80, MD-90, and B-717  
10 aircraft and to report findings of various inspection  
11 conditions of the jackscrew assembly. These  
12 inspections formed the basis for Airworthiness  
13 Directive AD-2000-0351, issued on February 11th, by the  
14 FAA.

15 During the initial fleet survey required by  
16 the AD, two additional MD-80s in the Alaska Airlines  
17 fleet, November 981 Alpha Sierra and November 982 Alpha  
18 sierra, were found to have jackscrews worn beyond  
19 limits. The wear rate on these two aircraft was over  
20 four times the wear rate anticipated by the  
21 manufacturer.

22 With three deficient jackscrews out of a  
23 fleet of only 34 aircraft, the investigation focused on  
24 possible unique differences in the Alaska Airlines  
25 operation of the MD-80s and that of other much larger

1 fleets in the industry. One factor was that Alaska  
2 Airlines was the only operator using Aeroshell 33 for  
3 lubrication. In order to assess the possible  
4 involvement of Aeroshell 33 on the wear characteristics  
5 of the Alaska Airlines fleet, we formed a Grease Group  
6 to study the relative characteristics of Aeroshell 33  
7 and Mobilgrease 28 and the effectiveness of each as a  
8 lubricant.

9 Dr. Joseph Kolly was the chairman of this  
10 group, and he will now give an overview of the group's  
11 activities and findings.

12 MR. KOLLY: Good morning, Madam Chairman and  
13 Members of the Board.

14 This morning, I would like to present the  
15 results of the testing that was conducted as part of  
16 this investigation into lubricating greases. As you  
17 just heard from Mr. Epperson, the recovered jackscrew  
18 was lacking grease and did not exhibit any material or  
19 fabrication defects. These factors suggest that  
20 lubrication effects played a key role in the excessive  
21 wear of the acme nut threads.

22 To further evaluate what role lubrication  
23 played in the accelerated wear, the investigation  
24 focused on the two brands of grease that were in use  
25 for jackscrew lubrication at Alaska Airlines,

1 Mobilgrease 28 and Aeroshell 33. Until 1997, Alaska  
2 Airlines used Mobilgrease 28. Mobilgrease 28 had a  
3 long history of satisfactory performance at Alaska  
4 Airlines. In fact, a majority of other carriers also  
5 used Mobilgrease 28 for jackscrew assembly lubrication  
6 and they have also experienced satisfactory  
7 performance.

8           Beginning in 1997 and up to the time of the  
9 accident, Alaska Airlines specified the use of  
10 Aeroshell 33 for lubrication of the jackscrew assembly  
11 components, although Mobilgrease 28 was apparently  
12 still also used.

13           The picture on the left shows a magnified  
14 view of a small amount of residual grease taken from  
15 the accident jackscrew assembly. Only a small amount  
16 was recovered from the screw and only from the  
17 locations outside the normal operating regions of the  
18 screw. Its appearance indicates it is highly degraded.  
19 It no longer has the semi-fluid character of fresh  
20 grease, like that exhibited by the sample of new unused  
21 grease shown on the right.

22           Because of the limited amount of grease  
23 recovered and its highly-degraded condition, a perfect  
24 chemical identification of the grease was not possible.  
25       However, analysis of the residue was consistent with



1 the presence of both Aeroshell 33 and Mobilgrease 28.

2           These images are of higher magnifications of  
3 the degraded grease sample just shown. The image on  
4 the left shows the presence of a high concentration of  
5 metallic particles. The image on the right shows a  
6 magnified view of these particles. These particles are  
7 aluminum bronze wear particles that were shed from the  
8 acme nut as a result of sliding wear. Particles  
9 generated by sliding wear are easily identified by  
10 their flat flake-like shape. Sliding wear is the type  
11 of wear that is expected in jackscrew operation. These  
12 particles do not indicate that other wear conditions  
13 were present. There is no evidence that wear was  
14 caused by corrosion or wear caused by abrasive foreign  
15 materials.

16           One of the primary questions that our testing  
17 was designed to address was whether Alaska Airlines  
18 switch to Aeroshell 33 could have resulted in poor  
19 lubricating performance and contributed to the  
20 accelerated wear of the acme nut threads that led to  
21 the accident. Therefore, we developed a test program  
22 to determine the relative performance of Aeroshell 33  
23 compared to that of Mobilgrease 28 under simulated  
24 conditions of jackscrew operations.

25           A test program was developed with three basic

1 parts consisting of grease testing, exposure testing,  
2 and wear testing. I will briefly describe the  
3 activities and results in each of these areas. Testing  
4 of the physical properties of Aeroshell 33 and  
5 Mobilgrease 28 was accomplished by the U.S. Navy  
6 Aerospace Materials Laboratory. The naval laboratory  
7 is the steward of the military specification or Mil  
8 Spec of both of these types of greases and has  
9 extensive experience in grease testing and interpreting  
10 their results.

11           Standardized grease tests were conducted on  
12 both Aeroshell 33 and Mobilgrease 28 and of many  
13 different mixture ratios of these two greases. These  
14 are the types of tests that are used to qualify greases  
15 under military specifications. The tests showed that  
16 the greases and their mixtures largely behaved in a  
17 normal or expected fashion. In a few instances of  
18 mixing, excursions from normal were marginal and  
19 considered to have an insignificant effect on  
20 performance. As a result, the investigation found that  
21 mixing of Aeroshell 33 and Mobilgrease 28, as for  
22 example would be caused by alternating use of these  
23 greases during maintenance, would not have  
24 significantly deteriorated the properties of either of  
25 the two greases.

1           Early in the investigation, there were  
2 questions raised regarding the possibility of  
3 corrosion. Therefore, a comprehensive set of exposure  
4 tests were performed to observe the effects of grease  
5 on aluminum bronze test specimens when exposed to  
6 simulated aircraft operating conditions. For this  
7 work, we contracted with the U.S. Navy Aerospace  
8 Materials Laboratory to conduct the exposure  
9 experiments. The subsequent chemical analysis was  
10 conducted by Science Applications International.

11           In these tests, a variety of conditions were  
12 examined. These include the effects of grease mixing  
13 and possible in-service contamination due to the  
14 aircraft's operating environment. Further,  
15 temperatures and durations of exposure were varied to  
16 represent extremes in the operating environment.

17           A sample test specimen from these tests is  
18 shown on the slide. Under certain conditions,  
19 Aeroshell 33 deposited a small localized discoloration  
20 on the surface of the test specimen. An example of  
21 this discoloration is shown in the slide just above the  
22 yellow arrow. The discoloration appears as a vertical  
23 stripe about one millimeter in width and occurred at  
24 the interface where the area of grease, the area  
25 covered with grease met an area that was not covered

1 with grease.

2           A chemical analysis of this area showed that  
3 it was not a corrosion product. Rather, it was a  
4 deposit caused by the reaction of anti-wear additives  
5 in the Aeroshell 33 grease. The presence of such  
6 deposits is not considered detrimental to the aluminum  
7 bronze.

8           The most significant element of this  
9 investigation's test program was the wear testing  
10 conducted jointly by Rensselaer Polytechnic Institute  
11 and Battelle Memorial Institute. These tests were  
12 designed to evaluate the effects that various factors  
13 of in-service operation have on the wear rate of  
14 aluminum bronze.

15           Before I describe the test results, I would  
16 like to briefly discuss the test method we selected for  
17 these tests. We chose a standard wear test method  
18 called the Block-on-Ring method. This test ring is  
19 shown on the slide before you now. The method employs  
20 a small stationary block that is forced against a  
21 rotating ring. These components are lubricated with  
22 grease where they come into contact. At this contact,  
23 the ring slowly wears a divot into the surface of the  
24 block. By carefully measuring the wear of the block  
25 during the test, we can very accurately determine the

1 wear rate caused by each type of grease.

2           The important features of actual jackscrew  
3 operation were captured by the Block-on-Ring test  
4 method. First, the materials used were the same as in-  
5 service jackscrew assembly materials. Test specimens  
6 were manufactured from actual jackscrew components with  
7 a block milled from a scrap acme nut and a ring turned  
8 from an acme screw forging. Second, the test pressures  
9 spanned nearly the entire range of pressures  
10 experienced between the threads of a jackscrew during  
11 aircraft operation. Third, the speeds at which the  
12 blocks-on-ring slide relative to each other are very  
13 close to that of the in-service jackscrew. Fourth, the  
14 type of motion used in the test is a reciprocating  
15 sliding motion which closely replicates the  
16 intermittent and reversing motion of the jackscrew.  
17 And finally, the geometry of the contact between the  
18 block-on-ring is over a discreet area, similar to the  
19 contact geometry of the jackscrew's mating screw  
20 threads.

21           Therefore, the block-on-ring test method was  
22 determined to be the best method to simulate the wear  
23 behavior of an actual jackscrew assembly under various  
24 lubricating conditions.

25           The tests were conducted for a variety of

1 conditions that were designed to replicate actual in-  
2 service conditions, such as various average pressures,  
3 grease mixtures, contaminants, grease aging, and sub-  
4 freezing conditions. A total of 49 tests were run  
5 using the block-on-ring test method.

6 The results shown here are from an extensive  
7 set of tests conducted at high average pressure loads.

8 The data are shown as colored bars with green  
9 representing tests using Aeroshell 33 grease, red  
10 representing Mobilgrease 28, and blue representing a  
11 50-50 mixture of the two greases. The scale on the  
12 left indicates the wear rate of aluminum bronze  
13 experienced during the test. The height of each bar  
14 represents the wear rate produced by that particular  
15 grease.

16 The first series of tests shown before you  
17 was conducted on the grease in its new out-of-the-  
18 container condition. These tests showed that Aeroshell  
19 33 had the lowest wear rate. The highest wear rate was  
20 achieved using Mobilgrease 28 and the test using a  
21 mixture fell in between these values.

22 We know that the exact wear rate experienced  
23 by the accident airplane since the last end-play check  
24 cannot be determined. However, the condition of the  
25 recovered acme nut remnants indicates the wear rate was

1 severe. Based on this information, we can arrive at a  
2 conservative estimation of a minimum wear rate for the  
3 accident aircraft. This minimum value is shown on the  
4 graph as a horizontal purple line.

5 Because these tests replicate the wear  
6 behavior of an actual jackscrew assembly in service, we  
7 can compare the wear rates of these tests to that of  
8 the minimum value estimated for the accident aircraft.

9 These data demonstrate that the use of Aeroshell 33 or  
10 a mixture containing Aeroshell 33 cannot account for  
11 the severe wear experienced by the accident aircraft.

12 The next set of tests examined the effect of  
13 fluid contamination of the grease. Water was added to  
14 the grease representing condensate generated during  
15 flight. As you can see, the addition of water had  
16 little effect on wear rate. We also tested Aeroshell  
17 33 contaminated with salt water representing conditions  
18 of a coastal environment and de-icing fluid  
19 representing inadvertent exposure during de-icing  
20 procedures. Neither of these conditions significantly  
21 altered the wear rate of test specimens lubricated with  
22 Aeroshell 33 and continued to exhibit wear rates below  
23 those lubricated with pure Mobilgrease 28. As you can  
24 see, none of these contamination conditions could  
25 account for the severe wear rate experienced by the

1 accident aircraft.

2 Another test examined Aeroshell 33 after it  
3 had been used in the previous tests. This used grease  
4 contained significant amounts of wear debris which was  
5 allowed to age for several months before being  
6 retested. The results show no significant effect on  
7 wear rate.

8 Another series of tests examined the grease's  
9 performance at subfreezing temperatures. The tests  
10 were conducted in an environmental chamber at  
11 temperatures of -20 degrees Fahrenheit to simulate  
12 flight temperatures. Subfreezing temperatures also had  
13 little effect on the wear performance of either grease.

14 At this point, we can see there is no indication that  
15 the use of Aeroshell 33 produces a higher wear rate  
16 than Mobilgrease 28. Additionally, there is no  
17 indication that any of these conditions could have  
18 resulted in the severe wear experienced by the accident  
19 aircraft.

20 The last condition shown here is one in which  
21 the test was run without any lubrication. The results  
22 of this test are shown as the gray bar. This produced  
23 wear rates on the order of 10 times that of Mobilgrease  
24 28. The dramatic difference in wear rate is easily  
25 identifiable. Thus, the unlubricated condition is the



1 only condition that was found that could explain the  
2 severe wear rate of the accident aircraft. We have  
3 uncovered no other explanation for that severe wear.

4 We examined the role of lubrication from a  
5 number of angles. In the end, there was no evidence  
6 that the use of Aeroshell 33 would have caused the  
7 severe and accelerated wear experienced by the accident  
8 aircraft's jackscrew. The only factor found to explain  
9 this level of severe wear is a lack of lubrication.

10 This concludes my presentation.

11 MR. RODRIGUEZ: Madam Chairman, at this time,  
12 before we proceed to other presentations on other  
13 issues, we're prepared to answer questions on the  
14 jackscrew failure sequence or grease and wear testing.

15 ACTING CHAIRMAN CARMODY: Thank you, Mr.  
16 Rodriguez. Thank you, Mr. Kolly, for your  
17 presentation. They've all been excellent this morning.

18 Member Hammerschmidt, any questions on this  
19 section?

20 MEMBER HAMMERSCHMIDT: No questions at this  
21 time. I would like to commend the staff for those  
22 outstanding presentations.

23 ACTING CHAIRMAN CARMODY: Member Goglia?

24 MEMBER GOGLIA: Yes, Madam Chairman.

25 Mr. Kolly, we have seen in the press a number

1 of concerns raised by folks involved with this  
2 accident, parties to this investigation, about the  
3 loads that were used by the NTSB in determining the  
4 wear rates.

5 I wonder if you would explain to everybody  
6 why we chose the loads that we did and the effects of  
7 those loads on the testing.

8 MR. KOLLY: First, it starts with a  
9 calculation of the aerodynamic loads imparted to the  
10 jackscrew that were conducted by our Performance Group  
11 through aircraft simulation.

12 Those loads were then transferred to a finite  
13 element analysis which showed a non-uniform  
14 distribution of loading across the screw threads. We  
15 used that average pressure across the screw thread  
16 flanks to conduct the majority of our wear tests. We  
17 also spanned -- we were also very conservative in that  
18 we spanned a pressure range much lower and much higher,  
19 covering basically every pressure range that could be  
20 conceived in the jackscrew mating threads.

21 MEMBER GOGLIA: Now, you mentioned that the  
22 loads vary over the screw, the length of the nut and  
23 screw contact. Would you expand that explanation just  
24 a little bit? How can that happen if it's precisely  
25 machined?

1           MR. KOLLY: It has to do with the way the  
2 loads are transferred through a material and the amount  
3 of elastic deformation that a mating thread goes  
4 through, that the threads closest to the applied load  
5 share more of the load, and then as you go away from  
6 the applied load through the series of threads, the  
7 load diminishes.

8           MEMBER GOGLIA: And what effect does that  
9 have on wear of the threads? In this case, the nut  
10 because it's the sacrificial piece.

11           MR. KOLLY: Wear is proportional to pressure,  
12 and so the threads with the highest pressure would tend  
13 to wear and then the pressure loads would tend to even  
14 out and start to become more and more involved with the  
15 wear of the other threads and it would progress towards  
16 a more uniform pressure distribution and a more uniform  
17 wear distribution.

18           MEMBER GOGLIA: So, you're saying in time,  
19 over time, the load, although in the beginning it may  
20 be carried by a few threads on either end closest to  
21 the load, over time, it gets spread over the entire  
22 nut?

23           MR. KOLLY: Yes. An average over the life of  
24 the screw is that all the threads eventually obtain the  
25 same wear.

1           MEMBER GOGLIA: Okay. Thank you. I have no  
2 further questions on this area.

3           ACTING CHAIRMAN CARMODY: Member Black?

4           MEMBER BLACK: Just a couple.

5           I guess we'll start in order. Mr. Epperson,  
6 could you talk a little bit about how the grease gets  
7 on to -- gets from the application point into the nut  
8 and what you found when you examined that passageway on  
9 the accident nut assembly?

10          MR. EPPERSON: Yes. One of the means of  
11 application of grease is through a grease fitting on  
12 the nut. It's referred to -- commonly referred to as  
13 the "zerk" fitting. You see it in every-day  
14 applications everywhere.

15          The zerk fitting is a one-way check valve on  
16 the outside of the nut. It's actually located on the  
17 upper forward surface of the nut, but then it's  
18 connected to the interior of the nut, the thread area,  
19 by a drilled passageway. This passageway also has a  
20 large counterbore so that it supplies grease to both  
21 thread paths.

22          On the accident aircraft, as it was  
23 recovered, this counterbore and part of the passageway  
24 were blocked with a hard crumbly degraded grease  
25 containing wear particles. We had to physically remove

1 this to get the passageway opened.

2 MEMBER BLACK: What did you find in the  
3 channel? This assembly was supposed to have been  
4 lubricated a couple of months before the accident, is  
5 that correct?

6 MR. EPPERSON: That is correct. We found  
7 some remnants of red grease that was very similar to  
8 Mobil 28 inside the grease fitting and around the  
9 grease fitting.

10 MEMBER BLACK: But if this were blocked, it  
11 would be difficult for the grease to get inside the nut  
12 which is part of the lubrication process?

13 MR. EPPERSON: We didn't fully test whether  
14 the blockage that was there would impede grease flow,  
15 how much it would impede grease flow. It certainly  
16 would to some extent. Whether it would totally stop  
17 grease, we didn't investigate that for some  
18 investigative reasons. We decided to take the blockage  
19 out before we passed additional grease through it which  
20 would have contaminated what we had there. So, we had  
21 to make a choice there. The blockage certainly would  
22 have impeded grease flow. How much is a question.

23 MEMBER BLACK: Did the blockage appear to be  
24 of some age or could you tell?

25 MR. EPPERSON: Difficult to say at what age.

1 It was definitely severely degraded. It had no  
2 grease-like appearance at all. It was more like  
3 charcoal, if you will.

4 MEMBER BLACK: Okay. We don't have a slide  
5 of that?

6 MR. EPPERSON: Figure 17. It's in the  
7 report.

8 MEMBER BLACK: Actually, I have one, if worst  
9 comes to worse.

10 MR. EPPERSON: That's following Page 125 in  
11 the report, Figure 17.

12 MEMBER BLACK: There you go.

13 MR. EPPERSON: Yes. This is my poor drawing  
14 illustrating the arrangement of materials. The threads  
15 are on the right side. I put threads in this case just  
16 to show that that's where they were supposed to be. In  
17 the accident, there weren't any obviously. The  
18 blockage there extends into the -- from the counterbore  
19 and back into the smaller diameter passageway.

20 MEMBER BLACK: Do you have Exhibit 50 that  
21 shows the material once you got it out?

22 MR. EPPERSON: It's not part of the report,  
23 but we can --

24 MEMBER BLACK: Okay. That's all right if you  
25 don't have it. But it was a dry material, --

1 MR. EPPERSON: It was --

2 MEMBER BLACK: -- clumps of dry material.

3 MR. EPPERSON: -- very dry. It basically  
4 resembled crumbled-up charcoal.

5 MEMBER BLACK: Okay.

6 MR. EPPERSON: If you can imagine how that  
7 has a dry crumbly consistency, and it was embedded with  
8 -- heavily embedded with wear particles.

9 MEMBER BLACK: Wear particles. Second  
10 question for you. You mentioned that it took about a  
11 hundred cycles on the torque tube to produce the low-  
12 cycle failure. You think, are a hundred loadings and  
13 unloadings off axis?

14 MR. EPPERSON: In our mechanical tests that  
15 we performed to reproduce the fractured surface, we  
16 could get it -- this was on a subsize specimen. So, it  
17 was not an exact replication of the torque tube. At  
18 very high cyclic loads, very high uniform cyclic loads,  
19 we could get it to fracture in a hundred cycles.

20 Looking at the loading that was on the acme  
21 -- on the jackscrew assembly following the first dive,  
22 it's very much non-uniform. It's typically referred to  
23 as spectrum loading.

24 MEMBER BLACK: Perhaps Mr. Bower has a  
25 diagram of that he might be going to produce later or

1 -- what I'm -- I'm afraid some people in the audience  
2 will confuse cycles of loading with cycles on the  
3 airplane. In other words, a take-off and landing, and  
4 the graph of the variances in the load after the first  
5 event might show how that could have accumulated  
6 between the time of the first event and the final  
7 failure of the torque tube.

8 DR. BOWER: Stand by, Member Black. We have  
9 one of my charts coming up.

10 MEMBER BLACK: Well, if you're going to do it  
11 later, Dan, you can explain it then.

12 DR. BOWER: Except I don't have a planned  
13 presentation.

14 MEMBER BLACK: Okay.

15 DR. BOWER: To, this should come up in a  
16 second.

17 MEMBER BLACK: Thank you.

18 DR. BOWER: It should be the eighth slide in  
19 my presentation. What this slide will show is the  
20 calculated tensile load on the jackscrew assembly that  
21 we calculated here at the Safety Board in the  
22 Performance Group and also a comparison with  
23 calculations provided by Boeing.

24 MEMBER BLACK: Perhaps next time, I should  
25 give you a list, John.



1 DR. BOWER: There we go. There, we have it  
2 now.

3 MEMBER BLACK: So, what we're seeing is the  
4 load on the left side and the first event is that peak  
5 on the left side?

6 DR. BOWER: Yes. This starts -- this time of  
7 this graph starts about the time right at the first  
8 initial dive, and we see the load is the calculated,  
9 the dark blue line here, and also for comparison, the  
10 dots are the numbers provided by Boeing for the same  
11 time period, and we start out on the left-hand side  
12 with the -- right at the initial dive and during the  
13 time when we are going through the dive and reach about  
14 the maximum overspeed portion is when we have our  
15 maximum load, 24,000 pounds, and that's the tensile  
16 load on that jackscrew assembly, again all developed  
17 the aerodynamic loads on the stabilizer. And after  
18 that, we have through the rest of them, the next eight-  
19 nine minutes, just a very cyclic loading approximately  
20 between 13 to 15,000 pounds, up until the final  
21 failure.

22 MEMBER BLACK: And of course, the airplane is  
23 changing speed during this time period and attitude,  
24 pitch angle and that, and the earnest efforts of the  
25 pilots to try to recover, so you can easily see in all

1 of those wiggings there that this -- each of this --  
2 these would have been loading that torque tube right at  
3 the very bottom, Joe, and that's where --

4 DR. BOWER: Correct.

5 MEMBER BLACK: -- the cycles come from.

6 DR. BOWER: On the bottom graph is actually  
7 the FDR elevator. You see with each elevator input, it  
8 does also change the load, also.

9 MEMBER BLACK: Right. Thank you. Sorry to  
10 slow things down there, but I thought those were  
11 important points.

12 Actually, I have one more for Mr. Kolly. You  
13 mentioned a minute ago that -- or someone mentioned  
14 that there were 34 aircraft in the fleet about the time  
15 this accident occurred, and we had three airplanes that  
16 had extraordinary wear rates. That would be 981, 982  
17 and the accident airplane 963.

18 So, if there had been some sort of grease  
19 contamination by mixing or by all Aeroshell or all 28  
20 or some mixture, all of these airplanes were being  
21 lubricated in the same general locations, were they  
22 not?

23 MR. GUZZETTI: Yes. I could probably address  
24 that a little bit better.

25 Pretty much, yeah. Most of Alaska Airlines

1 fleet of MD-80s were being lubricated either at Oakland  
2 during their C check, or during -- at San Francisco on  
3 the line. Maybe 20 percent of their fleet were getting  
4 lubes on the line in Seattle or Los Angeles, but for  
5 the most part, San Francisco and Oakland were the  
6 places that the lubrications were occurring.

7 MEMBER BLACK: So, I think I pulled one out  
8 of your data and it was a sister ship to 963, I believe  
9 it was 965, and it had almost identically the same  
10 lubrication history, yet it had an average wear rate.

11 MR. GUZZETTI: That's correct. We found that  
12 other than those three airplanes that were high-  
13 wearing, the rest of Alaska's MD-80 fleet, no matter  
14 where it was lubricated, had an excellent wear rate,  
15 less than -- less even than the Boeing average of  
16 1,000ths per thousand flight hours.

17 MEMBER BLACK: About 70 something percent of  
18 them, I think, had less than average, yes.

19 MR. GUZZETTI: Right.

20 MEMBER BLACK: So, thank you.

21 ACTING CHAIRMAN CARMODY: Mr. Kolly, this is  
22 on grease. As I recall, you said in your presentation  
23 that there was no evidence of corrosion, that the  
24 damage, the wear damage you saw was what you would  
25 expect, but it was not corrosive, is that correct?

1           MR. KOLLY: Yes, and our chemical analysis in  
2 the exposure tests did not indicate that the grease  
3 would be -- is corrosive, but further, the most  
4 significant evidence is on the recovered remnant  
5 itself. The opposite side -- the thread of the acme  
6 nut has a wear side and a non-wear side. The opposite  
7 side, the non-wear side, is original. It's original  
8 with its as-machined surface and the recovered  
9 condition still shows the original machining. So that,  
10 we know that the surface wasn't attacked in any  
11 significant way by corrosion during its entire life.

12           ACTING CHAIRMAN CARMODY: I raise that  
13 because I was reading the Alaska submission, the party  
14 submission, and they were talking about Aeroshell and  
15 saying it was corrosive to material and that jackscrew  
16 assembly wear rates associated with Aeroshell 33 use  
17 are three to 10 times greater than wear rates  
18 associated with Mobil 28.

19           Do you have any comment on that?

20           MR. KOLLY: Alaska Airlines and some  
21 consultants working for them conducted a wear test  
22 program and that is where that three to 10 times wear  
23 rate comes from.

24           We had several independent reviews of that  
25 entire volume of information, one by Rensselaer

1 Polytechnic, one by the FAA, another less formal one by  
2 Boeing, and the data do not support that conclusion.  
3 It was -- they were extensively looked at and there's  
4 no evidence in the data that that conclusion can be  
5 supported.

6 ACTING CHAIRMAN CARMODY: Good. Thank you,  
7 Mr. Kolly.

8 Member Goglia had a follow-up question, I  
9 believe.

10 MEMBER GOGLIA: Yes. Mr. Kolly, this goes to  
11 you.

12 The -- as we've just mentioned in Mr. Bower's  
13 presentation, the loads got as high as 24,000 pounds.  
14 Where does that fit with the upper end testing that you  
15 performed?

16 MR. KOLLY: Well, that was during the failure  
17 sequence and that doesn't have anything to do with the  
18 operating conditions associated with wear of the  
19 jackscrew. That was during the failure. So that, that  
20 wouldn't be a normal wear-operating environment.

21 MEMBER GOGLIA: And what was the higher limit  
22 that you used in the testing?

23 MR. CLARK: The highest pressures we examined  
24 were above 8,000 psi.

25 MEMBER GOGLIA: Okay. Thank you.

1           ACTING CHAIRMAN CARMODY: No other questions  
2 at this time. Let's move to the next presentation,  
3 please.

4           MR. RODRIGUEZ: Because -- thank you, Madam  
5 Chairman.

6           Because the acme nut threads on the accident  
7 airplane failed as a result of excessive wear, the  
8 investigation examined the lubrication and end-play  
9 inspection procedures and the intervals that were in  
10 place for these procedures prior to the accident.

11           At this time, Mr. Jeff Guzzetti will describe  
12 the procedure for lubrication and inspection of the  
13 jackscrew and discuss the extension of intervals  
14 between these activities.

15           MR. GUZZETTI: As we have already noted,  
16 lubrication of the jackscrew assembly is required to  
17 minimize the rate of wear of the acme threads.  
18 Previous service history has shown that inadequate  
19 lubrication causes accelerated wear of the jackscrew  
20 assemblies. This is documented in three Douglas All  
21 Operator Letters issued in 1967, '84, and '91, and they  
22 were issued to remind airlines to lubricate the  
23 jackscrew as per their recommended procedure. These  
24 three All Operator Letters were prompted after  
25 discoveries of several prematurely-worn jackscrews due

1 to a lack of lubrication.

2           The lubrication procedure first involves  
3 gaining access to the top of the tail assembly.  
4 Typically, this is performed with the use of a small  
5 lift bucket truck as shown here in this slide while the  
6 airplane is parked overnight. Several panels are then  
7 removed. Grease is then applied under pressure to the  
8 single acme nut fitting that Mr. Epperson referred to  
9 with the use of a grease gun. The mechanic is to pump  
10 the gun until grease exit out of the top of the acme  
11 nut.

12           The procedure then calls for a brush  
13 application of a light coat of grease to the jackscrew  
14 threads. So, not only do you have to hit the zerk  
15 fitting but then you have to apply grease to the entire  
16 length of the acme screw. This is followed by cycling  
17 the jackscrew through a full range of travel to  
18 distribute lubricant across the jackscrew.

19           Staff noted many differences in the methods  
20 used by personnel from various airlines to accomplish  
21 certain steps of the lube procedure, including the  
22 manner in which grease was applied to the acme nut  
23 fitting and to the screw. For example, several of the  
24 methods observed by or reported to investigators did  
25 not involve application of the grease to the entire

1 length of the jackscrew. There's two access panels  
2 that you have to get to and to get the top part and the  
3 bottom part of the jackscrew.

4 Staff also noted that the size of the access  
5 panels was not the optimum for the procedure and you  
6 could see in that slide Dr. Malcolm Brenner's hand just  
7 beneath one of the access panels to give you a sense of  
8 the size. Additionally, laboratory demonstrations  
9 established that applying grease only through the acme  
10 nut fitting did not provide an adequate amount of  
11 grease over the remainder of the acme screw. It was  
12 also noted that the lube procedure is not required to  
13 be inspected after it is to be performed.

14 As a result of these observations, Safety  
15 Board recommendations were issued last year and since  
16 the lubrication procedure has been revised. However,  
17 staff is proposing additional recommendations in this  
18 draft report.

19 A very significant aspect of this  
20 investigation focused on Alaska Airlines extension of  
21 the lubrication interval. A review of records  
22 indicates that the interval for jackscrew lubrication  
23 was extended four times with no objection from the FAA  
24 between March 1987 and July 1996. As you can see here,  
25 the Alaska Airlines interval criteria was based



1 exclusively on flight hours in 1987 at 500 hours as  
2 shown by the top yellow bar. Eventually, in July '96,  
3 the criteria was changed to eight calendar months  
4 without regard to accumulated flight hours. It was  
5 just by calendar time. Because of the increased  
6 utilization of Alaska Airlines airplanes during this  
7 time, this eight-month calendar interval was equivalent  
8 to 2,550 hours as shown by the bottom yellow bar.

9 The investigation did not determine what  
10 information, if any, was presented as justification for  
11 the interval extensions in '88, '91, and '94. However,  
12 according to an FAA inspector who reviewed and accepted  
13 the 1996 extension, Alaska Airlines presented the  
14 recently-extended manufacturer's lube interval, shown  
15 in the lower blue bar, as justification with no  
16 internal airline data to support the extension.

17 Staff believes this was inappropriate because  
18 each airline operates their airplanes under unique  
19 circumstances that require unique FAA oversight and  
20 data justification, regardless of the manufacturer's  
21 recommended intervals.

22 Additionally, in the wake of the most recent  
23 extension there in 1996, in '97, Alaska Airlines  
24 replaced Mobilgrease 28 with Aeroshell 33 for jackscrew  
25 lubrication without following appropriate internal and

1 standard industry practice procedures which dictate  
2 that the intervals should actually be decreased when a  
3 grease change is made until data shows its successful  
4 service history has been achieved.

5 In sum, Alaska Airlines extended lubrication  
6 intervals increased the likelihood that a missed or  
7 inadequate lubrication would result in excessive wear.

8 As I mentioned on the previous slide, the  
9 manufacturer's recommended lubrication interval was  
10 also extended. In 1964, the original Douglas  
11 lubrication specification for the jackscrew called for  
12 an interval of between 300 and 350 flight hours. One  
13 year later, when the DC-9 was introduced into service,  
14 the recommended interval was increased to 600 to 900  
15 flight hours. In 1996, this interval grew to 3,600  
16 flight hours through a process that's coordinated by  
17 the FAA that involved maintenance steering groups or  
18 MSGs and maintenance review boards or MRBs.

19 The investigation found that this process,  
20 these processes, MSG, MRB as well as local airline  
21 extensions, by which manufacturers recommend and  
22 operators establish their maintenance task intervals is  
23 deficient in several ways. For example, those  
24 processes do not ensure that the resulting intervals  
25 account for the assumptions of the original airplane

1 designers, are supported by adequate technical data,  
2 and take into account the possibility of missed or  
3 inadequate accomplishment of the task. The draft  
4 report contains several recommendations aimed at  
5 addressing these deficiencies.

6           The jackscrew also requires an inspection  
7 procedure known as the end-play check, and first, I'd  
8 like to give you a little background about the genesis  
9 of this end-play check procedure. When the DC-9 first  
10 entered service in the mid-'60s, the jackscrew was a  
11 life-limited part at 30,000 flight hours. There was no  
12 procedure to monitor wear. There was no end-play  
13 check. However, in 1965, Douglas initiated a sampling  
14 program to monitor how their new jackscrews were doing.

15       Jackscrews were removed from airplanes that were part  
16 of this sampling program. The jackscrews that were  
17 removed were placed on a bench and they had their end  
18 play bench checked under a controlled environment.  
19 This effort led to the discovery of six high-wearing  
20 jackscrews.

21           In 1967, as a result of these findings,  
22 Douglas made some changes to the screw metallurgy and  
23 they also increased the wear limits for the jackscrew  
24 and acme nut. They also developed a procedure to  
25 monitor the wear while the jackscrew remained on the

1 airplane and this is the birth of the end-play check  
2 back in '67, and it basically allowed the operator to  
3 check the wear without having to remove the jackscrew  
4 from the airplane.

5 This ad hoc procedure was developed with  
6 common tools that were already available to the  
7 airlines. The tools included a horizontal stabilizer  
8 restraining fixture that had been used solely to remove  
9 and install jackscrews, a dial indicator, and a torque  
10 wrench.

11 The purpose of the end-play check is to  
12 monitor the wear of the acme nut threads without having  
13 to remove the jackscrew from the airplane. The  
14 procedure involves pulling down on the horizontal  
15 stabilizer by applying a specific amount of torque to  
16 the restraining fixture to change the load on the acme  
17 screw from tension to compression. The movement or end  
18 play between the gap of the acme nut and the acme screw  
19 is measured with a dial indicator. The movement is  
20 picked up by a plunger at the back of the indicator and  
21 read in thousandths of an inch.

22 A new jackscrew has a gap of between 3,000ths  
23 of an inch and 10,000ths of an inch, as shown in that  
24 top illustration. Eventually, the gap increases as the  
25 acme nut threads wear down, as shown in the bottom

1 view.

2 To quickly summarize how the end-play  
3 procedure works, the stabilizer is moved to a pre-  
4 determined position from the cockpit, tail fairings are  
5 then removed, and then the restraining fixture is  
6 installed between the horizontal and vertical  
7 stabilizer, as you see here. The dial indicator is  
8 then clamped to the bottom of the screw. The indicator  
9 plunger is positioned against the bottom of the acme  
10 nut, as you see there. A pre-load is applied to the  
11 indicator probe and a reading is recorded. Then the  
12 restraining fixture is rotated with a torque of between  
13 250 to 300 inch pounds to change the load direction on  
14 the jackscrew assembly. The dial indicator is then  
15 read and there's some interpretation required that I'll  
16 mention in a moment.

17 The torque on the restraining fixture is  
18 relieved and the dial indicator is checked to ensure it  
19 has returned to the initial setting. The steps are  
20 repeated several times to ensure consistent results  
21 within a thousandths of an inch and then, finally, the  
22 mechanic checks that end-play limits are between the  
23 upper -- excuse me -- between the lower limit of  
24 3,000ths of an inch and the upper limit of 40,000ths of  
25 an inch. Readings less than the 3,000ths limit or

1 greater than the 40,000ths inch limit is cause for  
2 replacement of the jackscrew assembly. That's when you  
3 know your jackscrew is worn.

4 Another significant finding in the  
5 investigation was Alaska Airlines extension of the end-  
6 play check interval between March '85 and April '96,  
7 again with no objection from the FAA. This bar chart  
8 shows the airline's extension in yellow. The beginning  
9 interval was set at every other C check or 5,000 hours.

10 In July '88, the airline no longer used the flight  
11 hour limit for the C check. Rather, it based C checks  
12 on calendar time only, so that the end-play check was  
13 being performed at a 26-month calendar interval. Based  
14 on the airline's utilization rate at that time, this  
15 equated to 6,400 flight hours between inspections.  
16 This interval was increased again in April 1996 and the  
17 end-play checks were being performed every 30 months,  
18 again with no regard to flight hours.

19 Because the Alaska Airlines increased fleet  
20 utilization at that time, the interval between the end-  
21 play checks occurred approximately every 9,550 flight  
22 hours. By contrast, the manufacturer's recommended  
23 interval at that time, shown in the lower blue bar, was  
24 every 30 months or 7,200 flight hours, whichever comes  
25 first.

1           After the accident, the FAA established more  
2 stringent lubrication and end-play check intervals by  
3 way of the Airworthiness Directives that Mr. Rodriguez  
4 mentioned. However, during the investigation, we  
5 learned that extremely rapid wear mechanisms are  
6 possible and we became concerned that the 2,000-hour  
7 end-play check interval that's currently in effect may  
8 still not be conservative enough. Therefore, the draft  
9 report recommends that the FAA establish a more  
10 scientifically-based end-play check interval.

11           The Systems Group conducted hundreds of on-  
12 wing end-play tests at several airline maintenance  
13 facilities across the country. We found that the end-  
14 play check procedure was somewhat cumbersome and  
15 susceptible to measurement error. We determined that  
16 several variables could affect the accuracy and the  
17 reliability of end-play readings, such as installation  
18 of the dial indicator, difficulty in reading the dial  
19 indicator due to its small size, its upside-down  
20 mounting, and its backwards needle movement, adverse  
21 working conditions, restraining -- the condition of the  
22 restraining fixture, the amount of torque applied to  
23 the restraining fixture, and the direction in which  
24 that torque is applied. The amount of rotation the  
25 acme screw would experience during end-play check also

1 had an effect.

2 In the case of the accident airplane, a  
3 fabricated restraining fixture was used during the last  
4 end-play check in 1997. This Alaska Airlines-  
5 fabricated tool did not conform to Boeing  
6 specifications and the Systems Group documented several  
7 differences between the two tools.

8 Because the Systems Group discovered that  
9 there are many variables that can affect the end play,  
10 we were concerned about its reliability and its  
11 validity for monitoring the wear of such a critical  
12 item. Therefore, we asked Dr. Jana Price to perform  
13 some statistical work on end-play measurement data that  
14 were reported to Boeing and the FAA as a result of the  
15 Airworthiness Directive issued after the accident.

16 So, before we invite questions on this part  
17 of the report, I would like to ask Dr. Price to briefly  
18 describe her work in this area.

19 Dr. Price?

20 DR. PRICE: Good morning, Madam Chairman and  
21 Members of the Board.

22 Today, I will discuss the Safety Board's  
23 statistical end-play data study. I will describe  
24 results from two analyses that were conducted to assess  
25 the reliability and validity of the on-wing end-play



1 measurement. Reliability and validity are two  
2 necessary features of an effective measurement system.

3 By reliability, I'm referring to the ability  
4 of the on-wing end-play measurement to yield consistent  
5 or repeatable results. If a measure is not reliable,  
6 then it cannot provide accurate results. Reliability  
7 was examined using end-play data collected as a result  
8 of an Airworthiness Directive mentioned earlier by Mr.  
9 Rodriguez which directed operators to perform end-play  
10 checks at intervals of 2,000 flight hours or less.

11 The Board received a total of 3,174 on-wing  
12 end-play measurements from 1,493 airplanes and 44  
13 operators. According to Boeing estimates, very little  
14 change in actual end play is expected to occur over a  
15 2,000-flight hour interval and all changes are expected  
16 to be in an increasing direction.

17 In order to assess the degree of similarity  
18 between two consecutive measures, we used a correlation  
19 analysis that determined the relationship between the  
20 first and second measures for 852 jackscrew assemblies.

21 The correlation analysis produces a value known as the  
22 correlation coefficient or R. R can range between  
23 negative 1 and positive 1. An R value of positive 1  
24 would indicate a perfect correspondence between two  
25 measures, such that, when one increases, the other

1 increases proportionally. R values closer to zero  
2 would suggest that the measure is not repeatable and  
3 there's more measurement error.

4 In the current setting, we would expect a  
5 very high R value since we would expect very little  
6 change in the end-play measure over the course of 2,000  
7 flight hours. As an example, if there was a  
8 measurement error of plus or minus 5,000ths in the end-  
9 play measure, the R value would be around .85.

10 This scatter plot represents the raw data  
11 collected at Time 1 which is shown on the X axis along  
12 the bottom and Time 2 which is shown on the Y axis  
13 along the side. The blue line represents where we  
14 would expect all of the dots to be tightly clustered if  
15 there was a strong positive correlation between end-  
16 play measures at Time 1 and Time 2. This line  
17 represents the anticipated wear based on Boeing's  
18 estimate of 1,000ths of an inch per 1,000 flight hours,  
19 positioned to agree with the initial end play.

20 In fact, as you can see, the dots are fairly  
21 widely scattered, and in addition, there are numerous  
22 cases in which the second measure of end play was  
23 substantially smaller than the first measure. For  
24 example, in the case I have circled, the end play  
25 measured 35,000ths at Time 1. At Time 2, it decreased

1 to 8,000ths. Since this is not physically possible, we  
2 assume that it was due to measurement error.

3 The wide scatter in the data you see is  
4 represented numerically by the resulting R value for  
5 Time 1 and Time 2 which was .553. Based on the  
6 resulting correlation values, the study concluded that  
7 the on-wing end-play test had low reliability.

8 This slide provides another way to see the  
9 same data. It displays a histogram representing the  
10 differences in end play between Time 1 and Time 2.  
11 Positive numbers, shown in blue, indicate increases in  
12 end play between Time 1 and Time 2. Negative numbers,  
13 shown in red, indicate decreases. Since it is not  
14 physically feasible for end play to decrease, it is  
15 likely that all changes in that direction are  
16 attributable to measurement error.

17 If the on-wing end-play measure were highly  
18 reliable, we would expect to see a large majority of  
19 the cases with differences between zero and 2,000ths.  
20 As you can see in this graph represented by the dark  
21 blue bar, only about 40 percent of the cases were in  
22 this range. The light blue bars represent about 22  
23 percent of cases where the end play increased by more  
24 than 2,000ths with differences ranging from 3 to  
25 35,000ths. The red bars represent about 38 percent of

1 cases where the end play decreased with differences  
2 ranging from negative 1,000ths to negative 31,000ths.

3 Although I have only shown graphs depicting  
4 the relationship between Time 1 and Time 2, the results  
5 were all additional analyses were similar.

6 A second portion of the end-play study  
7 focused on an examination of 157 jackscrew assemblies  
8 that were returned to Integrated Aerospace, the  
9 manufacturer of the jackscrew assembly, during the 2000  
10 calendar year. At Integrated Aerospace, jackscrew  
11 assemblies are cleaned and end-play checks are  
12 conducted in a controlled setting known as the bench  
13 check described earlier by Mr. Guzzetti. Because the  
14 bench check is conducted in a controlled environment,  
15 it should provide a better representation of actual end  
16 play.

17 For each jackscrew assembly returned to  
18 Integrated Aerospace, Boeing contacted operators to  
19 obtain matching on-wing end-play data and they were  
20 able to do so in 63 cases. Our goal in this analysis  
21 was to determine how closely related the on-wing end-  
22 play measure was to the bench check measure. If they  
23 had a strong correlation, it would suggest that the on-  
24 wing measure is valid.

25 In this histogram, positive numbers indicate

1 cases where the on-wing check was greater than the  
2 bench check and negative numbers represent cases where  
3 the on-wing check was less than the bench check. The  
4 dark blue bar you see here represents six cases or  
5 about 10 percent where there was no difference between  
6 the on-wing and bench check end-play measures. To the  
7 right of the dark blue bar, in about 70 percent of  
8 cases, the on-wing check produced larger end-play  
9 measures than the bench check. To the left of the dark  
10 blue bar, in about 20 percent of the cases, the on-wing  
11 end-play check produced smaller measures than the bench  
12 check, suggesting that in these cases, the actual state  
13 of the assembly was more worn than the on-wing test  
14 indicated. In about 10 percent of the cases we  
15 studied, this difference was 11,00ths or greater.

16 We also conducted a correlation analysis to  
17 look at the relationship between the on-wing and bench  
18 check measure. We used the same correlation techniques  
19 that I described for the reliability analysis. In this  
20 case, the resulting correlation coefficient or R was  
21 .442. Based on this analysis, we concluded that the  
22 on-wing end-play test had low validity as compared to  
23 the bench check measure.

24 In conclusion, the reliability analysis  
25 examining repeated on-wing measures suggested low

1 reliability. This is important because reliable or  
2 repeatable measure is a necessary condition for an  
3 accurate measure. Furthermore, the validity analysis  
4 using on-wing and bench check measures also suggested  
5 low validity.

6 As a result of this study and work done by  
7 the Systems Group, the NTSB issued a recommendation  
8 asking Boeing to revise the measurement procedures and  
9 demonstrate that the new method is valid and reliable.

10 This concludes my presentation.

11 ACTING CHAIRMAN CARMODY: Thank you, Dr.  
12 Price.

13 I think in light of the hour, we'll take a  
14 short break and then come back for questions because I  
15 think there will be quite a few.

16 Why don't we return at 11:15? Thank you.

17 (Whereupon, a recess was taken.)

18 ACTING CHAIRMAN CARMODY: Let's come in and  
19 take our seats. I'd like to resume.

20 All right. Let's resume the hearing. Would  
21 those who are standing in the door either come in or go  
22 out, please? We'd like to get started again.

23 I guess I have some questions about the  
24 intervals and I'll start with Mr. Guzzetti or whoever  
25 wishes to answer. I was struck by the fact that the

1 manufacturer has intervals which include both calendar  
2 as well as flight hours, and yet in 1988, I believe you  
3 said, Alaska Air went to calendar time only, and I  
4 presume -- well, in fact, you said that was approved by  
5 the FAA.

6 Do we know what the FAA's analysis of that  
7 was or what the rationale was?

8 MR. GUZZETTI: No, we don't, Madam Chairman.

9 Since it happened so long ago, the personalities  
10 involved and the paperwork involved disappeared, and so  
11 we really don't know exactly how that process worked  
12 where the airline was allowed to remove that whichever  
13 comes first caveat. So, we just know that it was  
14 removed.

15 ACTING CHAIRMAN CARMODY: Do we know if the  
16 FAA inquired after that as to what the actual effect of  
17 this was? In other words, what are the flight hours  
18 that are -- that correlate to the calendar times as --  
19 because the flight hours kept increasing?

20 MR. GUZZETTI: That's correct. The fleet  
21 utilization of Alaska did keep increasing within that  
22 calendar time. I don't know if the FAA, even in the  
23 recent past, were aware that when you escalate -- when  
24 they extended their C check to, say, 13 months to 15  
25 months, that -- and then they increased their

1 utilization, I don't know if they put two and two  
2 together to realize that specific tasks, the flight  
3 hour limits, were being extended either.

4 ACTING CHAIRMAN CARMODY: This is your  
5 opinion, I realize. Would you expect that's something  
6 the FAA should be looking at or should have looked at?

7 MR. GUZZETTI: I would expect the FAA to --

8 ACTING CHAIRMAN CARMODY: So would I.

9 MR. GUZZETTI: -- ride herd on that.

10 ACTING CHAIRMAN CARMODY: I have another  
11 thought along those lines and it's floating around up  
12 here. I think it's just floated out.

13 Let me go to another question I had. On Page  
14 253, middle paragraph, we're talking about the MRB-3  
15 extension of the manufacturer's recommended interval,  
16 and there's a sentence there, starting on Line 8, that  
17 says, "Further, Boeing design engineers were not  
18 consulted about nor aware of the extended 3,600-hour  
19 MRB recommended lubrication interval."

20 Who made the decision about this interval, if  
21 none of the engineers at Boeing were consulted?

22 MR. GUZZETTI: Well, the MRB process involves  
23 people coming together from industry, airline  
24 representatives, manufacturer representatives, but not  
25 necessarily the original design engineers from the



1 manufacturers. They're usually folks that work in the  
2 maintenance area and don't typically talk to the design  
3 folks, and by committee, with the FAA simply setting up  
4 the meetings and kind of coordinating it all, by  
5 committee consensus, they look at whatever data they  
6 have and make decisions about extending certain  
7 maintenance task intervals.

8           So, we don't have any -- we asked whether  
9 there were meeting minutes for the particular MRB-3 MD-  
10 80 meetings. There were none to be found. So, we  
11 really don't have a firm idea on exactly who proposed  
12 3,600 hours or why it was proposed and what type of  
13 data was presented.

14           ACTING CHAIRMAN CARMODY: I believe you used  
15 the words "FAA sets up the meetings and coordinates  
16 it", and I think those words were the same that FAA  
17 used in our hearing about three years ago on this or  
18 two years ago.

19           Is that your understanding of the FAA's role,  
20 strictly coordinating the meetings?

21           MR. GUZZETTI: IT is. It is my  
22 understanding. They play a very limited role. We had  
23 the chairman of the MD-80 Maintenance Review Board at  
24 the public hearing, and he concurred with the fact that  
25 the FAA kind of hosts these meetings and coordinates

1     them, but in terms of approving the intervals or  
2     playing an active role in them, that doesn't appear to  
3     be taking place.

4             ACTING CHAIRMAN CARMODY: I remembered my  
5     other question about intervals. We were talking about  
6     the fact that Alaska was using a calendar as opposed to  
7     calendar hours. Any other airlines do that?

8             MR. GUZZETTI: There are other airlines that  
9     do that for other maintenance tasks, and I don't know  
10    exactly which airlines and which specific maintenance  
11    tasks, but yes, there are other airlines out there that  
12    strictly use calendar time, but a survey that we did of  
13    13 operators of DC-9s and MD-80s for the C check that's  
14    involved with the jackscrew end play and for the  
15    lubrication, all of them, except for Alaska Airlines,  
16    had a calendar time or a flight hour, whichever comes  
17    first, according to our survey.

18            ACTING CHAIRMAN CARMODY: Okay. Thank you.  
19            Member Hammerschmidt?

20            MEMBER HAMMERSCHMIDT: Well, just following  
21    up on Chairman Carmody's last question, at the time of  
22    the accident, how did a time frame of 9,550 flight  
23    hours for end-play checks as an interval, how did that  
24    compare to, say, other airlines that were operating MD-  
25    80s?

1           MR. GUZZETTI: According to the survey that  
2 we performed where we contacted these 13 operators, and  
3 by the way, each of these airlines had at least 10  
4 airplanes, so they were the big ones, it was the second  
5 highest of those 13 airlines. The first highest was an  
6 airline that had an interval of 10,500 hours and then  
7 Alaska Airlines came in second with 9,550, and then  
8 most of the rest of them, there was one here at 8,400  
9 hours, and then the rest were around the 7,200 flight  
10 hour, and then there were a few that were down into the  
11 3,000 and 5,000 range.

12           MEMBER HAMMERSCHMIDT: Okay. Thank you.

13           We point out in the Analysis Section of this  
14 report on Page 274 that, on Line 7, the Safety Board is  
15 aware that Boeing is currently developing improved end-  
16 play check procedures.

17           Could someone elaborate on that? Because it  
18 was my understanding that some time early this year,  
19 that Boeing briefed the Safety Board on these new  
20 procedures and in fact many of you actually went over  
21 to Reagan National Airport and participated in and  
22 experienced how those new procedures -- how they were  
23 effective.

24           MR. GUZZETTI: Certainly. Yeah. As a result  
25 of the hundreds of end-play checks that the Systems

1 Group did over a period of, you know, two-three years,  
2 the Systems Group started experimenting with what we  
3 thought might be better ways, improved ways to get a  
4 more repeatable measure on the jackscrew end play, and  
5 Boeing took the ball and ran with it, and they actually  
6 are working on, and I think they're very, very close to  
7 fielding the new end-play check procedure.

8           According to Boeing, it's greatly improved  
9 because they take a lot of the variables out of the  
10 process. It will involve a restraining fixture where  
11 it'll just have a green band and a red band. Rather  
12 than worrying about whether you're putting 250 inch  
13 pounds of torque on the restraining fixture or 300 inch  
14 pounds of torque, you'll be able to just intuitively  
15 look at a needle and once you're in that range, you're  
16 okay.

17           Also, the dial indicator face is mounted on  
18 top of the acme nut instead of below it and if you  
19 noticed on top of the acme nut, there's this very large  
20 banana fairing that you have much more access to access  
21 -- to install the dial indicator. The new dial  
22 indicator is also a very large dial. You don't need an  
23 inspection mirror to view it, like you did with the old  
24 procedure, and you don't have to interpret what the  
25 indicator is saying. With the old dial indicator, you

1 had to kind of subtract from 100 and with an inspection  
2 mirror and it was a bit cumbersome.

3 So, they've implemented that, and they've  
4 also implemented an anti-rotation device where you  
5 don't have to worry about the jackscrew rotating which  
6 the Systems Group found can throw off your reading.  
7 So, that's just -- those are just some of the major  
8 aspects, and it's -- according to Boeing, they tested  
9 this procedure and they have greatly enhanced the  
10 repeatability of the measure.

11 MEMBER HAMMERSCHMIDT: Hm-hmm.

12 MR. GUZZETTI: Also, just to conclude, you're  
13 right. Boeing set up a -- partnered with American  
14 Airlines and set up a demonstration for several Safety  
15 Board staff to actually perform this new procedure.  
16 Mr. Rodriguez and myself and several others here did it  
17 at night, at about midnight, several months ago.

18 MEMBER HAMMERSCHMIDT: Did you take various  
19 end-play measurements?

20 MR. GUZZETTI: Yes, we did.

21 MEMBER HAMMERSCHMIDT: I mean, among  
22 yourselves?

23 MR. GUZZETTI: Yes, we did.

24 MEMBER HAMMERSCHMIDT: How did those compare?

25 MR. GUZZETTI: They -- we all came up with

1 the same number.

2 MEMBER HAMMERSCHMIDT: Same number. Okay.  
3 Do you recall what that number was, by any chance?

4 MR. GUZZETTI: I think it was -- I don't  
5 recall. It was within limits. It was in the 18,000ths  
6 or 22,000ths. I don't recall.

7 MEMBER HAMMERSCHMIDT: Not important. I was  
8 just curious.

9 Speaking of Mr. Rodriguez, I was with the  
10 investigator-in-charge at Alaska Air's Oakland  
11 maintenance facility, observing an end-play check and  
12 lubrication, months ago, and you had mentioned in  
13 reference to one of Member Black's earlier questions  
14 that most of the lubrication in the Alaska Airlines  
15 system was accomplished at Oakland and at San Francisco  
16 International Airport, is that correct?

17 MR. GUZZETTI: Yes. Yes, that's correct.

18 MEMBER HAMMERSCHMIDT: Okay. I'd like to  
19 shift from the process of intervals to the actual work  
20 where the grease meets the metal, so to speak, and on  
21 Page 249, which is in the analysis, we have a sentence  
22 on Lines 16 and 17 which I'll just read.

23 It says, "This suggests that the SFO  
24 mechanic", meaning the mechanic at San Francisco  
25 International Airport, "who was responsible for

1 lubricating the jackscrew assembly in September 1999  
2 did not adequately perform the task", and this was the  
3 mechanic who was responsible for performing the last  
4 lubrication of the accident airplane's horizontal  
5 stabilizer components, including the jackscrew  
6 assembly.

7           When we say that this mechanic did not  
8 adequately perform the task, what leads us to that  
9 conclusion?

10           MR. GUZZETTI: There are several things that  
11 leads us to that conclusion. Let me list some of them.

12           First of all, Mr. McGill and Mr. Rodriguez interviewed  
13 that mechanic and that mechanic didn't appear to have a  
14 solid knowledge on the actual lubrication procedure.

15           Secondly, the Systems Group went back to the  
16 wreckage at Oxnard, granted it was two years after the  
17 wreckage, but we examined every single grease fitting  
18 on that tail of the wreckage, and we noted that at  
19 least 40 percent, about 40 percent of the grease  
20 fittings on the -- that are used in that task card for  
21 the jackscrew and the elevators were either dry or  
22 semi-dry. We compared that with other systems, most  
23 notably the rudder system, which was lubricated several  
24 months before the SFO lube, and just about all of the  
25 fittings on the rudder had fresh, what we would

1 determine as fresh, grease.

2           So, that was the second aspect, and the final  
3 aspect and perhaps the most compelling is when we  
4 pulled the jackscrew out of the ocean, the working area  
5 of the acme screw was void of grease. It didn't have  
6 much on it, and when you compare that fact with Dr.  
7 Kolly's aspects about what salt water does to grease,  
8 which isn't much, as well as other jackscrews we pulled  
9 out from the bottom of the ocean, most notably the  
10 China Air jackscrew, even an impact with the ocean and  
11 sitting on the ocean floor for a few days, you should  
12 still be able to see some remnants of grease on a  
13 jackscrew, and we didn't in the case of Alaska  
14 Airlines.

15           If the San Francisco lube would have been  
16 done adequately, staff feels that we would have seen  
17 some evidence of that on the screw.

18           MEMBER HAMMERSCHMIDT: Hm-hmm. And how long  
19 should it typically take for a mechanic to perform the  
20 lubrication procedure?

21           MR. GUZZETTI: We asked that of Boeing and  
22 they put their maintenance task folks on it, and they  
23 came up with an estimate, including removing access  
24 panels between, I think, three and a half to four  
25 person hours, and however, when we asked the mechanic



1 that did perform the lube, he indicated it took him  
2 about an hour to do the whole thing which also led us  
3 to feel that perhaps the procedure wasn't done  
4 adequately.

5 MEMBER HAMMERSCHMIDT: Okay. In this Section  
6 1, Other Questions, going back to end-play checks, we  
7 mentioned in the analysis some work that's been done at  
8 Sandia Laboratories concerning a new method of  
9 computing the end play on a jackscrew.

10 Could someone describe that somewhat for us?

11 MR. GUZZETTI: Yes, Member Hammerschmidt, I  
12 can describe that just to the best of my knowledge. I  
13 haven't been keeping up with what they've been doing,  
14 but right after the accident, Alaska Airlines, through  
15 some sort of FAA grant to experiment with new  
16 technologies, worked with Sandia to try to devise  
17 another method of performing an end-play check.

18 They came up with two experimental  
19 procedures. One was simply an x-ray where you bring an  
20 x-ray up to the jackscrew and take an x-ray film of it,  
21 so you can actually see the wear of the acme nut  
22 threads, which is something you can't do now, and then  
23 the other technology they used was ultrasound. They  
24 would just kind of like when -- during a pregnancy to  
25 determine the sex of the baby, the same principles

1 would apply to the jackscrew. You run an ultrasonic  
2 transmitter over the length of the acme nut and the  
3 readings you get on the screen would indicate the  
4 thickness.

5 The FAA pulled the funding on those, but I  
6 think Alaska Airlines later on began their own  
7 initiative to look into that. The Safety Board, the  
8 staff really didn't have much of an involvement, other  
9 than to report that there could be other technologies  
10 out there for this.

11 MEMBER HAMMERSCHMIDT: Very good. I just  
12 found that of significant interest. Thinking outside  
13 the box a little bit, as the saying goes.

14 One final question. You had mentioned that  
15 the staff at least has given us a position that this  
16 2,000 flight hours that the Airworthiness Directive  
17 calls for to be a limit for an end-play check was  
18 perhaps not as conservative as it needs to be, and you  
19 mentioned that it was based on a particular occurrence  
20 or event, and I believe that's the Hawaiian Airlines  
21 jackscrew situation where the garnet ingredients had  
22 gotten into the grease and had caused excessive wear.

23 MR. GUZZETTI: That's correct.

24 MEMBER HAMMERSCHMIDT: Is there anything else  
25 that that's based on, that position, that 2,000 hours

1 is not adequate?

2 MR. CLARK: Well, several things. One is, we  
3 don't know possibly what the worst wear rate is out  
4 there. I think Alaska -- the Hawaiian one, we're  
5 looking at a wear rate of approximately 13 times the  
6 1,000ths per thousand hours. Can it be worse? We  
7 don't know that. So, there's a concern there, and then  
8 we would like the -- there's quite a variance in the  
9 end-play measurements that you see in Dr. Price's data.  
10 There's also concern that since this is a critical --  
11 quite a critical item, that in other systems and  
12 structures, we always try to achieve at least two good  
13 inspections or have the opportunity to discover a flaw  
14 twice before we reach a failure mode.

15 So, if you start adding all of those bits and  
16 pieces up, we're not convinced that 2,000 hours is an  
17 appropriate inspection interval. Very well could be  
18 less. If they go through a systematic process, it may  
19 be greater than 2,000 hours, but we don't know that  
20 answer yet.

21 MEMBER HAMMERSCHMIDT: All right. And what  
22 is our suggested solution for that?

23 MR. CLARK: Well, there's several. One is to  
24 work at the reliability and validity of the  
25 measurements and also the -- one solution that would

1 simply take it off the table is to put on some sort of  
2 fail-safe device or some device that could mitigate any  
3 type of failure and that buys you the extra protection  
4 and then you don't have to worry so much about the  
5 appropriateness of the 2,000-hour inspection interval  
6 or the inspection techniques.

7 MEMBER HAMMERSCHMIDT: Okay. Thank you.  
8 That's all I have.

9 ACTING CHAIRMAN CARMODY: Member Goglia?

10 MEMBER GOGLIA: Excuse me. I have a few  
11 questions.

12 Mr. Clark, I'd like to take your comments  
13 just one step further. We just heard Mr. Guzzetti talk  
14 about the reliability of the new tooling that Boeing  
15 has designed to accomplish this task and its  
16 repeatability.

17 Would that have any effect on the comments  
18 that you just made?

19 MR. CLARK: We'll certainly take an  
20 improvement anywhere we can get it in the entire  
21 process. I think there's a number of things we don't  
22 know. We were going to address this a little more  
23 directly a little later, but if you want to interject  
24 that now, I guess we can.

25 MEMBER GOGLIA: In what way?

1 MR. CLARK: Well, --

2 MEMBER GOGLIA: Where are you going to put it  
3 later?

4 MR. CLARK: -- I think Mr. Rodriguez is going  
5 to discuss the Alaska Airlines Maintenance Program, the  
6 FAA oversight of that program, and then we're going to  
7 get into a number of issue areas, such as the possible  
8 design changes or fixes. Let's see. Another area is  
9 the crew decisionmaking process.

10 MEMBER GOGLIA: Flight crew or maintenance  
11 crew?

12 MR. CLARK: Flight crew.

13 MEMBER GOGLIA: I think I'd like you to talk  
14 about it now.

15 MR. CLARK: Okay. Okay. The -- what I'd  
16 like to do is there's been a lot of discussion about  
17 trying to devise a fail-safe system. We consider this  
18 as a single point failure mode that is catastrophic.  
19 So, I'd like to step through and describe what we had  
20 proposed to -- and why we proposed certain  
21 recommendations.

22 As this accident demonstrates, the total loss  
23 of the acme threads constitutes a catastrophic single  
24 point failure mode. To address this, the draft report  
25 contains recommendations to eliminate those

1 catastrophic effects of thread loss by incorporating  
2 the fail-safe mechanism or preclude single point  
3 catastrophic failure modes in any new horizontal  
4 systems, any new designs coming out. We think the  
5 regulations need to be fixed. Ensure that the  
6 certification process addresses wear-related failures  
7 so that they will not be catastrophic. There was an  
8 issue of whether this was a system or structure and  
9 where wear should be considered in the design process  
10 of this actuator.

11 I want to make one thing clear, that when we  
12 raised this design and certification issue by proposing  
13 these recommendations, we don't mean to minimize the  
14 importance of the maintenance and inspection failures  
15 that occurred to allow --

16 MEMBER GOGLIA: You sure could have fooled me  
17 by the words you used in the report.

18 MR. CLARK: How's that?

19 MEMBER GOGLIA: That's exactly why I'm  
20 pushing on this issue.

21 MR. CLARK: Okay.

22 MEMBER GOGLIA: The words that are used in  
23 the report had my blood pressure spiked because of some  
24 of the -- especially in the Conclusions where we can't  
25 rely upon the maintenance and inspection because that's

1 the foundation for the whole aviation system.

2 ACTING CHAIRMAN CARMODY: Let me just jump in  
3 for a minute. We have not covered the areas that the  
4 staff prepared on maintenance and oversight, and I  
5 think you raise valid points, but I think we ought to  
6 at least have the chance to hear the full picture  
7 before we get into this.

8 I wondered if we might go back to the natural  
9 order and get into John Clark's presentation a little  
10 later. Would that be agreeable? So we can cover the  
11 maintenance issues. I think we need to finish that  
12 part and then go on to this one and then we can have a  
13 full airing of everything. So, let's continue with --

14 MEMBER GOGLIA: Okay. I have some additional  
15 questions.

16 ACTING CHAIRMAN CARMODY: Okay.

17 MEMBER GOGLIA: Mr. Guzzetti, you mentioned  
18 one carrier had higher times of lube intervals?

19 MR. GUZZETTI: Yes, that's correct, Member  
20 Goglia.

21 MEMBER GOGLIA: And did we look at what kind  
22 of a history they had with jackscrews and replacements  
23 and --

24 MR. GUZZETTI: Not in-depth. They did have  
25 -- well, we cite it in the report. It's Delta Airlines

1 that had the highest end-play interval before the  
2 accident, of course. There were some interesting  
3 findings about that. They did have a handful of acme  
4 screws that were slightly higher wearing than some of  
5 the other airlines, but most notably, they had the  
6 highest wear on a jackscrew that we had ever seen. It  
7 was 75,000ths of an inch, and they had -- this was  
8 three or four years ago. We never got a chance to look  
9 at the screw, but it was pulled from the airplane and  
10 the records indicate it was 075 inches. So, we didn't  
11 take an in-depth look at that airline's jackscrews like  
12 we did with Alaska, however.

13 MEMBER GOGLIA: And you also made a comment  
14 when talking about the MRB and the FAA's role there,  
15 and you made the comment that the FAA approving. Don't  
16 they accept?

17 MR. GUZZETTI: That's -- in a way, you're  
18 correct. They do accept task card changes. For  
19 example, the individual -- some of the individual task  
20 card changes that extended the lube intervals were  
21 accepted by the FAA, but we're really talking about  
22 semantics here in that Alaska Airlines' entire  
23 maintenance program in which this acceptance is  
24 discussed is -- that entire maintenance program is  
25 approved by the FAA.



1           So, technically, in the case of the  
2 lubrication extension, the FAA did accept it. In the  
3 end-play inspection, technically, you would say  
4 approval because that did involve a C check extension,  
5 but overall, as it relates to the Maintenance Review  
6 Board or the MRB process, there really is no approval  
7 by the FAA of a specific manufacturer's recommended  
8 program.

9           The FAA does approve continuing airworthiness  
10 instructions, but I'm not too clear on the actual  
11 semantics of acceptance versus approval as we discussed  
12 this topic.

13           MEMBER GOGLIA: Okay. I wonder if you would  
14 talk a minute, one of you talk a minute about the  
15 tooling that was used by Alaska Airlines. We just  
16 talked about the new tooling that Boeing has designed.

17           Can you give us a little sketch on what the  
18 differences were and what the problems were between the  
19 tooling that was used to check the accident airplane  
20 and the Boeing-designed tooling and the newly-designed  
21 Boeing tooling?

22           MR. GUZZETTI: Certainly. We discovered that  
23 Alaska Airlines had fabricated a tool that did not meet  
24 Boeing specifications. We discovered it. It took us  
25 awhile to discover it. We noted that Alaska's -- we

1 requested information from Alaska regarding where they  
2 got the tool, how they fabricated it. Finally, they  
3 provided us the information the day they disclosed to  
4 the FAA that they had been using this non-compliant  
5 tool on their airplanes and they actually grounded some  
6 airplanes and redid the end-play check as a result of  
7 that.

8 But basically, we don't know exactly how  
9 Alaska Airlines tool was put into their system. We  
10 just know it existed there, went all the way back into  
11 the '80s, and as you can see on the monitor, it looks  
12 different. The Alaska Airlines-fabricated tool is on  
13 the left there. It's cylindrical, and -- excuse me.  
14 It's on the right. It's cylindrical and has two long  
15 turn buckles that go into it.

16 The Boeing tool on the left is red. It's  
17 rectangular, and it has an open area in there where you  
18 can actually see the turn buckles. The turn buckle  
19 screws themselves are much shorter than the Alaska  
20 tool. So, there's an extension issue.

21 We looked at the -- after the accident, when  
22 the AD came out and Alaska really needed to do a lot of  
23 end-play checks to conform to the Airworthiness  
24 Directive, they actually took the non-compliant tool  
25 and made a clone of it. They kind of reverse

1     engineered the improper tool and made 11 more of them  
2     and used those tools for several months.  Meanwhile,  
3     the Systems Group finally found out about it and we  
4     wanted to perform an investigation on whether or not  
5     this Alaska Airlines-fabricated tool could provide a  
6     different end-play reading than the Boeing tool.  So,  
7     we ran several series of laboratory tests as well as  
8     some on-wing end-play checks, and we determined that  
9     for the most part, the Alaska tool, it would always  
10    give a slightly -- in several cases, it gave us  
11    slightly lower end play, no greater than 5,000ths of an  
12    inch.  But for the most part, head-to-head, it gave  
13    about the same end play as the Boeing tool.

14           We also put it on a force gauge and the  
15    Boeing tool provides adequate force, 3,000 pounds of  
16    pulling force to really get that jackscrew to unload  
17    and go in the opposite direction.  You only need about  
18    1,700 or 1,800 pounds to get a full end play, and the  
19    Alaska Airlines tool kind of hovered -- its force  
20    output kind of hovered around 1,700-1,800 pounds.  So,  
21    it was right on the margin, but for the most part, it  
22    put out about the same reading.

23           We don't know the condition, Member Goglia,  
24    of the fabricated tool that was used during the '97  
25    end-play check.  We could have -- different readings

1     could have been attained if the tool was dry, if it  
2     wasn't properly lubricated, if it was in a different  
3     position. Did the jackscrew rotate back then in 1997?

4     We just don't know. So, we -- our staff's belief is  
5     that we can't come up with a solid determination on  
6     whether the fabricated tool had any effect or skewed  
7     the reading on the '97 end-play check.

8             The Boeing tools, every one we tested, were  
9     fine, but it still involved using this torque wrench  
10    and it gave a range between 250 inch pounds and 300  
11    inch pounds of torque that the mechanic would choose,  
12    but now, to answer the last part of your question about  
13    what Boeing is proposing, they took all the guesswork  
14    out of that. The tool has a little force gauge on it  
15    and you just torque it until the needle goes into the  
16    green and you're there. You don't have to worry about  
17    a specific torque amount. You don't have to worry  
18    about a lot of these variables.

19            MEMBER GOGLIA: Okay. And I have one  
20    additional question for Dr. Powell.

21            MR. GUZZETTI: Dr. Price.

22            MEMBER GOGLIA: Dr. Price. I'm sorry. I  
23    wrote it down wrong.

24            During your presentation, you talked at great  
25    length about the findings of the jackscrews that were

1 returned to overhaul facility and the numbers  
2 essentially of findings, the bench level and on-wing,  
3 comparing them on-wing.

4 Now, it's my experience in doing these checks  
5 that we really didn't care very much about the number  
6 and consequently, many of those tags that I filled out  
7 for other people, I just put a number down that would  
8 keep me out of trouble, essentially putting it over the  
9 40,000ths limit, and it had really no relationship in  
10 fact. We would often change jackscrews, replace  
11 jackscrews that were close, if we had a jackscrew  
12 available, the airplane was in a tail doc, and if we  
13 had manpower. It's just a heck of a lot easier to do  
14 it at our convenience than it was to run the thing to  
15 the end and maybe have to do it in some place that's  
16 less convenient or a time when we may not have a spare  
17 jackscrew.

18 So, I felt as you were going through those  
19 numbers that it would skew the results considerably.  
20 Is my feeling correct?

21 DR. PRICE: Well, I think I can answer that  
22 in a couple of ways. First of all, not all of the  
23 jackscrews that were used in that analysis came off  
24 because they were too high. I think what you're saying  
25 is that if a mechanic noticed it was too high, higher

1 than 40, for instance, he might not be concerned with  
2 what the actual number was, knowing that it would be  
3 removed anyhow.

4 The jackscrews that were looked at in that  
5 analysis had been removed for a variety of reasons and  
6 represented a range of different end plays that were  
7 taken when they were removed. Another thing, I think,  
8 that would be important to note is that these were all  
9 removed in the year 2000 and after the accident, and I  
10 think at that time, I would suspect that after the  
11 Airworthiness Directive was issued and that mechanics  
12 knew that their results were being reported to the FAA  
13 and the importance of that, that they may have been  
14 recording them as well as possible during that period.

15 MEMBER GOGLIA: You mentioned other reasons  
16 for removal. What were the other reasons?

17 DR. PRICE: If there was pitting, for  
18 example, on the screw or if there were problems with  
19 the free play. Those are two examples. Chips and  
20 flakes. That was another reason that they might have  
21 been removed. Some of them were removed because they  
22 were out of tolerance, but there was a variety of  
23 reasons that they were removed.

24 MEMBER GOGLIA: Do we have a sense for how  
25 many were removed for the flaking, pitting, the wearing

1 materials showing up?

2 DR. PRICE: I believe it was just a very few  
3 that had that reason listed. If I remember correctly,  
4 it was just a handful.

5 MEMBER GOGLIA: Okay. Thank you. No further  
6 questions.

7 ACTING CHAIRMAN CARMODY: Member Black?

8 MEMBER BLACK: I have a couple here.

9 First of all, Jeff, Mr. Guzzetti, going  
10 through the -- listening to you talk about the sequence  
11 of the -- how the end-play checks and lubrication  
12 intervals were arrived at, I'm a little curious as to  
13 how those long maintenance -- those long manufacturer's  
14 intervals got in there because at the same time, I  
15 believe in the docket, in the factual, there were  
16 several All Operator Letters that went out, the first  
17 one in the '60s, then maybe one or two more in the  
18 '80s, from McDonnell-Douglas to the operators saying  
19 we're getting wear rates that are higher than we  
20 expected. We know what they were from this test that  
21 we did back during the '60s, and we believe that it's  
22 lubrication, based on some basis.

23 Is there a disconnect somewhere between  
24 whoever is writing those letters and whoever is giving  
25 advice to the FAA and these maintenance steering

1 groups?

2 MR. GUZZETTI: Just based on my review of the  
3 facts, I would say there very much was a disconnect.  
4 You're correct. There were three AOLs that were issued  
5 that I mentioned, '67, '84, and '91, and then when the  
6 -- in 1996, I think, when MSG-3, MRB came out for the  
7 MD-80, suddenly it went to 3,600 hours which was a five  
8 to six times jump in lube interval for the jackscrew,  
9 and I think part of the problem was, is the lube  
10 interval itself wasn't really looked at specifically by  
11 the MRB. They kind of were looking at the C check  
12 extensions as a package, and the lube happened to kind  
13 of fall nicely into a C check, and so they just -- for  
14 whatever reason, it got absorbed into that C check and  
15 turned into 3,600 flight hours.

16 But I would agree with you that there was  
17 plenty of literature out there spanning three decades  
18 that indicated that frequent lubrication is very much  
19 needed for the jackscrew assembly.

20 MEMBER BLACK: Okay. Thank you.

21 I'm going to take them in order that I wrote  
22 them down. Something you didn't mention on this  
23 lubrication overnight at SFO, to perform the  
24 lubrication as required in the manual. It actually  
25 requires two people at least at one point to do that,



1 two mechanics, does it not, because of running the  
2 jackscrew up and down?

3 MR. GUZZETTI: Oh, yes, sir.

4 MEMBER BLACK: Somebody has to be in the  
5 cockpit. There has to be power on the airplane, and --

6 MR. GUZZETTI: And then somebody has to be in  
7 the tail.

8 MEMBER BLACK: -- someone has to be in the  
9 tail talking and also there has to be a headset run out  
10 so that they can talk to each other. So, that further  
11 complicates that process and makes it take longer.

12 MR. GUZZETTI: That's correct.

13 MEMBER BLACK: I'm not criticizing that. I'm  
14 just saying that's something else that needs to be done  
15 during that interval.

16 MR. GUZZETTI: That's correct, and there was  
17 more than one -- I believe there was more than one  
18 mechanic working at that station that evening. So,  
19 it's certainly feasible that that happened.

20 And if I may just make a quick comment here  
21 about the SFO mechanic and this issue? As you made a  
22 note in our factual analysis, we certainly don't --  
23 staff doesn't assert the fact that the procedure simply  
24 wasn't done. We just assert that the acme screw wasn't  
25 adequately lubricated, and there could be several

1 reasons for that.

2 MR. CLARK: One other key point on that last  
3 lubrication is we also, looking at the wear rates and  
4 the testing that Dr. Kolly's performed, is that that  
5 last lubrication in and of itself isn't the problem  
6 one.

7 MEMBER BLACK: No.

8 MR. CLARK: It's to -- if the grease can  
9 perform that 2,500-hour interval, it will -- we expect  
10 it to go some time beyond that 2,500-hour interval  
11 before we start getting into a problem. So, if we  
12 missed the last lubrication and/or performed it  
13 inadequately and there's not a lot of grease up and  
14 down that jackscrew, we would have had to have gone  
15 some period beyond that and then gone into an extremely  
16 high wear rate, orders of magnitude greater than  
17 anything we've ever measured to get to that failure  
18 point. So, that in and of itself, that last  
19 lubrication isn't the one that put us in a high wear  
20 rate.

21 MEMBER BLACK: And just another benchmark, I  
22 guess, that it ought to be fair to point out here, is  
23 that this airplane at the time, this airplane series at  
24 the time of the accident had close to a 100 million  
25 fleet hours on it and never one of these -- never

1 documented and apparently never had one of these  
2 catastrophic jackscrew assembly failures before. So,  
3 that means that a wide range of lubrications out in the  
4 field over the years had kept these things going and  
5 there had not been one before.

6 So, whatever it was, it couldn't be just a  
7 simple issue. It had to be a complex issue. Would you  
8 agree with that?

9 MR. CLARK: I agree.

10 MEMBER BLACK: Going through, we have  
11 mentioned American here a couple of times and their  
12 splendid cooperation in this investigation. Three of  
13 us at least visited Tulsa once to look at their  
14 operation. You might talk a little bit about their  
15 interval and their practices and what it led to with  
16 regard to wear rates, if you could.

17 MR. GUZZETTI: Certainly. American Airlines  
18 was one of the lowest interval --

19 MEMBER BLACK: It's also the largest operator  
20 in the world of the airplane, too.

21 MR. GUZZETTI: That's correct. Now that  
22 they've acquired the old TWA, they've got 400 and some  
23 DC-9 MD-80 series.

24 MEMBER BLACK: I think they'd be willing to  
25 sell you a few right now, too.

1           MR. GUZZETTI: And they were, I think, the  
2 largest operator even before they acquired TWA. But in  
3 any event, their interval was -- let me find it here --  
4 940 hours for lubrication and that is, you know, fairly  
5 consistent for the 600 to 900 hours that the original  
6 lube interval came when the DC-9 was rolled into  
7 service in '67 or '65.

8           American Airlines also, even before the  
9 accident, were tracking the end-play checks on --

10          MEMBER BLACK: We haven't said that before I  
11 don't believe in the meeting. When a mechanic checked  
12 one of these, they weren't required to write in the  
13 aircraft forms what they got, what the results of the  
14 check were.

15          MR. GUZZETTI: That is correct. It wasn't  
16 mandatory to actually write down what the end-play  
17 check was.

18          MEMBER BLACK: So, for instance, on the  
19 accident airplane, it had one or two previous end-play  
20 checks and we don't know what they were.

21          MR. GUZZETTI: That's correct.

22          MEMBER BLACK: Because they were not recorded  
23 nor were they required to be recorded.

24          MR. GUZZETTI: And that somewhat hampered our  
25 ability to really zero in on the wear rate of the

1 accident jackscrew, but American Airlines did, and we  
2 looked at -- they provided us the data and just an  
3 anecdotal note, you would expect a normal slope of --  
4 if you were to plot wear versus time, the jackscrew  
5 would slowly -- would wear out as time progressed, but  
6 American had kind of a flat line. It was as if their  
7 jackscrews were not wearing at all.

8 MEMBER BLACK: Didn't their two oldest  
9 airplanes still have the original in them?

10 MR. GUZZETTI: They all -- every airplane in  
11 their entire fleet had the original jackscrew and some  
12 of those airplanes were fairly old.

13 MEMBER BLACK: If you followed the guidance  
14 given by the manufacturer way back in the '60s, you got  
15 a very good result and these things are \$60,000 a  
16 piece.

17 MR. GUZZETTI: That's correct. So, you know,  
18 we found that American -- and also, I think they were  
19 one of the few airlines that, when the AD came out and  
20 they had to inspect and report any jackscrew that had  
21 any kind of shavings or an end play that was out  
22 limits, they had to report it. They reported no  
23 jackscrews out of 267 airplanes.

24 MEMBER BLACK: Thank you.

25 Let me transition one more, Madam Chairman,

1 to Ms. Price who's helped me two or three times on the  
2 phone trying to understand because we engineers are  
3 normally statistically challenged.

4 Do you think -- a lot of these numbers that  
5 you worked with were as a result of the original urgent  
6 AD for all airlines after the accident to measure, go  
7 out immediately and measure all of their airplanes, is  
8 that true?

9 DR. PRICE: That's correct. All of the data  
10 that I spoke about today was measured as a result of  
11 the Airworthiness Directive.

12 MEMBER BLACK: Okay. What makes me wonder  
13 about something is on the scatter that you got on the  
14 slide that at least is on our monitor here but is not  
15 being shown but it's the wide scatter, at Alaska Air, I  
16 noticed that some of the people who are performing end-  
17 play checks, when they were interviewed, they had only  
18 performed one or two or three in their entire career.

19 I'm wondering if during this race to get  
20 these things measured by the airlines so they could put  
21 their airplanes back in service, if we didn't get  
22 people doing this who had come off the 757 line or the  
23 Airbus line or somewhere who really didn't know how to  
24 do this, that might have further scattered your data.  
25 Do you think that's possible?

1 DR. PRICE: Well, I do think that  
2 inexperience or confusion with how to do the procedure  
3 may lead a mechanic to have a problem, yet I feel that  
4 that's important because if a mechanic -- a mechanic  
5 may never have had to do them very often in the past,  
6 and yet the decisions that they were making based on  
7 those were so of great importance.

8 One of the --

9 MEMBER BLACK: I totally agree.

10 DR. PRICE: However, in addition, we have  
11 made recommendations about training mechanics on this  
12 procedure, on the newly-developed procedure, and that  
13 is part of what is in the draft report.

14 MEMBER BLACK: Excellent. I agree with that.

15 And just as a general comment, I would at some point  
16 and maybe later is a better time to do it like to hear  
17 a little bit more about this accept versus approve in  
18 the maintenance programs and maybe we can talk a little  
19 bit more about that when we get into findings. As the  
20 husband of a lawyer, I smell a lawyer somewhere around  
21 that, and I'm just wondering what the significance of  
22 those two words are.

23 Thank you very much.

24 ACTING CHAIRMAN CARMODY: Member Goglia had a  
25 follow-up.

1           MEMBER GOGLIA: Yes. Mr. Guzzetti, go back  
2 for a second to the San Francisco lubrications. It's  
3 my understanding that there was no tail doc available  
4 in San Francisco, is that correct?

5           MR. GUZZETTI: We don't know, Member Goglia.  
6 We tried to vet that issue as best as we could. I  
7 believe that they did have one. I'm not sure. Mr.  
8 McGill may have -- or Mr. Rodriguez may have a better  
9 perspective on whether or not there was a lift  
10 available at SFO.

11           MR. RODRIGUEZ: We visited the facility a  
12 year and a half after the accident or so and the lift  
13 at that time was broken, but it was our understanding  
14 that the Alaska Airlines folks borrow a lift if one is  
15 broken and they need it.

16           MEMBER GOGLIA: And did we make an attempt to  
17 find out? How long was the out-of-service lift truck  
18 that was there when you visited, how long was that in  
19 the station?

20           MR. RODRIGUEZ: How long was it out of  
21 service or how long had they owned it?

22           MEMBER GOGLIA: How long was it in the  
23 station? They can own it and it can be somewhere else.

24           MR. RODRIGUEZ: I have no idea, sir.

25           MEMBER GOGLIA: And did we ask who they would



1 borrow one from?

2 MR. RODRIGUEZ: I know we did. I don't  
3 recall who it was. I made no notes on it.

4 MEMBER GOGLIA: Okay. Thank you.

5 MR. RODRIGUEZ: Yes, sir.

6 ACTING CHAIRMAN CARMODY: Member  
7 Hammerschmidt?

8 MEMBER HAMMERSCHMIDT: Thank you.

9 Just two quick points. Following up on  
10 Member Black's insights and questions, I might mention,  
11 I thought Member Black made sort of a preeminent point  
12 when he made fleeting reference to the 100 million  
13 hours of experience on the DC-9 series fleet and how  
14 really until this tragic occurrence we're in this room  
15 talking about occurred, there was really not very good  
16 situational awareness or context for much of the  
17 hindsight that we now have.

18 My quick question is concerning the intervals  
19 for lubrication of these components. I'm reminded of  
20 what we have in the factual report as sort of a lead-  
21 off sentence on Page 60, and I'm not sure if Mr.  
22 Guzzetti has referenced this already in his  
23 presentations, but they're on Line 8, beginning on Line  
24 8, we say that "Original DC-9 certification documents  
25 specified a lubrication interval for the jackscrew

1 assembly of 300 to 350 flight hours."

2 Now, how did that in the early stages of DC-9  
3 operations get extended?

4 MR. GUZZETTI: We asked that question, Member  
5 Hammerschmidt, and again when you go back to the '60s,  
6 it's tough to find any kind of paper trail. However,  
7 Boeing's best estimate is that it rolled into the 600  
8 to 900 flight hours a year later when the airplane was  
9 put into service because that was kind of their minimum  
10 convenient maintenance interval for that.

11 The 300 to 350 flight hours probably didn't  
12 fit conveniently into the on-airplane maintenance  
13 program that came with the DC-9 when it was rolled out  
14 of there.

15 MEMBER HAMMERSCHMIDT: Okay. Well, I just  
16 point that out as a point of information, that that was  
17 what the original certification documents called for.

18 MR. GUZZETTI: That's correct.

19 MEMBER HAMMERSCHMIDT: So, that's all I have.

20 ACTING CHAIRMAN CARMODY: All right. I think  
21 the next item is Alaska's Maintenance Program, Item 3.

22 Mr. Rodriguez, please.

23 MR. RODRIGUEZ: Yes, ma'am.

24 As a part of our investigation, we evaluated  
25 the Alaska Airlines Maintenance Program and, in

1 addition to the extension of intervals for both  
2 lubrication and inspection of the jackscrew assembly,  
3 we found other significant deficiencies in the  
4 Maintenance Program.

5 For example, Alaska replaced Mobilgrease 28  
6 with Aeroshell 33 without following appropriate  
7 internal and standard industry procedures and there was  
8 no follow-up evaluation of the grease performance.  
9 Alaska used a non-conforming restraining fixture for  
10 the end-play check procedure and fabricated 11 more  
11 after the accident and did not acknowledge the  
12 discrepancy until August 2nd, 2000. The high wear  
13 rates of the three jackscrew assemblies could not be  
14 explained by contamination, surface finish, or anything  
15 other than inadequate lubrication, as Dr. Kolly pointed  
16 out.

17 2-0 end-play readings resulted in replacement  
18 of the jackscrew assemblies on two different aircraft  
19 at Alaska Airlines as recently as Spring 2002.  
20 Inadequate lubrication was found on rudder control tab  
21 bearings on two separate aircraft also in the Spring of  
22 2002. One bearing fell apart when removed. One of  
23 these aircraft had been lubricated about six months  
24 earlier while the other was just short of the next  
25 scheduled lubrication. This information was not

1 released until issuance of a Maintenance Information  
2 Letter, dated July 19th, 2002.

3 The latter two items serve to underscore the  
4 need for maintenance personnel training on jackscrew  
5 assembly lubrication and inspection recommended in  
6 Recommendations A-0143 and A-0144, respectively, which  
7 were issued October 1st, 2001. Both of these  
8 recommendations are currently classified in an open  
9 unacceptable response status.

10 With respect to FAA oversight, we found in  
11 our investigation that FAA surveillance of Alaska's  
12 Maintenance Program in general and the Oakland facility  
13 in particular had been deficient for several years  
14 prior to the accident. The principal maintenance  
15 inspector who retired in November 1999, after eight and  
16 a half years, stated that they were too busy with  
17 administration to do any surveillance. The chief of  
18 the Seattle Certificate Management Office stated in a  
19 formal memorandum to the Director, Flight Standards  
20 Service, November 12th, 1999, that the staffing had  
21 reached a critical point. Alaska was in a state of  
22 aggressive growth and expansion and the FAA staff was  
23 not able to meet the work demands. He concluded that,  
24 "The risk of incidents or accidents at Alaska Airlines  
25 is heightened."

1           Following the accident, an FAA Headquarters-  
2 led team conducted a special inspection of Alaska  
3 Airlines in April 2000. Deficiencies which should have  
4 been apparent much earlier were identified in a June  
5 2nd, 2000, press release, and they included lack of  
6 management personnel in that there was no director of  
7 maintenance. That job was shared by two people with no  
8 delineation of their duties. No director of operations  
9 and no director of safety reporting to the highest  
10 level of management. This function was actually  
11 combined with director of quality control and training.

12           Alaska Airlines Training Manual did not  
13 specify formal training curriculum or on-the-job  
14 training procedures or objectives. The program had no  
15 structure, no identification of subjects, and no  
16 criteria for successful completion. The General  
17 Maintenance Manual procedures were not being followed  
18 and did not include how-to procedures for heavy check  
19 planning and/or production control. Two aircraft were  
20 released to service from C check without completion of  
21 necessary paperwork, raising questions about the  
22 completion of the work and the airworthiness of the  
23 airplane being released to passenger service.

24           There were numerous examples of incomplete or  
25 deleted work cards. Absence of a functional continuous

1 analysis surveillance program led to numerous other  
2 areas suffering from lack of oversight and reform.  
3 Alaska's program was being controlled by an under-  
4 staffed quality assurance department. Audits were not  
5 being completed in a timely manner and were incomplete,  
6 so problem areas were not being identified.

7 As a result of this inspection, the FAA  
8 proposed the suspension of Alaska Airlines heavy  
9 maintenance authority. However, because of Alaska's  
10 efforts to work with the FAA to correct the  
11 deficiencies outlined in the inspection, no suspension  
12 was issued. The FAA accepted an action plan proposed  
13 by Alaska Airlines on June 29th, 2000, to correct all  
14 problems. In July 2001, the FAA finally prepared a  
15 briefing document on their assessment of Alaska  
16 Airlines Maintenance Program. It stated in part that  
17 Alaska Airlines "convincingly demonstrated its  
18 completion of all initiatives and commitments", and the  
19 FAA panel had reached a consensus that Alaska Airlines  
20 met or exceeded all commitments set forth in their  
21 action plan.

22 In light of the recent maintenance errors by  
23 Alaska maintenance personnel, that is, the  
24 inadequately-lubricated rudder control tab bearings on  
25 two separate aircraft, and the two erroneous end-play

1 checks,, we remain concerned about the overall adequacy  
2 of Alaska's Maintenance Program and the ability of the  
3 FAA Certificate Management Office and the Northwest  
4 Mountain Region to monitor and assess its capability.

5 Accordingly, the draft report contains a  
6 recommendation for the FAA to conduct a Headquarters-  
7 led in-depth on-site follow-up safety inspection to  
8 evaluate the adequacy of the corrective measures  
9 implemented in Alaska's June 2000 plan.

10 At this time, we are prepared to answer  
11 questions on Alaska's Maintenance Program and FAA  
12 oversight.

13 ACTING CHAIRMAN CARMODY: Thank you, Mr.  
14 Rodriguez.

15 I was struck by your comments on the lack of  
16 training, lack of training for the maintenance  
17 personnel at Alaska. Would there not have to be --  
18 should there not have been a maintenance training  
19 program which was FAA-approved for the airline or not?

20 MR. RODRIGUEZ: Mr. McGill will handle that.

21 MR. MCGILL: Typically, Madam Chairman,  
22 maintenance training for mechanics is what we call OJT  
23 or on-the-job training. Perhaps initial system  
24 training is given at various times. It's not  
25 regulated. It's not defined. It's not maintained in

1 any manner and that's typical of the entire industry.  
2 Training records are kept on each individual mechanic,  
3 however, and in the past, this has been the  
4 justification that the FAA has used to accept  
5 maintenance training on large aircraft.

6 ACTING CHAIRMAN CARMODY: Thank you, and you  
7 mentioned the two FAA recommendations that were in an  
8 unacceptable status. They had to do with training.

9 Could you elaborate on the FAA's response on  
10 those two, please? I'm assuming they thought it wasn't  
11 necessary. I'm just curious to know what they may have  
12 said beyond that.

13 MS. WEINSTEIN: They said that their current  
14 procedures were adequate and the Board has asked them  
15 to reconsider their position.

16 ACTING CHAIRMAN CARMODY: What was the last  
17 time we asked them to reconsider?

18 MS. WEINSTEIN: It was in June 14th of this  
19 year --

20 ACTING CHAIRMAN CARMODY: Okay.

21 MS. WEINSTEIN: -- in our last letter to  
22 them.

23 ACTING CHAIRMAN CARMODY: All right. Thank  
24 you.

25 Member Hammerschmidt?



1 MEMBER HAMMERSCHMIDT: Thank you.

2 As has been described, the FAA has been a  
3 prominent presence at Alaska Airlines since the time of  
4 this accident, and I know from information that I've  
5 received from Alaska Airlines that they've been  
6 increasing their internal safety audits significantly.

7 I believe I've heard they've conducted something like  
8 1,040 separate internal audits since the time of the  
9 accident.

10 When you suggest that the FAA needs to go  
11 back and take yet another look-see at Alaska Airlines  
12 maintenance, are we really basing that on just a few  
13 mistakes, let's say, that have been brought to our  
14 attention or is there a more pronounced need for that?

15 Because for those of us that have been -- who have  
16 visited Alaska Airlines and have been briefed on the  
17 new systems that they've implemented in terms of their  
18 Safety Committee, their reporting right to the top of  
19 the organization, in various ways, it would seem that  
20 they have gone a long way to improving their internal  
21 methods for enhancing their maintenance safety.

22 MR. RODRIGUEZ: Mr. Hammerschmidt, the  
23 staffing at Alaska Airlines Maintenance Department has  
24 been increased in accordance with their action plan.  
25 I'm not sure what the totals are. I really wasn't able

1 to keep track of the comings and goings, but mechanics  
2 have been hired, I think it's somewhere in the  
3 neighborhood of a 170 additional positions, since the  
4 time of the accident. There have been a total of  
5 perhaps 340, I think, was the figure that they used  
6 total people added in the Maintenance Department. They  
7 have filled these positions that were vacant for two  
8 and a half years, and were you also interested in the  
9 FAA or just the --

10 MEMBER HAMMERSCHMIDT: Well, --

11 MR. RODRIGUEZ: -- Alaska maintenance?

12 MEMBER HAMMERSCHMIDT: -- FAA, too. Might as  
13 well complete the picture.

14 MR. RODRIGUEZ: Yes. At the time of the  
15 accident, Alaska PMI had just retired and a new PMI was  
16 in training actually when the accident occurred.

17 My recollection in rough figures is that  
18 there were perhaps seven to nine people assigned to  
19 that ticket, to the Certificate Management of Alaska  
20 under their Surveillance Program and that figure is now  
21 in the neighborhood of over 30. I believe we've heard  
22 figures of 32 and 34 and it seems to vary because for  
23 quite awhile there, the personnel were not stable.  
24 They were advancing and then going other places for  
25 promotions and that sort of thing which is

1 understandable.

2 MEMBER HAMMERSCHMIDT: Okay. Well, I was  
3 just trying to get more at the aspect of over-auditing  
4 an organization.

5 MR. CLARK: We're not interested in, I mean,  
6 trying to force an over-audit, but several things that  
7 Rod talked about are kind of the underlayment. We had  
8 several incidents that there were jackscrews being  
9 pulled off for zero end-play measurements which  
10 indicates that mechanics didn't know how to properly do  
11 the job. We had this issue on the lack of lubrication  
12 and then a general down-scaling of lubrication  
13 intervals, and I'm not sure how widespread that was at  
14 Alaska Airlines, but a number of their intervals were  
15 down-scaled, and I think the troubling thing to us is  
16 it seems that after the accident and what we found on  
17 the accident, that these types of things would keep  
18 coming up, especially in end-play measurements and  
19 especially anything doing with flight control  
20 lubrications was troubling.

21 And then, I think that's worrisome to us.  
22 The -- and that is -- those are very recent events,  
23 after a lot of this infrastructure has been put in  
24 place, and then, back in the time of the last audit,  
25 they had the ATOS Program in, the PTRS, and there's no

1     indication -- at the time of that inspection, has all  
2     that settled down, and are we back on an even keel?  
3     So, it's a worrisome thing because of the several  
4     specific things, but even at that, the FAA took more  
5     significant action on the cutting back on lubrication  
6     intervals.

7             MR. RODRIGUEZ: I would -- I guess I would  
8     point out, also, that the composition of the safety  
9     inspection that was done at Alaska Airlines was done by  
10    an outside source. When the final analysis, they call  
11    it the Gate 4 meeting, they were unable to meet the  
12    deadlines that were established initially and so they  
13    expanded it into several segments that they would  
14    approve as they were going along, and the final one was  
15    at Gate 4 when they met again to assess the adequacy of  
16    the Maintenance Program. That's what I quoted in here  
17    where they reached a consensus that Alaska Airlines met  
18    or exceeded all commitments.

19            I'm not sure what that means in the final  
20    report, but to me, it suggests that it was not  
21    unanimous, and I see a difference in that word  
22    "consensus" versus "unanimous", and we continue to get  
23    reports of problems in the maintenance area,  
24    unsolicited comments, and for that matter, undocumented  
25    largely, but it is troubling to us and it was because

1 of that that the staff felt that perhaps one more  
2 independent look at Alaska from the outside would be  
3 very worthwhile.

4 MEMBER HAMMERSCHMIDT: Okay. Thank you.  
5 That's all I have.

6 ACTING CHAIRMAN CARMODY: On that point, did  
7 the IG, the DOT IG, not do an investigation of Alaska  
8 Air, and could you comment on that, please?

9 MR. RODRIGUEZ: The answer is yes, ma'am,  
10 they did. At this point, my recollection of what all  
11 they found, I'm not sure that I ever saw the final  
12 report from the DOT IG. But there were --

13 ACTING CHAIRMAN CARMODY: The timing of it.  
14 Do we know when it was done? Was it after the FAA's  
15 report?

16 MR. RODRIGUEZ: No. It was already in  
17 process. It had been in process for a year and a half  
18 or so at the time --

19 ACTING CHAIRMAN CARMODY: Oh, I see.

20 MR. RODRIGUEZ: -- of the accident.

21 ACTING CHAIRMAN CARMODY: Oh, okay.

22 MR. RODRIGUEZ: There were significant  
23 investigations of Alaska Airlines prior to the accident  
24 for quite some time.

25 ACTING CHAIRMAN CARMODY: All right. Member

1 Goglia, any questions in this section?

2 MEMBER GOGLIA: I'm a little bit -- I think I  
3 understand what you're saying with the audits and you  
4 said a lot of they and they, and I'm assuming that or I  
5 get the feeling that some of that was blended.

6 Who did the last audit at Alaska? Do we know  
7 when the last audit was done?

8 MR. RODRIGUEZ: Yes, sir, we do. I don't  
9 have it on the top of my head, but it was -- the last  
10 audit was run in the Spring of 2000, after the  
11 accident. That was a safety inspection that was done,  
12 and then the follow-up of completion of those  
13 complaints that had been -- findings that had been  
14 listed, that was done and ended on July 19th, 2002.

15 The composition of the team, I have it in the  
16 documents here. I don't have them on the top of my  
17 head, but it was headed by -- the inspection was headed  
18 by Mr. Ed Hugg from Headquarters of the FAA and  
19 included quite a few of the staff from the Certificate  
20 Management Office and the region, and the subsequent  
21 assessment of the actions by Alaska Airlines was headed  
22 by Mr. Brad Pearson, who was the Flight Standards  
23 regional director for the Northwest Mountain Region.

24 MEMBER GOGLIA: You mentioned the increased  
25 staffing that has occurred there. Obviously you don't

1 go from -- I think you said it was seven people at the  
2 time of the accident?

3 MR. RODRIGUEZ: Yes, sir. It was less than  
4 10. It was an odd number. It's either seven or nine.  
5 I'm sorry, I can't bring it accurately.

6 MEMBER GOGLIA: That's okay. It doesn't  
7 matter. And bringing that number up to 30+, that  
8 doesn't happen overnight. What kind of time frames are  
9 we looking at before they finally got up to their end  
10 numbers?

11 MR. RODRIGUEZ: We did some interviews in  
12 November of 2001. That would be roughly a year and a  
13 half after the accident. I think at that time, it was  
14 basically the Certificate Management Office had been  
15 staffed out with the exception of an analyst to analyze  
16 all of the data that would be generated by the ATOS  
17 Program.

18 MEMBER GOGLIA: Okay. And given --

19 MR. RODRIGUEZ: And there have been changes  
20 in that since -- obviously since November of 2001.

21 MEMBER GOGLIA: And given, you know, if  
22 they're up to snuff in manpower levels by then, by the  
23 end of 2001, and then in the middle of 2002, this audit  
24 team that's been in place for more than a year?

25 MR. RODRIGUEZ: Yes, sir.

1           MEMBER GOGLIA: Then comes to a consensus  
2 agreement that they think that progress has been made  
3 and the airline is going in the right direction, what's  
4 the value added of another high-level team going in and  
5 looking at Alaska again, given the resource issues that  
6 all of us in government have today?

7           Those people are going to come from  
8 somewhere. They're going to come off --

9           MR. RODRIGUEZ: Yes, sir.

10          MEMBER GOGLIA: -- somebody else's  
11 certificate.

12          MR. RODRIGUEZ: There are within the FAA,  
13 there are agencies and offices that are designed to do  
14 just that sort of thing, and it would simply mean that  
15 rather than inspect a given carrier, they would use  
16 those resources on Alaska, and it's a matter of  
17 priority for higher than me to make that decision, but  
18 if I was in charge, I'd look at Alaska.

19          MEMBER GOGLIA: Now, I'm not so sure that I  
20 would agree with that because, you know, we only have a  
21 finite number of people that know what they're doing,  
22 that understand the process, and where do you put them?  
23 I mean, after -- are we going to move people here and  
24 then have a problem pop up somewhere else that -- on  
25 another carrier that should have received an inspection



1 that didn't because we've diverted the resources to  
2 satisfy us?

3 MR. RODRIGUEZ: As a matter of fact, Mr.  
4 Goglia, we did make a recommendation, I have it here  
5 somewhere, in '96, 1996, based on the Tower Air  
6 accident up at Kennedy, that the FAA apply resources to  
7 fast-growing carriers and that they focus on that  
8 effort with the resources they do have. As a matter of  
9 fact, that recommendation is still open, unacceptable,  
10 and I believe, let me check since it's here, they want  
11 to -- and they have requested us to close it  
12 acceptable.

13 My position is or my point would be that  
14 Alaska was a rapidly-growing and aggressive operator.  
15 They have introduced the 737-700, the 737-900. They  
16 have the MD-80s still flying and, of course, the  
17 generic 737-200s and -400s, and while their growth  
18 increased in terms of total numbers of aircraft, they  
19 also have increased their aircraft daily utilization  
20 significantly and -- well, I've said enough. That's my  
21 position and I'll rest.

22 MEMBER GOGLIA: No, you won't. You'll come  
23 back, I've got another question for you.

24 MR. RODRIGUEZ: Okay.

25 MEMBER GOGLIA: All right?

1 (Laughter)

2 MEMBER GOGLIA: Let's go to the other side of  
3 it now. All right. We now have two major carriers in  
4 this country in bankruptcy. What should the FAA do  
5 about that? Substantial reductions in personnel across  
6 the board. Do they not need additional oversight as  
7 well?

8 MR. RODRIGUEZ: Yes, I would say they do, and  
9 --

10 MEMBER GOGLIA: So, should we take the  
11 inspectors off of those and send them to Alaska?

12 MR. RODRIGUEZ: Well, --

13 MEMBER GOGLIA: I mean, this is a dilemma  
14 that everybody that has to make public service  
15 management decisions on how to allocate their resources  
16 is faced with, and right now, we're faced with a very  
17 troubled industry, and how do we divert six months  
18 after the closing of a major audit, how do we justify  
19 diverting those resources back to this carrier when  
20 there are other areas that need to be looked at?

21 MR. RODRIGUEZ: Well, for one thing, the  
22 industry is several years down the road with respect to  
23 the implementation of ATOS. Those other carriers that  
24 you're referring to have had and I assume -- of course,  
25 I have no direct knowledge, but they have surveillance

1 teams and a Certificate Management Office in place at  
2 each place, and I assume that they have not rapidly  
3 expanded in the recent past, but I don't know that  
4 because I don't know which ones you're referring to.

5 MEMBER GOGLIA: Expansion wasn't the issue.  
6 It's the other way. You know, like this -- in a speech  
7 recently by, I think it was Norm Mineta but it may not  
8 have been, he talked about over 100,000 people from the  
9 airline industry that are now out of work as a result  
10 of events of September 11th. Many of those people have  
11 come from the maintenance and engineering community.  
12 So, I think the entire industry needs watching now.

13 The FAA does not have unlimited resources to  
14 do the watching, and I think that that has to be a  
15 concern of ours. I guess maybe not of staff but as the  
16 Board, that's a concern of the Board.

17 All right. Thank you.

18 ACTING CHAIRMAN CARMODY: I certainly agree  
19 with that, yes.

20 MR. CLARK: Madam Chairman, one thing along  
21 that line is the last inspection that really got into  
22 this area, I believe, was July of 2001 and that's a  
23 little more than a year and a half ago.

24 The other issue is that historically, we kind  
25 of don't get in the FAA's business about trying to

1 apportion how they have to conduct their business. The  
2 real fundamental question here is, if these events and  
3 issues give us an idea that there's a problem that  
4 needs to be looked at, I think we need to make it clear  
5 and get that known and then the tough decisions have to  
6 be made how to apportion that out and make the hard  
7 decisions, but if we don't make that known, it just  
8 kind of goes away when there may be a problem there  
9 lingering. So, I think if there's an issue there, we  
10 need to outline the issue, and if the Board finds that  
11 they don't believe there's an issue, then we need to  
12 clean it off the books here for that reason.

13 ACTING CHAIRMAN CARMODY: No, you're right.  
14 I was going to say something along those lines, except  
15 I also agree very much with Member Goglia's over-  
16 arching concern about the industry, but I do understand  
17 the staff is raising this issue because of this  
18 accident and because of the work they've done and we  
19 value that. We'll have to make our judgment as to  
20 whether that's the way to go or not, and the resource  
21 allocation issue is a huge one, not just for us but  
22 really for the FAA, and we can't solve that today, but  
23 I take your point.

24 Member Black, any questions?

25 MEMBER BLACK: Just a couple. I would submit

1 that I suspect that there's at least one or two people  
2 here from the FAA and they might have even got the  
3 message that way. So, the report itself, I think, will  
4 speak for itself when it's finished with regard to what  
5 we think. It's not that I disagree or agree one way or  
6 another with it, but I definitely think that I'm a  
7 great believer in on-going oversight. Let's put it  
8 that way.

9 Speaking of that, something that is not in  
10 the report that would add into this history of  
11 oversight at the FAA is while this -- I could not help  
12 but observe that while this airplane, the accident  
13 airplane was going through its route through the  
14 inspections and that sort of thing, it's next-to-the-  
15 last C check, wasn't there a fairly in-depth  
16 investigation going on in 1998 at the criminal level by  
17 the FAA and the FBI of maintenance irregularities at  
18 Alaska?

19 MR. RODRIGUEZ: Yes, sir.

20 MEMBER BLACK: So, that was actually going on  
21 while this airplane was still flying before the  
22 accident occurred, and they were looking at things at  
23 that point in time in-depth.

24 MR. RODRIGUEZ: Yes, sir. As a matter of  
25 fact, I believe it began in and about the time it was

1 going through the C check.

2 MEMBER BLACK: Okay. That's just a point  
3 that I'm not real sure what it means. I guess you  
4 would think that some of these things, you would think  
5 that that would certainly create -- certainly when the  
6 FBI was around, it would have created a high level of  
7 tension on me if I had been there, and I can't help but  
8 wonder why that didn't have some effect on this process  
9 and that's more of an observation than it is a -- I do  
10 think it might be worthy of noting that in the report  
11 somewhere because if it's in there, I didn't see it,  
12 that there was actually on-going in-depth investigatory  
13 work during this process. Is it in there, Karen? I  
14 missed it then. I'm sorry.

15 MR. CLARK: 175.

16 MEMBER BLACK: Okay. Thank you.

17 ACTING CHAIRMAN CARMODY: Was that it, Member  
18 Black? Okay.

19 Member Hammerschmidt?

20 MEMBER HAMMERSCHMIDT: Mr. Rodriguez made  
21 reference to the ATOS Program, and we delved into that  
22 quite a bit in the public hearing, as I can recollect.  
23 The Air Transportation Oversight System.

24 What role did the ATOS System play in the  
25 rendering of effective oversight leading up to this

1 accident experienced by Alaska Airlines?

2 MR. RODRIGUEZ: The folks at the Certificate  
3 Management Office in Seattle told us that it was very  
4 disruptive, that they were trying to -- first of all,  
5 they lost control of their geographic inspectors who  
6 had been working with them at other sites, and that  
7 they had no -- while they had some training, there was  
8 an awful lot of language to learn and concepts to  
9 understand, and I think the PMI who retired, as I  
10 mentioned, in '99, made the point that there had been  
11 virtually no surveillance because of that. They were  
12 too busy developing their safety attributes and  
13 elements and that sort of thing. They were doing the  
14 administrative work and nobody was out pounding the  
15 beat, so to speak.

16 MEMBER HAMMERSCHMIDT: Right. Because of  
17 this transitional --

18 MR. RODRIGUEZ: Yes, sir.

19 MEMBER HAMMERSCHMIDT: -- stage --

20 MR. RODRIGUEZ: Yes, sir.

21 MEMBER HAMMERSCHMIDT: -- from the PTRS  
22 System?

23 MR. RODRIGUEZ: Yes, sir.

24 MEMBER HAMMERSCHMIDT: Program Tracking and  
25 Reporting System to the ATOS System.

1           MR. RODRIGUEZ: And in fact, after the  
2 accident, at Alaska, in order to facilitate inspection  
3 and surveillance, they did generate a hybrid program  
4 wherein they were using the PTRS System as well as ATOS  
5 simultaneously during this period while they spooled up  
6 the staffing of the office.

7           MEMBER HAMMERSCHMIDT: Well, I had seen what  
8 you had included in the factual portion of the report  
9 in this regard, even quoted, I believe, what the PMI  
10 who had recently retired, actually in November '99,  
11 what he had said at the public hearing and I  
12 highlighted just a couple of sentences out of this two-  
13 thirds of a page quotation. It would be on Page 156,  
14 but the parts I've highlighted of what he had testified  
15 to was, "None of us were -- we were too caught up doing  
16 ATOS things to actually go out and do any surveillance,  
17 do the system evaluations." And then, the last  
18 sentence that we quote in this passage has the PMI  
19 stating, "Nobody was out there looking at the carrier."

20           So, when you mention ATOS, I just wanted to  
21 insert that bit of information that was gleaned at the  
22 public hearing.

23           So, that's all I had.

24           ACTING CHAIRMAN CARMODY: Member Goglia, you  
25 had a question about a date, I believe.



1           MEMBER GOGLIA: Yes. Mr. Guzzetti or maybe  
2 it's Rod, we talked about the rudder bearing failures  
3 that came to light.

4           MR. RODRIGUEZ: Yes.

5           MEMBER GOGLIA: Do we know the date that  
6 those were last lubed? They don't fall apart  
7 overnight, it takes some time.

8           MR. RODRIGUEZ: I don't have the specific  
9 lube, sir. The best I got was six months previous  
10 because the initial notification we got was that they  
11 had both recently been lubed almost, you know, within  
12 the week or two weeks, and we got a letter from Alaska  
13 Airlines advising us that that was inaccurate  
14 information, that the one had been six months out of  
15 the lubrication cycle and the other was due for the  
16 lubrication cycle within a month or two. That's the  
17 closest -- I mean, there was no specific dates given.

18           MEMBER GOGLIA: And what was the cycle? I  
19 meant, I was trying to deduce it as you were talking.  
20 It's six months out and we lube -- are they on a six-  
21 month lube cycle for that, those bearings?

22           MR. RODRIGUEZ: I don't know what the lube  
23 cycle is for the rudder.

24           MEMBER GOGLIA: Jeff is frantically trying to  
25 read something.

1           MR. GUZZETTI: Yes. Okay. I think it's  
2 every C check.

3           MEMBER GOGLIA: So, that's not six months,  
4 that's --

5           MR. GUZZETTI: Well, no. I take that back.

6           MR. RODRIGUEZ: Well, C check would be 15  
7 months. So, it was -- the one was at 13 months, the  
8 other was six months out of the C -- it had passed the  
9 C check six months previously.

10           MR. GUZZETTI: It says here, Member Goglia,  
11 on April 23rd, 2002, Alaska's Reliability Program  
12 identified a concern with the rudder trim tab hinge  
13 support bearings. The wrap work concluded that the  
14 current C check lube interval adequately addressed the  
15 lube procedures. The Board recommended that the  
16 issuance of a maintenance information letter  
17 emphasizing the proper lubrication be issued, and then  
18 in September 23rd, 2002, the VP of Maintenance and  
19 Engineering directed the issue to be reopened for  
20 additional analysis. The result is Alaska submitting a  
21 wrap control board directive reducing the rudder trim  
22 tab lube interval from the current C check, which was  
23 approximately 4,350, to the Boeing MSG-2 OAMP low-end  
24 interval of 1,200 flight hours. Alaska initiated a  
25 fleetwide campaign on all of its MD-80 series airplanes

1 to inspect and lube the rudder. The campaign was  
2 completed on September 25th, 2002, with no additional  
3 bearing failures noted.

4 And then, it also indicates that prior to  
5 September 19th, 2002, the Alaska Airlines CMO, FAA CMO  
6 had no knowledge of the lube issues surrounding the  
7 rudder trim tab hinge bearing supports. Upon  
8 notification, the FAA requested all pertinent  
9 information, and their conclusion is on September 27th,  
10 2002, the VP directed a decrease in the lube intervals  
11 to 1,200 hours and the CMO will continue to monitor and  
12 take action, if appropriate.

13 MEMBER GOGLIA: Okay. Thank you.

14 ACTING CHAIRMAN CARMODY: I think in light of  
15 the hour, why don't we take a lunch break at this point  
16 and come back at quarter of 2 and resume?

17 (Whereupon, at 12:43 p.m., the meeting was  
18 recessed for lunch, to reconvene this same day,  
19 Tuesday, December 10th, 2002, at 1:45 p.m.)  
20  
21  
22  
23  
24  
25

1

2

## A F T E R N O O N   S E S S I O N

3

1:49 p.m.

4

5

6

7

8

ACTING CHAIRMAN CARMODY: Where is John? I'd like to get started because we have a lot to cover this afternoon. So, please come in if you're in the back or if not, close the door. I think people are filtering in slowly.

9

10

11

Yes, let's resume. Mr. Rodriguez, will you -- had you completed your presentation or you had some more to go?

12

13

MR. RODRIGUEZ: I believe we were in the question and answer session.

14

15

16

17

ACTING CHAIRMAN CARMODY: No. We had finished on that, but I wasn't quite clear if you had finished all of the section on FAA Oversight or if that was still to come.

18

19

MR. RODRIGUEZ: Okay. I have -- no, I have no other prepared statements on the FAA.

20

21

ACTING CHAIRMAN CARMODY: All right.

22

MR. RODRIGUEZ: It's still, as I said, questions and answers --

23

ACTING CHAIRMAN CARMODY: Okay.

24

25

MR. RODRIGUEZ: -- on the two subjects, either subject.

1           ACTING CHAIRMAN CARMODY: All right. I think  
2 we have covered those then, and we're ready to go on to  
3 the next area which is Design and Certification.

4           MR. RODRIGUEZ: Yes, ma'am.

5           ACTING CHAIRMAN CARMODY: We had started that  
6 briefly earlier.

7           MR. RODRIGUEZ: Mr. John Clark, Director,  
8 Office of Aviation Safety, will summarize the staff  
9 considerations on issues surrounding design and  
10 certification of the MD-80 horizontal stabilizer  
11 jackscrew assembly.

12          ACTING CHAIRMAN CARMODY: Please go ahead.

13          MR. CLARK: Madam Chairman, Members.

14                I briefly mentioned a little earlier about  
15 the three recommendations that we drafted to deal with  
16 the design and certification issues that we see, and  
17 the first one was to eliminate the catastrophic effects  
18 of the thread loss. The second one was to address new  
19 designs coming out so that that issue isn't on the  
20 table in new designs, and the third was to assure that  
21 the wear process was addressed in either the system  
22 structure, system safety part of the design.

23                So, what I wanted to make clear was that when  
24 we raised this design and certification issue and we're  
25 not trying to minimize the importance of this

1 maintenance inspection failure that we see going on  
2 here. That's extremely important in this accident  
3 investigation. What we're trying to do is to improve  
4 safety margins by suggesting the use of some practical  
5 design alternatives that could eliminate the  
6 catastrophic effects of the acme nut wear rather than  
7 relying solely on the inspection process to prevent the  
8 excessive wear.

9           There's several key reasons to consider  
10 design enhancements. The wear failure of the acme nut  
11 should be recognized as a single catastrophic-type  
12 failure. That means it should fall under the design  
13 requirements that state the probability of a single  
14 point catastrophic failure should be less than 10 to  
15 the minus 9th. Conversely, that means that you should  
16 be able to fly to 10 to the 9th hours, a billion hours,  
17 without this type of failure in a particular design of  
18 airplane.

19           Wear was not considered a failure mode during  
20 this design as such, and we now have about 100 million  
21 hours on this particular design. To reach this 10 to  
22 the minus 9th level, we need to fly these hours by a  
23 factor of 10 more. We're at one-tenth of this so-  
24 called 10 to the minus 9th. Some staff believe that we  
25 can achieve this safe service life, this nine times

1 more flying hours, through the maintenance route and  
2 some of us aren't convinced of that and that's our big  
3 concern.

4 To put this in perspective, I believe the  
5 entire transport fleet right now has about 500 million  
6 flight hours or about a half of this 10 to the minus  
7 9th, and we're dealing with a subset of the entire  
8 fleet right now at a 100 million hours.

9 When dealing with fatigue, for example, we  
10 require highly-controllable processes in engineering,  
11 manufacturing, inspection and training. These  
12 lubrication and measurement processes right now on this  
13 jackscrew arrangement are not considered highly-  
14 controllable events, and I think that's shown by Dr.  
15 Price's study. An acceptable position in the quality  
16 discipline -- the quality discipline out there kind of  
17 accepts the position that inspection is 80-percent  
18 effective at best. We don't have control over  
19 contamination of training either, and it appears that  
20 Alaska may still be struggling with their procedures  
21 and training regarding lubrication and end-play  
22 measurements.

23 In addition, and this is an important one, we  
24 have no direct measure of wear right now. We have an  
25 indirect measure with this jackscrew arrangement.

1 We're looking inside. We're wiggling the jackscrew and  
2 that we consider an indirect measure, not a direct  
3 measure, of wear.

4 The other issue that we have is that we  
5 consider the mechanic and maintenance operation in the  
6 United States to be first-class, but we're also dealing  
7 with a global issue. We're worried about what goes on  
8 out in the rest of the world, and there are operations  
9 out there that aren't as fortunate as us to have the  
10 kind of skilled people we have working in the  
11 maintenance operations.

12 Regarding wear of the acme nut, we have not  
13 seen the data that assures us this design could meet a  
14 10 to the minus 9th type of requirement relying on  
15 improved maintenance procedures. How do we generate  
16 these numbers that show we can rely on maintenance?  
17 I'm not sure. We've noted the issues raised in Dr.  
18 Price's study. There's concern there. Further, we  
19 don't know all the potential failure modes. We're not  
20 sure what those are. We can look at this failure mode  
21 and perhaps we can address it directly, but that  
22 doesn't assure us that there aren't other mechanisms.  
23 For example, the grit and the wear that came in on the  
24 Hawaiian Airlines was kind of unknown to us. It was  
25 out of the blue. So, that was a second type.



1           Further, an FAA expert testified at our  
2 hearing that wear is so complex, that we cannot conduct  
3 a statistical analysis of it for system safety.  
4 Basically, if you can't put a number to that, that  
5 almost -- that comment almost singlehandedly takes this  
6 10 to the minus 9th issue off the table. If you can't  
7 get that kind of number, you can't really rely on the  
8 10 to the minus 9th.

9           We think we have two ways to go. We can  
10 either develop a better understanding of all of the  
11 risks associated with the wear and rely on maintenance  
12 intervention or another way is to add margin on top of  
13 that and remove or mitigate the problem through a  
14 design based on the assumption that the acme nut will  
15 wear to failure. Now, when you put those designs in  
16 place, we don't want -- we never want it to wear to  
17 failure. We want everything working on the maintenance  
18 and design side, but as that last back-up on this 10 to  
19 the minus 9th issue, we want that there as a safety  
20 margin.

21           To solve this single failure or single point  
22 failure issue, there's -- we perceive potential types  
23 of design changes out there. There's been a number of  
24 them bandied about. There can be some design changes  
25 or modifications perhaps to capture the jackscrew in

1 the event that the nut fails, stabilize the situation.

2 We believe the airplane could land if the stabilizer  
3 quit working and that's happened before or possibly  
4 having some sort of active monitoring system. There's  
5 been suggestion that if we could get back there and  
6 look at a monitoring system once every flight, once  
7 every 10 flights, that would buy us that margin of  
8 safety that we really need.

9 For example, airplane brakes have wear pins  
10 on them that the crews can walk around and check before  
11 every flight. You can see if a brake has worn down or  
12 is wearing excessively. When that pin disappears from  
13 sight, you know it's not supposed to take off and fix  
14 the problem.

15 Now, the -- we recognize this is a tough  
16 issue, and here at staff level, we've had some really  
17 spirited discussions about some of the pros and cons of  
18 it, and I know the Board's equally concerned for lots  
19 of good reasons. The one thing I want to assure you is  
20 we don't want to be excessive in our recommendations,  
21 but on the other hand, we don't want to come up short  
22 either because this -- we're at this 100 million hours  
23 and it's a long, long time before we'll see that  
24 ninefold increase in our flying hours.

25 So, that's kind of a good overview of a lot

1 of our views. With all the spirited discussions, staff  
2 certainly are welcome to jump in and offer different  
3 views, if they choose, but basically I think we can try  
4 to answer any questions the Board may have.

5 ACTING CHAIRMAN CARMODY: Thank you, Mr.  
6 Clark. That was an intelligent discussion of the  
7 problem that's on all of our minds.

8 I guess from what you said, it's safe to say  
9 that you would view this design change and modification  
10 as another arrow in the quiver really of preventive  
11 things to increase the level of safety. Certainly it's  
12 not the only solution. It's a piece of a larger --

13 MR. CLARK: It can be that. It can be  
14 something that just simply takes that issue off the  
15 table, and we're looking for a practicable way to  
16 achieve that. We don't -- we're not looking for major  
17 redesign of the system, you know, going out and putting  
18 two jackscrews on or anything like that. Something  
19 that's simple, effective, and, you know, appropriate  
20 for just taking that edge off the risk.

21 ACTING CHAIRMAN CARMODY: That was going to  
22 my next question. How simple are these modifications?  
23 Do we have a sense of if they are truly simple ones?  
24 I appreciate your saying you don't want to redesign or  
25 add another jackscrew, but do we have a sense that this

1 is simple to do or not?

2 MR. CLARK: Well, since we haven't done it,  
3 it's always easy for us to sit there and declare that  
4 it's really simple. On the other hand, we have a lot  
5 of confidence that -- I mean, there's a lot of smart  
6 engineers out there that are very clever and can find  
7 effective ways to take the edge off and that's what  
8 we're -- we have confidence in.

9 There's been some designs about -- talking  
10 about followers on the jackscrew. The threads wear  
11 out. The followers simply engages the jackscrew, stops  
12 it where it is, and NASA has a certain number of  
13 designs like that on some of their applications.  
14 That's just an idea, but in a sense, it seems that it  
15 could be reasonably simple, reasonably effective, but  
16 again until you really get in and start trying to do  
17 the design, you never know for sure.

18 I would suggest that as we have gone through  
19 these types of issues in the past, it always amazes us  
20 how clever and good the engineers are to solve problems  
21 like this.

22 ACTING CHAIRMAN CARMODY: I may come back,  
23 but let me move on to Member Hammerschmidt. Any  
24 questions?

25 MEMBER HAMMERSCHMIDT: Well, first a comment.

1       Just yesterday actually, I was made aware of some  
2 information about what they've been doing down at the  
3 Kennedy Space Center on their jackscrews. They have  
4 several hundred that they have been trying to increase  
5 the safety of.

6               Is the staff thoroughly familiar with the  
7 work that's been done down there?

8               MR. CLARK: I would say thoroughly familiar,  
9 I'm not, or we're aware of it. We're aware of some of  
10 the design concepts. We've read the literature. We  
11 did, Jeff and -- I think Jeff and somebody else went up  
12 to Nook Industries, who's a leading manufacturer of  
13 acme screws and nuts, and received a lot of good advice  
14 from them, but we're aware of what NASA's done. We're  
15 aware of the literature and the patents, but as far as  
16 getting into the specifics of the design, no, we did  
17 not.

18               MEMBER HAMMERSCHMIDT: Okay. So, you  
19 wouldn't have a sense of whether or not their concept  
20 or their approach would be possibly transferrable to  
21 the DC-9 series of aircraft?

22               MR. CLARK: Oh, I think the concept is --  
23 seems to fit. Now, if there are problems or issues  
24 that we're not in business of designing jackscrews that  
25 would crop up to render that unusable, I'm not aware of

1 it, but the design and the concept and the purpose for  
2 which they designed it is the exact same one we have  
3 here.

4 MEMBER HAMMERSCHMIDT: Right, right. Well, I  
5 found this information, like I say, which I only became  
6 aware of yesterday, including, just for reference,  
7 something called a Technical Support Package, fail-  
8 safe, continued to operate concept for jackscrews, NASA  
9 Tech Briefs, KSC-12187/291/92.

10 MR. CLARK: I received a letter yesterday  
11 from one of the family groups or -- and we appreciate  
12 that. It had been provided to us earlier and it made a  
13 lot of sense, but in the process of us going down there  
14 to try to junior engineer the process, we didn't do  
15 that.

16 MEMBER HAMMERSCHMIDT: Well, of course.  
17 Right. I was just thinking as I looked at this  
18 information that it would seem almost to be useful in a  
19 report such as this Alaska Airlines report, at least in  
20 some reference or footnote or something along those  
21 lines. I don't know what staff has to say on that. We  
22 make reference to it in a generic way in the concepts,  
23 like you've already described in your presentation.  
24 But it just seemed to be just highly interesting.

25 MR. CLARK: Well, I believe it is. It's --

1 we try to be a little cautious if we really haven't  
2 done as much of a goodness check as we can before we  
3 endorse some product. I think it's perfectly  
4 appropriate and perhaps, you know, we can refer to that  
5 type of activity that NASA is very active in it, and  
6 that there may be various applications to buy ourselves  
7 a little --

8 MEMBER HAMMERSCHMIDT: That's what I mean.

9 MR. CLARK: -- qualifier. Certainly not an  
10 endorsement.

11 MEMBER HAMMERSCHMIDT: Yeah. Okay. Mr.  
12 Guzzetti, you've been involved in this issue for many  
13 months now. What are your thoughts on this single-  
14 point failure approach?

15 MR. GUZZETTI: Well, first, let me state that  
16 I fully understand and respect both sides of the issue.  
17 It's certainly a tough issue, and Mr. Clark has  
18 articulated both sides pretty well.

19 Notwithstanding the fact that he's my boss, I  
20 would have to agree -- disagree in certain areas of  
21 some of the recommendations and a few of the analyses  
22 that have been made.

23 I don't think it's a simple fix. I don't  
24 know enough yet or I don't think anyone's studied that  
25 well enough yet, but my intuition tells me it's not as

1 simple as it sounds, putting a follow-on nut on there  
2 or, for example, the KSC document that you referred to.

3 That mechanism, we have reviewed it, not in-depth, but  
4 that mechanism is vertically mounted, not horizontally  
5 mounted. It involves the nut moving and translating,  
6 not the jackscrew, and I'm not so sure you can just  
7 take that concept and apply it to the DC-9 MD-80.

8 That being said, I would think that if I knew  
9 that none of these recommendations we've made and are  
10 proposing regarding maintenance, if I knew that none of  
11 those or some of them were not going to be  
12 incorporated, then I'd be all for a modification of the  
13 jackscrew design, but I think there's a compelling case  
14 that needs to be made regarding maintenance  
15 intervention, lubrication and inspection, that if you  
16 tighten up those intervals and prove the reliability  
17 and validity of the end-play check or go with some  
18 other type of check that does involve direct measure of  
19 the jackscrew, I think it's a tough sell to burden  
20 carriers and to burden a manufacturer with what I  
21 believe could be a very, very expensive drain of  
22 resources, both in human attention, financial  
23 considerations, time involved, and perhaps those issues  
24 could be better left to concentrate on some of the  
25 other heavy hitters of what's causing accidents today,



1 like runway incursions and fatigue and inerting fuel  
2 tanks.

3           So, it's really a tough call because I think  
4 that if we're going to ask the FAA to require the  
5 manufacturer to come up with a design modification and  
6 then require that that modification be incorporated in  
7 well over a thousand airplanes flying in the U.S. and  
8 maybe another thousand worldwide, that's a fairly  
9 significant action on the scale of the 737 rudder PCU,  
10 and if you're going to base that on the Alaska Airlines  
11 accident in which we -- at least I'm fairly confident  
12 we've nailed it in terms of the fact that it's an  
13 inadequate lubrication issue, it's a maintenance issue,  
14 it's a procedural issue, interval issue, you plug the  
15 holes, then that would get at the fact that this very  
16 robust design should never wear down given those  
17 increased frequencies.

18           So, those are just some of the concerns that  
19 I have. I'm just not -- after being immersed in this  
20 for three years, I've really done a lot of soul  
21 searching, and I'm just not entirely comfortable with  
22 -- I have to go pick a side of the fence I'm going to  
23 sit on and I'm going to sit on the fence that is to  
24 give maintenance a chance before you alter the design.

25           That being said, I don't think this jackscrew

1 would meet a 10 to the minus 9 criteria. I agree with  
2 that. I can't argue with that. However, it's been a  
3 work horse for going on 40 years now, and the 10 to the  
4 minus 9 criteria wasn't in place back then, and I think  
5 we need to give some credit to this design that has  
6 served the airplane well, except for this one accident,  
7 in which there were some pretty clear failures of  
8 processes that occurred to get there. So, that's my  
9 take on it.

10 MEMBER HAMMERSCHMIDT: Okay. Well, that's a  
11 very good answer. Very complete. Of course, we're  
12 talking about not only civilian aircraft but military  
13 aircraft as well.

14 MR. GUZZETTI: That's correct. The Navy and  
15 the Air Force operates these airplanes.

16 MEMBER HAMMERSCHMIDT: Hm-hmm. And I've  
17 heard your thoughts echoed by others in our Office of  
18 Aviation Safety as well, just for reference.

19 Well, thank you. That's all I have for right  
20 now.

21 ACTING CHAIRMAN CARMODY: Member Goglia?

22 MEMBER GOGLIA: I have a few questions.

23 Mr. Clark, I'm trying to figure out which  
24 order to put these in. Let's do this. At what point  
25 as a design -- aircraft design engineer, which you were

1 one once, at what point does the designer have a right  
2 to rely upon the maintenance program to provide him the  
3 necessary support for his design so it can maintain its  
4 service life, design life?

5 MR. CLARK: Well, my prior life at the  
6 manufacturer, I really wasn't a design engineer and  
7 never got into that end of it. The issue, when should  
8 they -- where should they draw the line and say the  
9 maintenance is going to take care of everything? I  
10 think that that -- let me back up a little bit.

11 Jeff commented that this 10 the minus 9th  
12 issue wasn't a concept back when this airplane was  
13 designed, but it's not unfair to go back and look at it  
14 in that light and that's what we're doing. We're  
15 second-guessing a lot of people.

16 I think that what we try to look at is that  
17 if something is going to be catastrophic, can we buy  
18 margin or mitigate the effects, just simply make the  
19 assumption that something's going to be catastrophic  
20 and mitigate it or put the infrastructure in place  
21 where it makes it very, very difficult for that thing  
22 to occur?

23 The problems we have are like with high-  
24 rotating -- high-energy rotating parts out of engines.  
25 Very high energies. If the fan disk or the high-

1 pressure turbines on these jet engines let go, they're  
2 coming through whatever is in the way. They'll cut a  
3 wing off. They'll take the -- do serious damage, like  
4 we had up at Sioux City. We don't know of any way as a  
5 designer to contain it once it lets go. So, there's a  
6 huge amount of infrastructure in place to -- we go  
7 through the design. We go through double melts, triple  
8 melts on the titanium, very extensive inspection  
9 techniques. I know you've talked to me about what ones  
10 work out there and which ones don't.

11 We need that kind of infrastructure in place  
12 on something that can be catastrophic. So, where does  
13 the design come in? I would look at it as if you can  
14 size it up, if that thing -- if you assume that that  
15 failure occurs and it can be catastrophic, then we need  
16 to apply the 10 to the minus 9th. Now, is it fair to  
17 go back retroactively? I think it is in a sense. Not  
18 to criticize the design in and of itself, but what can  
19 we -- let's look at it, and if we can't get to that 10  
20 to the minus 9th, then we can see what we can do.

21 Right now, to add on, retrofit, look at the  
22 design, mitigate it the best we can, and if we're not  
23 going to do that, if we can't do that, then we need to  
24 put a very extensive infrastructure in place on these  
25 critical items just to make sure, a hundred percent

1 sure that they're very, very carefully controlled.

2           What I might point out, one of the options,  
3 you know, for the amount of -- let's talk about the  
4 amount of infrastructure that it takes to keep a fan  
5 disk running, the design, maintenance, very complicated  
6 stuff, costs a lot of money. If there with an  
7 inexpensive way to contain that, you may not have to  
8 put as much attention to doing that. So, we have a  
9 balance there, also, in this particular thing with this  
10 jackscrew, is do we want to have very rigorous, very  
11 repeatable low-hour-type maintenance, 2,000, 1,000  
12 hours, or 600 hour lubes, just repetitive, and with  
13 much more stringent training in process, or can we -- a  
14 lot of ADs that go out have -- you have to do  
15 repetitive inspections until there's some terminating  
16 action. When you take the terminating action, some  
17 sort of design change or you switch part or piece or  
18 something like that, then it takes away the burden of  
19 doing very extensive maintenance issues. So, that's a  
20 consideration, also, here.

21           MEMBER GOGLIA: Okay. Mr. Guzzetti, you  
22 mentioned just before lunch about American Airlines and  
23 the wear rates and their grease cycles. What did you  
24 say was their grease program?

25           MR. GUZZETTI: I believe they were

1 lubricating their jackscrews every 940 flight hours,  
2 was, I think, the second smallest, lowest interval in  
3 the industry.

4 MEMBER GOGLIA: And that's roughly three  
5 times the initial DC-9 interval, 300 --

6 MR. GUZZETTI: No, it was -- yes. On the  
7 specification.

8 MEMBER GOGLIA: Right.

9 MR. GUZZETTI: But when --

10 MEMBER GOGLIA: And then it went to 400 which  
11 would be double.

12 MR. GUZZETTI: It went to 600 to 900 when it  
13 rolled out the door, the DC-9, and these are -- and  
14 then when American started getting MD-80s, they were  
15 still lubing at the 940-hour interval, even though the  
16 MSG MRB Program escalated it up to 3,600.

17 MEMBER GOGLIA: Okay. And you mentioned that  
18 there was virtually no wear in their jackscrews because  
19 of that?

20 MR. GUZZETTI: That's correct.

21 MEMBER GOGLIA: All right. I guess I would  
22 go back to Mr. Clark since you're the 10th to the minus  
23 9th guru there. If we have virtually no wear on a  
24 jackscrew because we lubricate it, would that then make  
25 the 10th to the minus 9th?

1           MR. CLARK: I don't think we know. The --  
2 will it always make that? Can we go out there for that  
3 period of time and never have a maintenance failure  
4 that allows lubrication? Can we get -- we know we had  
5 a contaminant get in on the Hawaiian Air and give us a  
6 13 time. Is that the worse contaminant we can get in  
7 there that can give us problems between these 2,000-  
8 hour maintenance cycles? Those are things that concern  
9 us and it's the thing that we don't know that we're --  
10 that kind of keeps that open. I don't know how to  
11 answer that.

12           What I said earlier was that for this  
13 specific issue and this specific lubrication, would it  
14 appear that we've solved the problem by more  
15 lubrication rates? In a sense. But there's things,  
16 also, we don't know. For example, if I did miss one of  
17 those lubrications and for whatever mechanism I got  
18 into a high wear rate, what we don't know that if we  
19 relube that jackscrew or we -- will that self-heal  
20 itself and go back to a normal wear rate? Those are  
21 the kind of things we don't know.

22           If we want to look at how this thing got to  
23 40,000ths, could it be that back at 10,000 hours, the  
24 lubrication was missed and we had a small section of a  
25 high wear rate and then it went away? It's the unknown

1 that's worrisome, and if you can just simply take the  
2 argument off the table, you don't have to worry about  
3 the unknown, but I also recognize we do rely on  
4 standard practices, but most of those don't lead us to  
5 this type of catastrophic failure and that's -- so, I  
6 think that puts this thing in a class that there are  
7 very few parts and pieces that really fall right in  
8 that area.

9 MEMBER GOGLIA: As I listened to you explain  
10 that, I got thinking about Aloha and the accident, and  
11 why didn't we recommend double hulls like we do on  
12 tankers?

13 MR. CLARK: I don't think that would be  
14 practicable. I don't -- I wouldn't know how to do  
15 that. I wouldn't know how to contain a fan disk.  
16 Those, we have to handle other ways.

17 MEMBER GOGLIA: And what about bi-planes? Do  
18 you think we should go back to bi-planes, so we can  
19 have redundant wings?

20 MR. CLARK: No.

21 MEMBER GOGLIA: That's what comes to mind.  
22 It's a no-win situation.

23 MR. CLARK: It's a tough situation.

24 MEMBER GOGLIA: Okay. I will pass it on to  
25 Member Black.



1           MEMBER BLACK: Thank you.

2           A couple of questions. John, you shared with  
3 me a systems safety analysis fault tree which I can't  
4 find right now, by the way.

5           MR. CLARK: Okay.

6           MEMBER BLACK: That's okay. I didn't  
7 understand it anyway. But the -- something that comes  
8 to mind and one of the things that we're talking about  
9 with Dr. Price earlier about certainties here. We're  
10 putting an awful lot of confidence in this number of 10  
11 to the minus 9, and I often wonder what the error band  
12 is for the 10 to the minus 9. I mean, somebody  
13 selected somewhere along the line. It's my  
14 understanding from ValuJet or some other accident that  
15 we found that that was a pretty arbitrary selection  
16 when the FAA was asked to define extremely improbable,  
17 somehow they came up with 10 to the minus 9.

18           I'm just saying that I think we're dealing in  
19 things here that are not well-established numbers. Are  
20 we going to have 10 to the minus 9?

21           MR. CLARK: Ms. Schultz is our expert on  
22 that.

23           MEMBER BLACK: Okay.

24           MR. CLARK: Ms. Schultz is our expert on that  
25 10 to the minus 9th. She has -- comes with a systems

1 safety background.

2 MEMBER BLACK: Okay.

3 MR. CLARK: But I'd just make one comment.  
4 There's -- we worked a number of accidents where some  
5 of those parts and pieces should have made it to 10 to  
6 the minus 9th and they don't, and, I mean, there's  
7 some, I can't recall off the top of my head, but we  
8 dealt with it in prior accidents. But for the origin  
9 of 10 to the minus 9th.

10 MEMBER BLACK: Okay.

11 MS. SCHULTZ: Good afternoon, Member Black.

12 Just to answer your question, it is a  
13 somewhat arbitrary number, and it's currently a number  
14 that presides in the Federal Aviation Regulations, and  
15 it's a number that's used to assess systems and their  
16 ability to comply with the safety standards during  
17 certification, and the real issue here that we were  
18 looking at was the single-point failure nature, that  
19 this nut itself could be considered a single item whose  
20 failure surely in almost every circumstances, we  
21 believe we see it, would result in a catastrophic  
22 event, and we as a group looked at current aircraft and  
23 we failed to really see many situations where one  
24 single component fails.

25 Member Goglia mentioned the wings and that's

1 a very astute difficult discussion, but even in those  
2 circumstances from my understanding, and I don't have a  
3 lot of background in structures, but that the load-  
4 bearing capability, which is the function that the wing  
5 provides, is redundant. There are dual load paths  
6 through the wing, and so it's a difficult question, how  
7 far do you go?

8 MEMBER BLACK: Okay. Thank you. The best  
9 explanation I've heard. I still think they guess but  
10 okay.

11 There's also the issue here that we haven't  
12 addressed. Thank you. There's also the issue again  
13 here that we haven't directly addressed that we worried  
14 about in the USAir 427 accident in Pittsburgh, is first  
15 do no harm. In other words, you have a system that has  
16 performed perfectly, I guess, for lack of a better word  
17 for nearly a hundred million fleet hours at the time of  
18 the accident. You don't want to mess with it and  
19 create something by some other device design to make it  
20 fail-safe which will cause another problem, and of  
21 course, that's up to the manufacturers, if we make a  
22 recommendation and the FAA chooses to implement that  
23 recommendation, but I -- what I'm saying is we're sort  
24 of in the pseudoscience here about saying very large  
25 numbers.

1           If we were talking about an airplane that  
2 only had a few hundred thousand fleet hours, this would  
3 be a very different discussion, but in this particular  
4 one with a very large number of airplanes in the fleet  
5 and no previous failures, it becomes a different issue,  
6 and I think that's what the board members are  
7 struggling here with and what Jeff Guzzetti is trying  
8 to say, also, and I'm inclined to agree with him, that  
9 this process is before you go changing a system which  
10 has performed well, as we did in the 737s, we want to  
11 make sure that we have some issue, and of course, in  
12 the 737s, we had three or four incidents that led us  
13 down that path, and we don't have that here, and we  
14 certainly don't want that to happen.

15           There are other -- are there -- John, can you  
16 think of systems in the airplane that single-failure  
17 catastrophic systems, if a maintenance technician  
18 failed a certain operation?

19           MR. CLARK: There's a -- I assume there's a  
20 number in the sense that anything that's going to give  
21 you loss of control on approach or it was suggested to  
22 me that, you know, losing a flap on approach, put the  
23 flaps out and somewhere close to the ground, you lose a  
24 flap, you're going to be in a very oximetric lift  
25 condition, that can happen. We talked about the --

1 even right now in the 737 rudder hard-over situation,  
2 that there's a certain altitude below which, if we do  
3 have a hard-over, the pressure has to come up to handle  
4 the engine thrust. If we have a hard-over in those  
5 conditions, we're still going to lose an airplane, and  
6 again those are some of the decisions that are made and  
7 evaluated at -- it's cutting the risk in the sense that  
8 we -- at least we haven't eliminated it until they  
9 possibly go to the new design with redundancy built in,  
10 but it has a -- it's at least cut it down to for every  
11 flight to the first thousand feet up and the last  
12 thousand feet getting down and getting down below some  
13 sort of controllable speed.

14 MEMBER BLACK: Well, I can't help but think  
15 when I was reading this for the first time, I thought  
16 about the Aloha accident, also, which is, for those who  
17 don't know what it is, it's the airplane that lost its  
18 crown skin most of the way back, a 737, in Hawaii a  
19 number of years ago, and the pilot somewhat  
20 miraculously got it on the ground with only one  
21 fatality, and I guess I would -- and I don't know what  
22 the inspections are on 737s, but I guess I'd argue that  
23 someone was supposed to look at that seam probably the  
24 last time it was inspected and they didn't catch it,  
25 and it was almost a catastrophic incident. So, that in

1 essence by your definition, it almost sounds like a  
2 single-point failure.

3 MR. CLARK: From what I know about that, in  
4 the sense that once the cracks lined up, it certainly  
5 did become a single event, unzipped the top. It wasn't  
6 catastrophic. Of course, we're dealing with one that's  
7 very potentially that case over in Taiwan right now in  
8 China Air 611 that came apart in flight and lost  
9 everybody on board.

10 MEMBER BLACK: And there's some maintenance  
11 management. They don't have a cause for that accident  
12 yet, but there's some suspicions of maintenance  
13 management and maintenance practices on that airplane.

14 MR. CLARK: Yeah. We have to defer to Dr.  
15 Young over at Taiwan right now. He's the guy that's  
16 going to make the call on what it was, --

17 MEMBER BLACK: I understand.

18 MR. CLARK: -- but we did find some  
19 maintenance -- poorly-performed maintenance 20 years  
20 ago that there were some big cracks there. Now,  
21 whether those are the right cracks that got this  
22 airplane down.

23 MEMBER BLACK: We don't need to get into  
24 that. I'm just saying that there -- any time anyone  
25 touches an airplane, and I used to be an aircraft

1 maintenance officer and I was aware of this, any time  
2 anyone touches an airplane, there's the possibility  
3 that they can do some harm, and I think what the Board  
4 is saying here and Mr. Guzzetti is saying we have a  
5 maintenance system that works the vast majority of the  
6 time. Obviously it's worked on DC-9 series before this  
7 because it hadn't before, and I don't know whether I'm  
8 ready to abandon that system yet.

9 MR. CLARK: No, I don't think -- we're in no  
10 way, shape or form abandoning that system at all.  
11 That's not the case at all. When we have a  
12 demonstrated issue and this catastrophic loss, if we  
13 can do something reasonable and take that issue away  
14 and buy some margins for the mechanics, we want to do  
15 that.

16 I'll point out that we try to buy margin for  
17 the pilots. You know, many places that we put margins  
18 in every time to try to mitigate and cut the risk. We  
19 do it. The engineers try to do it in all of the  
20 designs they work on, and there's no reason not to try  
21 to buy margins when we can in a reasonable manner on  
22 these airplane designs to buy margins for mechanics  
23 making errors, and so that's -- I mean, that's the  
24 whole concept behind all this. It shouldn't be -- it  
25 turns out to be a killer operation, hugely expensive,

1 extremely complicated, then I don't -- I think money's  
2 better spent trying to take care of it on the  
3 maintenance side.

4 MEMBER BLACK: This might be the logical  
5 place to interpose the question about what about  
6 jackscrew or stab trim control assemblies on other  
7 types of airplanes?

8 MR. CLARK: Okay. What Member Black's  
9 referring to, other airplanes have different  
10 arrangements. Probably the most prominent out there  
11 are the -- it's called the ball screw arrangement. It  
12 looks -- the shaft looks kind of like a jackscrew and  
13 instead of having -- engaging threads from a nut,  
14 there's a series of balls that cycle around and create  
15 kind of a set of nut threads only using recirculating  
16 balls, and Mr. Guzzetti had done an extensive amount of  
17 work on that. We have a lot of concern about that, and  
18 in the process of trying to put the report together, I  
19 talked him into putting that in abeyance until we got  
20 the report together and then if we had time go back and  
21 more fully develop -- we had a number of questions  
22 about the issue of ball screws and where we were at and  
23 potential failure modes and things we didn't know, and  
24 in the process, it absorbed all of his time and even  
25 though he and I are kind of on opposite sides of the



1 fence, we still respect him very much and in fact, we  
2 promoted him to be Deputy Director for our Regional  
3 Operations.

4 So, I think that's a testament to what we  
5 think of his opinions. So, I don't want to be shooting  
6 myself in the foot bragging on him right now, but the  
7 --

8 MEMBER BLACK: You're making his case.

9 MR. CLARK: I know it. I know it. But that  
10 -- but we try to be very fair about what the issues are  
11 out on the table, but the -- we had decided to put that  
12 in abeyance and what we anticipated -- you know, get  
13 this report done and out and almost immediately, and we  
14 were looking at within two-three-four weeks trying to  
15 bring that second recommendation to the Board about how  
16 we really wanted to deal with those other actuating  
17 mechanisms on transport category airplanes because  
18 there are many out there that have similar features  
19 that have the potential to get into single-point  
20 failure modes. A lot of them have dual-load path  
21 structure like this thing did, but we really haven't  
22 addressed the loss of threads or the loss of the balls  
23 out of the actuator. So, that's coming, but I also --  
24 Member Black's been very active out there doing a lot  
25 of that research that we would like to have been

1 working on while we were moving this report forward.

2 So, we're doing right now, Mr. Guzzetti had a  
3 fairly comprehensive factual analysis and a  
4 recommendation, and it was right on the edge of  
5 incorporating and we believe there is an issue out  
6 there for the rest of the fleet.

7 MEMBER BLACK: Well, ever how we choose to do  
8 with it, I just think we're centering on one airplane  
9 because it had -- one type of airplane because it had  
10 the accident, but we certainly don't want to overlook  
11 others and ever how we choose to get our  
12 recommendation, perhaps some sort of a recommendation  
13 that this just be a general consideration, somewhat  
14 like we did in 427, is look at this, look at this issue  
15 in the fleet, all of the fleets, and if there's a  
16 problem with it, we need to do something about it.

17 MR. CLARK: Yeah. We talked to staff about  
18 that. You know, we can do the more extensive work and  
19 hand that off to the FAA or I think in a sense, Jeff  
20 has really outlined the issue for other airplanes.  
21 That could be incorporated into this report, and then  
22 our Systems people would have to assign a person to  
23 kind of keep track of that to make sure we keep on the  
24 focus over at FAA and so either way, we're prepared to  
25 go either way, whatever the Board chooses.

1           ACTING CHAIRMAN CARMODY: Member Goglia?

2           MEMBER GOGLIA: You know, I've seen a list,  
3 and I think George, you may have a copy of it, on these  
4 jackscrews, and it's the ones that use the acme nut,  
5 not necessarily the reciprocating ball. It's  
6 extensive, including some of the most recently-designed  
7 airplanes, which there are virtually hundreds and  
8 hundreds on order and that's the regional jets. It is  
9 -- I think that we're -- we need to address the entire  
10 issue, the entire fleet, everywhere in our  
11 recommendations. We keep saying DC-9 MD-80s, 717, but,  
12 you know, the regional jets, I think there's something  
13 like 7 or 800 of them on order, and when you look at  
14 the jackscrew that's used on them, it looks like  
15 somebody put it in -- took the drawings, put it in the  
16 xerox machine and said reduce it by 50 percent and  
17 printed it.

18           MR. CLARK: Oh, yeah. Yes. I fully agree  
19 with you.

20           MEMBER GOGLIA: It's extensive. Extensive.  
21 Now, I have a couple more questions.

22           MR. CLARK: Your microphone, Member Black.

23           MEMBER BLACK: I've received information from  
24 two regional jet manufacturers that were kind enough to  
25 send it to me just recently and I haven't had a chance

1 to analyze it, but it is -- they're selling rapidly,  
2 and we need to find out if there is an issue here, it  
3 needs to be addressed because it's a very active issue,  
4 and as you can see from the list, there are everywhere  
5 from 707s and DC-8s all the way up through the RJs that  
6 have some sort of an assembly similar to this.

7 Thank you. I'm sorry, John.

8 MEMBER GOGLIA: John, let's talk a minute  
9 about the dual path, the single-point failure, and just  
10 a minute ago, our Systems Analysis person here  
11 mentioned the nut is a single failure in this design.

12 How do you feel about the screw and the fact  
13 that it has the torque tube on the inside which gives  
14 us an alternate path?

15 MR. CLARK: Well, I think that was clearly  
16 meant to be a dual structural load path, and for  
17 everything we know about it, it does fulfill that on  
18 the screw side. Yeah.

19 MEMBER GOGLIA: And would you agree with the  
20 assessment that the nut in this particular installation  
21 is 300-percent overload? It's robust enough?

22 MR. CLARK: Strength-wise? The threads are  
23 in place?

24 MEMBER GOGLIA: Yeah.

25 MR. CLARK: I think it's even much more than

1 that. I think it's -- I think you can wear it to the  
2 replacement limit 10 times. Strength-wise, if the  
3 threads are in place, it's much, much more than that.  
4 In fact, I'd point out that you saw the remnant and  
5 much of that remnant had been pushed out of the way and  
6 we were down to the last 100th of an inch of that  
7 remaining thread and that was sufficient to operate and  
8 maintain strength with the thinness of that thread  
9 element still reasonably in place. So, structurally,  
10 it's the thread. The brass nut first meets any  
11 standard we could dream up. Yeah.

12 MEMBER GOGLIA: I asked and had a jackscrew  
13 nut cut to give us a dual path, and it's not sound  
14 engineering. I actually have it here. I don't know if  
15 I want to bring it out, but with a hacksaw, with a  
16 simple hacksaw, I can make that one nut into two nuts  
17 and provide us with the redundancy that you're talking  
18 about.

19 MR. CLARK: Works for me. The -- what you  
20 want to -- the object there is, for -- there's a dual  
21 concentric path and what that means is you have one  
22 spiral of threads and then a second one that's  
23 interleaved within that. So, in theory, from the  
24 structural side, you could break off one set of threads  
25 and you would have the other thread, even though

1 they're interwoven.

2           What defeated this design was the wear, that  
3 you really can't wear out one set of threads without  
4 wearing out the other set. So, wear is the problem  
5 that got us to the issue. So, structurally, the  
6 threads in the dual concentric make sense. From wear  
7 standpoint, that was the failure point.

8           MEMBER GOGLIA: Just by cutting the nut in  
9 half on an angle, it satisfies the verbiage of the FAR.

10          MR. CLARK: Yeah. The issue right there,  
11 John, is if you can wear out one side without wearing  
12 out the other and that's the concern. I don't know  
13 that that would do that in that case.

14          MEMBER GOGLIA: But that's not in the  
15 certification requirement.

16          MR. CLARK: No, it isn't, but what we do --  
17 we certainly don't limit ourselves to what the FAA  
18 rules were in place then or even what is in place now.  
19 What we want to do is make sure we solve the problem.

20          MEMBER GOGLIA: Okay. I have one question,  
21 and it goes back to Jeff, and I think it's going to end  
22 up over at -- how quick we forget. No, not Ron  
23 Battocchi. You can rest at ease.

24                 The training for the mechanics back in '97  
25 when they did the end-play check and Mr. Leontine is

1 the one who wrote it up at 40,000ths, did we get the  
2 training records and experience level of Leontine and  
3 the others who subsequently said that this -- redid the  
4 wear check and said it was

5 MR. CLARK: I did not, but Mr. McGill would  
6 probably be better to answer that question. He's the  
7 one that checked into some of that.

8 MR. MCGILL: We looked at all the training  
9 records. I had probably 50 of them sent to my office,  
10 but as you know, training in a 121 environment because  
11 of the lack of definement that is such as flight  
12 attendants, dispatchers, pilots, so forth, it doesn't  
13 really tell you a lot. It just says, yes, they were  
14 given some courses here and they would document them  
15 whenever they got them. Mr. Leontine had courses  
16 documented that he had took, given by Alaska Airlines,  
17 so did many other mechanics that we looked at, but  
18 there is no structure to that and that's just -- that's  
19 in the industry itself, not specifically Alaska  
20 Airlines. They were kind of following suit.

21 So, what you can get from this is they went  
22 to some four hours or eight hours and did some sort of  
23 training. I don't know what happened because it's not  
24 recorded properly. So, we can never determine exactly  
25 the degree of sophistication nor can we figure out or

1 articulate in any manner what the training accomplished  
2 on these individual mechanics.

3 MEMBER GOGLIA: Okay. Thank you. I have no  
4 further questions.

5 ACTING CHAIRMAN CARMODY: All right. I think  
6 we're finished with this section then, and we can move  
7 on to Flight Crew Decisionmaking.

8 MR. IVEY: Good afternoon, Madam Chairman,  
9 Members of the Board.

10 I have a very brief presentation highlighting  
11 the findings in the staff report concerning flight crew  
12 decisionmaking. The Operations Group spent a great  
13 deal of time evaluating the flight crew's actions and  
14 their decisionmaking on the accident flight.

15 The report concludes that the crew's decision  
16 not to return to Puerto Vallarta immediately after  
17 recognizing the trim system malfunction was  
18 understandable. The decision to divert to Los Angeles  
19 rather than continue to San Francisco as originally  
20 planned was prudent and appropriate. The use of the  
21 autopilot when the horizontal stabilizer was jammed was  
22 not appropriate. The captain should have kept the  
23 slats and flaps extended when the airplane was found to  
24 be controllable in that configuration after the initial  
25 dive. His retraction of the flaps and slats was not



1 appropriate.

2           The report also includes a recommendation for  
3 clearer guidance to flight crews who encounter flight  
4 control system failures. In particular, we believe  
5 that they should complete only checklist procedures and  
6 if not effective land at nearest suitable airports.  
7 Pilots should not attempt any additional corrective  
8 actions.

9           This concludes my brief presentation.

10           ACTING CHAIRMAN CARMODY: Thank you, Captain  
11 Ivey.

12           Any questions? Member Hammerschmidt?

13           MEMBER HAMMERSCHMIDT: Could someone go into  
14 the communications between the flight crew and the  
15 Dispatch and maintenance people on the ground that were  
16 -- that took place and whether or not the flight crew  
17 was being helped by their ground support during the  
18 flight?

19           MR. IVEY: Actually, the beginning of  
20 attempted communications started over Mexico as the  
21 flight was proceeding towards the border with the  
22 United States. There are repeater stations down there  
23 in which it's like a dial telephone, if you will, in  
24 which they're able to dial in for assistance, and the  
25 Operations Group interviewed the flight crew who was

1 paralleling the accident flight and actually reported  
2 that they had heard a couple of attempts to dial up,  
3 but that was not successful.

4           Once they reached the area of Tijuana,  
5 Mexico, the accident crew did contact Maintenance  
6 Control in Seattle and also the Los Angeles Operations  
7 was listening on the conversation. So, the three were  
8 actually on the same line at that point.

9           When the attempt was made to contact  
10 Maintenance Control in Seattle, we were able to get a  
11 written log more or less of the conversation. However,  
12 as you know, the cockpit voice recorder began in the  
13 middle of that conversation when the flight crew was  
14 talking to Maintenance Control in Seattle.

15           I don't know if there's any specifics that  
16 you're interested in regarding that conversation I may  
17 be able to answer.

18           MEMBER HAMMERSCHMIDT: Well, I was just  
19 wondering if the ground support should have given the  
20 flight crew just better information in terms of getting  
21 the plane on the ground rather than suggesting all  
22 these optional things to look for in the cockpit.

23           MR. IVEY: I think the flight crew believed  
24 that they had a jammed stabilizer. Obviously they had  
25 been hand-flying the airplane and quite well at 31,000

1 feet for the duration of the flight from when the trim  
2 actually ceased operation. But the crew had no way of  
3 knowing what had transpired in the back of the  
4 airplane. Similarly, when talking to Maintenance  
5 Control, they, too, would have had no idea of the  
6 nature of the problem that the crew was experiencing,  
7 other than to establish a dialogue to try to understand  
8 and through the limits of their knowledge offer  
9 suggestions.

10 In the case of the mechanic who was also  
11 monitoring the conversation in the Los Angeles  
12 Maintenance Facility, he was trying to volunteer his  
13 help as well, but I don't think anyone, anyone on the  
14 ground or in the air, really understood the nature of  
15 the problem.

16 MEMBER HAMMERSCHMIDT: Thank you. That's all  
17 I have.

18 ACTING CHAIRMAN CARMODY: Member Goglia?

19 MEMBER GOGLIA: Yes, I have a few questions.

20 I agree with you, Mr. Ivey. I don't think  
21 anybody knew. This airplane after the first event was  
22 clearly flying in uncharted territory, and having said  
23 that, I'm still very troubled by the role of Dispatch  
24 and Maintenance Control in Seattle, you know, and as  
25 you were talking, I recalled one or two sentences in

1 the -- it's actually in the report, where the captain  
2 asked for the numbers for Los Angeles because of his  
3 intention to return to -- to divert to Los Angeles, and  
4 the dispatcher gives him the numbers for San Francisco.

5 Now, there's no doubt in my mind, having been on the  
6 one end of those microphones more than once, that  
7 that's pressure being put on the captain to take the  
8 airplane to its original landing site and this guy,  
9 this crew finds themselves in a very difficult  
10 situation and at least part of the time when they're on  
11 the radio asking for help essentially from others in  
12 the organization, it wasn't there. It was adding to  
13 the problem and not adding to the solution, and I'm  
14 really bothered by the fact, and I was going to raise  
15 this a little further one, that we really need to have  
16 recommendations in this report that deal with that and  
17 how the flight crews interface with Maintenance  
18 Control.

19 I know from my experience in the industry,  
20 that the FAA has struggled with this as well, and it's  
21 about time that we brought this out into the open and  
22 started to address it.

23 MR. IVEY: I certainly agree that there was  
24 not a lot of assistance provided and to cite two  
25 examples, Number 1, when the flight crew asked to talk

1 to an instructor, someone up on the second floor of the  
2 building, that was never acknowledged nor was that  
3 request fulfilled. Similarly, that Maintenance Control  
4 actually passed off the idea of helping the crew obtain  
5 the center of gravity and the information needed for  
6 landing and passed that off to -- asked L.A. to  
7 calculate these numbers for them, and in fact, the L.A.  
8 Operations agent on duty at the time actually was  
9 unable to do so, even though they had had that training  
10 early on as working in Operations.

11 So, that was not the assistance that they  
12 could have used. I totally agree.

13 MEMBER GOGLIA: Okay. I'm going to make a  
14 request that we modify this as a motion at one point.  
15 Do you want -- Madam Chairman, do you want to do that  
16 now or you want to wait until --

17 ACTING CHAIRMAN CARMODY: What is it you're  
18 referring to? The recommendations? Because we haven't  
19 gotten --

20 MEMBER GOGLIA: Yes. I want to add an  
21 additional recommendation which I do not have language  
22 for.

23 ACTING CHAIRMAN CARMODY: Well, I think we'd  
24 have to see the language before we consider it.

25 MEMBER GOGLIA: Well, I have another way of

1 dealing with it.

2 ACTING CHAIRMAN CARMODY: Well, you may want  
3 to at the break circulate the language and then we can  
4 talk about it with the recommendations.

5 MEMBER GOGLIA: Well, we may at the break ask  
6 staff to prepare something and present it to us.

7 ACTING CHAIRMAN CARMODY: Does staff know  
8 what you want because I don't?

9 MEMBER GOGLIA: We'll talk about it.

10 ACTING CHAIRMAN CARMODY: We can talk.

11 MEMBER GOGLIA: We'll try to --

12 MS. WEINSTEIN: Chairman Carmody, what we can  
13 do from safety recommendations is go and do a run on  
14 prior recommendations on dispatch and that might help  
15 Member Goglia with some language. We'll do that now.

16 ACTING CHAIRMAN CARMODY: Okay. That's a  
17 good idea.

18 All right. Are you through with questions  
19 for now?

20 MEMBER GOGLIA: Yes.

21 ACTING CHAIRMAN CARMODY: Member Black?

22 MEMBER BLACK: Thank you.

23 Dave, could we have up the slide again where  
24 you list the conclusions? Could you put all of them  
25 up? This is so fuzzy on my screen, that even with my

1 glasses, I have trouble with it.

2 I certainly agree with the first two, and I  
3 have some -- really, the third one, also, and I tried  
4 to find in my records a copy of the checklist. I'm  
5 sure you know what I'm talking about, but there  
6 actually is a checklist item that you run for a stab  
7 problem or a jam that has a line in it that says do not  
8 engage the autopilot, is that not --

9 MR. IVEY: That's correct. In fact, if  
10 you'll look into the staff report behind Page 151, that  
11 is the stabilizer inoperative procedure.

12 MEMBER BLACK: Okay. I read that one and  
13 knew that one. The difficulty that we were talking  
14 about a minute ago about this incident and with the  
15 crew's response to it, I do have some difficulty with  
16 the retraction of the flaps and slats, and I guess one  
17 of the fortunate or maybe unfortunate things is one of  
18 the things a board member does is get to listen to the  
19 actual taperecordings and it's often quite distressing  
20 to do this.

21 But there isn't any guidance about what  
22 happened basically after the first event. They were on  
23 their own. Would you agree with that?

24 MR. IVEY: I think the guidance after the  
25 first event changed significantly because the only two

1 procedures that are in the Quick Reference Handbook,  
2 the QRH as it's called, related to stabilizer is a run-  
3 away stabilizer and the stabilizer inoperative. In  
4 both those cases, prior to the first dive, these are  
5 abnormal procedures.

6 I as a pilot, if I'd taken a 7,000-foot dive  
7 without the ability to get this airplane back to a  
8 stable and level position, I've now gone from an  
9 abnormal situation --

10 MEMBER BLACK: Sure.

11 MR. IVEY: -- into an emergency situation.

12 MEMBER BLACK: Emergency, yes. Absolutely.  
13 And there are lots of others that agree with you on  
14 that.

15 I just feel like and what John was saying a  
16 minute ago, sort of summed up, is this has never  
17 happened before. There's no documentation that this  
18 has ever occurred before, and the pilots gave some  
19 indication of understanding vaguely what was back in  
20 the tail of the airplane, but they didn't -- they  
21 probably couldn't have drawn a picture of it to be very  
22 accurate, and I for one think that to have the fourth  
23 finding there is -- I suspect that if they had a chance  
24 to do it over again, they would agree with that  
25 position, but given the situation they were in at that



1 time, they had no prior guidance and so we can -- I  
2 don't expect you to agree or disagree with that. I  
3 just -- I have some difficulty with that one.

4 I also have some comments on what John said.

5 I think that it is especially distressing to find that  
6 pilots had asked for some help from Training and I  
7 can't help but wonder if some people, some instructor  
8 pilots had come down to talk, that they might have  
9 changed some of the actions that occurred before the  
10 first event, but we'll never know the answer to that  
11 because that didn't occur.

12 There also was another bit that John talked  
13 about that distressed me, is that clearly the  
14 dispatcher to me from listening to the part of the  
15 recording that we have was very interested in having  
16 the crew go to San Francisco. There was some  
17 discussion of flow control or air traffic control  
18 procedures that might be restrictive. There was some  
19 discussion about immigration and naturalization because  
20 they had people -- it was an international flight, and  
21 all of this seemed inappropriate to me to be talking  
22 about with an airplane that has mechanical problem with  
23 88 souls on board is somewhat distressing to me, and I  
24 don't know whether there's some kind of a  
25 recommendation or something.

1           It would seem to me that this -- even though  
2 they hadn't declared an emergency at that point, that  
3 they certainly deserved expedited handling and  
4 certainly deserved all the help that could be provided  
5 to them and hopefully we learned something from that.

6           Thank you, Madam Chairman.

7           ACTING CHAIRMAN CARMODY: Anything else on  
8 this section?

9           (No response)

10          ACTING CHAIRMAN CARMODY: Thank you, Captain  
11 Ivey.

12          Then we can go on to the last --

13          MEMBER BLACK: Madam Chairman?

14          ACTING CHAIRMAN CARMODY: Yes?

15          MEMBER BLACK: Let me add one more thing,  
16 too. Something that might have gone unnoticed here  
17 when I was reading the transcript again. This crew  
18 kept this airplane out over the water. We don't know  
19 what would have happened had they turned, had they not  
20 -- had they kept the flaps out and turned immediately  
21 for LAX. There are varying opinions on whether the  
22 airplane would have been able to maneuver successfully  
23 to the -- to LAX and land. It could very well be  
24 there's some people in Burbank who owe their lives to  
25 these two guys and I don't know whether that's been

1 appreciated by people enough or not, but I think it  
2 should be.

3 ACTING CHAIRMAN CARMODY: All right. Mr.  
4 Guzzetti?

5 MR. GUZZETTI: Thank you, Madam Chairman.

6 This is -- this presentation is actually very  
7 brief. I don't even have any slides, other than the  
8 cover slide, and it addresses the issue involving  
9 jackscrew assembly overhaul procedures.

10 Although the accident jackscrew assembly was  
11 never overhauled, the Systems Group investigation  
12 evaluated overhaul procedures and practices and  
13 identified several deficiencies in the DC-9 Overhaul  
14 Maintenance Manual and the practices of several  
15 maintenance facilities that were visited during the  
16 course of this investigation.

17 The most significant of these findings was  
18 that there is currently no requirement for overhaul  
19 facilities to record or inform customers of the end-  
20 play measurement of the assemblies that are being  
21 returned to the airlines after they've been overhauled.

22 Because overhaul does not necessarily involve  
23 restoring the end play to manufacturing specifications,  
24 the absence of such a requirement could result in an  
25 airline unknowingly returning an assembly to service

1 with a higher-than-expected end-play measurement.

2 There's several other issues related to  
3 overhauls, but that's the most significant. The draft  
4 report includes several recommendations to address  
5 these issues as well as other shortcomings in the  
6 overhaul process.

7 That's it. That concludes my presentation.

8 ACTING CHAIRMAN CARMODY: All right. Thank  
9 you.

10 Member Hammerschmidt, any questions?

11 MEMBER HAMMERSCHMIDT: No questions.

12 ACTING CHAIRMAN CARMODY: Member Goglia?

13 MEMBER GOGLIA: Mr. Guzzetti, I share your  
14 concerns on the overhaul, so-called overhaul  
15 facilities, other than the manufacturer's facility,  
16 which I found to be on multiple visits truly a first-  
17 class operation.

18 I'm concerned because of the -- with the  
19 others that do the work because of the data that's  
20 available or lack of data. You know, Boeing calls this  
21 design proprietary, and the repair information that's  
22 available to facilities to accomplish these tasks is  
23 not very robust, and this is not the only place that --  
24 I'll have to turn it off. The only that that -- that  
25 we have that. We have it in other areas of other

1 airplanes, and I'm surprised that we didn't have any  
2 verbiage in the report to address that. There is a  
3 little bit, but I'm surprised that we didn't have more  
4 on point, and can you enlighten me why?

5 MR. GUZZETTI: Yes, Member Goglia. I think  
6 it's simply because the Systems Group at the request of  
7 the investigator-in-charge was out chasing jackscrews  
8 all over the place. We must have visited over two  
9 dozen cities in a two-year time span, and we could only  
10 go so far in depth into the overhaul process, and so  
11 what we decided to do in terms of prioritizing and  
12 triaging our efforts, we decided to just really solely  
13 focus on the jackscrew assembly. That was it. We  
14 didn't want to start to get into more global issues  
15 related to overhaul facilities which I'm sure there are  
16 plenty of global issues out there.

17 Several of the overhaul facilities that we  
18 visited gave us an earful about some of the issues that  
19 you've addressed. So, in the context of this  
20 particular investigation, we really just focused our  
21 efforts on the jackscrew assembly and the essence of  
22 utilizing our resources as best as we could.

23 That being said, you mentioned lack of data  
24 and the data not being robust. I would certainly agree  
25 with you. In fact, again as it only relates to the

1 jackscrew, the staff feels that the DC-9 Overhaul  
2 Manual instructions for the jackscrew assembly are  
3 lacking, is the best word I guess I could -- is a kind  
4 word I could use for it, and I've documented that to  
5 great detail in my factual group chairman's report and  
6 we've highlighted some of that in the draft factual  
7 that you have before you. But we just didn't have the  
8 resources to tackle the global issues.

9 MEMBER GOGLIA: Well, Mr. Clark, can I  
10 interrupt your reading there for a second? Just  
11 earlier, you made -- you talked about what we should  
12 do, what we can do.

13 MR. CLARK: Right.

14 MEMBER GOGLIA: All right. And since long  
15 before I came to the Board and after I've come to the  
16 Board, I have felt that we don't do what we should do  
17 in the maintenance arena, and this report just  
18 continues my feelings in that area.

19 MR. CLARK: What's that?

20 MEMBER GOGLIA: Well, here's an example of  
21 manual instructions, instructions for continued  
22 airworthiness, the keystone of the operation, safe  
23 operation of airplanes, and they're lacking, and we do  
24 identify it in the text of the report. We don't  
25 identify it in any of the conclusions, and we have no

1 recommendation. Why not?

2 MR. CLARK: I don't know.

3 MEMBER GOGLIA: Well, I guess you can say I  
4 don't know, but, you know, that's your job. You're  
5 supposed to know. So, we'll deal with that as we go on  
6 further with the report, but that's just a concern, and  
7 it goes on and on and on. We need to start dealing  
8 with this stuff.

9 MR. CLARK: You commented about the specific  
10 issue of maintenance, but I think trying to put the  
11 control, I think we do have recommendations that do try  
12 to deal with the control and get the proper -- not  
13 necessarily the documentation but to try to get proper  
14 control of these critical parts.

15 MEMBER GOGLIA: But we don't get proper  
16 control of the people who are dealing with them, and we  
17 haven't made recommendations to it. Mr. McGill  
18 testified or commented moments ago about the training.  
19 Where's the training recommendation? Where's the  
20 qualifications for the people? It's missing.

21 MR. CLARK: Yeah.

22 MEMBER GOGLIA: It's missing.

23 MR. CLARK: I believe we do have  
24 recommendations specifically to this issue, to properly  
25 train the mechanics to deal with this critical safety

1 item. We put those out before, and we have others,  
2 also.

3 ACTING CHAIRMAN CARMODY: We made them to the  
4 FAA and they've not acted on them yet, the ones we made  
5 last year.

6 MEMBER GOGLIA: No further questions.

7 ACTING CHAIRMAN CARMODY: Member Black, any  
8 questions?

9 MEMBER BLACK: I, too, am somewhat distressed  
10 to find the -- it might even be a tribute to the  
11 jackscrew assembly that it could survive that process  
12 and we not have had other accidents because some of the  
13 things that are described in Jeff's factual and the  
14 addendums are very frightening and these things get --  
15 a jackscrew could actually get back to the audience, a  
16 jackscrew could actually get back on an airplane with,  
17 let's say, a 038 wear level and there would be no  
18 notification to the airline. Unless they measured it,  
19 they wouldn't know that it was very nearly worn out  
20 because there was no requirement for it. So, it's just  
21 atrocious, some of the things that could have happened  
22 and probably did happen and somehow they survived it.

23 ACTING CHAIRMAN CARMODY: Is that it, Member  
24 Black?

25 MEMBER BLACK: Yes, ma'am.



1           ACTING CHAIRMAN CARMODY: Okay. Member  
2 Hammerschmidt, anything from you?

3           MEMBER HAMMERSCHMIDT: No.

4           ACTING CHAIRMAN CARMODY: I propose we take a  
5 15-minute break and come back and we'll start on the  
6 Conclusions then.

7           Thank you.

8           (Whereupon, a recess was taken.)

9           ACTING CHAIRMAN CARMODY: All right. Let's  
10 resume.

11           Mr. Clark, I believe you had something else  
12 you wanted to add.

13           MR. CLARK: Just a little bit. With the  
14 conversation going on between the members and Captain  
15 Ivey, this -- we have this Finding Number 17 that --  
16 where we -- and it goes with the last bullet on Captain  
17 Ivey's presentation, where we talk about this crew  
18 should not have retracted the flaps and slats after  
19 they had extended it.

20           In one sense, we fully recognize this is  
21 20/20 hindsight and that they were in uncharted  
22 territory, but what we were after with that is not to  
23 criticize the crew in this situation but to try to take  
24 a lessons learned into the -- out into the future, and  
25 in a number of accidents and incidents, we've seen that

1 the crew end up doing things that either cost more time  
2 or take them further away from a good landing  
3 condition.

4           Let me just step through a couple here, if I  
5 may. In this case, this crew had just gone through a  
6 very serious upset and they were in a very critical  
7 emergency-type situation, and as they needed to get  
8 headed for the airport and they were doing that, and  
9 part of the thing you have to do is you have to start  
10 getting the airplane configured, getting it slowed down  
11 and still keep progressing towards the airport, and  
12 some of the, I guess, adages in aviation, you know, if  
13 you do something that isn't working, undo it fast, but  
14 -- or go back to the last thing that was working for  
15 you, but in this case, they had to progress toward some  
16 sort of landing configuration or that was not  
17 unreasonable to do so. So, the fact that the slats got  
18 extended and we started getting slowed down is  
19 perfectly reasonable.

20           It's not clear to us that there was any  
21 reason to retract the flaps and slats, but we weren't  
22 there. The captain was. So, he made his decision for  
23 whatever reason he chose to. But if there's not a good  
24 reason for the crew, keep what you've got and keep that  
25 progression going to get that airplane safely down on

1 the end of the runway. So, that was the intent out of  
2 this, to go after a lessons learned in the future, not  
3 to take an unfair hit because we weren't in that  
4 cockpit to know what this guy was doing or why he did  
5 what he did. So.

6 ACTING CHAIRMAN CARMODY: No, I understand.  
7 I think that's --

8 MR. CLARK: Part of that stemmed out of the  
9 thing like on the ValuJet where there was a fire on  
10 board and we didn't make recommendations in that, but  
11 there's a lot of discussions at staff level that the  
12 crew took several minutes and then took a radar vector  
13 kind of still going outbound and there was a lot of  
14 discussion on that one to try to get people thinking  
15 about making the turn, get headed -- get to the  
16 airport, get to safe haven, as fast as you can,  
17 regardless of what air traffic's telling you or  
18 whatever.

19 ACTING CHAIRMAN CARMODY: Hm-hmm.

20 MR. CLARK: We saw elements of that in the  
21 Swiss Air 111, and I don't want to comment too much  
22 because the Canadians are still having issues with  
23 their report. But we also saw a positive benefit not  
24 too long ago. We had a maintenance issue on an AirTran  
25 airplane, had a heck of a fire cooking on board, and

1 that crew beat heat to the airport just as fast as they  
2 could, and had they not done that, we fully expect we  
3 could have lost another airplane due to a fire on  
4 board.

5 So, that's the purpose of this, is go after  
6 the lessons learned.

7 ACTING CHAIRMAN CARMODY: Yeah. No, I  
8 understand. Thank you. Excuse me one second.

9 (Discussion off the record.)

10 ACTING CHAIRMAN CARMODY: All right. I think  
11 what we'll do now is proceed with reading the  
12 Conclusions. There are quite a few of them, and I  
13 think there are going to be some changes as I go along.

14 So, why don't I start and -- one at a time. There may  
15 be many that don't need changing, but I think there  
16 will be some that will. So, let me begin with the  
17 Findings.

18 Number 1. The flight crew on Alaska Airlines  
19 Flight 261 were properly certificated and qualified and  
20 had received the training and off-duty time prescribed  
21 by the Federal Air Regulations. No evidence indicated  
22 any pre-existing medical or other condition that might  
23 have adversely affected the flight crew's performance  
24 during the accident flight.

25 2. The airplane was dispatched in accordance

1 with FAA regulations and approved Alaska Air  
2 procedures. The weight and balance of the airplane  
3 were in limits for dispatch, take-off, climb, and  
4 cruise.

5 3. Weather was not a factor in the accident.

6 4. There was no evidence of a fire or an  
7 impact with birds or any other foreign object.

8 5. No evidence indicated that the airplane  
9 experienced any pre-impact structural or system  
10 failures, other than those associated with the  
11 longitudinal trim control system, the horizontal  
12 stabilizer and its surrounding structure.

13 6. Both engines were operating normally  
14 before the final dive.

15 7. Air Traffic Control personnel involved  
16 with the accident flight were properly certificated and  
17 qualified for their assigned duty stations.

18 8. The longitudinal trim control system on  
19 the accident airplane was functioning normally during  
20 the initial phase of the accident flight.

21 9. The horizontal stabilizer stopped  
22 responding to autopilot and pilot commands after the  
23 airplane passed through 23,400 feet. The pilots  
24 recognized that the longitudinal trim control system  
25 was jammed, but neither they nor the Alaska Airlines

1 maintenance personnel could determine the cause of the  
2 jam.

3           10. The worn threads inside the horizontal  
4 stabilizer acme nut were incrementally sheared off by  
5 the acme screw and were completely sheared off during  
6 the accident flight. As the airplane passed through  
7 23,400 feet, the acme screw and nut jammed, preventing  
8 further movement of the horizontal stabilizer until the  
9 initial dive.

10           11. The accident airplane's initial dive  
11 from 31,050 feet began when the jam between the acme  
12 screw and nut was overcome as a result of operation of  
13 the primary trim motor. Release of the jam allowed the  
14 acme screw to pull up through the acme nut, causing the  
15 horizontal stabilizer leading edge to move upward, thus  
16 causing the airplane to pitch rapidly downward.

17           12. The acme screw did not completely  
18 separate from the acme nut during the initial dive  
19 because the screw's lower mechanical stop was  
20 restrained by the lower surface of the acme nut until  
21 just before the second and final dive about 10 minutes  
22 later.

23           13. The cause of the final dive was the low-  
24 cycle fatigue failure of the torque tube, followed by  
25 the failure of the vertical stabilizer tip fairing

1 brackets which allowed the horizontal stabilizer  
2 leading edge to move upwards significantly beyond what  
3 is permitted by a normally-operating jackscrew  
4 assembly.

5 The resulting upward movement of the horizontal  
6 stabilizer leading edge created an excessive upward  
7 aerodynamic tail load which caused an uncontrollable  
8 downward pitching of the airplane from which recovery  
9 was not possible.

10           14. In light of the absence of a checklist  
11 requirement to land as soon as possible and the  
12 circumstances confronting the flight crew, the flight  
13 crew's decision not to return to Lic Gustavo Diaz Ordaz  
14 International Airport, Puerto Vallarta, immediately  
15 after recognizing the horizontal stabilizer trim system  
16 malfunction was understandable.

17           15. The flight crew's decision to divert the  
18 flight to Los Angeles International Airport, Los  
19 Angeles, California, rather than continuing to San  
20 Francisco as originally planned, was prudent and  
21 appropriate.

22           16. The flight crew's use of the autopilot  
23 while the horizontal stabilizer was jammed was not  
24 appropriate.

25           Member Goglia?

1           MEMBER GOGLIA: Captain Ivey or Mr.  
2 Rodriguez, on this recommendation, do we have any  
3 indication that possibly the flight crew may have  
4 switched off the stabilizer system, pulled the circuit  
5 breakers, or --

6           MR. IVEY: With regard to the stabilizer  
7 inoperative system, --

8           MEMBER GOGLIA: Right.

9           MR. IVEY: -- there is a reset allowed for  
10 the circuit breakers if tripped, and under general  
11 circuit breaker procedures, you're allowed a reset once  
12 of a circuit breaker. If it popped again, of course,  
13 then you would leave it to pop. You wouldn't reset it.

14          MEMBER GOGLIA: Isn't there a trim switch  
15 shut-off?

16          MR. IVEY: There is. The system -- it  
17 depends on whether you've got a run-away stabilizer.  
18 In that case, there's a red guarded switch that would  
19 stop the high-speed trim from operation and that's a  
20 switch down by the pilot, the captain's right-hand  
21 side, and then that stops high-speed trim. Then you  
22 assess the situation in the case of run-away.

23                   In the case of the stabilizer inoperative,  
24 there are circuit breakers that are also mentioned that  
25 you can check to see if that could be part of the



1 problem.

2 MEMBER GOGLIA: But in an effort to lighten  
3 their load, could they not pull the circuit breakers to  
4 remove electrical power from the motors and then engage  
5 the autopilot to fly?

6 MR. IVEY: No, not by procedure, because the  
7 autopilot uses the low-speed trim system as part of its  
8 controls. So, you would be, as they were, you'd be  
9 masking the situation by engaging the autopilot because  
10 it would not be using low-speed trim to trim out any  
11 undue loads that the autopilot would be experiencing,  
12 and in the case where the flight crew engaged the  
13 autopilot, again upon the disconnect which was just  
14 preceding the dive, the first dive, apparently the  
15 captain was using some other than the normal means of  
16 disconnect of the autopilot while the co-pilot was the  
17 flying pilot. So, here he is holding the control yoke  
18 and more than likely we believe that he either  
19 attempted to use the high-speed trim which will  
20 disconnect the autopilot on the control yoke or the  
21 high-speed longitudinal suitcase handles which is an  
22 alternative measure. That also would disconnect the  
23 autopilot.

24 But the autopilot would not have been able to  
25 use the alternate trim because of the jam as we know,

1 and so it still would have masked the condition as to  
2 what flight controls were being held in, and once the  
3 autopilot released, then the elevator would go more  
4 than likely to an entrail position or at least until  
5 the pilot flying was able to grasp whatever control  
6 inputs were different than what he expected and to  
7 correct the elevator.

8 MEMBER GOGLIA: We said that it took about a  
9 hundred pounds of force for them to hand-fly this  
10 airplane? Or was it 50 pounds for the cruise and then  
11 it was a hundred pounds?

12 MR. RODRIGUEZ: Initially, it was 50 pounds  
13 in the climb-out, sir, and in the recovery, it was a  
14 130 to a 140.

15 MEMBER GOGLIA: Okay. Gotcha. All right.  
16 Thank you.

17 MR. IVEY: Yes. The crew did a very nice job  
18 at 31,000 feet flying. In fact, when you look at that  
19 FDR trace, they held altitude very close and they had  
20 actually increased speed. That does two things. That  
21 actually increases your fuel burn which gets the weight  
22 down which is certainly a necessary consideration for  
23 landing. Your air speeds are going to be based upon  
24 your gross weight for landing, and they found what I  
25 believe to be an optimum speed at that altitude that

1 really did release a lot of those control pressures  
2 that they initially encountered. So, they found a good  
3 harmony, if you will, hand-flying the airplane at  
4 31,000 feet.

5 MEMBER GOGLIA: Okay. Thank you.

6 ACTING CHAIRMAN CARMODY: 17. The captain  
7 should have kept the slats and flaps extended when the  
8 airplane --

9 MR. CLARK: We need your microphone.

10 ACTING CHAIRMAN CARMODY: I'm sorry. Thank  
11 you.

12 17. The captain should have kept the slats  
13 and flaps extended when the airplane was found to be  
14 controllable in that configuration after the initial  
15 dive.

16 MEMBER GOGLIA: Okay. Go ahead, George, you  
17 can start.

18 MEMBER BLACK: I'll just repeat what I said a  
19 minute ago. I understand what you're saying, John, and  
20 I think there's nothing wrong with having it in the  
21 text. I don't necessarily think that there's any  
22 purpose in having it in the Findings, and I would hold  
23 that we just leave this one out as a Finding because it  
24 certainly is in hindsight a great idea, but with  
25 everything going on, the way I read this, we're -- when

1 they say "should", we're holding them responsible for  
2 it, and I'll bet they would have liked to have done it,  
3 too, although it probably wouldn't have made any  
4 difference.

5 ACTING CHAIRMAN CARMODY: Is there another  
6 way we could say it that -- other than should? I think  
7 it's worth preserving the idea just for future lessons,  
8 but I take your point that it's not intended to be a  
9 criticism of the crew.

10 MEMBER BLACK: Well, --

11 ACTING CHAIRMAN CARMODY: Is there nothing  
12 thing we could say or any other --

13 MEMBER BLACK: -- I suppose we could say in  
14 retrospect.

15 ACTING CHAIRMAN CARMODY: Well, I mean, that  
16 -- this is all in retrospect.

17 MEMBER BLACK: That's what I'm saying.

18 MEMBER GOGLIA: Well, I agree with that, but,  
19 you know, I don't think we need to use these words.  
20 You said it very well without using any of these words  
21 after you restated it. So, maybe we should just agree  
22 to lift this verbiage out of here and circulate before  
23 the next few days some new language that clearly says  
24 what you articulated to us here because I think what  
25 you said was right. What's written here, I can't

1 support.

2 ACTING CHAIRMAN CARMODY: Captain Ivey?

3 MR. IVEY: The fact that the crew had  
4 selected the slats and flaps to 11, as Mr. Clark  
5 stated, ultimately you're going to have to slow the  
6 airplane and configure the airplane for landing. They  
7 took those steps. In fact, the captain initially did  
8 what I think was a very proper approach, took a proper  
9 approach in that he asked for the slats first, a  
10 methodical and slow approach to attempting to reduce  
11 this airplane down to a target air speed of a 180  
12 knots.

13 Once he got slats, he was satisfied. I will  
14 say this, that there was no remarks on the CVR  
15 indicating to the contrary because if in fact this  
16 airplane had at any point started to generate an  
17 increased control pressure or something that he was not  
18 able to maintain, then you would go back to, as you  
19 say, a happy position or somewhere where you were in  
20 controllable flight. So, Flaps 11 was the next  
21 selection.

22 It's my understanding that you can actually  
23 -- this is from the manufacturer. It's my  
24 understanding that you can take that flap handle and  
25 you could very gently move this thing back towards from

1 zero flaps towards 11 degrees of flaps in increments,  
2 and that would have been my approach to the flap  
3 selection.

4           Nevertheless, 11 degrees of flaps was  
5 selected and the co-pilot actually asked the captain,  
6 "How does it feel?" He says, "It feels pretty good."  
7 And so, they were at a configuration that would enable  
8 the airplane to slow and the next critical factor in  
9 trying to land this airplane at some point in time is  
10 going to be trying to drop the landing gear, and I  
11 believe that there would have been a case of  
12 preparation, saying that as I drop this landing gear,  
13 if I lose control of this airplane, then bring that  
14 landing gear right back up. We're just -- if it  
15 doesn't work, it doesn't work.

16           So, ultimately based upon the configuration  
17 that they were able to achieve, they're either going to  
18 have to land with gear down, land with gear up, and not  
19 to belabor this point, but both of these gentlemen were  
20 military pilots, were very familiar with all the  
21 military fields around there, and their choice of Los  
22 Angeles was excellent because they had 12,000 feet of  
23 runway. March Air Force Base. There are numerous  
24 bases around there that have got lots of runway, but  
25 most importantly, in any military pilot that had flown

1 in California as these two gentlemen had, would be very  
2 much aware of Edwards Air Force Base which is the best  
3 airport we got in the country. There's over 5,000 feet  
4 -- five miles of paved runway at Edwards Air Force  
5 Base, and I think even I could make a decent landing  
6 out there on five miles.

7 But furthermore, the dry lake bed is -- it  
8 just goes on forever. The space shuttle lands on that.

9 So, if in fact you were not able to get the landing  
10 gear down and you were traveling at very high rates of  
11 speeds, there were a lot of options. Unfortunately,  
12 the crew was not able to move through all those steps  
13 in decisionmaking. So, I do believe that once you had  
14 achieved slats and flaps 11, that it should have  
15 remained there.

16 ACTING CHAIRMAN CARMODY: Mr. Clark, I  
17 noticed you had a piece of paper. Have you got a  
18 redraft of this, by any change, or some suggestions?

19 MR. CLARK: No. We're working on the one  
20 Member Goglia suggested in an earlier conversation.

21 ACTING CHAIRMAN CARMODY: All right. Member  
22 Black?

23 MEMBER BLACK: How about leaving the flaps  
24 and slats extended at Time 16:18:00 might have allowed  
25 better control of the aircraft?

1           MR. CLARK: I believe that's true. It's the  
2 -- I think it's somewhat a little indirect from the  
3 concern of the issue of undoing or taking a step back.  
4 So, I --

5           MR. RODRIGUEZ: Madam Chairman, could I throw  
6 my oar in?

7           ACTING CHAIRMAN CARMODY: Yes, please do.

8           MR. RODRIGUEZ: I feel that in this case just  
9 the opposite of what a lot of people have been  
10 expressing. I believe that the safety message here is  
11 if people don't already know it, and I would have  
12 thought they would, as you progress toward a landing in  
13 any kind of an emergency situation, each step in the  
14 progression, barring loss of -- further loss of control  
15 or something, is an irreversible step, and so once the  
16 flaps were extended and the slats were out, I feel they  
17 should have been left out. I feel that as a finding,  
18 for those who may not be aware of that kind of a  
19 philosophy, I think it's an important safety message  
20 for it to be highlighted in the Findings, and perhaps  
21 if you want to -- I would offer some alternate language  
22 which I haven't written down, but if you come at it  
23 from a different direction and say that something to  
24 the effect that we were unable to understand the  
25 benefit to be derived by raising the flaps and then say



1 that there was a possible benefit to have left them  
2 down or something of that nature, the safety message  
3 comes out without perhaps any sense of condemnation of  
4 the crew specifically.

5 ACTING CHAIRMAN CARMODY: Well, why don't we  
6 do this? Perhaps you could -- staff could continue to  
7 work on this and we could circulate language later, if  
8 necessary, for the board members. I think we kind of  
9 have a sense we'd like something in here, but we want  
10 it worded differently.

11 MEMBER BLACK: Yes. Something like Rod's  
12 talking about, if better worded, of course, would --

13 (Laughter)

14 ACTING CHAIRMAN CARMODY: Well, just to  
15 convey the safety message. So, let's --

16 MR. CLARK: We'll give Captain Ivey a shot at  
17 it.

18 MEMBER BLACK: Why don't we let Karen write  
19 it?

20 MR. CLARK: Okay. We'll do that. We  
21 understand what your concerns are and we'll try to make  
22 sure we address them.

23 ACTING CHAIRMAN CARMODY: Okay. Let's kind  
24 of put a little question mark on that one.

25 All right. 18. Without clearer guidance to

1 flight crews regarding which actions are appropriate  
2 and which are inappropriate, in the event of an  
3 inoperative or malfunctioning flight control system,  
4 pilots may experiment with improvised troubleshooting  
5 measures that could inadvertently worsen the condition  
6 of a controllable airplane.

7 19. The acme nut threads on the accident  
8 airplane's horizontal stabilizer jackscrew assembly  
9 wore at an excessive rate.

10 20. Alaska Airlines use of Aeroshell 33 for  
11 lubrication of the jackscrew assembly, acme screw  
12 thread surface finish, foreign debris, and abnormal  
13 loading of the acme nut threads were not factors in the  
14 excessive wear of the accident acme nut threads.

15 21. There was no effective lubrication on  
16 the acme screw and nut interface at the time of the  
17 Alaska Airlines Flight 261 accident.

18 MEMBER BLACK: Just an editorial. Karen, Ms.  
19 Bury, should that be lubricant rather than lubrication?

20 In other words, grease? Don't worry about it. It  
21 can't be of any consequence. Lubricant. We're really  
22 saying that there was no material on it which would be  
23 the lubricant.

24 ACTING CHAIRMAN CARMODY: Well, yeah.

25 MEMBER BLACK: Just leave it then. No

1 problem.

2           ACTING CHAIRMAN CARMODY: Okay. 22. The  
3 excessive and accelerated wear of the accident  
4 jackscrew assembly acme nut threads, was the result of  
5 insufficient lubrication which was directly causal to  
6 the Alaska Airlines Flight 261 accident.

7           23. Alaska Airlines extension of its  
8 lubrication interval for its McDonnell-Douglas MD-80  
9 horizontal stabilizer components, the last of which was  
10 based on Boeing's extension of the recommended  
11 lubrication interval, increased the likelihood that a  
12 missed or inadequate lubrication would result in  
13 excessive wear of jackscrew assembly acme nut threads  
14 and therefore was a direct cause of the excessive wear  
15 that led to Alaska Airlines Flight 261 accident.

16           The Federal Aviation Administration's  
17 acceptance of those extensions was a contributing  
18 factor.

19           I'd like to propose a change to this language  
20 to say Alaska Airlines extension of the lubrication  
21 interval, etc., and the FAA's acceptance of those  
22 extensions increased the likelihood and therefore was a  
23 direct cause of the excessive wear that led to the  
24 accident. In other words, I'm saying the FAA was more  
25 than a contributing factor.

1           Do I take by your silence you're agreeing or  
2 do members have comments on this?

3           MEMBER GOGLIA: I'm trying to digest it.

4           ACTING CHAIRMAN CARMODY: Okay. All I'm  
5 doing is moving the last sentence up and put it after  
6 the first comma, so it's both Alaska Airlines extension  
7 and FAA's acceptance which resulted in excessive wear,  
8 was a direct cause of the excessive wear that led to  
9 the accident.

10           John?

11           MEMBER HAMMERSCHMIDT: Well, from a meeting  
12 process standpoint, we're going to be edging into the  
13 probable cause determination in a few of these  
14 conclusions.

15           ACTING CHAIRMAN CARMODY: Right.

16           MEMBER HAMMERSCHMIDT: And I haven't quite  
17 digested the different options we have before us at  
18 this point.

19           ACTING CHAIRMAN CARMODY: All right. Good  
20 point. Well, why don't we -- I'm going to put a mark  
21 on this one and hold it, and after we discuss probable  
22 cause, we may need to return to this one. Is that  
23 reasonable? Okay. 23.

24           24. When lubricating the jackscrew assembly,  
25 removal of used grease from the acme screw before

1 application of fresh grease will increase the  
2 effectiveness of the lubrication.

3 25.

4 MEMBER GOGLIA: We didn't talk about that at  
5 all during -- I think Joe Kolly, I think that's your  
6 area. You know, what are we basing that on?

7 MR. GUZZETTI: Member Goglia, we -- you're  
8 right. We didn't talk about it, but it is addressed in  
9 the report, and you're right. Dr. Kolly is kind of  
10 tag-teaming with me as far as this issue's concerned,  
11 but used grease contains contaminants or the wear  
12 debris, if you will, and that wear debris takes up the  
13 space that you would normally have the oils that are  
14 needed to emulsify the grease.

15 So, if you remove the used grease from the  
16 acme screw and then put fresh grease on it, there's  
17 basically more room for that fresh grease to go, and  
18 you don't have a lot of space taken up with grease that  
19 has more wear debris than it does the characteristics  
20 of the lube. You need to get the -- Mr. Epperson also  
21 reminds me that in the case of Hawaiian Airlines where  
22 we found a grit-lasting medium in there, it sure would  
23 be good to get that old grease out which may contain  
24 abrasive contaminants, so you can put fresh grease on  
25 it. So, we think that's a good thing to do.

1           We have been told that Boeing is very much  
2 strongly considering that in their revised lubrication  
3 procedure, and when we talked to other jackscrew  
4 assembly or acme screw manufacturers, they also felt  
5 that that was prudent.

6           Oh, the -- well, as a matter of fact, Boeing,  
7 when they came here to provide a briefing on their  
8 revised end-play check, they also showed us a comb, a  
9 device that they're trying to field where it's got --  
10 you clamp it right on to the acme screw and the teeth  
11 of the comb fit right into the threads and then you  
12 rotate the -- you move the comb around and it just  
13 scrapes out all that old grease and then you put fresh  
14 grease on it. So, they're going to be adopting a  
15 procedure like that.

16           MEMBER GOGLIA: Okay. Now, you mentioned  
17 everybody that had this feeling that this was better,  
18 but there's no testing done that we know of?

19           MR. GUZZETTI: Testing in regard to?

20           MEMBER GOGLIA: Making a determination  
21 whether or not, because it's a pretty strong statement  
22 here, it'll increase the effectiveness of the  
23 lubrication. I happen to agree with that. I'm just  
24 challenging you to the -- how did we get there?

25           MR. KOLLY: Yes. We received that guidance

1 from jackscrew manufacturers who said one of the most  
2 important features of relubrication is in fact removing  
3 the wear debris from inside the screw threads to allow  
4 this fresh grease to now take up the space and provide  
5 a reservoir for continuing lubrication during the  
6 course of the lubrication interval. So, that's from  
7 manufacturers of jackscrews and also in some -- it has  
8 to do with purging. Essentially, it's a purging  
9 operation. We got into a lot of discussion with grease  
10 manufacturers and maintenance groups about how you --  
11 we know that when you purge a system that has a grease  
12 fitting, you introduce new grease until the old grease  
13 is taken out. That's a standard.

14 On a screw, on an external screw surface, you  
15 don't have a classic purging technique and that's why  
16 you would want to use something like this comb and  
17 manually remove it, but it's accepted across the  
18 industry that when you introduce new lubricant, it's  
19 best to remove the most -- as much as you can of the  
20 old lubricant.

21 MEMBER GOGLIA: Okay. Thank you.

22 ACTING CHAIRMAN CARMODY: That was 24.

23 25. A larger access panel would facilitate  
24 the proper accomplishment of the jackscrew assembly  
25 lubrication task.

1           26. If the jackscrew assembly lubrication  
2 procedure was a required inspection item for which an  
3 inspector's sign-off is needed, the potential for  
4 missed or improperly-performed lubrications would be  
5 reduced.

6           MEMBER GOGLIA: Question on the word  
7 "missed". I read that to mean the card wasn't issued,  
8 the task wasn't issued during a maintenance visit.  
9 What do you mean by missed? Maybe I should ask you  
10 what you mean by it.

11           MR. CLARK: Well, I think the -- what we mean  
12 by missed is that somebody tried to lube that and  
13 perhaps we would not see the lubrication extruding out  
14 of the acme nut or that the screw had not been properly  
15 slathered with grease or it had not been done at all.

16           ACTING CHAIRMAN CARMODY: So, you'd say  
17 unperformed or improperly performed? Is that what you  
18 meant?

19           MR. CLARK: Yes.

20           MEMBER GOGLIA: The role of the inspector at  
21 this level, if the card, the task document, was not  
22 issued, the inspector has no way of knowing when it's a  
23 time-controlled card, like 650 hours. He wouldn't  
24 know. So, if it was missed by planning, the inspector  
25 wouldn't pick that up.



1 MR. CLARK: No, I understand that.

2 MEMBER GOGLIA: So, that's why the word  
3 "missed" --

4 MR. CLARK: Okay. That's fair.

5 MEMBER GOGLIA: -- raised my attention. We  
6 need either another word or actually if we drop the  
7 word, then it really addresses the role of the  
8 inspector. It doesn't address the whole role of the  
9 maintenance program.

10 MR. CLARK: Yeah. I think we're good with  
11 either way. Unperformed or --

12 ACTING CHAIRMAN CARMODY: Unperformed or  
13 improperly performed. All right.

14 MR. CLARK: Okay.

15 ACTING CHAIRMAN CARMODY: Okay.

16 MR. CLARK: Super.

17 ACTING CHAIRMAN CARMODY: Okay. 27. Alaska  
18 Airlines extension of the end-play check interval  
19 allowed the accident acme nut threads to wear to  
20 failure without the opportunity for detection and  
21 therefore was the direct cause of the excessive wear  
22 that led to Alaska Airlines Flight 261 accident. The  
23 FAA's approval of that extension was a contributing  
24 factor.

25 This is one that I'll come back to after we

1 discuss probable cause.

2 MEMBER GOGLIA: I have a couple of words on  
3 that, too.

4 ACTING CHAIRMAN CARMODY: Okay.

5 MEMBER GOGLIA: So, bring it back.

6 ACTING CHAIRMAN CARMODY: Okay. All right.

7 28. Alaska Airlines end-play check interval  
8 extension should have been but was not supported by  
9 adequate technical data to demonstrate that the  
10 extension would not present a potential hazard.

11 29. The existing process by which  
12 manufacturers revise recommended maintenance task  
13 intervals and by which airlines establish and revise  
14 these intervals does not include task-by-task  
15 engineering analysis and justification and therefore  
16 allows for the possibility of inappropriate interval  
17 extensions for potentially-critical maintenance items.

18 30. Because of the possibility that higher-  
19 than-expected wear could cause excessive wear in less  
20 than 2,000 flight hours and the additional possibility  
21 that an end-play check could be missed or improperly  
22 performed, the current 2,000 flight-hour end-play check  
23 interval specified in Airworthiness Directive 2000-15-  
24 15 may be inadequate to ensure the safety of the  
25 Douglas DC-9, McDonnell-Douglas MD-80/90 and Boeing 717

1 fleet.

2 Do you have the same concerns about "missed"  
3 in this paragraph?

4 MEMBER GOGLIA: I have concerns about  
5 "missed", but I have concerns about the whole paragraph  
6 as well.

7 ACTING CHAIRMAN CARMODY: All right.

8 MEMBER GOGLIA: Because, you know, the 2,000  
9 flight hours and the 650-hour lubrication intervals  
10 with an inspection that's hauled out looking for the  
11 debris, looking for shavings in the grease and so on, I  
12 think really does increase the probability that any  
13 defects will be found, and I can't support this one  
14 simply.

15 I think that the work that was done by the  
16 industry and the FAA in this area is adequate, and I  
17 think that we need to defer to their judgment until  
18 such time as we can show that three additional  
19 lubrication visits between a shortened end-play check  
20 isn't going to produce satisfactory results. I think  
21 it is.

22 DR. ELLINGSTAD: Excuse me, Mr. Goglia. This  
23 particular finding addresses the inspection interval  
24 and not lubrication by itself, and what I would remind  
25 you is what was shown with respect to the failure to

1 demonstrate reliability and validity for the end-play  
2 procedures calls into question the capacity of the  
3 available measuring procedures to reliably detect this  
4 condition. So, that is coupled with these  
5 possibilities of not performing an inspection on those  
6 intervals, so which gives rise to the concern about  
7 missing significant wear.

8 MEMBER GOGLIA: And I would counter that with  
9 the AD note which I might note that I requested from  
10 staff and took a rather unusual length of time for  
11 something that's referenced in the report so many times  
12 to be able to put their hands on to give it to me. But  
13 in the AD note that the FAA issued in this area, it  
14 calls for an intensive visual examination at the grease  
15 job which did not exist up until this AD note was  
16 issued and they actually give you the detail and what  
17 you have to accomplish this inspection. Those are all  
18 additional requirements that did not exist at the time  
19 that this airplane was lubricated and that's the reason  
20 why I say that coupled. The two of them are not in a  
21 vacuum separately. They're together. You add those  
22 together and additionally add the Boeing tool, the new  
23 tool, into the mix, and I think that there is the  
24 2,000-hour cycle for end-play checks is a substantial  
25 improvement, and we don't need this recommendation.

1 DR. ELLINGSTAD: Well, one additional point  
2 that I'd like to make is that in addition to the  
3 changes in the end-play procedures that Boeing has  
4 developed, there was also, as a focus of our earlier  
5 recommendation, a request that that procedure be  
6 validated and that the reliability be demonstrated.

7 Now, we understand that Boeing is in fact  
8 engaged in the study to accomplish that, but we have  
9 not yet seen the results.

10 MR. CLARK: In addition, examining the grease  
11 is again not one of those things we would consider a  
12 highly-controllable process since that's the kind of  
13 thing we think is required for such a critical item,  
14 and again this goes back to trying to control fatigue  
15 and prevent fatigue or catch it before it reaches  
16 critical mass requires that highly-controllable  
17 environment, and we do recognize cutting the inspection  
18 intervals down to 2,000 hours is a big bite at that and  
19 also doing things like examining the grease.

20 If you find the flakes in there or find  
21 something extremely unusual, certainly grounds to pull  
22 it off. What we're not convinced of is that are you  
23 always going to find something right there when you're  
24 doing that or is it always going to get done properly  
25 or to a certain level, and can those things get missed,

1 and I think that goes back to the comment I made  
2 earlier that for the system safety-type work or  
3 maintainability-type work, I think it's been well  
4 established, the number I've been told, I'm not an  
5 expert in that area, that maintenance items should be  
6 considered an 80-percent reliability level, and so  
7 again, this is part of the out of the ordinary is we're  
8 dealing with this highly-critical system where I think  
9 in many other situations we've dealt with in parts  
10 failures and that lead to accidents and stuff, that  
11 that may be appropriate, but again it's still, we  
12 think, better to be cautious, and we haven't asked them  
13 to change it, but we want to see the numbers to see  
14 that it fully supports this, and if the reliability and  
15 the accuracy of these measurements and processes don't  
16 get us there, then we may need a shorter number.

17 For example, again we don't know that this 13  
18 times wear rate from the grit that showed up in Hawaii  
19 Airlines is the worst we can get. It's a number. We  
20 know we can get that because we had that at Hawaii.  
21 How much worse can it get? So, then if we go back and  
22 start looking at we still want to try to have the  
23 opportunity for a blown inspection and at least get two  
24 shots at it before it fails, that's where our concern  
25 is. You can get into some high wear rates up in this

1 Hawaiian number, maybe a little bit greater, and you  
2 blow one of those 2,000-hour cycles, you can be in a  
3 critical state before you get to the next 2,000-hour  
4 cycle. That's a concern we have.

5 MEMBER BLACK: Madam Chairman, we're always  
6 saying maybe in here. Maybe we could handle this at  
7 the recommendation stage and have them to monitor the  
8 performance of the new end-play check and lubrication  
9 process and report back or something. It might be a  
10 way out of this. We're saying it might be. We don't  
11 know. And then, if we -- and this is just a finding.  
12 Then at the recommendation stage, ask them to monitor  
13 it and report back or something of that nature.

14 We keep talking about Hawaii. How long have  
15 they been flying DC-9s out there? This is the first  
16 time that happened. How long have they been using that  
17 grit stuff?

18 MR. CLARK: As far as we know, they used it  
19 one or two times on a couple airplanes back in the tail  
20 cone.

21 MEMBER BLACK: That's all we know.

22 MR. CLARK: That's the difficulty when we're  
23 dealing with one of these out of 80 million flight  
24 hours, it's not just going to show up in the normal  
25 course of business. It's --

1           MEMBER BLACK: Well, but Hawaii had had DC-9s  
2 a long time.

3           MR. CLARK: Oh, absolutely. Yeah.

4           MEMBER BLACK: And I assume that it had  
5 corrosion for a long time. So, you know.

6           MR. CLARK: I assume there's a good reason to  
7 use the grit back there, that's for sure.

8           MEMBER BLACK: Yeah.

9           ACTING CHAIRMAN CARMODY: As I understand it,  
10 Member Black has proposed that we strike the Finding  
11 and perhaps incorporate another recommendation that  
12 would suggest that --

13          MEMBER BLACK: I don't even know that we need  
14 to strike it. It says may be.

15          ACTING CHAIRMAN CARMODY: Well, I would leave  
16 it in, but, I mean, I'm trying to --

17          MEMBER BLACK: Then --

18          ACTING CHAIRMAN CARMODY: And then, craft a  
19 recommendation that would say --

20          MEMBER BLACK: I think there is a  
21 recommendation that says something about it and just  
22 handle the recommendation when we get to it.

23          ACTING CHAIRMAN CARMODY: Hm-hmm.

24          MEMBER BLACK: Is that okay, John?

25          MEMBER GOGLIA: I think so.



1           ACTING CHAIRMAN CARMODY: All right. I'll  
2 put a note on 30 as well.

3           MEMBER GOGLIA: Before we move on, Mr. Clark,  
4 when this AD note was issued, did we comment on this?  
5 I don't remember.

6           MR. CLARK: I don't remember.

7           MEMBER GOGLIA: Because one of the things  
8 that --

9           MR. CLARK: I think Jeff just said it was a  
10 telegraphic AD and I don't remember. Was it  
11 telegraphic?

12           MR. GUZZETTI: The first one was a  
13 telegraphic AD that was issued two-three days after the  
14 accident and then they simply revised it four or five  
15 months later. I don't think -- it was already a final  
16 rule. I don't think it was an MPRM. I could be wrong  
17 about that, though.

18           MR. CLARK: And I think for what we saw at  
19 that time, it made sense to us, and it was appropriate.  
20 I think we had no objections to it in that sense,  
21 whether we commented on it or not.

22           MEMBER GOGLIA: Well, I agree with you. I  
23 think it was appropriate, but one of the things that  
24 you said that had my ears perk up was about the -- in  
25 the grease inspections, somebody not identifying what's

1 in it, and if that's the case, I wanted to know if we  
2 were -- if we had responded to this AD, to have  
3 chemical analysis done on the grease when we take it,  
4 which is routine on oil samples.

5 MR. CLARK: Sure. We didn't do that. I  
6 think the way I would kind of go back and what was on  
7 everybody's mind back then, I probably can't  
8 reconstruct that, certainly can't from my own memory,  
9 but the issue is that that is a good thing to do. It's  
10 one way to get at the problem. It's one way to, you  
11 know, take an edge off or to have mechanics out there  
12 looking. We don't know that that's in one sense  
13 reliable enough to get away from escalating from 2,000  
14 hours or extending from 2,000 hours what it is now or  
15 is it enough not to back off of that 2,000 hours even  
16 now. It's still a good thing to do. It's still good  
17 practice having the mechanics out there taking every  
18 shot they can to take the edge off the risk.

19 MEMBER GOGLIA: Knowledgeable mechanics.

20 MR. CLARK: That's true, too.

21 MEMBER GOGLIA: Okay.

22 ACTING CHAIRMAN CARMODY: All right. Member  
23 Hammerschmidt?

24 MEMBER HAMMERSCHMIDT: Are we agreeing to  
25 leave it in for the moment?

1           MEMBER GOGLIA: I think for the time being,  
2 until we get the recommendations.

3           MR. CLARK: Okay.

4           ACTING CHAIRMAN CARMODY: I have it circled.  
5 I have a couple of things we'll come back to.

6           MEMBER HAMMERSCHMIDT: Well, I might mention  
7 that this was really the first conclusion that I put a  
8 question mark by, but the two words "may be" softened  
9 it, made it enough uncertain --

10          ACTING CHAIRMAN CARMODY: May be inadequate.

11          MEMBER HAMMERSCHMIDT: So, I mean, we could  
12 say may be adequate. It may be inadequate, it may be  
13 adequate. I believe that's what Mr. Clark was getting  
14 at in your -- whenever I asked you about this earlier  
15 on this morning, I believe, that it's just an  
16 uncertainty.

17          MR. CLARK: Well, it is right now and part of  
18 it is, is that, in where we're at right now, we haven't  
19 set down and tried to develop very specific -- take a  
20 rigorous approach and develop those numbers. That's  
21 kind of not the business we're in. Sometimes we sure  
22 take a try at it to push people the wrong -- force them  
23 to take a try, but we haven't done that in this case.

24          ACTING CHAIRMAN CARMODY: Okay. 31. The  
25 continued collection and analysis of end-play data are

1 critical to monitoring acme nut thread wear and  
2 identifying excessive or unexpected wear rates, trends  
3 or anomalies.

4 32. Until August 2000, Alaska Airlines used  
5 a fabricating restraining fixture that did not meet  
6 Boeing specifications. However, the Safety Board could  
7 not determine whether the use of this non-compliant  
8 fixture generated an inaccurate end-play measurement  
9 during the last end-play check or whether the use of  
10 this fixture contributed to the accident.

11 33. The on-wing end-play check procedure, as  
12 currently practiced, has not been validated and has low  
13 reliability.

14 34. Deficiencies in the overall process  
15 increase the likelihood that jackscrew assemblies may  
16 be improperly overhauled.

17 35. The absence of a requirement to record  
18 or inform customers of the end-play measurement of an  
19 overhauled jackscrew assembly could result in an  
20 operator unknowingly returning a jackscrew assembly to  
21 service with the higher-than-expected end-play  
22 measurement.

23 36. Operators will maximize the usefulness  
24 of end-play measurements and wear rate calculations by  
25 recording on-wing end-play measurements whenever a

1 jackscrew assembly is replaced on an airplane.

2 37. Because the jackscrew assembly is an  
3 integral and essential part of the horizontal  
4 stabilizer trim system, a critical flight system, it is  
5 important to ensure that maintenance facilities  
6 authorized to overhaul these assemblies possess the  
7 proper qualifications and equipment.

8 38.

9 MEMBER GOGLIA: Mr. Clark, what about adding  
10 manuals here?

11 MR. CLARK: I put documentation. I just  
12 penciled in documentation, manuals.

13 MEMBER GOGLIA: Documentation is fine.

14 MR. CLARK: Okay.

15 MEMBER GOGLIA: Instructions for continued  
16 airworthiness. Use the FAA's terms.

17 ACTING CHAIRMAN CARMODY: What are we saying?  
18 Possess the proper qualifications, equipment and?

19 MEMBER GOGLIA: Instructions for continued  
20 airworthiness.

21 ACTING CHAIRMAN CARMODY: Okay.

22 MR. CLARK: Okay. Usually -- I don't like to  
23 get into their term of art because that forces us to  
24 kind of weave our way through their terms and  
25 regulations. If we just get back and say

1 documentation, then we can --

2 ACTING CHAIRMAN CARMODY: Okay.

3 MR. CLARK: Is that all right?

4 MEMBER GOGLIA: That's fine.

5 MR. CLARK: Okay.

6 ACTING CHAIRMAN CARMODY: Okay. We're adding  
7 and documentation to Number 37. All right.

8 38. The dual-thread design of the acme screw  
9 and nut does not provide redundancy with regard to  
10 wear.

11 39. The design of the Douglas DC-9,  
12 McDonnell-Douglas MD-80/90, and Boeing 717 horizontal  
13 stabilizer jackscrew assembly did not account for the  
14 loss of the acme nut threads as a catastrophic single-  
15 point failure mode. The absence of a fail-safe  
16 mechanism to prevent the catastrophic effects of total  
17 acme nut thread loss contributed to the Alaska Airlines  
18 Flight 261 accident.

19 Now, this is another one that relates to the  
20 probable cause. Do we want to go back to this after we  
21 go to probable cause? All right.

22 40.

23 MEMBER BLACK: Well, if we were going to  
24 interject, John, a finding with regard to Jeff's other  
25 aircraft systems, probably somewhere in this vicinity

1 would be the place to do it.

2 MR. CLARK: Yeah. The findings, we usually  
3 take in the words that were developed in the analysis  
4 and wherever we would put that would fall out. I  
5 assume it would fall right here, but --

6 MEMBER BLACK: Okay. Wherever. Let's just  
7 not forget it.

8 MR. CLARK: Okay. But I agree with you. It  
9 most likely will fall somewhere close here.

10 MEMBER BLACK: Okay. Good.

11 MR. CLARK: The only other problem it could  
12 be is that it may be easier to put it in a separate  
13 section right at the very end and address that issue in  
14 its entirety by itself, so then it would fall later.

15 MEMBER BLACK: Okay.

16 ACTING CHAIRMAN CARMODY: So, do we have a  
17 proposal for a new finding or what?

18 MEMBER BLACK: Not yet.

19 ACTING CHAIRMAN CARMODY: Not yet. All  
20 right.

21 40. When a failure could have catastrophic  
22 results, it is not appropriate to rely on maintenance  
23 and inspection intervention to prevent the failure from  
24 occurring if a practicable design alternative could  
25 eliminate the catastrophic effects of the failure mode.

1                   MEMBER GOGLIA: Don't -- go on. Do I count  
2 to 10?

3                   MEMBER BLACK: Well.

4                   ACTING CHAIRMAN CARMODY: Well, what is the  
5 --

6                   MEMBER GOGLIA: We have to rely upon the  
7 entire system. It's the design, it's the operation,  
8 and it's the maintenance and inspection process. That  
9 statement is -- the word "inappropriate" and the words  
10 on either side of it, they are not appropriate. That  
11 whole aviation system as well as other modes of  
12 transportation, even the elevators that we rode up and  
13 down in today in this building, they all rely upon  
14 maintenance. If you don't maintain it, the outcome is  
15 certain. So, I mean, I just --

16                   MR. CLARK: Well, the -- you're seeing  
17 something different in this than I am because we're not  
18 -- maintenance is absolutely critical out there and  
19 they need to perform well, and I think you just made a  
20 comment a moment ago about properly-trained and  
21 properly-qualified mechanics. They aren't out there.  
22 There are those that aren't properly trained or  
23 properly qualified and we have our overseas operations  
24 where they don't have the opportunity to reach the  
25 skills that our United States mechanics do perhaps, and



1 so this in no way means to take away from the critical  
2 responsibility that maintenance has, but when there is  
3 -- I would offer a slight analogy that we expect pilots  
4 out there to be professional and do their jobs, but  
5 CFIT is one of the worse situations going. So, we put  
6 other instruments in there to help them evaluate the  
7 situation better and to help them use the instruments  
8 that they have better to try to mitigate those kinds of  
9 risks.

10 I see what we're doing here is that  
11 maintenance needs to be doing their job, first and  
12 foremost, every time. What we're saying here is that  
13 in those areas that are so critical, if we can go in  
14 there and buy that safety margin, then we ought to do  
15 it, and if it's something like a fan disk where we  
16 cannot contain it if it ruptures, then we better take  
17 other actions, but we're looking for a practical  
18 solution here to buy that margin for the maintenance  
19 side and that's all we're saying.

20 ACTING CHAIRMAN CARMODY: Maybe I could  
21 suggest something where we eliminate some of the  
22 language that disturbs Member Goglia. Maybe we could  
23 say when a failure could have catastrophic results, it  
24 may be appropriate to consider a practicable design  
25 alternative to eliminate the catastrophic effects of

1 the failure mode.

2 MEMBER GOGLIA: That's fine with me.

3 ACTING CHAIRMAN CARMODY: Would that be all  
4 right?

5 MR. CLARK: Well, I would consider for that  
6 one, it's almost mandatory to consider. It's not  
7 maybe. It is mandatory to consider and if we can --

8 ACTING CHAIRMAN CARMODY: So it doesn't get  
9 us anything.

10 MR. CLARK: Well, no. I think to say that it  
11 is mandatory to consider and that's all we're doing  
12 here. What can we do in a practical way to buy that  
13 margin for that mechanic and that's no different than  
14 what we try to do in a practical way in buying margins  
15 for the pilots in all different phases of their flight  
16 operations.

17 MEMBER GOGLIA: You're talking about a  
18 systemic approach but that's not how it's worded here.  
19 Can we -- I don't want to bog us down here. Can we  
20 take this one, Number 40, and put it in the same place  
21 that we put Number 17 where we work on some additional  
22 language and circulate it?

23 ACTING CHAIRMAN CARMODY: Sure.

24 MR. CLARK: When we start that, somebody  
25 offered up that right at that first line, it says it's

1 not appropriate to rely solely upon, and I think that  
2 doesn't quite fix everything I know you're after, but  
3 that is the issue. It's not just maintenance. Why  
4 stick it all to them if we can find other ways to get  
5 us off the --

6 ACTING CHAIRMAN CARMODY: Okay.

7 MR. CLARK: -- same --

8 MEMBER BLACK: Would solely work, John? I  
9 mean, it sounds okay to me.

10 MEMBER GOGLIA: It does sound -- let's just  
11 move it. We can deal with this later.

12 ACTING CHAIRMAN CARMODY: All right. Well,  
13 let's perfect some language on that one, if you will.

14 41. Douglas DC-9, McDonnell-Douglas MD-  
15 80/90, and Boeing 717 series airplanes should be  
16 modified to ensure that loss of the horizontal  
17 stabilizer trim system jackscrew assembly acme nut  
18 threads does not preclude continued safe flight and  
19 landing.

20 MEMBER GOGLIA: This one begs the question,  
21 what about the rest of the fleet?

22 MR. CLARK: We agree, and that's what we  
23 talked about, that we hadn't progressed far enough in  
24 developing Jeff's whole factual analysis and he had a  
25 proposed recommendation on ball screws, and I think

1 that we talked to Member Black a little bit about kind  
2 of detuning that a little bit, just basically going to  
3 get a study going of all of those systems out there and  
4 make sure we don't have a lingering or a potential  
5 failure mode like we saw here due to wear specifically  
6 and any other thing they may find while they're looking  
7 at it.

8 So, I think that's something that Member  
9 Black had put together perhaps for a follow-on.

10 ACTING CHAIRMAN CARMODY: Do we want to take  
11 up your suggestions at this point, George?

12 MEMBER BLACK: I don't know. This is the  
13 thing John and I have been talking about, when to put  
14 in, for quite some time, and --

15 ACTING CHAIRMAN CARMODY: Well, maybe we  
16 should finish -- go down through 45 and then return to  
17 these because I know you had some amendments to these  
18 conclusions and it might be a good time to take them  
19 up. Would that be reasonable? Let's do that.

20 MEMBER BLACK: Yeah. I think this one's  
21 going to be difficult, though.

22 ACTING CHAIRMAN CARMODY: All right. Well,  
23 we're circling 41 to return to, right?

24 MEMBER GOGLIA: Hm-hmm.

25 ACTING CHAIRMAN CARMODY: Okay. I hope

1 somebody's keeping track of all these. Good.

2 42. Catastrophic single-point failure modes  
3 should be prohibited in the design of all future  
4 airplanes with horizontal stabilizer trim systems,  
5 regardless of whether any element of that system is  
6 considered structure rather than system or is otherwise  
7 considered exempt from certification standards for  
8 systems.

9 43. The certification requirements  
10 applicable to transport category airplanes should fully  
11 consider and address the consequences of failures  
12 resulting from wear.

13 44. At the time of the Flight 261 accident,  
14 Alaska Airlines Maintenance Program had widespread  
15 systemic deficiencies, some of which apparently still  
16 have not been corrected.

17 45. The FAA did not fulfill its  
18 responsibility to properly oversee the maintenance  
19 operations at Alaska Airlines, and at the time of the  
20 Alaska Airlines Flight 261 accident, FAA surveillance  
21 of Alaska Airlines had been deficient for several  
22 years.

23 So, that completes the draft of the  
24 Conclusions.

25 Now, do we want to move on to the Probable

1 Cause and then return to Conclusions later? Would that  
2 make sense or do you want to take up your Conclusions?

3 MEMBER BLACK: From a logical sense, it  
4 doesn't make sense.

5 ACTING CHAIRMAN CARMODY: Well, we're split  
6 here. I mean, we have some conclusions that kind of  
7 hinge on the probable cause. We have others that do  
8 not.

9 MEMBER BLACK: It's all right to discuss it.  
10 It doesn't -- I mean, we already have a framework  
11 we're working on. So, I suppose it makes sense.

12 ACTING CHAIRMAN CARMODY: The Probable Cause?

13 MEMBER BLACK: Right.

14 ACTING CHAIRMAN CARMODY: Well, I will read  
15 the Draft Probable Cause and then I have a proposed  
16 revision, and I'm sure others do as well. So, let me  
17 read the draft first.

18 The National Transportation Safety Board  
19 determines the probable cause of this accident was a  
20 loss of airplane pitch control resulting from in-flight  
21 failure of the horizontal stabilizer trim system  
22 jackscrew assembly acme nut threads. The thread  
23 failure was caused by excessive wear resulting from (1)  
24 Alaska Airlines insufficient lubrication of the  
25 jackscrew assembly, (2) Alaska Airlines extended

1 lubrication interval which increased the likelihood  
2 that a missed or inadequate lubrication would result in  
3 excessive wear of the acme nut threads, and (3) Alaska  
4 Airlines extended end-play check interval which allowed  
5 the excessive wear of the acme nut threads to progress  
6 to failure without the opportunity for detection.

7           Contributing to the accident was (1) the  
8 FAA's acceptance of Alaska Airlines extended  
9 lubrication interval and the FAA's approval of Alaska  
10 Airlines extended end-play check interval, and (2) the  
11 absence on the MD-80 of a fail-safe mechanism to  
12 prevent the catastrophic effects of total acme nut  
13 thread loss.

14           Now, I will take the liberty of reading my  
15 proposal and then I know Member Black has one and we'll  
16 see.

17           Probable Cause. The National Transportation  
18 Safety Board determines that the probable cause of this  
19 accident was the loss of airplane pitch control  
20 resulting from the in-flight failure of the horizontal  
21 stabilizer trim system jackscrew assembly acme nut  
22 threads. That's the same as the original one.

23           The thread failure was caused by excessive  
24 wear resulting from (1) Alaska Airlines insufficient  
25 lubrication of the jackscrew assembly, (2) Alaska

1 Airlines extended lubrication interval which increased  
2 the likelihood that a missed or inadequate lubrication  
3 would result in excessive wear of the acme nut threads  
4 and the FAA's approval of Alaska Airlines extended  
5 lubrication interval, and (3) Alaska Airlines extended  
6 end-play check interval which allowed the excessive  
7 wear of the acme nut threads to progress to failure  
8 without the opportunity for detection and the FAA's  
9 approval of Alaska Airlines extended end-play check  
10 interval.

11 Contributing to the accident was the absence  
12 on the MD-80 of a fail-safe mechanism to prevent the  
13 catastrophic effects of total acme nut thread loss.

14 What my proposal does, it retains the same  
15 language as the draft, but it essentially moves the FAA  
16 up to make them one of the -- along with Alaska  
17 Airlines the cause of the accident as opposed to  
18 contributing, and the reason I think this is important  
19 is that the FAA is the government and I think the  
20 public trusts the government to assure the safety of  
21 flight. The public pays the FAA. The public has faith  
22 in the FAA to do this, and I feel in this instance, the  
23 FAA failed miserably in the oversight of Alaska  
24 Airlines.

25 So, while certainly Alaska Airlines is --



1 (Applause)

2 ACTING CHAIRMAN CARMODY: While I think  
3 Alaska Airlines has a heavy responsibility, a primary  
4 responsibility to enforce the regulations, I don't  
5 think that the FAA's role is any less crucial nor do I  
6 think they should be seen as contributing. I think  
7 they were causal. That's my view, and I wanted to say  
8 that.

9 Member Black?

10 MEMBER BLACK: Well, as you know, I've had  
11 this written both ways. I had it written almost  
12 identically to that and then I have another option  
13 here, and I guess that is the -- you well stated the  
14 fundamental question. We in government, and I used to  
15 be in the local government where I had inspectors  
16 working for me on the roadway system and the people who  
17 paid my salary and their salary expected those people  
18 to produce a safe roadway system, and if we didn't, we  
19 were certainly held accountable for it, and it -- I  
20 mentioned during the meeting they were -- actually had  
21 intensive scrutiny of this airline going on as this  
22 airplane, the accident airplane, was proceeding through  
23 its course to its ultimate destiny, and it was not  
24 caught, and I don't know why. I don't think anybody  
25 will ever know really why, but it's just a question of

1     how you weigh this out, and I see that it can be argued  
2     either way.

3             There's also another one that is around that  
4     basically, I guess I could read that I wrote once that  
5     says, the National Transportation Safety Board  
6     determines the probable cause of this accident to be a  
7     loss of airplane pitch control resulting from the in-  
8     flight failure of the horizontal stabilizer trim system  
9     jackscrew assembly acme nut threads. The thread  
10    failure was caused by excessive wear resulting from  
11    Alaska Airlines insufficient lubrication of the  
12    jackscrew assembly.

13            This particular addition then moves to  
14    contributing. Contributing to the accident were (1)  
15    Alaska Airlines extended lubrication interval and the  
16    FAA's approval and/or acceptance, whatever the proper  
17    word is, of that extension which increased the  
18    likelihood that a missed or inadequate lubrication  
19    would result in excessive wear of the acme nut threads,  
20    and (2) Alaska Airlines extension of the end-play check  
21    interval and the FAA's approval or acceptance of that  
22    extension which allowed the excessive wear of the acme  
23    nut threads to progress to failure without proper  
24    opportunity for detection, and I also had as a separate  
25    paragraph, contributing also to it was the absence of

1 the MD-80 -- on the MD-80 of a fail-safe mechanism to  
2 prevent catastrophic effects of total acme nut thread  
3 loss.

4 That one was similar to an earlier staff  
5 draft, I believe, was it not, John?

6 MR. CLARK: Yeah. We had one similar around  
7 the director's review similar to that.

8 ACTING CHAIRMAN CARMODY: Are there other  
9 views? Member Goglia, you were expressing something to  
10 me just now.

11 MEMBER GOGLIA: I actually like what Member  
12 Black has proposed, and if we merge some of what you  
13 said and dropped "contributing" in the second paragraph  
14 of what you were reading and just listed all as part of  
15 the probable cause, and --

16 ACTING CHAIRMAN CARMODY: Okay. Would you  
17 make -- yeah. Has the same practical effect of mine.

18 MEMBER GOGLIA: Right.

19 ACTING CHAIRMAN CARMODY: Hm-hmm.

20 MEMBER GOGLIA: It flows better.

21 ACTING CHAIRMAN CARMODY: It's just different  
22 language.

23 MEMBER BLACK: Okay. I'm certainly --  
24 engineers are notoriously illiterate.

25 MEMBER GOGLIA: No, good.

1           ACTING CHAIRMAN CARMODY: No, no.

2           MR. CLARK: John, one thing. The -- as we've  
3           tried to develop this, the one that -- when we put it  
4           up, we were trying to put, even though it's a factor on  
5           this -- on the design, that we were trying to separate  
6           it to some extent from the others, and I commented  
7           about that earlier, that it's -- so, anyway, that was  
8           one part of what we were trying to do, is get a little  
9           separation in there, that it's an issue. It's  
10          something we need to deal with or, you know, we think  
11          people need to be aware of, but it didn't measure up in  
12          a sense to the others. So, there's -- that's one  
13          reason we ended up the way we did.

14          MEMBER GOGLIA: John, we talk here and we've  
15          talked a lot today about the fail-safe mechanisms for  
16          these screws, but we haven't even mentioned at all  
17          whether or not this technology was available at the  
18          time the airplane was certified, and one of the things  
19          that we do very well is hold airplanes that have been  
20          designed a long time ago to today's standards.

21                 Do we know anything in that area? What was  
22          available?

23          MR. CLARK: No, I really don't. What we know  
24          is there's nothing available for this jackscrew right  
25          now, but I think the -- starting off with the clean

1 sheet of paper, that if one of the design goals is to  
2 accept that that thing would wear out, wear completely  
3 through and then what would be the consequences, we may  
4 have seen a different design. We don't know what we  
5 would have seen, but the concept could have been on the  
6 table at that time to think of it in that terms.

7 Now, whether it would -- I don't know. It  
8 seems to me that jackscrews have probably been around a  
9 heck of a lot longer than airplanes, and so is there  
10 something out there, something that could have been  
11 added, it would surprise me if there wasn't, but it  
12 still could have -- the same engineering effort could  
13 have been put in then that we would like to see as an  
14 attempt right now. It may have been easier then. I  
15 mean, what we're trying to do now is go back and  
16 accommodate an existing design and enhance it where,  
17 when you start off with a clean sheet of paper with  
18 that design goal in mind, it's a lot easier to  
19 incorporate whatever needed to be incorporated.

20 MEMBER GOGLIA: I tend to think, given the  
21 work that NASA's done, that maybe there wasn't anything  
22 out there.

23 MR. CLARK: That would surprise me if there  
24 wasn't. I would -- but it could be.

25 ACTING CHAIRMAN CARMODY: Member

1 Hammerschmidt, did you have a comment?

2 MEMBER HAMMERSCHMIDT: Well, I was just going  
3 to say that I think we're achieving a consensus here.  
4 I mentioned to Member Black prior to the meeting even  
5 that I thought he had come up with a good alternate  
6 probable cause statement. The only improvement I would  
7 offer is concerning the last sentence, the one that  
8 we've been stating, contributing also to the cause was  
9 the absence of the MD-80, on the MD-80, of the fail-  
10 safe mechanism to prevent the catastrophic effects of  
11 total acme nut thread loss, and we've discussed that at  
12 length today.

13 I'm not sure that that's really part of the  
14 cause of this accident as a causal element.

15 MEMBER BLACK: It's an interesting point. It  
16 certainly is true if there had been something there,  
17 the accident wouldn't have happened, but it was not --  
18 I don't know whether -- are we saying yes or no at the  
19 time this airplane was certified, that it should have  
20 been there in our reading of the -- that was the Civil  
21 Aviation Regulations then. Should it have had the --  
22 the DC-9 have had a fail-safe device?

23 ACTING CHAIRMAN CARMODY: I don't know if it  
24 makes sense to go back and say what it should have had  
25 when it was certified.

1 MEMBER BLACK: Well, it certainly --

2 ACTING CHAIRMAN CARMODY: I think it makes  
3 sense -- it makes sense to observe that it was a causal  
4 factor or a contributing factor. It was.

5 MR. CLARK: I don't -- like I said, that had  
6 been the design thought or design requirement to take  
7 that on at that time and consider that --

8 MEMBER BLACK: Well, --

9 MR. CLARK: Well, what I would say is that  
10 they did put dual redundancy in there in many places in  
11 that. They put the torque tube inside of the  
12 jackscrew. So, they put the dual threads on. So, they  
13 were absolutely thinking about putting in dual-load  
14 paths for structure and which is good, I mean, and we  
15 believe that was there. It was the wear thing that  
16 slipped through. So, should it have been considered  
17 then? I don't know, but the fact -- we're dealing more  
18 now with what is right now.

19 MEMBER BLACK: Well, of course, certainly it  
20 was a hard time item when it was first designed, a life  
21 item it's called here. In other words, they were going  
22 to change it out. They said its life was X, whatever  
23 it was, 30,000 hours.

24 MR. CLARK: 30,000. It wouldn't make that.  
25 So, they backed off and, of course, this one made it no

1 where near 30,000 hours.

2 ACTING CHAIRMAN CARMODY: Well, let me just  
3 clarify what we agree on. It seems to me this  
4 formulation -- we agreed to strike the first  
5 "contributing to the accident" which is the top of that  
6 second paragraph.

7 MEMBER GOGLIA: And roll it together.

8 ACTING CHAIRMAN CARMODY: And roll it  
9 together. Shall I read it? Maybe I should read it so  
10 we know what we have.

11 The NTSB determines that the probable cause  
12 of this accident was the loss -- yes? Slowly. Was the  
13 loss of airplane pitch control resulting from the in-  
14 flight failure of the horizontal stabilizer trim system  
15 jackscrew assembly acme nut threads. The thread  
16 failure was caused by excessive wear resulting from  
17 Alaska Airlines insufficient lubrication of the  
18 jackscrew assembly.

19 MEMBER GOGLIA: 2.

20 ACTING CHAIRMAN CARMODY: I'm sorry.

21 MEMBER GOGLIA: That was 1.

22 ACTING CHAIRMAN CARMODY: That was 1. Yeah.  
23 You're right.

24 MEMBER GOGLIA: And jump on to 2.

25 ACTING CHAIRMAN CARMODY: 2. Thank you,



1 John. Alaska Airlines extended lubrication interval  
2 and the FAA's approval of that extension which  
3 increased the likelihood that a missed or inadequate  
4 lubrication would result in excessive wear of the acme  
5 nut threads, and 3. I guess this is, Alaska Airlines  
6 extended end-play check interval and the FAA's approval  
7 of that extension which allowed the excessive wear of  
8 the acme nut threads to progress to failure without the  
9 opportunity for detection.

10 Now, the remaining paragraph is the one  
11 contributing about the fail-safe mechanism, and I still  
12 don't have a clear idea of where we are on that.

13 MEMBER GOGLIA: I'd like to drop that.

14 ACTING CHAIRMAN CARMODY: I think it's a  
15 statement of what occurred in this accident. Now, I  
16 think we can look at recommendations and modify those  
17 in some way, if that's an issue, but I think to say  
18 that this wasn't even a factor in the accident is  
19 denying what seems to be the case.

20 I'm sorry. We're going to have just the  
21 people on the stage talking.

22 Any other thoughts, Member Black, Member  
23 Hammerschmidt?

24 MR. CLARK: Microphone.

25 MEMBER BLACK: Well, it's certainly a true

1 statement, but I guess there was a reason I asked about  
2 history because whether it's contributing was whether  
3 it was required in the first place. If it wasn't  
4 required to be in the series, it's sort of a moot  
5 point.

6 ACTING CHAIRMAN CARMODY: No, it's not.

7 MR. CLARK: What was required, they did go to  
8 the effort to put the redundancy in many areas and this  
9 one -- we heard at the hearing was that, you know,  
10 there was debate whether it was a system or a structure  
11 and certain parts were considered systems, certain  
12 parts were considered structure, and wear in and of  
13 itself wasn't considered at all in the failure mode.  
14 So, was it specifically required? Perhaps not because  
15 that's why we're making some specific recommendations  
16 in that area, but should it have been? We think  
17 so.

18 MEMBER BLACK: That's fair enough. Thank  
19 you.

20 MEMBER GOGLIA: Mr. Guzzetti?

21 MR. GUZZETTI: I just wanted to offer an  
22 unsolicited comment, but even though I express my  
23 uncomfortableness regarding the recommendation,  
24 Recommendation 13, I'm not uncomfortable at all with  
25 placing this as a contributing factor in this report.

1           As long as I've been writing proposed  
2 probable causes, in my mind, a contributing factor is  
3 something that if it was there, the accident wouldn't  
4 have occurred, and if this jackscrew assembly would  
5 have had some sort of mitigating device that would have  
6 handled the catastrophic effects of total acme nut  
7 thread loss, this accident wouldn't have happened.

8           So, I think that's a pretty compelling case  
9 to at least make it -- well, to make it a contributing  
10 factor, certainly not causal but contributing, and  
11 that's coming from a person that is uncomfortable with  
12 making a recommendation in that regard. So, I just  
13 wanted to offer that.

14           ACTING CHAIRMAN CARMODY: That goes to my  
15 point, Mr. Guzzetti, that I think the recommendations  
16 we can discuss, but I think this really needs to be in  
17 because it is what happened and it reflects this  
18 accident and that's what we're addressing here today.

19           MEMBER GOGLIA: Let me -- thinking out loud  
20 here. What's missing was a requirement to have a fail-  
21 safe mechanism and that requirement transcends MD-80s,  
22 although we're focused here on the MD-80.

23           MR. GUZZETTI: Actually, Member Goglia, there  
24 was a requirement, it wasn't this 1309 10 to the minus  
25 9th, but there was a CAR 4b, I think it was. Back

1 then, it was -- just one moment here. 4b.606,  
2 Equipment Systems and Installations, and basically it  
3 said all equipment systems and installations shall be  
4 designed to safeguard against hazards to the airplane  
5 in the event of their malfunctioning or failure, and I  
6 think it even went on to state something regarding  
7 single-point failures. I'm trying to find it right  
8 now, but there was a requirement back then. It just  
9 wasn't as embellished and as detailed as the  
10 replacement requirement which was FAR Part 25-1309.  
11 So, I just wanted to make that clear. It just made  
12 reference to a probable -- any probable single-point  
13 failure.

14           The interpretation, Boeing interpreted --  
15 they didn't feel it was probable to have a complete  
16 wear-out of the entire acme nut threads. They felt  
17 that the system was so robust, that you didn't even  
18 have to go there and be concerned about wear because  
19 even if you wore down 90 percent of the threads, you  
20 were still well above the safety margin, the structural  
21 safety margin.

22           What they did not consider was some mechanism  
23 where you could actually wear them all out.

24           MEMBER GOGLIA: Somebody totally disregarding  
25 the instruction for continued airworthiness and not

1 performing maintenance in any meaningful way over an  
2 extended period of time that led to the failure.

3 (Applause)

4 MEMBER GOGLIA: And I don't know how you  
5 could design any mechanical system to take that into  
6 effect.

7 MEMBER HAMMERSCHMIDT: Mr. Guzzetti, where is  
8 the information in the report that you just referenced?

9 MR. GUZZETTI: Page 41 of the factual report.

10 MEMBER HAMMERSCHMIDT: 41. Okay. This is a  
11 315-page tome. So, it's hard to --

12 MEMBER GOGLIA: Don't forget all the  
13 submissions.

14 MEMBER HAMMERSCHMIDT: Yes.

15 (Pause)

16 MR. GUZZETTI: Actually, if I could just  
17 point out on the bottom of Page 39 is what I was trying  
18 to grapple for. It's CAR Section 4b.320(d), and it  
19 says, "Control Systems. Each adjustable stabilizer  
20 must have a means to allow any adjustment necessary for  
21 continued safety of flight after the occurrence of any  
22 reasonably-probable single-failure of the actuating  
23 system."

24 Now, this kind of goes into the whole  
25 argument about system versus structure. The FAA

1 testified that they didn't consider the acme nut as a  
2 system, they considered it structure which falls under  
3 this other regulation. Well, of course, staff  
4 vehemently disagreed with that and we felt that this  
5 control systems should have been considered, but the  
6 regulations were such that they were interpreted that  
7 it wasn't very clear. So, I just wanted to point that  
8 out.

9 MEMBER HAMMERSCHMIDT: Well, the reason I had  
10 asked is because I actually had highlighted something  
11 on this page, and I forgot what page it was in the  
12 factual part of the report. So, that answers that  
13 question.

14 ACTING CHAIRMAN CARMODY: Are there other  
15 comments on this?

16 (No response)

17 ACTING CHAIRMAN CARMODY: Are we ready to  
18 come to a decision about this? Do we need to have a  
19 break and a little more time?

20 MEMBER GOGLIA: Take a break.

21 ACTING CHAIRMAN CARMODY: Let's take a break.  
22 Come back in 10 minutes, please.

23 (Whereupon, a recess was taken.)

24 ACTING CHAIRMAN CARMODY: Let's take our  
25 seats, please. I'd like to get started again.

1           I think there have been a number of  
2 formulations suggested. I think Member Black has one  
3 more. So, let's ask you to read that, please.

4           MEMBER BLACK: Okay. If I can read through  
5 my strike-throughs, and I would like to ask counsel or  
6 someone first, is it approval or acceptance is the  
7 proper word?

8           MR. BATTOCCHI: If you look at the original  
9 draft, it makes a distinction between approval and  
10 acceptance. For purposes of FAA's rules, there is a  
11 distinction. I don't know that the Board needs to feel  
12 bound by that, but the FAA does differentiate between  
13 acceptance and approval. They use approval when  
14 they're looking for formal written blessing to  
15 something as opposed to acceptance which may be silent  
16 acquiescence. So, there is a distinction within the  
17 regulatory framework for approval and acceptance, and  
18 again, I don't think the Board needs to feel bound by  
19 it if it's using approval in a broader sense, but there  
20 is a distinction.

21           MEMBER BLACK: I guess I don't know which one  
22 to read now. I've got both.

23           MEMBER GOGLIA: We probably should read it  
24 acceptance.

25           MR. BATTOCCHI: On the way the original was

1 drafted, the end-play check is approval, and the --

2 ACTING CHAIRMAN CARMODY: Lubrication is  
3 acceptance.

4 MR. BATTOCCHI: -- extended lubrication was  
5 approval rather, and the end-play -- I'm sorry. The  
6 acceptance was the lubrication interval, and the end-  
7 play check was approval.

8 MEMBER BLACK: Okay.

9 MR. BATTOCCHI: Okay.

10 MR. CLARK: But we've gone through that a  
11 lot. That's the way it was originally written, but  
12 there is the global sense of approval, and I'm going to  
13 talk until I get in trouble, then Frank's going to be  
14 helping me out here.

15 On the escalation of the lubrication  
16 interval, there are specific requirements in there that  
17 are maintenance tasks, if they extend 10 percent,  
18 requires an approval. It can be accepted if it's less  
19 than 10 percent, but if it's greater than the  
20 manufacturing recommended interval, and it exceeds 10  
21 percent, it requires approval.

22 Now, in this case, the manufacturing  
23 recommended value was 3,600 hours which was greater  
24 than 2,700. So, in that sense, it wouldn't require an  
25 acceptance, but that 3,600 came from an MSG-3 program,



1 and they were operating on the MSG-2 program. Somebody  
2 had to allow them to use the MSG-3. So, I think with  
3 all of that going on, they -- somewhere, there had to  
4 have been approval to work their way into that  
5 situation, but that whole situation, each step, I'm not  
6 clear.

7 ACTING CHAIRMAN CARMODY: Does it matter a  
8 lot?

9 MEMBER BLACK: Does it matter?

10 ACTING CHAIRMAN CARMODY: I think it's a  
11 distinction with no difference.

12 MEMBER BLACK: Okay. Let's make them both --

13 MR. CLARK: You're certainly free to use  
14 approval for both.

15 ACTING CHAIRMAN CARMODY: All right.

16 MEMBER BLACK: Thank you.

17 If I might, Madam Chairman? The National  
18 Transportation Safety Board determines that the  
19 probable cause of this accident was a loss of airplane  
20 pitch control resulting from the in-flight failure of  
21 the horizontal stabilizer trim system. I probably have  
22 a typo here. Horizontal stabilizer trim system  
23 jackscrew assembly acme nut threads. The thread  
24 failure was caused by an excessive wear resulting from  
25 Alaska Airlines insufficient lubrication of the

1 jackscrew assembly.

2           Contributing to the accident were: (1)  
3 Alaska Airlines extended lubrication interval and the  
4 FAA's approval of that extension which increased the  
5 likelihood that a missed or inadequate lubrication  
6 would result in excessive wear of the acme nut threads,  
7 (2) Alaska Airlines extension of the end-play check  
8 interval and the FAA's approval of that extension which  
9 allowed the excessive wear rate of the acme nut threads  
10 to progress to failure without opportunity for  
11 detection.

12           Contributing also was the absence on the MD-  
13 80 of a fail-safe mechanism to prevent the catastrophic  
14 effects of total acme nut thread loss.

15           ACTING CHAIRMAN CARMODY: Thank you, Member  
16 Black.

17           May I have a motion to adopt?

18           MEMBER BLACK: So moved.

19           ACTING CHAIRMAN CARMODY: And a second?

20           MEMBER HAMMERSCHMIDT: Second.

21           ACTING CHAIRMAN CARMODY: All in favor, say  
22 aye.

23           (Chorus of ayes)

24           ACTING CHAIRMAN CARMODY: Opposed?

25           (No response)

1           ACTING CHAIRMAN CARMODY: Unanimously  
2 carried.

3           Thank you for your cooperation on that.  
4           (Applause)

5           ACTING CHAIRMAN CARMODY: Thank you. I know  
6 you all are interested. I'm going to have to ask you  
7 to hold your applause and let us have quiet because we  
8 have to proceed with our work.

9           Shall we go now to the Recommendations? Yes,  
10 Member Goglia? Good idea. Why don't we go clean up  
11 the Conclusions first since there were a number of  
12 those that were dependent on our action on the Probable  
13 Cause? All right.

14           MEMBER GOGLIA: 23.

15           ACTING CHAIRMAN CARMODY: 23.

16           MEMBER BLACK: Well, someone is supposed to  
17 be getting us wording on 17.

18           ACTING CHAIRMAN CARMODY: That's true. Well,  
19 17 may not be complete yet. So, 23 can stay as it is,  
20 I guess.

21           MEMBER GOGLIA: 17 and 40 were -- we held for  
22 redraft.

23           ACTING CHAIRMAN CARMODY: Hm-hmm.

24           MEMBER GOGLIA: 23 was the first we turned  
25 to.

1           ACTING CHAIRMAN CARMODY: Yeah. But that was  
2 -- that's moot. So, we don't need -- and 27 was -- can  
3 stay as it is. I have 30.

4           Yes, Dan?

5           MR. CAMPBELL: Madam Chairman, 23, when you  
6 say stays as it is, I believe that you had suggested a  
7 modification as the last sentence there was FAA's  
8 contributing. So, you mean stay as it is modified as  
9 earlier suggested.

10          ACTING CHAIRMAN CARMODY: No. Stays as it is  
11 here because of what we did in Probable Cause.

12          MR. CAMPBELL: Well, microphone.

13          ACTING CHAIRMAN CARMODY: Sorry. Stay as it  
14 is written because of how we handled the Probable  
15 Cause.

16          MR. CAMPBELL: As written, it has the Federal  
17 Aviation Administration as a contributing factor.

18          ACTING CHAIRMAN CARMODY: I know. That's  
19 what we just did with the Probable Cause, and the same  
20 with 27, and I have 30. Was there going to be -- there  
21 was going to be some redrafting on 30 as well, wasn't  
22 there?

23          MEMBER GOGLIA: Yes.

24          ACTING CHAIRMAN CARMODY: If it's not ready  
25 yet, that's fine, but is by chance the redrafting on 30

1 available? No? Okay. Well, we'll catch that later  
2 then. Then I have 39.

3 MEMBER GOGLIA: That one's okay, too.

4 ACTING CHAIRMAN CARMODY: That one's okay.  
5 All right. Well, I guess we didn't have as much  
6 cleaning up as we thought. We still have two  
7 outstanding for redrafting.

8 MEMBER GOGLIA: Wait a minute. There's one I  
9 would like to --

10 DR. ELLINGSTAD: Excuse me, Madam Chairman.  
11 I believe both 23 and 27 are stated the way that they  
12 are written with Alaska as direct cause, and I believe  
13 that the Probable Cause that the Board just voted on  
14 has Alaska as contributing for both of those rather  
15 than as cause.

16 ACTING CHAIRMAN CARMODY: Well, let's look at  
17 the -- well, no. We said the insufficient lubrication,  
18 Alaska Airlines insufficient lubrication was the  
19 primary. So, that's not inconsistent with what's  
20 written on 23.

21 MEMBER BLACK: 27.

22 ACTING CHAIRMAN CARMODY: I think 23's fine.

23 MEMBER BLACK: 27, no.

24 ACTING CHAIRMAN CARMODY: I'm sorry? Yes?

25 MR. CLARK: The intent of putting in -- it

1 says the -- it says, "Therefore, was a direct cause of  
2 the excessive wear". That was going to a causal  
3 statement rather than --

4 ACTING CHAIRMAN CARMODY: Is there a  
5 suggestion for change? I'm kind of lost here.

6 MEMBER GOGLIA: We've got to slow down.  
7 We've got too much going on.

8 ACTING CHAIRMAN CARMODY: I know.

9 MR. CLARK: I think it'll stay.

10 ACTING CHAIRMAN CARMODY: I thought so.

11 MR. CAMPBELL: Madam Chairman, that  
12 conclusion is the extension of the lubrication interval  
13 which was then changed to contributing, and in this  
14 instance, it is listed as direct. So, to match the  
15 Probable, that would be a contributing factor.

16 ACTING CHAIRMAN CARMODY: Okay, okay. Could  
17 someone reformulate that for us, please? I take your  
18 point. And 27, the same, so it matches the Probable  
19 Cause. Okay.

20 MR. CLARK: I think one thing we're talking  
21 with our writers is that this comment about direct  
22 cause of excessive wear is in and of itself accurate  
23 and doesn't necessarily go to saying that entire thing  
24 is causal to the accident. It's a direct cause of the  
25 excessive wear which can be contributing.

1           MEMBER GOGLIA: Which one are we talking  
2 about?

3           MR. CLARK: We're on 23, Line 19, right now,  
4 but 27 is the same.

5           MEMBER GOGLIA: One at a time.

6           ACTING CHAIRMAN CARMODY: Okay.

7           MEMBER GOGLIA: We got too much.

8           ACTING CHAIRMAN CARMODY: Let me suggest  
9 something. Since we've agreed on the Probable Cause  
10 and we know what that language is, could we ask staff  
11 to make recommendations, 23 and 27, consistent with the  
12 Probable Cause rather than us doing it here? I think  
13 we all know what we intended, but rather than craft it  
14 in public, it might be easier if you would redraft  
15 those two consistent with the Probable Cause.

16           MR. CLARK: We're working on it now.

17           ACTING CHAIRMAN CARMODY: Since you're  
18 smarter than we are at this point. Okay. So, that's  
19 23 and 27. Now, --

20           MEMBER GOGLIA: 39 and 41.

21           ACTING CHAIRMAN CARMODY: -- 39. Hmm. Well,  
22 that's consistent with the Probable Cause. Okay. So,  
23 that's okay. All right. And you mentioned 41.

24           MEMBER GOGLIA: And they were going to reword  
25 that.

1           ACTING CHAIRMAN CARMODY: 41 was going to be  
2 reworded, is that it? Oh, 40 was going to be reworded.

3           MEMBER GOGLIA: 40. You're right. Reading  
4 the wrong one.

5           ACTING CHAIRMAN CARMODY: 40. Okay. So,  
6 reword 40.

7           MEMBER BLACK: 41 is an independent decision.

8           ACTING CHAIRMAN CARMODY: 41's --

9           MEMBER BLACK: Probable Cause.

10          ACTING CHAIRMAN CARMODY: Okay.

11          MEMBER GOGLIA: We're going to fold that into  
12 Recommendations.

13          ACTING CHAIRMAN CARMODY: I think you're  
14 right. All right. So, no.

15          MEMBER GOGLIA: So, 41, we hold.

16          ACTING CHAIRMAN CARMODY: 41, we hold. 23,  
17 27, 39, and 41.

18          MEMBER HAMMERSCHMIDT: My memory may be a  
19 little short here, but I was thinking that on 41, we  
20 had considered maybe substituting all transport  
21 category aircraft instead of those models that are  
22 listed. I think, wasn't that the option that we were  
23 debating over?

24          MEMBER GOGLIA: That's one.

25          ACTING CHAIRMAN CARMODY: I don't know if we



1 were agreeing they all should be modified. Maybe they  
2 should be --

3 MEMBER GOGLIA: Well, if you say one  
4 shipment, --

5 MR. CLARK: I think where we were at on our  
6 discussions on that was that we need the -- usually  
7 what we do is we identify the model that's particularly  
8 a problem and then follow on almost immediately with  
9 the second recommendation to do the any and all, check  
10 the rest of the fleet, and so this finding would be  
11 that -- should be modified and then the second -- the  
12 next one should be, if that's the appropriate place it  
13 falls out, would be some way -- there'd be a finding to  
14 address that we have concern about the rest of the  
15 fleet or something, and I think Jeff is pretty close to  
16 that. Either Jeff or George have the set-up of  
17 language for that, for the more --

18 ACTING CHAIRMAN CARMODY: You have some  
19 expansive language, Member Black, I do believe.

20 MEMBER BLACK: I do, but I got it from you,  
21 John.

22 ACTING CHAIRMAN CARMODY: All right. Well,  
23 whoever has it, let's --

24 MR. CLARK: I don't have a copy right now.

25 ACTING CHAIRMAN CARMODY: I've got it in

1 front of me. 39. Why don't you -- 40? Here we are.  
2 Sorry.

3 MR. CLARK: We did have that in the language  
4 on the page changes that came up December 6th. It's  
5 the very last page. It says, "Possible new  
6 recommendation." It says to add it between 13 and 14,  
7 and the text would be, "The Safety Board also believes  
8 that the FAA should evaluate the horizontal trim system  
9 of all transport category airplanes that employ a  
10 single-actuating assembly to identify any designs that  
11 have a catastrophic single-point failure mode and for  
12 any such systems identify means to eliminate that  
13 catastrophic effect of that single-point failure mode  
14 and require that such fail-safe mechanisms be  
15 incorporated into the design of all existing and future  
16 airplanes that are equipped with such horizontal trim  
17 systems."

18 ACTING CHAIRMAN CARMODY: Now, you're reading  
19 a recommendation.

20 MR. CLARK: Yeah. But the finding could be  
21 --

22 ACTING CHAIRMAN CARMODY: Could be the same.  
23 Okay.

24 MR. CLARK: -- very similar.

25 ACTING CHAIRMAN CARMODY: Do we have --

1           MEMBER HAMMERSCHMIDT: I have Member Black's  
2 suggestion on Finding 41 that supports the  
3 recommendation. I mean, that would be corresponding to  
4 the recommendation you were -- do you have this?

5           ACTING CHAIRMAN CARMODY: I don't see that  
6 that supports what he just said.

7           MEMBER HAMMERSCHMIDT: Okay.

8           MEMBER GOGLIA: In this package?

9           MR. CLARK: What page are we on?

10          MEMBER HAMMERSCHMIDT: 8.

11          MR. CLARK: The -- his 41 is okay in the  
12 sense of going global, but it says if found necessary,  
13 and of course, we believe that it is necessary for the  
14 DC-9 series. So, if that were broken up into two  
15 separate ones and leave 41 the way it was and then  
16 start in and say -- I would say the if found necessary  
17 on other transport category airplanes -- if found  
18 necessary, other transport category airplanes should be  
19 modified to ensure. So, basically break it up into two  
20 and keep them separate.

21          MEMBER GOGLIA: I like George's version.

22          ACTING CHAIRMAN CARMODY: I think Mr. Clark's  
23 point about the if found necessary is important. We  
24 should strike that, I think.

25          MR. CLARK: Or the other way to do that is do

1 the DC-9 and other transport category aircraft, if  
2 necessary. Isolate the if necessary to the other  
3 transport categories.

4 ACTING CHAIRMAN CARMODY: Okay. All right.  
5 So, Douglas DC-9, McDonnell-Douglas and Boeing 717  
6 series airplanes and other transport category aircraft,  
7 if necessary. Would that be what you -- or as  
8 necessary?

9 MR. CLARK: In a sense, that doesn't  
10 explicitly isolate the two, but --

11 ACTING CHAIRMAN CARMODY: Hm-hmm.

12 MR. CLARK: -- it still -- the language would  
13 still incorporate both.

14 ACTING CHAIRMAN CARMODY: Okay.

15 MR. CLARK: Now, you can move the if  
16 necessary to the front of that and talk about the DC-9  
17 series airplane and, if necessary, other transport  
18 category, that would isolate it.

19 ACTING CHAIRMAN CARMODY: Okay. Okay. So,  
20 we have one revised 41.

21 MEMBER GOGLIA: We have three versions that  
22 he just proposed.

23 ACTING CHAIRMAN CARMODY: Okay. Mr. Clark,  
24 would you read your latest proposal and let's see if we  
25 can agree on that? 41 as revised, starting with

1 Douglas DC-9, etc.

2 MR. CLARK: 41, I believe we have now, is  
3 just a slight modification from the one from Member  
4 Black. It says, "Douglas DC-9, McDonnell-Douglas MD-  
5 80/90 and Boeing 717 series airplanes and, if found  
6 necessary, other transport category aircraft should be  
7 modified to ensure that the loss of the horizontal  
8 stabilizer trim system jackscrew assembly acme nut  
9 threads or other control assembly does not preclude  
10 continued safe flight and landing."

11 MEMBER BLACK: You might want to work on the  
12 language there because the others don't have acme nuts.  
13 Some of them don't.

14 MR. CLARK: Well, okay. We said horizontal  
15 trim system acme nut threads or other control assembly.  
16 You had that in there.

17 MEMBER BLACK: I put it in, but does that  
18 cover it? I mean, is that adequate wording, John?

19 MR. CLARK: Well, we always think so. Now,  
20 when we get our responses back from FAA, we're  
21 surprised sometimes that we weren't careful enough.

22 ACTING CHAIRMAN CARMODY: Let's assume it  
23 does.

24 MR. CLARK: But it makes sense to us right  
25 now.

1           ACTING CHAIRMAN CARMODY: It makes sense to  
2 me.

3           May I have a motion on -- well, wait a  
4 minute. We ought to adopt all of them. So, that's  
5 revised 41. I think that's the last of the Findings,  
6 other than 23, 27 and 40, which are being reworked  
7 right now.

8           MR. CLARK: Okay. If we can take on 23 and  
9 27, --

10          ACTING CHAIRMAN CARMODY: All right.

11          MR. CLARK: Let's see. I've lost my place.

12          ACTING CHAIRMAN CARMODY: Okay.

13          MEMBER GOGLIA: 17.

14          ACTING CHAIRMAN CARMODY: You're right.

15          MEMBER GOGLIA: 17, 40 --

16          ACTING CHAIRMAN CARMODY: You're right,  
17 you're right.

18          MEMBER GOGLIA: -- are being circulated for  
19 rewrite.

20          MEMBER BLACK: Circulating? Okay.

21          ACTING CHAIRMAN CARMODY: Yeah. They were  
22 going to do it after --

23          MR. CLARK: We have a little more concern on  
24 17, but first, on 23, I think we can essentially on the  
25 top of 23 put in that -- and we talk about Alaska

1 Airlines extension of the lubrication and the FAA's  
2 acceptance. Then everything stays the same. Even the  
3 word, was a direct cause of the excessive wear that led  
4 to the accident, and what we can say was a direct cause  
5 of the excessive wear and contributed to the accident  
6 and that could -- puts the connotation of contributing  
7 into --

8 ACTING CHAIRMAN CARMODY: All right.

9 MR. CLARK: Is the direct cause of the  
10 excessive wear and just simply contributed to the --

11 ACTING CHAIRMAN CARMODY: All right.

12 MR. CLARK: And then everything else would  
13 stay the same, and then basically we have quite a  
14 similar situation --

15 MEMBER GOGLIA: Wait, wait, wait. Don't go  
16 on. Read that one to me one time.

17 MR. CLARK: I was going to try to bluff my  
18 way through it. All right. The -- okay. Let me see  
19 if I have it. Okay.

20 "Alaska Airlines extension of the lubrication  
21 interval and FAA's acceptance of the interval extension  
22 for its McDonnell-Douglas MD-80 horizontal stabilizer  
23 components, the last of which was based on Boeing's  
24 extension of the recommended lubrication interval,  
25 increased the likelihood that a missed or inadequate

1 lubrication would result in excessive wear of jackscrew  
2 assembly acme nut threads and therefore was a direct  
3 cause of the excessive wear and contributed to the  
4 Alaska Airlines Flight 261 accident.

5 The Federal Aviation Administration's  
6 acceptance of those extensions was a contributing  
7 factor."

8 ACTING CHAIRMAN CARMODY: Why would you need  
9 the last sentence if you have it in the first part?

10 MR. CLARK: I'm sorry.

11 ACTING CHAIRMAN CARMODY: Strike it.

12 MR. CLARK: You're right.

13 ACTING CHAIRMAN CARMODY: Okay. All right.

14 MR. CLARK: Yep.

15 ACTING CHAIRMAN CARMODY: Okay. Because that  
16 squares with the Probable Cause, and I think with 27,  
17 we can do the same thing.

18 MR. CLARK: Right.

19 ACTING CHAIRMAN CARMODY: Alaska Airlines  
20 extension and FAA's approval of that extension allowed  
21 the accident, etc., etc. Strike the last sentence.

22 MR. CLARK: I said acceptance in 23. I lost  
23 track. Are we going to go with approval in both or --

24 ACTING CHAIRMAN CARMODY: Whatever we do,  
25 let's just make a decision and go with it.



1           MR. CLARK: Approval, we believe, is the  
2 appropriate word.

3           ACTING CHAIRMAN CARMODY: Okay. Well, I'm  
4 really not of a strong mind on that. All right.

5           MEMBER GOGLIA: Wait a minute. How is the  
6 extension of the time a cause of excessive wear?  
7 Extension of the end-play check interval was a direct  
8 cause of the excessive wear.

9           MR. CLARK: Well, you need both a high wear  
10 rate and time and the extension of the time allowed the  
11 excessive wear to occur.

12           MEMBER GOGLIA: Read it, John. Let's hear  
13 it. Let's hear it. Read it aloud and see if you --  
14 27.

15           ACTING CHAIRMAN CARMODY: I can read it, if  
16 you'd -- okay.

17           MR. CLARK: No. I just wanted to add in a  
18 few notes here.

19           ACTING CHAIRMAN CARMODY: Okay.

20           MR. CLARK: And okay. "Alaska Airlines  
21 extension of the end-play check interval and FAA's  
22 approval of the extension allowed the accident acme nut  
23 threads to wear to failure without the opportunity for  
24 detection and therefore was a direct cause of the  
25 excessive wear that led to -- was a direct cause of the

1 excessive wear and contributed to the Alaska Airlines  
2 Flight 261 accident."

3 MEMBER GOGLIA: Do we really need anything  
4 after detection?

5 MR. CLARK: Well, we usually in the Findings  
6 identify those particular findings that go to cause or  
7 go to contributing.

8 MEMBER GOGLIA: I'll defer to everybody else  
9 on that.

10 ACTING CHAIRMAN CARMODY: Okay. Let me  
11 suggest that we -- oh, John has one. Yes. You go  
12 ahead and then we'll --

13 MEMBER GOGLIA: I have one at the end and  
14 it's Number 44. "At the time of the Flight 261  
15 accident, Alaska Airlines Maintenance Program had  
16 widespread systemic deficiencies, some of which have  
17 apparently not been corrected."

18 I'm not particularly comfortable with some of  
19 which have not been corrected in there. Is that --

20 ACTING CHAIRMAN CARMODY: Just strike it.

21 MEMBER GOGLIA: Just strike it there. Right  
22 after the deficiencies, put a period instead of a  
23 comma.

24 ACTING CHAIRMAN CARMODY: Let me suggest on  
25 the Conclusions that we vote on them with the

1 understanding that 17 and 40, we agreed to in principle  
2 and they're being drafted, and we will see the  
3 language, but -- and with the corrections we have noted  
4 as we've gone through today.

5 So, if I could have a motion on the  
6 Conclusions? Yes, Member Hammerschmidt?

7 MEMBER HAMMERSCHMIDT: I just wanted to make  
8 sure we're clear on Finding 44.

9 MEMBER GOGLIA: Period after deficiencies.

10 MEMBER HAMMERSCHMIDT: Okay.

11 MEMBER BLACK: Okay. We'll take care of it  
12 in the Recommendations.

13 MEMBER GOGLIA: All right. 41, we were  
14 holding 41 until we --

15 ACTING CHAIRMAN CARMODY: 41 was redrafted  
16 with George's formulation, I thought.

17 MEMBER BLACK: Yes.

18 ACTING CHAIRMAN CARMODY: Yeah. We agreed to  
19 that.

20 MEMBER GOGLIA: Okay. That's right.

21 ACTING CHAIRMAN CARMODY: Yeah. Okay? All  
22 right. May I have a motion?

23 MEMBER GOGLIA: I make a motion that we  
24 accept the Conclusions as modified with the  
25 understanding that Number 17 and Number 40 in the draft

1 report are to be rewritten by staff and circulated for  
2 members' concurrence.

3 ACTING CHAIRMAN CARMODY: Right.

4 MEMBER GOGLIA: Did I miss anything?

5 ACTING CHAIRMAN CARMODY: No. You said as  
6 modified and you mentioned those two. Second?

7 MEMBER HAMMERSCHMIDT: Second.

8 ACTING CHAIRMAN CARMODY: All in favor?

9 (Chorus of ayes)

10 ACTING CHAIRMAN CARMODY: Opposed?

11 (No response)

12 ACTING CHAIRMAN CARMODY: Conclusions are  
13 carried.

14 Now for the Recommendations. There are quite  
15 a few of these and I want to propose a new one. This  
16 is John's. Okay. I'll let John do this one when we  
17 get to it. This is yours. Yeah.

18 Okay. I am going to read it. There are 13  
19 of these. They are all for the FAA. I will read them  
20 and I'm sure my colleagues will stop me as we go  
21 through with modifications or corrections.

22 Number 1. Issue of Flight Standards  
23 Information Bulletin directing air carriers to instruct  
24 pilots that in the end of an inoperative or  
25 malfunctioning flight control system, if the airplane

1 is controllable, they should complete only the  
2 applicable checklist procedures and should not attempt  
3 any corrective actions beyond those specified.

4 In particular, in the event of an inoperative  
5 or malfunctioning horizontal stabilizer trim control  
6 system, after final determination has been made in  
7 accordance with the applicable checklist that both the  
8 primary and alternate trim systems are inoperative,  
9 neither the primary nor the alternate trim motors  
10 should be activated, either by engaging the autopilot  
11 or using any other trim control switch or handle.  
12 Pilots should further be instructed that if checklist  
13 procedures are not effective, they should land at the  
14 nearest suitable airport.

15 MEMBER BLACK: I assume we're talking about  
16 DC-9 series here?

17 ACTING CHAIRMAN CARMODY: Well, it's not  
18 specific in the recommendation, but I would assume. Do  
19 we need to specify?

20 MEMBER BLACK: Maybe we should say that.  
21 Shouldn't we, John?

22 ACTING CHAIRMAN CARMODY: Although --

23 MEMBER BLACK: This is talking about DC-9 MD-  
24 80 series, is it not?

25 MR. CLARK: Well, I don't see that it is

1 exclusive of any airplane out there.

2 MEMBER BLACK: Okay. All right.

3 ACTING CHAIRMAN CARMODY: All right. I think  
4 it's a generic caveat.

5 MEMBER BLACK: Is that okay, David? Captain  
6 Ivey?

7 MR. IVEY: I think that would apply to all  
8 aircraft.

9 MEMBER BLACK: Okay.

10 ACTING CHAIRMAN CARMODY: Okay. 2. As part  
11 of the response to Safety Recommendation A0141, those  
12 were one of the ones we made earlier to the FAA, as  
13 part of that recommendation, require operators of  
14 Douglas DC-9, McDonnell-Douglas MD-80/90, and Boeing  
15 717 series airplanes to remove used grease from the  
16 jackscrew assembly acme screw and flush degraded grease  
17 and particulates from the acme nut before applying  
18 fresh grease.

19 Number 3.

20 MEMBER BLACK: Madam --

21 ACTING CHAIRMAN CARMODY: Yes?

22 MEMBER BLACK: Madam Chairman?

23 ACTING CHAIRMAN CARMODY: Hm-hmm?

24 MEMBER BLACK: Dr. Kolly, isn't the correct  
25 word "worn grease" and not used grease?

1           MR. KOLLY: I believe both of those -- we're  
2 talking about grease that needs now renewal. So,  
3 however you want to call it, whether you want to call  
4 it worn or used, degraded.

5           MEMBER BLACK: Degraded might actually be  
6 better. Let's use degraded because that's really what  
7 it is. It's lost its capabilities and it's  
8 contaminated with particles, right?

9           MR. KOLLY: That's right.

10          MEMBER BLACK: If you don't mind, let's use  
11 degraded.

12          ACTING CHAIRMAN CARMODY: Degraded. Okay.

13          3. As part of the response to Safety  
14 Recommendation A0141, require operators of Douglas DC-  
15 9, McDonnell-Douglas MD-80/90, and Boeing 717 series  
16 airplanes in coordination with Boeing to increase the  
17 size of the access panels that are used to accomplish  
18 the jackscrew assembly lubrication procedure.

19          Number 4.

20          DR. DOWNS: If feasible, I think we should  
21 put in there. I mean, this is a monumental task.  
22 Doors and access panels on airplanes are not easy.  
23 It's not just a simple case of hacking the hole a  
24 little larger and putting a bigger piece of aluminum  
25 over it.

1           MR. GUZZETTI:  Actually in this case, you  
2 know, and we have some communication with Boeing that  
3 they're already doing this, that one panel where the  
4 banana fairing is, it just has a hinged -- it's a  
5 fiberglass.  It has a hinge on it and they'll just be  
6 able to cut out a larger panel and put a hinge on it.  
7 So, they telegraphed to us that they're going to be  
8 doing it anyway.

9           ACTING CHAIRMAN CARMODY:  I would think we  
10 could go ahead and make the recommendation.  If it  
11 turns out the FAA finds it obsessive or excessive, they  
12 can let us know.  Okay.

13           4.  Establish the jackscrew assembly  
14 lubrication procedure as a required inspection item  
15 that must have an inspector sign-off before the task  
16 can be considered complete.

17           Number 5.  Review all existing maintenance  
18 intervals for tasks that could affect critical aircraft  
19 components and identify those that have been extended  
20 without adequate engineering justification in the form  
21 of technical data and analysis demonstrating that the  
22 extended interval will not present any increased risk  
23 and require modifications of those intervals to ensure  
24 that they (1) take into account assumptions made by the  
25 original designers, (2) are supported by adequate



1 technical data and analysis, and (3) include an  
2 appropriate safety margin that takes into account the  
3 possibility of missed or inadequate accomplishment of  
4 the maintenance task.

5 In conducting this review, the FAA should  
6 also consider original intervals recommended or  
7 established for new aircraft models that are  
8 derivatives of earlier models, and if the aircraft  
9 component and the task are substantially the same and  
10 the recommended interval for the new model is greater  
11 than that recommended for the earlier, treat such  
12 original intervals for the derivative model as extended  
13 intervals.

14 That is a complicated one.

15 6. Conduct a systematic industry-wide  
16 evaluation and issue a report on the process by which  
17 manufacturers recommend and airlines establish and  
18 revise maintenance task intervals and make changes to  
19 the process to ensure that in the future, intervals for  
20 each task (1) take into account assumptions made by the  
21 original designers, (2) are supported by adequate  
22 technical data and analysis, and (3) include an  
23 appropriate safety margin that takes into account the  
24 possibility of missed or inadequate accomplishment of  
25 the maintenance task.

1           7. Require operators to supply the FAA  
2 before the implementation of any changes in maintenance  
3 task intervals that could affect critical aircraft  
4 components, technical data and analysis for each task  
5 demonstrating that none of the proposed changes will  
6 present any potential hazards, and obtain written  
7 approval of the proposed changes from the principal  
8 maintenance inspector and written concurrence from the  
9 appropriate FAA aircraft certification office.

10           8. Pending the incorporation of a fail-safe  
11 mechanism in the design of the Douglas DC-9, McDonnell-  
12 Douglas MD-80/90, and the Boeing 717 horizontal  
13 stabilizer jackscrew assembly, as recommended in  
14 Recommendation 13, (a) establish an end-play check  
15 interval that (1) accounts for the possibility of  
16 higher-than-expected wear rates and measurement error  
17 in estimating acme nut thread wear, and (2) provides  
18 for at least two opportunities to detect excessive wear  
19 before a potentially catastrophic wear condition  
20 becomes possible, and (b) until such a scientifically-  
21 based interval is determined, immediately establish an  
22 end-play check interval that is appropriately more  
23 conservative than the 2,000 flight hours.

24           MEMBER GOGLIA: Don't go on.

25           ACTING CHAIRMAN CARMODY: I'm not. I was

1 waiting for your intervention.

2 MEMBER GOGLIA: Yes. Again, I need to digest  
3 the changes that were given to us.

4 ACTING CHAIRMAN CARMODY: Yes. Pending the  
5 incorporation of a fail-safe -- establish an interval  
6 -- I have the change page.

7 MEMBER GOGLIA: Well, I guess I would say  
8 here that I disagree with more conservative than 2,000.  
9 I think 2,000 hours in conjunction with the 650-hour  
10 grease cycle and the inspections that go with that 650-  
11 hour cycle, at least in the interim until we do (a) in  
12 this, certainly would provide us with enough safety  
13 margin.

14 ACTING CHAIRMAN CARMODY: I'm sorry. We're  
15 trying to figure out what page that was. What -- did  
16 you make a suggestion, John, that I didn't hear?

17 MEMBER GOGLIA: I just said I don't agree  
18 with (b).

19 ACTING CHAIRMAN CARMODY: And that's (b)  
20 being until such time as an interval is determined,  
21 immediately establish an end-play check interval  
22 appropriately more conservative. Would you suggest  
23 what?

24 MEMBER GOGLIA: I think we have to defer to  
25 the FAA's folks and what they did with the 650-hour

1 grease job with the inspection, the AD Notice  
2 essentially, until they can --

3 ACTING CHAIRMAN CARMODY: Well, are we saying  
4 --

5 MEMBER GOGLIA: -- accomplish a --

6 DR. ELLINGSTAD: Excuse me. Again, Member  
7 Goglia, this relates to the fact that there is  
8 considerable uncertainty about the reliability and  
9 validity of the end-play measure. We're awaiting the  
10 results of validity studies and reliability studies  
11 that Boeing has underway. So, again staff feels that  
12 this approach to condition this recommendation on the  
13 conclusion of that scientific research is a  
14 conservative and a cautious method to make sure that  
15 there is an opportunity to catch excessive wear if it  
16 does in fact happen and if there is an inspection that  
17 is improperly performed or not performed at all.

18 So, it's conditional on the completion of  
19 that work that we know is in progress and we're  
20 expecting to see some results from.

21 MEMBER GOGLIA: And you started that  
22 conversation with the considerable concern or -- I  
23 mean, we're basing this, unless I missed something that  
24 was said, we're basing this on the wear of one or two  
25 jackscrews.

1 DR. ELLINGSTAD: No, sir. We're basing this  
2 on the results of all of the data that we have seen  
3 from repeated end-play measurements that have come in  
4 in response to the AD and all of the data that we have  
5 looked at has produced highly-variable results and a  
6 relatively low correlation between successive intervals  
7 and also a very low correlation between on-wing and  
8 bench end-play measures and no results from any other  
9 kind of a direct measure of wear.

10 MEMBER GOGLIA: I still don't -- we're  
11 cutting it essentially in half, the time between end-  
12 play checks. The FAA has done that already and  
13 essentially we're saying that's not adequate and I  
14 disagree. So -- well, how do you want to handle this?

15 I will make a motion that we strike (b) and  
16 now we can have a discussion on the motion and move  
17 forward and deal with it.

18 ACTING CHAIRMAN CARMODY: Is there a second  
19 to the motion?

20 MEMBER BLACK: Second.

21 ACTING CHAIRMAN CARMODY: All in favor?

22 (Chorus of ayes)

23 ACTING CHAIRMAN CARMODY: Okay. All right.  
24 The ayes have it.

25 MEMBER GOGLIA: Okay.

1           ACTING CHAIRMAN CARMODY: Okay. Moving on to  
2 Number 9, and I seem to have the latest package you  
3 sent, John. I'm reading from it, and the others don't  
4 seem to have it. The changes are not large. I'll read  
5 what I have.

6           Number 9. Require operators to permanently  
7 (1) track end-play measures according to airplane  
8 registration number and jackscrew assembly serial  
9 number, (2) calculate and record average wear rates for  
10 each airplane based on end-play measurements and flight  
11 times, and (3) develop and implement a program to  
12 analyze these data, to identify and determine the cause  
13 of excessive or unexpected wear rates, trends or  
14 anomalies.

15           The FAA should also require operators to  
16 report this information to the FAA for use in  
17 determining and evaluating an appropriate end-play  
18 check interval.

19           MEMBER GOGLIA: That's fine.

20           ACTING CHAIRMAN CARMODY: Okay. 10. Require  
21 that maintenance facilities that overhaul jackscrew  
22 assemblies record and inform customers of an overhaul  
23 jackscrew assembly end-play measurement.

24           11. Require operators to measure and record  
25 the on-wing end-play measurement whenever a jackscrew

1 assembly is replaced.

2           12. Require that maintenance facilities that  
3 overhaul jackscrew assemblies obtain specific  
4 authorization beyond a Class 1 accessory rating to  
5 perform such overhauls, predicated on demonstrating  
6 that they possess the necessary capability,  
7 documentation, and equipment for the task, and that  
8 they have procedures in place to (1) perform and  
9 document the detailed steps that must be followed to  
10 properly accomplish the end-play check procedure and  
11 lubrication of the jackscrew assembly, including  
12 specification of appropriate tools and grease types,  
13 (2) perform and document the appropriate steps for  
14 verifying that the proper acme screw thread surface  
15 finish has been applied, and (3) ensure that  
16 appropriate packing procedures are followed for all  
17 returned overhauled jackscrew assemblies, regardless of  
18 whether the assembly has been designated for storage or  
19 for shipping.

20           MEMBER BLACK: Question on that one.

21           ACTING CHAIRMAN CARMODY: Yes.

22           MEMBER BLACK: Are we talking about ball jack  
23 screws or just acme jackscrews?

24           MR. GUZZETTI: When the Systems Group did  
25 their evaluation to come up with this rec, in my mind,

1 it just addressed acme screws because there, you have  
2 an issue involving surface finish and we --

3 MEMBER BLACK: I think you're right. It just  
4 doesn't say that and we found in looking at this  
5 information that a lot of people use the word jackscrew  
6 and ball jackscrew interchangeably. So, it might not -  
7 - we might ought to say acme jackscrew if that's what  
8 we're talking about.

9 MR. GUZZETTI: Or we could just specify the  
10 airplane model.

11 MEMBER BLACK: Or the DC-9 series. Yeah.

12 MR. GUZZETTI: In my mind, we meant it to be  
13 for the DC-9, MD-80/90 and 717 series only.

14 MR. CLARK: Which is to say, that overhauled  
15 DC-9 series or DC-9 type?

16 MEMBER BLACK: Whatever the right terminology  
17 is.

18 MR. CLARK: DC-9 series and that should  
19 include the MD-80s, the 717s.

20 ACTING CHAIRMAN CARMODY: Okay. So, what --  
21 let's -- require -- how does that read now?

22 MR. CLARK: Just in the first line, it says  
23 require that maintenance facilities that overhaul DC-9  
24 series jackscrew assemblies and the implication there,  
25 I suppose we could add MD-80 and 717 like we have



1 elsewhere, but --

2 MEMBER BLACK: Aren't they all theoretically  
3 DC-9s and MD-80 is a -80?

4 MR. CLARK: I would think so.

5 ACTING CHAIRMAN CARMODY: All right.

6 MEMBER GOGLIA: There's a -50 in there, too.  
7 DC-910, 15, 20, 30, 50, 80, 90, and I don't think it  
8 changed until we went to the 717.

9 MR. CLARK: We can easily add the DC-9, MD-80  
10 and 717 series and just -- we have other language down  
11 below that's quite similar in 13. We'll just carry  
12 that.

13 ACTING CHAIRMAN CARMODY: Okay.

14 MR. CLARK: Sure.

15 MEMBER GOGLIA: And before we move on, Mr.  
16 Guzzetti, --

17 MR. GUZZETTI: Yes, sir?

18 MEMBER GOGLIA: -- Class 1 accessory rating.  
19 I'm going by memory here. There is nothing today  
20 that's beyond that, is there?

21 MR. GUZZETTI: No, there isn't. You're  
22 correct.

23 MEMBER GOGLIA: And then, that would require  
24 a rule change which, by the time that's done, this  
25 fleet type will be beer cans.

1           MR. GUZZETTI: I would hope that you wouldn't  
2 have to do a rule change. Maybe it could simply be --  
3 well, if you're going to require maintenance facilities  
4 obtain specific authorization, it could be -- I don't  
5 know the answer to that, Member Goglia. It could be  
6 some sort of inspector's handbook guideline or  
7 something.

8           MEMBER GOGLIA: Not binding. We need to look  
9 at that.

10          MR. CLARK: What's -- what we've asked for is  
11 to require and we always run into this with FAA that  
12 when they see require, that requires an AD and we've  
13 repeatedly told them we're using the more generic  
14 require and however they can make that happen, we'd be  
15 perfectly happy with, and so --

16          MEMBER GOGLIA: Well, we're saying the stuff  
17 in paren, the verbiage in paren is what's going to get  
18 us in trouble.

19          ACTING CHAIRMAN CARMODY: Should we strike  
20 it? Strike the paren?

21          MEMBER GOGLIA: At least we need to strike  
22 the paren.

23          ACTING CHAIRMAN CARMODY: Strike the paren.

24          MR. GUZZETTI: Yeah. Striking the parens  
25 would probably be the best bet for that.

1           ACTING CHAIRMAN CARMODY: Okay. Let's fix  
2 that one.

3           MR. GUZZETTI: Ms. Weinstein suggested that,  
4 also.

5           ACTING CHAIRMAN CARMODY: Good. Great minds.  
6 Okay.

7           13. Conduct a systematic engineering review  
8 of the Douglas DC-9, McDonnell-Douglas MD-80/90, and  
9 Boeing 717 series airplanes to identify means to  
10 eliminate the catastrophic effects of total acme nut  
11 thread failure in the horizontal stabilizer trim system  
12 jackscrew assembly and require that such fail-safe  
13 mechanisms be incorporated in the design of all  
14 existing and future DC-9, MD-80 and 717 series  
15 airplanes and their derivatives.

16           MEMBER GOGLIA: Again, we go back to all the  
17 airplanes that have the same acme nut and there are a  
18 considerable number. We've excluded those. I think  
19 that we should not mention the airplane type in this  
20 recommendation but mention the jackscrew type since  
21 it's to the FAA, we'd like them to look at all of the  
22 airplanes that have this system or similar system, and  
23 maybe we should talk about the recirculating ball, but  
24 at the very least, we need to talk about all the  
25 airplanes that have the acme nut installed on the

1 airplane, not single out these group.

2 ACTING CHAIRMAN CARMODY: I do have a  
3 recommendation, a new recommendation that I guess came  
4 from Mr. Clark.

5 MR. CLARK: It grew out of Member Black's  
6 concern of how we broaden this and part of this for 13  
7 still is -- usually we issue the recommendations for  
8 the things that we really have a handle on and then  
9 issue the more global recommendations to study here.

10 MEMBER GOGLIA: I have so much paper now.

11 ACTING CHAIRMAN CARMODY: I know. This is  
12 John's paper. Do we want to talk about this proposal?

13 MEMBER BLACK: We could leave this one and  
14 then put in the other one.

15 ACTING CHAIRMAN CARMODY: Well, that was what  
16 I thought we were doing.

17 MEMBER HAMMERSCHMIDT: Well, I'm thinking  
18 like Member Goglia here. I had looked over Member  
19 Black's revisions yesterday and he had quite a revision  
20 on this one, and then I tweaked it some more from an  
21 editorial standpoint and came up with this for another  
22 option, and it would read: conduct a systematic  
23 engineering review of all transport category airplanes  
24 to identify means to reduce the maximum extent possible  
25 the catastrophic effects of a system or associated

1 structure failure in the horizontal stabilizer trim  
2 control system and, if necessary, require that such  
3 fail-safe mechanisms be incorporated in the design of  
4 all existing and future transport category airplanes.

5 MEMBER BLACK: I like it.

6 MEMBER GOGLIA: I like it as well.

7 ACTING CHAIRMAN CARMODY: That's good.

8 MEMBER HAMMERSCHMIDT: Okay.

9 ACTING CHAIRMAN CARMODY: Any comments?

10 MEMBER GOGLIA: Second.

11 ACTING CHAIRMAN CARMODY: Are there any  
12 comments from staff we should be aware of? This sounds  
13 good to us.

14 MEMBER HAMMERSCHMIDT: That would be to  
15 replace 13. It's a double modification of 13. It's  
16 Member Black's substitution and then my editing of his  
17 substitution.

18 ACTING CHAIRMAN CARMODY: Hammerschmidt.

19 MEMBER HAMMERSCHMIDT: Amend the amendment.

20 MR. CLARK: I think the -- what it does leave  
21 open is that what we want out of 13 -- wanted out of 13  
22 is specific efforts in the MD-80 because we have had  
23 the failure there, and the one thing I saw in 13 was  
24 that we had left out -- we say require and for  
25 existing, we should have the practicable in there, but

1 what I see that -- and I'm not sure I heard everything  
2 in what you read, is that, it leaves it really open for  
3 any and all airplanes out there, and I guess our  
4 preference was to -- of course, that's certainly, you  
5 know, the Board's prerogative, but our preference was  
6 to directly deal with the MD-80 airplane and then, if  
7 those design deficiencies were found on other  
8 airplanes, to include those. So, and again, I may have  
9 misheard or not totally absorbed.

10 MEMBER HAMMERSCHMIDT: Well, I was trying to  
11 incorporate all transport category airplanes, which is  
12 essentially what Member Black had done, other than the  
13 fact that I tweaked his language a bit. Let me read it  
14 again just for --

15 MR. CLARK: Okay.

16 MEMBER HAMMERSCHMIDT: -- the sake of repeat  
17 here. Conduct a systematic engineering review of all  
18 transport category airplanes to identify means to  
19 reduce to the maximum extent possible the catastrophic  
20 effects of a system or associated structure failure in  
21 the horizontal stabilizer trim control system and, if  
22 necessary, require that such fail-safe mechanisms be  
23 incorporated in the design of all existing and future  
24 transport category airplanes.

25 MR. CAMPBELL: If I might try and explain the

1 difficulty we're having at the table with that  
2 formulation? It's the term "if necessary" which we  
3 think would be appropriate for all category of  
4 aircraft, except that which we're looking at here. For  
5 the group that we've actually identified in this  
6 accident, we think that the "if necessary" has already  
7 been determined and that we would like to proceed to  
8 the fail-safe mechanism, and so by lumping them all  
9 together, that if necessary seems to put back into play  
10 whether or not this particular category of aircraft  
11 needs that fail-safe mechanism.

12 MEMBER HAMMERSCHMIDT: I thought I heard Mr.  
13 Clark just say that he would insert "if practical" at  
14 some point in there.

15 MR. CLARK: Well, that's different than if  
16 necessary and again that still directs to DC-9 MD-80  
17 series airplanes.

18 MEMBER HAMMERSCHMIDT: Okay. Well, if  
19 practical is all right with me. I was just using the  
20 language that Member Black had utilized. So, if  
21 practical works.

22 MR. CLARK: Okay. Then the only other issue  
23 or the one thing I saw in there is that I still think  
24 the language where we had originally had it eliminate  
25 the catastrophic effects because in a sense, how do you

1 reduce to the maximum extent possible a catastrophic?  
2 It's kind of either catastrophic or you've eliminated  
3 the catastrophic effect. You can't have probably half  
4 a catastrophic --

5 MEMBER HAMMERSCHMIDT: I was satisfied with  
6 that word "eliminate", but I was talking to someone in  
7 the Office of Aviation Safety who said, "Well, how can  
8 you actually eliminate something conclusively?" So, I  
9 was -- it wasn't the people at this front table, but I  
10 was taking a lead on that alternate language from  
11 someone from your office.

12 ACTING CHAIRMAN CARMODY: Why don't we return  
13 to "eliminate"?

14 MEMBER HAMMERSCHMIDT: Okay. I know it's a  
15 subtle point, I think.

16 MR. CLARK: No. It's a fair point to say  
17 we're never certain in the sense to eliminate that.  
18 That's the goal. That's what we strive for, is to  
19 eliminate it, get it -- take it off the table, and I  
20 think that language is clear.

21 MEMBER HAMMERSCHMIDT: It's certainly more  
22 concise.

23 MR. CLARK: I think so, also.

24 MEMBER HAMMERSCHMIDT: That's fine.

25 MR. CLARK: Okay. Let me -- okay. I think



1 the -- I guess we'd have to just take a quick look.  
2 The -- what I was going -- in the way this is, I think  
3 what you -- you've added other language about  
4 jackscrews and other control structure which I think is  
5 appropriate if we're going to expand it.

6           What I think is that it's -- for existing  
7 designs, if practical, and of course, we want it for  
8 future designs. It's a little hard without seeing it  
9 written. You have to really sit down, but -- well, I  
10 think the -- okay. It's still easier to us to separate  
11 them, but if we're going to combine them, I guess we  
12 need to see it written out, but the gist of what we're  
13 after seems --

14           ACTING CHAIRMAN CARMODY: Let this be one  
15 that we kind of agree in principle but you will redraft  
16 it and circulate it to us. How does that sound?

17           MR. CLARK: Okay. All right.

18           ACTING CHAIRMAN CARMODY: And we'll take  
19 another look at it because I think there are some  
20 subtleties here we might need to consider.

21           MR. CLARK: Okay. On the whole of it, I  
22 think it's pretty good. It seems to get to where we  
23 want to go, but, you know, I can't -- it's hard to sort  
24 out the loopholes in it that we don't intend to be in  
25 there.

1           MEMBER BLACK: Well, I was trying to catch  
2 some of that business between system and structure,  
3 you'll notice, which is --

4           MR. CLARK: Yeah.

5           MEMBER BLACK: Just so that we wouldn't have  
6 that problem happen again. It is clumsy-sounding.

7           MR. CLARK: Yeah. It's a fair observation.

8           MEMBER GOGLIA: I think the sense of the  
9 Board is that we want to combine all the airplanes that  
10 have this system in it. We want to ask the FAA to take  
11 a look at all of them. I don't think it makes sense to  
12 ask them to look at them one-by-one-by-one. I think in  
13 the broad sense, that they should bring all the parties  
14 together and they should look at this issue globally,  
15 as you said, and not pick the one fleet type today and  
16 defer any work on the rest of it for -- as we often see  
17 months or years. I'd like the FAA to sit and address  
18 this in a timely way, all the airplanes, because I  
19 don't want to ever sit here looking at people like this  
20 again for another airplane that has a similar design  
21 that we didn't get to or they didn't get to yet.

22           ACTING CHAIRMAN CARMODY: But, of course, as  
23 a practical matter, the FAA's going to have to start  
24 with something and they're not going to be able to do  
25 them all simultaneously. So, in any event.

1           Okay. 14. Modify the certification  
2 regulations, policies or procedures to ensure that new  
3 horizontal stabilizer trim control system designs are  
4 not certified if they have a single-point catastrophic  
5 failure mode, regardless of whether any element of that  
6 system is considered structure rather than system or is  
7 otherwise considered exempt from certification  
8 standards for systems.

9           15. Review and revise aircraft certification  
10 regulations and associated guidance applicable to the  
11 certification of transport category airplanes to ensure  
12 that wear-related failures are fully considered and  
13 addressed, so that to the maximum extent possible, they  
14 will not be catastrophic.

15           16. Convene a Headquarters-led team to  
16 conduct another in-depth on-site follow-up inspection  
17 of Alaska Airlines to evaluate whether adequate  
18 corrective measures have been fully implemented to  
19 address the deficiencies identified in the FAA's April  
20 2000 Special Inspection Report.

21           MEMBER GOGLIA: Madam Chairman, we talked  
22 about this at length this morning, and I would like to  
23 propose that we just eliminate this recommendation.

24           ACTING CHAIRMAN CARMODY: Is there a second?

25           MEMBER HAMMERSCHMIDT: We're talking about --

1 ACTING CHAIRMAN CARMODY: 16, John. Sorry.

2 MEMBER HAMMERSCHMIDT: Second.

3 ACTING CHAIRMAN CARMODY: Okay. All in  
4 favor?

5 (Chorus of ayes)

6 ACTING CHAIRMAN CARMODY: Opposed?

7 (No response)

8 ACTING CHAIRMAN CARMODY: Okay. All right.  
9 Now, John, you had one more you wanted to propose and  
10 you'll have to work on the language but why don't you  
11 do that?

12 MEMBER GOGLIA: Right. We earlier talked  
13 about the role of dispatch and putting a recommendation  
14 in and given all that's going on and the fact that  
15 we're coming back with Number 17 and Number 40 as well  
16 as --

17 ACTING CHAIRMAN CARMODY: 13.

18 MEMBER GOGLIA: -- Number 13 in the  
19 Recommendations, why don't we add this dispatch  
20 recommendation to that list, make it four items that  
21 we'll circulate and deal with. Just given all that  
22 we've had, it's just too much.

23 ACTING CHAIRMAN CARMODY: Did you read it?

24 MEMBER GOGLIA: No. What we had proposed,  
25 it's simple, issue a flight safety information

1     bulletin.  This is to the FAA, asking them to issue a  
2     flight safety information bulletin directing air  
3     carriers to advise dispatch and maintenance control  
4     personnel not to place pressure on flight crews to  
5     continue scheduled flight when they are troubleshooting  
6     emergency situations, and I think that we need a little  
7     more time to develop the language to fully vet that  
8     proposal.

9             MEMBER BLACK:  Was this one going to cover  
10     giving them adequate assistance, also?

11            MEMBER GOGLIA:  Yes, that's what we were  
12     struggling with earlier.

13            ACTING CHAIRMAN CARMODY:  Okay.  So, we need  
14     to work on that.

15            MEMBER GOGLIA:  So, it needs some work to  
16     capture all that this flight crew experienced from  
17     their support on the other end of the radio.

18            ACTING CHAIRMAN CARMODY:  So, that will  
19     probably be Recommendation 16 since we struck 16.  That  
20     will be the new 16.

21            MEMBER GOGLIA:  Yes.

22            ACTING CHAIRMAN CARMODY:  Okay.  So, 13 and  
23     16 are going to be reworked.

24            MEMBER GOGLIA:  And 17 and 40 on the  
25     Conclusions.

1           ACTING CHAIRMAN CARMODY: On the Conclusions.  
2       Yeah. We've already agreed to that.

3           MEMBER GOGLIA: Hm-hmm.

4           ACTING CHAIRMAN CARMODY: Now we're looking  
5       at a motion for the --

6           MR. CLARK: Which recommendation?

7           ACTING CHAIRMAN CARMODY: I'm sorry? Yes?

8           MR. CLARK: Which recommendation?

9           ACTING CHAIRMAN CARMODY: Recommendation 13,  
10       which is being redrafted, and then this new  
11       Recommendation 16 from Member Goglia on the dispatch.

12           MEMBER GOGLIA: Okay. I make a motion that  
13       we accept the recommendations as modified.

14           MR. CLARK: Okay. And that's the Findings we  
15       -- we have 17 --

16           ACTING CHAIRMAN CARMODY: We've already done  
17       that, but 17 and 40 were the --

18           MR. KOLLY: 17 and 40.

19           ACTING CHAIRMAN CARMODY: -- two Findings  
20       that needed to be perfected.

21           MR. CLARK: And then a Finding of Dispatch  
22       that goes along with the Rec 16.

23           ACTING CHAIRMAN CARMODY: That's a good idea,  
24       yes.

25           MR. CLARK: Okay.

1           ACTING CHAIRMAN CARMODY: Okay. Member  
2 Goglia's made a motion. Is there a second?

3           MEMBER HAMMERSCHMIDT: Yes, second.

4           ACTING CHAIRMAN CARMODY: All in favor?

5           (Chorus of ayes)

6           ACTING CHAIRMAN CARMODY: Opposed?

7           (No response)

8           ACTING CHAIRMAN CARMODY: The Recommendations  
9 are adopted.

10           Now, we need to adopt the whole report.

11           MEMBER GOGLIA: I make a motion.

12           ACTING CHAIRMAN CARMODY: Yes. Member  
13 Hammerschmidt?

14           MEMBER HAMMERSCHMIDT: Well, your motion is  
15 to approve?

16           MEMBER GOGLIA: Yes.

17           MEMBER HAMMERSCHMIDT: I would suggest that  
18 -- I will second that motion, that we approve it as  
19 modified and as modified per the changes that have been  
20 made in the Findings, Safety Recommendations  
21 essentially, that those changes be taken into  
22 consideration in the text of the report itself, and so  
23 that the report will be modified accordingly, to be  
24 consistent with the changes that were made in the  
25 Recommendations and Findings.

1           MR. CLARK: What we normally do is for the  
2 Recs, we back up and have a finding and then  
3 appropriate text. For those that are eliminated, those  
4 need to be adjusted. For those that are added, we need  
5 to add text to fit. But other than that, those that  
6 aren't touched by that, the report is okay.

7           MEMBER HAMMERSCHMIDT: Right. So, so  
8 seconded.

9           ACTING CHAIRMAN CARMODY: Okay. All in  
10 favor?

11           (Chorus of ayes)

12           ACTING CHAIRMAN CARMODY: Opposed?

13           (No response)

14           ACTING CHAIRMAN CARMODY: The report is  
15 adopted then.

16           Well, this has been a long and, I hope,  
17 productive day. I congratulate all the staff for their  
18 hard work and their patience. I think you've all done  
19 an outstanding job, not only today but in the last  
20 three years, on this accident, and I'm very grateful to  
21 you.

22           MR. CLARK: Madam Chairman, if I may, the --  
23 I'd like to especially acknowledge people and I  
24 probably lost a little bit of a list here, so I'm  
25 really going to goof it up. But this whole report



1 always comes together with our writers and editors and  
2 Karen Bury and Kristen Sears are really the ones that  
3 pull it together, make it readable, and I think we've  
4 had an opportunity to see a number of people up here  
5 that worked actively on it, but basically we ended up  
6 with probably at least 25 investigators that each one  
7 contributed.

8 I'm not going to go down through their whole  
9 name, but there's some other people that -- like Gina  
10 John and Kevin Renze that worked on the graphics,  
11 Carolyn Dargan that set up the room and took care of  
12 all of this, and Antoine Downs who certainly helped  
13 churn all of that. So, we kind of get our names out  
14 here on the factualls and stuff, but Chris Annibale is a  
15 student intern working with us, and so he's been  
16 running all the graphics, always does. So, we got a  
17 lot of key players, but out of that, we have about 50  
18 investigators at Headquarters and Vern has probably 20  
19 and so out of that 70, at least 25 people were actively  
20 involved in this investigation.

21 I really want to express my appreciation to  
22 each and every one of them.

23 MEMBER BLACK: Madam Chairman?

24 ACTING CHAIRMAN CARMODY: Yes?

25 MEMBER BLACK: As the engineer in the group

1 here, I feel obligated to say that this is in many  
2 respects one of the best reports that I've seen because  
3 there is really basic science done in several areas.  
4 So, we haven't talked much about it, but aircraft  
5 performance and trying to deal with airplanes that are  
6 not exactly like they left the factory and trying to  
7 figure out what the loads were and the materials area  
8 and the grease area and Mr. Guzzetti and we haven't  
9 talked about structures, but the documentation of all  
10 of the structures that Lorenda did was just first-rate  
11 engineering work, and I'd like to thank them for that.

12 ACTING CHAIRMAN CARMODY: Are there comments  
13 from any other board members? Member Hammerschmidt?

14 MEMBER HAMMERSCHMIDT: Let me just say very  
15 briefly that I thought the staff did an outstanding job  
16 on this accident investigation and report. I was very  
17 close to this investigation being the board member on  
18 scene and then having the opportunity to chair the  
19 public hearing in this room, and I believe that the way  
20 that the staff has operated in a very dedicated  
21 purposeful way to come up with solutions so that this  
22 accident, Alaska Air Flight 261, will not happen again  
23 is certainly evident and to be commended, the staff's  
24 dedication and purpose.

25 George has already mentioned that it's a very

1 intelligent report and I was commenting to a few people  
2 at the front table here, staff table, after the first  
3 coffee break that I thought that the animation that Mr.  
4 Guzzetti showed this morning and narrated was one of  
5 the most impressive ones that I've seen since I've been  
6 here at the Board and that's pushing quite a few years,  
7 and I just want to commend the staff for very hard  
8 work, difficult work, and good work, and to the  
9 families, I certainly want to extend again my deepest  
10 sympathy and hopefully that the fruit of all these  
11 efforts by these many dedicated investigators will be  
12 such that there'll be some good that may come out of  
13 such a tragic event.

14 ACTING CHAIRMAN CARMODY: Member Goglia?

15 MEMBER GOGLIA: I'll say ditto. It was  
16 especially in the maintenance issues not exactly easy  
17 on staff when we get maintenance issues and you guys  
18 did a very good job of investigating those issues,  
19 putting them on the table and coming up with good ways  
20 to deal with them.

21 So, even though it pains me to give Jeff  
22 Guzzetti any credit, he really deserves a lot of credit  
23 along with Frank McGill and, of course, the IIC  
24 deserves something. Some credit for it. I can't give  
25 you credit, Rod. You've been -- but it was really an

1       excellent, excellent job on this report.

2                   ACTING CHAIRMAN CARMODY: We're going to  
3 record that and hold you to it.

4                   But thanks to all. It was very good work and  
5 thanks to my colleagues for their patience and their  
6 cooperation, and we're very glad the families were able  
7 to be here and to observe. I hope you've felt that the  
8 process was productive. I think we've all -- I believe  
9 we've all done something to improve safety today and  
10 that's why we all are here.

11                   Thank you all. Adjourn the meeting.

12                   (Whereupon, at 5:56 p.m., the meeting was  
13 adjourned.)

14

15

16

17

18

19

20

21

22

23

24

25