STATEMENT OF ANTHONY J. BRODERICK, ASSOCIATE ADMINISTRATOR FOR REGULATION AND CERTIFICATION, FEDERAL AVIATION ADMINISTRATION, BEFORE THE SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, SUBCOMMITTEE ON AVIATION, CONCERNING AGING AIRCRAFT. APRIL 11, 1989.

Mr. Chairman and Members of the Subcommittee:

I welcome the opportunity to appear before the Subcommittee today to describe for you the FAA's programs to address the issue of aging aircraft. I appreciate your interest in this important topic and look forward to your continued support as we proceed on what I believe is a comprehensive and aggressive program to respond to the challenge presented by an aging airline fleet.

A little less than one year ago, the Aloha accident in Hawaii was a catalyst for focusing renewed attention on the issue of aging aircraft. It led the FAA to critically reexamine its approach toward inspection requirements and other facets of our program through which we have worked to ensure that aging aircraft continue to operate at the highest levels of safety.

We concluded that, although we already knew much about inspecting for corrosion and fatigue, we needed to learn more, and we set out to establish an improved framework of industry-government cooperation, began work to develop an accelerated research and development effort to address these issues, and reached some important conclusions about the regulatory way we have dealt with aircraft as they grow older. Concurrently, the Congress, with the sponsorship of this Subcommittee, enacted legislation highlighting the need for further research and development work in this area.

One of the first steps we took following the Aloha tragedy was to convene a symposium, last June, in which recognized experts from throughout the world participated. A lot of important information was generated through that symposium and the first steps were taken toward solidifying the groundwork for improved efforts in this area. Equally important, it sent a strong signal that we were vitally interested in coming to grips with this safety concern, and helped establish that improved framework of industry-government cooperation which I mentioned a moment ago.

I would like to briefly describe some of the actions we have taken since, where we are now, and where we are headed. First, though, let me take a moment to highlight the general concern we have with aging aircraft. In simple terms, the life cycle of an aircraft, much like a human being's, can be divided into three parts: infancy, the middle years, and old age. During infancy, many "childhood" diseases occur--in an aircraft, we might call them "bugs," which need to be worked out. And a lot of effort is devoted to learning about any problems experienced in actual operation and ironing them out through corresponding corrective action. In the middle years, most people, or aircraft, are relatively free from disease, although occasional problems occur which have to be addressed. In later life, there is an expectation of increased problems occurring, and a need for more aggressive monitoring of health factors. In the case of aircraft, those increased problems, which need extra monitoring, typically are associated with fatigue or corrosion, and the means of monitoring those factors has generally been through mandated, increased inspection activity, with replacement of parts or components as needed.

I should clarify one point concerning aircraft. An aircraft's age is not necessarily measured chronologically, although chronological age is the primary factor influencing the state of corrosion. Instead of chronological age, we typically are more interested in the number of cycles an aircraft has flown--a cycle being one take-off, pressurization, depressurization, and landing--since these are the activities which stress an aircraft and its components, consequently leading to fatigue.

I should also make clear that the issue of aging aircraft is one with which we and industry have dealt since the 1970's. There are several approaches in place which have been used as the primary means of responding to aging aircraft, one of which, adopted by the FAA in 1978, is an aircraft design concept called "damage tolerance."

A damage tolerant structure is one which has been designed to tolerate damage due to fatigue, corrosion, or accident and still be able to continue to carry expected operational loads until that damage is detected either by the problem becoming evident or during a scheduled inspection. Scheduled inspections of such components are based on the fracture mechanics characteristics of the part, and are designed to detect any crack before it reaches unsafe proportions. Under the damage tolerance approach, we <u>assume</u> that damage is going to occur to a part. That part must then be designed to safely accommodate that damage until it can be corrected. In some cases where the damage tolerance approach is not appropriate--landing gears, for example--a specific life use is placed on the component.

We believe damage tolerance will provide improvements in aircraft design for future aircraft, but it does not apply directly to most aircraft in the current air carrier fleet because they were certificated prior to our adoption of the damage tolerance rule in 1978. Therefore, to address on a more current basis the need to assure that fatigue and corrosion were detected on aircraft in the fleet, the FAA issued guidance information to industry which outlines methods (including fracture mechanics assessment) to assure safety of older airplanes through additional structural inspections. In other words, we used today's damage tolerance technology to analyze yesterday's designs and develop a state-of-the-art maintenance program for the existing fleet through improved inspection programs.

The number and extent of these additional structural inspections are based on an engineering analysis that assumes the existence of a crack at all critical locations and determines its growth rate and the point at which it would become unsafe. This approach, which we finalized in concert with industry in 1981, is called the "Supplemental Structural Inspection Documents" (SSID) program. Under SSID, manufacturers are asked to identify all structural components whose failure could affect the safety of the aircraft, and to establish a special inspection program for those components. The FAA through regulatory action then requires the airlines to adhere to the schedules called for in these SSID's.

We have also conducted special airworthiness reviews as potential problems have been identified in the aging fleet. On the whole, these programs have worked well and, over time, have led to a variety of safety improvements, some in the form of airworthiness directives (AD's) which impose regulatory requirements on an operator. Nevertheless, we concluded that these measures alone are not enough.

Following last year's Aging Airplane Conference, the FAA announced that it was implementing six procedures to help evaluate and maintain safety margins of older aircraft. They are:

1. FAA inspectors will exercise more "hands on" involvement at airlines during heavy maintenance checks of hightime aircraft to ensure a better understanding of fatigue and corrosion.

2. FAA aircraft certification engineers will make field visits to airline maintenance shops to gain more knowledge of the human factors involved in maintenance and inspection.

3. FAA's aircraft certification, inspection, and research and development organizations will jointly develop specific programs to promote safety of older aircraft and engines.

4. FAA will develop agency experts in nondestructive testing and inspection technologies and set up improved training programs.

5. FAA will develop a "lessons learned" document on engine maintenance.

6. FAA aircraft certification personnel will promote and work with industry to develop supplemental structural inspection documents for aircraft used in commuter service.

We have made considerable progress since that time, although much remains to be done. In February 1989, we initiated our "Aging Flight Evaluation Program" by conducting a review of one major airline's heavy maintenance ("D" check) on a Boeing 737 with 70,000 hours. "D" checks involve a complete stripdown of the aircraft to bare metal to check for cracks and other problems. This review was the first of many "hands on" inspections which will take place over the next year that will help us evaluate the effectiveness of corrosion control programs, structural inspection techniques, age-related AD's, and human factors engineering. It will be accomplished by FAA regional inspectors and engineers who will visit air carriers during D-checks of a given aircraft type. This year long program --which will become a standard part of our surveillance during which all air carriers are visited--calls for first inspecting 737's, followed by 727's, 707/720's, 747's, DC-9's, and DC-10's. The information gained, we are confident, will provide a basis for further modification to our aircraft maintenance policies.

We are also working on a comprehensive R&D program. The R&D program will include issues such as multi-site cracking, corrosion, nondestructive testing techniques and equipment, engine nondestructive evaluations, and engine repair practice evaluations. FAA's objective is to develop handbooks on both damage tolerance and corrosion within 3 years of the program start. A handbook on nondestructive testing equipment may be issued within a year. We also expect to produce an engine practices handbook as a result of our R&D efforts.

The Regional Airline Association (RAA) and the General Aviation Manufacturers Association (GAMA) have established a steering group for a task force to examine aging commuter airplane issues. The FAA attended the first meeting that was held February 1, in Washington. The steering group has called for a general operators/manufacturers meeting to be held during April in Kansas City. FAA will participate in that meeting.

We also have other activities ongoing or planned. We have requested Boeing and McDonnell Douglas to provide training to FAA maintenance inspectors concerning supplemental structural inspection documents and corrosion control. Boeing began its first FAA training session in November 1988. Douglas is currently preparing its FAA training program. The purpose of this training is to familiarize FAA inspectors with the manufacturers' detailed maintenance objectives and specific technical means for dealing with corrosion in their aircraft models.

We issued an AD covering the first 291 737's produced by Boeing, including those aircraft which were produced by the "cold bonding" process. This AD, issued last December, requires that the counter-sunk rivets on the top row of lap joints be replaced with oversized button-head rivets. We also have proposed in an NPRM that all counter-sunk rivets on the top row of lap joints on Boeing 727's be replaced with oversized button-head rivets.

And, within the FAA, we have taken steps to better coordinate all facets of our aging aircraft program by establishing an Aging Airplane Program Management Team of key individuals who are concerned with each part of the aging airplane problem, running the gamut from transport category aircraft, commuter aircraft, maintenance practices, and testing techniques to human factors.

We plan to investigate the methods, equipment, and procedures used in visual and nondestructive inspection of aircraft structure from both a hardware and a human factors standpoint, to develop updated "probability of crack detection" estimates which will provide us adequate assurance that a crack will be detected, reported, and repaired well before it becomes critical. We expect that the human factors investigation will yield results in areas across the board pertaining to the maintenance of airplanes--ranging from the better preparation of airworthiness directives to better coordination of inspection tasks during a heavy maintenance inspection to an assessment of where the most can be accomplished from an inspection and repair standpoint. We expect to develop methods of using current inspection techniques which are less reliant on vigilance and decisionmaking by the inspector, as well as provide the opportunity for emerging inspection techniques to be beneficially applied in the aviation industry.

We have already made some changes in our approach to airworthiness directives. We have in the past issued airworthiness directives which rely upon repeated inspection to detect damage in aircraft structure. Then, when the damage becomes obvious during one of these required inspections, the damaged areas are required to be modified or repaired. These repetitive inspections continue adding to the maintenance workload as an airplane continues in service and more and more airworthiness directives are issued. We have now changed our philosophy in this regard. We now insist that the manufacturer's engineers make every effort within the time constraints afforded by the safety implications of the problem to develop a permanent or terminating modification that will eliminate the problem and result in little or no increase in the inspection requirements for the airplane. In other words, if a design change or repair can stop a potential problem from occurring, this will generally be our initial preference over the establishment of a process of repetitive inspections.

We are now reexamining, in conjunction with industry, existing Supplemental Structural Inspection Documents to determine their adequacy in light of recent catastrophic events and the industry's service experience with them. We anticipate developing a similar supplemental inspection program for corrosion, which would implement for the current aging fleet the basic corrosion requirements we are studying for possible incorporation into future airplane designs.

And, in cooperation with airlines and manufacturers, we are looking at existing AD's which impose inspection requirements to determine whether the inspections should be terminated in favor of design modifications or repairs. Late this month or early next month, we should issue the first required series of changes stemming from this work: over 160 structural changes will be proposed for Boeing 727, 737, and 747 aircraft. The task force will finish its work on the remaining aircraft in the fleet by the end of this summer.

In closing, Mr. Chairman, I want to stress that we are working on a variety of efforts to address the aging aircraft issue. This is a high priority issue with us. We are directing our efforts toward immediate corrective action for problems as they manifest themselves in our aging fleet. We are taking long range action towards the improvement of an airplane's tolerance to fatigue damage and corrosion, and in the improvement of inspection reliability including reducing reliance on inspections as a means of limiting the possibility of human error. We have also initiated cooperative efforts with industry in both the transport and commuter environment and are finalizing a comprehensive research and development program covering a variety of key areas. We appreciate the Subcommittee's continuing interest in and support of this vital safety program.

That completes my prepared statement, Mr. Chairman. I would be pleased to respond to questions you may have at this time.