STATEMENT OF THE HONORABLE LANGHORNE M. BOND, FEDERAL AVIATION ADMINISTRATOR, BEFORE THE AVIATION SUBCOMMITTEE OF THE SENATE COMMERCE, SCIENCE, AND TRANSPORTATION COMMITTEE, CONCERNING AIRCRAFT CERTIFICATION AND INSPECTION PRACTICES. JULY 11, 1979.

Mr. Chairman and Members of the Subcommittee:

I appreciate having the opportunity to appear before you today to discuss issues concerning the current situation relative to the DC-10 aircraft and the broader questions of certification and maintenance of U.S. air carrier aircraft. I am confident that today's hearing will provide a meaningful forum for thoughtful discussion of major issues concerning air safety, and I welcome the benefit of your views.

Let me give you a chronology of events and the actions taken by FAA subsequent to the tragic crash of May 25th. Following the accident, an NTSB/FAA accident investigation team was dispatched from Washington and arrived at Chicago at 10:35 p.m. (EDT). The team directed its principal inquiry toward an early report that the left engine separated from the aircraft during the takeoff roll. The engine and pylon had been located approximately eight thousand feet down the runway.

At 3:00 p.m. (EDT) on Sunday, May 27th, a broken bolt was found near the resting place of the separated engine. It was determined that this bolt secured the thrust link bushing and attach fitting to the wing. The ensuing inspection suggested that the bolt had backed out of its hole at some time prior to the actual separation of the engine/pylon assembly. It was also reported that the appearance of the fracture surface indicated fatigue failure. With this information in hand, FAA's Western Region was ordered to concentrate their efforts on the forward thrust link assembly design to determine what action should be taken immediately to preclude the possibility of another accident.

At 7:00 p.m. (EDT) on the same day, the NTSB recommended that the FAA issue an emergency Airworthiness Directive "to inspect all DC-10 aircraft by approved inspection methods." This recommendation was based on their finding that the thrust link attach bolt had failed as a result of fatigue.

After analyzing the available data and taking the time necessary to develop a comprehensive inspection program that could be carried out in the field, at 1:00 p.m. (EDT) on Monday, May 28th, I directed that an emergency Airworthiness

Directive be issued by the FAA ordering all U.S. DC-10 operators to inspect the pylon aft bulkhead and thrust link bolt, in accordance with a McDonnell Douglas Alert Service Bulletin issued that same day. The Airworthiness Directive required the inspection be performed by 12:00 midnight PDT; all DC-10's not inspected by that time were to be grounded until the inspection was performed.

As we began to receive reports of the inspections required by the Airworthiness Directive, we learned that discrepancies were being found with respect to the pylon web structure, aft bulkhead attach fittings, huck bolts, fasteners, loose monoball bolts and fittings, some loose thrust link bolts, and cracked thrust bolt bushings. Based on these findings, I grounded all DC-10 aircraft effective 1:00 p.m. (EDT), May 29th, until a more comprehensive inspection could be accomplished in accordance with an amendment to the Airworthiness Directive which expanded the previous inspection requirements. This amended Airworthiness Directive also required a recurrent inspection at 100 hour service intervals or 10 calendar days, whichever occurred first.

FAA surveillance of air carrier Airworthiness Directive compliance and inspections was increased. FAA inspectors monitored inspections on 95 of the DC-10's, about 70% of the 138 total aircraft. Reports of findings from these inspections were forwarded to the FAA Western Region, Los Angeles, and to the FAA Washington Headquarters for analysis and for any further action that might be required. We also began developing inspection routines for all wing-to-engine mounting assemblies on wide-bodied aircraft, conducting a comprehensive design review of their wing-to-engine mounting assemblies, and a reassessment of pylon maintenance standards and requirements for all wide-bodied aircraft.

On June 2nd our continuing analyses began to indicate that cracks in the aft pylon attach structure were possibly related to the maintenance procedures employed by the operators in handling the aircraft's engine/pylon assembly. The relationship of maintenance procedures to the existence of these cracks was confirmed that afternoon when NTSB informed us of their findings at American Airlines' Tulsa maintenance base establishing a positive correlation between cracks found in the pylon mounting structure cracks and engine/pylon maintenance procedures. Later that evening, my

staff informed the NTSB of the FAA plan to issue an order to assure compliance with the manufacturer's recommended engine/pylon handing procedures. We further indicated that we would likely issue an amendment to the existing Airworthiness Directive to enforce such compliance.

On June 4th at 1:16 p.m. (EDT), an NTSB recommendation was received at FAA Headquarters confirming and amplifying data discussed on June 2nd between NTSB and FAA staff. The Board recommended that the FAA issue an Airworthiness Directive requiring the inspection called for in the previously-issued FAA order. We concurred, and at 10:33 p.m. (EDT), a second amendment to our initial Airworthiness Directive was issued to include inspection requirements in the aft pylon attach structure area if an engine reinstallation had occurred.

Late in the evening of June 5th FAA's technical staff confirmed the existence of new cracks in two American Airlines DC-10 aircraft in California. Confirmation of this new problem, and the questions raised by our ongoing fail-safe analyses of the DC-10 engine/pylon mounting structure, were communicated to me early on the morning of June 6th. Based upon this new information, and its potential

implications as to the airworthiness of the DC-10 series aircraft, I determined that the type certificate for the DC-10 series aircraft should be suspended immediately. I directed my staff to issue such an order at 2:20 a.m. (EDT) on June 6th.

The Emergency Order of Suspension was prepared by my staff and served on the McDonnell Douglas Corporation at 6:48 a.m. (EDT) on June 6th.

In addition to grounding the U.S. DC-10 fleet indefinitely, I directed that an emergency Special Federal Aviation Regulation (SFAR) be drafted to prohibit the operation of foreign-registered DC-10 series aircraft within United States airspace, except for overflights or for non-revenue return of these aircraft to foreign destinations.

On June 7th I directed FAA's Chief Counsel to issue two formal Orders of Investigation in the aftermath of my earlier suspension of McDonnell Douglas' Type Certificate for the model DC-10 series aircraft. One Order, directed to the

McDonnell Douglas Corporation, commenced a systematic investigation of the type certification of the engine-to-wing attachment structure of the DC-10 series aircraft. The second Order, directed at the eight U.S. operators of the DC-10 series aircraft, initiated a comprehensive field investigation of the maintenance practices and airworthiness procedures employed by those carriers and sought to establish whether there was any relationship between the post-accident findings concerning the engine-to-wing attachment structure of the DC-10 series aircraft and the qualifications of engineering and maintenance personnel.

Pursuant to the Order directed at McDonnell Douglas, FAA personnel were dispatched to the McDonnell Douglas' Long Beach, California, manufacturing facility to begin their on-site investigation. These FAA personnel were divided into four mission-oriented teams as follows:

--Pylon Design Team, including six airframe engineers;
--Service Bulletin Team, including two airframe engineers;
--Airworthiness Directive/System Defect Report Team, including one engineer and one maintenance specialist;

--Quality Control Team, including one engineer and one maintenance specialist;

Additionally, two lawyers were assigned to this McDonnell Douglas team.

Pursuant to the Order directed to the eight United States DC-10 operators, four teams--each composed of three maintenance specialists, an engineer and a lawyer--began an in depth field investigation of the maintenance procedures and practices of the following operators: American Airlines, Continental Airlines, National Airlines, Northwest Airlines, Trans International Airlines, United Airlines, Western Airlines and World Airlines.

The FAA's field investigation of the maintenance procedures of the U.S. air carriers utilizing DC-10 aircraft has been completed. The findings, conclusions and recommendations resulting from that investigation have been incorporated into a report that I received on June 25, 1979.

The Maintenance Review Teams not only observed actual maintenance being accomplished on DC-10 engine/pylon assemblies but also conducted a thorough review of each operator's aircraft maintenance records and related documents. Their efforts, and those of other FAA personnel, led to the development of a comprehensive and detailed inspection program to ensure the structural integrity of each DC-10 series aircraft in certain critical areas. The required inspections, all of which were observed by FAA inspectors, were accomplished on July 7th, and focused upon the wing engine pylon, the pylon-to-wing attach area, and the pylon-to-nacelle attach area. In addition to sophisticated visual inspections, various non-destructive test methods were employed to spot discrepancies including dye penetrant, ultra-sonic, eddy current, and magnetic particle testing. These are the inspections that were required in part in the McDonnel Douglas service bulletins and that will be contained in detail in forthcoming Airworthiness Directives.

I would interject here, Mr. Chairman, that the maintenance report was critical of certain FAA procedures, and I can assure you that these shortcomings and others which may surface as we take a closer look at our current way of doing

business will get my closest scrutiny and I will not hesitate to make changes where needed. High on the list of problems I will address are the following:

> Currently, a wide range of maintenance procedures are changed or substituted by U.S. air carrier operators with no indication that all such actions are approved by the manufacturer or the Federal Aviation Administration.
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> At present Federal Aviation Regulations and written agency guidance do not adequately define what constitutes a "major" repair, thus leaving very broad discretion in air carriers to define the term. Major repairs must be reported to the FAA.

The other investigation we initiated was directed to the original certification of the wing engine pylon of the DC-10. The investigation of the Pylon Design Review Team includes the design and structural integrity of the wing engine pylon configurations of the DC-10 series airplanes to determine the validity of the type certification substantiating data with respect to the certification

requirements. Further, the investigation includes the basic loads for the airplane and correlation of analytically derived loads with loads obtained under test conditions. In addition, the external loads derivation and stress analysis for the sound pylon and the pylon with selected single and obvious partial failures are incorporated in the investigation as well as an assessment of service experience of the airplanes to locate any unairworthy aspects of the design.

To date the following data omitted from the original analysis was requested from and supplied by Douglas to demonstrate compliance with FAR 25:

1. Revised DC-10-10 aft bulkhead lug fail-safe analysis to include additional cuts on the bulkhead;
2. Revised DC-10-10 fail-safe analysis for CF6-6D2 engine loads;
3. Fail-safe analysis of aft bulkhead with the thrust link failed;
4. Fail-safe analysis of "coathanger" fitting at station 286;
5. Revised DC-10-30 aft bulkhead lug fail-safe analysis to include additional cuts on the bulkhead;

6. Fail-safe analysis of thrust link with the sleeve assumed failed;
7. Fail-safe analysis of pylon aft bulkhead at station 418 to include thrust load effect;
8. Revised DC-10-40 aft bulkhead lug fail-safe analysis to include cuts on the bulkhead;
9. Revised DC-10-10 pylon stress analysis to include additional critical load cases and update of loads and/or analysis.

In the areas of the aircraft basic loads the investigation is examining maneuver, gust, landing and taxi loads as well as the external loads of the wing and tail pylons for both fail safe and non-fail safe conditions.

The second team in the certification investigation is the Records Review Team. This team's evaluation includes the quality control systems records for the DC-10-10 pylon assembly manufacturing and installation. This review is an evaluation of the entire process from the procurement of raw materials through the installation of completed pylons and engine assemblies on production aircraft.

The third team's review includes the aircraft's continuing airworthiness, including an examination of all service difficulty reports and service bulletins. This will allow us to compare the DC-10 to other wide-body aircraft and to establish a data base for a recommended maintenance program.

In addition to these FAA teams, Dr. Ray Bisplinghoff chaired a team of non-FAA scientists who were asked to examine the engine pylon failure that occurred at Chicago and other in-service structural difficulties disclosed by the inspections I ordered of the pylon. The report of this group is part of the information that is being used in the certification examination.

I have also directed an investigation of the ability of the DC-10 to be safely flown after experiencing asymmetrical slats. This review is being conducted in our Western Region.

Before proceeding with my discussion of FAA maintenance and certification procedures, I want to make it clear that my statements reflect the way we currently do business. As deficiencies in the present process come to light, I will make whatever changes are necessary. At present, the investigations are not sufficiently complete for me to be in a position to announce what changes may be needed.

At this point, let me describe structural changes within the FAA initiated prior to this accident, and recently approved by the Secretary, that will result in far better coordination within the agency among the engineering, manufacturing, and maintenance disciplines. In the past, the critical safety functions were distributed to several organizations within the FAA, some reporting directly to me, others through my associates. I have now established the Office of Aviation Standards with responsibility for all the safety related functions centralized. This organizational change not only places in organizational association these key elements of Airworthiness, but structures the elements of Flight Operations in a comprehensive, single office. In addition,

our Aviation Safety office is functionally strengthened to encompass accident investigation, safety analysis, and special programs which deserve top-level focus. In general, the new organization places optimum span of control over the complex safety issues constantly confronting us. Further, we are in the process of implementing a "lead region" concept in which the expertise of the FAA will be centered in the region having the greatest experience with a particular aircraft type. This special expertise will be used to develop and manage national certification procedures and practices. For example, either our Southwest or New England Region will probably be responsible for helicopters, and our Central Region light aircraft. This will have the effect of greater standardization and better utilization of FAA expertise in the certification of aircraft.

Let me turn now to the certification process itself. The certification process begins with the development and promulgation, by FAA, of an extensive body of rules which establish the basis for certification of aircraft. For transport category aircraft, Federal Aviation Regulations, Part 25, covering nearly 150 pages of the Code of Federal

Regulations, contains over 350 regulatory design standards on a variety of factors affecting aircraft performance and design. These rules were developed with full public participation, under the safeguards of the full administrative procedure process. In addition, any interested person can propose changes or additions and all such actions are with full public participation.

The certification of an aircraft begins with the aircraft usually in the concept or design stage, when an aircraft manufacturer files an application for type certification with the FAA. The FAA will then convene a Type Certification Board comprised of FAA engineering, manufacturing, maintenance and operating personnel. It is this Board that is responsible for determining that the applicant has met the certification standards and is eligible for a type certificate.

The first meeting of the Certification Board is where the applicant presents the concept and engineering basis for the new aircraft. At this preliminary meeting, the FAA Type Certification Board specifies the relevant Federal Aviation Regulations that will form the certification basis for the aircraft.

With the initial board meeting, the extensive evaluation process that leads to certification is initiated. The applicant proposes a regulatory compliance program--flight tests, computer analysis, destructive tests, laboratory tests, and other sophisticated techniques--by which the applicant will demonstrate to the FAA that the aircraft complies with applicable Federal Aviation Regulations. Following the FAA's approval of the broad compliance approach, the applicant will propose a testing methodology or analysis for each of the aircraft's thousands of engineering design details. Each of these proposals is reviewed by the FAA which modifies, rejects or approves the proposed methods of demonstrating compliance with the regulations.

The actual testing and analysis is then conducted under FAA surveillance. Upon completion of each of these test procedures and analyses, the applicant formally documents the results and submits them to the FAA for further review. These evaluation activities take the largest portion of time in the certification process since they involve analyses or tests on literally thousands upon thousands of parts, components and assemblies, and finally the actual aircraft. During the evaluation process, one or more Interim Type Certification Boards may be held to permit the FAA to review

progress, evaluate significant design philosophies and to establish plans for subsequent portions of the evaluation process.

The evaluation process continues until the aircraft is ready to be subjected to formal flight testing. By this time an initial aircraft has been built, and the applicant has conducted its own initial flight testing.

When the applicant informs the FAA that they believe the aircraft is ready for FAA flight testing, a Preflight Certification Board meets. At this time the Board reviews the applicant's progress toward compliance and if the FAA finds the aircraft ready for flight inspection and testing, a Type Inspection Authorization is issued. A period of flight testing follows with both applicant and FAA personnel participating.

During the flight test process, evaluation results that were previously assessed through analysis are rechecked in light of actual aircraft performance, and the entire engineering design is thoroughly reviewed. At the completion of this phase, the final Type Certification Board meets and reviews

all compliance showings and test results. If the FAA finds that all applicable safety regulations have been met, a type certificate is issued.

Because there have been expressions of concern over the make up of the Type Certification Board, the nature of the process and the FAA's relationship with industry, I would like to expand my description of this portion of the process. As I indicated earlier, the Type Certification Board is composed solely of FAA employees, however FAA Orders specifically provide that others, including non-government employees, may "be invited to participate on an advisory basis" when such participation is warranted by technical considerations. For example, in conjunction with the ongoing certification of the DC-9-80, the Air Line Pilots Association (ALPA) has expressed interest in the methods for evaluating crew workload. In response, the FAA has invited ALPA to submit a proposed cockpit evaluation test plan to the Type Certification Board and ALPA has indicated that they will do so.

We believe that the certification process should be as open as is possible. At present we have public input in the development and amendment of the regulations that establish

the design standards. Our Type Certification Board accepts proposals for standards and tests from qualified members of the public and the decisions of the Certification Board are public records. Only when participation would require access to protected proprietary data supplied by the applicant or when making the actual decisions on whether the aircraft has met the design standards is public participation limited. In both instances statutes dictate the processes we use.

In this respect the Freedom Of Information Act constrains our ability to reveal all the information submitted to the FAA by an applicant. Under the current reading of the Act, release of a manufacturers' proprietary data, that would otherwise be protected, to non-government parties virtually eliminates our ability to withhold the data from other requestors, such as foreign or domestic competitors. Thus, we in the FAA are left with a difficult choice: maximizing meaningful participation by qualified, interested members of the public while respecting the manufacturer's legitimate right to have its trade secrets protected. This is a particularly sensitive point today with the erosion of what once was America's overwhelming technological lead in aviation.

With these problems in mind, I can assure you that I am committed to public participation to the extent possible and will continually direct the certification process to that end.

The certification process requires the FAA to make literally thousands of engineering decisions each involving the exercise of professional judgment. The amount of testing and evaluation conducted to enable us to make those decisions is staggering. For example, the original type certification of the DC-10-10, the first model of the series, took 2 1/2 years (the original application for the DC-10 was filed on December 26, 1967, amended on January 20, 1969 for the DC-10-10, and type certification granted on July 29, 1971). During this period of time, the following materials were received by the FAA from McDonnell-Douglas: 190,000 drawings and drawing changes; 1,400 engineering reports and revisions; 150 vendor reports; 80 ground test reports; and 1,200 letters.

In this process the FAA directly reviews all those documents that involve fundamental design philosophy and its application. It is here that the FAA positions itself to the extent it believes is appropriate in the aircraft design process.

I am questioning in my own mind whether the FAA, in the certification process, has positioned itself at all the critical points in the design process. Should our review of this question call for a greater level of involvement in the process or a restructuring of FAA involvement, I will not hesitate to make those changes. One cautionary note; in reviewing the certification process itself and the extent to which it injects the FAA in the development of an aircraft, we must bear in mind that aircraft design and production is a complex, integrated process. Any restructuring of the process or the FAA's involvement must be accompanied by a realistic assessment of the impact of such actions on the ability of the American aviation industry to design and produce products within a time certain and at competitive prices. This does not mean that I am willing to trade safety for speed or economy--it only means that this is a complex process that has worked well overall and if it is to be changed, those changes must be carefully considered.

The development of a safe aircraft design is, of course, only one part of the safety equation. Adequate maintenance procedures must exist to assure that the aircraft remains in a safe (airworthy) condition. For air carrier aircraft, the

FAA requires each airline to have an approved comprehensive maintenance program for each aircraft type they operate. These programs are developed by the carriers and approved by the FAA before an airline receives FAA authority to operate the aircraft. There are several facets to this program I would bring to your attention.

First the FAA requires that an adequate company organization exist to carry out an air carrier's continuous airworthiness maintenance program. For certain positions the air carrier's employees must be certificated by the FAA, and a training program must exist that assures that the carrier's employees remain up to date with changes in maintenance practices. To assure that adequate "checks and balances" exist, the FAA requires that the air carrier inspection personnel be organizationally separated from the personnel who perform the work. Additionally, auditing procedures and detailed recordkeeping of maintenance performed is required of each carrier to ensure that the carrier is constantly monitoring the quality of maintenance performed and to permit detailed examinations of carrier maintenance activities not observed firsthand by FAA maintenance inspectors.

In the actual maintenance program, there are three general categories. They are: (1) What maintenance must be performed; (2) When such maintenance must be performed; and, (3) How such maintenance is to be performed.

Initially, the "what" that must be done to maintain an aircraft is described in the manufacturer's maintenance manual. This manual contains the detailed instructions, including how maintenance can be performed, that the manufacturer considers necessary for the proper maintenance of the aircraft. The FAA does not formally "approve" this document but reviews it for adequacy and conformance with accepted practices. If deficiencies are found during the FAA review, the manufacturer revises the document accordingly. The manufacturer is required by regulations to produce an acceptable document prior to delivery of the first aircraft to an operator.

"When" maintenance must be performed is established at the outset by the FAA Maintenance Review Board (MRB). Input from the manufacturer, operator(s), and FAA maintenance experts establishes maintenance schedules for specific components.

These vary according to type of maintenance to be performed, the aircraft or component design philosophy (fail-safe or safe life), the structural application (under stress load, not stressed), etc. This set of schedules is documented by FAA in a Maintenance Review Board report which is provided to the manufacturer and operators.

"How" maintenance is to be performed by an air carrier is established by the air carrier based on the manufacturer's maintenance manual, the FAA Maintenance Review Board report, and the air carrier's planned maintenance program. The air carrier's maintenance manual forms a part of his overall proposed maintenance program which must be approved by FAA and documented under formal signature as part of the operator's operations specification. The operator's maintenance program is controlled by regulation and FAA approval; but the maintenance practices may vary from those in the manufacturer's manual by virtue of unique capabilities, peculiarities of routes and schedules, operating cycles, maintenance base locations, equipment availability, etc. Further, the initial maintenance program defined by the operations specifications may be revised after

aircraft are in service based on service experience, information from the manufacturer, experience by other operators, and the like. Revisions also are from FAA, based on our continuous surveillance program and analysis of information assimilated from various sources. In general, such revisions to the initial program are FAA-approved just as the original approval was obtained; however, qualified carriers may be authorized to alter specifications other than the frequency of inspections under a reliability program. In this case, the FAA must be made aware of all revisions, the basis for the revisions and retains the right to disapprove the changes.

To assure compliance with this program, the FAA assigns a Principal Maintenance Inspector (PMI) to each carrier whose responsibility is to oversee the carrier's maintenance practices. It is not the function of the PMI, or his staff, to observe firsthand the performance of all maintenance or inspections on the operator's aircraft. We do not believe this is a proper role for us any more than we believe the Federal Government should have an inspector on every flight observing the pilots. Instead, our role is one of assuring both that an effective system is in place and that there is

compliance with the procedures dictated by that system. To do so, we work with the carrier's employees to improve their practices, and monitor their activities through spot-checks, reviews of their maintenance records, and through other similar means. Our critical role, in assuring safety, is to insert ourselves far enough into the process to be sure that the process is being followed.

People, however, sometimes overlook the airline's role in the process. As the Members of this Committee know well, the Congress has specifically recognized by statute the duty of air carriers to provide the highest possible degree of safety (§601 of the Federal Aviation Act of 1958) and to perform inspections, maintenance, overhaul and repairs in accordance with the Federal Aviation Act or any rules or regulations the FAA issues pursuant to the Act (§605).

Mr. Chairman, I repeat my pledge to take all necessary steps to ensure that the aircraft certification and maintenance systems used in the United States are the best possible.

The critical question for me is whether the FAA has inserted itself far enough and at the right places into the design and maintenance processes. This is a difficult question, but I will not stop my inquiry until I am satisfied that the FAA's processes are right.

Mr Chairman, that completes my prepared statement. My associates and I will be pleased to answer any questions you may have at this time.