

GAO

Report to the Chairman, Subcommittee  
on Aviation, Committee on Public  
Works and Transportation,  
House of Representatives

May 1991

# AIRCRAFT MAINTENANCE

## Additional FAA Oversight Needed of Aging Aircraft Repairs (Vol. II)



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Resources, Community, and  
Economic Development Division

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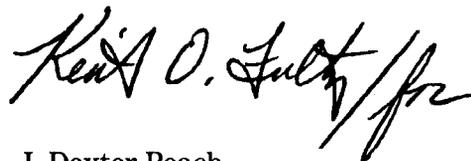
May 24, 1991

The Honorable James L. Oberstar, Chairman  
The Honorable William F. Clinger, Jr.  
Ranking Minority Member  
Subcommittee on Aviation  
Committee on Public Works and Transportation  
House of Representatives

This document is the second volume of our report to you on the United States aircraft repair station industry. Volume I discusses that portion of the industry that performs heavy airframe maintenance on large transport aircraft. Specifically, it examines increases in demand for heavy airframe maintenance; constraints on supply, including parts, skilled mechanics, and hangar space; and air carriers' efforts to comply with the new requirements for aging aircraft and the Federal Aviation Administration's (FAA) oversight of air carriers as they attempt to comply with the new rules. Volume II provides the questionnaire responses of the 48 air carriers and 35 independent repair stations participating in our review on the issues we examined in Volume I.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to the Secretary of Transportation; the Administrator, FAA; the Director, Office of Management and Budget; and other interested parties. We also will make copies available to others upon request.

This work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues, (202) 275-1000. Major contributors are listed in appendix VI.



J. Dexter Peach  
Director, Transportation Issues

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**Abbreviations**

FAA      Federal Aviation Administration  
GAO      General Accounting Office

# Objectives, Scope, and Methodology

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## Objectives

The Chairman and Ranking Minority Member of the Subcommittee on Aviation, House Committee on Public Works and Transportation, asked GAO to determine the aircraft repair industry's ability to satisfy the approaching demand by airlines for repair services. Based on a survey of U.S. airlines and independent aircraft repair stations, volume A of the report examines the

- increases in demand for heavy airframe maintenance;
- constraints on supply, including availability of parts, skilled mechanics, and hangar space; and
- air carriers' efforts to comply with the new requirements for aging aircraft and FAA's oversight of air carriers as they attempt to comply with the new rules.

To accomplish this, we mailed separate questionnaires to 54 commercial air carriers operating and maintaining their aircraft under the Code of Federal Regulations, title 14 Part 121 and 38 independent repair stations operating under the Code of Federal Regulations, title 14 Part 145.

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## Scope and Methodology

Our surveys included 54 air carriers operating large transport aircraft and 38 independent repair stations capable of performing heavy airframe maintenance and airframe modifications as of January 1, 1990. Appendix II and appendix III show the specific 48 air carriers and 35 independent repair stations, respectively, that responded to our surveys. We performed our review from January 1990 to February 1991, in accordance with generally accepted government auditing standards.

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## Developing the Survey Instruments

Between April 5, 1990, and July 11, 1990, we surveyed air carriers and independent repair stations. Specifically, we mailed questionnaires to air carriers operating large transport aircraft and similar, though not identical, questionnaires to independent repair stations capable of performing heavy airframe maintenance and airframe modifications on large transport aircraft. The topics of the surveys included a facility profile, including information such as the number of hangars and the facility's utilization rates for 1988, 1989, and 1990; maintenance being performed, including information such as the type of aircraft capable of being maintained and the types of maintenance capable of being performed; the number of personnel, including any shortages of mechanics; and any plans for expansion in the areas of hangars, personnel, or service.

Air carriers can either perform their own maintenance, as well as maintain other air carriers' aircraft, or they can contract with independent repair stations for maintenance. In developing the questionnaires, therefore, we visited both air carriers and independent repair stations to obtain critical reviews of and suggested changes to our questions and approach for the sake of clarity and completeness. On the basis of our objectives, we designed two separate questionnaires, one for airline-owned repair stations and one for independent repair stations. We developed the substance of the questionnaires using information from one air carrier and one independent repair station as a starting point. We added and deleted questions on the basis of suggestions provided by four other air carriers and three other independent repair stations.

To establish the potential universe of air carriers operating large transport aircraft and independent repair stations capable of performing heavy airframe maintenance and airframe modifications, we consulted a list of 65 air carriers provided by the Department of Transportation and a list of over 100 independent repair stations provided by FAA. After contacting and qualifying the 65 carriers and the 100 independents, we developed a universe of 54 carriers and 38 independent repair stations that perform heavy airframe and airframe modifications on large transport aircraft. We sent questionnaires to these air carriers and independent repair stations and received completed surveys from 48 carriers, representing 99 percent of the large transport aircraft in the U.S. fleet as of January 1, 1990, and 35 of 38 independent repair stations.

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## **Questionnaire Procedures**

We conducted pretests of our survey instrument at one air carrier and independent repair station. During each pretest session, an individual respondent completed a questionnaire in the presence of three GAO observers who timed the respondent and observed reactions to questions and question flow. Afterwards, the observers debriefed the respondent to identify ambiguities, incorrect use of technical language, potential bias, or other problems in question wording or questionnaire format.

Questionnaires were mailed to officials of air carriers and independent repair stations identified when contacts were made in the universe identification phase. We sent follow-up letters to nonrespondents. The letters also included a second copy of the questionnaire in case the respondent could not locate the original. We subsequently phoned some air carrier and independent repair station officials to clarify information provided in the questionnaires.

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## **Survey Results**

The completed responses to most of the survey questions can be found in appendixes IV and V. The responses for questions 7, 8, 37, 40, 45, and 62 of the air carrier questionnaire and question 25 of the independent repair station questionnaire were not given because of the sensitive nature of some questions. For the same reason, respondents were promised confidentiality to encourage a reply. In order to maintain confidentiality, a control number was written on each questionnaire upon receipt to identify the respondents without using their names.

# List of Air Carriers That Completed GAO's Mail Survey of Maintenance Activities

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Listed below are the 48 air carriers that completed our mail survey. These carriers represent 99 percent of the large transport aircraft in the U.S. fleet as of January 1, 1990.

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## Large Passenger Airlines (100 or More Aircraft)

American Airlines  
Continental Airlines  
Delta Air Lines  
Eastern Airlines  
Northwest Airlines  
Pan American World Airways  
Trans World Airlines  
United Airlines  
USAir

## Small Passenger Airlines (Less Than 100 Aircraft)

Alaska Airlines  
Aloha Airlines  
America West Airlines  
Hawaiian Airlines  
Markair  
Midway Airlines  
Midwest Express Airlines  
Southwest Airlines  
The Trump Shuttle

## Cargo Carriers

ABX Air, Inc.  
Air Transport International  
Amerijet International  
Arrow Air  
Buffalo Airways  
Challenge Air Cargo  
Connie Kalitta Services  
DHL Airways  
Emery Worldwide  
Evergreen International Airlines  
Express One International  
Federal Express  
Florida West Airlines  
Independent Air  
Ryan International Airlines  
Southern Air Transport

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**Appendix II  
List of Air Carriers That Completed GAO's  
Mail Survey of Maintenance Activities**

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TPI International Airways  
Trans Continental Airlines  
United Parcel Service

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**Charter Passenger  
Carriers**

Airlift International  
American Trans Air  
Casino Express  
Emerald Air Lines  
Great American Airways  
Key Airlines  
MGM Grand Air  
Private Jet Expeditions  
Rich International Airways  
Sun Country Airlines  
Tower Air

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# List of Independent Repair Stations That Completed GAO's Mail Survey of Maintenance Activities

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Thirty-five of the 38 repair stations to which we mailed surveys completed them and returned them to us. The repair stations that responded are located in 12 different states.

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## Independent Repair Stations

Aero Corp.  
Aerotest  
Aircraft Maintenance Services, Inc.  
Agro Air Associates  
Associated Air Center, Inc.  
Greenwich Air Services  
Boeing Commercial Airplanes-Seattle  
Boeing Wichita Company  
Clinton-Sherman Aviation, Inc.  
Commodore Aviation Services  
Cross Continent Aircraft Services, Inc.  
Dalfort Aviation Services  
Dee Howard Company  
DynAir Tech of Arizona  
DynAir Tech of Florida  
E-Systems, Inc.  
Chrysler Technologies Airborne Systems  
Elsinore Airframe Services, Inc.  
Georgetown Aircraft Services, Inc.  
Grumman St. Augustine  
Hamilton Aviation Company  
Hughes Aviation Services  
Intertec Aviation  
Lockheed Aeromod Center  
NARCAM Aircraft, Inc.  
Page Avjet Corp.  
Pan Aviation, Inc.  
Pemco Aeroplex-Birmingham  
Pemco Aeroplex-Clearwater  
Pemco Aeroplex-Dothan  
Professional Modification Services, Inc.  
Rockwell, North American Aircraft  
Tracor Aviation  
Tramco  
Volpar Aircraft Corp.

# Responses to Air Carrier Survey

## U.S. General Accounting Office



### Survey of Airline and Air Cargo Maintenance Activities

#### Introduction

The U.S. General Accounting Office (GAO) is an agency that reviews federal programs for the U.S. Congress. Congress asked GAO to determine how the aircraft maintenance industry can meet the increasing demands for aircraft maintenance and modification. There is special concern over a series of airworthiness directives (ADs) that will be issued by FAA. The new directives will require replacement or modification of specific parts of aircraft that were previously only recommended.

This survey is being sent to all Part 121 airline and air cargo carriers. Many of the questions can be answered by simply checking a box or filling in a blank. There is also space at the end to add any comments about your maintenance activities.

Please return the survey in the enclosed envelope within three weeks. If you have any question, call Steven Calvo of our Seattle Regional Office collect at (206) 442-5356.

If the return envelope is missing, please send your survey to:

Mr. Steven Calvo  
U.S. General Accounting Office  
Federal Building, Room 1992  
915 Second Avenue  
Seattle, WA 98174

#### Note:

1. N=total number of respondents answering the questions.
2. Unless otherwise noted figures reported are for the number of respondents giving the answers.
3. "Sum" indicates the totals for all respondents are reported.

#### DEFINITIONS

1. **Heavy airframe maintenance and airframe modifications.** Include the following activities:
  - Routine airframe maintenance [D checks or equivalent]; include nonroutine discrepancies and repairs; include service bulletins affecting airframes
  - Mandated FAA airframe inspections and modifications [FAA airworthiness directives (ADs) and other FAA rules affecting airframes]
  - Non-mandated airframe modifications affecting the airframe [for example, fleet standardizations, refurbishments, and reconfigurations affecting the airframe]
2. **Large transport aircraft:** Include the following aircraft—A-300, A-310, A-320, B-707, B-727, B-747, B-757, B-767, DC-8, DC-9, DC-10, MD-80, and L-1011.
3. **Your HAM/LTA facility:** Your air carrier's maintenance facility that handles *heavy airframe maintenance and airframe modifications* (HAM) for *large transport aircraft* (LTA). If your air carrier has more than one maintenance facility, please limit your answers to the facility that handles 50 percent or more of your heavy airframe maintenance for large transport aircraft.
4. **Your air carrier:** Your airline or air cargo company.

Carrier Name:

(attach label)

#### Air Carrier Fleet

1. As of December 31, 1989, did your air carrier (your airline or air cargo company) operate any large transport aircraft? (By large transport aircraft, we mean the following: A-300, A-310, A-320, B-707, B-727, B-737, B-747, B-757, B-767, DC-8, DC-9, DC-10, MD-80, and L-1011.) (Check one) N=48

1.  Yes
2.  No

If you checked "No" please STOP HERE. Please call Steven Calvo to notify him that you may have received our survey by mistake. If you checked "Yes" please complete the questionnaire. N=48

2. How many total aircraft were in your airline's fleet as of January 1, 1990? Include only aircraft listed on your air carrier's operating certificate. (Enter number)

3,788 aircraft

The 48 airlines had a total of 3,788 aircraft, with fleet sizes ranging from 1 to 503.

**Appendix IV  
Responses to Air Carrier Survey**

3. For each of the types of aircraft listed below, please give the number in your air carrier's fleet as of January 1, 1990, in column A. In column B, please give the number of each aircraft you expect to have in your fleet as of January 1, 1995. In column C, please give your best estimate of the number you expect to have as of January 1, 2000. If you have future orders for other models of large transport aircraft that are not on our list, please write these in items "o" through "r". (Enter numbers; if none, enter 0)

Number of Aircraft in Your Fleet as of . . .

	N=48 (A) Jan. 1, 1990	N=43 (B) (Projected) Jan. 1, 1995	N=33 (C) (Projected) Jan. 1, 2000
a. Boeing 707	26	19	17
b. Boeing 727	1,144	893	825
c. Boeing 737	743	1,060	1,294
d. Boeing 747	181	211	189
e. Boeing 757	149	379	321
f. Boeing 767	111	126	77
g. DC-8	138	144	106
h. DC-9	516	392	360
i. DC-10	177	197	142
j. MD-80	397	443	171
k. L-1011	102	15	15
l. Airbus 300	68	78	44
m. Airbus 310	19	23	30
n. Airbus 320	6	154	100
o. <u>Airbus 330</u>		35	41
p. <u>Airbus 340</u>		25	64
q. <u>MD-11</u>		33	17
r. <u>MD-90</u>		1	40
Fokker 100		116	40

\*Please specify other models of large transport aircraft that you have ordered.

**Other Aircraft in Your Fleet as of January 1, 1990**

s. Please list any other models in your fleet as of January 1, 1990, and the number of each below. (We do not need projections for 1995 or 2000 for these other models).

Model number	How many?	Model number	How many?
1. _____	_____	5. _____	_____
2. _____	_____	6. _____	_____
3. _____	_____	7. _____	_____
4. _____	_____	8. _____	_____

**Appendix IV  
Responses to Air Carrier Survey**

**Heavy Airframe Maintenance In-House**

4. During calendar year 1989, did your air carrier (your airline or air cargo company) handle 50 percent or more of the heavy airframe maintenance or airframe modifications (see definition, page 1) on your large transport aircraft (see definition, page 1) at your own facilities? N=48

- 1.  24 Yes → Skip to 6
- 2.  24 No → Go to next question

5. Does your air carrier plan to provide 50 percent or more of the heavy airframe maintenance or airframe modification service for your large transport aircraft in any one year between January 1, 1990, and December 31, 1995? (Check one) N=24

- 1.  1 Yes → Skip to 56
- 2.  23 No → Skip to 60

**Your Facility Profile (for air carriers who handle 50 percent or more of their heavy airframe maintenance)**

6. Does your air carrier conduct heavy airframe maintenance and airframe modifications (see definition, page 1) for large transport aircraft at more than one facility? (Check one) N=24

- 1.  12 Yes → Go to next question
- 2.  12 No → Skip to 8

7. Please list the locations (by city name, for example) where your air carrier conducts heavy airframe maintenance and modifications (see definition, page 1) for large transport aircraft. For each location, please give an approximate percentage for the portion of this work that your air carrier conducts at each facility location. We do not need precise numbers for these percentages; just give us an expert opinion. (Enter names, percentages)

	Percent of Heavy Airframe Maintenance and Modification for Large Transport Aircraft
1. _____	_____ %
2. _____	_____ %
3. _____	_____ %
4. _____	_____ %
5. _____	_____ %
	<b>Total 100%</b>

8. The questions in the next several sections of our survey concern the maintenance facility where you conduct 50 percent or more of your heavy airframe maintenance and airframe modifications (HAM) for large transport aircraft (LTA). We refer to this facility as your HAM/LTA facility. Please write the location name below for your HAM/LTA facility:

Name: \_\_\_\_\_

**Appendix IV  
Responses to Air Carrier Survey**

**Large Transport Aircraft Maintenance**

The questions below concern your air carrier's experiences with large transport aircraft. These include both those in your fleet and those of other air carriers for which you might provide maintenance services.

9. During either calendar year 1988 or 1989, did your HAM/LTA facility (see definition, page 1) provide maintenance or modification services to any of the following Boeing aircraft? (Check all that apply)  
N=24

- 1.  3 Boeing 707
- 2.  14 Boeing 727
- 3.  11 Boeing 737
- 4.  6 Boeing 747
- 5.  6 Boeing 757
- 6.  4 Boeing 767
- 7.  2 NONE OF THE ABOVE → Skip to 11

10. Please check the boxes for the types of service that your HAM/LTA facility provided to Boeing aircraft during calendar year 1988 or 1989 (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Scheduled Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. Boeing 707	2	2	3	2	2	2	1	1	1
b. Boeing 727	13	13	11	14	12	11	12	13	13
c. Boeing 737	9	10	10	11	10	8	8	9	8
d. Boeing 747	6	5	6	6	6	6	6	5	6
e. Boeing 757	5	6	5	6	6	6	6	6	6
f. Boeing 767	3	4	3	4	4	4	4	4	4

\* Include annual visits or equivalent under C Check.

+ Include heavy maintenance visits under D Check.

**Appendix IV  
Responses to Air Carrier Survey**

11. During either calendar year 1988 or 1989, did your HAM/LTA facility (see definition, page 1) provide maintenance or modification services to any of the following McDonnell Douglas aircraft? (Check all that apply) N=24

- 1.  DC-8
- 2.  DC-9
- 3.  DC-10
- 4.  MD-80
- 5.  NONE OF THE ABOVE → Skip to 13

12. Please check the boxes for the types of service that your HAM/LTA facility provided to McDonnell Douglas aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Sched. Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. DC-8	6	7	5	7	4	7	6	6	6
b. DC-9	10	12	10	12	10	11	10	11	11
c. DC-10	6	6	5	6	5	6	6	6	6
d. MD-80	5	8	6	8	7	5	7	7	8

\* Include annual visits or equivalent under C Check.

+ Include heavy maintenance visits under D Check.

**Appendix IV  
Responses to Air Carrier Survey**

13. During either calendar year 1988 or 1989, did your HAM/LTA facility (see definition, page 1) provide maintenance or modification services to any of the following Airbus aircraft? (Check all that apply) N=24

1.  4 Airbus 300
2.  1 Airbus 310
3.  1 Airbus 320
4.  8 NONE OF THE ABOVE → Skip to 15

14. Please check the boxes for the types of service that your HAM/LTA facility provided to Airbus aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Scheduled Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. Airbus 300	3	3	3	3	3	4	4	4	4
b. Airbus 310	1	1	1	1	1	1	1	1	1
c. Airbus 320	1	1	0	1	1	1	1	1	1

\* Include annual visits or equivalent under C Check.  
+ Include heavy maintenance visits under D Check.

15. During either calendar year 1988 or 1989, did your HAM/LTA facility (see definition, page 1) provide maintenance or modification services to any Lockheed L-1011 aircraft? (Check one) N=24

1.  5 Yes → Go to next question
2.  19 No → Skip to 17

16. Please check the boxes for the types of service that your HAM/LTA facility provided to Lockheed L-1011 aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Sched. Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. L-1011	5	4	4	5	4	5	4	4	4

\* Include annual visits or equivalent under C Check.  
+ Include heavy maintenance visits under D Check.

**Appendix IV  
Responses to Air Carrier Survey**

**Hangar Facilities**

17. Were there any months during *calendar year 1988* when the hangar space at your HAM/LTA facility (see definition page 1) was *not* used at full capacity? (Check one) N=24

1.  Yes → Go to next question  
2.  No → Skip to 20

18. Overall, what percent of the hangar space at your HAM/LTA facility was used in *calendar year 1988*? (Check one) N=13

1.  None  
2.  1-30%  
3.  31-40%  
4.  41-60%  
5.  61-80%  
6.  81-95%  
7.  96-100% → Skip to 20

19. To what extent, if any, do each of the following explain why you did *not* use more of the hangar space at your HAM/LTA facility in *calendar year 1988*? (Check one for each row) N=12

	Major Reason	Minor Reason	Not a Reason
a. Unable to hire enough skilled labor	2	10	0
b. Could not obtain enough equipment/tools	0	1	11
c. Could not obtain enough spare parts	0	0	12
d. Low demand for service	2	3	7
e. Air carrier schedules created gaps in hangar use	3	2	7

f. Please describe any other reasons below.  
7 comments

20. Were there any months during *calendar year 1989* when the hangar space at your HAM/LTA facility (see definition page 1) was *not* used at full capacity? (Check one) N=24

1.  Yes → Go to next question  
2.  No → Skip to 23

21. Overall, what percent of the hangar space at your HAM/LTA facility was used in *calendar year 1989*? (Check one) N=12

1.  None  
2.  1-30%  
3.  31-40%  
4.  41-60%  
5.  61-80%  
6.  81-95%  
7.  96-100% → Skip to 23

22. To what extent, if any, do each of the following explain why you did *not* use more of the hangar space at your HAM/LTA facility in *calendar year 1989*? (Check one for each row) N=10

	Major Reason	Minor Reason	Not a Reason
a. Unable to hire enough skilled labor	1	0	9
b. Could not obtain enough equipment/tools	0	0	10
c. Could not obtain enough spare parts	0	0	10
d. Low demand for service	1	4	5
e. Air carrier schedules created gaps in hangar use	6	1	3

f. Please describe any other reasons below.  
4 comments

**Appendix IV  
Responses to Air Carrier Survey**

23. Overall, what percent of the hangar space at your HAM/LTA facility (see definition, page 1) do you expect to use in calendar year 1990? (Check one) N=24

- 0 None
- 2 1-30%
- 0 31-40%
- 0 41-60%
- 1 61-80%
- 6 81-95%
- 5 96-100% → Skip to 25

24. To what extent, if any, do each of the following explain why you do *not* expect to use all, or almost all, of the hangar space at your HAM/LTA facility in calendar year 1990? (Check one for each row) N=9

	Major Reason	Minor Reason	Not a Reason
a. Won't be able to hire enough skilled labor	1	1	7
b. Won't be able to obtain enough equipment/tools	0	0	9
c. Won't be able to obtain enough spare parts	0	0	9
d. Low demand for service	1	3	5
e. Air carrier schedules will create gaps in hangar use	6	2	1

f. Please describe any other reasons below.  
2 comments

25. How many square feet of hangar space (in thousands) did your HAM/LTA facility (see definition, page 1) have as of December 31, 1989? (Enter number; round to nearest thousand square feet) N=24

Sum 4,814 .000 sq. ft. N=24

26. How many square feet of ramp space (in thousands) did your HAM/LTA facility have as of December 31, 1989? (Enter number; round to nearest thousand square feet) N=24

Sum 18,368 .000 sq. ft. N=24

27. During calendar year 1989, did you perform any of the following activities outside the hangars at your HAM/LTA facility? (Check one for each row) N=24

	Yes	No
a. Heavy maintenance (D checks or equivalent)	3	21
b. Modification work	10	14
c. Nonscheduled maintenance	20	4
d. Preinduction/preparation work	20	4
e. Storage	16	8
f. Other (Please describe below)	5	19

**Appendix IV  
Responses to Air Carrier Survey**

28. As of December 31, 1989, how many hangars did your HAM/LTA (see definition, page 1) facility have? (Check one) N=24

- 1.  One
- 2.  Two
- 3.  Three
- 4.  Four
- 5.  Five
- 6.  Six
- 7.  Seven
- 8.  Eight or more

29. Considering your HAM/LTA facility as of December 31, 1989, how many bays did you have for each of the following types of aircraft? (Enter numbers) N=24

	Sum	
a. Narrow body only	96	_____
b. Wide body only	22	_____
c. Both narrow and wide body	30	_____

30. Considering your HAM/LTA facility as of December 31, 1989, how many bays did you use for heavy airframe maintenance and airframe modifications (see definition, page 1) for large transport aircraft for each of the following types of aircraft? (Enter numbers) N=24

	Sum	
a. Narrow body only	89	_____
b. Wide body only	18	_____
c. Both narrow and wide body	27	_____

31. Please check all the aircraft models below that could be fully enclosed (including the tail) inside the hangars at your HAM/LTA facility (see definition, page 1) as of December 31, 1989. (Check all that apply) N=24

- |  |  |
|--|--|
| a. <input checked="" type="checkbox"/> B-747 | h. <input checked="" type="checkbox"/> DC-8  |
| b. <input checked="" type="checkbox"/> DC-10 | i. <input checked="" type="checkbox"/> B-757 |
| c. <input type="checkbox"/> L-1011           | j. <input type="checkbox"/> B-707            |
| d. <input checked="" type="checkbox"/> B-767 | k. <input checked="" type="checkbox"/> B-727 |
| e. <input type="checkbox"/> A-300            | l. <input checked="" type="checkbox"/> DC-9  |
| f. <input type="checkbox"/> A-310            | m. <input checked="" type="checkbox"/> MD-80 |
| g. <input type="checkbox"/> A-320            | n. <input type="checkbox"/> B-737            |

**Personnel**

32. As of December 31, 1989, what was the number of employees at your HAM/LTA facility in each of the following categories? (Enter a number for each type of employee. If none, enter 0) N=24

	Sums	
a. Licensed mechanics	24,019	_____
b. Unlicensed mechanics	8,514	_____
c. Inspectors	2,808	_____
d. Engineers	1,265	_____
e. Technicians	1,411	_____
f. Planners	1,251	_____
g. Administrative	4,200	_____
h. Other (Please describe below)	5,790	_____

33. Approximately how many additional mechanics, if any, were needed to fully staff the hangars at your HAM/LTA facility as of December 31, 1989? (Enter number; if none, enter 0) N=24

Sum 2,046 additional mechanics

**Appendix IV  
Responses to Air Carrier Survey**

34. Please consider how the hours spent by the *mechanics* at your HAM/LTA facility are divided between the two categories of maintenance activities defined below for calendar years 1988, 1989, and 1990 (projected). Just give us an expert opinion for this breakdown using percentages in Columns A and B in the large box below. We do not need precise numbers; we only need estimates. In Column C, please give an approximate figure for the total hours (in thousands) used by *mechanics* at your HAM/LTA facility for each year. (Enter two percentages and number of mechanic-hours for each year below) N=24

	(A) Category 1	+	(B) Category 2	=	(C)
	Heavy airframe maintenance and airframe modifications (see definition below) performed by <i>mechanics</i> at your HAM/LTA facility on large transport aircraft.		All other maintenance and modification activities by <i>mechanics</i> at your HAM/LTA facility. Examples: Mechanics working on powerplant, radio, instruments, and accessories.		<b>Total Number of Hours for Mechanics (in thousands)</b>
1988	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           47 %         </div>	+	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           53 %         </div>	=	<div style="border: 1px solid black; padding: 2px; display: inline-block;">100%</div> →  61,282 .000 hours
1989	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           48 %         </div>	+	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           52 %         </div>	=	<div style="border: 1px solid black; padding: 2px; display: inline-block;">100%</div> →  65,381 .000 hours
1990	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           51 % <i>(projected)</i> </div>	+	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           49 % <i>(projected)</i> </div>	=	<div style="border: 1px solid black; padding: 2px; display: inline-block;">100%</div> →  73,384 .000 hours <i>(projected)</i>

**Note:** Percent is computed by estimating a number of hours for each air carrier and calculating the average percentages for category 1 and 2 based on the total hours.

**Definition:** (repeated from page 1)

**Heavy airframe maintenance and airframe modifications.** Include the following activities:

- Routine airframe maintenance (D checks or equivalent); include nonroutine discrepancies and repairs; service bulletins affecting airframes
- Mandated FAA airframe inspections and modifications [FAA airworthiness directives (ADs) and other FAA rules affecting airframes]
- Non-mandated airframe modifications affecting the airframe [for example, fleet standardizations, refurbishments, and reconfigurations affecting the airframe]

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**Maintenance for Other Carriers**

35. During calendar year 1988, did your air carrier perform any heavy airframe maintenance or airframe modifications on large transport aircraft for other air carriers? (Check one) N=24

- 1.  Yes → Go to next question
- 2.  No → Skip to 38

36. Please estimate the percentage of hours used by the maintenance personnel at your HAM/LTA facility (see definition, page 1) to perform heavy airframe maintenance or airframe modification for other carriers' large transport aircraft during calendar year 1988. (Check one) N=8

- 1.  None
- 2.  1-15%
- 3.  16-35%
- 4.  36-65%
- 5.  66-85%
- 6.  86-100%

37. Please list names of the other air carriers below that were serviced by your HAM/LTA facility in calendar year 1988 for heavy airframe maintenance or airframe modifications. Check the box or boxes that show the types of service provided.

**Type of Service**  
(Check all that apply)

Names of Air Carriers  
Services in 1988  
(List Names)

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_

Routine Airframe Maintenance*	Mandated FAA Airframe Modifications +	Non-mandated Airframe Modifications#

\* D checks or equivalent. Include nonroutine discrepancies and repairs. Also, include service bulletins affecting airframes.

+ FAA airworthiness directives (ADs) and FAA rules affecting airframes. Include mandated airframe inspections.

# For example, fleet standardization, refurbishments, or reconfigurations affecting the airframe.

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38. During calendar year 1989, did your air carrier perform any heavy airframe maintenance or airframe modifications on large transport aircraft for other air carriers? (Check one) N=24

- 1.  Yes → Go to next question
- 2.  No → Skip to 41

39. Please estimate the percentage of hours used by the maintenance personnel at your HAM/LTA facility (see definition, page 1) to perform heavy airframe maintenance or airframe modification for other carriers' large transport aircraft during calendar year 1989. (Check one) N=8

- 1.  None
- 2.  1-15%
- 3.  16-35%
- 4.  36-65%
- 5.  66-85%
- 6.  86-100%

40. Please list names of the other air carriers below that were serviced by your HAM/LTA facility in calendar year 1989 for heavy airframe maintenance or airframe modifications. Check the box or boxes that show the types of service provided.

**Type of Service**  
(Check all that apply)

**Names of Air Carriers  
Services in 1988**  
(List Names)

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
- 7. \_\_\_\_\_

	<b>Routine Airframe Maintenance*</b>	<b>Mandated FAA Airframe Modifications+</b>	<b>Non-mandated Airframe Modifications#</b>
1. _____			
2. _____			
3. _____			
4. _____			
5. _____			
6. _____			
7. _____			

\* D checks or equivalent. Include nonroutine discrepancies and repairs. Also, include service bulletins affecting airframes  
 + FAA airworthiness directives (ADs) and FAA rules affecting airframes. Include mandated airframe inspections.  
 # For example, fleet standardization, refurbishments, or reconfigurations affecting the airframe.

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41. Does your air carrier have any contracts to provide heavy airframe maintenance or airframe modification services for large transport aircraft to other air carriers in 1990? (Check one) N=24

- 1.  8 Yes → Skip to 44
- 2.  16 No → Go to next question

42. Does your air carrier plan to provide heavy airframe maintenance or airframe modification services for large transport aircraft to other air carriers in 1990? (Check one) N=16

- 1.  1 Definitely yes
  - 2.  1 Probably yes
  - 3.  2 Uncertain
  - 4.  7 Probably not
  - 5.  5 Definitely not
- } Skip to 46
- } Go to next question

43. To what extent does each of the following explain why your air carrier does not plan to provide heavy airframe maintenance or airframe modification services in 1990 to other air carriers for large transport aircraft? (Check one for each) N=12

**Major Reason    Minor Reason    Not a Reason    No Basis to Judge**

- a. Prefer not to do work for our competitors
- b. Never considered doing maintenance for other air carriers
- c. No requests from other air carriers
- d. Don't have excess hangar space
- e. Unable to hire enough skilled labor
- f. Can't obtain enough equipment/tools
- g. Can't obtain enough spare parts
- h. Please describe any other reasons below.  
2 comments

	Major Reason	Minor Reason	Not a Reason	No Basis to Judge
a.	0	1	9	2
b.	1	0	10	1
c.	1	1	9	1
d.	10	1	1	0
e.	4	4	4	0
f.	1	1	10	0
g.	0	3	9	0

*Now Skip to Question 46*

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44. Please consider the hours the maintenance personnel at your HAM/LTA facility (see definition, page 1) use in performing heavy airframe maintenance or airframe modification. What percentage of such hours do you expect them to use for other carriers' large transport aircraft during calendar year 1990? (Check one) N=8

- 1.  None → Skip to 46
- 2.  5 1-15%
- 3.  2 16-35%
- 4.  1 36-65%
- 5.  0 66-85%
- 6.  0 86-100%

45. Please list names of the air carriers below that you have scheduled to receive heavy airframe maintenance or airframe modifications at your HAM/LTA facility in calendar year 1990. Check the box or boxes that show the type of service that will be provided.

Names of Air Carriers Served in 1990 (List Names)	Type of Service (Check all that apply)		
	Routine Airframe Maintenance*	Mandated FAA Airframe Modifications +	Non-mandated Airframe Modifications#
1. _____			
2. _____			
3. _____			
4. _____			
5. _____			
6. _____			
7. _____			

\* D checks or equivalent. Include nonroutine discrepancies and repairs. Also, include service bulletins affecting airframes.

+ FAA airworthiness directives (ADs) and FAA rules affecting airframes. Include mandated airframe inspections.

# For example, fleet standardization, refurbishments, or reconfigurations affecting the airframe.

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**Plans for Expansion**

46. Between January 1, 1990, and the end of 1995, does your air carrier have any plans (even developmental) to add more square feet of hangar space to your HAM/LTA facility (see definition page 1). (Check one)  
N=24

1.  9 Yes → Go to next question  
2.  5 No → Skip to 48

47. For each of the years listed below, please indicate the number of square feet of hangar space that you plan to add to your HAM/LTA facility and the number of hangars and bays that this will create. Please show which plans have actually been approved and funded by writing those answers in Box I. Show plans that are still developmental by writing those answers in Box II. For example, if your plans are authorized to add 50,000 sq. ft. in 1990 and then add 50,000 more in 1991, under column A, you would write 50,000 for 1990 and 50,000 for 1991. (Enter numbers rounded to nearest thousand; if none, enter 0)  
N=9

**Sums**

	I. Plans That Are Approved and Funded			II. Developmental Plans Only		
	(A) Additional Square Feet	(B) Number of Hangars	(C) Number of Bays	(D) Additional Square Feet	(E) Number of Hangars	(F) Number of Bays
1990:	<u>220</u> ,000 sq. ft.	<u>3</u>	<u>5</u>	<u>76</u> ,000 sq. ft.	<u>2</u>	<u>6</u>
1991:	<u>438</u> ,000 sq. ft.	<u>3</u>	<u>7</u>	<u>325</u> ,000 sq. ft.	<u>2</u>	<u>3</u>
1992:	<u>52</u> ,000 sq. ft.	<u>1</u>	<u>4</u>	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>
1993:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>
1994:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>150</u> ,000 sq. ft.	<u>1</u>	<u>3</u>
1995:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>

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48. Do you presently have plans to increase the number of *mechanics* at your HAM/LTA facility (see definition, page 1) between January 1, 1990 and the end of 1995? (Check one) N=24

1.  Yes → Go to next question  
 2.  No → Skip to 50

49. Please check the boxes under columns A and C to indicate the years in which you have plans to increase the number of *mechanics* at your HAM/LTA facility. Then give the additional numbers of mechanics planned. Please show plans that have actually been authorized by writing those answers in Box I. Show plans that are still *developmental* by writing the answers in Box II. (Check all that apply. Then, enter numbers: if none, enter 0) N=19

I. Authorized to Hire			II. Developmental Plans Only		
(A)	(B)		(C)	(D)	
<i>(Check all that apply)</i>			<i>(Check all that apply)</i>		
		Sums			Sums
1990	<input checked="" type="checkbox"/> → How many more?	<u>2,300</u>	1990	<input checked="" type="checkbox"/> → How many more?	<u>186</u>
1991	<input checked="" type="checkbox"/> → How many more?	<u>15</u>	1991	<input checked="" type="checkbox"/> → How many more?	<u>939</u>
1992	<input type="checkbox"/> → How many more?	<u>0</u>	1992	<input checked="" type="checkbox"/> → How many more?	<u>496</u>
1993	<input type="checkbox"/> → How many more?	<u>0</u>	1993	<input checked="" type="checkbox"/> → How many more?	<u>181</u>
1994	<input type="checkbox"/> → How many more?	<u>0</u>	1994	<input checked="" type="checkbox"/> → How many more?	<u>665</u>
1995	<input type="checkbox"/> → How many more?	<u>0</u>	1995	<input checked="" type="checkbox"/> → How many more?	<u>80</u>

**Appendix IV  
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**Plans for Expansion at Other Locations**

50. Will your air carrier be handling heavy airframe maintenance or airframe modifications at existing facilities other than your HAM/LTA facility (that is, other than the facility you wrote down for Question 8) between January 1, 1990 and the end of 1995? (Check one)  
N=24

- 1.  Yes → Go to next question
  - 2.  No
  - 3.  Uncertain
- } → Skip to 56

51. Please consider current maintenance facilities identified in Question 7 other than your HAM/LTA facility (identified in Question 8) where you will be performing heavy airframe maintenance or airframe modifications between January 1, 1990, and the end of 1995. Does your air carrier presently have any plans (even developmental) to add additional square feet of hangar space to those other facilities? (Check one)  
N=8

- 1.  Yes → Go to next question
- 2.  No → Skip to 53

52. For each of the years listed below, please indicate the number of square feet of hangar space that you plan to add to these other facilities that handle heavy airframe maintenance or airframe modifications. Please show the number of hangars and bays that this will create. Indicate plans that have actually been approved and funded in Box I. Show plans that are developmental only in Box II. (Enter numbers rounded to nearest thousand; if none, enter 0) N=0

	I. Plans That Are Approved and Funded			II. Developmental Plans Only		
	(A) Additional Square Feet	(B) Number of Hangars	(C) Number of Bays	(D) Additional Square Feet	(E) Number of Hangars	(F) Number of Bays
1990:	_____ ,000 sq. ft.	_____	_____	_____ ,000 sq. ft.	_____	_____
1991:	_____ ,000 sq. ft.	_____	_____	_____ ,000 sq. ft.	_____	_____
1992:	_____ ,000 sq. ft.	_____	_____	_____ ,000 sq. ft.	_____	_____
1993:	_____ ,000 sq. ft.	_____	_____	_____ ,000 sq. ft.	_____	_____
1994:	_____ ,000 sq. ft.	_____	_____	_____ ,000 sq. ft.	_____	_____
1995:	_____ ,000 sq. ft.	_____	_____	_____ ,000 sq. ft.	_____	_____

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53. Please consider current maintenance facilities (identified in Question 7) other than your *HAM/LTA* facility (the facility you wrote down for Question 8) where you will be performing heavy airframe maintenance or airframe modifications between January 1, 1990, and the end of 1995. Do you presently have any plans to expand heavy airframe maintenance or airframe modification services to *additional aircraft models* at these other locations? This expansion might include starting a new type of service or expanding a previously offered service to additional aircraft models. (Check one) N=8

- 1.  Yes
- 2.  No

54. Do you presently have plans to increase the number of *mechanics* at these other locations (see previous question) between January 1, 1990, and the end of 1995? (Check one) N=8

- 1.  Yes → Go to next question
- 2.  No → Skip to 56

55. Please check the boxes under columns A and C to indicate the years in which you have plans to increase the number of *mechanics* at these other facilities. Then give the additional numbers of mechanics planned. Please show plans that have actually been *authorized* by writing those answers in Box I. Show plans that are still *developmental* by writing the answers in Box II. (Check all that apply. Then, enter numbers; if none, enter 0) N=3

I. Authorized to Hire				II. Developmental Plans Only			
(A)		(B)		(C)		(D)	
<i>(Check all that apply)</i>				<i>(Check all that apply)</i>			
		Sums				Sums	
1990	<input checked="" type="checkbox"/>	→	How many more? <u>229</u>	1990	<input type="checkbox"/>	→	How many more? <u>0</u>
1991	<input type="checkbox"/>	→	How many more? <u>0</u>	1991	<input checked="" type="checkbox"/>	→	How many more? <u>125</u>
1992	<input type="checkbox"/>	→	How many more? <u>0</u>	1992	<input checked="" type="checkbox"/>	→	How many more? <u>125</u>
1993	<input type="checkbox"/>	→	How many more? <u>0</u>	1993	<input type="checkbox"/>	→	How many more? <u>0</u>
1994	<input type="checkbox"/>	→	How many more? <u>0</u>	1994	<input checked="" type="checkbox"/>	→	How many more? <u>240</u>
1995	<input type="checkbox"/>	→	How many more? <u>0</u>	1995	<input type="checkbox"/>	→	How many more? <u>0</u>

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**Plans for New Facilities**

56. Does your air carrier presently have any plans (even developmental) for a new facility that would handle heavy airframe maintenance or airframe modifications (see definition page 1) between January 1, 1990, and the end of 1995? (Check one) N=25

1.  Yes → Go to next question

2.  No → 56a. In 1989, did your air carrier handle at least 50 percent of the heavy airframe maintenance or airframe modifications on your large transport aircraft in-house? (Give the same answer you did for Question 4.) N=18

1.  Yes → Skip to 39

2.  No → Skip to 60

57. For each of the years listed below, please indicate the number of square feet of hangar space that you plan to add with the new facility you referred to in the previous question. Please indicate the number of hangars and bays that this will create. Please show plans that actually have been approved and funded in Box I. Show plans that are developmental only in Box II. For example, your plans may be authorized to build a new facility of 50,000 sq. ft. in 1990 and then add 50,000 to it in 1991. Under column A, you would write 50,000 for 1990 and 50,000 for 1991. (Enter numbers rounded to nearest thousand; if none, enter 0) N=7

Sums

	I. Plans That Are Approved and Funded			II. Developmental Plans Only		
	(A) Additional Square Feet	(B) Number of Hangars	(C) Number of Bays	(D) Additional Square Feet	(E) Number of Hangars	(F) Number of Bays
1990:	<u>142</u> ,000 sq. ft.	<u>2</u>	<u>4</u>	<u>24</u> ,000 sq. ft.	<u>1</u>	<u>2</u>
1991:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>
1992:	<u>687</u> ,000 sq. ft.	<u>1</u>	<u>7</u>	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>
1993:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>385</u> ,000 sq. ft.	<u>5</u>	<u>12</u>
1994:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>78</u> ,000 sq. ft.	<u>1</u>	<u>2</u>
1995:	<u>0</u> ,000 sq. ft.	<u>0</u>	<u>0</u>	<u>74</u> ,000 sq. ft.	<u>1</u>	<u>2</u>

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58. Please check the boxes under columns A and C to indicate the years in which you have plans to hire *mechanics* for the new facility you reported on the previous page. Then give the additional numbers of mechanics planned. Please show plans that have actually been *authorized* by writing those answers in Box I. Show plans that are still *developmental* by writing the answers in Box II. (Check all that apply. Then, enter numbers: if none, enter 0) ~~N=7~~

I. Authorized to Hire				II. Developmental Plans Only			
(A)		(B)		(C)		(D)	
(Check all that apply)			Sums	(Check all that apply)			Sums
1990	<input checked="" type="checkbox"/>	→ How many more?	<u>349</u>	1990	<input type="checkbox"/>	→ How many more?	<u>0</u>
1991	<input checked="" type="checkbox"/>	→ How many more?	<u>27</u>	1991	<input type="checkbox"/>	→ How many more?	<u>0</u>
1992	<input checked="" type="checkbox"/>	→ How many more?	<u>12</u>	1992	<input checked="" type="checkbox"/>	→ How many more?	<u>1,181</u>
1993	<input checked="" type="checkbox"/>	→ How many more?	<u>12</u>	1993	<input checked="" type="checkbox"/>	→ How many more?	<u>1,699</u>
1994	<input checked="" type="checkbox"/>	→ How many more?	<u>12</u>	1994	<input checked="" type="checkbox"/>	→ How many more?	<u>1,240</u>
1995	<input checked="" type="checkbox"/>	→ How many more?	<u>12</u>	1995	<input checked="" type="checkbox"/>	→ How many more?	<u>1,300</u>

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59. The previous questions asked about your air carrier's plans to increase hangar space, hire more mechanics, or offer services to more types of aircraft between 1990 and 1995. To what extent do each of the following explain why your air carrier plans these increases in capacity for maintenance and modification services? (Check one for each row)

N=24

If your air carrier has no such plans at the present time, please check the box below and skip to Question 60.

No plans:  → Skip to 60

	Major Reason	Minor Reason	Not a Reason
a. Our fleet is getting older, increasing the maintenance needed for our aircraft.	8	6	4
b. Our company wants more non-mandated modifications such as refurbishment and reconfigurations.	2	11	5
c. FAA mandates for aging aircraft are increasing our work load.	12	5	1
d. Other FAA mandates (other ADs and other FAA rules) are increasing our work load.	10	6	2
e. Our fleet size is increasing.	13	2	3
f. Please describe any other reasons below. 4 comments			

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60. Below is a list of items that can limit plans for increasing your air carrier's capacity for heavy airframe maintenance and airframe modification services for large transport aircraft. To what extent, if at all, will each one limit your plans between January 1, 1990 and 1995? (Check one for each row)  
N=48

Greatly    Somewhat    Does Not    No Basis  
Limits    Limits    Limit    to Judge

	Greatly Limits	Somewhat Limits	Does Not Limit	No Basis to Judge
a. Obtaining necessary capital	13	16	15	4
b. Hiring skilled employees	16	26	5	1
c. Hiring capable managers	13	20	14	1
d. Obtaining enough spare parts	2	21	24	1
e. Obtaining necessary equipment/tooling	1	14	31	2
f. Buying/leasing land and facilities	13	13	16	6
g. Having enough demand for services	8	11	26	3

i. Please describe any other problems below.  
7 comments

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**Maintenance By Other Carriers or Repair Stations**

61. Did your air carrier contract with any other air carriers or with any independent repair stations for heavy airframe maintenance or airframe modifications (see definition page 1) for your large transport aircraft in calendar years 1988 or 1989, or do you have plans for such contracts in 1990? (Check all that apply) N=48

- a.  39 Yes, 1988
  - b.  42 Yes, 1989
  - c.  38 Yes, 1990
  - d.  5 No, none of these
- } → Go to next question
- } → Skip to 63

62. In the spaces below, please list the names of all other air carriers and independent repair stations (both domestic and foreign) from which your airline obtained such maintenance or modification work in 1988, 1989, or plans to obtain such services in 1990. If the number is greater than 10, add additional sheets. In columns A, B, and C, please indicate whether or not this service was obtained in calendar years 1988, 1989, or will be obtained in 1990. (Check three boxes for each air carrier or independent repair station)

	YEAR OF SERVICE					
	(A) 1988		(B) 1989		(C) 1990 <i>(projected)</i>	
	Yes	No	Yes	No	Yes	No
<p><b>We received heavy airframe services from: (List names of air carriers, independent repair stations)</b></p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p> <p>4. _____</p> <p>5. _____</p> <p>6. _____</p> <p>7. _____</p> <p>8. _____</p> <p>9. _____</p> <p>10. _____</p>	(Check one)		(Check one)		(Check one)	

*Attach additional sheets if necessary*

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63. Does your air carrier have a preference for conducting the majority of its own heavy airframe maintenance and airframe modification work in-house for your large transport aircraft? (Check one) N=48

- |   |                   |                         |
|---|-------------------|-------------------------|
| 1. <input checked="" type="checkbox"/> 31 | Strongly prefer   | } → Go to next question |
| 2. <input type="checkbox"/> 2             | Moderately prefer |                         |
| 3. <input type="checkbox"/> 0             | Slightly prefer   | } → Skip to 65          |
| 4. <input checked="" type="checkbox"/> 13 | Do not prefer     |                         |
| 5. <input type="checkbox"/> 2             | UNCERTAIN         |                         |

64. In the previous question, you indicated that your air carrier has a preference for doing the majority of its heavy maintenance and modification work in-house. To what extent do each of the following explain why your air carrier has this preference? (Check one for each row) N=33

	Major Reason	Minor Reason	Not a Reason	No Basis to Judge
a. We can control the quality of the work better in-house.	28	5	0	0
b. Maintenance and modification costs are higher at independent repair stations.	25	5	2	1
c. Maintenance and modification costs are higher at other air carriers.	20	7	2	4
d. We can control the maintenance schedule better if we do the work in-house.	27	5	1	0
e. Please describe any other reasons below. 3 comments				

**Appendix IV  
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65. For each of the factors listed below, please indicate the impact that each factor will have on the work load for heavy airframe maintenance and airframe modifications for your large transport aircraft for 1990. (Check one for each row) N=48

	No Impact	Some Impact	Moderate Impact	Great Impact
a. Need for unforeseen airframe work during routine maintenance visits	1	14	17	16
b. Refurbishments to keep this air carrier's competitive edge (new seats, galleys, etc.)	13	19	10	6
c. Aircraft standardization by this air carrier	12	28	6	2
d. FAA airworthiness directives and regulatory requirements	3	3	12	30
e. Manufacturers' service bulletins	2	15	22	9
f. Increases in this air carrier's fleet size	9	8	17	14
g. Please describe any other factors below. 1 comment				

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Responses to Air Carrier Survey**

**Aging Aircraft**

66. As of December 31, 1989, did your air carrier operate any aircraft that will be affected between January 1, 1990, and January 1, 1994, by proposed or anticipated airframe FAA airworthiness directives (ADs) for aging aircraft? (Check one) N=48

- 1.  47 Yes → Go to next question
- 2.  1 No → Skip to 75

67. Please show the number of each type of aircraft that were in your fleet as of January 1, 1990, that will be affected by January 1, 1995, under proposed or anticipated FAA airworthiness directives (ADs) for aging aircraft. Also, please estimate the number of these aircraft that will still be in your fleet on January 1, 1995. (Enter number for each box. If none, enter 0)

Sums

	(A) Number of Aircraft in Present Fleet Affected By N=47 January 1, 1995	(B) Estimated Number Still in Fleet as of January 1, 1995
a. Boeing 707	26	11 N=46
b. Boeing 727	962	580 N=43
c. Boeing 737	294	230 N=46
d. Boeing 747	162	128 N=45
e. DC-8	126	94 N=46
f. DC-9	449	331 N=45
g. DC-10	168	165 N=45
h. MD-80	320	275 N=45
i. L-1011	102	15 N=45
j. Airbus 300	43	38 N=46

**Appendix IV  
Responses to Air Carrier Survey**

68. Below are several strategies that air carriers might use in order to comply with FAA airworthiness directives for aging aircraft. How likely are you to do each of the following between January 1, 1990 and January 1, 1994? If your air carrier plans to use more than one strategy, you may mark more than one as "very likely." (Check one for each row) N=47

	Very Likely	Somewhat Likely	Not at All Likely	Undecided
a. Continue to maintain aging aircraft indefinitely	31	7	7	2
b. Sell aging aircraft for operation by other air carriers	8	17	15	7
c. Dispose of aging aircraft (Retire, sell for scrap, use for parts, etc.)	5	4	33	5
d. Return leased, aging aircraft to leasing company	15	10	18	4
e. Please describe any other strategies below. 3 comments				

**Appendix IV  
Responses to Air Carrier Survey**

69. Compliance with FAA's future airworthiness directives for aging aircraft will require additional aircraft inspections, maintenance, repairs, and modifications. Will any of this work be performed for your carrier by independent repair stations (domestic or foreign) or other air carriers (domestic or foreign)? (Check all that apply) N=47

- a.  31 Yes, domestic repair station
- b.  8 Yes, foreign repair station
- c.  9 Yes, domestic air carrier
- d.  5 Yes, foreign air carrier
- e.  14 No

70. How much of this maintenance work to comply with FAA's airworthiness directives will be conducted in-house by your air carrier's maintenance crews? (Check one) N=47

- 1.  20 All or almost all
- 2.  3 More than half
- 3.  4 About half
- 4.  4 Less than half
- 5.  16 Little or none → Skip to 72

71. If your air carrier performs maintenance work in-house to meet forthcoming airworthiness directives (ADs) for aging aircraft, other maintenance and modification work may be displaced. Please indicate the likelihood for each of the following between January 1, 1990, and January 1, 1994 (Check one for each row) N=31

	Very Likely	Somewhat Likely	Not at All Likely	Undecided
a. All of our in-house work will take place as scheduled.	20	9	2	0
b. We will expand our in-house facilities/capabilities.	13	11	6	1
c. We will contract out routine maintenance that is displaced.	11	2	16	2
d. More of our aircraft will be out of service.	8	12	11	0
e. We will cut back on the work we do for other air carriers.	6	2	19	4
f. Please describe any other situations below. No comments				

**Appendix IV  
Responses to Air Carrier Survey**

72. Between January 1, 1990, and January 1, 1994, do you expect demands for heavy airframe maintenance for your fleet to exceed your carrier's future capacity to do the work in-house? (Check one) N=47

- |    |                                       |                |                         |
|----|---------------------------------------|----------------|-------------------------|
| 1. | <input checked="" type="checkbox"/> 2 | Definitely yes | } → Go to next question |
| 2. | <input checked="" type="checkbox"/> 1 | Probably yes   |                         |
| 3. | <input type="checkbox"/> 3            | Uncertain      | } → Skip to 73          |
| 4. | <input checked="" type="checkbox"/> 8 | Probably not   |                         |
| 5. | <input checked="" type="checkbox"/> 4 | Definitely not |                         |

73. During calendar year 1990, how difficult will it be to find either independent repair stations (domestic or foreign) or other air carriers (domestic or foreign) to do the heavy airframe maintenance work that your carrier cannot handle in-house? (Check one) N=32

1.  6 Very difficult
2.  9 Moderately difficult
3.  7 Somewhat difficult
4.  9 Not difficult
5.  1 Uncertain

74. Please consider possible difficulties your air carrier might have, between January 1, 1990 and January 1, 1994, in finding domestic independent repair stations or domestic carriers to do the heavy airframe maintenance for large transport aircraft. If your carrier cannot handle all your heavy airframe maintenance and airframe modifications in-house and cannot find domestic facilities to do this work, how likely are you to pursue the following strategies? (Check one for each) N=32

Possible Strategies	Very Likely	Somewhat Likely	Not at All Likely	Uncertain
a. Use foreign repair stations	16	9	7	0
b. Use foreign air carriers	8	9	13	2
c. Sell or retire aircraft	4	6	17	5
d. Reduce flight schedules so fewer planes are needed	1	1	29	1
e. Return planes to leasing company	2	8	19	3
f. Request "alternate means of compliance" from FAA	9	12	6	5
g. Please describe any other strategies. No comments				

**Appendix IV  
Responses to Air Carrier Survey**

75. Please fill in the name, title, and telephone number of the person we should contact, if necessary, for additional information relating to this survey.

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Phone: (    ) \_\_\_\_\_

76. Thank you for your voluntary cooperation in making our study as complete and accurate as possible. Please add any comments you wish to make about the topics in this survey.

# Responses to Independent Repair Station Survey

U.S. General Accounting Office



## Survey of Independent Aircraft Repair Stations

### Introduction

The U.S. General Accounting Office (GAO) is an agency that reviews federal programs for the U.S. Congress. Congress asked GAO to determine how the aircraft maintenance industry can meet the increasing demands for aircraft maintenance and modification. There is special concern over a series of airworthiness directives (ADs) that will be issued by FAA. The new directives will require replacement or modification of specific parts of aircraft that were previously only recommended.

This survey is being sent to all independent repair stations that are rated by the FAA to work on large transport aircraft airframes. Many of the questions can be answered by simply checking a box or filling in a blank. There is also space at the end to add any comments about your repair station.

Please return the survey in the enclosed envelope within three weeks. If you have any question, call Steven Calvo of our Seattle Regional Office at (206) 442-5356.

If the return envelope is missing, please send your survey to:

Mr. Steven Calvo  
U.S. General Accounting Office  
Federal Building, Room 1992  
915 Second Avenue  
Seattle, WA 98174

### Note:

1. N=total number of respondents answering the questions.
2. Unless otherwise noted figures reported are for the number of respondents giving the answer.
3. "Sum" indicates the totals for all respondents are reported.

### Repair Station:

(attach label)

### Facility Profile

1. Has your repair station facility performed any heavy airframe maintenance and airframe modifications (see definition below) on large transport aircraft since January 1, 1988? (By large transport aircraft, we mean the following: A-300, A-310, A-320, B-707, B-727, B-737, B-747, B-757, B-767, DC-8, DC-9, DC-10, MD-80, and L-1011.) (Check one).

1.  Yes N=35  
2.  No

If you checked "No" please STOP HERE. Please call Steven Calvo to notify him that you may have received our survey by mistake. If you checked "Yes" please complete the questionnaire.

2. In what month and year did your repair station first begin any types of maintenance of large transport aircraft (see definition below)? Also, in what month and year did you first begin heavy airframe maintenance and airframe modification (see definition below) of large transport aircraft? (ENTER TWO-DIGIT CODES FOR MONTH AND YEAR; FOR EXAMPLE: 01 88 IS JANUARY 1988.)

	06	48
Any Maintenance:	02	90
	(Month)	(Year)
	12	60
Heavy airframe:	01	90
	(Month)	(Year)

### DEFINITIONS

1. **Heavy airframe maintenance and airframe modifications.** Include the following activities:
  - Routine airframe maintenance [D checks or equivalent]; include nonroutine discrepancies and repairs; include service bulletins affecting airframes
  - Mandated FAA airframe inspections and modifications [FAA airworthiness directives (ADs) and other FAA rules affecting airframes]
  - Non-mandated airframe modifications affecting the airframe [for example, fleet standardizations, refurbishments, and reconfigurations affecting the airframe]
2. **Large transport aircraft:** Include the following aircraft—A-300, A-310, A-320, B-707, B-727, B-737, B-747, B-757, B-767, DC-8, DC-9, DC-10, MD-80, and L-1011.
3. **Your facility:** Your repair station's maintenance facility that handles heavy airframe maintenance and airframe modifications for large transport aircraft.

**Appendix V  
Responses to Independent Repair  
Station Survey**

3. How many square feet of hangar space (in thousands) did your facility have as of December 31, 1989? (Enter number; round to nearest thousand square feet)

Sum 9,344, 000 sq. ft. N=35

4. How many square feet of ramp space (in thousands) did your facility have as of December 31, 1989? (Enter number; round to nearest thousand square feet)

Sum 25,778, 000 sq. ft. N=35

5. During calendar year 1989, did you perform any of the following activities outside your hangars? (Check one for each row)

N=35

	Yes	No
a. Heavy maintenance (D checks or equivalent)	11	24
b. Modification work	22	13
c. Nonscheduled maintenance	29	6
d. Preinduction/preparation work	28	7
e. Storage	32	3
f. Other (Please describe below)	8	27

6. How many hangars did your facility have as of December 31, 1989? (Check one)

- 1.  One N=35
- 2.  Two
- 3.  Three
- 4.  Four
- 5.  Five
- 6.  Six
- 7.  Seven
- 8.  Eight or more
- 9.  2 None

7. Please check all the aircraft models below that could be fully enclosed (including the tail) inside the hangars at your facility as of December 31, 1989. (Check all that apply)

N=35

- a.  B-747
- b.  DC-10
- c.  L-1011
- d.  B-767
- e.  A-300
- f.  A-310
- g.  A-320
- h.  DC-8
- i.  B-757
- j.  B-707
- k.  B-727
- l.  DC-9
- m.  MD-80
- n.  B-737
- o.  2 None

**Appendix V  
Responses to Independent Repair  
Station Survey**

8. Were there any months during *calendar year 1988* when the hangar space at your facility was *not* used at full capacity? (Check one)

1.  25 Yes → Go to next question N=35  
 2.  12 No → Skip to 11

9. Overall, what percent of the hangar space at your facility was used in *calendar year 1988*? (Check one)

1.  0 None N=23  
 2.  2 1-30%  
 3.  2 31-40%  
 4.  5 41-60%  
 5.  6 61-80%  
 6.  5 81-95%  
 7.  3 96-100% → Skip to 11

10. To what extent, if any, do each of the following explain why you did *not* use more of your hangar space in *calendar year 1988*? (Check one for each row)

N=20

Major Reason    Minor Reason    Not a Reason

	Major Reason	Minor Reason	Not a Reason
a. Unable to hire enough skilled labor	0	6	14
b. Could not obtain enough equipment/tools	0	2	18
c. Could not obtain enough spare parts	0	4	16
d. Low demand for service	5	8	7
e. Could not avoid gaps in hangar use due to customer or repair station schedules	12	4	4

f. Please describe any other reasons below.

4 Comments

11. Were there any months during *calendar year 1989* when the hangar space at your facility was *not* used at full capacity? (Check one)

1.  26 Yes → Go to next question N=35  
 2.  9 No → Skip to 14

12. Overall, what percent of the hangar space at your facility was used in *calendar year 1989*? (Check one)

1.  0 None N=26  
 2.  2 1-30%  
 3.  1 31-40%  
 4.  5 41-60%  
 5.  7 61-80%  
 6.  7 81-95%  
 7.  4 96-100% → Skip to 14

13. To what extent, if any, do each of the following explain why you did *not* use more of your hangar space in *calendar year 1989*? (Check one for each row)

N=22

Major Reason    Minor Reason    Not a Reason

	Major Reason	Minor Reason	Not a Reason
a. Unable to hire enough skilled labor	0	6	16
b. Could not obtain enough equipment/tools	1	2	19
c. Could not obtain enough spare parts	0	1	21
d. Low demand for service	7	8	7
e. Could not avoid gaps in hangar use due to customer or repair station schedules	11	4	7

f. Please describe any other reasons below.

6 Comments

**Appendix V  
Responses to Independent Repair  
Station Survey**

14. Overall, what percent of the hangar space at your facility do you expect to use in calendar year 1990? (Check one)

- 1.  None N=35
- 2.  1-30%
- 3.  31-40%
- 4.  41-60%
- 5.  61-80%
- 6.  81-95%
- 7.  96-100% → Skip to 16

15. To what extent, if any, does each of the following explain why you do not expect to use all, or almost all, of your hangar space in 1990? (Check one for each row)

N=22

	Major Reason	Minor Reason	Not a Reason
a. Won't be able to hire enough skilled labor	1	5	16
b. Won't be able to obtain enough equipment/tools	2	2	18
c. Won't be able to obtain enough spare parts	0	4	18
d. Low demand for service	7	8	7
e. Customer or repair station schedules will create gaps in hangar use	9	7	6
f. Please describe any other reasons below.			

9 Comments

**Appendix V  
Responses to Independent Repair  
Station Survey**

**Large Transport Aircraft Maintenance**

16. During either calendar year 1988 or 1989, did your facility provide maintenance or modification services to any of the following Boeing aircraft?

N=35

1.  27 Boeing 707
2.  26 Boeing 727
3.  23 Boeing 737
4.  12 Boeing 747
5.  6 Boeing 757
6.  5 Boeing 767
7.  4 NONE OF THE ABOVE → Skip to 18

17. Please check the boxes for the types of services that your facility provided to Boeing aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check+	Non-Scheduled Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. Boeing 707	11	14	9	19	15	10	6	8	8
b. Boeing 727	18	25	17	24	22	12	12	14	14
c. Boeing 737	14	13	13	17	17	9	7	10	9
d. Boeing 747	4	5	4	10	10	2	2	3	2
e. Boeing 757	4	2	1	3	5	0	0	1	0
f. Boeing 767	3	1	2	5	2	1	1	1	1

\* Include annual visits or equivalent under C Check.  
+ Include heavy maintenance visits under D Check.

**Appendix V  
Responses to Independent Repair  
Station Survey**

18. During either calendar year 1988 or 1989, did your facility provide maintenance or modification services to any of the following McDonnell Douglas aircraft? (Check all that apply)

N=35

- 1.  20 DC-8
- 2.  23 DC-9
- 3.  9 DC-10
- 4.  11 MD-80
- 5.  6 NONE OF THE ABOVE → Skip to 20

19. Please check the boxes for the types of service that your facility provided to McDonnell Douglas aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Scheduled Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. DC-8	14	15	11	17	15	9	7	10	9
b. DC-9	15	18	11	17	15	7	6	10	8
c. DC-10	6	6	2	8	6	5	1	3	4
d. MD-80	5	4	1	7	10	1	1	4	1

\* Include annual visits or equivalent under C Check.

+ Include heavy maintenance visits under D Check.

**Appendix V  
Responses to Independent Repair  
Station Survey**

20. During either calendar year 1988 or 1989, did your facility provide maintenance or modification services to any of the following Airbus aircraft? (Check all that apply)

N=35

- 1.  3 Airbus 300
- 2.  1 Airbus 310
- 3.  0 Airbus 320
- 4.  31 NONE OF THE ABOVE → Skip to 22

21. Please check the boxes for the types of service that your facility provided to Airbus aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Scheduled Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. Airbus 300	2	2	2	3	2	1	2	1	1
b. Airbus 310	0	0	0	0	1	0	0	0	1
c. Airbus 320	0	0	0	0	0	0	0	0	0

- \* Include annual visits under C Check.
- + Include heavy maintenance visits under D Check.

22. During either calendar year 1988 or 1989, did your facility provide maintenance or modification services to any Lockheed L-1011 aircraft? (Check one)

N=35

- 1.  10 Yes → Go to next question
- 2.  25 No → Skip to 24

23. Please check the boxes for the types of service that your facility provided to Lockheed L-1011 aircraft during calendar year 1988 or 1989. (Check all that apply)

	AIRFRAME					OTHER			
	A&B Checks	C Check*	D Check +	Non-Scheduled Maint.	Modification	Power Plant	Instruments	Radio	Accessory
a. L-1011	3	2	2	9	5	2	0	2	1

- \* Include annual visits or equivalent under C Check.
- + Include heavy maintenance visits under D Check.

**Appendix V  
Responses to Independent Repair  
Station Survey**

24. For how many of each aircraft below did your repair station provide heavy airframe maintenance or airframe modifications in 1988 or 1989, or plan to provide it in 1990. If estimates for 1990 are unavailable, please indicate by writing an "X" in the blank where appropriate. (Enter numbers; if none, enter 0)

SUMS

	HEAVY AIRFRAME MAINTENANCE Number of Aircraft					
	1988 N=34		1989 N=34		1990 (projected)	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
Airbus 300	3	2	3	0	33	0
Airbus 310	0	1	0	0	0	0
Airbus 320	0	0	0	0	0	0
Boeing 707	46	39	77	45	42	22
Boeing 727	286	27	419	46	703	42
Boeing 737	80	17	113	17	155	39
Boeing 747	30	7	16	3	25	12
Boeing 757	41	1	23	5	20	22
Boeing 767	2	1	0	0	6	3
DC-8	161	23	106	16	110	21
DC-9	55	4	93	16	85	14
DC-10	60	10	101	11	27	2
MD-80	35	3	18	3	41	7
L-1011	36	14	19	17	5	1

Not all repair stations responded to this question for each type of aircraft. Repair stations responding for each type of aircraft ranged from 29 to 33.

**Appendix V  
Responses to Independent Repair  
Station Survey**

25. In Column A, please write the names of all airlines and air cargo companies (both domestic and foreign) for which your facility provided *heavy airframe maintenance or airframe modifications* for large transport aircraft in calendar years 1988 or 1989. Also, list the names of any additional companies with whom you have *contracts* to provide such services in 1990. If the number is greater than 15, add additional sheets. In columns B and C please indicate whether or not this service was provided for calendar years 1988 or 1989. In column D, check "yes" only for the air carriers you plan to *continue servicing or, new air carriers* with whom you already have *contracts* for 1990. (Check a box for each year for each air carrier)

(A) Name of Air Carrier: (Please list)	YEAR OF SERVICE					
	(B) 1988		(C) 1989		(D) 1990 (projected)	
	Yes	No	Yes	No	Yes	No
1. _____	<i>(Check one)</i>		<i>(Check one)</i>		<i>(Check one)</i>	
2. _____						
3. _____						
4. _____						
5. _____						
6. _____						
7. _____						
8. _____						
9. _____						
10. _____						
11. _____						
12. _____						
13. _____						
14. _____						
15. _____						

*Attach additional sheets if necessary*

**Appendix V  
Responses to Independent Repair  
Station Survey**

**Personnel**

26. As of December 31, 1989, what was the number of employees at your facility in each of the following categories? (Enter a number for each type of employee. If none, enter 0)

Sums N=35

a. Licensed mechanics	<u>5118</u>
b. Unlicensed mechanics	<u>6537</u>
c. Inspectors	<u>1143</u>
d. Engineers	<u>808</u>
e. Technicians	<u>449</u>
f. Planners	<u>412</u>
g. Other (Please describe below)	<u>1898</u>

27. Approximately how many additional mechanics, if any, were needed to fully staff the hangars at your facility as of December 31, 1989? (Enter number; if none, enter 0)

N=35

Sum  
863 additional mechanics

- 10 -

**Appendix V  
Responses to Independent Repair  
Station Survey**

28. Please consider how the hours spent by the *mechanics* at your repair station are divided between the two categories of maintenance activities defined below for calendar years 1988, 1989, and 1990 (projected). Just give us an expert opinion for this breakdown using percentages in Columns A and B in the large box below. We do not need precise numbers; we only need estimates. In column C, please give an approximate figure for the total hours (in thousands) used by *mechanics* at your repair station for each year. (Enter two percentages and number of mechanic hours for each year below)

N=35

	(A) Category 1		(B) Category 2		(C)
	Heavy airframe maintenance and airframe modifications (see definition below) performed by <i>mechanics</i> at your HAM/LTA facility on large transport aircraft.		All other maintenance and modification activities by <i>mechanics</i> at your HAM/LTA facility. Examples: Mechanics working on powerplant, radio, instruments, and accessories.		Total Number of Hours for Mechanics (in thousands)
1988	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           _____            76 %         </div>	+	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           _____            24 %         </div>	=	<div style="border: 1px solid black; padding: 2px; display: inline-block;">100%</div> →  16,497,000 hours
1989	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           _____            75 %         </div>	+	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           _____            25 %         </div>	=	<div style="border: 1px solid black; padding: 2px; display: inline-block;">100%</div> →  16,404,000 hours
1990	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           _____            77 %  <i>(projected)</i> </div>	+	<div style="border: 1px solid black; padding: 5px; width: 80px; margin: 0 auto;">           _____            23 %  <i>(projected)</i> </div>	=	<div style="border: 1px solid black; padding: 2px; display: inline-block;">100%</div> →  20,472,000 hours <i>(projected)</i>

Note: Percent is completed by estimating a number of hours for each air carrier and calculating the overall percentages for category 1 and 2 based on the total hours.

Definition: (repeated from page 1)

Heavy airframe maintenance and airframe modifications. Include the following activities:

- Routine airframe maintenance [D checks or equivalent]; include nonroutine discrepancies and repairs; service bulletins affecting airframes
- Mandated FAA airframe inspections and modifications [FAA airworthiness directives (ADs) and other FAA rules affecting airframes]
- Non-mandated airframe modifications affecting the airframe [for example, fleet standardizations, refurbishments, and reconfigurations affecting the airframe]

**Appendix V  
Responses to Independent Repair  
Station Survey**

**Plans for Expansion**

29. Does your facility presently have any plans (even developmental) to add more square feet of hangar space between January 1, 1990, and the end of 1995? (Check one)

N=35

1.  20 Yes → Go to next question  
 2.  15 No → Skip to 31

30. For each of the years listed below, please indicate the number of square feet of hangar space that you plan to add to your facility and the number of hangars that this will create. Please show which plans have actually been approved and funded in Box I. Show plans that are developmental only in Box II. For example, if your plans are authorized to add 50,000 sq. ft. in 1990 and then add 50,000 more in 1991, under Column A, you would write 50,000 for 1990 and 50,000 for 1991. (Enter numbers rounded to nearest thousand; if none, enter 0)

N=20

I. Plans that are Approved and Funded		II. Developmental Plans Only			
	(A) Additional Square Feet	(B) Number of Hangars		(C) Additional Square Feet	(D) Number of Hangars
1990:	<u>1,157</u> ,000 sq. ft.	<u>13</u>	1990:	<u>211</u> ,000 sq. ft.	<u>2</u>
1991:	<u>407</u> ,000 sq. ft.	<u>5</u>	1991:	<u>665</u> ,000 sq. ft.	<u>9</u>
1992:	<u>355</u> ,000 sq. ft.	<u>3</u>	1992:	<u>983</u> ,000 sq. ft.	<u>14</u>
1993:	<u>70</u> ,000 sq. ft.	<u>1</u>	1993:	<u>340</u> ,000 sq. ft.	<u>6</u>
1994:	<u>70</u> ,000 sq. ft.	<u>1</u>	1994:	<u>215</u> ,000 sq. ft.	<u>4</u>
1995:	<u>220</u> ,000 sq. ft.	<u>2</u>	1995:	<u>390</u> ,000 sq. ft.	<u>3</u>

**Appendix V  
Responses to Independent Repair  
Station Survey**

31. Do you presently have plans to increase the number of *mechanics* at your facility between January 1, 1990, and the end of 1995? (Check one)

N=35

- 1.  28 Yes → Go to next question
- 2.  7 No → Skip to 33

32. Please check the boxes under columns A and C to indicate the years in which you have plans to increase the number of *mechanics* at your facility. Then give the additional numbers of mechanics planned. Please show plans that have actually been *authorized* by writing those answers in Box I. Show plans that are still *developmental* by writing the answers in Box II. (Check all that apply. Then, enter numbers; if none, enter 0)

N=28

I. Authorized to Hire				II. Developmental Plans Only			
(A)		(B)		(C)		(D)	
<i>(Check all that apply)</i>				<i>(Check all that apply)</i>			
1990	<input type="checkbox"/>	→ How many more?	Sum <u>2463</u>	1990	<input type="checkbox"/>	→ How many more?	Sum <u>1055</u>
1991	<input type="checkbox"/>	→ How many more?	<u>1200</u>	1991	<input type="checkbox"/>	→ How many more?	<u>2300</u>
1992	<input type="checkbox"/>	→ How many more?	<u>565</u>	1992	<input type="checkbox"/>	→ How many more?	<u>2105</u>
1993	<input type="checkbox"/>	→ How many more?	<u>400</u>	1993	<input type="checkbox"/>	→ How many more?	<u>820</u>
1994	<input type="checkbox"/>	→ How many more?	<u>400</u>	1994	<input type="checkbox"/>	→ How many more?	<u>680</u>
1995	<input type="checkbox"/>	→ How many more?	<u>400</u>	1995	<input type="checkbox"/>	→ How many more?	<u>680</u>

**Appendix V  
Responses to Independent Repair  
Station Survey**

33. Does your facility presently have any plans to expand heavy airframe maintenance or airframe modification services to *additional aircraft models* between January 1, 1990, and the end of 1995? This expansion might include starting a new type of service or expanding a previously offered service to additional aircraft models. (Check one)

1.  25 Yes → Go to next question N=35  
 2.  10 No → Skip to 35

34. Below is a list of aircraft models. Please indicate your future plans for services (regardless of whether your plans are developmental or authorized) for these models as follows. If you plan to start offering heavy airframe maintenance or airframe modification services for any of these models for the *first time* between 1990 and 1995, please write the letter "F" (first time) in the appropriate box. If you plan to add *new types* of heavy airframe maintenance or airframe modification services for models you already work on, write the letter "N" (new services) in the appropriate boxes to indicate the year you plan to begin each new service.

**Examples:**

- (1) If you plan to start offering heavy airframe maintenance for the B-747 in 1990 for the *first time*, and expand the types of services by offering Section 41 modifications for B-747s in 1991, you would write "F" under 1990 and "N" in the B-747 row for 1991.  
 (2) If you already perform routine heavy airframe maintenance on B-747s and you plan to start offering Section 41 modifications for B-747s in 1990, you would write "N" for new service under 1990. N=25

**Year Service Will Start or Expand**

F = First Time for Any Services  
N = New Types of Services Added  
*(Write letters in boxes)*

Type of Aircraft	1990	1991	1992	1993	1994	1995
A-300	6F 2N	2F 2N	2F 1N	1F 1N	1F 1N	2N
A-310	2F	5F	2F 1N	2F 1N	1F 1N	1N
A-320	2F	4F 1N	2F 1N	2F 1N	1F 1N	2N
B-707	4F 4N	1F 3N	1F 3N	3N	3N	3N
B-727	3F 7N	1F 6N	3N	3N	3N	3N
B-737	5F 3N	1F 4N	1F 4N	2N	2N	2N
B-747	3F 4N	4F 4N	1F 2N	2F 2N	1F 3N	2N

*(go to next column for other models)*

**Year Service Will Start or Expand**

F = First Time for Any Services  
N = New Types of Services Added  
*(Write letters in boxes)*

Type of Aircraft	1990	1991	1992	1993	1994	1995
B-757	3F 2N	3F 3N	2F 3N	3N	1F 3N	3N
B-767	4F	4F 1N	1F 2N	1F 2N	1F 2N	2N
DC-8	1F 4N	2F 1N	1F 2N	2N	2N	2N
DC-9	3F 2N	2N	1N	1N	1N	1N
DC-9	2F 4N	1F 2N	1N	1N	1N	1N
MD-80	3F 2N	2F 1N	1N	1F 1N	2N	2N
L-1011	2F 3N	2N	1F 1N	1F 1N	2N	2N

**Appendix V  
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35. The previous questions asked about your repair station's plans to increase hangar space, hire more mechanics, or offer services to more types of aircraft between 1990 and 1995. To what extent does each of the following explain why your facility plans these increases in your capacity for maintenance and modification services? (Check one for each row)

N=35

If your repair station has no such plans at the present time, please check the box below and skip to Question 36.

No plans:  → Skip to 36

- a. The older aircraft will need more maintenance (routine and nonroutine) and modification.
- b. There will be more demand for non-mandated modifications such as refurbishments and reconfigurations.
- c. FAA mandates for aging aircraft will increase requests for services.
- d. Other FAA mandates (other ADs and other FAA rules) will increase requests for services.
- e. The number of aircraft in service worldwide is increasing.
- f. Please describe any other reasons below.

	Major Reason	Minor Reason	Not a Reason
a.	23	5	1
b.	14	13	2
c.	25	4	0
d.	18	11	0
e.	14	11	4

4 Comments

**Appendix V  
Responses to Independent Repair  
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36. Below is a list of items that can limit your plans for increasing your facility's capacity for heavy airframe maintenance and airframe modification services for large transport aircraft. To what extent, if at all, will each one limit your plans between January 1, 1990, and the end of 1995?  
(Check one for each row)

N=35

	Greatly Limits Plans	Somewhat Limits Plans	Does Not Limit Plans	No Basis to Judge
a. Obtaining necessary capital	6	11	13	5
b. Hiring skilled employees	4	14	11	6
c. Hiring capable managers	4	13	12	6
d. Obtaining enough spare parts	2	9	19	5
e. Obtaining necessary equipment/tooling	1	9	20	5
f. Buying/leasing land and facilities	6	3	20	6
g. Having enough demand for services	5	14	11	5
h. Please describe any other problems below.				

7 Comments

**Appendix V  
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37. In our cover letter, we mentioned some additional materials that we need from your repair station. Have you enclosed copies of each of the following? If not, please explain alongside the item. (Check one for each row)

A Copy of . . .

- a. Your FAA air agency certificate
- b. Your FAA operations specifications
- c. Brochures/literature describing your facility

Yes	No

38. Please fill in the name, title, and telephone number of the person we should contact, if necessary, for additional information relating to this survey.

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Phone: (     ) \_\_\_\_\_

39. Thank you for your voluntary cooperation in making our study as complete and accurate as possible. Please add any comments you wish to make about the topics in this survey.

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