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FAA-02-13458-3

Evaluation

AIRCRAFT REGULATORY ANALYSIS BRANCH, APO-320

OFFICE OF AVIATION POLICY AND PLANS

PRELIMINARY REGULATORY EVALUATION, INITIAL REGULATORY FLEXIBILITY DETERMINATION, INTERNATIOANL TRADE IMPACT ASSESSMENT, AND UNFUNDED MANDATES

PROPOSED RULE

CORROSION PREVENTION AND CONTROL PROGRAM

June, 1999
Revised July, 2001

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EXECUTIVE SUMMARY

This regulatory evaluation examines the impacts of a proposed rule to amend parts 121, 129, and 135 of Title 14 of the Code of Federal Regulations (14 CFR). The proposed rule would require all airplanes operated under part 121, all U.S. registered airplanes used in scheduled passenger carrying operations under part 129, and all multiengine airplanes used in scheduled passenger carrying operations conducted under part 135 to include a Federal Aviation Administration (FAA) approved corrosion prevention and control program (CPCP) in the airplane's maintenance or inspection program.

Over the twenty-year study period of this analysis, the proposed CPCP operating requirement for existing certification models is projected to cost $80.0 million to the industry and $221 thousand to the FAA (all costs in present value.) For newly type certificated models, the proposed rule is projected to cost $534 thousand to the industry and $30 thousand to the FAA. Based upon an independent risk analysis of over 1,500 National Transportation Safety Board accidents and conservative risk assessment results in a forecast of a range between 25 to 50 corrosion-induced accidents over a twenty-year period. Under the assumption that these accidents are uniformly distributed, then the present value of these safety benefits range from $72.5 million to $145.0 million. The FAA does not intend to wait for a series of accidents to provide justification for this proposed rule. The FAA needs the corrosion prevention and control program to assure the continued airworthiness of the affected fleet. In addition to the safety benefits of the proposed rule, a short extension of the existing life of the fleet subject to this rule exceeds the cost of this proposed rule. This rule extends to a significant number of airplanes the corrosion prevention and control program found to be necessary for in-service commercial jet airplanes based on studies following the Aloha Boeing 737 accident. The FAA concludes that the benefits of this proposed rule justify the costs.

The FAA has made initial determinations that the proposed amendment: (1) would have a significant economic impact on a substantial number of small entities, (2) would not constitute a barrier to international trade, and (3) would not constitute an unfunded mandate.

Corrosion Prevention and Control Program

I. Introduction

This regulatory evaluation examines the impacts of a proposed rule to amend parts 121, 129, and 135 of Title 14 of the Code of Federal Regulations (14 CFR). The proposed rule would require all airplanes operated under part 121, all U.S. registered airplanes used in scheduled passenger carrying operations under part 129, and all multiengine airplanes used in scheduled passenger carrying operations conducted under part 135 to include a Federal Aviation Administration (FAA) approved corrosion prevention and control program (CPCP) in the airplane's maintenance or inspection program. This action is necessary to control airplane structural material loss and the detrimental effects of corrosion because existing maintenance or inspection programs may not provide comprehensive, systematic corrosion prevention and control.

II. Background

On April 28, 1988, an in-flight accident occurred when a large transport airplane lost approximately 18 feet of the upper fuselage. The National Transportation Safety Board (NTSB) investigation revealed that the probable cause of this accident was the failure of the operator to detect the presence of skin disbonding, with resulting corrosion and metal fatigue, that ultimately led to the separation of the aircraft's skin and structure. The NTSB observed numerous areas of corrosion on the accident airplane and on other airplanes in the operator's fleet. The NTSB noted that the operator did not have a programmatic approach to corrosion prevention and control. In its accident investigation report (NTSB/AAR-89/03; Recommendation No. A-89-59), the NTSB recommended that the FAA "develop a model program for a comprehensive corrosion prevention and control program (CPCP) to be included in each operator's approved maintenance program."

Prior to 1988, the FAA lacked compelling evidence that existing maintenance and inspection programs were not controlling corrosion to a safe level. Although many airplane manufacturers had provided maintenance programs for corrosion prevention and control, the FAA saw no reason to mandate such programs.

After the 1988 accident, the FAA sponsored an aging fleet conference at which the Air Transport Association of America (ATA) and the Aerospace Industries Association of America (AIA) committed to identifying and implementing procedures to ensure continued structural airworthiness of aging transport category airplanes. As a result, an Airworthiness Assurance Task Force (AATF) was established which included aircraft operators, manufacturers, and regulatory authorities. An immediate objective of the task force was to sponsor airplane model-specific working groups to identify aging fleet structural maintenance requirements. The working groups were tasked to: (1) select service bulletins to be recommended for mandatory implementation; (2) develop baseline corrosion prevention and control programs; (3) review supplemental structural inspection programs; (4) assess repair quality; and (5) review maintenance programs. Task 2 resulted in airworthiness directives that mandated specific corrosion prevention and control programs for the following 11 airplane models: the Airbus A-300, British Aerospace BAC 1-11, Boeing 707/720, 727, 737, and 747, Fokker F-28, Lockheed L-1011, and McDonnell Douglas DC-8, DC-9, and DC-10.

A typical CPCP AD requires the operator to incorporate a baseline CPCP into its maintenance or inspection program. The baseline CPCP consists of corrosion prevention and control tasks, definitions of corrosion levels, compliance times (implementation thresholds and repeat intervals) and reporting requirements. After an operator has incorporated a baseline CPCP into its maintenance or inspection program, the AD's allow adjustment of the CPCP repeat intervals in cases where the maintenance program is controlling corrosion to an acceptable level. The FAA has determined that corrosion damage occurring between successive inspections that is local and can be blended out within allowable limits, is an acceptable level of corrosion.

The FAA is proposing general rulemaking that would mandate CPCP's for a significant number of airplanes used in air transportation. The FAA considered continuing the practice of issuing individual CPCP ADs for each airplane model, but has decided that a rule of general applicability should be issued instead of waiting for the unsafe conditions that would initiate AD actions for individual models.

III. Discussion of Costs and Benefits

Costs

The primary costs of the proposed rule would be borne by those scheduled operators of multiengine airplanes not currently subject to a mandatory corrosion prevention and control program. Additional costs would also be incurred by manufacturers who participate in the assessment and development of the corrosion programs for the affected airplane models, but this evaluation assumes that all such costs would eventually be passed through to the operators. The FAA itself would incur relatively minor costs for reviewing and approving: (1) the corrosion prevention and control programs, and (2) the incorporation of these new procedures into existing maintenance and inspection programs.

Note that the attributed costs of this proposal do not include the expense of making major repairs or modifications that may be found necessary during the inspections mandated by this proposal. While the FAA recognizes that such repairs may constitute a significant expense, repair costs are not attributed to this proposed rule because existing FAA regulations require that repairs be made as found to be necessary to assure the continued airworthiness of the airplane. The major cost elements of the proposed rule are for development of the CPCP and conducting the actual inspections.

The methodology used in the evaluation first computes the costs that would be incurred if it were economically viable for all of the airplanes in the affected fleet to meet the requirements of the proposed rule. Based on these costs, and their comparison to the approximate fleet value, the methodology later estimates the numbers of airplanes and models where compliance would not actually be economically viable, and where instead, the airplanes would likely be retired from scheduled service.

The CPCP development and implementation costs described in this section are calculated from a 1997 data collection of the potentially affected fleet. The worksheets for these calculations are detailed below and are included in the Appendix as Table 1. Approximately 7,100 airplanes were identified as being subject to the proposed rule and are included in the data set. For the majority of these airplanes, the proposal would not generate any additional costs since the subject airplanes already comply with airworthiness directives that parallel the proposal. Some 2,900 of these airplanes would be affected by the proposal in one manner or another, and as such, would incur costs.

Development cost factors (Table 1, Column E) were estimated for each airplane model group. These factors, ranging from zero to one, represent the proportion of full CPCP development costs that would be incurred for each airplane model group. The factors account for the fact that full compliance programs are in place for some models (factor = 0) and that the development costs for some other models would be reduced (factor less than 1) either due to their similarities to other models, or because some models have partially compliant programs. The factors also account for the fact that airplanes certificated under existing § 25.571, amendment 45 or later, are already required to undergo an evaluation of their strength, detail design, and fabrication to show that failure due to corrosion will be avoided throughout the operational life of the airplane.[1] For these newer models, development factors of .1 were assigned to represent the estimated additional effort (equal to one-tenth of a completely incremental CPCP evaluation and development) that would be necessary to comply with the proposed rule. Taken together, the various cost factors produce an estimated cost equivalence of approximately 47 full CPCP development efforts among the 88 model groups that were identified.

As input to later calculations, described below, data were collected and aggregated measuring the average weight and average year of manufacture for the airplanes in each model group (Table 1,

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[1] Similar requirements exist under § 23.573(b) for commuter category airplanes and § 23.574 for composite materials airplanes, but none of the airplanes in this evaluation were certificated under the latest amendments to these regulations.

Columns B and C). Column F estimates the number of hours that would be necessary to develop the CPCP for each model. The cost methodology employs a three step functional estimate of the time needed to develop each CPCP. First, the nominal number of development hours is estimated as a function of the average maximum takeoff weight (MTOW) for each model.

Eq. 1. $$\text{Hours} = 2{,}296 + (.04 \times \text{MTOW})$$

This equation was derived from a two-point linear plot of the estimated costs expended to develop the CPCP for two existing airplane models (the DC-9 and the Piper Navajo). The results of the Eq. 1 estimates were then multiplied by the development factors (from Column E) to account for the reduced development efforts for similar or partially compliant models described above. Finally, a third factor (calculated in Column M and described below) was applied to account for the possibility that a CPCP would not be developed for an airplane model where it was reasonably expected that the airplanes in that model would have been retired before the effective period of the proposed rule.

The hours for development were converted into cost estimates (Column G) for each model by applying a fully burdened engineering cost rate of $95 per hour for CPCP development. This produced a cost per model ranging between $32,000 and $427,000 (for the non-zero development cases.) The estimated development cost for all models sums to $10.4 million, or $7.9 million expressed in present value terms.

Column H estimates the FAA's costs to review and approve the CPCP's described above. The evaluation employs a straight factor of 80 hours of review per newly developed CPCP, at a burdened cost rate of $55 per hour. These factors produce estimated costs of $4,400 per model, and $246,400 for the affected fleet, or in present value $141,171.

Similar to the "development" cost factors described above, Column I contains the "implementation" cost factors for each model. The implementation factors also range between zero and one, and constitute the expected proportions of full incremental implementation effort that would be caused by the proposal for each model. In addition to accounting for the existence of fully or partially compliant CPCP's themselves, the implementation factors also account for those cases whereby an industry developed CPCP may exist for a given airplane model, but its implementation is either not currently mandated by FAA direction, or where the associated work level would be increased by this proposal. The evaluation projects the work load equivalence of 60 full incremental implementations within the 88 affected model groups.

The first stage of implementation for the proposed rule would be incorporating the model-specific CPCP into an operator's maintenance or inspection program. The resource data set described above was cross-tabulated to determine the distribution and number of unique combinations of operators and subject airplane models to estimate the number of new CPCP's that would need to be incorporated into existing operator programs (487 operator-model combinations were found.) These results are shown in Column J. In turn, Column K calculates the expected cost of these CPCP incorporations for the operators of each model by multiplying the number of operator-model combinations in Column J, by an estimated 40 hours incremental work per incorporated program, and by a unit labor rate of $55 per hour. The total expected cost of this work, across all operator-model combinations, sums to $609,400, or $434,494 in present value.

Similar to their review of the actual CPCP's, FAA personnel would also need to review and approve the incorporation of the CPCP's into the existing maintenance and inspection programs of the operators. The calculation of these costs parallels the operator cost calculation from above with the exception that only 8 hours of review work would be necessary per incorporation. These "second" FAA review costs are shown in Column L and sum to $121,880, or $78,683 in present value.

Next, the calculation of the actual operator inspection activities that would result from the CPCP's are computed, starting in Column M. The evaluation assumes that the proposed rule would become final at the end of the year 2000, that the required new CPCP's would be developed by the end of the year 2002, and that inspections and maintenance, where scheduled, would start in the year 2003. The evaluation uses a 20-year study period (from the effective date of the rule) and, therefore, assesses expected costs through the year 2020. The inspections for any particular airplane would not begin before the time specified in the CPCP for that model, and the initiation of work under the CPCP's would vary by airplane model and by individual airplane structure. This evaluation assumes that the preponderance of corrosion related inspection and maintenance work under the proposed rule would begin in the tenth year of an airplane's operation. The evaluation further assumes that the airplanes under this proposal would not be retired from service until age 35. Implicitly, this exaggerated average service carries the assumption that the distribution of sizes, ages, and numbers of airplanes in the future would be similar to the present fleet. The evaluation simplifies the cost calculation by assuming that the fleet remains essentially constant over the effective duration of the study period, as opposed to making explicit fleet retirement and replacement assumptions by model.

Using the four parameters described above, Column M estimates the projected number of years that inspections under this proposal would be conducted within the study period. For each airplane model, this period is calculated as the intersection of: (1) the years included within the study period, and (2) the years where the average age of the affected airplanes would be between 10 and 35 years old. Similarly, Column N computes the median year of the inspection period under the proposal for each airplane model. This information is used later in the calculations to estimate the time-dependent present value of the inspection costs.

The projected, average number of years that each model would be inspected under the program (from Column M above) multiplied by the number of affected airplanes in each model (Column O) produces the expected airplane-years of program coverage under the proposal, by model. This figure, in turn, is multiplied by the projected number of hours of work per year (Column Q) that the CPCP would require, and by the cost of labor per hour for that work, to produce the estimated cost of implementation. The assumed unit cost rate is $55 per hour. The projected annual number of work hours for each airplane under the proposal is computed as a function of airplane size (maximum takeoff weight).

Eq. 2. Hours = 88 + (.0006 x MTOW)

This functional estimate was derived from a linear regression (r^2 = .58) of the airplane weights and the annual work-hour projections included in 13 CPCP airworthiness directives (the original eleven plus two subsequent directives for the Casa C-212 and the Fokker F-27) mandating industry developed corrosion programs. The "hours per airplane per year" results of Column Q are the product of the functional estimate in Equation 2, above, multiplied by the implementation factors from Column I. Finally, the projected inspection costs over the study period are shown in Column R. These costs were computed as the product of: (1) Column P, the numbers of airplane-years of coverage under the program, (2) Column Q, the work hours per airplane per year, (3) a unit cost factor of $55 per hour for the inspection and maintenance work, and (4) a factor of 1.2 to account for the 20 percent overhead of record keeping and paperwork. These computations forecast a total of $155 million in inspection costs ($64.5 million in present value) through the year 2020.

In addition to the actual costs of inspecting the airplanes, costs can also be attributed to the incremental downtime that would be necessitated by the work required under the proposal. The evaluation assumes that each 40 hours of work necessitated by the CPCP requirement would require 1 additional day of airplane downtime. The projected additional down-days are computed in Column S as the product of: (1) Column P - the number airplane years in the program, (2) Column Q - the work hours per airplane per year, and (3) the assumed unit factor of 1 down day per 40 hours of added work. Under these assumptions, the evaluation projects 58,658 days of additional downtime for the affected fleet throughout the twenty-year study period as a result of the work attributed to the proposal.

The economic valuation of this downtime was computed under the assumption that the average productive return on capital is equal to 7 percent of the value of that capital, per year. Accordingly, the downtime costs were calculated as the product of: (1) the number of additional downtime days, from Column S, divided by 365 days per year, (2) the estimated economic value of the fleet for each model, from Column T, calculated at the median program year for that model, from Column N, and (3) the 7 percent per year assumed rate of return on capital. These costs are detailed in Column U, and they total $21.5 million, or in terms of present value $8.6 million.

Columns V through Y compute the present values (7 percent discount rate) of the four component costs of the proposal to the industry. For computational expediency, the present value calculations assume that all development costs occur in the year 2002, operator incorporation costs occur in the year 2003, and both the inspection and downtime costs occur in the median year of the inspection program for each model. The four component present-value costs are combined in Column Z to estimate the present value of the total expected cost of the proposed rule to industry ($81.5 million, not including the FAA review costs described earlier.)

Present Value Cost To The Industry

Development Cost	Operator Cost	Inspection Cost	Downtime Cost	Total Cost
$7,913,985	$ 434,494	$64,524,942	$8,626,515	$81,499,936

As noted in the introductory remarks of the cost section, the calculations described above assume that all of the subject airplanes would comply with the CPCP requirements of the proposed rule. At this point, however, the evaluation recognizes that it may not, in fact, be economical to develop and implement a CPCP for some older airplane models with very few subject airplanes. In order to account for this possibility, the evaluation compares the expected industry costs of the rule, computed for each model in Column Z, with the estimated fleet values of the affected models in Column AB. Column AC tests whether the expected CPCP program costs would exceed 50 percent of the value of the airplane fleet for each model. In the 11 cases where the program costs are projected to be prohibitive for that model, the expected compliance costs for the model are removed from the program implementation costs in Column AE, and instead, a reduction of 50 percent of the value of the airplanes in that model is assigned as the attributed cost of the proposed rule for that model. Under this scenario, the present value costs to industry of the proposed rule would consist of $78.7 million in implementation costs and $1.3 million in costs resulting from reductions in airplane value due to a forecast economic inability to comply with the proposal. These two costs are merged in Column AG to constitute the total $80.0 million present-value cost of the proposed requirement to industry. Finally, Column AH shows the present value of the FAA costs for review, $220,885, computed previously in Columns H and L.

In addition to the proposed requirements for existing airplane models, the proposal would also require baseline corrosion prevention and control programs for future, newly certificated airplane models that would likely be marketed for scheduled passenger operations. These relatively lower costs are estimated and described in Table 2 of the Appendix. The projection of the numbers and sizes of future airplane certifications, particularly in the out years, is very speculative. As such, Table 2 is intended to be representative rather than predictive, and readers are encouraged to make adjustments in the estimations in line with their own predictions.

For the purpose of example, Table 2 shows one new certification per year between the effective date of the proposed rule and the end of the evaluation study period. In order to represent the likely sizes of the airplanes that might be certificated, the existing airplane models evaluated above were sorted by their maximum takeoff weights, and were grouped into 18 classifications. The average weight of the airplanes in each of these 18 classes was then computed to represent the likely size of airplanes that would be certificated in each of the 18 years of the study period. In an effort to remove the bias of the order in which the various size airplanes were presumed to be certificated over time, the 18 airplane weight classes were assigned randomly across the 18 study years.

As noted previously, the existing certification standards for all part 25 models and for certain part 23 models (commuter category and composite materials airplanes) require that future airplane models undergo an evaluation of their strength, detail design, and fabrication to show that failure due to corrosion will be avoided throughout the operational life of the airplane. As previously described, a development factor of .1 was assigned to the existing airplane models that were certificated to these standards, and in a parallel fashion, one-tenth of a full development cost is also assigned to the affected future airplane models. It should be noted that the existing certification procedures that would cause this reduced incremental impact are not required for metallic (non-composite material) airplanes in the normal, utility, or acrobatic categories for part 23. The evaluation assigns to these airplanes (weighing 12,500 pounds or less) a CPCP factor of .5, which recognizes that: (1) in the absence of this rule, these airplanes would not be substantially compliant with a CPCP requirement, but (2) substantial savings (one-half) in CPCP development would be realized as the development of the corrosion program would be included in the development of the airplane itself, rather than being retroactively considered for an existing model.

The evaluation also recognizes that not all future airplane models will likely be marketed or used for scheduled passenger operations. In the absence of model-specific information, the evaluation assumes that future models under 6,000 pounds (2 of the 18 models considered here) would not incur additional costs as a result of this rule.

Returning to the computations in Table 2, Column C calculates the estimated hours necessary to develop a CPCP for each airplane model in the example forecast. For the non-zero cases, the same formula that was used above (Eq 1: Hours = 2,296 + (.04 x MTOW)) was also applied here, with the result being multiplied by a factor of either .1 or .5 depending, respectively, on whether the airplane model was above or below 12,500 pounds. Again, parallel to the previous computations, the development costs are computed in Column D by multiplying the expected development hours by an engineering labor rate of $95 per hour. Similarly, the expected FAA review costs were computed as 80 hours of review per CPCP, multiplied by a unit labor factor of $55 per hour. Finally, the industry and FAA costs are combined in Column F (total $1.3 million) and the annual present values of these costs are computed and summed ($563,835) in Column G.[2]

In summary, over the twenty-year study period of this analysis, the proposed CPCP operating requirement for existing certification models is projected to cost $80.0 million to the industry and $221 thousand to the FAA (all costs in present value.) For newly type certificated models, the proposed rule is projected to cost $534 thousand to the industry and $30 thousand to the FAA.

Description of Benefits

The purpose of this rulemaking is to assure that corrosion does not degrade the airworthiness of affected air carrier airplanes. The corrosion prevention and control program contained in this proposal originates, in part, from the recommendations following the investigations of the Aloha Boeing 737-200 accident on April 28, 1988 when 18 feet of upper fuselage separated from the airplane in flight. The National Transportation Safety Board determined the probable cause of that accident was that corrosion and metal fatigue led to separation of the airplane's skin and structure.

All metal airframe structures are vulnerable to corrosion and older aircraft are much more likely to experience corrosion than newer airplanes. Corrosion is a natural process and occurs because of the tendency of metals over time to return to their original state. Maintenance and inspection records reveal that the presence of corrosion is more prevalent and pervasive in older aircraft. A review of the annual total of the number of listings in the Service Difficulty Reports involving corrosion over a subset of U.S. commercial airplanes provides a sense of the magnitude of the

[2] This evaluation does not address the "inspection" portion of the costs that would result for these future models since, within the study period, very few airplanes would be certificated, produced, and then age to the point where the inspections from a CPCP would be prevalent. Furthermore, the

problem.

present values of these few, out-year expenses would be negligible relative to the other costs of this proposal..

Number of Service Difficulty Reports Involving "Corrosion"

1990 - 1997

	Year of Occurrence							
Aircraft Type	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
B-727	2293	1746	3126	2786	2874	2520	2308	2350
B-737	536	521	928	1003	1099	906	868	1223
B-747	523	222	433	441	228	422	522	899
DC-9	564	436	375	732	657	1197	1104	1037
DC-10	117	78	217	122	281	111	364	602
MD-80	4	0	14	21	44	14	5	28
A-300	11	18	32	37	10	17	109	184
Total	**4048**	**3021**	**5125**	**5142**	**5193**	**5187**	**5280**	**6323**

The problem of corrosion is that it is both prevalent and destructive. Multiple Site Damage (MSD) is an undesirable condition caused by wide spread cracking of an airplane structure. R. Plelloux, et al in "Fractographic Analysis of Initiation and Growth of Fatigue Cracks at Rivet Holes writes "In the case of MSD, fatigue cracks are reported to initiate at rivet holes in the fuselage lap joints after the epoxy bond failed as a result of corrosion in high humidity environments … the cracks grow to a length of approximately 6 to 8 mm (.25 inches to .30 inches) on each side of the rivet, before fracture by tensile instability. Note that rivets (on the airplane skin) are spaced an inch apart center to center. Crack growth in service has been reported to occur over 20,000 to 40,000 cycles." Thus corrosion can cause multiple cracks around a rivet. When the cracks reach a length of .25 to .3 inches fracture by tensile instability occurs. Cracks have been reported in aircraft with much fewer cycles than those recently upgraded from Stage 2 to Stage 3 standards in the last ten years.

Corrosion's detrimental effects are not limited to rivet holes. Corrosion decreases the size of structural members and can also have bad synergisms with factors leading to early cracking. When a fatigue crack reaches a corroded section the growth rate of the crack increases by a factor of 3 (J.P. Chubb, et al, "The Effect of Exfoliation Corrosion on the Fatigue Behavior of Structural Aluminum Alloys"). The NTSB report to the FAA on the Aloha Boeing 737 accident cited finding corrosion in the throttle cables (in the leading edge). When the appropriate cable sections were removed from the aircraft and inspected there were indications of corrosion and this corrosion likely weakened the cables so that they separated at lower than design load. Corrosion was present for the entire length of that portion of the cable routed through the leading edge.

Since different sources may use slightly different definitions, for charity, several important definitions are now identified. The definition of multiple site damage is a source of widespread fatigue damage characterized by the simultaneous presence of fatigue cracks in the same structural element (i.e., fatigue cracks that may coalesce with or without other damage leading to a loss of required residual strength). Widespread fatigue damage (WFD) in a structure is characterized by the simultaneous presence of cracks at multiple structural details that are of sufficient size and density whereby the structure will no longer meet its damage tolerance requirement (i.e., to maintain its required residual strength after partial structural failure). Multiple element damage (MED) is a source of widespread fatigue damage characterized by the simultaneous presence of fatigue cracks in similar adjacent structural elements.

The Boeing 737 lap splice design originally required a good bond for load transfer. Environmental degradation caused the bond to deteriorate to the point where all of the load transfer ended up transferred through the fasteners, which were never designed to take that load. MED can also result from corrosive environments as well.

Benefits - A Risk Assessment

The FAA employed GRA[3], Inc. to provide a risk assessment to help make determinations regarding the likelihood of aviation accidents related to corrosion. Under this contract, GRA qualitatively identified and characterized the types of potential corrosion hazards faced by aircraft and developed a method to assign quantitative risk evaluation.

For their analysis, GRA relied upon the National

[3] "CORROSION PREVENTION AND CONTROL RISK ANALYSIS", FAA Contract No. DTFA01-93-C-00066, Work Order 52, Prepared by GRA, Incorporated, May 12, 1999. A copy of this document is filled in the docket.

Transportation Safety Board (NTSB) Aviation/Incident Database. The NTSB database contains detailed information on over 37,000 accidents that have been catalogued since 1985; it includes a "sequence of events" history for each accident that describes the events leading up to an accident. A broad search of the 37,000 NTSB accidents resulted in a total of 1,551 accidents that were examined in detail.

The FAA Incident Data System (AIDS) was used to help assess the impacts of the Airworthiness Directives issued in the early 1990's. The FAA Service Difficulty Reporting System (SDRS) assisted by providing information assessing the incident and severity of the corrosion problem, as well as information of the effectiveness of current safety programs. GRA found it difficult to link incident and service difficulty reports with observed or anticipated changes in accident or incident rates. As a result, GRA took a conservative approach by not attempting to quantify benefits using either AIDS or SDRS.

The methodology employed by GRA is known as "event tree" analysis. Event tree analysis is used to characterize a chain of events leading to accidents under a variety of circumstances. This methodology has been used successfully in other environments where, as with aircraft, the probabilities of occurrence are very small.

Event trees are defined by:

- An initiating event
- A further chain of events related to "safety functions", which represent aircraft system responses or operator actions when a particular event occurs
- A terminating event
- Estimation of success and failure probabilities at relevant nodes in the event tree

An event tree should define a comprehensive set of accident sequences that encompass the effects of all possible accidents involving the aircraft. These trees begin with the initiating event, or the starting point. Following the initiating event, the set of events related to safety functions, which end with the terminating, event is specified. With the event tree constructed information from the NTSB, 1,551 accidents were used to populate (provide probability estimates) the tree.

Event trees with corrosion-induced initiating events were defined based on these records for the following ten aircraft systems:

- Flight control surfaces/attachments
- Flight control system-internal
- Landing gear
- Fuselage forward
- Fuselage center
- Fuselage aft
- Fuel system
- Nacelle/Pylons
- Engines
- Electrical systems and wiring

The subsequent events, which occur after the initiating event, were defined with the following generic sequence:

- Operator error in addressing/mitigating the initiating event
- Failure of operator to recover after initial failure to address/mitigate
- Failure of flight control function
- Failure of operator to recover flight control function
- Failure of landing gear during take-off or landing
- Failure of operator to recover landing gear function

Beginning with the initiating event probability, each subsequent event probability is multiplied across each branch. The multiplication of events along each branch results in the probability of an outcome (or terminating event). Summing the terminating event probabilities, which end in damage, equals the probability of a corrosion-related accident by aircraft system. GRA's Table 2 with the estimated corrosion-related accident rates by aircraft system is reproduced below.

Estimated Corrosion-Related Accident Rates by Aircraft System	
Aircraft System	Rate per 1,000,000 Operations
1. Flight Control Attachments	6.53 E-02
2. Flight Control System (internal)	7.51 E-02
3. Landing Gear	1.89 E-01
4. Fuselage Forward	9.60 E-03
5. Fuselage Center	1.97 E-02
6. Fuselage Aft	2.05 E-03
7. Nacelle/Pylons	2.63 E-02
8. Fuel Systems	1.94 E-02
9. Engine	2.15 E-01
10. Electrical Wiring	8,80 E-02
Total	7.01 E-01
Skin-Related Only (1,4,5,6,7)	1.23 E-01

These probabilities of occurrence then need to be translated into numbers of accidents. Since the probabilities are rates per one million operations, estimates of future operations were needed. GRA computed the total take-offs and landings at US airports from the May 1996 Official Airline Guide (OAG). This estimate is conservative as it excludes U.S. aircraft performing foreign operations. The initial estimate of affected operations was 23,231,976 for 1996.

GRA then excluded aircraft already subject to existing ADs and discounted the number of operations for other aircraft subject to other overlapping directives and rules. After scaling down the total number of operations, the adjusted estimate was 7,150,932 US operations that would be affected by the proposed rule. To this adjusted OAG base, GRA applied the growth rate in FAA airport operations for air carriers and air taxi/commuters through the year

2008. By 2008, the number of affected operations rises to 9,133,300. Based upon the GRA databases and methodology, in the absence of this rule or other preventative action, it is estimated that over the period of 1999 through 2008 ten accidents due to corrosion are likely to occur in the part 121, 129 and 135 fleets.

More than 27 percent of the airplanes subject to this proposal are already 20 years old or older; 7 percent are over 30 years old; and 1 percent of the airplanes are over 40 years old. The number of airplanes in air carrier service operating beyond their expected life is growing larger. As airplanes age, the likelihood of corrosion increases. Corrosion causes the formation of cracks and accelerates the growth of existing cracks. Thus corrosion is an identified problem presenting a growing threat to aviation safety. Experience has demonstrated that, under existing maintenance and inspection procedures, the FAA cannot assure the continuing airworthiness of these airplanes. This constitutes an unacceptable risk to air transportation.

The FAA has extensively deliberated on how to mitigate this risk. Technical experts and academic leaders were consulted. Based upon these considerations and deliberations, the FAA believes that the corrosion prevention and control procedures proposed in this rule are the best approach to assure the continued protection of the subject fleet from corrosion damage that could impact safety.

The primary benefit of this rule is increased aviation safety through assurance that the affected airplanes are free from dangerous corrosion. As has been shown, service difficulty reports of corrosion are increasing, and without this, or a similar rule, the FAA is convinced that unchecked corrosion will cause increasing numbers of future accidents. A secondary benefit from minimizing corrosion is to extend aircraft service life. In response to a corrosion-related accident, the FAA is likely to ground similar aircraft until it can be assured of their airworthiness. As more accidents occur to different aircraft types, or if the inspections show corrective measures can not restore airworthiness, the FAA may determine that aircraft of a certain age need to be retired from the air carrier fleet. Consequently, in addition to expected safety benefits, society would benefit by a longer utilization of the affected aircraft, thereby reducing the cost of air transportation. The FAA has attempted to quantify the safety benefits and discusses the extended life benefits in qualitative terms.

Safety Benefits

Based on GRA's risk assessment analysis, ten accidents due to corrosion could occur within the affected fleet during the ten year period 1999 through 2008. Since the period of analysis for this rule is 20 years, GRA's estimate has been extended by an additional ten years. A straight-line extrapolation based on the additional ten years of operations growth results in an estimate of about 25 accidents over a 20-year period. In this analysis such a straight-line forecast is viewed as a lower-bound estimate, because the GRA analysis did not factor in the joint problem an aging fleet coupled with unchecked metal corrosion increases the rate-of-risk over time. In order to provide an upper bound estimate, a simple, conservative methodology can be used. The actual probability distribution for corrosion-related accidents in the affected fleet is not known. A normal distribution, however, provides a close approximation of a number of other distributions. To be very conservative in this analysis, the FAA assumes that all affected aircraft remain in operation until a corrosion-related accident terminates their service. Under the assumption that the ten accidents from 1999 to 2008 belong to the left tail of a normal distribution of future corrosion-related accidents for the entire 2,900 affected aircraft, then it can be shown that these 10 accidents are more than 2.45 standard deviations from the mean. Assuming that these observations are 2.45 standard deviations from the mean, then 99.3 percent of the fleet would not have a corrosion-caused accident by 2008. This distribution has approximately a twenty-five year standard deviation. Such a distribution would have more than half of these aircraft still without a corrosion-caused accident fifty years from now. If this methodology can be accepted as providing a reasonable estimate of the upper bound of accidents, then in the absence of this rule, slightly more than 50 corrosion-related accidents are estimated to occur in the study period. This, in turn, provides a range of between 25 to 50 corrosion-caused accidents that may occur in 20 years.

As previously discussed, this proposed rule is directed toward the smaller air carrier aircraft. From NTSB data, GRA estimated that the average casualty counts per accident were 1.100 minor injuries, 0.474 serious injuries, and 1.605 fatalities. As a baseline estimate to compare safety benefits with costs, the FAA estimates that the value of: $38,500 to represent avoiding a minor injury, $51,800 to represent avoiding serious injury, and $2.7 million to represent avoiding a statistical fatality. Based on these values the expected benefit of avoiding one such accident today is $4.6 million, excluding the loss of the airframe, investigation, and ground damage. The FAA believes a conservative benefit estimate of avoiding such an accident is at least $5 million with a reasonable upper bound value of $6 million. Using the lower $5 million estimate and assuming that accidents for the are uniformly distributed over time, then in the thirteenth year the present value benefits of the accidents prevented roughly equals the cost of the proposed rule (at that time the number of accidents equals 34). Thirty-four accidents falls between the upper and lower bound estimates, and is considered a reasonable number that could occur.

This breakeven calculation assumes the proposed rule to be 100 percent effective in preventing these accidents. The FAA can not determine a priori the effectiveness of the proposed rule, but can provide a reasonable effectiveness range and the associated range of benefits. Assuming that the rule would prevent 40 to 80 percent of the expected 25 to 50 accidents, then the rule could be expected to prevent between 9 accidents (40 percent x 25 accidents) to 40 accidents (80 percent x 50 accidents). In the case of the lower bound estimate of 9 accidents, for the present value safety benefits to equal the cost of the rule, the value of an avoided accident would need to increase approximately fourfold. Such an increase is entirely feasible since the assumed 1.6 averted fatalities per accident is conservative. Included in the potentially affected fleet are 178 Beech 1900 airplanes each with 19 passenger seats. If just 2.4 of the prevented accidents are Beech 1900 airplanes with a 75 percent load factor, then the present value benefits exceed the present value of costs.

Exactly how many corrosion-related accidents will occur, which airplanes would suffer such an accident, and how effective the proposed rule would be can not be determined a priori. The FAA risk assessment estimated that this proposed rule would help to avert 25 to 50 accidents. The rule needs only to be effective enough to prevent 2.4 Beech 1900 accidents with 75 percent of the available seats occupied. It is known with certainty that corrosion currently exists in the fleet and if left unchecked will lead to accidents. Based upon this knowledge, and the estimates contained in this analysis, the FAA concludes that the benefits justify the costs of this proposed rule.

Unquantified Benefits

The FAA proposed rule would require scheduled corrosion inspections sooner than the much more costly emergency inspections that would follow a corrosion-caused accident. It is more economical and efficient to correct an unsafe condition proactively, than after an accident makes it clear that corrective action is past due and immediate measures must be taken. Performing the proposed procedures by this rule would allow air carriers to schedule inspections and repairs in a planned, orderly, least cost manner without disrupting aircraft service time. In cases where corrosion is occurring, this proposal would make it known sooner and allow more economical corrective action. On the other hand, without a corrosion inspection plan, metal corrosion will continue, accidents are expected, and once an accident occurs it is highly likely that the FAA will mandate inspections. In that case, there usually is not sufficient time to thoroughly evaluate alternative solutions; instead, immediate corrective action must be selected. Such urgent action is rarely the most economical choice. Compliance with emergency inspections will result in these inspections being unscheduled, airline operators will incur aircraft out-of-service-time costs, airline flight schedules can be disrupted, and flights can be canceled. All of these factors result in reduced airline profits and lower benefits to the traveling public.

As discussed above, it is expected that this proposal would result in corrosion damage observed sooner than it would otherwise, and therefore, the corrections would be less costly. In the absence of the rule, however, it is very possible for some aircraft that corrosion could continue to breakdown the metal undetected until it becomes uneconomic to repair the damage. In that event, earlier inspection could have extended the service life of such aircraft. It is expected that the proposed rule inspections would result in corrosion damage to be repaired before this damage would cause the aircraft to not be airworthy, or to be retired. Thus the proposed rule can extend the service life of the affected aircraft. Without knowing the condition the affected fleet, it is not possible to accurately quantify the dollar value of this benefit. However, it is possible to provide some idea of the value of longer service life by noting the value of extending the service life by one year of a hypothetical aircraft. In such a case, the annual capital loss equals the value of the aircraft multiplied by airline's rate-of-return on capital. For an aircraft whose resale value is a million dollars and when the rate-of-return on capital equals 10 percent, the annual capital loss is $100,000. In addition, the travelling public suffers when airline service is unexpectedly reduced by the corrosion-caused premature retirement of this aircraft.

The FAA believes that the unquantified benefits discussed above further support and justify this proposal. Addressing corrosion damage in an orderly fashion, rather than waiting for an emergency action to be required, provides for less interrupted commercial service and extends airplane service life. These outcomes are clearly benefits of this proposal, even though there is insufficient data to quantify these benefits at this time.

Comparison of Costs and Benefits

Corrosion is a natural process and occurs because of the tendency over time of metals to return to their original state. Maintenance and inspection records reveal that the presence of corrosion is more prevalent and pervasive in older aircraft. Based upon an independent risk analysis of over 1,500 National Transportation Safety Board accidents and conservative risk assessment results in a forecast of a range between 25 to 50 corrosion-induced accidents over a twenty-year period, with a present value benefit between $72.5 million and $145 million. The safety benefits of averting these accidents justify the costs of the proposed rule.

The FAA does not intend to wait for a series of accidents to provide justification for this proposed rule. The FAA needs the assurance of the corrosion prevention and control program to assure the continued airworthiness of the affected fleet. With this program in place the industry avoids unplanned inspections and maintenance resulting from corrosion-related accidents and benefits by an extended aircraft service life.

This proposed rule would extend to a significant number of airplanes the corrosion prevention and control program found to be necessary for in-service commercial jet airplanes based on studies following the Aloha Boeing 737 accident. Based on the analysis contained herein, the FAA concludes that the benefits of this proposed rule justify the costs.

IV. Initial Regulatory Flexibility Analysis

The Regulatory Flexibility Act of 1980 establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination finds that it will, the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify, and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

Recently, the Office of Advocacy of the Small Business Administration (SBA) published new guidance for Federal agencies in responding to the requirements of the Regulatory Flexibility Act, as amended. Application of that guidance to this proposed rule indicates that it would have a significant impact on a substantial number of small entities. Accordingly, a full regulatory flexibility analysis was conducted and is summarized as follows.

1. A description of the reasons why action by the agency is being considered.

This action is being considered in order to control airplane structural material loss and the detrimental effects of corrosion because existing maintenance or inspection programs may not provide comprehensive, systematic corrosion prevention and control.

2. A succinct statement of the objectives of, and legal basis for, the proposed rule.

The objective of the proposed rule is to ensure the continuing airworthiness of aging airplanes operating in air transportation by requiring all airplanes operated under part 121, all U.S. registered airplanes used in scheduled passenger carrying operations under part 129, and all multiengine airplanes used in scheduled passenger carrying operations conducted under part 135, to include a Federal Aviation Administration (FAA) approved corrosion prevention and control program (CPCP) in the airplane's maintenance or inspection program.

This proposal represents a critical step toward compliance with the Aging Aircraft Safety Act of 1991. In October of 1991, Congress enacted Title IV of Public Law 102 143, the "Aging Aircraft Safety Act of 1991," to address aging aircraft concerns. The act was subsequently recodified as 49 U.S.C. 44717. Section 44717 of Title 49 instructs the Administrator to "prescribe regulations that ensure the continuing airworthiness of aging aircraft."

3. A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes or types of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record.

The proposed rule would not impose any incremental record keeping authority. Existing 14 CFR 43, in part, already prescribes the content, form, and disposition of maintenance, preventive maintenance, rebuilding, and alteration records for any aircraft having a U.S. airworthiness certificate or any foreign registered aircraft used in common carriage under parts 121 or 135. The FAA recognizes, however, that the proposed rule would necessitate additional maintenance work, and consequently, would also require that the additional recordkeeping associated with that work also be performed.

The FAA estimates that each hour of actual inspection and maintenance conducted under the proposal would require an additional 20 percent of an hour (12 minutes) for reporting and record keeping. This record keeping would be performed by the holder of an FAA approved repairman or maintenance certificate. The projected record keeping and reporting costs of the proposal are included as part of the overall costs computed in the evaluation and included below in the Regulatory Flexibility Cost Analysis.

4. An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap, or conflict with the proposed rule.

The FAA is unaware of any federal rules that would duplicate, overlap, or conflict with the proposed rule.

5. A description and an estimate of the number of small entities to which the proposed rule would apply.

The proposed rule would apply to the operators of all airplanes operated under 14 CFR part 121, all U.S. registered multiengine airplanes operated under 14 CFR part 129, and all multiengine airplanes used in scheduled operations under 14 CFR part 135. Standard industrial classification coding does not exactly coincide with the subsets of operators who could be affected by the proposed rule. Nevertheless, the following distributions of employment size and estimated receipts per employee for all scheduled air transportation firms (SIC Code 4512) are representative of the operators who would be affected by the proposed rule.

EMPLOYMENT CATEGORY	NUMBER OF FIRMS	ESTIMATED RECEIPTS PER EMPLOYEE
0 - 4	137	$611,695
5 - 9	45	$510,555
10 - 19	52	$299,123
20 - 99	112	$264,065
100 - 499	78	$232,666
500+	70	$252,334
TOTALS	494	$252,214

Based on existing operator/airplane distributions, the FAA estimates that 210 operators would be subject to the rule and approximately 132 would actually incur costs.[4] The agency has also estimated the numbers of subject and affected airplanes that each operator uses and has categorized the operators by fleet size in the following table.

	COUNT OF OPERATORS	
OPERATOR CATEGORY (AIRPLANES)	SUBJECT TO RULE	AFFECTED BY RULE
1 - 10	119	84
11 - 20	37	16
21 - 30	12	4
31 - 40	8	6
41 - 50	4	4
51 AND UP	30	18
	210	132

6. Regulatory Flexibility Cost Analysis

The proposed rule would affect certain existing and future production aircraft, and it would also apply to new model airplanes intended for use in scheduled service. This Regulatory Flexibility

[4] The remaining operators use airplane models that would be subject to the proposed rule but are already in full compliance.

Cost Analysis focuses on the first of these two categories because: (1) that impact represents almost 99 percent of the evaluated costs of the proposed rule, and (2) it is possible to make some estimate of the distributional impact of these costs based on the existing operator fleet composition.

Table 3 in the Appendix details the computations used to estimate the annualized costs of the proposal per airplane, by model. Column A in Table 3 lists each airplane model and Column B details the estimated counts of the airplanes in each model that would be subject to the proposed rule. As noted in the evaluation, an estimated 7,108 airplanes would be subject to this major provision. These airplanes are included within the regulatory scope of the proposal but the vast majority would be unaffected because they already comply with the proposal. Column C, by comparison, shows the projected counts of those airplanes that would actually be affected; where incremental work would be accomplished and incremental expenses incurred. This column sums to a projected 2,901 airplanes. Column D contains the present value of the projected cost of the major proposal to industry, by airplane model, as computed in the regulatory evaluation and shown previously as Column AG of Table 1 in the Appendix. The present value estimated cost of this provision totals $80.0 million.

Column E of Table 3 divides the cost-per-model data in Column D by the numbers of affected airplanes per model in Column C to produce the expected present value cost of the proposal per affected airplane. It is useful to consider the annualized equivalent of these costs; that is to say, the annual future payments that would be necessary to equal the present value costs for each model. Such payments are a function of: (1) the assumed interest rate, and (2) the time period over which the future payments would be borne. Consistent with the discount factor, this evaluation applies a 7 percent interest rate. As for the time period, the evaluation assesses costs over a 20-year time period, and this analysis assumes that, on average, the CPCP development and implementation costs would be borne over that period. Based on these two assumptions, the annualized cost of the CPCP would range between $484 and $30,170 per airplane (for those airplanes that would actually be affected.)

Next, the annualized cost estimates, by model, *per affected airplane,* from Table 3 were collated into the original evaluation data set of operators and airplanes. Crosstabulations were performed and aggregated (see Table 4 in the Appendix) to project the expected annualized cost *per operator.* Table 4 includes all 210 of the estimated operators of airplanes that would be subject to the proposed rule, and projects that 132 would actually incur costs. The table includes counts, by operator, the number of airplanes that would be subject to (within the scope of) the proposed rule, and the numbers of airplanes that would actually be affected by the proposal. The data in these calculations are summarized in the table below which shows the average annualized impact per operator; where the operator classifications are grouped both by: (1) the number of all airplanes that the operator uses, and (2) the number of each operator's airplanes that would actually be affected by the proposal.

AVERAGE ANNUALIZED IMPACT PER OPERATOR

COUNT OF AIRPLANES *OPERATED*	AVERAGE ANNUALIZED IMPACT	COUNT OF AIRPLANES *AFFECTED*	AVERAGE ANNUALIZED IMPACT
1-10	$7,318	1-10	$14,057
11-20	$17,551	11-20	$46,479
21-30	$30,711	21-30	$72,326
31-40	$53,838	31-40	$104,708
41-50	$64,359	41-50	$55,789
51-60	$90,769	51-60	$196,433
61-70	$191,587	61-70	$195,857
71-80	$144,698	71-80	$185,253
81-90	$111,116	81-90	$111,116
91-100	$92,093	91-100	$112,023
100 Plus	$217,054	100 Plus	$460,822

7. Affordability Analysis and Disproportionality Analysis

As a measure of the affordability of the proposal, the table below shows a distribution of the projected annualized impacts of the proposed rule as a percentage of operator annual receipts. Operator receipt levels were estimated assuming: (1) the average of $252,214 annual receipts *per employee* for SIC Code 4512 operators, described above in Paragraph 5, and (2) an example factor of 5 employees per airplane operated. (This factor varies widely across operators.) The affordability statistic was then calculated for each of the 210 subject operators as the projected annualized cost of the rule for that operator divided by the product of $252,214 times 5 employees per airplane times the number of airplanes operated. Under these assumptions, the expected annualized cost of the proposal for 209 of the 210 operators falls below 0.6 percent of their respective estimated annualized receipts. For one operator, costs would total 1.38 percent of estimated receipts.

The table can also be used to gauge the disproportionality of the proposed rule's relative burden. The percentage impact calculations are shown for three sizes of operators, depending on the numbers of airplanes that they operate. The calculations show a minor disproportionate impact on smaller operators who are slightly under-represented in the lowest "percentage impact" categories, and correspondingly, slightly over-represented in the higher impact categories.

COUNT OF OPERATORS BY
PERCENTAGE IMPACT AND BY OPERATOR SIZE

PERCENTAGE	AIRPLANES OPERATED			
IMPACT	1-10	11-50	51 +	Total
0% - .1%	68	38	19	125
.1% - .2%	10	10	6	26
.2% - .3%	15	4	2	21
.3% - .4%	16	7	3	26
.4% - .5%	8	2	0	10
.5% - .6%	1	0	0	1
-----	--0--	--0--	--0--	--0--
1.3% - 1.4%	1	0	0	1
Total	119	61	30	210

8. Business Closure Analysis

The FAA feels that the annualized average impact of the rule as a function of an affected firm's average annual receipts is low. The agency recognizes, and this evaluation has described, that the potential impact for some operators may be above average and may not be distributed evenly over time. The cost methodology for this evaluation further addresses the fact that it may not be economical to develop and implement a corrosion prevention and control program for some older airplane models with few subject airplanes. The evaluation estimated that program costs would be prohibitive for 11 airplane models, and included a 50 percent reduction of fleet resale value as an estimated cost attributable to the rule.

9. Competitiveness Analysis

No quantitative estimate of the proposed rule's potential impact on small business competitiveness has been made. However, the FAA feels that the findings from the Affordability Analysis and the Disproportionality Analysis above support the argument that the proposed rule will not seriously impede small entity competitiveness.

10. Description of Alternatives

The FAA has considered several approaches to this proposed rulemaking and has attempted to minimize the potential economic impact of the proposal, especially the impact on the operation of aircraft most likely to be used by small entities. The principal alternative would be to take no new rulemaking action and to rely on the existing corrosion related requirements in parts 23 and 25. The FAA has determined that these existing requirements have not always resulted in a comprehensive and systematic corrosion prevention and control program for either transport, commuter, or small category airplanes. In addition, the FAA has determined that such inaction would not respond to the provisions of 49 U.S.C. 44717, which requires the Administrator to prescribe regulations that ensure the continuing airworthiness of aging aircraft.

A second alternative would be to omit all small aircraft from the proposal since there is an identifiable correlation between smaller firms and smaller aircraft. Again, the FAA opposes this alternative since it would leave the existing problem for a significant segment of the scheduled passenger industry and would create an unacceptable safety inequity.

As proposed, this rulemaking would apply to all airplanes operated under part 121, all U.S. registered multiengine airplanes operated under part 129, and all multiengine airplanes used in scheduled operations under part 135. The proposed rule would not include helicopters, single-engine airplanes operated under part 135 or part 129, airplanes used in cargo operations under part 135, or airplanes used in unscheduled (on-demand) operations under part 135.

The aircraft and operations omitted from this proposal are not exclusively operated by small entities, but the FAA holds that the excluded airplane categories are more likely to be operated by small entities than, for example, large transport category airplanes would be. As noted above, the proposed rule would actually affect some 2,900 airplanes. By comparison, the exclusions described here, taken together, remove an estimated 5,023 additional aircraft from the proposal. This includes, with overlap, 1,441 helicopters; 4,663 aircraft used in on-demand operations; and 1,812 single-engine aircraft.

The FAA specifically requests comments regarding the exclusion of such aircraft operations from this proposed rule.

11. Compliance Assistance

In its efforts to assist small entities and other affected parties in complying with the proposed rule, the FAA is publishing an advisory circular, "Development of Corrosion Prevention and Control Programs." A notice of availability for this circular will be published concurrently with the proposed rule. This circular details acceptable means of compliance with the proposed rule.

Additionally, the FAA has developed a CPCP for a generic, civil, twin-engine aircraft and will make this document available as part of the appendix to the advisory circular accompanying the proposed rule. This document can serve as a core framework for the baseline program for defining the corrosion prevention and control requirements for a subject airplane model based on the average operating profile and operating environment. This generic CPCP model would be particularly useful to small operators in the event that the type certificate holder for a given model is not available to develop the CPCP for that model.

V. Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards.

In accordance with the above statute, the FAA has assessed the potential effect of this proposed rule and has determined that the objective of the rule is to maintain the current level of safety. In addition, the rule would have only a domestic impact and therefore create no obstacles to the foreign commerce of the United States.

VI. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Pub. L. 104-4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this proposed rule would not contain a significant intergovernmental or private sector mandate as defined by the Act.

APPENDIX

TABLE 1 - PROGRAM COST CALCULATIONS

MODELGROUP (A)	AVG-MTOW (B)	AVG-YR-MAN (C)	COUNT (D)
A300	372,657	1989.4	76
A310	300,613	1984.2	31
A320	164,793	1992.1	119
ATR42	36,898	1989.9	109
ATR72	47,496	1992.9	51
B707	330,774	1967.8	8
B727	184,957	1974.5	870
B737	126,499	1985.2	1,096
B747	795,928	1978.2	236
B757	239,136	1990.5	467
B767	367,227	1988.5	214
B777	523,264	1994.5	12
BAE 146	91,837	1986.9	26
BAE ATP	50,682	1990.4	10
BAE JETSTREAM 31/32	15,999	1988.4	102
BAE JETSTREAM 41	23,949	1995.4	25
BEECH 100 KING AIR	11,683	1972.0	1
BEECH 1300 AIRLINER	12,474	1989.0	2
BEECH 18 TWIN BEECH	10,293	1959.9	13
BEECH 1900 AIRLINER	16,894	1989.9	178
BEECH 200 SUPER KING AIR	12,675	1979.6	9
BEECH 300/350 SUPER KING AIR	15,486	1990.5	2
BEECH 400 BEECHJET / MU DIAMOND	14,599	1980.0	1
BEECH 58 BARON	5,356	1987.7	3
BEECH 76 DUCHESS	3,892	1980.5	2
BEECH 80 QUEEN AIR	8,942	1968.5	2
BEECH 90 KING AIR	10,366	1976.0	10
BEECH 99 AIRLINER	11,182	1980.7	27
CANADAIR CL600	51,405	1993.7	39
CANADAIR REGIONAL JET	53,000	1996.0	2
CASA 212 AVIOCAR	16,688	1980.0	1
CESSNA 208 CARAVAN	8,859	1989.4	243
CESSNA 210 CENTURION	3,911	1977.0	6
CESSNA 310	5,588	1975.0	1
CESSNA 320 SKYKNIGHT	5,384	1966.0	1
CESSNA 401/402	6,732	1977.3	87
CESSNA 404/414/421	7,417	1976.0	2
CESSNA 500/525/550 CITATION	12,888	1977.8	4
CESSNA 560 CITATION V	16,154	1989.5	2
CONVAIR (ALLISON) 580	54,485	1955.0	15
CONVAIR 240	42,208	1950.5	6
CONVAIR 440 METROPOLITAN	52,308	1955.1	12

CONVAIR 600/640	52,421	1958.5	17
DASSAULT FALCON 10/20	29,000	1968.4	17
DHC6 TWIN OTTER	12,545	1974.4	51
DHC7 DASH 7	44,141	1981.0	25
DHC8 DASH 8	35,071	1990.0	143
DORNIER 328	30,228	1994.8	37
DOUGLAS DC10	500,741	1975.7	205
DOUGLAS DC3	27,223	1942.4	11
DOUGLAS DC6	104,855	1954.5	19
DOUGLAS DC8	338,357	1968.0	178
DOUGLAS DC9	107,324	1970.8	471
DOUGLAS MD11	619,427	1993.0	66
DOUGLAS MD80	150,671	1987.5	617
DOUGLAS MD90	156,715	1995.1	19
EMBRAER 110 BANDEIRANTE	12,987	1981.9	11
EMBRAER 120 BRASILIA	25,996	1990.0	195
EMBRAER 145	43,582	1996.2	5
EVANGEL 4500	5,588	1968.0	1
FAIRCHILD SA226 MERLIN	12,638	1979.4	11
FAIRCHILD SA227 METRO	14,768	1986.4	105
FOKKER 100 / F28	93,608	1989.6	156
FOKKER F27 FRIENDSHIP	44,506	1970.9	45
GA AERO COMMANDER 500/600/700	7,387	1963.8	19
GA GRUMMAN 1159 GULFSTREAM I/II	36,000	1961.0	1
GRUMMAN G44 WIDGEON	5,190	1946.0	1
IAI 1123/24/25	35,000	1984.0	1
LEARJET 24	13,729	1970.0	3
LEARJET 25	15,084	1972.8	5
LEARJET 35/36	18,613	1980.0	7
LOCKHEED 1329 JETSTAR	41,000	1968.5	2
LOCKHEED L1011	453,832	1976.9	107
LOCKHEED L188 ELECTRA	114,901	1959.2	24
MITSUBISHI MU2	10,973	1970.0	1
NAMC YS11	55,000	1968.8	8
PBN 2 ISLANDER	6,880	1976.2	32
PBN 2 TRISLANDER	9,330	1977.3	4
PIPER 23 235/250	5,114	1970.9	7
PIPER 31 CHEYENNE	8,980	1982.3	4
PIPER 31 NAVAJO	7,456	1978.3	66
PIPER 34 SENECA	4,455	1975.3	8
PIPER 60	5,843	1976.5	2
RAYTHEON/BEECH/BAE/HS 125	24,891	1984.7	3
SAAB 340	28,630	1990.4	219
SABRE (ROCKWELL) 40-80	23,000	1977.5	2
SHORTS 360	26,052	1984.8	53
SHORTS SC7 SKYVAN	12,700	1968.0	1
Grand Total	**170,545**	**1982.7**	**7,108**

TABLE 1 - CONTINUED

MODELGROUP (A)	DEV-FACTOR (E)	DEV-HOURS (F)	DEV-COST (G)
A300	0	0	$0
A310	0.1	1,432	$136,040
A320	0.1	889	$84,455
ATR42	0.1	377	$35,815
ATR72	0.1	420	$39,900
B707	0	0	$0
B727	0	0	$0
B737	0	0	$0
B747	0	0	$0
B757	0.1	1,186	$112,670
B767	0.1	1,699	$161,405
B777	0.1	2,323	$220,685
BAE 146	0.1	597	$56,715
BAE ATP	0.1	432	$41,040
BAE JETSTREAM 31/32	0	0	$0
BAE JETSTREAM 41	1	3,254	$309,130
BEECH 100 KING AIR	1	2,763	$262,485
BEECH 1300 AIRLINER	1	2,795	$265,525
BEECH 18 TWIN BEECH	1	0	$0
BEECH 1900 AIRLINER	1	2,972	$282,340
BEECH 200 SUPER KING AIR	0.25	701	$66,595
BEECH 300/350 SUPER KING AIR	0.25	729	$69,255
BEECH 400 BEECHJET / MU DIAMOND	1	2,880	$273,600
BEECH 58 BARON	1	2,510	$238,450
BEECH 76 DUCHESS	0.25	613	$58,235
BEECH 80 QUEEN AIR	1	2,654	$252,130
BEECH 90 KING AIR	0.25	678	$64,410
BEECH 99 AIRLINER	1	2,743	$260,585
CANADAIR CL600	0.1	435	$41,325
CANADAIR REGIONAL JET	0.1	442	$41,990
CASA 212 AVIOCAR	0	0	$0
CESSNA 208 CARAVAN	1	2,650	$251,750
CESSNA 210 CENTURION	1	2,452	$232,940
CESSNA 310	1	2,520	$239,400
CESSNA 320 SKYKNIGHT	0.25	0	$0
CESSNA 401/402	1	2,565	$243,675
CESSNA 404/414/421	1	2,593	$246,335
CESSNA 500/525/550 CITATION	1	2,812	$267,140
CESSNA 560 CITATION V	0.25	736	$69,920
CONVAIR (ALLISON) 580	1	0	$0
CONVAIR 240	1	0	$0
CONVAIR 440 METROPOLITAN	1	0	$0

CONVAIR 600/640	1	0	$0
DASSAULT FALCON 10/20	1	3,456	$328,320
DHC6 TWIN OTTER	0	0	$0
DHC7 DASH 7	0	0	$0
DHC8 DASH 8	1	3,699	$351,405
DORNIER 328	0.1	351	$33,345
DOUGLAS DC10	0	0	$0
DOUGLAS DC3	1	0	$0
DOUGLAS DC6	1	0	$0
DOUGLAS DC8	0	0	$0
DOUGLAS DC9	0	0	$0
DOUGLAS MD11	0.1	2,707	$257,165
DOUGLAS MD80	0	0	$0
DOUGLAS MD90	0.1	856	$81,320
EMBRAER 110 BANDEIRANTE	1	2,815	$267,425
EMBRAER 120 BRASILIA	0.1	334	$31,730
EMBRAER 145	0.1	404	$38,380
EVANGEL 4500	1	0	$0
FAIRCHILD SA226 MERLIN	1	2,802	$266,190
FAIRCHILD SA227 METRO	0.5	1,443	$137,085
FOKKER 100 / F28	0	0	$0
FOKKER F27 FRIENDSHIP	0	0	$0
GA AERO COMMANDER 500/600/700	1	0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	1	0	$0
GRUMMAN G44 WIDGEON	1	0	$0
IAI 1123/24/25	1	3,696	$351,120
LEARJET 24	1	2,845	$270,275
LEARJET 25	0.25	725	$68,875
LEARJET 35/36	0.25	760	$72,200
LOCKHEED 1329 JETSTAR	1	3,936	$373,920
LOCKHEED L1011	0	0	$0
LOCKHEED L188 ELECTRA	1	0	$0
MITSUBISHI MU2	1	2,735	$259,825
NAMC YS11	1	4,496	$427,120
PBN 2 ISLANDER	0	0	$0
PBN 2 TRISLANDER	0	0	$0
PIPER 23 235/250	1	2,501	$237,595
PIPER 31 CHEYENNE	0.25	664	$63,080
PIPER 31 NAVAJO	1	2,594	$246,430
PIPER 34 SENECA	1	2,474	$235,030
PIPER 60	1	2,530	$240,350
RAYTHEON/BEECH/BAE/HS 125	1	3,292	$312,740
SAAB 340	0.1	344	$32,680
SABRE (ROCKWELL) 40-80	1	3,216	$305,520
SHORTS 360	0.5	1,669	$158,555
SHORTS SC7 SKYVAN	1	0	$0
Grand Total	**46.95**	**109,196**	**$10,373,620**

TABLE 1 - CONTINUED

MODELGROUP (A)	FAA - REVIEW1 (H)	IMP-FACTOR (I)	OP-MDL-CMBS (J)	OP-INCORP (K)	FAA - REVIEW2 (L)
A300	$0	0	5	$0	$0
A310	$4,400	0.1	1	$2,200	$440
A320	$4,400	0.1	5	$11,000	$2,200
ATR42	$4,400	0.1	7	$15,400	$3,080
ATR72	$4,400	0.1	5	$11,000	$2,200
B707	$0	0	6	$0	$0
B727	$0	0	45	$0	$0
B737	$0	0	23	$0	$0
B747	$0	0	18	$0	$0
B757	$4,400	0.1	14	$30,800	$6,160
B767	$4,400	0.1	8	$17,600	$3,520
B777	$4,400	0.1	1	$2,200	$440
BAE 146	$4,400	0.1	4	$8,800	$1,760
BAE ATP	$4,400	0.1	2	$4,400	$880
BAE JETSTREAM 31/32	$0	1	5	$11,000	$2,200
BAE JETSTREAM 41	$4,400	1	1	$2,200	$440
BEECH 100 KING AIR	$4,400	1	1	$2,200	$440
BEECH 1300 AIRLINER	$4,400	1	1	$2,200	$440
BEECH 18 TWIN BEECH	$0	1	4	$0	$0
BEECH 1900 AIRLINER	$4,400	1	12	$26,400	$5,280
BEECH 200 SUPER KING AIR	$4,400	1	7	$15,400	$3,080
BEECH 300/350 SUPER KING AIR	$4,400	1	2	$4,400	$880
BEECH 400 BEECHJET / MU DIAMOND	$4,400	1	1	$2,200	$440
BEECH 58 BARON	$4,400	1	1	$2,200	$440
BEECH 76 DUCHESS	$4,400	1	1	$2,200	$440
BEECH 80 QUEEN AIR	$4,400	1	1	$2,200	$440
BEECH 90 KING AIR	$4,400	1	6	$13,200	$2,640
BEECH 99 AIRLINER	$4,400	1	9	$19,800	$3,960
CANADAIR CL600	$4,400	0.1	3	$6,600	$1,320
CANADAIR REGIONAL JET	$4,400	0.1	1	$2,200	$440
CASA 212 AVIOCAR	$0	0	1	$0	$0
CESSNA 208 CARAVAN	$4,400	1	3	$6,600	$1,320
CESSNA 210 CENTURION	$4,400	1	2	$4,400	$880
CESSNA 310	$4,400	1	1	$2,200	$440
CESSNA 320 SKYKNIGHT	$0	1	1	$0	$0
CESSNA 401/402	$4,400	1	17	$37,400	$7,480
CESSNA 404/414/421	$4,400	1	2	$4,400	$880

CESSNA 500/525/550 CITATION	$4,400	1	4	$8,800	$1,760
CESSNA 560 CITATION V	$4,400	1	1	$2,200	$440
CONVAIR (ALLISON) 580	$0	1	4	$0	$0
CONVAIR 240	$0	1	2	$0	$0
CONVAIR 440 METROPOLITAN	$0	1	5	$0	$0
CONVAIR 600/640	$0	1	2	$0	$0
DASSAULT FALCON 10/20	$4,400	1	1	$2,200	$440
DHC6 TWIN OTTER	$0	1	9	$19,800	$3,960
DHC7 DASH 7	$0	1	8	$17,600	$3,520
DHC8 DASH 8	$4,400	1	9	$19,800	$3,960
DORNIER 328	$4,400	0.1	3	$6,600	$1,320
DOUGLAS DC10	$0	0	11	$0	$0
DOUGLAS DC3	$0	1	6	$0	$0
DOUGLAS DC6	$0	1	4	$0	$0
DOUGLAS DC8	$0	0	14	$0	$0
DOUGLAS DC9	$0	0	18	$0	$0
DOUGLAS MD11	$4,400	0.1	6	$13,200	$2,640
DOUGLAS MD80	$0	0	14	$0	$0
DOUGLAS MD90	$4,400	0.1	1	$2,200	$440
EMBRAER 110 BANDEIRANTE	$4,400	1	5	$11,000	$2,200
EMBRAER 120 BRASILIA	$4,400	0.1	7	$15,400	$3,080
EMBRAER 145	$4,400	0.1	1	$2,200	$440
EVANGEL 4500	$0	1	1	$0	$0
FAIRCHILD SA226 MERLIN	$4,400	1	6	$13,200	$2,640
FAIRCHILD SA227 METRO	$4,400	1	9	$19,800	$3,960
FOKKER 100 / F28	$0	0	4	$0	$0
FOKKER F27 FRIENDSHIP	$0	0	6	$0	$0
GA AERO COMMANDER 500/600/700	$0	1	2	$0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	$0	1	1	$0	$0
GRUMMAN G44 WIDGEON	$0	1	1	$0	$0
IAI 1123/24/25	$4,400	1	1	$2,200	$440
LEARJET 24	$4,400	1	3	$6,600	$1,320
LEARJET 25	$4,400	1	5	$11,000	$2,200
LEARJET 35/36	$4,400	1	6	$13,200	$2,640
LOCKHEED 1329 JETSTAR	$4,400	1	2	$4,400	$880
LOCKHEED L1011	$0	0	6	$0	$0
LOCKHEED L188 ELECTRA	$0	1	4	$0	$0
MITSUBISHI MU2	$4,400	1	1	$2,200	$440
NAMC YS11	$4,400	1	2	$4,400	$880

PBN 2 ISLANDER	$0	1	8	$17,600	$3,520
PBN 2 TRISLANDER	$0	1	2	$4,400	$880
PIPER 23 235/250	$4,400	1	5	$11,000	$2,200
PIPER 31 CHEYENNE	$4,400	1	1	$2,200	$440
PIPER 31 NAVAJO	$4,400	1	18	$39,600	$7,920
PIPER 34 SENECA	$4,400	1	4	$8,800	$1,760
PIPER 60	$4,400	1	2	$4,400	$880
RAYTHEON/BEECH/BAE/ HS 125	$4,400	1	2	$4,400	$880
SAAB 340	$4,400	0.1	7	$15,400	$3,080
SABRE (ROCKWELL) 40-80	$4,400	1	2	$4,400	$880
SHORTS 360	$4,400	1	12	$26,400	$5,280
SHORTS SC7 SKYVAN	$0	1	1	$0	$0
Grand Total	**$246,400**	**59.7**	**487**	**$609,400**	**$121,880**

TABLE 1 - CONTINUED

MODELGROUP (A)	PROJECTED YEARS OF PROGRAM (M)	MEDIAN YEAR OF PROGRAM (N)	AFFECTED AIRPLANES (O)	AIRPLANE YEARS OF PROGRAM (P)	WORK HOURS PER AIRPLANE PER YEAR (Q)
A300	0	0.0	0	0	0
A310	16	2011.1	31	501	27
A320	17	2011.5	119	2,023	19
ATR42	17	2011.5	109	1,853	11
ATR72	17	2011.5	51	867	12
B707	0	0.0	0	0	0
B727	0	0.0	0	0	0
B737	0	0.0	0	0	0
B747	0	0.0	0	0	0
B757	17	2011.5	467	7,939	24
B767	17	2011.5	214	3,638	31
B777	16	2012.3	12	186	41
BAE 146	17	2011.5	26	442	14
BAE ATP	17	2011.5	10	170	12
BAE JETSTREAM 31/32	17	2011.5	102	1,734	98
BAE JETSTREAM 41	15	2012.7	25	364	103
BEECH 100 KING AIR	4	2005.0	1	4	95
BEECH 1300 AIRLINER	17	2011.5	2	34	96
BEECH 18 TWIN BEECH	0	0.0	0	0	0
BEECH 1900 AIRLINER	17	2011.5	178	3,026	98
BEECH 200 SUPER KING AIR	12	2008.8	9	104	96
BEECH 300/350 SUPER KING AIR	17	2011.5	2	34	98
BEECH 400 BEECHJET / MU DIAMOND	12	2009.0	1	12	97
BEECH 58 BARON	17	2011.5	3	51	91
BEECH 76 DUCHESS	13	2009.3	2	25	90
BEECH 80 QUEEN AIR	1	2003.3	2	1	94
BEECH 90 KING AIR	8	2007.0	10	80	94
BEECH 99 AIRLINER	13	2009.3	27	342	95
CANADAIR CL600	16	2011.9	39	634	12
CANADAIR REGIONAL JET	14	2013.0	2	28	12
CASA 212 AVIOCAR	0	0.0	0	0	0
CESSNA 208 CARAVAN	17	2011.5	243	4,131	94
CESSNA 210	9	2007.5	6	54	90

CENTURION					
CESSNA 310	7	2006.5	1	7	91
CESSNA 320 SKYKNIGHT	0	0.0	0	0	0
CESSNA 401/402	9	2007.7	87	812	92
CESSNA 404/414/421	8	2007.0	2	16	93
CESSNA 500/525/550 CITATION	10	2007.9	4	39	96
CESSNA 560 CITATION V	17	2011.5	2	34	98
CONVAIR (ALLISON) 580	0	0.0	0	0	0
CONVAIR 240	0	0.0	0	0	0
CONVAIR 440 METROPOLITAN	0	0.0	0	0	0
CONVAIR 600/640	0	0.0	0	0	0
DASSAULT FALCON 10/20	0	2003.2	17	6	106
DHC6 TWIN OTTER	6	2006.2	51	326	96
DHC7 DASH 7	13	2009.5	25	325	115
DHC8 DASH 8	17	2011.5	143	2,431	110
DORNIER 328	15	2012.4	37	564	11
DOUGLAS DC10	0	0.0	0	0	0
DOUGLAS DC3	0	0.0	0	0	0
DOUGLAS DC6	0	0.0	0	0	0
DOUGLAS DC8	0	0.0	0	0	0
DOUGLAS DC9	0	0.0	0	0	0
DOUGLAS MD11	17	2011.5	66	1,122	47
DOUGLAS MD80	0	0.0	0	0	0
DOUGLAS MD90	15	2012.5	19	284	18
EMBRAER 110 BANDEIRANTE	14	2010.0	11	153	96
EMBRAER 120 BRASILIA	17	2011.5	195	3,315	10
EMBRAER 145	14	2013.1	5	69	11
EVANGEL 4500	0	0.0	0	0	0
FAIRCHILD SA226 MERLIN	11	2008.7	11	125	96
FAIRCHILD SA227 METRO	17	2011.5	105	1,785	97
FOKKER 100 / F28	0	0.0	0	0	0
FOKKER F27 FRIENDSHIP	0	0.0	0	0	0
GA AERO COMMANDER 500/600/700	0	0.0	0	0	0
GA GRUMMAN 1159 GULFSTREAM I/II	0	0.0	0	0	0
GRUMMAN G44 WIDGEON	0	0.0	0	0	0
IAI 1123/24/25	16	2011.0	1	16	110
LEARJET 24	2	2004.0	3	6	97
LEARJET 25	5	2005.4	5	24	97

LEARJET 35/36	12	2009.0	7	84	100
LOCKHEED 1329 JETSTAR	1	2003.3	2	1	113
LOCKHEED L1011	0	0.0	0	0	0
LOCKHEED L188 ELECTRA	0	0.0	0	0	0
MITSUBISHI MU2	2	2004.0	1	2	95
NAMC YS11	1	2003.4	8	6	122
PBN 2 ISLANDER	8	2007.1	32	263	92
PBN 2 TRISLANDER	9	2007.6	4	37	94
PIPER 23 235/250	3	2004.4	7	20	91
PIPER 31 CHEYENNE	14	2010.1	4	57	94
PIPER 31 NAVAJO	10	2008.2	66	681	93
PIPER 34 SENECA	7	2006.6	8	58	91
PIPER 60	9	2007.3	2	17	92
RAYTHEON/BEECH/BAE/HS 125	17	2011.3	3	50	103
SAAB 340	17	2011.5	219	3,723	11
SABRE (ROCKWELL) 40-80	10	2007.8	2	19	102
SHORTS 360	17	2011.4	53	889	104
SHORTS SC7 SKYVAN	0	0.0	0	0	0
Grand Total	**734**		**2,901**	**45,643**	

TABLE 1 - CONTINUED

MODELGROUP (A)	INSPECTION COST (R)	INCREMENTAL DOWN DAYS (S)	AIRPLANE MIDPROGRAM VALUE (T)	DOWN DAYS COST (U)
A300	$0	0	$0	$0
A310	$903,152	342	$4,542,860	$297,962
A320	$2,530,381	958	$5,504,917	$1,011,397
ATR42	$1,354,760	513	$1,067,288	$105,004
ATR72	$671,218	254	$1,799,631	$87,664
B707	$0	0	$0	$0
B727	$0	0	$0	$0
B737	$0	0	$0	$0
B747	$0	0	$0	$0
B757	$12,328,417	4,670	$6,466,721	$5,791,701
B767	$7,542,946	2,857	$7,762,824	$4,253,390
B777	$503,580	191	$17,356,236	$635,761
BAE 146	$421,826	160	$1,977,774	$60,688
BAE ATP	$133,812	51	$1,520,813	$14,875
BAE JETSTREAM 31/32	$11,205,074	4,244	$414,274	$337,185
BAE JETSTREAM 41	$2,469,749	936	$1,042,291	$187,098
BEECH 100 KING AIR	$25,146	10	$124,492	$239
BEECH 1300 AIRLINER	$214,837	81	$347,610	$5,400
BEECH 18 TWIN BEECH	$0	0	$0	$0
BEECH 1900 AIRLINER	$19,663,984	7,448	$500,095	$714,328
BEECH 200 SUPER KING AIR	$657,998	249	$190,076	$9,077
BEECH 300/350 SUPER KING AIR	$218,998	83	$488,582	$7,777
BEECH 400 BEECHJET / MU DIAMOND	$76,861	29	$221,403	$1,231
BEECH 58 BARON	$307,504	116	$144,425	$3,213
BEECH 76 DUCHESS	$149,250	57	$70,543	$771
BEECH 80 QUEEN AIR	$6,175	2	$82,983	$32
BEECH 90 KING AIR	$498,646	189	$134,041	$4,859
BEECH 99 AIRLINER	$2,143,058	812	$178,129	$27,739
CANADAIR CL600	$500,903	190	$2,027,096	$73,864
CANADAIR REGIONAL JET	$22,303	8	$2,317,321	$3,555
CASA 212 AVIOCAR	$0	0	$0	$0
CESSNA 208 CARAVAN	$25,495,844	9,658	$264,091	$489,155

CESSNA 210 CENTURION	$322,423	122	$60,290	$1,411
CESSNA 310	$42,273	16	$73,962	$227
CESSNA 320 SKYKNIGHT	$0	0	$0	$0
CESSNA 401/402	$4,941,348	1,872	$96,748	$34,734
CESSNA 404/414/421	$97,812	37	$99,105	$703
CESSNA 500/525/550 CITATION	$247,087	94	$177,665	$3,203
CESSNA 560 CITATION V	$219,921	83	$463,757	$7,382
CONVAIR (ALLISON) 580	$0	0	$0	$0
CONVAIR 240	$0	0	$0	$0
CONVAIR 440 METROPOLITAN	$0	0	$0	$0
CONVAIR 600/640	$0	0	$0	$0
DASSAULT FALCON 10/20	$41,942	16	$249,558	$766
DHC6 TWIN OTTER	$2,060,856	781	$148,464	$22,237
DHC7 DASH 7	$2,471,787	936	$672,281	$120,679
DHC8 DASH 8	$17,593,016	6,664	$1,026,616	$1,312,041
DORNIER 328	$397,065	150	$1,264,740	$36,383
DOUGLAS DC10	$0	0	$0	$0
DOUGLAS DC3	$0	0	$0	$0
DOUGLAS DC6	$0	0	$0	$0
DOUGLAS DC8	$0	0	$0	$0
DOUGLAS DC9	$0	0	$0	$0
DOUGLAS MD11	$3,476,148	1,317	$18,885,104	$4,769,912
DOUGLAS MD80	$0	0	$0	$0
DOUGLAS MD90	$345,907	131	$6,329,221	$159,011
EMBRAER 110 BANDEIRANTE	$969,958	367	$216,669	$15,250
EMBRAER 120 BRASILIA	$2,276,811	862	$766,107	$126,649
EMBRAER 145	$52,321	20	$1,930,485	$7,405
EVANGEL 4500	$0	0	$0	$0
FAIRCHILD SA226 MERLIN	$790,677	299	$187,900	$10,775
FAIRCHILD SA227 METRO	$11,445,335	4,335	$320,415	$266,384
FOKKER 100 / F28	$0	0	$0	$0
FOKKER F27 FRIENDSHIP	$0	0	$0	$0
GA AERO COMMANDER 500/600/700	$0	0	$0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	$0	0	$0	$0
GRUMMAN G44 WIDGEON	$0	0	$0	$0
IAI 1123/24/25	$115,745	44	$615,316	$5,192
LEARJET 24	$38,218	14	$131,935	$354
LEARJET 25	$154,195	58	$163,933	$1,823

LEARJET 35/36	$551,728	209	$278,555	$11,165
LOCKHEED 1329 JETSTAR	$7,478	3	$351,922	$202
LOCKHEED L1011	$0	0	$0	$0
LOCKHEED L188 ELECTRA	$0	0	$0	$0
MITSUBISHI MU2	$12,515	5	$107,167	$103
NAMC YS11	$48,280	18	$474,799	$1,639
PBN 2 ISLANDER	$1,602,044	607	$93,684	$10,906
PBN 2 TRISLANDER	$229,067	87	$128,982	$2,152
PIPER 23 235/250	$120,393	46	$56,692	$500
PIPER 31 CHEYENNE	$352,077	133	$156,817	$4,000
PIPER 31 NAVAJO	$4,164,201	1,577	$110,777	$33,503
PIPER 34 SENECA	$347,588	132	$61,852	$1,566
PIPER 60	$102,838	39	$82,331	$616
RAYTHEON/BEECH/BAE/HS 125	$341,164	129	$456,059	$11,283
SAAB 340	$2,596,881	984	$868,513	$163,899
SABRE (ROCKWELL) 40-80	$128,183	49	$303,973	$2,857
SHORTS 360	$6,107,844	2,314	$478,904	$212,529
SHORTS SC7 SKYVAN	$0	0	$0	$0
Grand Total	**$154,859,547**	**58,658**		**$21,483,409**

PRESENT VALUES

MODELGROUP (A)	DEVELOP COST (V)	OPER INCORP (W)	INSPECTION COST (X)	DOWN COST (Y)	TOTAL COST TO INDUSTRY (Z)
A300	$0	$0	$0	$0	$0
A310	$103,784	$1,569	$372,737	$122,971	$601,060
A320	$64,430	$7,843	$1,015,091	$405,733	$1,493,097
ATR42	$27,323	$10,980	$543,477	$42,124	$623,904
ATR72	$30,440	$7,843	$269,267	$35,167	$342,716
B707	$0	$0	$0	$0	$0
B727	$0	$0	$0	$0	$0
B737	$0	$0	$0	$0	$0
B747	$0	$0	$0	$0	$0
B757	$85,955	$21,960	$4,945,683	$2,323,406	$7,377,005
B767	$123,135	$12,549	$3,025,938	$1,706,295	$4,867,917
B777	$168,360	$1,569	$192,021	$242,424	$604,373
BAE 146	$43,268	$6,274	$169,220	$24,346	$243,108
BAE ATP	$31,309	$3,137	$53,680	$5,967	$94,094
BAE JETSTREAM 31/32	$0	$7,843	$4,495,042	$135,266	$4,638,150
BAE JETSTREAM 41	$235,834	$1,569	$912,270	$69,110	$1,218,783
BEECH 100 KING AIR	$200,249	$1,569	$15,660	$149	$217,626
BEECH 1300 AIRLINER	$202,568	$1,569	$86,184	$2,166	$292,487
BEECH 18 TWIN BEECH	$0	$0	$0	$0	$0
BEECH 1900 AIRLINER	$215,396	$18,823	$7,888,429	$286,561	$8,409,208
BEECH 200 SUPER KING AIR	$50,805	$10,980	$317,346	$4,378	$383,508
BEECH 300/350 SUPER KING AIR	$52,834	$3,137	$87,853	$3,120	$146,945
BEECH 400 BEECHJET / MU DIAMOND	$208,728	$1,569	$36,516	$585	$247,398
BEECH 58 BARON	$181,912	$1,569	$123,359	$1,289	$308,129
BEECH 76 DUCHESS	$44,427	$1,569	$69,718	$360	$116,074
BEECH 80 QUEEN AIR	$192,349	$1,569	$4,329	$22	$198,269
BEECH 90 KING AIR	$49,138	$9,411	$271,230	$2,643	$332,423
BEECH 99 AIRLINER	$198,799	$14,117	$995,446	$12,885	$1,221,247
CANADAIR CL600	$31,527	$4,706	$195,951	$28,895	$261,079
CANADAIR REGIONAL JET	$32,034	$1,569	$8,084	$1,288	$42,975
CASA 212 AVIOCAR	$0	$0	$0	$0	$0
CESSNA 208 CARAVAN	$192,059	$4,706	$10,227,945	$196,230	$10,620.940

CESSNA 210 CENTURION	$177,709	$3,137	$169,543	$742	$351,131
CESSNA 310	$182,637	$1,569	$23,785	$128	$208,118
CESSNA 320 SKYKNIGHT	$0	$0	$0	$0	$0
CESSNA 401/402	$185,898	$26,666	$2,569,226	$18,060	$2,799,849
CESSNA 404/414/421	$187,928	$3,137	$53,203	$382	$244,650
CESSNA 500/525/550 CITATION	$203,800	$6,274	$126,673	$1,642	$338,390
CESSNA 560 CITATION V	$53,342	$1,569	$88,224	$2,961	$146,095
CONVAIR (ALLISON) 580	$0	$0	$0	$0	$0
CONVAIR 240	$0	$0	$0	$0	$0
CONVAIR 440 METROPOLITAN	$0	$0	$0	$0	$0
CONVAIR 600/640	$0	$0	$0	$0	$0
DASSAULT FALCON 10/20	$250,474	$1,569	$29,549	$540	$282,131
DHC6 TWIN OTTER	$0	$14,117	$1,183,630	$12,772	$1,210,519
DHC7 DASH 7	$0	$12,549	$1,135,266	$55,427	$1,203,241
DHC8 DASH 8	$268,085	$14,117	$7,057,637	$526,341	$7,866,180
DORNIER 328	$25,439	$4,706	$150,096	$13,753	$193,994
DOUGLAS DC10	$0	$0	$0	$0	$0
DOUGLAS DC3	$0	$0	$0	$0	$0
DOUGLAS DC6	$0	$0	$0	$0	$0
DOUGLAS DC8	$0	$0	$0	$0	$0
DOUGLAS DC9	$0	$0	$0	$0	$0
DOUGLAS MD11	$196,190	$9,411	$1,394,496	$1,913,504	$3,513,601
DOUGLAS MD80	$0	$0	$0	$0	$0
DOUGLAS MD90	$62,039	$1,569	$129,456	$59,510	$252,573
EMBRAER 110 BANDEIRANTE	$204,017	$7,843	$432,000	$6,792	$650,652
EMBRAER 120 BRASILIA	$24,207	$10,980	$913,368	$50,807	$999,362
EMBRAER 145	$29,280	$1,569	$18,836	$2,666	$52,350
EVANGEL 4500	$0	$0	$0	$0	$0
FAIRCHILD SA226 MERLIN	$203,075	$9,411	$383,820	$5,231	$601,537
FAIRCHILD SA227 METRO	$104,581	$14,117	$4,591,425	$106,863	$4,816,987
FOKKER 100 / F28	$0	$0	$0	$0	$0
FOKKER F27 FRIENDSHIP	$0	$0	$0	$0	$0
GA AERO COMMANDER 500/600/700	$0	$0	$0	$0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	$0	$0	$0	$0	$0
GRUMMAN G44 WIDGEON	$0	$0	$0	$0	$0
IAI 1123/24/25	$267,868	$1,569	$48,030	$2,154	$319,621
LEARJET 24	$206,192	$4,706	$25,466	$236	$236,600
LEARJET 25	$52,544	$7,843	$93,461	$1,105	$154,953

LEARJET 35/36	$55,081	$9,411	$262,122	$5,304	$331,919
LOCKHEED 1329 JETSTAR	$285,262	$3,137	$5,242	$142	$293,783
LOCKHEED L1011	$0	$0	$0	$0	$0
LOCKHEED L188 ELECTRA	$0	$0	$0	$0	$0
MITSUBISHI MU2	$198,219	$1,569	$8,340	$69	$208,196
NAMC YS11	$325,848	$3,137	$33,561	$1,139	$363,685
PBN 2 ISLANDER	$0	$12,549	$864,981	$5,888	$883,418
PBN 2 TRISLANDER	$0	$3,137	$119,438	$1,122	$123,697
PIPER 23 235/250	$181,260	$7,843	$77,930	$324	$267,357
PIPER 31 CHEYENNE	$48,123	$1,569	$155,010	$1,761	$206,463
PIPER 31 NAVAJO	$188,000	$28,234	$2,094,205	$16,849	$2,327,289
PIPER 34 SENECA	$179,303	$6,274	$193,923	$874	$380,374
PIPER 60	$183,362	$3,137	$54,999	$329	$241,827
RAYTHEON/BEECH/BAE/HS 125	$238,588	$3,137	$138,414	$4,578	$384,716
SAAB 340	$24,931	$10,980	$1,041,768	$65,750	$1,143,430
SABRE (ROCKWELL) 40-80	$233,080	$3,137	$66,273	$1,477	$303,967
SHORTS 360	$120,961	$18,823	$2,469,070	$85,914	$2,694,768
SHORTS SC7 SKYVAN	$0	$0	$0	$0	$0
Grand Total	**$7,913,985**	**$434,494**	**$64,524,942**	**$8,626,515**	**$81,499,936**

TABLE 1 - CONTINUED

MODELGROUP (A)	PER AIRPLANE VALUE 2003 (AA)	FLEET VALUE 2003 (AB)	PROGRAM COST EXCEED 0.5 / FLEET VALUE (AC)	COUNT OF EXCEED 0.5 / FLEET VALUE (AD)	PRESENT VALUES PROGRAM IMPLEMENT COSTS (AE)
A300	$0	$0	FALSE	0	$0
A310	$9,554,927	$296,202,734	FALSE	0	$601,060
A320	$12,033,889	$1,432,032,789	FALSE	0	$1,493,097
ATR42	$2,333,119	$254,309,964	FALSE	0	$623,904
ATR72	$3,934,039	$200,636,004	FALSE	0	$342,716
B707	$0	$0	FALSE	0	$0
B727	$0	$0	FALSE	0	$0
B737	$0	$0	FALSE	0	$0
B747	$0	$0	FALSE	0	$0
B757	$14,136,415	$6,601,706,004	FALSE	0	$7,377,005
B767	$16,969,731	$3,631,522,448	FALSE	0	$4,867,917
B777	$40,651,852	$487,822,220	FALSE	0	$604,373
BAE 146	$4,323,464	$112,410,069	FALSE	0	$243,108
BAE ATP	$3,324,536	$33,245,356	FALSE	0	$94,094
BAE JETSTREAM 31/32	$905,614	$92,372,612	FALSE	0	$4,638,150
BAE JETSTREAM 41	$2,549,145	$63,728,630	FALSE	0	$1,218,783
BEECH 100 KING AIR	$149,645	$149,645	TRUE	1	$0
BEECH 1300 AIRLINER	$759,885	$1,519,771	FALSE	0	$292,487
BEECH 18 TWIN BEECH	$0	$0	FALSE	0	$0
BEECH 1900 AIRLINER	$1,093,221	$194,593,270	FALSE	0	$8,409,208
BEECH 200 SUPER KING AIR	$323,448	$2,911,032	FALSE	0	$383,508
BEECH 300/350 SUPER KING AIR	$1,068,052	$2,136,105	FALSE	0	$146,945
BEECH 400 BEECHJET / MU DIAMOND	$384,539	$384,539	TRUE	1	$0
BEECH 58 BARON	$315,717	$947,151	FALSE	0	$308,129
BEECH 76 DUCHESS	$125,372	$250,744	FALSE	0	$116,074
BEECH 80 QUEEN AIR	$84,914	$169,828	TRUE	1	$0
BEECH 90 KING AIR	$193,676	$1,936,758	FALSE	0	$332,423
BEECH 99 AIRLINER	$319,014	$8,613,391	FALSE	0	$1,221,247
CANADAIR CL600	$4,585,495	$178,834,310	FALSE	0	$261,079
CANADAIR REGIONAL JET	$5,815,414	$11,630,828	FALSE	0	$42,975
CASA 212 AVIOCAR	$0	$0	FALSE	0	$0
CESSNA 208 CARAVAN	$577,310	$140,286,319	FALSE	0	$10,620,940
CESSNA 210 CENTURION	$91,214	$547,285	TRUE	1	$0
CESSNA 310	$102,063	$102,063	TRUE	1	$0

CESSNA 320 SKYKNIGHT	$0	$0	FALSE	0	$0
CESSNA 401/402	$148,634	$12,931,157	FALSE	0	$2,799,849
CESSNA 404/414/421	$143,196	$286,392	TRUE	1	$0
CESSNA 500/525/550 CITATION	$278,230	$1,112,920	FALSE	0	$338,390
CESSNA 560 CITATION V	$1,013,784	$2,027,568	FALSE	0	$146,095
CONVAIR (ALLISON) 580	$0	$0	FALSE	0	$0
CONVAIR 240	$0	$0	FALSE	0	$0
CONVAIR 440 METROPOLITAN	$0	$0	FALSE	0	$0
CONVAIR 600/640	$0	$0	FALSE	0	$0
DASSAULT FALCON 10/20	$253,643	$4,311,935	FALSE	0	$282,131
DHC6 TWIN OTTER	$199,220	$10,160,236	FALSE	0	$1,210,519
DHC7 DASH 7	$1,222,608	$30,565,189	FALSE	0	$1,203,241
DHC8 DASH 8	$2,244,210	$320,921,985	FALSE	0	$7,866,180
DORNIER 328	$2,997,478	$110,906,701	FALSE	0	$193,994
DOUGLAS DC10	$0	$0	FALSE	0	$0
DOUGLAS DC3	$0	$0	FALSE	0	$0
DOUGLAS DC6	$0	$0	FALSE	0	$0
DOUGLAS DC8	$0	$0	FALSE	0	$0
DOUGLAS DC9	$0	$0	FALSE	0	$0
DOUGLAS MD11	$41,283,317	$2,724,698,917	FALSE	0	$3,513,601
DOUGLAS MD80	$0	$0	FALSE	0	$0
DOUGLAS MD90	$15,206,051	$288,914,976	FALSE	0	$252,573
EMBRAER 110 BANDEIRANTE	$410,862	$4,519,477	FALSE	0	$650,652
EMBRAER 120 BRASILIA	$1,674,730	$326,572,258	FALSE	0	$999,362
EMBRAER 145	$4,889,413	$24,447,063	FALSE	0	$52,350
EVANGEL 4500	$0	$0	FALSE	0	$0
FAIRCHILD SA226 MERLIN	$316,935	$3,486,281	FALSE	0	$601,537
FAIRCHILD SA227 METRO	$700,436	$73,545,819	FALSE	0	$4,816,987
FOKKER 100 / F28	$0	$0	FALSE	0	$0
FOKKER F27 FRIENDSHIP	$0	$0	FALSE	0	$0
GA AERO COMMANDER 500/600/700	$0	$0	FALSE	0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	$0	$0	FALSE	0	$0
GRUMMAN G44 WIDGEON	$0	$0	FALSE	0	$0
IAI 1123/24/25	$1,284,617	$1,284,617	FALSE	0	$319,621
LEARJET 24	$144,651	$433,952	TRUE	1	$0
LEARJET 25	$204,442	$1,022,209	FALSE	0	$154,953
LEARJET 35/36	$483,802	$3,386,614	FALSE	0	$331,919
LOCKHEED 1329 JETSTAR	$360,111	$720,221	FALSE	0	$293,783
LOCKHEED L1011	$0	$0	FALSE	0	$0
LOCKHEED L188 ELECTRA	$0	$0	FALSE	0	$0
MITSUBISHI MU2	$117,495	$117,495	TRUE	1	$0
NAMC YS11	$491,467	$3,931,740	FALSE	0	$363,685
PBN 2 ISLANDER	$136,734	$4,375,473	FALSE	0	$383,418

PBN 2 TRISLANDER	$197,397	$789,590	FALSE	0	$123,697
PIPER 23 235/250	$64,656	$452,590	TRUE	1	$0
PIPER 31 CHEYENNE	$302,067	$1,208,268	FALSE	0	$206,463
PIPER 31 NAVAJO	$178,075	$11,752,954	FALSE	0	$2,327,289
PIPER 34 SENECA	$86,339	$690,710	TRUE	1	$0
PIPER 60	$121,729	$243,458	TRUE	1	$0
RAYTHEON/BEECH/BAE/HS 125	$981,786	$2,945,358	FALSE	0	$384,716
SAAB 340	$1,898,591	$415,791,326	FALSE	0	$1,143,430
SABRE (ROCKWELL) 40-80	$470,589	$941,179	FALSE	0	$303,967
SHORTS 360	$1,036,049	$54,910,599	FALSE	0	$2,694,768
SHORTS SC7 SKYVAN	$0	$0	FALSE	0	$0
Grand Total		**$18,195,409,097**		**11**	**$78,698,390**

TABLE 1 - CONTINUED

MODELGROUP (A)	PRESENT VALUES COST OF REDUCED VALUE (AF)	EXISTING FLEET COMBINED COSTS (AG)	FAA COSTS (AH)
A300	$0	$0	$0
A310	$0	$601,060	$3,451
A320	$0	$1,493,097	$4,706
ATR42	$0	$623,904	$5,333
ATR72	$0	$342,716	$4,706
B707	$0	$0	$0
B727	$0	$0	$0
B737	$0	$0	$0
B747	$0	$0	$0
B757	$0	$7,377,005	$7,529
B767	$0	$4,867,917	$5,647
B777	$0	$604,373	$3,451
BAE 146	$0	$243,108	$4,392
BAE ATP	$0	$94,094	$3,765
BAE JETSTREAM 31/32	$0	$4,638,150	$1,569
BAE JETSTREAM 41	$0	$1,218,783	$3,451
BEECH 100 KING AIR	$53,347	$53,347	$0
BEECH 1300 AIRLINER	$0	$292,487	$3,451
BEECH 18 TWIN BEECH	$0	$0	$0
BEECH 1900 AIRLINER	$0	$8,409,208	$6,902
BEECH 200 SUPER KING AIR	$0	$383,508	$5,333
BEECH 300/350 SUPER KING AIR	$0	$146,945	$3,765
BEECH 400 BEECHJET / MU DIAMOND	$137,086	$137,086	$0
BEECH 58 BARON	$0	$308,129	$3,451
BEECH 76 DUCHESS	$0	$116,074	$3,451
BEECH 80 QUEEN AIR	$60,542	$60,542	$0
BEECH 90 KING AIR	$0	$332,423	$5,019
BEECH 99 AIRLINER	$0	$1,221,247	$5,961
CANADAIR CL600	$0	$261,079	$4,078
CANADAIR REGIONAL JET	$0	$42,975	$3,451
CASA 212 AVIOCAR	$0	$0	$0
CESSNA 208 CARAVAN	$0	$10,620,940	$4,078
CESSNA 210 CENTURION	$195,103	$195,103	$0
CESSNA 310	$36,385	$36,385	$0
CESSNA 320 SKYKNIGHT	$0	$0	$0
CESSNA 401/402	$0	$2,799,849	$8,470
CESSNA 404/414/421	$102,097	$102,097	$0
CESSNA 500/525/550 CITATION	$0	$338,390	$4,392
CESSNA 560 CITATION V	$0	$146,095	$3,451

CONVAIR (ALLISON) 580	$0	$0	$0
CONVAIR 240	$0	$0	$0
CONVAIR 440 METROPOLITAN	$0	$0	$0
CONVAIR 600/640	$0	$0	$0
DASSAULT FALCON 10/20	$0	$282,131	$3,451
DHC6 TWIN OTTER	$0	$1,210,519	$2,823
DHC7 DASH 7	$0	$1,203,241	$2,510
DHC8 DASH 8	$0	$7,866,180	$5,961
DORNIER 328	$0	$193,994	$4,078
DOUGLAS DC10	$0	$0	$0
DOUGLAS DC3	$0	$0	$0
DOUGLAS DC6	$0	$0	$0
DOUGLAS DC8	$0	$0	$0
DOUGLAS DC9	$0	$0	$0
DOUGLAS MD11	$0	$3,513,601	$5,019
DOUGLAS MD80	$0	$0	$0
DOUGLAS MD90	$0	$252,573	$3,451
EMBRAER 110 BANDEIRANTE	$0	$650,652	$4,706
EMBRAER 120 BRASILIA	$0	$999,362	$5,333
EMBRAER 145	$0	$52,350	$3,451
EVANGEL 4500	$0	$0	$0
FAIRCHILD SA226 MERLIN	$0	$601,537	$5,019
FAIRCHILD SA227 METRO	$0	$4,816,987	$5,961
FOKKER 100 / F28	$0	$0	$0
FOKKER F27 FRIENDSHIP	$0	$0	$0
GA AERO COMMANDER 500/600/700	$0	$0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	$0	$0	$0
GRUMMAN G44 WIDGEON	$0	$0	$0
IAI 1123/24/25	$0	$319,621	$3,451
LEARJET 24	$154,701	$154,701	$0
LEARJET 25	$0	$154,953	$4,706
LEARJET 35/36	$0	$331,919	$5,019
LOCKHEED 1329 JETSTAR	$0	$293,783	$3,765
LOCKHEED L1011	$0	$0	$0
LOCKHEED L188 ELECTRA	$0	$0	$0
MITSUBISHI MU2	$41,886	$41,886	$0
NAMC YS11	$0	$363,685	$3,765
PBN 2 ISLANDER	$0	$883,418	$2,510
PBN 2 TRISLANDER	$0	$123,697	$627
PIPER 23 235/250	$161,345	$161,345	$0
PIPER 31 CHEYENNE	$0	$206,463	$3,451
PIPER 31 NAVAJO	$0	$2,327,289	$8,784
PIPER 34 SENECA	$246,233	$246,233	$0
PIPER 60	$86,791	$86,791	$0
RAYTHEON/BEECH/BAE/HS 125	$0	$384,716	$3,765
SAAB 340	$0	$1,143,430	$5,333

SABRE (ROCKWELL) 40-80	$0	$303,967	$3,765
SHORTS 360	$0	$2,694,768	$6,902
SHORTS SC7 SKYVAN	$0	$0	$0
Grand Total	**$1,275,517**	**$79,973,907**	**$220,855**

TABLE 2

FUTURE CERTIFICATION COSTS

YEAR (A)	AIRPLANE WEIGHT (B)	DEVELOP HOURS (C)	DEVELOP COST (D)	FAA REVIEW (E)	COMBINED COST (F)	PRESENT VALUE COST (G)
2003	15,882	293	$ 27,835	$ 4,400	$ 32,235	$ 22,983
2004	9,281	1,334	$ 126,730	$ 4,400	$ 131,130	$ 87,377
2005	69,586	508	$ 48,260	$ 4,400	$ 52,660	$ 32,794
2006	7,174	1,291	$ 122,645	$ 4,400	$ 127,045	$ 73,941
2007	13,794	285	$ 27,075	$ 4,400	$ 31,475	$ 17,120
2008	4,512	-	$ -	$ -	$ -	$ -
2009	578,639	2,544	$ 241,680	$ 4,400	$ 246,080	$ 116,911
2010	12,652	280	$ 26,600	$ 4,400	$ 31,000	$ 13,764
2011	50,862	433	$ 41,135	$ 4,400	$ 45,535	$ 18,895
2012	27,380	339	$ 32,205	$ 4,400	$ 36,605	$ 14,196
2013	5,552	-	$ -	$ -	$ -	$ -
2014	21,469	315	$ 29,925	$ 4,400	$ 34,325	$ 11,627
2015	120,850	713	$ 67,735	$ 4,400	$ 72,135	$ 22,836
2016	372,569	1,720	$ 163,400	$ 4,400	$ 167,800	$ 49,646
2017	209,243	1,067	$ 101,365	$ 4,400	$ 105,765	$ 29,245
2018	43,088	402	$ 38,190	$ 4,400	$ 42,590	$ 11,006
2019	11,336	1,375	$ 130,625	$ 4,400	$ 135,025	$ 32,610
2020	34,639	368	$ 34,960	$ 4,400	$ 39,360	$ 8,884
TOTAL			$1,260,365	$70,400	$1,330,765	$ 563,835

TABLE 3 - DERIVATION OF ANNUALIZED COSTS PER AIRPLANE, BY MODEL

MODEL GROUP (A)	SUBJECT AIRPLANES (B)	AFFECTED AIRPLANES (C)	PRESENT VALUE COST TO INDUSTRY (D)	PRESENT VALUE COST PER AIRPLANE (E)
A300	76	0	$0	$0
A310	31	31	$601,060	$19,389
A320	119	119	$1,493,097	$12,547
ATR42	109	109	$623,904	$5,724
ATR72	51	51	$342,716	$6,720
B707	8	0	$0	$0
B727	870	0	$0	$0
B737	1,096	0	$0	$0
B747	236	0	$0	$0
B757	467	467	$7,377,005	$15,797
B767	214	214	$4,867,917	$22,747
B777	12	12	$604,373	$50,364
BAE 146	26	26	$243,108	$9,350
BAE ATP	10	10	$94,094	$9,409
BAE JETSTREAM 31/32	102	102	$4,638,150	$45,472
BAE JETSTREAM 41	25	25	$1,218,783	$48,751
BEECH 100 KING AIR	1	1	$53,347	$53,347
BEECH 1300 AIRLINER	2	2	$292,487	$146,243
BEECH 18 TWIN BEECH	13	0	$0	$0
BEECH 1900 AIRLINER	178	178	$8,409,208	$47,243
BEECH 200 SUPER KING AIR	9	9	$383,508	$42,612
BEECH 300/350 SUPER KING AIR	2	2	$146,945	$73,472
BEECH 400 BEECHJET / MU DIAMOND	1	1	$137,086	$137,086
BEECH 58 BARON	3	3	$308,129	$102,710
BEECH 76 DUCHESS	2	2	$116,074	$58,037
BEECH 80 QUEEN AIR	2	2	$60,542	$30,271
BEECH 90 KING AIR	10	10	$332,423	$33,242
BEECH 99 AIRLINER	27	27	$1,221,247	$45,231
CANADAIR CL600	39	39	$261,079	$6,694
CANADAIR REGIONAL JET	2	2	$42,975	$21,487
CASA 212 AVIOCAR	1	0	$0	$0
CESSNA 208 CARAVAN	243	243	$10,620,940	$43,708
CESSNA 210 CENTURION	6	6	$195,103	$32,517
CESSNA 310	1	1	$36,385	$36,385

CESSNA 320 SKYKNIGHT	1	0	$0	$0
CESSNA 401/402	87	87	$2,799,849	$32,182
CESSNA 404/414/421	2	2	$102,097	$51,048
CESSNA 500/525/550 CITATION	4	4	$338,390	$84,597
CESSNA 560 CITATION V	2	2	$146,095	$73,048
CONVAIR (ALLISON) 580	15	0	$0	$0
CONVAIR 240	6	0	$0	$0
CONVAIR 440 METROPOLITAN	12	0	$0	$0
CONVAIR 600/640	17	0	$0	$0
DASSAULT FALCON 10/20	17	17	$282,131	$16,596
DHC6 TWIN OTTER	51	51	$1,210,519	$23,736
DHC7 DASH 7	25	25	$1,203,241	$48,130
DHC8 DASH 8	143	143	$7,866,180	$55,008
DORNIER 328	37	37	$193,994	$5,243
DOUGLAS DC10	205	0	$0	$0
DOUGLAS DC3	11	0	$0	$0
DOUGLAS DC6	19	0	$0	$0
DOUGLAS DC8	178	0	$0	$0
DOUGLAS DC9	471	0	$0	$0
DOUGLAS MD11	66	66	$3,513,601	$53,236
DOUGLAS MD80	617	0	$0	$0
DOUGLAS MD90	19	19	$252,573	$13,293
EMBRAER 110 BANDEIRANTE	11	11	$650,652	$59,150
EMBRAER 120 BRASILIA	195	195	$999,362	$5,125
EMBRAER 145	5	5	$52,350	$10,470
EVANGEL 4500	1	0	$0	$0
FAIRCHILD SA226 MERLIN	11	11	$601,537	$54,685
FAIRCHILD SA227 METRO	105	105	$4,816,987	$45,876
FOKKER 100 / F28	156	0	$0	$0
FOKKER F27 FRIENDSHIP	45	0	$0	$0
GA AERO COMMANDER 500/600/700	19	0	$0	$0
GA GRUMMAN 1159 GULFSTREAM I/II	1	0	$0	$0
GRUMMAN G44 WIDGEON	1	0	$0	$0
IAI 1123/24/25	1	1	$319,621	$319,621
LEARJET 24	3	3	$154,701	$51,567
LEARJET 25	5	5	$154,953	$30,991
LEARJET 35/36	7	7	$331,919	$47,417
LOCKHEED 1329 JETSTAR	2	2	$293,783	$146,891
LOCKHEED L1011	107	0	$0	$0
LOCKHEED L188 ELECTRA	24	0	$0	$0
MITSUBISHI MU2	1	1	$41,886	$41,886
NAMC YS11	8	8	$363,685	$45,461
PBN 2 ISLANDER	32	32	$883,418	$27,607

PBN 2 TRISLANDER	4	4	$123,697	$30,924
PIPER 23 235/250	7	7	$161,345	$23,049
PIPER 31 CHEYENNE	4	4	$206,463	$51,616
PIPER 31 NAVAJO	66	66	$2,327,289	$35,262
PIPER 34 SENECA	8	8	$246,233	$30,779
PIPER 60	2	2	$86,791	$43,396
RAYTHEON/BEECH/BAE/HS 125	3	3	$384,716	$128,239
SAAB 340	219	219	$1,143,430	$5,221
SABRE (ROCKWELL) 40-80	2	2	$303,967	$151,984
SHORTS 360	53	53	$2,694,768	$50,845
SHORTS SC7 SKYVAN	1	0	$0	$0
TOTALS	7,108	2,901	$79,973,907	

REGULATORY IMPACT
Executive Order 12866 and DOT Regulatory Policies and Procedures
Economic Evaluation Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. section 2531-2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act also requires the consideration of international standards and, where appropriate, that they be the basis of U.S. standards. And fourth, the Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation.

In conducting these analyses, the FAA has determined this rule:

1) has benefits which do justify its costs, is a "significant regulatory action" as defined in the Executive Order and is "significant" as defined in DOT's Regulatory Policies and Procedures;
2) would have a significant impact on a substantial number of small entities;
3) would not constitute barriers to international trade; and
4) does not impose an unfunded mandate on state, local, or tribal governments, or on the private sector. These analyses, available in the docket, are summarized below.

Description of Costs

The primary costs of the proposed rule would be borne by those scheduled operators of multiengine airplanes not currently subject to a mandatory corrosion prevention and control program. Additional costs would also be incurred by manufacturers who participate in the assessment and development of the corrosion programs for the affected airplane models, but this evaluation assumes that all such costs would eventually be passed through to the operators. The FAA itself would incur relatively minor costs for reviewing and approving (1) the corrosion prevention and control programs, and (2) the incorporation of these new procedures into the existing maintenance and inspection programs.

Note that the attributed costs of this proposal do not include the expense of making major repairs or modifications that may be found necessary during the inspections mandated by this proposal. While the agency recognizes that such repairs may constitute a significant expense, their costs are not attributed to this proposed rule because existing FAA regulations require that repairs be made as found to be necessary to assure the continued airworthiness of the airplane.

The methodology used in the evaluation first computes the costs that would be incurred if it were economically viable for all of the airplanes in the affected fleet to meet the requirements of the proposed rule. Based on these costs, and their comparison to the approximate fleet value, the methodology later estimates the numbers of airplanes and models where compliance would not actually be economically viable, and where instead, the airplanes would likely be retired from scheduled service.

Approximately 7,100 airplanes were identified as being *subject* to the proposed rule. For the majority of these airplanes, the proposal would not generate any additional costs, since the subject airplanes already comply with airworthiness directives that parallel the proposal. Some 2,900 airplanes would be *affected* by the proposal in one manner or another, and as such would incur costs.

In projecting the cost of the proposed rule, development cost factors were estimated for each airplane model. These factors, ranging from zero to one, represent the proportion of full CPCP development costs that would be incurred for each airplane model group. The factors account for the fact that full compliance programs are in place for some models (factor = 0) and that the development costs for some other models would be reduced to less than 1 either due to their similarities to other models or because some models have partially compliant programs. The factors also account for the fact that airplanes certificated under existing § 25.571, amendment 45 or later, are already required to undergo an evaluation of their strength, detail design, and fabrication to show that failure due to corrosion will be avoided throughout the operational life of the airplane.[1] For these newer models, development factors of .1 were assigned to represent the estimated additional effort (equal to one-tenth of a completely incremental CPCP evaluation and development) that would be necessary to comply with the proposed rule. Taken together, the various cost factors produce an estimated cost equivalence of approximately 47 full CPCP development efforts among the 88 model groups that were identified.

The cost methodology employs a three step functional estimate of the time needed to develop each CPCP. First, the nominal number of development hours is estimated as a function of the average maximum takeoff weight (MTOW) for each model.

Eq. 1. $$\text{Hours} = 2{,}296 + (.04 \times \text{MTOW})$$

This equation was derived from a two-point linear plot of the estimated costs expended to develop the CPCP for two existing airplane models (the DC-9 and the Piper Navajo). The results of the Eq. 1 estimates were then multiplied by the development factors to account for the reduced development efforts for similar or partially compliant models described above. Finally, a third factor (described below) was applied to account for the possibility that a CPCP would not be developed for an airplane model where it was reasonably expected that the airplanes of that model would have been retired before the effective period of the proposed rule.

The hours for development were converted into cost estimates for each model by applying a fully burdened engineering cost rate of $95 per hour for CPCP development. This produced a cost per model ranging between $32,000 and $427,000. The estimated development cost for all models totals to $10.4 million, or $7.9 million expressed in present value terms.

It was also necessary to estimate the FAA's costs to review and approve the CPCP's described above. The evaluation employs a simple factor of 80 hours of review per newly developed CPCP, at a burdened cost rate of $55 per hour. This produces estimated costs of $4,400 per model and for the affected fleet the total cost is $246,400, or in present value terms $141,171.

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[1] Similar requirements exist under §23.574 for commuter category airplanes, and damage tolerance requirements related to the effects of corrosion for both composite and metallic airframe structure are

Similar to the "development" cost factors described above, the evaluation also employed "implementation" cost factors for each model. The implementation factors also range between zero and one, and constitute the expected proportions of full incremental implementation effort that would be caused by the proposal for each model. In addition to accounting for the existence of fully or partially compliant CPCP's themselves, the implementation factors also account for those cases whereby an industry developed CPCP may exist for a given airplane model, but either its implementation is not currently mandated by FAA direction, or the associated work level would be increased by this proposal. The evaluation projects the work load equivalence of full incremental implementation in 60 of the 88 affected model groups.

The first stage of implementation for the proposed rule would be incorporating the model-specific CPCP into an operator's maintenance or inspection program. Data were cross-tabulated to determine the distribution and number of unique combinations of operators and subject airplane models to estimate the number of new CPCP's that would need to be incorporated into existing operator programs (487 operator-model combinations.) In turn, the expected cost of these CPCP incorporations for the operators of each model were computed by multiplying the number of operator-model combinations, by an estimated 40 hours incremental work per incorporated program, and by a unit labor rate of $55 per hour. The total expected cost of this work, across all operator-model combinations, sums to $609,400, or $434,494 in present value.

Similar to their review of the actual CPCP's, FAA personnel would also need to review and approve the incorporation of the CPCP's into the existing maintenance and inspection programs of the operators. The calculation of these costs parallels the operator cost calculation from above with the exception that only 8 hours of review work would be necessary per incorporation. These "second" FAA review costs sum to $121,880, or $79,683 in present value. FAA review costs are expected to be incurred in 2003.

Next, the calculation of the actual operator inspection activities that would result from the CPCP's are computed. The evaluation assumes that the proposed rule would become final at the end of the year 2000, that the required new CPCP's would be developed by the end of the year 2002, and that inspections and

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found in §§23.573(a) and (b), respectively.

maintenance, where scheduled, would start in the year 2003. The evaluation uses a 20-year study period (from the effective date of the rule) and, therefore, assesses expected costs through the year 2020. The inspections for any particular airplane would not begin before the time specified in the CPCP for that model, and the initiation of work under the CPCP's would vary by airplane model and by individual airplane structure. This evaluation assumes that the preponderance of corrosion related inspection and maintenance work under the proposed rule would begin in the tenth year of an airplane's operation. The evaluation further assumes that the airplanes under this proposal would not be retired from service until age 35.

The four parameters described above are used to estimate the projected number of years that inspections under this proposal would be conducted within the study period. For each airplane model, this period is calculated as the intersection of: (1) the years included within the study period, and (2) the years where the average age of the affected airplanes would be between 10 and 35 years old.

The projected, average number of years that each model would be inspected under the program multiplied by the number of affected airplanes in each model produces the expected airplane-years of program coverage under the proposal, by model. This figure, in turn, is multiplied by the projected number of hours of work per year that the CPCP would require, and by the cost of labor per hour for that work, to produce the estimated cost of implementation. The assumed unit cost rate is $55 per hour. The projected annual number of work hours for each airplane under the proposal is computed as a function of airplane size (maximum takeoff weight).

Eq. 2. $$\text{Hours} = 88 + (.0006 \times \text{MTOW})$$

This functional estimate was derived from a linear regression of the airplane weights and the annual work-hour projections included in 13 CPCP airworthiness directives (the original eleven plus two subsequent directives for the Casa C-212 and the Fokker F-27) mandating industry developed corrosion programs. The "hours per airplane per year" results are the product of the functional estimate in Equation 2, above, multiplied by the implementation factors described previously. Finally, the projected inspection costs over the study period are computed as the product of: (1)

the numbers of airplane-years of coverage under the program, (2) the work hours per airplane per year, (3) a unit cost factor of $55 per hour for the inspection and maintenance work, and (4) a factor of 1.2 to account for the 20 percent overhead of paperwork and record keeping. These computations forecast a total of $155 million ($64.5 million in present value) in inspection costs through the year 2020.

In addition to the actual costs of inspecting the airplanes, costs can also be attributed to the incremental downtime that would be necessitated by the work required under the proposal. The evaluation assumes that each 40 hours of work necessitated by the CPCP requirement would require 1 additional day of airplane downtime. The projected additional down-days are computed as the product of: (1) the number of airplane years in the program, (2) the work hours per airplane per year, and (3) the assumed unit factor of 1 down-day per 40 hours of added work. Under these assumptions, the evaluation projects 58,658 days of additional downtime for the affected fleet throughout the twenty-year study period as a result of the work attributed to the proposal.

The economic valuation of this downtime was computed under the assumption that the average productive return on capital is equal to 7 percent of the value of that capital, per year. Accordingly, the downtime costs were calculated as the product of: (1) the number of additional downtime days that would be required, divided by 365 days per year, (2) the estimated economic value of the fleet for each model, calculated at the median program year for that model, and (3) the 7 percent per year assumed rate of return on capital. These costs total $21.5 million, or in terms of present value $8.6 million.

Next, the present values (7 percent discount rate) of the four component industry costs were calculated. For computational expediency, the present value calculations assume that all development costs occur in the year 2002, operator incorporation costs occur in the year 2003, and both the inspection and downtime costs occur in the median year of the inspection program for each model. The present value of the total expected cost of the proposed rule to industry is $81.5 million, not including the FAA review costs described earlier.

PRESENT VALUE COST TO THE INDUSTRY

Development Cost	Operator Cost	Inspection Cost	Downtime Cost	Total Industry Cost
$7,913,985	$434,494	$64,524,942	$8,626,515	$81,499,936

As noted in the introductory remarks of the cost section, the calculations described above assume that all of the subject airplanes would comply with the CPCP requirements of the proposed rule. At this point, however, the evaluation recognizes that it may not, in fact, be economical to develop and implement a CPCP for some older airplane models with very few subject airplanes. In order to account for this possibility, the evaluation compares the expected industry costs of the rule with the estimated fleet values of the affected models. For 11 models, the program costs are projected to be prohibitive and the expected compliance costs for the model are removed from the program implementation costs, and instead, a reduction of 50 percent of the value of the airplanes in that model is assigned as the attributed cost of the proposed rule for that model. Under this scenario, the present value costs to industry of the proposed rule would consist of $78.7 million in implementation costs and $1.3 million in costs resulting from reductions in airplane value due to a forecast economic inability to comply with the proposal. The total present-value cost of the proposed requirement to industry is projected at $80.0 million. The present value of the FAA cost for review is estimated at $220,885.

In addition to the proposed requirements for existing airplane models, the proposal would also require baseline corrosion prevention and control programs for future, newly certificated airplane models that would likely be marketed for scheduled passenger operations. For the purpose of example, the evaluation assumes one new certification per year between the effective date of the proposed rule and the end of the evaluation study period. In order to represent the likely sizes of the airplanes that might be certificated, the existing airplane models evaluated above were sorted by maximum takeoff weight, and were grouped into 18 classifications. The average weight of the airplanes in each of these 18 classes was then computed to represent the likely size of airplanes that would be certificated in each of the 18 years of the study period. In an effort to remove the bias of the order in which the various size airplanes were presumed to be certificated over time, the 18 airplane weight classes were assigned randomly across the 18 study years.

As noted above, the existing certification standards for all part 25 models and for certain part 23 models (commuter category and composite materials airplanes) require that future airplane models undergo an evaluation of their strength, detail design, and fabrication to show that failure due to corrosion will be avoided throughout the operational life of the airplane. As previously described, a development factor of .1 was assigned to the existing airplane models that were certificated to these standards, and in a parallel fashion, one-tenth of a full development cost is also assigned to the affected future airplane models. It should be noted that the existing certification procedures that would cause this reduced incremental impact are not required for metallic (non-composite material) airplanes in the normal, utility, or acrobatic categories for part 23. The evaluation assigns to these airplanes (weighing 12,500 pounds or less) a CPCP factor of .5, which recognizes that: (1) in the absence of this rule, these airplanes would not be substantially compliant with a CPCP requirement, but (2) substantial savings (one-half) in CPCP development would be realized as the development of the corrosion program would be included in the development of the airplane itself, rather than retroactively considered for an existing model.

The evaluation also recognizes that not all future airplane models will likely be marketed or used for scheduled passenger operations. In the absence of model-specific information, the evaluation assumes that future models under 6,000 pounds (2 of the 18 models considered here) would not incur additional costs as a result of this rule.

Returning to the computations, the estimated hours necessary to develop a CPCP for each airplane model in the example forecast were computed using the same formula that was used above (Eq 1; Hours = 2,296 + (.04 x MTOW)) with the result being multiplied by a factor of either .1 or .5 depending, respectively, on whether the airplane model was above or below 12,500 pounds. Again, parallel to the previous computations, the development costs were computed by multiplying the expected development hours by an engineering labor rate of $95 per hour. Similarly, the expected FAA review costs were computed as 80 hours of review per CPCP, multiplied by a unit labor factor of $55 per hour. Finally, the industry and FAA costs were combined for a total projected development and review cost of $1.3 million. The present values of these costs sum to $563,835.[2]

In summary, over the twenty-year study period of this analysis, the proposed CPCP operating requirement for existing certification models is projected to cost $80.0 million to the industry and $221 thousand to the FAA (all costs in present value.) For newly type certificated models, the proposed rule is projected to cost $534 thousand to the industry and $30 thousand to the FAA.

Description of Benefits

The purpose of this rulemaking is to assure that corrosion does not degrade the airworthiness of affected air carrier airplanes. The corrosion prevention and control program contained in this proposal originates, in part, from the recommendations following the investigations of the Aloha Boeing 737-200 accident on April 28, 1988 when 18 feet of upper fuselage separated from the airplane in flight. The National Transportation Safety Board determined the probable cause of that accident was that corrosion and metal fatigue led to separation of the airplane's skin and structure.

All metal airframe structures are vulnerable to corrosion and older aircraft are much more likely to experience corrosion than newer airplanes. Corrosion is a natural process and occurs because of the tendency of metals over time to return to their original state. Maintenance and inspection records reveal that the presence of corrosion is more prevalent and pervasive in older aircraft. A review of the annual total of the number of listings in the Service Difficulty Reports involving corrosion over a subset of U.S. commercial airplanes provides a sense of the magnitude of the problem.

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[2] This evaluation does not address the "inspection" portion of the costs that would result for these future models since, within the study period, very few airplanes would be certificated and produced, and then age to the point where the inspections from a CPCP would be prevalent. Furthermore, the present values of these few, out-year expenses would be negligible relative to the other costs of this proposal.

Number of Service Difficulty Reports Involving "Corrosion"

1990 - 1997

	Year of Occurrence							
Aircraft Type	1990	1991	1992	1993	1994	1995	1996	1997
B-727	2293	1746	3126	2786	2874	2520	2308	2350
B-737	536	521	928	1003	1099	906	868	1223
B-747	523	222	433	441	228	422	522	899
DC-9	564	436	375	732	657	1197	1104	1037
DC-10	117	78	217	122	281	111	364	602
MD-80	4	0	14	21	44	14	5	28
A-300	11	18	32	37	10	17	109	184
Total	4048	3021	5125	5142	5193	5187	5280	6323

The problem of corrosion is that it is both prevalent and destructive. Multiple Site Damage (MSD) is an undesirable condition caused by wide spread cracking of an airplane structure. R. Plelloux, et al in "Fractographic Analysis of Initiation and Growth of Fatigue Cracks at Rivet Holes writes "In the case of MSD, fatigue cracks are reported to initiate at rivet holes in the fuselage lap joints after the epoxy bond failed as a result of corrosion in high humidity environments ... the cracks grow to a length of approximately 6 to 8 mm (.25 inches to .30 inches) on each side of the rivet, before fracture by tensile instability. Note that rivets (on the airplane skin) are spaced an inch apart center to center. Crack growth in service has been reported to occur over 20,000 to 40,000 cycles." Thus corrosion can cause multiple cracks around a rivet. When the cracks reach a length of .25 to .3 inches fracture by tensile instability occurs. Cracks have been reported in aircraft with much fewer cycles than those recently upgraded from Stage 2 to Stage 3 standards in the last ten years.

Corrosion's detrimental effects are not limited to rivet holes. Corrosion decreases the size of structural members and can also have bad synergisms with factors leading to early cracking. When a fatigue crack reaches a corroded section the growth rate of the crack increases by a factor of 3 (J.P. Chubb, et al, "The Effect of Exfoliation Corrosion on the Fatigue Behavior of Structural Aluminum Alloys"). The NTSB report to the FAA on the Aloha Boeing 737 accident cited finding corrosion in the throttle cables (in the leading edge). When the appropriate cable sections were removed from the aircraft and inspected there were indications of corrosion and this corrosion likely weakened the cables so that they separated at lower than design load. Corrosion was present for the entire length of that portion of the cable routed through the leading edge.

Since different sources may use slightly different definitions, for charity, several important definitions are now identified. The definition of multiple site damage is a source of widespread fatigue damage characterized by the simultaneous presence of fatigue cracks in the same structural element (i.e., fatigue cracks that may coalesce with or without other damage leading to a loss of required residual strength). Widespread fatigue damage (WFD) in a structure is characterized by the simultaneous presence of cracks at multiple structural details that are of sufficient size and density whereby the structure will no longer meet its damage tolerance requirement (i.e., to maintain its required residual strength after partial structural failure). Multiple element damage (MED) is a source of widespread fatigue damage characterized by the simultaneous presence of fatigue cracks in similar adjacent structural elements.

The Boeing 737 lap splice design originally required a good bond for load transfer. Environmental degradation caused the bond to deteriorate to the point where all of the load transfer ended up transferred through the fasteners, which were never designed to take that load. MED can also result from corrosive environments as well.

Benefits - A Risk Assessment

The FAA employed GRA[3], Inc. to provide a risk assessment to help make determinations regarding the likelihood of aviation accidents related to corrosion. Under this contract, GRA qualitatively identified and characterized the types of potential corrosion hazards faced by aircraft and developed a method to assign quantitative risk evaluation.

For their analysis, GRA relied upon the National Transportation Safety Board (NTSB) Aviation/Incident Database. The NTSB database contains detailed information on over 37,000 accidents that have been catalogued since 1985; it includes a "sequence of events" history for each accident that describes the events leading up to an accident. A broad search of the 37,000 NTSB accidents resulted in a total of 1,551 accidents that were examined in detail.

The FAA Incident Data System (AIDS) was used to help assess the impacts of the Airworthiness Directives issued in the early 1990's. The FAA Service Difficulty Reporting System (SDRS) assisted by providing information assessing the incident and severity of the corrosion problem, as well as information of the effectiveness of current safety programs. GRA found it difficult to link incident and service difficulty reports with observed or anticipated changes in accident or incident rates. As a result, GRA took a conservative approach by not attempting to quantify benefits using either AIDS or SDRS.

The methodology employed by GRA is known as "event tree" analysis. Event tree analysis is used to characterize a chain of events leading to accidents under a variety of circumstances. This methodology has been used successfully in other environments where, as with aircraft, the probabilities of occurrence are very small.

Event trees are defined by:

- An initiating event
- A further chain of events related to "safety functions", which represent aircraft system responses or operator actions when a particular event occurs
- A terminating event
- Estimation of success and failure probabilities at relevant nodes in the event tree

An event tree should define a comprehensive set of accident sequences that encompass the effects of all possible accidents involving the aircraft. These trees begin with the initiating event, or the starting point. Following the initiating event, the set of events related to safety functions, which end with the terminating, event is specified. With the event tree constructed information from the NTSB, 1,551 accidents were used to populate (provide probability estimates) the tree.

Event trees with corrosion-induced initiating events were

[3] "CORROSION PREVENTION AND CONTROL RISK ANALYSIS", FAA Contract No. DTFA01-93-C-00066, Work Order 52, Prepared by GRA, Incorporated, May 12, 1999. A copy of this document is filled in the docket.

defined based on these records for the following ten aircraft systems:

- Flight control surfaces/attachments
- Flight control system-internal
- Landing gear
- Fuselage forward
- Fuselage center
- Fuselage aft
- Fuel system
- Nacelle/Pylons
- Engines
- Electrical systems and wiring

The subsequent events, which occur after the initiating event, were defined with the following generic sequence:

- Operator error in addressing/mitigating the initiating event
- Failure of operator to recover after initial failure to address/mitigate
- Failure of flight control function
- Failure of operator to recover flight control function
- Failure of landing gear during take-off or landing
- Failure of operator to recover landing gear function

Beginning with the initiating event probability, each subsequent event probability is multiplied across each branch. The multiplication of events along each branch results in the probability of an outcome (or terminating event). Summing the terminating event probabilities, which end in damage, equals the probability of a corrosion-related accident by aircraft system. GRA's Table 2 with the estimated corrosion-related accident rates by aircraft system is reproduced below.

Estimated Corrosion-Related Accident Rates by Aircraft System	
Aircraft System	Rate per 1,000,000 Operations
1. Flight Control	6.53 E-02
Attachments	7.51 E-02
2. Flight Control System	1.89 E-01
(internal)	9.60 E-03
3. Landing Gear	1.97 E-02
4. Fuselage Forward	2.05 E-03
5. Fuselage Center	2.63 E-02
6. Fuselage Aft	1.94 E-02
7. Nacelle/Pylons	2.15 E-01
8. Fuel Systems	8,80 E-02
9. Engine	
10. Electrical Wiring	
Total	7.01 E-01
Skin-Related Only (1,4,5,6,7)	1.23 E-01

These probabilities of occurrence then need to be translated into numbers of accidents. Since the probabilities are rates per one million operations, estimates of future operations were needed. GRA computed the total take-offs and landings at US airports from the May 1996 Official Airline Guide (OAG). This estimate is conservative as it excludes U.S. aircraft performing foreign operations. The initial estimate of affected operations was 23,231,976 for 1996.

GRA then excluded aircraft already subject to existing ADs and discounted the number of operations for other aircraft subject to other overlapping directives and rules. After scaling down the total number of operations, the adjusted estimate was 7,150,932 US operations that would be affected by the proposed rule. To this adjusted OAG base, GRA applied the growth rate in FAA airport operations for air carriers and air taxi/commuters through the year 2008. By 2008, the number of affected operations rises to 9,133,300. Based upon the GRA databases and methodology, in the absence of this rule or other preventative action, it is estimated that over the period of 1999 through 2008 ten accidents due to corrosion are likely to occur in the part 121, 129 and 135 fleets.

More than 27 percent of the airplanes subject to this proposal are already 20 years old or older; 7 percent are over 30 years old; and 1 percent of the airplanes are over 40 years old. The number of airplanes in air carrier service operating beyond their expected life is growing larger. As airplanes age, the likelihood of corrosion increases. Corrosion causes the formation of cracks and accelerates the growth of existing cracks. Thus corrosion is an identified problem presenting a growing threat to aviation safety. Experience has demonstrated that, under existing maintenance and inspection procedures, the FAA cannot assure the continuing airworthiness of these airplanes. This constitutes an unacceptable risk to air transportation.

The FAA has extensively deliberated on how to mitigate this risk. Technical experts and academic leaders were consulted. Based upon these considerations and deliberations, the FAA believes that the corrosion prevention and control procedures proposed in this rule are the best approach to assure the continued protection of the subject fleet from corrosion damage that could impact safety.

The primary benefit of this rule is increased aviation safety through assurance that the affected airplanes are free from dangerous corrosion. As has been shown, service difficulty reports of corrosion are increasing, and without this, or a similar rule, the FAA is convinced that unchecked corrosion will cause increasing numbers of future accidents. A secondary benefit from minimizing corrosion is to extend aircraft service life. In response to a corrosion-related accident, the FAA is likely to ground similar aircraft until it can be assured of their airworthiness. As more accidents occur to different aircraft types, or if the inspections show corrective measures can not restore airworthiness, the FAA may determine that aircraft of a certain age need to be retired from the air carrier fleet. Consequently, in addition to expected safety benefits, society would benefit by a longer utilization of the affected aircraft, thereby reducing the cost of air transportation. The FAA has attempted to quantify the safety benefits and discusses the extended life benefits in qualitative terms.

Safety Benefits

Based on GRA's risk assessment analysis, ten accidents due to corrosion could occur within the affected fleet during the ten year period 1999 through 2008. Since the period of analysis for this rule is 20 years, GRA's estimate has been extended by an additional ten years. A straight-line extrapolation based on the additional ten years of operations growth results in an estimate of about 25 accidents over a 20-year period. In this analysis such a straight-line forecast is viewed as a lower-bound estimate, because the GRA analysis did not factor in the joint problem an aging fleet coupled with unchecked metal corrosion increases the rate-of-risk over time. In order to provide an upper bound estimate, a simple, conservative methodology can be used. The actual probability distribution for corrosion-related accidents in the affected fleet is not known. A normal distribution, however, provides a close approximation of a number of other distributions. To be very conservative in this analysis, the FAA assumes that all affected aircraft remain in operation until a corrosion-related accident terminates their service. Under the assumption that the ten accidents from 1999 to 2008 belong to the left tail of a normal distribution of future corrosion-related accidents for the entire 2,900 affected aircraft, then it can be shown that these 10 accidents are more than 2.45 standard deviations from the mean. Assuming that these observations are 2.45 standard deviations from the mean, then 99.3 percent of the fleet would not have a corrosion-caused accident by 2008. This distribution has approximately a twenty-five year standard deviation. Such a distribution would have more than half of these aircraft still without a corrosion-caused accident fifty years from now. If this methodology can be accepted as providing a reasonable estimate of the upper bound of accidents, then in the absence of this rule, slightly more than 50 corrosion-related accidents are estimated to occur in the study period. This, in turn, provides a range of between 25 to 50 corrosion-caused accidents that may occur in 20 years.

As previously discussed, this proposed rule is directed toward the smaller air carrier aircraft. From NTSB data, GRA estimated that the average casualty counts per accident were 1.100 minor injuries, 0.474 serious injuries, and 1.605 fatalities. As a baseline estimate to compare safety benefits with costs, the FAA estimates that the value of: $38,500 to represent avoiding a minor injury, $51,800 to represent avoiding serious injury, and $2.7 million to represent avoiding a statistical fatality. Based on these values the expected benefit of avoiding one such accident today is $4.6 million, excluding the loss of the airframe, investigation, and ground damage. The FAA believes a conservative benefit estimate of avoiding such an accident is at least $5 million with a reasonable upper bound value of $6 million. Using the lower $5 million estimate and assuming that accidents for the are uniformly distributed over time, then in the thirteenth year the present value benefits of the accidents prevented roughly equals the cost of the proposed rule (at that time the number of accidents equals 34). Thirty-four accidents falls between the upper and lower bound estimates, and is considered a reasonable number that could occur.

This breakeven calculation assumes the proposed rule to be 100 percent effective in preventing these accidents. The FAA can not determine a priori the effectiveness of the proposed rule, but can provide a reasonable effectiveness range and the associated range of benefits. Assuming that the rule would prevent 40 to 80 percent of the expected 25 to 50 accidents, then the rule could be expected to prevent between 9 accidents (40 percent x 25 accidents) to 40 accidents (80 percent x 50 accidents). In the case of the lower bound estimate of 9 accidents, for the present value safety benefits to equal the cost of the rule, the value of an avoided accident would need to increase approximately fourfold. Such an increase is entirely feasible since the assumed 1.6 averted fatalities per accident is conservative. Included in the potentially affected fleet are 178 Beech 1900 airplanes each with 19 passenger seats. If just 2.4 of the prevented accidents are Beech 1900 airplanes with a 75 percent load factor, then the present value benefits exceed the present value of costs.

Exactly how many corrosion-related accidents will occur, which airplanes would suffer such an accident, and how effective the proposed rule would be can not be determined a priori. The FAA risk assessment estimated that this proposed rule would help to avert 25 to 50 accidents. The rule needs only to be effective enough to prevent 2.4 Beech 1900 accidents with 75 percent of the available seats occupied. It is known with certainty that corrosion currently exists in the fleet and if left unchecked will lead to accidents. Based upon this knowledge, and the estimates contained in this analysis, the FAA concludes that the benefits justify the costs of this proposed rule.

Unquantified Benefits

The FAA proposed rule would require scheduled corrosion inspections sooner than the much more costly emergency inspections that would follow a corrosion-caused accident. It is more economical and efficient to correct an unsafe condition proactively, than after an accident makes it clear that corrective action is past due and immediate measures must be taken. Performing the proposed procedures by this rule would allow air carriers to schedule inspections and repairs in a planned, orderly, least cost manner without disrupting aircraft service time. In cases where corrosion is occurring, this proposal would make it known sooner and allow more economical corrective action. On the other hand, without a corrosion inspection plan, metal corrosion will continue, accidents are expected, and once an accident occurs it is highly likely that the FAA will mandate inspections. In that case, there usually is not sufficient time to thoroughly evaluate alternative solutions; instead, immediate corrective action must be selected. Such urgent action is rarely the most economical choice. Compliance with emergency inspections will result in these inspections being unscheduled, airline operators will incur aircraft out-of-service-time costs, airline flight schedules can be disrupted, and flights can be canceled. All of these factors result in reduced airline profits and lower benefits to the traveling public.

As discussed above, it is expected that this proposal would result in corrosion damage observed sooner than it would otherwise, and therefore, the corrections would be less costly. In the absence of the rule, however, it is very possible for some aircraft that corrosion could continue to breakdown the metal undetected until it becomes uneconomic to repair the damage. In that event, earlier inspection could have extended the service life of such aircraft. It is expected that the proposed rule inspections would result in corrosion damage to be repaired before this damage would cause the aircraft to not be airworthy, or to be retired. Thus the proposed rule can extend the service life of the affected aircraft. Without knowing the condition the affected fleet, it is not possible to accurately quantify the dollar value of this benefit. However, it is possible to provide some idea of the value of longer service life by noting the value of extending the service life by one year of a hypothetical aircraft. In such a case, the annual capital loss equals the value of the aircraft multiplied by airline's rate-of-return on capital. For an aircraft whose resale value is a million dollars and when the rate-of-return on capital equals 10 percent, the annual capital loss is $100,000. In addition, the travelling public suffers when airline service is unexpectedly reduced by the corrosion-caused premature retirement of this aircraft.

The FAA believes that the unquantified benefits discussed above further support and justify this proposal. Addressing corrosion damage in an orderly fashion, rather than waiting for an emergency action to be required, provides for less interrupted commercial service and extends airplane service life. These outcomes are clearly benefits of this proposal, even though there is insufficient data to quantify these benefits at this time.

Comparison of Costs and Benefits

Corrosion is a natural process and occurs because of the tendency over time of metals to return to their original state. Maintenance and inspection records reveal that the presence of corrosion is more prevalent and pervasive in older aircraft. Based upon an independent risk analysis of over 1,500 National Transportation Safety Board accidents and conservative risk assessment results in a forecast of a range between 25 to 50 corrosion-induced accidents over a twenty-year period, with a present value benefit between $72.5 million and $145 million. The safety benefits of averting these accidents justify the costs of the proposed rule.

The FAA does not intend to wait for a series of accidents to provide justification for this proposed rule. The FAA needs the assurance of the corrosion prevention and control program to assure the continued airworthiness of the affected fleet. With this program in place the industry avoids unplanned inspections and maintenance resulting from corrosion-related accidents and benefits by an extended aircraft service life.

This proposed rule would extend to a significant number of airplanes the corrosion prevention and control program found to be necessary for in-service commercial jet airplanes based on studies following the Aloha Boeing 737 accident. Based on the analysis contained herein, the FAA concludes that the benefits of this proposed rule justify the costs.

IV. Initial Regulatory Flexibility Analysis

The Regulatory Flexibility Act of 1980 establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination finds that it will, the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify, and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

Recently, the Office of Advocacy of the Small Business Administration (SBA) published new guidance for Federal agencies in responding to the requirements of the Regulatory Flexibility Act, as amended. Application of that guidance to this proposed rule indicates that it would have a significant impact on a substantial number of small entities. Accordingly, a full regulatory flexibility analysis was conducted and is summarized as follows.

1. A description of the reasons why action by the agency is being considered.

This action is being considered in order to control airplane structural material loss and the detrimental effects of corrosion because existing maintenance or inspection programs may not provide comprehensive, systematic corrosion prevention and control.

2. A succinct statement of the objectives of, and legal basis for, the proposed rule.

The objective of the proposed rule is to ensure the continuing airworthiness of aging airplanes operating in air transportation by requiring all airplanes operated under part 121, all U.S. registered airplanes used in scheduled passenger carrying operations under part 129, and all multiengine airplanes used in scheduled passenger carrying operations conducted under part 135, to include a Federal Aviation Administration (FAA) approved corrosion prevention and control program (CPCP) in the airplane's maintenance or inspection program.

This proposal represents a critical step toward compliance with the Aging Aircraft Safety Act of 1991. In October of 1991, Congress enacted Title IV of Public Law 102 143, the "Aging Aircraft Safety Act of 1991," to address aging aircraft concerns. The act was subsequently recodified as 49 U.S.C. 44717. Section 44717 of Title 49 instructs the Administrator to "prescribe regulations that ensure the continuing airworthiness of aging aircraft."

3. A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes or types of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record.

The proposed rule would not impose any incremental record keeping authority. Existing 14 CFR 43, in part, already prescribes the content, form, and disposition of maintenance, preventive maintenance, rebuilding, and alteration records for any aircraft having a U.S. airworthiness certificate or any foreign registered aircraft used in common carriage under parts 121 or 135. The FAA recognizes, however, that the proposed rule would necessitate additional maintenance work, and consequently, would also require that the additional record keeping associated with that work also be performed.

The FAA estimates that each hour of actual inspection and maintenance conducted under the proposal would require an additional 20 percent of an hour (12 minutes) for reporting and record keeping. This record keeping would be performed by the holder of an FAA approved repairman or maintenance certificate. The projected record keeping and reporting costs of the proposal are included as part of the overall costs computed in the evaluation and included below in the Regulatory Flexibility Cost Analysis.

4. An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap, or conflict with the proposed rule.

The FAA is unaware of any federal rules that would duplicate, overlap, or conflict with the proposed rule.

5. A description and an estimate of the number of small entities to which the proposed rule would apply.

The proposed rule would apply to the operators of all airplanes operated under 14 CFR part 121, all U.S. registered multiengine airplanes operated under 14 CFR part 129, and all multiengine airplanes used in scheduled operations under 14 CFR part 135. Standard industrial classification coding does not exactly coincide with the subsets of operators who could be affected by the proposed rule. Nevertheless, the following distributions of employment size and estimated receipts per employee for all scheduled air transportation firms (SIC Code 4512) are representative of the operators who would be affected by the proposed rule.

EMPLOYMENT CATEGORY	NUMBER OF FIRMS	ESTIMATED RECEIPTS PER EMPLOYEE
0 - 4	137	$611,695
5 - 9	45	$510,555
10 - 19	52	$299,123
20 - 99	112	$264,065
100 - 499	78	$232,666
500+	70	$252,334
TOTALS	494	$252,214

Based on existing operator/airplane distributions, the FAA estimates that 210 operators would be subject to the rule and approximately 132 would actually incur costs.[4] The agency has also estimated the numbers of subject and affected airplanes that each operator uses and has categorized the operators by fleet size in the following table.

	COUNT OF OPERATORS	
OPERATOR CATEGORY (AIRPLANES)	SUBJECT TO RULE	AFFECTED BY RULE
1 - 10	119	84
11 - 20	37	16
21 - 30	12	4
31 - 40	8	6
41 - 50	4	4
51 AND UP	30	18
	210	132

6. Regulatory Flexibility Cost Analysis

The proposed rule would affect certain existing and future production aircraft, and it would also apply to new model airplanes intended for use in scheduled service. This Regulatory Flexibility Cost Analysis focuses on the first of these two categories because: (1) that impact represents almost 99 percent of the evaluated costs

[4] The remaining operators use airplane models that would be subject to the proposed rule but are already in full compliance.

of the proposed rule, and (2) it is possible to make some estimate of the distributional impact of these costs based on the existing operator fleet composition.

Table 3 in the Appendix details the computations used to estimate the annualized costs of the proposal per airplane, by model. Column A in Table 3 lists each airplane model and Column B details the estimated counts of the airplanes in each model that would be subject to the proposed rule. As noted in the evaluation, an estimated 7,108 airplanes would be subject to this major provision. These airplanes are included within the regulatory scope of the proposal but the vast majority would be unaffected because they already comply with the proposal. Column C, by comparison, shows the projected counts of those airplanes that would actually be affected; where incremental work would be accomplished and incremental expenses incurred. This column sums to a projected 2,901 airplanes. Column D contains the present value of the projected cost of the major proposal to industry, by airplane model, as computed in the regulatory evaluation and shown previously as Column AG of Table 1 in the Appendix. The present value estimated cost of this provision totals $80.0 million.

Column E of Table 3 divides the cost-per-model data in Column D by the numbers of affected airplanes per model in Column C to produce the expected present value cost of the proposal per affected airplane. It is useful to consider the annualized equivalent of these costs; that is to say, the annual future payments that would be necessary to equal the present value costs for each model. Such payments are a function of: (1) the assumed interest rate, and (2) the time period over which the future payments would be borne. Consistent with the discount factor, this evaluation applies a 7 percent interest rate. As for the time period, the evaluation assesses costs over a 20-year time period, and this analysis assumes that, on average, the CPCP development and implementation costs would be borne over that period. Based on these two assumptions, the annualized cost of the CPCP would range between $484 and $30,170 per airplane (for those airplanes that would actually be affected.)

Next, the annualized cost estimates, by model, *per affected airplane,* from Table 3 were collated into the original evaluation data set of operators and airplanes. Crosstabulations were performed and aggregated (see Table 4 in the Appendix) to project the expected annualized cost *per operator*. Table 4 includes all 210 of the estimated operators of airplanes that would be subject to the proposed rule, and projects that 132 would actually incur costs. The table includes counts, by operator, the number of airplanes that would be subject to (within the scope of) the proposed rule, and the numbers of airplanes that would actually be affected by the proposal. The data in these calculations are summarized in the table below which shows the average annualized impact per operator; where the operator classifications are grouped both by: (1) the number of all airplanes that the operator uses, and (2) the number of each operator's airplanes that would actually be affected by the proposal.

AVERAGE ANNUALIZED IMPACT PER OPERATOR

COUNT OF AIRPLANES *OPERATED*	AVERAGE ANNUALIZED IMPACT	COUNT OF AIRPLANES *AFFECTED*	AVERAGE ANNUALIZED IMPACT
1-10	$7,318	1-10	$14,057
11-20	$17,551	11-20	$46,479
21-30	$30,711	21-30	$72,326
31-40	$53,838	31-40	$104,708
41-50	$64,359	41-50	$55,789
51-60	$90,769	51-60	$196,433
61-70	$191,587	61-70	$195,857
71-80	$144,698	71-80	$185,253
81-90	$111,116	81-90	$111,116
91-100	$92,093	91-100	$112,023
100 Plus	$217,054	100 Plus	$460,822

7. Affordability Analysis and Disproportionality Analysis

As a measure of the affordability of the proposal, the table below shows a distribution of the projected annualized impacts of the proposed rule as a percentage of operator annual receipts. Operator receipt levels were estimated assuming: (1) the average of $252,214 annual receipts *per employee* for SIC Code 4512 operators, described above in Paragraph 5, and (2) an example factor of 5 employees per airplane operated. (This factor varies widely across operators.) The affordability statistic was then calculated for each of the 210 subject operators as the projected annualized cost of the rule for that operator divided by the product of $252,214 times 5 employees per airplane times the number of airplanes operated. Under these assumptions, the expected annualized cost of the proposal for 209 of the 210 operators falls below 0.6 percent of their respective estimated annualized receipts. For one operator, costs would total 1.38 percent of estimated receipts.

The table can also be used to gauge the disproportionality of the proposed rule's relative burden. The percentage impact calculations are shown for three sizes of operators, depending on the numbers of airplanes that they operate. The calculations show a minor disproportionate impact on smaller operators who are slightly under-represented in the lowest "percentage impact" categories, and correspondingly, slightly over-represented in the higher impact categories.

COUNT OF OPERATORS BY
PERCENTAGE IMPACT AND BY OPERATOR SIZE

PERCENTAGE	AIRPLANES OPERATED			
IMPACT	1-10	11-50	51 +	Total
0% - .1%	68	38	19	125
.1% - .2%	10	10	6	26
.2% - .3%	15	4	2	21
.3% - .4%	16	7	3	26
.4% - .5%	8	2	0	10
.5% - .6%	1	0	0	1
-----	--0--	--0--	--0--	--0--
1.3% - 1.4%	1	0	0	1
Total	119	61	30	210

8. Business Closure Analysis

The FAA feels that the annualized average impact of the rule as a function of an affected firm's average annual receipts is low. The agency recognizes, and this evaluation has described, that the potential impact for some operators may be above average and may not be distributed evenly over time. The cost methodology for this evaluation further addresses the fact that it may not be economical to develop and implement a corrosion prevention and control program for some older airplane models with few subject airplanes. The evaluation estimated that program costs would be prohibitive for 11 airplane models, and included a 50 percent reduction of fleet resale value as an estimated cost attributable to the rule.

9. Competitiveness Analysis

No quantitative estimate of the proposed rule's potential impact on small business competitiveness has been made. However, the FAA feels that the findings from the Affordability Analysis and the Disproportionality Analysis above support the argument that the proposed rule will not seriously impede small entity competitiveness.

10. Description of Alternatives

The FAA has considered several approaches to this proposed rulemaking and has attempted to minimize the potential economic impact of the proposal, especially the impact on the operation of aircraft most likely to be used by small entities. The principal alternative would be to take no new rulemaking action and to rely on the existing corrosion related requirements in parts 23 and 25. The FAA has determined that these existing requirements have not always resulted in a comprehensive and systematic corrosion prevention and control program for either transport, commuter, or small category airplanes. In addition, the FAA has determined that such inaction would not respond to the provisions of 49 U.S.C. 44717, which requires the Administrator to prescribe regulations that ensure the continuing airworthiness of aging aircraft.

A second alternative would be to omit all small aircraft from the proposal since there is an identifiable correlation between smaller firms and smaller aircraft. Again, the FAA opposes this alternative since it would leave the existing problem for a significant segment of the scheduled passenger industry and would create an unacceptable safety inequity.

As proposed, this rulemaking would apply to all airplanes operated under part 121, all U.S. registered multiengine airplanes operated under part 129, and all multiengine airplanes used in scheduled operations under part 135. The proposed rule would not include helicopters, single-engine airplanes operated under part 135 or part 129, airplanes used in cargo operations under part 135, or airplanes used in unscheduled (on-demand) operations under part 135.

The aircraft and operations omitted from this proposal are not exclusively operated by small entities, but the FAA holds that the excluded airplane categories are more likely to be operated by small entities than, for example, large transport category airplanes would be. As noted above, the proposed rule would actually affect some 2,900 airplanes. By comparison, the exclusions described here, taken together, remove an estimated 5,023 additional aircraft from the proposal. This includes, with overlap, 1,441 helicopters; 4,663 aircraft used in on-demand operations; and 1,812 single-engine aircraft.

The FAA specifically requests comments regarding the exclusion of such aircraft operations from this proposed rule.

11. Compliance Assistance

In its efforts to assist small entities and other affected parties in complying with the proposed rule, the FAA is publishing an advisory circular, "Development of Corrosion Prevention and Control Programs." A notice of availability for this circular will be published concurrently with the proposed rule. This circular details acceptable means of compliance with the proposed rule.

Additionally, the FAA has developed a CPCP for a generic, civil, twin-engine aircraft and will make this document available as part of the appendix to the advisory circular accompanying the proposed rule. This document can serve as a core framework for the baseline program for defining the corrosion prevention and control requirements for a subject airplane model based on the average operating profile and operating environment. This generic CPCP model would be particularly useful to small operators in the event that the type certificate holder for a given model is not available to develop the CPCP for that model.

International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards.

In accordance with the above statute, the FAA has assessed the potential effect of this proposed rule and has determined that the objective of the rule is to maintain the current level of safety. In addition, the rule would have only a domestic impact and therefore create no obstacles to the foreign commerce of the United States.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Pub. L. 104-4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a

Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this proposed rule would not contain a significant intergovernmental or private sector mandate as defined by the Act.