Job Task Analysis of the
Aviation Maintenance
Technician

Larin K. Adams
Edward J. Czepiel
Gilbert K. Krulee

The Transportation Center
Northwestern University
1936 Sheridan Road
Evanston IL 60208

Jean Watson
Office of Aviation Medicine
Federal Aviation Administration

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Executive Summary

The Federal Aviation Administration (FAA) is responsible for the training and certification of Aviation Maintenance Technicians (AMTs). In carrying out these responsibilities, there has always been a need to rely on a realistic understanding of the work actually performed and of the skills in carrying out this work. At the present time, the regulations are based upon data that is now somewhat out of date. Specifically, regulations are based upon data collected as part of the Allen Study, completed in 1974. Because of the many technological changes that have taken place over the past 25 years, Northwestern University has taken on the responsibility for carrying out a second job task analysis (JTA) with the objective of bringing up-to-date and understanding of the work currently performed by AMTs. This effort has the overall objective of setting the stage for a number of important improvements. First, there is the need to encourage the schools responsible for the training of AMTs to engage in an effort at curriculum revision and reform. The objectives of these changes would be to modernize these instructional programs in light of the changes that have taken that govern both the certification of the schools as well as of the AMT graduates of these schools.

This job task analysis now being completed by Northwestern University's Transportation Center has been carried out in three phases, with the current phase being the third in this sequence. In Phase I, the emphasis was on developing and validating an appropriate survey methodology for the collection of necessary data. Phase II, which was completed in July 1996, focussed on the actual collection of data. The survey instrument that was utilized covered 303 tasks, representing a broad coverage of the work responsibilities of AMTs. With the aid of this instrument plus supporting interviews, a total of 2,434 surveys were collected from 84 facilities covering all segments of the aviation industry. In Phase III, which is the subject of this final report, the emphasis is on the analysis and interpretation of the data. As for interpretation, the emphasis is on the implications for curriculum revision and on regulatory changes needed for the support of these revisions. In all phases of research, the project team has worked closely with representatives from industry and AMT schools. The input from these committees has been of great value in the interpretation of the data as well as in the formulation of pertinent recommendations.

1. Introduction

1.1 Background

Aviation Maintenance Technicians have a major role in ensuring that all aircraft can be expected to function reliably as well as safely. The Federal Aviation Administration is responsible for the training and certification requirements that apply to AMTs. The pertinent standards and regulations are currently summarized in two parts of the Federal Aviation Regulations. Specifically, FAR Part 65 governs the certification of AMTs, while FAR Part 147 applies to the certification of schools that provide the initial training of AMTs. It is extremely important that the regulations build upon a realistic understanding of the job responsibilities of an AMT.

The regulations outlined in FAR Part 65 are currently under review. The proposed FAR Part 66 will revise the certification structure of AMTs. An Aviation Maintenance Technician certificate will replace the existing Airframe and Powerplant (A&P) certificate. An added transport endorsement will allow the holder of the certificate to return Part 25 and Part 29 aircraft to service. Along with these revisions, there is also a need to revise FAR Part 147 so that the training requirements harmonize with the certification requirements.

The current version of FAR Part 147 is based upon the Allen Study, a job task analysis of aviation mechanics occupation, completed in 1974. Since that time, many changes have occurred in the industry. The overall objective of the Northwestern University's JTA is to provide an accurate description of the work being performed by AMTs across all segments of the aviation industry. As one important outcome, this study will set the stage for curriculum revisions to be incorporated into the programs of study for AMT schools.

1.2 Objectives and Scope

The job task analysis was designed with the following objectives:

- Compare the tasks in the current project with those included in the Allen Study (Allen, 1974). In this manner, *relative* historical changes could be demonstrated.
- Develop task descriptions that indicate skill and/or proficiency levels that could be viewed as prerequisites for advanced training.
- Relate the task analysis results to the current version of Part 147 which defines the initial training requirements of an AMT
- Relate the task analysis results to sections of the Part 66 proposal which defines the proposed additional training requirements for a transport endorsement of an AMT

To fulfill these objectives, this research has been carried out in three phases. The objective of Phase I was to develop and validate the survey instruments. The full-scale survey was performed during Phase II. Phase III emphasized a more complete analysis of the job task analysis data along with a discussion of implications for curriculum reform and regulatory change.

1.3 Overview of Report

This report summarizes the reviews the process of collecting and analyzing the job task analysis data. *Review of Survey Methodology* that was developed in Phase I and discussion of the implementation of the full-scale survey in Phase II. *Curriculum Development* details the process of analyzing the data and the respective results. *Comparison to FAR Part 147* correlates the task analysis to the curriculum included in the current version of FAR Part 147. Similarly, *Comparison to Proposed FAR Part 66 Transport Curriculum* correlates the results of the task analysis to the subject areas that are included in transport curriculum listed in the NPRM for Part 66. *Survey of Industry Training* summarizes the results of the interviews conducted on this topic. The final section of the report, *Implications for AMT Training,* offers possible strategies for using the JTA results in both AMT school and industry training programs.

2. Review of Survey Methodology

2.1 Introduction

Most job task analyses focus on a specific occupation, or examine a position within a single organization. The objective of this study is to complete a job task analysis for the position of AMT across the entire aviation industry. Because the aviation industry varies greatly in terms of work environment and type of aircraft, the occupation of AMT can be defined in equally as broad terms. For this reason, traditional job task analysis methods needed to be revised to accommodate this expanded scope.

This section briefly reviews the process by which the survey and interview schedule were developed and implemented. A survey methodology to collect the necessary data to perform the task analysis was developed and validated. A written survey questionnaire and an interview process provided the two primary means of data collection. Technicians at a representative sample of maintenance facilities completed the survey and interview. More detailed information on these topics is available in reports of the two previous phases.

2.2 Survey Questionnaire

The primary means by which quantitative data was collected was a survey questionnaire. The major constraint in developing the questionnaire was that it should take no longer than one hour to complete. There were two sections to the survey: Background Information and Task Information.

The Background Information section sought to gather basic data regarding the respondent to the survey. This included level of current position within the company, maintenance certificates or licenses held, areas of previous work experience, and total number of years experience while working in the field of aircraft maintenance.

The task information section sought to gather information about the tasks that the respondent performed. This involved developing a task list and performance measures.

Figure 2-1 depicts the general matrix that was used to construct the task list. The top axis lists major systems and components of an aircraft. The side axis lists the generic levels of performance that occur on each system or component. These levels are grouped into three categories: service, inspect, test or check; repair, replace, modify, overhaul or calibrate; and troubleshoot. The applicable actions were then noted for each system.

Systems and Components / Performance Levels	Major System	Major Components
Check, Test, Service, Inspect		
Repair, Replace, Modify, Calibrate		
Troubleshoot		

Figure 2-1. Task List Generation Matrix

From this point, if the task in the matrix was too general, it was deconstructed either into its components or further sub-actions. For example, "rig flight controls" could be further broken down into "rig flaps," "rig rudder," etc. Or, if the task in the matrix was too specific, some tasks could be condensed into one. For example, "check tires" and "inflate tires" could be combined into one single task, "check and service tires." The result of this process is a list of 303 tasks. The tasks were then grouped by the applicable ATA chapter code of the particular component or system. This list was further grouped into 20 subject areas.

Three performance measures were included for each task: frequency, criticality, and difficulty to learn. Each of these measures has a discrete scale from one to five associated with it, where one represents the minimum in that measure, and five the maximum. A fourth measure, percent response, is the number of respondents who report that they performed the task in the last calendar year.

Difficulty to learn was used as a measure versus difficulty to perform. This is an important distinction because a task that is difficult to learn may initially be easy to perform once proficiency is achieved. Information about the difficulties in learning tasks is valuable in helping schools and industry training providers determine where extra time is needed on a particular subject area or where alternative teaching methods should be employed.

The criticality measure determines how critical a task is to the safety of flight operations. Identifying critical tasks is imperative because these are areas where technicians need to have sufficient expertise even if the task is performed infrequently.

2.3 Interview

Interviews were conducted to supplement information collected in the survey questionnaire. While the surveys gather information in a very structured format, the interviews allow for more open-ended response to the questions. The interview focused on issues related to the maintenance organization, the work environment, and training.

The interview schedule comprises four sections. The background information section asks questions about the experience of the respondent, including current position, total years experience working in aircraft maintenance, educational experience, and previous work experience.

The remaining three sections involve questions specific to the facility at which the respondent works. The first section focuses on questions related to task assignment and supervision. The second section deals with training within the organization, when it is delivered and for what reasons. The third section pertains to specialization of technicians and shops. This section tries to determine the reasons a specialized shop exists within an organization and if unique skills are required and/or obtained.

2.4 Site Classification and Selection

The objective of the classification scheme is to group facilities that are similar in both organization and work environment for the AMT. The classification is depicted in Figure 2-2. Major airline facilities were divided into line (ML) and base (MB). The categories of regional airline (RG) and corporate (CP) facilities were added. General aviation facilities were classified as large if the facility employed more than 20 technicians and had dedicated specialized shops, such as an avionics or sheetmetal shop. Likewise, general aviation facilities were classified as small if they employed fewer than twenty technicians with no specialized shops.

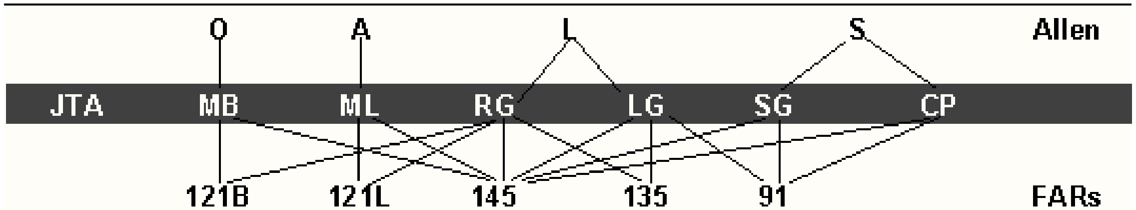

Figure 2-2. Comparison of Industry Classification Schemes

The classification scheme also allows an easier comparison to the Allen Study. Overhaul (O) and line (A) facilities of major airlines correspond directly. The large general aviation (L) segment in the Allen Study corresponds to the regional airline and large general aviation segments in the JTA study. The small general aviation (S) segment encompasses both the small general aviation and corporate facilities in the JTA study.

The ATA, NATA, the National Business Aircraft Association and the Regional Airline Association also enlisted the support of their respective memberships. The local FAA FSDO also often proved an excellent source of potential sites.

A large facility would be chosen, such as an airline's base or line facility or a major repair station. Then, as many smaller facilities in the vicinity would be involved in the study as possible.

2.5 Profile of Sample

A total of 2,434 surveys from 84 facilities were collected. Figure 2.3 depicts the percentage of facilities surveyed by industry segment. The largest number of facilities visited were those in the small general aviation and corporate aviation segments. While these categories do not represent the largest concentrations of AMTs, it was necessary to visit proportionately more of these facility types in order to obtain an appropriately representative sample from all industry segments.

Figure 2-3. Percentage of Facilities Surveyed by Industry Segment

Figure 2-4 shows the percentages of surveys by industry segment. This breakdown details the actual representation in the database of the different facility types. The two largest segments of the industry are base (MB) and line (ML) facilities of the major airlines. Approximate matching of this percentage breakdown to actual employment levels in the industry was a key objective of the surveying process.

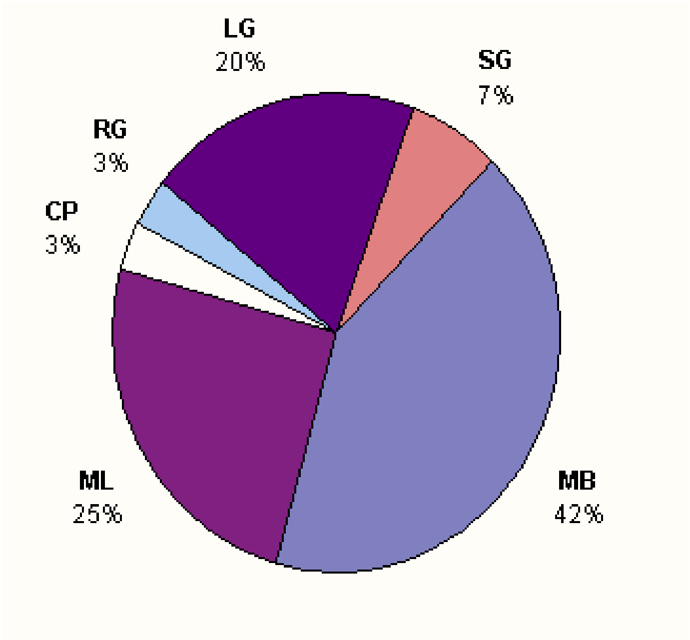

Figure 2-4. Percentage of Surveys from Each Industry Segment

Figure 2-5 depicts the frequency distribution of the years of experience data. The median experience for all survey respondents is 14 years. The frequency distribution exhibits a bimodal shape, where the medians of the two modes are approximately 10 years and 29 years of experience. The concentrations of technicians with these levels of experience correspond to the two historical periods of major airline expansion in 1985 and 1966. Also evident from the frequency distribution is that there are relatively few technicians with 0-4 years of experience, indicating that there has been relatively little new hiring over the last few years.

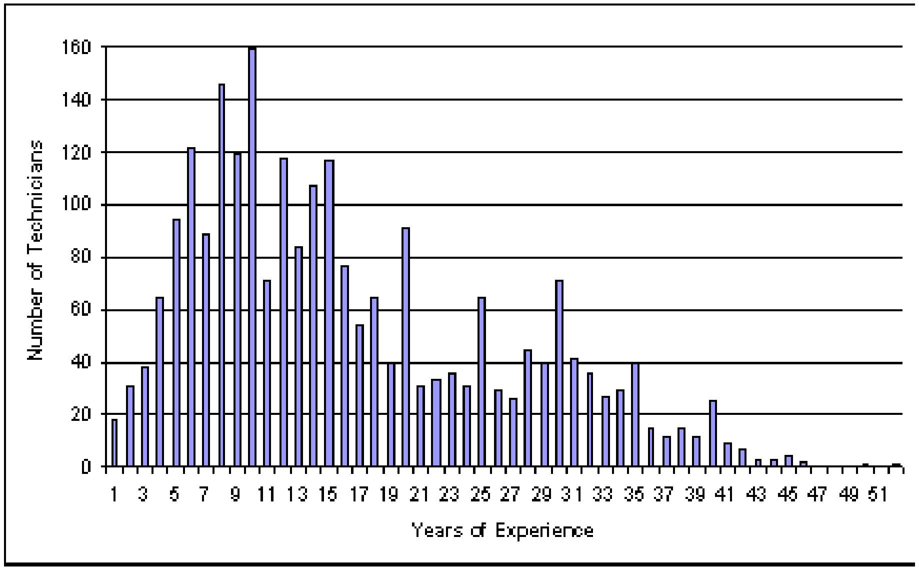

Figure 2-5. Frequency Count of Years Experience for All Respondents

2.6 Visit Committee

The purpose of the visit committee is to review the survey procedures and results from an industry perspective. The membership includes representatives from all segments of the industry and is listed in Table 2-1.

Table 2-1. Visit Committee Members

Mr. William Culhane	American Airlines
Mr. David Henley	FFV Aerotech
Mr. Michael Mertens	Duncan Aviation
Mr. William Magyar	Flight Safety International
Mr. Robert Mukenschnabl	Mukenschnabl Aviation
Mr. Alan Radecki	Ameriflight
Mr. James Rezich	Nams International
Mr. Terry Washow	Flagship Airlines
Mr. Richard Yeatter	USAirways

The first visit committee meeting was held in May 1994. The objectives of this meeting were to review the Phase I results and to provide suggestions for improving the presentation, content, and clarity of the associated report. The committee also offered recommendations on proceeding into Phase II of the study. The issues covered included constructing the task list and revising the survey methods accordingly.

A second committee comprised of representatives from AMT schools. The school committee assisted in developing proposals for curriculum revision based upon the Phase II data. This committee also provided insight into the impacts of these proposals might have on AMT schools.

Table 2-2. School Committee Members	
Mr. William Bowman	Laurel Oaks Career Development Campus
Mr. Robert B. Clifton	Orange Coast College
Mr. James M. Dehlin	Northern Michigan University
Mr. Thomas Eisman	Purdue University
Ms. Laurie L. Johns	Columbus State Community College
Mr. Ivan D. Livi	Consultant
Mr. Richard G. Power	United States Air Force
Mr. Charlie White	Consultant

3. Curriculum Development

3.1 Introduction

In this section, the survey results and their possible implication for curriculum reform and for changes in regulations that govern certification will be discussed. Along these lines, it should be clear that an examination of the data by themselves does not lead directly to a set of conclusions. Rather, there is a need for interpretation and the appropriateness of these conclusions should be reviewed with care by the industry as a whole, by our visit and school committees, and by the FAA. The following discussion has been influenced by the Part 66 proposal and includes two key issues.

1. Part 66 suggests the desirability of defining a core curriculum that would be appropriate for service in all segments of the industry. However, given the assumption that the current number of hours (approximately 2000) used to define a program should not be increased, we are assuming that approximately 1500 hours should be used as the basis for a core curriculum. This would leave an additional 500 hours to maintain the program to its present length as a two-year program. One strategy for the use of these 500 hours would be to encourage schools to specialize by developing one or more focussed programs to be completed in the 500 hours. For schools that wish to focus on the transport industry, their focus would be on advanced training for that portion of the industry. For schools that wish to prepare graduates for work in the field of general aviation, their focus would be oriented toward work in that portion of the industry. In principle, any given school might wish to support both options. We assume that this decision should be left to each school, subject to regulatory review. The decision might depend upon the availability of resource and whether these resources could support more than one option. In addition, each school would want to consider the “market” in which it operates. How does it recruit students and what are their career objectives?

2. Since the Allen Study was completed, the set of skill requirements for an AMT has increased. Most of the aircraft flying 25 years ago are still in operation. Many new types of aircraft have been introduced which require may require an additional set of skills to maintain. Given the constraint of a 2000 hour program, how can the schools be expected to respond to the need to cover more material?

First, in some areas of skill, the level of competency could be decreased in order to emphasize knowledge of general principles along with some emphasis on the manipulative skills. This would make it possible to take two or more existing courses to be condensed into a smaller number of courses. Second, industry would be expected to focus their on-the-job training in order to expand on what was being accomplished through programs offered by AMT schools. The details for implementing these strategies are clearly beyond the scope of this report and suggest the desirability of greater collaboration between industry and the schools.

3.2 Strategy for Interpretation

As a key to understanding the detailed summaries that follow, one should note that the data have been organized with respect to four major headings. These are Airframe or Structure, Avionics, General and Powerplant.

Within each system, there appears a summary of the actual tasks, subsystem by subsystem and task by task within a subsystem. In addition, the data are reported separately for each segment of the industry. With respect to overall interpretation of the result, our strategy has been to organize the interpretation so as to maximize the implications for existing programs of study that are being followed by schools that are offering programs for the training of AMTs. In this regard, we must note that each school has the responsibility of offering a sequence of courses such that the courses cover the material that is described in FAR Part 147. In a typical program there are likely to be 24 courses such that each course covers a specific set of tasks required by Part 147. There are no rules that govern the selection of courses or their sequencing, only that the total set of courses must meet the Part 147 requirements. Although no two schools will offer the identical set of courses, there will be considerable similarity between schools. As one final note, schools are likely to organize their curriculum around three major systems rather than four. It is common practice to describe the curriculum under the headings of Airframe, General, and Powerplant, with the limited offerings relating to Avionics somehow covered under either Airframe or Powerplant. Very likely, the reason for this lack of specific emphasis on Avionics lies in the fact that Avionics was of less importance in the past although it clearly is in need of increasing emphasis in the future. Note also that this organization of the curriculum under three system headings is consistent with the current curriculum description given in Part 147.

In reviewing the data, our overall objective has been to develop a set of guidelines to be followed by schools in identifying a possible core curriculum. Since each school is responsible for organizing a curriculum subject only to meeting the requirements set down in Part 147, we are assuming that it would be inappropriate to define a single core curriculum to be applied to all schools. However, as a secondary objective, in the final section of this report, *Implications for AMT Training*, we have included some illustrations of how the guidelines might be applied in order to identify a core curriculum.

The strategy that we have identified makes use of the following specific guidelines.

1. Review all tasks and identify those tasks that are of little importance to all segments of the industry. Somewhat surprisingly, there are very few tasks that meet this stringent requirement. These are candidates for elimination from the core curriculum.

2. Identify those tasks that are of importance to at least one segment of the industry and of no importance to other segments of the industry. For example, reciprocating engines are important to general aviation and of little importance to airline or transport facilities. Tasks that fit this guideline and candidates for inclusion in a focus or specialized area but not for inclusion in the core curriculum.

3. Finally, identify a collection of related tasks that could be covered more efficiently by combining material from two or more courses into a smaller number of courses. In general, this can be accomplished only by emphasizing the development of a general understanding and by reducing the level of skill to be achieved by the training.

With the aid of these guidelines, we have constructed charts that identify how each task might be related to either the core (C), a general aviation focus (G), or a transport curriculum (T).

3.3 Definitions

3.3.1 Subject Areas

Subject areas are system level divisions of the entire aviation maintenance field. The survey supporting this work queried specific tasks within many of the systems and those results are used to support generalizations about the system they occur within. Some systems were surveyed at several points, (e.g., survey questions were asked about inspect, service, troubleshoot and overhaul). Other systems may have only a few data points. The charts following each section summarize the data from the survey and include additional considerations provided by the industry and school committees.

3.3.2 Generic Tasks

Generic tasks are general actions or skills that may be associated with any system or component and are listed in Table 3-1. A generic task will generally include several sub-tasks. Thus detailed inspection of a fuel tank will involve several different subtasks including disassembly for some detailed inspections.

Furthermore, a task may apply to different technologies or materials used on different planes. Using inspect fuel tank as an example, an AMT at a small general aviation facility will have to know how to inspect both integral and bladder fuel tanks, whereas an AMT working only on heavy transport jets needs to know only how to inspect integral fuel tanks. The generic task descriptions avoid mention of specific materials or technologies since the materials or technologies used to perform the primary functions of a system vary considerably over time, but the functions themselves are relatively stable.

Table 3-1. Generic Task Description

Understanding	To have a basic knowledge of the system, including its purpose, functionality, operation and major components. Knowledge of the relationships between components is also mastered.
Inspect	To examine a system in order to determine if the system or any components are defective. Inspection includes both basic and detailed examinations. In some cases special inspection equipment (NDI) may need to be used.
Service	To perform regularly scheduled tasks in order to assure continued operation of the system and it's components.
Test/Check	To verify the proper operation of a system. Tests may be functional, operational or diagnostic. In combination with inspections, test and check tasks determine the airworthiness of a system or component.
Perform	A few systems have tasks that are neither repair, replace, nor overhaul. For these tasks, such as painting, successful performance of the task is the competency objective.
Repair System	To re-establish the integrity of a complete system. Repairing a system will usually involve the replacement of several individual components and the connections between those components.

Replace Component	To remove and replace specific components within the system. Connections between components electrical, hydraulics, pneumatic or others may also be replaced. Successful replacement includes verification that the affected system functions correctly
Troubleshoot	To identify and analyze malfunctions. Successful troubleshooting entails complete knowledge of system including all inputs (communication or kinetic) to the system, within the system, and out of the system.
Repair Component	To rebuild a component within a system. Repair tasks are more extensive that replace tasks since they involve opening and fixing the components that have been removed or replaced.
Overhaul	To completely disassemble, inspect, and repair and entire system. Even components not repaired are evaluated for tolerances and other airworthiness qualities.

3.4 Description of Subject Area Sections

Each subject area includes three sections:

i) Discussion of Survey Results. This discussion focuses on the percent response and frequency reported for each task associated with each major sub-systems in the subject area. Input from both the industry and school committees are included in this section.

ii) Comparison with Allen Study. In some areas maintenance tasks performed often in 1970 are seldom or no longer performed. In other areas the reverse is true, and in other cases there has been no significant change. Providing substantive reasons for the changes can help anticipate future developments.

iii) Recommendations. Supported by the survey data and subject matter experts, the recommendations are given as the minimal competencies that new graduates should obtain. Competencies consist of “core” skills every graduate should have and two sets of “focus” skills unique to either the general aviation or Transport industry segments. The recommendations are summarized in the curriculum summary chart following each subject area.

3.5 Curriculum Summary Chart

The curriculum summary chart is provided with each subject area and is included after the written summary. The generic tasks are listed in the horizontal side of the grid. Systems or components are listed in the vertical section of the grid. Within the grid, letters indicate the focus of the tasks within each box:

- The letter **C** indicates the task is a core component of the curriculum. These tasks have shown a high percent response and a high frequency, which facilitates inclusion in the core curriculum.
- The letter **G** indicates the task is a component of the general aviation curriculum. These tasks have shown a high percent response and a high frequency in the general aviation industry.
- The letter **T** indicates the task is a component of the transport curriculum. These tasks have shown a high percent response and a high frequency in the major airline line and base segments.

3.6 Description of Charts

Data for each subject area is displayed in a series of charts. A description of each chart follows.

3.6.1 Percent Response and Frequency Chart

The percent response and frequency charts are provided with each subject area summary. Each task is listed within its functional category. The response rates and frequencies are listed for each industry segment and the overall values are shown in the rightmost column. The percent response is an indication of the number of mechanics responding to the task versus the number of mechanics surveyed.

The frequency is a measure of the number of times each task is performed in a calendar year:

- A **1** indicates the task is performed on a less than quarterly basis.
- A **2** indicates the task is performed on a quarterly basis.
- A **3** indicates the task is performed on a monthly basis.
- A **4** indicates the task is performed on a weekly basis.
- A **5** indicates the task is performed on a daily basis.

3.6.2 Criticality and Difficulty Chart

The criticality and difficulty chart is also provided with each subject area. Each task is listed within its functional category. The criticality and difficulty values are listed for each industry segment and the overall values are shown in the rightmost column.

Criticality measures the importance of the task in terms of the negative consequences if the task is not completed properly. The rating scale is defined in terms of damage to equipment or injury to passengers and crew and the operation of the aircraft:

- A **1** means the effects are negligible. There is little effect on the operation of the aircraft.
- A **2** means the effects are low. The system or function would still not be critical to the continuation of the flight. However, special maintenance procedures are required to dispatch the aircraft with the system inoperative.
- A **3** means the effects are average. Failure to perform this task correctly may result in a flight incident.
- A **4** means the effects are high. There are maintenance manual warnings and/or cautions associated with this task. There is possible injury to people or damage to equipment.
- A **5** means the effects are extremely high. There is great potential for a condition threatening the safety of the aircraft or human life.

Difficulty refers to the effort associated in becoming skilled at performing a task. This measure considers what training is required, the complexity of the task and any special skills required in completing the task:

- A **1** means the task is not difficult. The task can be completed following straight-forward directions. No special skill or knowledge is required.
- A **2** means the task is somewhat difficult. The task can be mastered with a minimal amount of practice. On-the-job training is useful.
- A **3** means the task is moderately difficult. The task requires the ability to transfer existing knowledge to new situations. Basic, formal training is useful.
- A **4** means the task is increasingly difficult. The completion of this task requires the subjective judgement of the technician. In-depth training is useful.
- A **5** means the task is very difficult. Proficiency at this task is shown only after considerable experience and practice. Specialized training is required. This task is complex and involves multiple steps.

3.6.3 Allen Comparison Chart

The Allen Comparison Charts provide comparisons between the response rates in the Job Task Analysis and the Allen Study. The response rate is defined as a ratio of the number of respondents to a particular task versus the mechanics surveyed. A 15% difference in the response rate from the Allen Study to the JTA is considered the threshold for a significant shift in the task's performance by aviation mechanics. Each JTA subject area is shown with its corresponding tasks. Each Allen Study task is shown with its corresponding table number. Due to different task grouping methods, an Allen Study task may be related to several JTA tasks. The Allen Study tables are analogous to the JTA subject areas.

In the main body of the chart, the leftmost column states the JTA section and task description; this column is labeled JTA Description. The two rightmost columns indicate the Allen Study task and its corresponding table identification; these columns are labeled ALLEN Description and Allen Table, respectively. The middle columns show comparisons between the two studies in four segment areas:

- major line, labeled JTA major line and Allen line;
- major base, labeled JTA major base and Allen base;
- large general aviation, labeled JTA large general aviation and Allen large general aviation; and
- small general aviation, labeled JTA small general aviation and Allen small general aviation.

For each task, the first line shows the percent response in the JTA survey and the translated Allen study frequency rate. Because the Allen study reported percent response in a range, a midpoint value is used for the comparison. If the difference from the Allen Study to the JTA is greater than 15%, then the upward (UP) or downward (DN) movement is indicated. This column is labeled +/-. If the threshold value has not been broken, then "same" is indicated in this column.

The second line shows the average frequency in the Allen study nomenclature. **H** indicates a high frequency, corresponding to the 4 to 5 range for the JTA. **M** indicates a medium frequency, corresponding to the 2 to 3 range for the JTA. **L** indicates a low frequency, corresponding to a 1 for the JTA.

3.7 Airframe or Structure

3.7.1 Cleaning and Corrosion Control

3.7.1.1 Discussion

3.7.1.1.1 Cleaning

The duties of an AMT include several types of cleaning tasks. The JTA surveyed three kinds of cleaning tasks. General surface cleaning covers all types of mechanical cleaning procedure on every type of surface. Chemical cleaning includes cleaning processes involving chemicals like stripping agents, solvents, etc. The third type of cleaning task focuses on filters.

The survey results for general surface cleaning are similar for all segments. Overall, a slightly higher percentage of technicians than typical perform general surface cleaning tasks on at least a monthly basis.

Cleaning filters on electronic equipment varies by segment, although the results indicate that the task is performed no more frequently than monthly on average. The percent response for electronic filter cleaning is higher than typical at major line facilities. Major line technicians also have a high frequency, similar to what is found at major base facilities. As is true of most subject areas, major base technicians have a low percent response and high frequency for both chemical cleaning and filter cleaning. Low percent response and high frequency is what would be expected if a task is performed by specialized technicians.

Electronic filter cleaning is performed less than quarterly at small general aviation facilities.

A lower percentage of technicians perform paint stripping, and not more than semi-annual on average. Paint stripping, a chemical cleaning task, is not a frequent task or performed by a majority of technicians (the percent response scores are lower than typical for all industry segments).

None of the three cleaning tasks were reported as very critical or difficult to learn.

3.7.1.1.2 Corrosion Control

Most technicians perform corrosion inspection on many different areas and components of the aircraft. The removal and repair of corrosion on sheet metal is also widely practiced. Composite materials are most likely to be worked on at the both major and regional airlines and large general aviation facilities, but not at corporate or small general aviation facilities. The survey results also indicate that these tasks are of moderate criticality and are moderately difficult to learn.

In each segment other than major base and large general aviation facilities, technicians are more likely to inspect for corrosion than complete repairs. Interview data suggests that in the line environment, terminal technicians seldom repair corrosion, while hangar technicians will perform this task while completing scheduled checks. At base and large general aviation facilities, technicians inspect as well as repair.

The percent response and frequency of technicians identifying composite disbonding is lowest at small general aviation facilities which reflects the decreased likelihood that technicians at small general aviation facilities are maintaining aircraft with composite materials. Relative percent response is highest at both line and base facilities. While the percent response is high at corporate facilities, the reported frequency is less than quarterly. Most corporate facilities contract this work to a third party facility. Airlines and corporate aviation operate and maintain the most modern aircraft where composite usage is highest. A lower percentage of technicians at large general aviation and regional airline facilities inspect composite materials as compared to sheetmetal.

Even as inspection for corrosion on any structural material is performed frequently and by high percentage of technicians throughout the industry, more technicians will perform tasks related to composite maintenance as composite technology continues to penetrate the industry. This trend will continue as aircraft using composite-based components age.

3.7.1.1.3 Painting

Painting smaller items is performed by a majority of technicians in almost every industry segment. However, painting larger items such as control surfaces are done by significantly fewer technicians.

At the major airlines, painting is primarily performed at base facilities. The lower percent response but high frequency seen at major base facilities indicates that painting is performed by specialized shops. Small and large general aviation and regional airlines perform painting of components with an average percent response and average frequency. Corporate facilities do not perform painting very frequently.

The interview data collected with the survey shows that most painting of entire aircraft (and large components) is done in specialized shops with specialized personnel. In corporate and small general aviation, contractors fulfill the same role that paint shops do at larger facilities. The EPA and many states have adopted strict rules about how painting must be conducted. As a result, many facilities have found it more cost effective to contract this work out.

3.7.1.2 Comparison with Allen Study

Since composites are a new technology, the Allen study did not survey tasks associated with composites and no comparison is possible. Painting tasks could not be directly compared to the Allen study since the Allen study questioned different aspects of painting (e.g., "touch-up", "brush", "spray") whereas the JTA surveyed painting at a more aggregate level.

In general the percentage of technicians involved in cleaning has increased slightly since the Allen study and correspondingly those performing the cleaning tasks do so less frequently. The rise in percent response and the drop in frequency correspond to the general trend seen throughout the surveys. The most significant change was at major base and major line facilities where significantly more technicians are involved in cleaning tasks than in the Allen study.

3.7.1.3 Recommendations

In spite of the minority of technicians involved with chemical cleaning, the committee suggested that the potential hazards that chemical cleaning presents to technicians and aircraft are an important educational issue. Although many technicians are involved in identifying delamination and disbonding of composites, the survey did not specifically address the repair of composite delamination. Other survey data, interviews and the committees suggest that current and future uses of composites are extensive and repairing composites is an important skill for all technicians to acquire.

The cleaning skills acquired by new graduates should include the ability to clean all types of filters (including the knowledge of which processes are appropriate for different types of filters). New graduates should also have the ability to do general surface cleaning and remove surface deposits. These skills require the ability to inspect filters, surfaces, and components before and after cleaning. An awareness of the chemical cleaning processes, including potential harm to aircraft and personnel, should also be obtained in the core curriculum. Actual performance of chemical cleaning is a skill that can be acquired after graduation.

All new graduates should be able to identify different types of corrosion and the disbonding of delaminate material. The ability to remove and control corrosion is also an expected skill. This subject area does not cover extensive repair of sheetmetal or composite materials that might be needed in cases of advanced corrosion. Those skills are covered in the subject area "Structural Component Repair."

Painting preparation outside of chemical baths is a skill that new graduates should obtain. Special attention should be paid to the properties that different materials have. Painting small components and small areas appears to be a skill that new graduates should acquire, but the skills relating to large scale painting are not essential for new graduates.

3.7.1.4 Frequency and Percent Response

3.7.1.5 Criticality and Difficulty

3.7.1.6 Allen Comparison

3.7.2 Cabin Atmosphere Control

3.7.2.1 Discussion

3.7.2.1.1 Air conditioning/Heating

For each of the tasks surveyed (check, service, repair, and troubleshoot), a very high percentage of technicians performed air conditioning and heating tasks. The percentages were lowest for repair tasks and highest for functional checks. With the exception of the base facilities, the majority of technicians in each industry segment perform work on the air conditioning system.

A high percentage of both major line and corporate technicians perform all of the tasks in this area (check, service, repair, and troubleshoot), but at small general aviation the percent response for repair tasks is only half of that of check tasks. Large general aviation and regional facilities are more like small general aviation but to a lesser extent. As is typical of most systems, the percent response at major base facilities is generally less than 30% but the median frequency is monthly. Major line frequencies are higher than major base for check tasks, presumably since checking the air conditioning system is an important terminal task. Corporate and major line results are distinguished by frequency--higher for major line as would be expected.

One interesting point on this system is how much more often than small general aviation technicians major line technicians repair air/vapor cycle conditioning systems. Typically, a higher percentage of small general aviation technicians will repair a system than major line technicians (since the small general aviation technicians have to cover more types of aircraft and systems), but for air conditioning the reverse is true. The data might indicate a use of vendors by small general aviation facilities for air conditioning repair.

3.7.2.1.2 Oxygen

Each of the industry segments has a majority of technicians involved with each task in this section except the testing of oxygen cylinders. The major line technicians are more likely to replace a component of the system (mask, regulator, or bottle) than regional, large general aviation or small general aviation technicians.

Tasks in this area consist mostly of inspecting/testing and replacing oxygen system components. Excluding base facilities, the majority of technicians do work with the oxygen system with some frequency. The one exception is that only a few technicians rarely hydrostatically test high pressure oxygen cylinders.

3.7.2.1.3 Pressurization

The percent response for this system was among the highest of any of the subject areas. The high percent response (with only moderate frequency) held true for check, repair, replace, and troubleshoot tasks.

Base facilities again had a lower percent response but even this industry segment had 36% of its technicians operationally checking pressurization systems monthly. Lower frequencies, but still high percent response characterized small general aviation and corporate facilities.

The relatively high percent response seen at major base facilities may reflect the fact that pressurization system component are spread throughout the airplane and some components are probably serviced/overhauled in separate shops (e.g., powerplant and structures shop).

3.7.2.2 Comparison with Allen Study

All tasks appear to be comparable with the Allen study.

In the Allen study, the percentage of technicians working on air conditioning tasks was high and it has continued to increase for every industry segment.

Tasks dealing with the oxygen systems are done at about the same or higher frequency and percent response as in the Allen study, except for hydrostatically testing oxygen bottles which is now seldom done.

Pressurization systems are maintained by a higher percentage of technicians in every industry segment though the frequency of performance has dropped except in the small general aviation segment

3.7.2.3 Recommendations

The results from hydrostatically testing oxygen bottles indicate that this task no longer represents a necessary AMT competency.

The data indicate that a general knowledge of underlying principles should be achieved for air conditioning systems, oxygen systems, and pressurization systems. For these systems, new AMTs should be able to inspect, check, service, repair the system, replace a component, and troubleshoot. As with most areas, the skills needed for repairing a component and overhauling the entire systems are beyond the scope of newly graduated AMTs.

Link to grid.

3.7.2.4 Frequency and Percent Response

Airframe or Structure

Cabin Atmosphere Control - % Response and Frequency

	Major Line		Major Base		Regional		Large GA		Small GA		Corporate		Overall	
	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq
air conditioning														
Repair air/vapor cycle conditioning system.	69%	3	19%	3	42%	3	45%	2	34%	1	74%	1	35%	3
Troubleshoot and repair air/vapor cycle conditioning system.	72%	3	20%	3	51%	3	42%	2	56%	1	80%	1	38%	3
Service and inspect air/vapor cycle cooling system.	69%	3	21%	3	45%	2	47%	3	55%	2	79%	2	38%	3
Operational check air conditioning system.	85%	4	28%	3	51%	3	51%	3	68%	2	87%	2	46%	3
Functional check air conditioning and pressurization systems.	84%	4	30%	3	62%	3	52%	3	65%	2	88%	2	48%	3
oxygen														
Hydrostatically test high pressure oxygen cylinders.	17%	1	4%	1	6%	2	13%	2	8%	1	15%	1	8%	1
Service passenger oxygen system.	74%	4	19%	3	60%	4	53%	4	60%	3	88%	4	40%	4
Replace regulator, masks or oxygen bottles.	78%	3	25%	3	47%	2	47%	2	53%	2	85%	1	41%	3
Inspect passenger and crew oxygen system components.	75%	5	24%	3	62%	3	49%	3	67%	3	90%	2	43%	3
pressurization														
Troubleshoot cabin pressurization system and/or ECS System.	83%	3	22%	3	57%	3	50%	3	67%	2	87%	1	43%	3
Repair or replace pressurization system components.	82%	3	35%	3	63%	3	54%	3	67%	1	88%	1	52%	3
Operational check pressurization system.	81%	3	36%	3	61%	3	53%	3	63%	2	90%	1	53%	3

3.7.2.5 Criticality and Difficulty

3.7.2.6 Allen Comparison

3.7.3 Fuel System

3.7.3.1 Discussion

3.7.3.1.1 Fuel Distribution

For fuel systems, inspect, test, replace and troubleshoot tasks are all done by majority of technicians (outside of major base facilities). The frequencies are not high (yearly to monthly), but the high percent response indicates how often tasks related to fuel storage are performed.

Every task in this area is performed by a majority or significant minority of technicians in every industry segment, except major base. At major base, the lower percent responses are indicative of shop-level specialization. Large general aviation has the next lowest percent response but it is a robust 48%-49%. Frequencies in every segment range from quarterly to monthly except at corporate facilities where troubleshooting and replacement tasks are done only yearly.

The relatively high percentages of technicians performing in this area across industry segments disguises the fact that fuel systems can vary from small general aviation to large transport jets. But the variation between small general aviation planes and transport jets should not be overstated since the most fuel distribution systems includes many similar concepts and components.

3.7.3.1.2 Fuel Storage

Unless a facility has specialized shops (like major base facilities), most technicians at that facility will inspect, troubleshoot and repair fuel storage systems. The service tasks are performed frequently (weekly) and the other tasks less frequently (monthly to yearly). major base, large general aviation, and regional facilities again show evidence of specialization by having higher frequency scores corresponding to lower percent response. The highest percent responses were seen at corporate, major line and small general aviation facilities as expected.

The survey indicated that bladder tanks are dealt with in every industry segment but they are repaired only rarely in every segment except for small general aviation. In fact other evidence indicates that the extremely low frequencies for major line and major base may indicate “moonlighting” by major line mechanics and not work performed the facility surveyed. Consequently, only those technicians specializing in small general aviation should be expected to be able to actually replace (but not repair) bladder.

The results for these tasks are generally characterized by high difficulty and high criticality.

3.7.3.1.3 Contamination

A majority of non-major base technicians is involved in preventing water contamination. Every industry segment except major base and large general aviation has the majority of their technicians checking fuel tanks for water daily or weekly.

Bacterial contamination is a concern of a much smaller percentage of technicians in most industry segments (a minority except at corporate—61%). Those who are identifying or controlling for bacterial contamination are doing so only yearly or quarterly. At large general aviation facilities, bacterial contamination tasks are performed by a significant minority and more frequently than in other industry segments.

Although a small minority of technicians perform inspection tasks related to bacterial contamination, the process of identifying of microscopic contaminants is generally a straightforward visual inspection of build-up within the fuel tank or taking a sample of fuel and then having the sample analyzed, and neither option involves significant training. The difficulty results for this segment were correspondingly low.

3.7.3.1.4 Accessories

Outside of rigging fuel shut-off valves, the fuel distribution system is maintained by a significant minority of technicians, but only to the level of replacing components. If the major base results are excluded the percent response rises to a majority of technicians and even rigging fuel shut-off valves is performed by a significant minority.

The overall percentage of technicians rigging shut-off valves was held down by low base numbers. However, even in industry segments where it was high (e.g., corporate at 49%), the frequency of performance was only "yearly." This data pattern indicates that the skills associated with rigging shut-off valves are not core skills.

Only small minority of major base technicians rigs shut-off valves, and they do so at least monthly. At large general aviation and regional facilities the percent response is higher (24% and 34% respectively) but the frequency lowers to quarterly. This trend continues in the remaining industry segments. In major line, small general aviation and corporate facilities, a significant minority of technicians rig shut off valves but the median frequency is yearly. Fuel filters, pumps and other plumbing components are replaced by majority of technicians in every segment (except major base). For filter and pump maintenance, the median frequency ranges from weekly at large general aviation facilities to quarterly at corporate facilities. Fuel system plumbing repairs/replacements are less frequent. At major line and corporate facilities fuel system plumbing repairs/replacements are typically done only yearly by those technicians, and at the remaining industry segments the typical frequency rises to quarterly.

3.7.3.1.5 Fuel Quantity Indicating

Most tasks related to fuel quantity indicating systems are performed by at least a significant minority of technicians in every industry segment except major base. Exceptions to this generalization are float based systems and fuel system warning devices that are arguably part of the avionics system. Float-based systems appear to be a small general aviation system and conversely the repair or replacement of fuel warning devices is not a small general aviation task.

With the exception of troubleshooting float based fuel indicating systems, 40%-70% of the technicians (except those at major base) check, calibrate, repair/replace, and troubleshoot fuel indicating systems. The frequency associated with these percent response was low (quarterly to yearly) in every industry segment except large general aviation and major base. The results from both large general aviation and major base indicate some specialization in this area. In fact the major base data indicates a high degree of specialization.

A minority of technicians (8%-33%) troubleshoots float-based systems in every segment except small general aviation facilities where 64% of the technicians did this task at least quarterly.

3.7.3.1.6 Related Systems

Aside from major base facilities most technicians fuel and defuel aircraft. The survey indicates that these are not considered difficult tasks.

3.7.3.2 Comparison with Allen Study

Comparison with the Allen Study is made somewhat difficult by the way in which the Allen Study organized its tasks. The Allen Study grouped fuel and oil storage together, and, furthermore, it combined measurement and containment. The JTA divided all of these into separate categories.

In spite of the different organization of the two studies, it is apparent that generally the JTA results have a higher percent response and a lower frequency than the Allen Study. This trend is more pronounced in the major line and major base results. The source of this trend may be a difference in organization within facilities. However, no evidence supporting or disproving a difference in organization has been developed.

3.7.3.3 Recommendations

Technicians headed for small general aviation employment should be able to inspect and service bladder fuel tanks and float based fuel quantity indicating systems. Graduates entering transport maintenance facilities do not need these skills to the same degree. Consequently, the result gridline for storage and fuel-indicating does not assume one particular fuel tank type or a particular fuel indicating system.

The maintenance training related to fuel systems for AMT schools should include requiring new graduates to acquire an understanding of the principles of operation associated with fuel distribution and storage as well as fuel quantity indicating systems. New graduates should also be able to check, inspect, and service fuel distribution systems, most storage systems, and fuel quantity indicating systems. In addition they should be able to able to repair and replace fuel distribution components and integral fuel tanks, and fuel quantity indicating systems that are not float based. Finally new graduates should be able to troubleshoot problems related to the fuel distribution, storage and quantity indicating.

	Understanding	Inspect	Service	Test/Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
Distribution	C	C	C	C		C	C	C		
Storage	C	C	C	C		C	G	C	G	
Accessories	C	C	C	C		C	C	C		
Fuel Quanity Indicating	C	C	C	C		C	C	C		
Contamination	C	C		C						
Defueling	C		C							

3.7.3.4 Frequency and Percent Response

3.7.3.5 Criticality and Difficulty

3.7.3.6 Allen Comparison

3.7.4 Flight Controls

3.7.4.1 Discussion

Tasks related to flight controls were divided into those tasks that focus more on components of the flight control system and those that deal directly with the flight control surfaces and those tasks.

3.7.4.1.1 *Flight Control System Components*

For all industry segments, both inspection and repair/replace tasks are performed by the majority of technicians. The difference is that inspection tasks are done frequently but repair/replace tasks are done infrequently (yearly in most cases). Major Base facilities showed a much lower percent response for both inspection and repair tasks and correspondingly a higher frequency of performance.

One exceptional task was “fabricate control cables.” This task was performed infrequently by a low percentage of technicians.

3.7.4.1.2 *Flight Control Surfaces*

Tasks dealing with the surfaces used in flight control systems are performed by the majority of technicians in most industry segments. Major Base facilities have fewer technicians performing these tasks and these technicians are performing the tasks more frequently. The rigging and replacement tasks are done by as many technicians, but less frequently.

Checking and performing of control surface balance is done infrequently and by a minority of technicians at Major Line facilities. In other industry segments, balance tasks are still infrequent, but they are performed by more technicians.

3.7.4.2 Comparison with Allen Study

At Major Line and Major Base facilities, the percentage of technicians performing tasks in this area has increased but the frequency with which the tasks are performed has decreased. On the general aviation side, comparisons are more varied, but it appears that fewer technicians now perform these tasks and they do so less frequently.

3.7.4.3 Recommendations

New AMTs should have a general knowledge of the underling principles for all flight controls systems and all accessories related to flight control systems (cables, actuators, bearings, etc.). AMTs should be expected to inspect, check and service flight controls and accessories related to flight control systems. AMTs should have repair and replace and troubleshoot skills for accessories related to flight control systems, but not for the individual flight controls.

	Understanding	Inspect	Service	Test/Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
Flight Controls	C	C	C							
Components	C	C	C	C	C			C		

3.7.4.4 Frequency and Percent Response

3.7.4.5 Criticality and Difficulty

3.7.4.6 Allen Comparison

3.7.5 Landing Gear

3.7.5.1 Discussion

3.7.5.1.1 Anti-skid

Outside of the exceptions noted, most technicians at most facilities will test, repair or replace components of, and troubleshoot anti-skid systems from quarterly to monthly.

Anti-skid systems are one area where technicians working on larger aircraft perform a different range of tasks than those working on smaller aircraft. The testing, repair and troubleshooting of anti-skid systems is done by the majority of technicians in every industry segment except major base facilities and small general aviation facilities. These two industry segments have different reasons for using fewer technicians to work on anti-skid systems.

Major base facilities specialize so that a lower percentage of technicians are in a position to work on these systems. However, major base technicians will perform these tasks with relative frequency. The lower percent response seen in Small general aviation facilities may result from this industry segment having less exposure to aircraft with anti-skid systems. A relatively high percent of small general aviation technicians do functionally test anti-skid systems, but they do so infrequently.

Anti-skid systems are no longer technology found only on higher-end aircraft. The trend toward anti-skid systems being incorporated on general aviation aircraft should result in a higher percentage of small general aviation technicians working on these systems in the future.

3.7.5.1.2 Brakes and Tires

Most technicians test, repair, and troubleshoot brakes and tires. Only major base facilities appear to have technicians specializing in brake and tire maintenance.

The JTA survey did not address overhaul or repair tasks related to brakes.

One factor that is not reflected in the survey data, but did appear in interviews, is the extensive use of third-party vendors for both brake and tire maintenance. Many large general aviation and small general aviation companies involved in the study have attempted to develop independent wheel and brake shops, but found it more economical to have the brakes rebuilt by a vendor.

3.7.5.1.3 Main Gear, Nose Gear, and Retractable Gear

Except for major base facilities which have a low percent response, most tasks related to landing gear, retractable or otherwise, are performed by the majority of technicians in all industry segments. One exception is modifying or altering landing gear assembly. In every industry segment, this task was done by less than 30% of the technicians, and only yearly by those technicians. The task with the next lowest percent response was overhaul, repair or replace landing gear, followed by repair landing gear wiring and switches.

One explanation for the low percent response seen for modifying landing gear is that modifying landing gear is generally perceived as a major modification. A task like repairing landing gear might involve only fixing some component, wire, or hydraulic line and correspondingly this task had a higher percent response. Supporting this observation is the high percent response seen for other ‘minor’ tasks like with “service and inspect landing gear.”

One important observation is the high percent response and relative high frequency that appears with retractable gear at small general aviation facilities. It appears that most small general aviation facilities service at least some aircraft that have retractable landing gear.

3.7.5.1.4 Landing Gear Position Sensing

A majority of technicians in every segment, except major base facilities, repair/replace and troubleshoot landing gear position indication system/components. The frequencies were relatively low ranging from quarterly to yearly except at large general aviation facilities where troubleshooting was done at least monthly.

3.7.5.2 Comparison with Allen Study

Comparison with the Allen study is fairly direct in this section. For most landing gear systems, the percent and frequency scores have not dramatically changed. One cannot assume, however, that these maintenance tasks have not themselves changed. Landing gear systems employ some components today that were not common 25 years ago (e.g., electronic indicating systems).

In every industry segment the percent response and frequency of performance of anti-skid tasks has increased significantly since the Allen study. The percent response and frequency scores for brake and tire tasks and for landing gear tasks have not changed significantly since the Allen study.

3.7.5.3 Recommendations

The results in this subject area indicate that new graduates should acquire extensive capabilities in this aspect of landing gear. Landing gear is a critical system that the majority of technicians perform maintenance tasks on. In addition, interview evidence suggests that tires and brakes are one of the first systems new hires are likely to be assigned. Repairs on landing gear components appear to be only minor ones. The training for some tasks classified as a transport aircraft skill (e.g., overhaul nose gear) may be more appropriately handled by the specialized industry shops where this work occurs.

Interviews and information from the industry and school committees indicate that third-party vendors often play a significant role in maintenance work performed in this subject area.

A general knowledge of underling principles should be achieved for anti-skid systems, brakes, main and nose gear, retractable gear, tires, and landing gear indicating systems. Inspection, test and service skills need to be acquired for (see also the “Inspection” subject area) anti-skid systems, brakes, main and nose gear, retractable gear, tires, and landing gear indicating systems. Replace or repair system skills should be acquired for brakes, main and nose gear (only minor repairs), retractable gear (only minor repairs), tires, landing gear indicating systems. And the troubleshooting skills of new graduates should include competency on brakes, main and nose gear, retractable gear, tires, and landing gear indicating systems. No overhaul skills need to be acquired.

Link to grid.

3.7.5.4 Frequency and Percent Response

Airframe or Structure

Landing Gear - % Response and Frequency

	Major Line		Major Base		Regional		Large GA		Small GA		Corporate		Overall	
	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq
anti-skid system														
Troubleshoot anti-skid system.	73%	2	14%	2	55%	2	56%	2	31%	1	74%	1	36%	2
Repair or replace anti-skid system components.	75%	3	18%	2	54%	2	59%	2	30%	2	84%	1	39%	2
Functional test anti-skid system.	78%	3	21%	3	54%	3	65%	3	51%	1	87%	2	43%	3
brakes														
Troubleshoot brake system.	72%	3	17%	2	50%	2	46%	3	70%	3	77%	1	37%	3
Functional test brake system.	74%	4	23%	3	64%	4	54%	4	73%	4	85%	2	44%	3
landing gear position sensing														
Repair or replace landing gear position indication and warning components.	64%	2	13%	2	58%	2	53%	2	78%	2	81%	1	36%	2
Troubleshoot landing gear position indication and warning systems.	65%	2	16%	2	60%	2	61%	3	76%	2	86%	1	39%	2
main/nose gear														
Modify or alter landing gear assembly.	25%	1	9%	2	24%	1	29%	1	27%	1	26%	1	18%	1
Repair landing gear wiring and switches.	47%	2	9%	2	55%	2	52%	2	83%	2	82%	1	31%	2
Rig nose gear steering.	54%	1	19%	2	49%	2	45%	2	57%	2	77%	1	35%	2
Overhaul, repair or replace landing gear.	42%	1	20%	2	49%	2	50%	2	72%	2	63%	1	35%	2
Detailed inspection of landing gear assemblies and subassemblies.	57%	5	18%	3	57%	4	49%	3	75%	4	77%	2	37%	4
Service nose gear assemblies.	70%	3	22%	3	53%	3	50%	3	73%	3	82%	1	41%	3
Visually inspect landing gear, wheel wells, and doors.	75%	5	21%	3	62%	5	54%	4	77%	4	85%	4	42%	4
Service shock struts.	78%	3	23%	3	59%	3	53%	3	79%	3	83%	2	44%	3
Lubricate landing gear components (bearings, hinges, pivots, up/downlocks, etc).	70%	3	25%	3	66%	4	52%	4	80%	3	85%	3	44%	3
retractable gear														
Troubleshoot retractable gear system.	66%	2	16%	2	52%	3	46%	3	76%	2	78%	1	36%	2
Repair or replace landing gear control and actuating system components.	68%	2	20%	2	52%	2	47%	3	70%	2	78%	1	38%	2
Functional test emergency gear extension system.	50%	1	23%	3	58%	3	54%	3	79%	3	83%	2	40%	3
Troubleshoot landing gear control and actuating systems.	68%	2	23%	3	60%	2	56%	3	75%	2	85%	1	42%	2
Functional test retractable gear.	65%	1	24%	3	65%	3	54%	4	73%	3	82%	2	43%	3
tires														
Replace tire or wheel assemblies.	79%	4	25%	3	61%	4	54%	3	80%	3	88%	3	45%	4
Service tires.	79%	5	25%	3	62%	5	53%	3	78%	4	82%	4	45%	4
Remove and replace tires or brakes.	83%	4	28%	3	66%	4	53%	3	75%	4	85%	3	47%	4
Check pressure of tires.	81%	5	28%	4	66%	5	55%	4	82%	4	88%	5	48%	4

Check pressure of tires.	81%	5	28%	4	66%	5	55%	4	82%	4	88%	5	48%	4

3.7.5.5 Criticality and Difficulty

3.7.5.6 Allen Comparison

3.7.6 Structural Component Repair

3.7.6.1 Discussion

Materials are grouped into three classes:

i. older materials (wood, dope, and fabric)

ii. newer materials or at least materials with continuing use (plastics, fiberglass, and composites)

iii. sheet metal

The clear generalization is that older materials are disappearing and newer materials are on the rise, even in the small general aviation segment.

Inspection skills in this area are not included since the inspection of specific materials is handled within the general subject area pertaining to inspections. Troubleshooting in this subject area is not relevant.

3.7.6.1.1 Wood, Dope, and Fabric

Only a very small minority of small general aviation and corporate technicians perform wood, dope, or fabric repairs. The frequency accompanying this minority was only yearly. No other industry segment performed any wood, dope, or fabric repairs.

3.7.6.1.2 Plastics, Fiberglass, Composites

Carbon composites are repaired by the highest percentage of technicians at large general aviation facilities. The frequency of composite repair was highest at major base (monthly), but the percent response was only 11%. Technicians at large general aviation and small general aviation also have the highest percentage of technicians performing repairs of honeycomb structures, but all industry segments have similar percent responses (22%-37%). Small general aviation and corporate technicians, on the other hand, have the highest percent response for performing the repair of plastics and fiberglass.

3.7.6.1.3 Sheetmetal

Sheetmetal is still the dominant structural material used in aircraft as evidenced by the extremely high percent response at major base facilities. Most sheetmetal tasks are done by at least 30% of the major base technicians and half are performed by more than 40%. Conversely, only two sheetmetal tasks, stop drilling and replacing fasteners, are performed by a majority of major line technicians. For all the other industry segments the percent response is either very high or very low with frequencies ranging from weekly to quarterly.

The survey did not specifically address the distinction between small-scale sheet metal repair and large-scale sheet metal fabrication. Both kinds of sheetmetal work is performed in aviation, but interview evidence strongly suggest that large scale sheet metal fabrication is done by relatively few, very specialized, technicians (often non-AMT-certified employees). The two tasks that come closest to large-scale sheet metal work are: "repair or replace sheet metal frame sections and fittings, fairings, or stringers" and "fabricate flexible or rigid lines and attach connectors". These two tasks are done by a lower percentage of technicians.

Major line technicians have very low response on every task in this subject area except for the two sheetmetal tasks mentioned above.

3.7.6.1.4 Welding and Soldering

Welding is seldom performed by anyone but specialized welders. Inspection of welds will always be an important skill for technicians to possess.

A small minority of technicians in every segment performs welding only yearly. Given the additional requirements for certified welders for most repairs this result is not surprising.

The two soldering tasks look identical, but "soldering a part" appeared with other sheet metal tasks in that ATA category whereas "soldering a device" appeared with other avionics tasks. Electronic soldering is far more common than structural soldering. Only in small general aviation and corporate facilities do a majority of technicians perform structural soldering.

3.7.6.2 Comparison with Allen Study

Composite repair tasks are not comparable with the Allen study since these materials were not addressed in that survey. The comparison of sheetmetal tasks is informative but the tasks are not a direct match between the surveys. Wood, dope and fabric tasks match well as do the plastics and honeycomb tasks.

In every industry segment, the percent response and most frequency results have increased for plastics, fiberglass, and honeycomb repairs. Sheetmetal tasks are done by a higher percentage of mechanics, but the frequencies are lower, especially at major base and major line facilities where the frequency often has dropped from H (daily) to L (monthly to yearly).

Structural soldering has held about the same since the Allen Study, but electrical soldering has increased substantially in percent response (except small general aviation where it was already high). For welding the biggest change was at small general aviation facilities where the percent response and frequency dropped significantly.

Interestingly, the wood, dope and fabric results are about the same as in the Allen study. It appears that even in 1970 most technicians were not performing repairs to wood, dope or fabric airplanes with any regularity.

3.7.6.3 Recommendations

Composite training should be included in the core curriculum not because of survey numbers but because the use of composite materials is on the increase, future technicians in every industry segment will have to deal with composites with increasing frequency. In addition, composite repair involves technical detail that is not easily obtained through OJT. The committee advised that many of these skills are best acquired through a combination of hands-on experience and lecture. The minimum level of practical experience that should be obtained by graduates is doing a "wet lay-up" for a minor repair. Since many schools have invested in additional equipment, it would be desirable if students were trained even further.

In a curriculum, major and minor repairs need to be distinguished--regardless of the material used. Students need to be able to perform minor repairs on a variety of materials, including sheetmetal, composites, and honeycomb. However, the ability to perform major repairs and/or fabricate large components is a specialized skill and is not appropriate in the core curriculum

The maintenance training related to minor repairs and welding for AMT schools should include requiring new graduates to acquire a general knowledge of underling principles for performing repairs with plastics, fiberglass, composites, and sheetmetal. In addition, an adequate understanding of welding and soldering should be obtained by all new AMTs.

New graduates need to be able to inspect (see also the "Inspection" subject area) check and service skills for plastics, fiberglass, composites, sheetmetal, welding and soldering. The repair and replace skills of new graduates should include the ability to perform soldering (electrical components only) and to make minor repairs to plastics, fiberglass, composite and sheetmetal components.

Technicians focussing on small general aviation should have an additional understanding of fabric surfaces and wood structures. They should also be able to inspect fabric surfaces and wood structures. However, the ability to repair fabric surfaces or wood structures does need not be achieved by new graduates.

Link to grid.

3.7.6.4 Frequency and Percent Response

3.7.6.5 Criticality and Difficulty

3.7.6.6 Allen Comparison

3.7.7 Structures (Misc.)

3.7.7.1 Discussion

Many of the tasks that are traditionally associated with "structural" maintenance have been spread into related subject areas like:

a. Minor repairs and welding

b. Inspections

c. Cleaning and corrosion control

d. Landing gear

The remaining tasks are primarily related to doors and windows, along with a few tasks related to slides/rafts and wing structure. Troubleshooting and overhaul tasks for these structures were not addressed specifically by the survey.

3.7.7.1.1 Doors

Tasks related to the inspection and servicing of doors are performed by most technicians with an average frequency of at least weekly—a higher than typical frequency. Rigging doors happens with less frequency, but still the percentage of technicians performing these tasks is quite high. Replacing doors is also done by slightly less than half of the technicians surveyed, but unlike the other tasks, is done very infrequently (only one time per year on average).

3.7.7.1.2 Slides/Life rafts

Except at major line facilities, a minority of technicians operationally tests life rafts or slides. Corresponding to these results was the committee's suggestion that new graduates know locations and operational principles of slides and life rafts, but not be expected to repair or replace them. Information about repairing or replacing life rafts and slides was not covered in the survey.

3.7.7.1.3 Windows

The task asked by the survey covered repairing, replacing or polishing windows. This task covers several types of activities that vary substantially. Replacing a windshield in transport jet, and polishing a passenger window in the fuselage of a private single engine airplane are disparate skills.

3.7.7.1.4 Wings

As expected, many technicians visually inspect wing structure very frequently.

The survey obtained data about repairing and replacing generic sheet metal (and composite) components (both of which were performed often), but it did not specifically address repairing and replacing wing components.

3.7.7.2 Comparison with Allen Study

Most tasks in area did not have a direct match with the Allen Study.

The one common task between the studies, "Rig doors and emergency systems," showed a slight increase in response in every segment except small general aviation. Frequency scores varied across the different segments. Major line and major base frequencies declined, but large general aviation frequencies went up slightly. Small general aviation frequencies stayed the same although the percent response declined somewhat.

3.7.7.3 Recommendations

The committee agreed that new graduates should be able to rig doors, but that even though a significant percent of technicians replace doors yearly, "replacing doors" is an advanced skill that is best developed after graduation.

The committee clarified the window replacement tasks by suggesting that the principles concerning window replacement should be covered, but new graduates should not be expected to replace windows without extra training or supervision.

Based on the data and augmented by the committee’s recommendation, the following conclusions were drawn. A general knowledge of underling principles should be achieved for the operation doors, windows, slides, life rafts, and other accessories. Inspect (see also the “Inspection” subject are), check and service skills are considered core skills for wings, doors, windows, slides, life rafts, and other accessories. Finally, rigging doors should also be considered a core tasks (classified as repair system). Additional tasks in this subject area are not considered core tasks.

Link to grid.

3.7.7.4 Frequency and Percent Response

Airframe or Structure

Structures - % Response and Frequency

	Major Line		Major Base		Regional		Large GA		Small GA		Corporate		Overall	
	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq
doors														
Replace doors.	45%	1	23%	2	45%	2	37%	1	52%	1	37%	1	32%	1
Rig doors and emergency evacuation systems.	58%	2	28%	3	48%	2	42%	3	56%	2	62%	1	39%	2
Service doors, windows and movable components with appropriate lubricant.	64%	3	28%	3	54%	4	48%	3	79%	3	85%	3	43%	3
Inspect access door latches and hinge attachments.	73%	4	28%	3	59%	4	49%	3	78%	3	85%	3	45%	4
Inspect cargo and passenger doors.	78%	5	28%	4	67%	4	48%	3	73%	4	85%	2	46%	4
related equipment														
Operational test escape slides or liferafts.	48%	2	13%	2	16%	1	15%	1	9%	1	23%	1	19%	1
windows														
Repair, replace or polish windows or windscreens.	70%	2	28%	3	53%	2	49%	2	69%	2	85%	1	43%	2
wings														
Visually inspect wing structure.	76%	5	23%	4	62%	4	48%	3	78%	4	91%	3	43%	4

3.7.7.5 Criticality and Difficulty

3.7.7.6 Allen Comparison

3.8 Avionics

3.8.1 Autoflight

3.8.1.1 Discussion

3.8.1.1.1 Autopilot

Autopilot tasks are performed by a significant minority in every industry segment except major base and regionals. The substantial percentage of technicians troubleshooting autopilot systems performs this task frequently with frequency scores ranging as high as weekly at major line facilities. Additional information acquired from interviews and the advising committees supported the general conclusion that autopilot maintenance is a core task for many technicians in every industry segment.

3.8.1.1.2 Autothrottle

Only at major line facilities do a significant percentage of technicians perform maintenance tasks on autothrottle systems. Autothrottle tasks are performed much less frequently in both large and small general aviation than they are at major line facilities.

The percent response for autothrottle tasks at regional, small general aviation and large general aviation facilities is low on checking and troubleshooting tasks. At corporate facilities and major line facilities, the percent response on autothrottle tasks is substantially higher leading to the hypothesis that autothrottle technology is new enough that it has not penetrated significantly into small aircraft maintenance. The major base percent response is quite low as usual.

Overall autothrottle maintenance is a core task only at major line facilities.

3.8.1.1.3 Related autoflight systems (actuators, servos, etc.)

A majority of the technicians in every industry segment (except major base) performs tasks on systems related to the autoflight system. Consequently, autoflight maintenance constitutes a core task for AMTs.

Industry wide, many technicians are working on autoflight systems. This is true of check, replace, rig, and troubleshoot tasks. The percentages are lower at base facilities as expected, but high elsewhere including small general aviation facilities.

The “related systems” category does not include flight controls. Flight controls have their own subject area.

3.8.1.2 Comparison with Allen Study

The Allen study included only tasks related to autopilot systems, and the percentage of technicians now working on autopilot tasks is ten times higher. Autoflight systems are clearly a technology that has arrived in full force in the years since the Allen study.

3.8.1.3 Recommendations

The committee strongly recommended a system level approach to this and other avionics subject areas. A system level approach would include ensuring that new graduates understand:

a. the overall purpose of an autoflight system,

b. what and how information enters the system, and

c. how other components and systems interface with the system.

Understanding inputs, outputs, and how information is processed is more important than being able to repair or replace specific components of the system. System level information transfers across aircraft types, but component specific information may not.

The committee also emphasized some basic prerequisites like diagram reading, understanding byte testing, and understanding basic electrical components like switches and connectors.

The percent response for autothrottle tasks at general aviation facilities is low enough on checking and troubleshooting tasks to allow them to be excluded from a core curriculum unless other considerations apply.

New AMT graduates should have a general knowledge of underling principles governing autopilot systems, autothrottle systems, and the related systems (actuators, servos, landing systems, etc.) that implement autoflight systems. This knowledge needs to be more than cursory.

Core autoflight tasks include inspecting, testing and servicing the "related systems."

Focus skill for the transport industry troubleshoot skills for autopilot and autothrottle systems, as well as repair systems skills for autopilot and related systems.

Link to grid.

3.8.1.4 Frequency and Percent Response

Avionics

Autoflight - % Response and Frequency

	Major Line		Major Base		Regional		Large GA		Small GA		Corporate		Overall	
	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq	%	frq
autopilot														
Troubleshoot autopilot.	49%	4	14%	3	26%	3	40%	3	46%	2	76%	1	27%	3
autothrottle														
Operational test autothrottle.	48%	2	6%	3	17%	2	17%	3	3%	1	30%	1	16%	2
Troubleshoot autothrottle.	52%	2	17%	2	25%	2	22%	1	20%	1	35%	1	26%	2
related systems/accessories														
Replace automatic flight control, autopilot or all-weather landing systems components.	48%	3	19%	3	45%	2	41%	3	53%	2	67%	1	32%	3
Rig or check autopilot flight control actuators and servos.	52%	2	15%	2	38%	2	53%	3	54%	2	65%	1	32%	2
Operational check flight control and landing systems.	61%	4	32%	4	56%	3	53%	4	62%	4	98%	2	50%	4

3.8.1.5 Criticality and Difficulty

3.8.1.6 Allen Comparison

3.8.2 Communications

3.8.2.1 Discussion

Communication tasks were divided into three groups:

a. Voice/Data communications (except ACARS)

b. ACARS

c. Related equipment (antennas, static discharge wicks, etc.)

3.8.2.1.1 Voice/Data communications

Overall, the percent response numbers for communication systems are robust, but some argument can be made for not involving technicians headed for the small general aviation sector in extensive training on these systems. A much smaller percentage of small general aviation technicians work on communication systems (except testing) infrequently.

The testing, repair, and troubleshooting of voice and data communication systems are tasks where regionals, small general aviation and major base facilities report relatively low percent responses.

The low percent response in these industry segments appears to come from different sources. In the small general aviation environment, the low percent response is accompanied by low frequency, indicating that overall this industry segment is not widely involved in repairing and troubleshooting communication systems. Regionals and major base facilities also have a low percent response, but they differ in having a high frequency. Low percent response combined with high frequency indicates specialized technicians--not low involvement by that industry segment.

Few major base and small general aviation technicians operationally test cockpit voice recorders. Conversely a majority of regional, major line and corporate technicians do this task and except for corporate technicians they do it frequently (weekly to monthly). At large general aviation facilities a less than half of the technicians perform this task monthly.

3.8.2.1.2 ACARS

ACARS is currently a technology found primarily on transport or high-end general aviation aircraft. Facilities that have a significant minority of technicians maintaining ACARS systems are those that service transport or business class aircraft. Like most other avionics technology, ACARS systems will probably soon penetrate into small general aviation aircraft.

The low percent response and high frequency observed with ACARS tasks at major base facilities and large general aviation facilities is evidence that maintenance related to ACARS is specialized. Technicians at major line facilities report both high percent response and frequency scores on ACARS systems. At small general aviation, regional, and corporate facilities, very few technicians work with ACARS systems with any regularity.

It should be noted that the survey questions only addressed testing and troubleshooting ACARS systems and not their repair or replacement. Information on the other ACARS tasks came from interviews and the advising committees.

3.8.2.1.3 Accessories (antennas, wicks and mounts)

Antenna and static discharge wicks are inspected, repaired, and replaced by most technicians indicating that these are core tasks. Wicks are inspected daily by major line technicians and at least weekly in every other industry segment. Antennae are repaired by a majority or significant minority of technicians in every industry segment (except major base) but only yearly or quarterly.

3.8.2.2 Comparison with Allen Study

Since the Allen study, the percentage of technicians working communications accessories/components has increased dramatically by nearly tenfold. A significant increase in percent response for other communications tasks also appears, but not on the scale seen for antenna and static discharge wicks.

ACARS tasks were not in existence during the Allen study.

3.8.2.3 Recommendations

In addition to the recommendations below, the committee felt that ACARS systems would continue to be diffused into the general aviation segment, which justified some knowledge of ACARS systems for all technicians.

AMT courses should cover a general knowledge of underling principles for ACARS systems, voice/data communications, and related accessories (static discharge, antenna, etc.). Core tasks covered in an AMT curriculum should include inspect (see the "Inspection" subject area), check and service skills for voice/data communications and related accessories (static discharge, antenna, etc.). Core tasks also include repair or replace skills for voice/data communications and related accessories.

	Understanding	Inspect	Service	Test/Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
ACARS	C									
Voice/Data Communications	C	C	C	C			C			
Accessories	C	C	C	C	C		C			

3.8.2.4 Frequency and Percent Response

3.8.2.5 Criticality and Difficulty

3.8.2.6 Allen Comparison

3.8.3 Electrical Power and Aircraft Lighting

3.8.3.1 Discussion

3.8.3.1.1 Batteries

Surveyed tasks on batteries included battery inspection/checking and batteries maintenance. Both tasks were performed by a very high percentage of technicians. The percent response at major base facilities was probably lower due specialization at major base facilities since high frequencies accompanied the percent response in this area. Overall, battery tasks are core tasks for AMTs.

3.8.3.1.2 Generators

Overall, the results from checking, servicing, replacement, and troubleshooting of generator tasks indicate that a substantial percentage of all technicians are involved with these systems.

The percentage of technicians at small and large general aviation facilities who replace or service CSDs or IDGs is quite small as would be expected, given a relatively low ratio of turbine based powerplants (principally at small general aviation facilities). The small general aviation technicians working on IDG/CSDs do so only yearly and the large general aviation technicians do so quarterly. It may also be the case that these systems (IDG/CSD) are on longer inspection cycles and consequently these tasks will not be performed as often on non-transport airplanes that are not in constant use.

The committee pointed out that the range of "generators" included in a generic category like "Generators" would including CSD, APUs, or power generation on small aircraft. These different systems share a conceptual similarity at the level of "system" that allows knowledge of one system to be transferred to another.

3.8.3.1.3 Lights

With the exception of major base facilities, the majority of technicians test, repair, replace, and troubleshoot lighting systems. This appears to be true of exterior and cabin lighting.

3.8.3.1.4 Switching and Distribution

Electrical switching and distribution equipment is universal on most aircraft. Consequently, most technicians test, replace, and troubleshoot this equipment. Some larger general aviation shops and line/base hangars are likely to have special "electrician" or "line avionics" technicians who do more electrical troubleshooting and repairing than other technicians. As consequence, the large general aviation and major base segments report a lower percentage of technicians performing with switching and distribution tasks. However, the relative specialization in these two industry segments is less important that the prevalence of these tasks in the other segments.

3.8.3.1.5 Wiring

Wiring tasks, like switching and distribution tasks, are performed by a high percentage of technicians. Technicians perform wiring modifications infrequently, but many still identified themselves as performing a wiring modification in the last year. The results seen for wiring modification may be influenced by how each mechanics defined a wiring modification (e.g., as major or minor).

Inspection, repair, and troubleshoot tasks were all performed by a high percentage of technicians. In addition, interviews of current technicians repeatedly included suggestions that Part 147 schools include more time on electrical systems including the use and identification of different connectors.

3.8.3.1.6 Accessories

The least common task in this area was “repair circuit board.” Most, if not all, facilities designate special avionics technicians for this work, or alternatively, use an outside vendor. The percent response for this task may be artificially high if some respondents considered replacement of a circuit board as a form of “repair.”

Most of the other tasks in this area dealt with replacing electrical system components like transformers, solid state inverters, rectifiers, and filters. Such tasks are performed by a significant percentage of technicians with a median frequency of quarterly. Major base and large general aviation facilities show some evidence of specialization in these areas.

One final task deals with troubleshooting electrically operated mechanical components. As might be expected most technicians perform these kinds of tasks very frequently (weekly).

3.8.3.2 Comparison with Allen Study

For battery tasks, the percent response has apparently increased since the Allen study (frequency has declined), but direct comparison is difficult since the Allen study surveyed specific types of batteries.

In general, changes from Allen are significant at major line facilities only. At major base and, large and small general aviation facilities, the percentage of technicians performing tasks in the above areas is about the same as is the frequency. At major line facilities, the frequency is lower than in the Allen study, but the percent response is much higher (e.g., 25% to 56%).

3.8.3.3 Recommendations

Comments from the committee were consistent with the interview data, which shows that increasing the electrical knowledge base of technicians is one of the highest priorities. Among the basic prerequisite skills is an awareness of overall electrical system functions. Other emphases include how to use and evaluate connectors, and how to inspect and use electrical switches and wiring. Differences in general aviation and transportation aviation are relatively insignificant since both sectors need technicians with relatively advanced electrical skills.

The committee also indicated that the increase in semiconductor-based components justifies technicians being able to troubleshoot and replace computer cards, but repair of such cards is a specialized skill.

New AMTs should have a general knowledge of underling principles for batteries, generators, lighting systems, switching and distribution systems, wiring and other electrical system accessories (circuit boards, transformers, rectifiers, etc.). New graduates should be able to inspect, check and service batteries, generators, lighting systems, switching and distribution systems, wiring and other electrical system accessories. AMT competencies should include repair or replace skills for batteries, lighting systems, switching and distribution systems, wiring and other electrical system accessories. The appropriate troubleshooting skills include competency on batteries, lighting systems, switching and distribution systems, wiring and other electrical system accessories.

Link to grid.

3.8.3.4 Frequency and Percent Response

3.8.3.5 Criticality and Difficulty

3.8.3.6 Allen Comparison

3.8.4 Central Maintenance and Warning Systems

3.8.4.1 Discussion

Many of the systems maintained by aviation technicians involve warning and indicating subsystems. Some aspects of the warning and indicating subsystems are similar across different systems. Other warning and indicating subsystems have characteristics unique to the system they are monitoring. The "warning" section of this subject area involves tasks that are not tightly associated with a particular system. Other warning and indicating tasks that are more closely associated with particular systems sections (e.g., "fuel", "landing gear", and "engine") have been included with those subject areas.

3.8.4.1.1 Centralized Maintenance Systems

Technicians working at major line facilities are involved with advanced central maintenance systems, but technicians in other industry segments are not. Aspects of the central maintenance systems including data exchange system and electronic displays are incorporated in other systems and consequently are maintained by more technicians in every industry segment. However, the overall percent response on these tasks is still below the significant minority threshold (30%).

Some tasks related to centralized maintenance systems occur only with the central maintenance system/computer found on only a few recent aircraft. As expected only the major airlines had contact with these systems. A few recently produced business class jets are also equipped with these systems, but the survey did not capture this generalization.

The other centralized maintenance systems tasks had to do with troubleshooting intersystem data exchange and electronic displays. Data exchange and electronic displays systems play a role in even more basic maintenance warning systems. Consequently, it is not surprising that all segments have technicians working in this area. The percent response scores are typical for electronic display tasks except in the general aviation segments where the percent response was lower, though still a significant minority is involved. Data exchange tasks are done by a lower than usual percentage of technicians in every segment.

Only 18% (the lowest percentage) of AMTs at regional facilities troubleshoot data exchange problems. It is unclear why the percent response is so low for this industry segment.

3.8.4.1.2 Warning Systems

Functionally testing aircraft warning systems had one of the highest percent responses and highest frequency of any task on the survey. The high scores were repeated in every industry segment. Stall warning tests and operational check of caution and warning systems was performed by most of the technicians in every industry segment weekly.

Crew alerting systems (EFIS, ECAM, and EICAS) are worked on by the majority of technicians at major line and corporate facilities. Checking crew alerting systems (EFIS, ECAM, EICAS) was done by significantly fewer technicians at small and large general aviation and regional facilities (range=11% - 32%), although the frequencies stayed at weekly to quarterly. This disparity is expected given the technological innovation incorporated into these systems.

3.8.4.2 Comparison with Allen Study

Comparison with the Allen Study in this area was not feasible since most of these systems have become widely used only after the Allen Study was completed.

3.8.4.3 Recommendations

The committee recommended that centralized maintenance systems be divided into two parts: basic systems and advanced systems (involving a central maintenance computer). The specific differences between the two need to be clarified, but there was agreement that the general aviation segment needs graduates with skills appropriate for basic systems and the transport sector needs technicians able to work with advanced systems.

A general knowledge of underling principles should be achieved for advanced centralized maintenance systems, and basic warning systems. In addition AMTs should be able to inspect, check and service basic warning systems. Troubleshooting skills on basic warning systems are also required.

In addition to the above skills, AMTs working in the transport industry segments need to be able to inspect, check and service advanced central maintenance systems. AMTs in the transport industry also need to have trouble shooting skills for central maintenance systems.

	Understanding	Inspect	Service	Test/Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
Central Maintenance System	C									
Central Maintenance System (Advanced	C	T	T	T	T	T				
Central Maintenance System (Simple)	C	G	G	G	G	G				
Warning Systems	C	C	C	C						

3.8.4.4 Frequency and Percent Response

3.8.4.5 Criticality and Difficulty

3.8.4.6 Allen Comparison

3.8.5 Navigation

3.8.5.1 Discussion

The most general point from this subject area is that it contains several tasks that are performed by relatively few technicians. The low percent response for some tasks indicates that curriculum limitations are appropriate here.

3.8.5.1.1 Flight (air) data

Air data computers are relatively recent technology and as the data shows, are much less likely to be maintained in small aviation facilities. Correspondingly, corporate facilities have the highest percent response as expected, given the sophisticated nature of most corporate jets. The percent response was also robust at large general aviation facilities, perhaps because large general aviation facilities often renovate overhaul sophisticated business class jets.

Tasks related to air data computers, collection or distribution, are seldom performed in the small general aviation environment. Regional and major base facilities also have low percent response scores for air data computer, collection, and distribution, but they have high frequencies which indicates specialization.

Air data computers are most prevalent in upper end aircraft, but the percent response and frequency numbers in the small general aviation sector indicate that this technology may become more common even in the small general aviation sector over time.

3.8.5.1.2 Flight instruments and accessories

One simple observation for virtually every task in this section is that few technicians at Base facilities perform these tasks, however, these technicians perform them frequently. Also more corporate technicians appear to perform tasks electronic flight instrument than in any other industry segment.

Pitot static inspection and repair tasks are frequently performed in all segments with some frequency. Tasks related to vacuum driven instruments are performed by the majority of small general aviation technicians but by a minority (less than 30%) of the technicians in the other industry segments. For electronic flight instruments the situation is reversed. The lowest percent response in the small general aviation segment was for functionally testing EFIS systems; however, 13% of the technicians have worked on EFIS systems and they have done so monthly to quarterly. Avionics technology appears to enter the general aviation environment at only a slightly slower pace than in the other industry segments.

For most tasks in this subject area, the percent response and frequency score are similar for between test, repair, and troubleshoot tasks are not large. Often, in other subject areas, repair/replace tasks have a much lower percent response and frequency than other tasks. This generalization is most often true with systems that take significant manipulative skill. For most of the flight instrument tasks, manipulative skills are much less important than knowledge about how the systems operate.

One important caution for this section is that the range of equipment covered by flight instruments is very extensive. Generalization made over a wide range of instruments will have exceptions for specific instrumentation systems.

3.8.5.1.3 Flight management

Flight management systems like many navigational systems are infused with new technology on a regular basis. This infusion is following the typical pattern of starting with transport jets, moving to corporate jets, and slowly penetrating the small general aviation sector.

Many, though not a majority, of major line technicians perform all the flight management tasks, and the percent response among corporate technicians was even higher.

Two tasks were performed by fewer than 30% of the small general aviation technicians. One task related to the complete flight management system, while the other involves a specific component. The task involving the complete flight management system was only performed by 11% of regional technicians.

The percent response among regional technicians tended to be lower than among large general aviation technicians. This is unusual because most of the newer aircraft flown be regional airlines generally have newer flight management systems.

3.8.5.2 Comparison with Allen Study

In all industry segments, the percent response on comparable tasks is higher now than in the Allen study. In addition, for every industry segment except major base the frequencies are also higher. Only a couple of tasks dealing with older navigation technology (e.g., gyroscopes) deviate from this pattern.

3.8.5.3 Recommendations

In general, the traditional distinction between navigation, communication, autoflight and maintenance systems is disappearing. Increasingly, single displays are capable of reporting information from any system and the systems are communicating with each other. It might even be argued that a single EFIS system is emerging. At this point it is important to remember that significant changes are and will continue to occur within avionics systems.

Currently, all new AMTs should have a general knowledge of underling principles flight data systems, all flight instruments and accessories, and flight management systems. These AMTs should also have the ability to inspect, check and service flight data systems, flight instruments and accessories, and flight management systems. The replace/repair system skills these AMTs have should include replacing flight instruments and accessories (electronic, but not vacuum driven) and flight management systems. Troubleshooting skills should also be required for flight instruments and accessories.

Link to grid.

3.8.5.4 Frequency and Percent Response

3.8.5.5 Criticality and Difficulty

3.8.5.6 Allen Comparison

3.9 General

3.9.1 Anti-icing and De-icing systems

3.9.1.1 Discussion

3.9.1.1.1 Ice Control Systems

Aside from ice control systems specifically related to propeller tasks, most technicians in all industry segments inspect and troubleshoot ice, rain, and fog control systems. Only base facilities appear to be specialized in this area.

The components involved in leading edge, scoop and windshield anti-ice systems are repaired or replaced by at least 60% of the technicians in every industry segment except major base. The frequency of repair/replace task performance is low, except at regional where it is monthly.

Propeller heat systems are not maintained at major base or major line facilities. A low percentage of large general aviation and corporate technicians troubleshoot or test propeller heat. Only at regionals and small general aviation facilities do a significant majority of technicians inspect and troubleshoot propeller heat, which is not surprising since the majority of propeller driven airplanes are serviced at these facilities.

3.9.1.1.2 De-ice boots

The results show that the repair of electrical de-ice boots is not a line maintenance task and is rarely done at major base facilities. It is however performed at regionals and in both large and small general aviation facilities by 40-60% of the technicians. In the corporate environment the percent response drops, as does the frequency.

3.9.1.2 Comparison with Allen Study

Overall there is a general trend toward higher percent response and lower frequency in the JTA. However, there are no dramatic differences between the two studies. The biggest changes come from the major line and small general aviation sectors where the percent response has doubled or nearly doubled on most tasks.

3.9.1.3 Recommendations

New AMTs should possess a general knowledge of underling principles for ice, rain and fog control systems and all types of de-ice boots. They should be able to inspect, check and service ice, rain and fog control systems, but not de-ice boots. They should be able to and be able to replace component or repair the integrity of ice, rain and fog control systems. In addition troubleshooting skills should be acquired for ice, rain and fog control systems.

Link to grid.

3.9.1.4 Frequency and Percent Response

3.9.1.5 Criticality and Difficulty

3.9.1.6 Allen Comparison

3.9.2 Fire Protection

3.9.2.1 Discussion

3.9.2.1.1 Fire Protection

The major line, regional, small general aviation and corporate industry segments showed higher than average percent response rates for the functional testing of the protection system and the inspection of both the engine fire loop and the fire extinguishing system. In addition, the troubleshooting of the fire detection circuits and the extinguishing and control systems also showed higher than average response rates in the major line, regional and corporate industry segments.

All tasks at regionals showed higher than average percent response rates.

The functional testing of the fire protection system showed a higher than average criticality in all industry segments except corporate facilities. With the exception of the inspection of the fire detection system, all tasks showed a higher than average criticality in the large general aviation segment. The large and small general aviation and corporate segments showed a less than average difficulty for the inspection of the fire extinguishing system.

In the major line industry segment, three tasks showed a daily performance frequency: functional and operational tests of the fire protection system and troubleshooting the fire extinguishing and control systems. These three tasks showed a weekly frequency in the regional industry segment.

For the operational checking of fire detection systems, the large general aviation segment showed a higher than average difficulty.

3.9.2.1.2 Smoke Detection

For the testing of passenger or cargo smoke detection systems, the major line, large general aviation and corporate segments showed a higher than average percent response ratio.

Major line and corporate facilities provided the highest percent response rates, followed by region, large and small general aviation facilities. Major base facilities showed the lowest percent response ratio.

With the exception of the small general aviation segment, all frequency scores were consistent with the averages over all tasks. Major base, regional and large general aviation facilities showed higher than average criticality for the two tasks in this category. All segments reported difficulty scores consistent with averages over all tasks.

Small general aviation facilities showed below average frequencies for both tasks in this category.

3.9.2.1.3 Accessories

All three tasks in the major line and regional industry segments showed higher than average percent response ratios. For the inspection of the extinguishers and fire bottles, the major line, major base, regional, large general aviation and corporate segments showed higher than average percent response rates.

For these three tasks, the major line facilities showed the highest percent response rates, followed closely by the corporate and regional facilities. Large and small general aviation facilities showed roughly the same percent response rate, while the major base facilities showed the lowest percent response rate. Major line, major base, regional and large general aviation facilities showed roughly the same frequency, while small general aviation and corporate facilities showed lower frequencies.

The inspection of fire extinguishers and fire bottles showed a higher than average criticality in the regional, large and small general aviation and corporate facilities. Large general aviation facilities showed a higher than average criticality for all three tasks. All industry segments showed a lower than average difficulty for the inspection of fire detection elements for connections and security.

The repair and replacement of fire detection / protection components showed a weekly frequency in the major line segment, while the inspection of fire detection elements for connections and security showed a less than quarterly frequency in the small general aviation segment.

3.9.2.2 Comparison with Allen Study

At major line facilities, the percent response rate increased from the Allen study to the JTA. For four tasks, the performance frequency also increased. At major base facilities, the percent response rate increase in for two tasks: the inspection of fire extinguishers and fire bottles and the repair or replacement of fire detection / protection components. The frequency increased in three tasks, while it decreased in one. At large general aviation facilities, the response rate increased for five tasks from the Allen Study to the JTA. These five tasks are all related to the inspection of repair/replacement of fire extinguishing components. The frequency increased for four tasks and decreased for one task. For small general aviation facilities, the percent response rate increased for all but two tasks. The performance frequency decreased for three tasks and increased for one task.

3.9.2.3 Recommendations

A graduate should have a general knowledge of principles of fire detection and smoke detection systems and related accessories and components. One should be able to inspect, check, service, repair or replace or troubleshoot these systems. The grid below summarizes these recommendations.

	Understanding	Inspect	Service	Test/Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
Fire Detection	C	C	C	C	C	C	C	C		
Smoke Detection	C	C	C	C			C	C		
Accessories/Components	C	C	C	C						

3.9.2.4 Frequency and Percent Response

3.9.2.5 Criticality and Difficulty

3.9.2.6 Allen Comparison

3.9.3 Hydraulics and Pneumatics

3.9.3.1 Discussion

3.9.3.1.1 Hydraulic System

In the major line, regional, large and small general aviation and corporate industry segments, higher than average percent response rates were recorded for five tasks. These tasks include checking for leaks in the hydraulic system, functional testing the hydraulic system, servicing the hydraulic system, bleeding the hydraulic system pressure and repairing or replacing hydraulic components. Frequency scores for these tasks were also higher than average. All tasks in the major line and corporate segments recorded higher than average frequency scores. With the exception of servicing the hydraulic accumulator, the percent response scores in the small general aviation segment were also above average.

Major line and corporate facilities yielded the highest percent response ratios, while small general aviation facilities provided slightly smaller results. Regional and large general aviation facilities yielded roughly the small result, with major base facilities providing the lowest percent response rates.

Major line and major base facilities rated the repair or replacement of hydraulic components with above average criticality. Regional facilities rated the repair of hydraulic system leaks and troubleshooting the pressurized hydraulic system with above average criticality.

At the major line facilities, technicians check for leaks in the hydraulic system on a daily basis. Technicians at regional facilities rated the servicing of the hydraulic system with a low level of difficulty.

3.9.3.1.2 Pneumatic System

Major line facilities yielded higher than average results for all three tasks in this category. All tasks in each of the five other industry segments were near average values. In addition, all criticality and difficulty results were near average values.

Technicians at small general aviation facilities repair bleed air ducting systems on a less than quarterly basis.

3.9.3.2 Comparison with Allen Study

For the major line facilities, percent response rates for hydraulic system tasks stayed roughly the same, while percent response rates for pneumatic systems increased from the Allen Study to the JTA. Frequency of performance increased for both hydraulic and pneumatic systems. For the major base facilities, the percent response rates increased in all tasks, while the frequency of performance increased in four of seven tasks.

For large general aviation facilities, the percent response rate for hydraulic system tasks decreased from the Allen Study to the JTA, while the percent response rate increased for the repair or replacement of pneumatic system components. The frequency of performance increased in five of the seven tasks. For small general aviation facilities, the percent response rate stayed the same for hydraulic system components, while it increased for two of three pneumatic system components. The frequency of performance increased for only one of seven tasks.

3.9.3.3 Recommendations

The committee recommended that special attention be given to safety issues associated with hydraulic and pneumatic systems. In addition, they suggested that the experience of tearing down and rebuilding a pump is a valuable educational experience although new graduates should be expected to do this task unsupervised.

Graduates should have a general knowledge of the principles involved in hydraulic and pneumatic systems. These principles include inspection, checking, servicing, repair or replacement and troubleshooting skills for both systems.

Link to grid.

3.9.3.4 Frequency and Percent Response

3.9.3.5 Criticality and Difficulty

3.9.3.6 Allen Comparison

3.9.4 Inspections

3.9.4.1 Discussion

The data from this subject area are rather straightforward. Most new graduates should be able to perform a basic visual inspection of almost any material or system. One exception is wood, dope and fabric. These older materials are only inspected in the small general aviation segment. Even in the small general aviation segment only 10% of the technicians inspect these materials and they do so only quarterly.

Non-destructive-testing (NDT) inspections provide some interesting data. Of the five types of NDT surveyed (eddy current, ultrasound, magnetic particle, x-ray and dye penetrant), only one, dye penetrant, is performed by a significant percentage of technicians. This would indicate that new graduates should be able to perform dye penetrant inspections but not other NDT inspections.

3.9.4.2 Comparison with Allen Study

Most of the tasks in this section are comparable with the Allen study. Even the NDT inspections, which are often thought of as recent developments, were surveyed in the Allen Study.

Visual inspections of different components and materials were common in the Allen Study and will always be common. Somewhat surprisingly, even in the Allen study only a small minority of technicians inspected fabric coverings. NDT tasks are performed by a higher percentage of technicians now, but the frequency is lower. In both surveys dye penetrant was the most common NDT inspection. It appears that X-ray and Ultrasonic inspections have undergone the greatest increase in popularity since the Allen Study.

3.9.4.3 Recommendations

Interestingly, many schools have equipped themselves to teach advanced NDT techniques, but the survey numbers and a consideration of how NDT is handled in the industry suggests that most technicians are not involved in NDT inspections.

An additional concern focused on explicitly teaching the difference between a general visual inspection and a detailed visual inspection.

The committee agreed that eliminating inspection skills for wood, dope, and fabric is acceptable. They also agreed that of the NDT test only dye-penetrant testing should be required. Only specialized technicians who receive additional training after employment perform other NDT inspection methods. These other NDT inspection methods should be taught to impart the principles and theory of these methods but not with the intent to achieve performance competence. Even a focus curriculum directed toward transport aircraft need not include the other NDT inspection methods as an area of required competence.

The maintenance training related to inspections for all AMT schools should include requiring new graduates to acquire a general knowledge of underling principles for the visual inspection of most/all materials, components, connectors, filters, etc (except wood, dope and fabric materials). All new AMTs must also understand difference between general and detail visual inspections and be able to perform both. New AMTs must also understand the principles and function of all NDT inspection methods. The ability to perform visual inspection of most/all materials, components, connectors, filters, etc. (except wood, dope, and fabric materials) is also required. In addition all AMTs should be able to perform dye-penetrant inspections.

For inspection tasks, troubleshoot and repair/replace skill sets are not relevant.

Link to grid.

3.9.4.4 Frequency and Percent Response

3.9.4.5 Criticality and Difficulty

3.9.4.6 Allen Comparison

3.10 Powerplant

3.10.1 Reciprocating and Turbine Engines

3.10.1.1 Discussion

3.10.1.1.1 Piston Engines

No major line, major base or regional technicians are performing work on piston engines. Few technicians at large general aviation and corporate facilities work on these types of engines. On the other hand, the majority of small general aviation technicians work on piston engines. Not surprising, some types of piston engines (e.g., radial engines) are worked on rarely even in the small general aviation sector.

Even though only two or three industry segments actually work on piston engines (small general aviation, large general aviation and corporate), the general principles of operation governing piston engines has traditionally been part of the knowledge that technicians acquire. In order to facilitate technicians moving between different industry segments, some knowledge of the tasks performed in the different segments should be part of the core knowledge that an employer can assume of any technician.

As a whole the small general aviation environment seems to be moving away from performing overhaul maintenance on piston engines. In light of this trend, it should be left to employers or other career considerations by technicians if they want to pursue advanced knowledge of piston engines.

3.10.1.1.2 Turbine Engines

Tasks associated with turbine engines can be divided into those tasks that are done only on turboprops and those done on any turbine engine. There are also a few tasks that are related only to non-turboprop turbine engines (e.g., thrust reversers).

Generic turbine tasks like inspect, service, or troubleshoot a turbine engine are performed across the industry segments. Even the small general aviation segment has 39% of its technicians servicing turbine engines at least monthly. More advanced turbine tasks such as replacing hot sections or replacing entire engines are done by significantly fewer technicians except at major line facilities. Included in this group of tasks are those related to the repair or replacement of fan blades and service reduction gears. Other systems associated with turbine engines, like APUs, are checked, serviced, and repaired/replaced by a majority (or significant minority) of the technicians in every industry segment except small general aviation. Only 20% of small general aviation technicians maintain APUs, and this minority does so only yearly.

Tasks specific to turboprops are performed in every industry segment except major base and major line. Regionals show the most involvement with turboprops, although the other industry segments are likely to service or troubleshoot a turboprop engine. Small and large general aviation facilities have a low percentage of technicians who are likely to replace a turboprop engine. The lower percentage may reflect the use of vendors for this task.

Tasks specific to non-turboprop turbine engines (i.e., jets) are relatively rare in the survey. The surveyed tasks indicate that most regional facilities are not maintaining jets, but large general aviation and to a lesser extent small general aviation facilities are performing maintenance on jet engines.

3.10.1.1.3 Both Turbine and Piston

Some tasks like boroscope inspection, or general inspection for leaks, security, etc. are performed on all power plants. With one exception, most technicians in every segment (excluding major base) perform these tasks. The one exception was "perform internal repairs to engine." This task was the most overhaul-specific task asked and it received a low percent response in every segment. Interview data indicates that third party vendors are performing a large portion of the overhaul work on powerplants (piston or turbine), and the survey results support that generalization.

3.10.1.1.4 Engine Indicating

While the majority of technicians (except those at major base facilities) repair, replace and trouble shoot generic engine indicating components, a much lower, though still significant, percentage of technicians troubleshoot electronic engine indicating system. Corporate technicians had the highest percent response (above 80%) in these areas and yet did the tasks only yearly.

3.10.1.2 Comparison with Allen Study

One interesting observation between the two studies is how similar their results are. In both studies only in the small general aviation segments has a majority of technician working on reciprocating engines. In the Allen study, almost all small general aviation technicians performed tasks on these powerplants, but currently barely half do so.

The percent response on APU related tasks has increased significantly in all sectors as would be expected given the increasing popularity of turbine engines.

3.10.1.3 Recommendations

Perhaps the most significant point brought up by the committee was the transference of skills from one kind of powerplant to the other. Even though reciprocating engines have not been the dominant powerplant for decades, the background skills that students achieve from learning to tear down and rebuild a piston engine gives them many skills that transfer easily to turbine engines. In addition, the basic principles and theories of powerplants (e.g., fuel storage, fuel delivery, ignition systems, etc.) apply to most any type of powerplant. The conclusions drawn from these points are:

1. Even though a minority of technicians will overhaul powerplants once employed, many related and valuable skills are obtained through the process of overhauling a powerplant in school. Thus, either the core or focus curriculum should include actually rebuilding some powerplant.

2. Students should be able to choose the powerplant they want to rebuild based upon their employment objectives. Reciprocating engine rebuilds would be appropriate for a student with a small general aviation focus and turbine engine rebuild would be appropriate for students tending toward transport aircraft.

3. Basic troubleshooting and inspect/service skills should be obtained by new graduates on whichever powerplant they are trained on.

The committee also remarked that if a focus curriculum is aimed at the new AMT-T certification, the powerplant education should be on turbines and not reciprocating engines. Some streamlining of the core curriculum will be obtained by selecting one type of powerplant to train on and then limiting training on the other powerplant to a general introduction to the differences found with the other powerplant type(s). Over time, additional types powerplants may appear and ideally a revised part 147 regulation would allow schools and students to select whatever type of powerplant characterizes the industry segment where the student seeks employment.

One further note is that “test or check” for powerplants generally means being able to determine if parts are operating within acceptable parameters

3.10.1.3.1 Relating Results to Grid

Since the actual performance of tasks related to piston engines is limited primarily to the small general aviation environment, only those technicians focusing on small general aviation maintenance should be trained to the point where they can independently perform check and inspect tasks and troubleshooting tasks on piston engines. Thus, troubleshooting and check and inspect tasks on piston engines should be part of the focus curriculum for these technicians.

Maintenance training related to engines should include an understanding of the principles of operation for all powerplant types and engine indicating systems. New graduates should be able to check, inspect and perform basic service tasks (e.g. change fluids and filters) on all power plants. They should be able to inspect, check, service and replace components of engine indicating systems. New AMTs should also be able to troubleshoot engine indicating systems.

In addition, AMTs should gain advanced skills on one type of powerplant. They should have the experience of overhauling some powerplant. The experience is required but the ability to perform an overhaul after graduation is not required.

On the powerplant type that a technician chooses to focus on that AMT should be able to troubleshoot and identify problems on every system. They should also be able to inspect, check, service, and troubleshoot related systems specific to that powerplant type (e.g., thrust reversers, gear reduction systems, etc.).

Link to grid.

3.10.1.4 Frequency and Percent Response

3.10.1.5 Criticality and Difficulty

3.10.1.6 Allen Comparison

3.10.2 Powerplant Fuel and Lubrication Systems

3.10.2.1 Discussion

3.10.2.1.1 Powerplant Fuel Systems

One consideration in evaluating these results is that the surveyed tasks were directed toward generic fuel control systems. Except at major base and large general aviation facilities, most technicians are involved in testing fuel control systems, troubleshooting systems, and repairing/replacing components of a system. The same is true of replacing and installing a fuel control unit -- except at small general aviation facilities where the percent response drops to 29% and those 29% are only performing this task yearly.

Recommendations in this area may need to take into account the different types of fuel control systems and consider if some components of fuel control systems are more or less likely to be replaced. This is especially true on newer jets where fuel control systems may be more integrated with other systems.

3.10.2.1.2 Lubrication

One of the tasks surveyed in this area, "Drain and replace oil in piston engine" was specific to piston engines. Accordingly none of the technicians at major base, major line, or regional facilities performed this task. Comparatively, most of the small general aviation technicians did this task weekly. Less than half of the large general aviation and corporate technicians perform this task. The remaining service tasks surveyed in this area were performed by more than half of the technicians in all industry segments, except at major bases.

3.10.2.1.3 Accessories

Tasks in this section related primarily to filter inspection and repair. The general task of replacing and engine filter was done by the majority of technicians in every industry segment except major base. Scavenge filters and turbine oil filters were serviced and replaced by the majority of technicians at major line, regionals, and corporate facilities. At large and small general aviation facilities, a lower percentage of technicians were involved with these tasks (28% - 45%). At large general aviation facilities, the slightly higher frequencies seen may indicate some specialization.

Perhaps the most important observation is that 34% of the small general aviation technicians are replacing filters on turbine engines monthly. This task is evidence that small general aviation facilities are not just maintaining aircraft with reciprocating engines.

3.10.2.2 Comparison with Allen Study

Unlike most other subject areas, work done on fuel control systems is done by a lower percentage of technicians than in the Allen study. Lubrication tasks remained about the same.

3.10.2.3 Recommendations

The committee recommended distinguishing types of fuel control systems. Carburetor/float systems would not be part of a core curriculum, but other fuel control systems would. In addition, the committee emphasized the importance of being able to understand and evaluate fuel control systems as a complete system.

A new AMT should have a general knowledge of fuel systems, lubrication systems and related accessories (like filters). This AMT should be able to inspect, check and service fuel systems (but not carburetor/float systems), lubrication systems, and related accessories. The ability to repair a system or replace a component should be obtained on fuel systems (not carburetor/float systems) and other related accessories. In addition the new graduate should be able to troubleshoot fuel systems.

Link to grid.

3.10.2.4 Frequency and Percent Response Charts

3.10.2.5 Criticality and Difficulty Charts

3.10.2.6 Allen Comparison

3.10.3 Ignition and Starting

3.10.3.1 Discussion

3.10.3.1.1 Ignition

The lowest percent response in this area is the inspection of battery ignition systems. The percent response varies from 49% to 20% across industry segments. However, this same task is done frequently. The remaining inspect, repair/replace, and troubleshoot tasks are done by a majority of the technicians in every industry segment except major base.

Some important distinctions between small general aviation and transport aircraft are not found in the data.

3.10.3.1.2 Starting

The booster starting system tasks appear to have been misinterpreted at the major line and major base facilities. Current transport jets do not have booster starting systems. Therefore it is expected that segments that do not handle jet engines with show a high percent response rate. Small general aviation has a significant percent response but the other segments are around ten percent. The other starting task is the removal of a generic starter and the percent response and frequencies are high for this task.

3.10.3.2 Comparison with Allen Study

There are some notable differences between the two studies. The Allen study had a task “Inspect and Repair Turbine ignition systems” which was done by 45% of the line technicians and 3% of the base technicians. Similar tasks in the Allen study (e.g., inspect and repair booster starting systems, etc.) showed no technicians at either line or base facilities were performing them.

In general aviation, the common trend of the Allen study reporting lower percent response and high frequency continued to be true of ignition and starting tasks.

3.10.3.3 Recommendations

New AMTs should have a general knowledge of ignition systems and starting systems. They should also be able to inspect, check, service, repair system and replace component on all ignitions systems and most starting systems (booster starting systems are not included in this competency. Troubleshooting skills need to be acquired for all ignition systems.

AMTs working in general aviation should have additional inspect, check, service, repair, troubleshoot, and even overhaul skills on booster starting systems.

	Understanding	Inspect	Service	Test/Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
Ignition	C	C	C	C			C	C		
Starting	C	C	C	C			C			

3.10.3.4 Frequency and Percent Response Chart

3.10.3.5 Criticality and Difficulty

3.10.3.6 Allen Comparison

3.10.4 Propellers

3.10.4.1 Discussion

Technicians at major airline facilities do not perform these tasks since major airlines do not operate aircraft with propellers. The regional airline, large and small general aviation and corporate segments all perform tasks on propellers.

3.10.4.1.1 Propeller Assembly

Technicians at regional facilities inspect propellers for damage daily. At regionals, a below average response rate was seen for three tasks: overhaul propeller assembly, tear-down and build-up of prop assembly, and troubleshoot constant speed propellers. For criticality, no tasks showed significant deviation from the average for all tasks. For difficulty, one task, overhaul of the propeller assembly, showed a high score.

At large general aviation facilities, the response rate for all tasks was below average. This may indicate these shops predominantly work with jet engines. Two tasks showed frequency scores below the average for all tasks: overhauling propeller assemblies and the tear-down and build-up of propeller assemblies. For criticality, overhaul of the propeller assembly, had above the average criticality and difficulty. The lubrication of the propeller showed a difficulty score below the average for all tasks, while the tear-down and build-up of the propeller assembly was more difficult to learn.

At small general aviation facilities, two tasks showed low percent response: overhaul propeller assemblies and tear-down and build-up of propeller assemblies. These two tasks also showed frequency scores below the average for all tasks. Inspecting the propeller for damage, showed a frequency and response rate above the average for all tasks. For criticality, one task, overhaul of the propeller assembly, showed a criticality of 5 and a difficulty of 4, both above the averages for all tasks. The lubrication of the propeller showed a difficulty score below the average for all tasks, while the tear-down and build-up of the propeller assembly showed a score above average.

The response rate for all tasks in corporate facilities was below the average. This is probably due to the presence of more jets in this industry segment. Two tasks showed frequency scores above the average for all tasks: inspection of the propeller for damage and operational check fixed and constant speed propellers. One task, the tear-down and build-up of the propeller assembly, showed a high difficulty score.

The overhaul of the propeller assembly showed low frequency and response rates for all industry segments. This task, however, showed a high criticality in the general aviation segments and a high difficulty in the regional and general aviation segments. In addition, the tear-down and build-up of the propeller assembly, a related task, shows a similar trend – low response rate and frequency with a high level of difficulty. This shows that these tasks, though performed infrequently by a few technicians, are critical to the aircraft's operation and are difficult to learn.

Most technicians inspect the propeller for damage on a frequent basis. More specialized tasks are perform infrequently and require special skills to master.

In the regional segment, the inspection of propellers for damage showed a daily frequency score. The overhaul of the propeller assembly showed a criticality score of 5 in both general aviation segments. The percent response rates for all tasks in the large general aviation and corporate facilities were below the averages for all tasks in the respective industry segments.

3.10.4.1.2 Blades

In the large general aviation and corporate segments, two tasks showed percent response rates below the average for all industry tasks in the respective segments. In the small general aviation segment, the dressing of nicks and irregularities showed a higher percent response rate than the average for all tasks, while a lower percent response rate for rigging the propeller blades. Scores for criticality and difficulty were consistent with the averages for all tasks in the respective industry segments. These patterns indicate that the rigging of the propeller blades in performed infrequently at these facilities.

The percent response rate for small general aviation facilities was significantly below the average for rigging propeller blades, while significantly above the average for dressing irregularities in propellers. The percent response rate for the large general aviation facilities was well below the average for the response rate for all tasks within the segment. In addition, the percent response rate for the two tasks in corporate facilities was well below the average for all tasks in the segment.

3.10.4.1.3 Propeller Controls

Only regional and small general aviation facilities are significantly involved with the maintenance of propeller controls.

The percent response rates for the servicing of the bleed valve propeller governor in all industry segments was below the average for all tasks in the respective segments. Below average response rates were also observed for all tasks in the large general aviation and corporate segments. For regional facilities, the troubleshooting of the propeller synchronization showed a criticality below the average for all tasks in the segment.

The percent response rates for the three propeller controls tasks at large general aviation and corporate facilities were below the average for all tasks in the respective segments.

3.10.4.2 Comparison with Allen Study

The greatest changes can be seen in the small general aviation segment. For the propeller assembly, frequency of inspection and replacement of propellers increased from the Allen study to the JTA, while lubrication decreased. For the propeller controls, frequency of propeller synchronization troubleshooting and governor adjustment increased. For the other industry segments, frequency for all tasks stayed the same.

3.10.4.3 Recommendations

Graduates should have acquired a general knowledge of the principles concerning propeller blades, propeller assembly systems and propeller control systems. In addition, graduates should be able to inspect, check and service propeller blades, and inspect and check propeller assembly and control systems.

3.10.4.4 Frequency and Percent Response

3.10.4.5 Criticality and Difficulty

3.10.4.6 Allen Comparison

3.11 Summary

A summary of the entire list of the curriculum grids is provided below as a reference.

		Understanding	Inspect	Service	Test/ Check	Perform	Repair System	Replace Component	Troubleshoot	Repair Component	Overhaul
Cleaning	Cleaning	C	C	C	C	C					
Cleaning	Corrosion/ Disbonding	C	C	C	C	C					
Cleaning	Paint Large Components/ Areas	C	C	C	C						
Cleaning	Paint Small Components/ Areas	C	C	C	C	C					
Cleaning	Chemical Process	C									
Cabin	Air Conditioning/ Heating	C	C	C	C		C	C	C		
Cabin	Oxygen	C	C	C	C		C	C	C		
Cabin	Pressurization	C	C	C	C		C	C	C		
Fuel System	Distribution	C	C	C	C		C	C	C		

Fuel System	Storage	C	C	C	C		C	G	C	G	
Fuel System	Accessories	C	C	C	C		C	C	C		
Fuel System	Fuel Quanity Indicating	C	C	C	C		C	C	C		
Fuel System	Contamination	C	C		C						
Fuel System	Defueling	C		C							
Landing Gear	Anti-skid	C	C		C		T	T	T		
Landing Gear	Brakes	C	C	C	C		C	C	C		T
Landing Gear	Landing Gear Position Indicating	C	C	C	C		C	C	C		
Landing Gear	Main/Nose Gear	C	C	C	C		C	T	C		T
Landing Gear	Retractable Gear	C	C	C	C		C	T	C		T
Landing Gear	Tires	C	C	C	C		C	C	C		T
Minor Repairs	Plastics, Fiberglass, Composites	C	C	C	C	C	C		T		
Minor Repairs	Sheet Metal	C	C	C	C	C	C				
Minor Repairs	Soldering	C	C	C	C	C	C				
Minor Repairs	Welding	C	C	C	C	T	T				
Minor Repairs	Wood, Dope, Fabric	C	G								
Structures	Doors	C	C	C	C	C	C				
Structures	Windows	C	C	C	C						
Structures	Slides, Liferafts, etc.	C	C	C	C						
Structures	Wing Inspection	C	C								
Autoflight	Autopilot	C	C	C	C		T		C		
Autoflight	Autothrottle	C	T				T	T	T		
Autoflight	Related Systems/ Accessories	C	C	C	C	C					
Communications	ACARS	C									
Communications	Voice/Data Communications	C	C	C	C			C			

Communications	Accessories	C	C	C	C	C		C	
Electrical	Batteries	C	C	C	C			C	
Electrical	Generators	C	C	C	C				C
Electrical	Lights	C	C	C	C	C		C	C
Electrical	Switching and Distribution	C	C	C	C	C		C	C
Electrical	System Accessories	C	C	C	C			C	C
Electrical	Wiring	C	C	C	C	C			C
Flight Controls	Flight Controls	C	C	C					
Flight Controls	Components	C	C	C	C	C			C
Ignition & Starting	Ignition	C	C	C	C			C	C
Ignition & Starting	Starting	C	C	C	C			C	
Navigation	Flight Data	C	C		C				
Navigation	Flight Instruments/ Accessories	C	C		C			C	C
Navigation	Flight Managements	C	C		C				
Anti-ice	De-ice Boots	C	C						
Anti-ice	Ice Control Systems	C	C	C	C	C	C		C
Fire Protection	Fire Detection	C	C	C	C	C	C	C	C
Fire Protection	Smoke Detection	C	C	C	C			C	C
Fire Protection	Accessories/ Components	C	C	C	C				
Hydraulic & Pneumatic	Hydraulic Systems	C	C	C	C	C	C	C	C
Hydraulic & Pneumatic	Pneumatic Systems	C	C	C	C	C	C	C	C
Indicate & Warning	Central Maintenance System	C							

Indicate & Warning	Central Maintenance System (Advanced)	C	T	T	T	T	T			
Indicate & Warning	Central Maintenance System (Simple)	C	G	G	G	G	G			
Indicate & Warning	Warning Systems	C	C	C	C					
Engines	APU	C	C	C	C					
Engines	Reciprocating Only	C	C	C	C	G		G	G	G
Engines	Related Systems	C	C							
Engines	Turbine or Reciprocating	C	C	C	C					
Engines	Engine Indicating	C	C	C	C	C		C	C	
Engines	Turbine Only	C	C	C	C	T		T	T	T
Fuel Control	Fuel Control	C	C	C	C	C	C	C		
Fuel Control	Lubrication	C	C	C	C					
Fuel Control	Accessories	C	C	C	C			C		
Propellers	Blades	C	C	C						
Propellers	Propeller Assembly	C	C							
Propellers	Propeller Control	C	C							
Inspections	Visual Inspections	C	C			C[1]				
Inspections	NDT Inspections	C	C			C[2]				

C[1] does not include wood, dope and fabric

C[2] applies only to dye-penetrant testing

4. Comparison to FAR Part 147 Curriculum

4.1 Introduction

FAR Part 147 contains the requirements for an AMT school to be certificated by the FAA. Specifically, this regulation outlines the curriculum that AMT schools are required to teach. The current version of Part 147 is provided as Appendix B of this report. This chapter provides a comparison between the results of this study and the AMT curriculum included in Part 147.

4.2 Development and Structure of FAR Part 147

The Allen Study, performed by David Allen at the University of California at Los Angeles, formed the basis for much of the content of Part 147. This project spanned from 1967-1974 and was conducted in three parts. The first phase identified a common core curriculum for the training of AMTs. The second phase identified through experimental research, ways to implement the common core curriculum utilizing instructional techniques at the time. The third phase involved hosting workshops with instructors from AMT schools to review the curriculum. In addition, methods were developed to resurvey the industry in order to identify trends in the industry and areas in the curriculum that need revision.

There is a linkage between the analysis performed as part of the Allen Study and the curriculum contained in FAR Part 147. The Allen Study survey included a list of 589 tasks and was completed by a sample of AMTs from all segment of the industry. The analysis of this data provided the basis with which to develop the core curriculum. In turn, the recommendations in the Allen Study were adapted to become the curriculum objectives and corresponding teaching levels in FAR Part 147. This version of the regulation took effect in 1974. For the most part, FAR Part 147 is still the same in structure and content. The last revision to the regulation occurred in 1992.

The main body of Part 147 contains the general certificate requirements, the certification requirement of the school, and the operating rules the school must follow. The curriculum requirements are listed as appendices.

The Part 147 curriculum is comprised of 129 curriculum subjects. The curriculum subjects are grouped under subject headings which represent particular concepts or systems of the aircraft. Each item listed under each subject heading indicates a level of proficiency at which the item must be taught. The levels are summarized as follows:

Level 1 requires:

(i) Knowledge of general principles, but no practical application.

(ii) No development of manipulative skill.

(iii) Instruction by lecture, demonstration, and discussion.

Level 2 requires:

(i) Knowledge of general principles, and limited practical application.

(ii) Development of sufficient manipulative skill to perform basic operations.

(iii) Instruction by lecture, demonstration, discussion, and limited practical application.

Level 3 requires:

(i) Knowledge of general principles, and performance of a high degree of practical application.

(ii) Development of sufficient manipulative skills to simulate return to service.

(iii) Instruction by lecture, demonstration, discussion, and a high degree of practical application.

4.3 Comparison to FAR Part 147

A listing of relevant tasks from the current job task analysis is provided for each curriculum subject listed in FAR Part 147. This grouping of tasks provides a method to compare the results of the job task analysis with the current version of Part 147.

Each curriculum subject in Part 147 is listed with its teaching level in parentheses. Under each subject, the applicable tasks are listed from the current job task analysis. The overall results for percent response (%) and the median value for frequency (F), criticality (C) and difficulty to learn (D) are listed for each task. The overall results include all surveys for all industry segments. The results for each individual industry segment may be referenced in the previous section of this report.

147 Areas and Sub Areas	Overall			
	%	F	C	D
General Curriculum Subjects				
A. Basic Electricity				
1. Calculate and measure capacitance and inductance. (2)				
2. Calculate and measure electrical power. (2)				
3. Measure voltage, current, resistance, and continuity. (3)				
4. Determine the relationship of voltage, current, and resistance in electrical circuits. (3)				
5. Read and interpret aircraft electrical circuit diagrams, including solid state devices and logic functions. (3)				
6. Inspect and service batteries. (3)				
Maintain batteries.	29	3	3	2
B. Aircraft Drawings				
7. Use aircraft drawings, symbols, and system schematics. (2)				
8. Draw sketches of repairs and alterations. (3)				
9. Use blueprint information. (3)				
10. Use graphs and charts. (3)				
C. Weight and Balance				
11. Weigh aircraft. (2)				
12. Perform complete weight-and-balance check and record data. (3)				
D. Fluid Lines and Fittings				
13. Fabricate and install rigid and flexible fluid lines and fittings. (3)				
Fabricate flexible or rigid lines and attach connectors.	27	2	3	3
E. Materials and Processes				

14. Identify and select appropriate nondestructive testing methods. (1)

Perform eddy current or ultrasound inspection on skin or structure. 13 2 3 3

15. Perform dye penetrant, eddy current, ultrasonic, and magnetic particle

inspections. (2)

Perform a magnetic particle inspection. 18 3 3 3

Perform eddy current or ultrasound inspection on skin or structure. 13 2 3 3

Visually inspect parts or components to detect surface cracks with dye 55 3 3 3

penetrant.

Perform an x-ray or similar non-destructive inspection of skin or 25 2 4 4

16. Perform basic heat-treating processes. (1)

17. Identify and select aircraft hardware and materials. (3)

18. Inspect and check welds. (3)

19. Perform precision measurements. (3)

F. Ground Operation and Servicing

20. Start, ground operate, move, service, and secure aircraft and identify typical

ground operation hazards. (2)

21. Identify and select fuels. (2)

G. Cleaning and Corrosion

22. Identify and select cleaning materials. (3)

Clean or remove surface deposits or material. 42 4 2 2

Clean or remove paint or coatings from parts or skin using stripping 22 2 2 2

agents or chemical bath.

Remove corrosion and repair surrounding area. 50 3 3 3

Replace or clean engine components. 36 4 3 3

Clean electronic equipment cooling filters. 31 3 2 1

23. Inspect, identify, remove, and treat aircraft corrosion and perform aircraft

cleaning. (3)

Remove corrosion and repair surrounding area. 50 3 3 3

Clean or remove paint or coatings from parts or skin using stripping 22 2 2 2

agents or chemical bath.

147 Areas and Sub Areas **Overall**

	%	F	C	D
Inspect for general corrosion, corrosion under lap joints, etc.	50	4	3	2

Replace or clean engine components. 36 4 3 3

Clean or remove surface deposits or material. 42 4 2 2

H. Mathematics

24. Extract roots and raise numbers to a given power. (3)

25. Determine areas and volumes of various geometrical shapes. (3)

26. Solve ratio, proportion, and percentage problems. (3)

27. Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers. (3)

I. Maintenance Forms and Records

28. Write descriptions of work performed including aircraft discrepancies and corrective actions using typical aircraft maintenance records. (3)

29. Complete required maintenance forms, records, and inspection reports. (3)

J. Basic Physics

30. Use and understand the principles of simple machines; sound, fluid, and heat dynamics; basic aerodynamics; aircraft structures; and theory of flight. (2)

K. Maintenance Publications

31. Demonstrate ability to read, comprehend, and apply information contained in FAA and manufacturers' aircraft maintenance specifications, data sheets. (3)

32. Read technical data. (3)

L. Mechanics Privileges

33. Exercise mechanic privileges within the limitations prescribed by Part 65 of this chapter. (3)

Airframe Curriculum Subjects

Airframe Structures

A. Wood structures

1. Service and repair wood structures. (1)

Repair, replace or construct wood structures. 1 1 4 4

2. Identify wood defects. (1)

Inspect wood structure. 1 1 4 3

3. Inspect wood structures. (1)

Inspect wood structure. 1 1 4 3

B. Aircraft Covering

4. Select and apply fabric and fiberglass covering materials. (1)

Identify types of corrosion such as fretting, interangular, granular, etc. 48 3 3 3

Repair or replace plastics and fiberglass. 36 3 3 3

Inspect plastics and fiberglass. 45 4 3 2

Inspect fabric covered and doped surfaces. 1 2 3 2

5. Inspect, test, and repair fabric and fiberglass. (1)

Identify types of corrosion such as fretting, interangular, granular, etc. 48 3 3 3

Inspect fabric covered and doped surfaces. 1 2 3 2

Inspect plastics and fiberglass. 45 4 3 2

Repair or replace plastics and fiberglass. 36 3 3 3

C. Aircraft Finishes

6. Apply trim, letters, and touchup paint. (1)

Paint parts or surfaces. 39 3 2 2

Paint control surfaces. 16 1 2 2

7. Identify and select aircraft finishing materials. (2)

Prepare surface and prime. 32 3 2 2

Paint parts or surfaces. 39 3 2 2

8. Apply finishing materials. (2)

Replace or rejuvenate fabric covered and doped surfaces. 7 1 3 3

147 Areas and Sub Areas Overall

147 Areas and Sub Areas	%	F	C	D
Paint control surfaces.	16	1	2	2
Paint parts or surfaces.	39	3	2	2

9. Inspect finishes and identify defects. (2)

Paint parts or surfaces. 39 3 2 2

Inspect fabric covered and doped surfaces. 1 2 3 2

Paint control surfaces. 16 1 2 2

Identify delamination or disbonding of carbon composites. 41 3 3 3

Identify types of corrosion such as fretting, interangular, granular, etc. 48 3 3 3

D. Sheet Metal and non-metallic structures

10.Select, install, and remove special fasteners for metallic, bonded, and composite

structures. (2)

Replace loose or missing fasteners. 54 4 3 2

11. Inspect bonded structures. (2)

Inspect for loose rivets, defects, disbonds, cracks, etc. 55 4 3 2

Identify types of corrosion such as fretting, interangular, granular, etc.	48	3	3	3

12. Inspect, test, and repair fiberglass, plastics, honeycomb, composite, and laminated primary and secondary structures. (2)

Inspect honeycomb and laminated structure.	45	3	3	3
Prepare and install patch (composite, fabric, metal).	39	3	3	3
Refinish composite blades.	11	1	4	4
Repair or replace honeycomb structure.	26	2	3	3

13. Inspect, check, service, and repair windows, doors, and interior furnishings. (2)

Service doors, windows and movable components with appropriate lubricant.	43	3	2	2
Replace doors.	32	1	4	3
Repair, replace or polish windows or windscreens.	43	2	3	3
Perform a general interior or exterior visual inspection.	56	5	3	2
Inspect cargo and passenger doors.	46	4	3	2
Inspect access door latches and hinge attachments.	45	4	3	2
Inspect aircraft interior areas.	41	4	2	2
Rig doors and emergency evacuation systems.	39	2	4	3

14. Inspect and repair sheet-metal structures. (3)

Visually inspect wing structure.	43	4	3	2
Repair or replace sheetmetal frame sections and fittings, fairings or stringers.	34	3	4	3
Repair minor sheet metal defects or damage to control surfaces.	37	3	3	3
Repair carbon composites.	16	2	3	4
Drill or ream structure or component.	44	3	3	3
Prepare and install patch (composite, fabric, metal).	39	3	3	3
Inspect body skin and lower body surface.	39	4	3	2
Repair structure or component by riveting.	44	3	3	3
Repair small cracks by stop drilling.	49	3	2	2
Repair skin.	34	2	3	3

15. Install conventional rivets. (3)

Repair skin.	34	2	3	3
Repair minor sheet metal defects or damage to control surfaces.	37	3	3	3

16. Form, lay out, and bend sheet metal. (3)

Fabricate replacement brackets, panels or small parts.	45	3	3	3

E. Welding

17. Weld magnesium and titanium. (1)

18. Solder stainless steel. (1)

19. Fabricate tubular structures. (1)

20. Solder, braze, gas-weld, and arc-weld steel. (2)

Repair or install a part by soldering. 18 2 3 2

147 Areas and Sub Areas Overall

% F C D

Repair or install a device by soldering. 32 3 3 2

Perform repairs using gaseous welding. 9 1 3 3

Perform repairs using arc or spot welding. 8 1 3 3

Perform repairs by brazing. 9 1 3 3

21. Weld aluminum and stainless steel. (1)

F. Assembly and Rigging

22. Rig rotary-wing aircraft. (1)

Adjust, align or rig flight control components. 46 3 5 4

Repair or replace attach points or tracks for control surfaces. 34 2 4 3

Change primary flight control servos or actuators. 49 2 4 3

Fabricate control cables. 24 1 5 3

23. Rig fixed-wing aircraft. (2)

Adjust, align or rig flight control components. 46 3 5 4

Rig or check autopilot flight control actuators and servos. 32 2 4 3

Repair or replace attach points or tracks for control surfaces. 34 2 4 3

Fabricate control cables. 24 1 5 3

Change flight control surfaces. 44 2 5 3

Change primary flight control servos or actuators. 49 2 4 3

24. Check alignment of structures. (2)

Repair or replace attach points or tracks for control surfaces. 34 2 4 3

Check flight control travel. 44 3 4 3

Troubleshoot flight control systems. 46 3 4 4

Inspect hinge bearings for condition and excessive play. 47 3 3 2

25. Assemble aircraft components, including flight control surfaces. (3)

Lubricate required flight control components (hinges, rollers, pinions, 48 4 3 2
gears).

Repair or replace attach points or tracks for control surfaces. 34 2 4 3

26. Balance, rig, and inspect movable primary and secondary flight control surfaces. (3)

Check control surface balance. 29 1 4 3

Change flight control surfaces. 44 2 5 3

Inspect cable routing, pulleys, turnbuckles or flight control	45	3	4	3
Inspect flight control cables for tension, fraying, nicks or crimps.	46	3	4	3
Inspect flight control surface for damage.	48	4	4	2
Inspect hinge bearings for condition and excessive play.	47	3	3	2
Lubricate required flight control components (hinges, rollers, pinions, gears).	48	4	3	2
Repair or replace attach points or tracks for control surfaces.	34	2	4	3
Rig or check autopilot flight control actuators and servos.	32	2	4	3
Troubleshoot flight control systems.	46	3	4	4
Balance control surfaces.	28	2	4	3

27. Jack aircraft. (3)

G. Airframe Inspection

28. Perform airframe conformity and airworthiness inspections. (3)

Perform a detailed dimensional inspection.	47	4	3	3
Perform an intensive visual inspection of a zone or system.	45	4	3	3

Airframe Systems and Components

A. Aircraft Landing Gear

29. Inspect, check, service, and repair landing gear, retraction systems, shock struts, brakes, wheels, tires, and steering systems. (3)

Service nose gear assemblies.	41	3	3	2
Service shock struts.	44	3	3	2
Check pressure of tires.	48	4	3	1
Service tires.	45	4	3	1

147 Areas and Sub Areas	**Overall**			
	%	**F**	**C**	**D**
Troubleshoot landing gear position indication and warning systems.	39	2	4	3
Detailed inspection of landing gear assemblies and subassemblies.	37	4	4	3
Troubleshoot retractable gear system.	36	2	4	3
Visually inspect landing gear, wheel wells, and doors.	42	4	3	2
Remove and replace tires or brakes.	47	4	3	2
Troubleshoot brake system.	37	3	3	3
Overhaul, repair or replace landing gear.	35	2	4	3
Modify or alter landing gear assembly.	18	1	4	4
Lubricate landing gear components (bearings, hinges, pivots,	44	3	3	1

up/downlocks, etc).

Functional test retractable gear. 43 3 4 3

Functional test emergency gear extension system. 40 3 4 3

Functional test brake system. 44 3 3 2

Repair or replace landing gear control and actuating system 38 2 4 3

Rig nose gear steering. 35 2 4 3

Replace tire or wheel assemblies. 45 4 3 2

B. Hydraulic and Pneumatic

30. Repair hydraulic and pneumatic power systems components. (2)

Service hydraulic accumulator. 44 3 3 2

Repair bleed air ducting systems. 42 2 3 3

Repair hydraulic system leaks. 44 3 3 3

Repair or replace hydraulic components. 55 3 3 3

Repair or replace pneumatic system controls, ducts, valves, lines and 40 3 3 3

other components.

31. Identify and select hydraulic fluids. (3)

Service hydraulic system. 47 4 3 2

32. Inspect, check, service, troubleshoot, and repair hydraulic and pneumatic power

systems. (3)

Bleed hydraulic system pressure. 46 4 3 2

Check clogging indicators on filters

Check clogging indicators on filters. 47 4 3 2

Operational test thrust reversers. 38 3 3 3

Troubleshoot pressurized hydraulic system (1,000-3,000 psi). 40 3 3 3

Repair or replace thrust reversers. 24 2 3 3

Operational test lift dumpers, air brakes, or spoilers. 40 3 3 3

Check for leaks in hydraulic system. 49 4 3 2

Functional check pneumatic system. 38 3 3 3

Troubleshoot pneumatic system. 44 3 3 3

Repair bleed air ducting systems. 42 2 3 3

Functional test hydraulic system. 46 4 3 3

Operational test flight controls and actuators. 45 4 4 3

C. Cabin Atmosphere Control

33.Inspect, check, troubleshoot, service, and repair heating, cooling, air

conditioning, pressurization systems, and air cycle machines. (1)

Service and inspect air/vapor cycle cooling system.	38	3	3	3
Repair or replace pressurization system components.	52	3	3	3
Repair air/vapor cycle conditioning system.	35	3	3	3
Troubleshoot and repair air/vapor cycle conditioning system.	38	3	3	3

34. Inspect, check, troubleshoot, service, and repair heating, cooling,

air-conditioning, and pressurization systems. (1)

Operational check air conditioning system.	46	3	2	3
Troubleshoot cabin pressurization system and/or ECS System.	43	3	3	3
Operational check pressurization system.	53	3	3	3
Functional check air conditioning and pressurization systems.	48	3	3	3

147 Areas and Sub Areas	Overall			
	%	**F**	**C**	**D**
35. Inspect, check, troubleshoot, service and repair oxygen systems. (2)				
Service passenger oxygen system.	40	4	3	2
Replace regulator, masks or oxygen bottles.	41	3	3	2
Inspect passenger and crew oxygen system components.	43	3	3	2
Hydrostatically test high pressure oxygen cylinders.	8	1	4	3

D. Aircraft Instrument Systems

36. Inspect, check, service, troubleshoot, and repair electronic flight instrument systems and both mechanical and electrical heading, speed, altitude, temperature, pressure, and position indicating systems to include the use of built-in test equipment. (1)

Troubleshoot central air data collection and distribution system.	22	2	4	4
Swing (calibrate) compass system.	26	1	3	3
Remove and replace flight instruments (airspeed indicator, altimeter, VSI, etc.).	45	3	3	3
Repair or replace vacuum pumps, hoses and connectors.	17	2	3	2
Repair or replace vacuum driven flight instrument components.	22	2	3	3
Repair or replace sensitive position sensing devices (examples: gimble gyroscopes, laser ring gyros).	22	2	4	3
Repair or replace electronic system components.	37	4	3	3
Service fluid in compass system.	12	1	3	2
Perform stall warning test.	37	3	4	2
Troubleshoot flight instruments.	26	3	4	4
Troubleshoot intersystem data exchange problems.	18	2	3	4
Troubleshoot vacuum driven flight instruments.	19	2	3	3

Troubleshoot vacuum system. 22 2 3 3

Repair or replace central air data collection and distribution 21 3 4 3

Test electronic instrumentation systems. 22 3 3 3

Remove and install air data computer. 23 3 3 3

Certify transponder and altitude reporting equipment. 18 3 4 3

Functional test aircraft warning systems. 55 4 4 3

Inspect components for loose connections. 52 4 3 2

Functional test EFIS (Electronic Flight Instrumentation System). 25 3 3 3

37. Install instruments and perform a static pressure system leak test. (2)

Repair or replace sensitive position sensing devices (examples: gimble 22 2 4 3
gyroscopes, laser ring gyros).

Leak check pitot static system. 39 3 4 3

Certify pitot and static system. 24 3 4 3

Replace pitot/static system components. 33 2 3 3

E. Communication and Navigation

38. Inspect, check, and troubleshoot autopilot, servos and approach coupling (1)

Operational test autothrottle. 16 2 3 3

Operational check flight control and landing systems. 50 4 4 4

Replace automatic flight control, autopilot or all-weather landing 32 3 4 4
systems components.

Troubleshoot autothrottle. 26 2 3 4

Troubleshoot autopilot. 27 3 4 4

39. Inspect, check, and service aircraft electronic communication and navigation

systems, including VHF passenger address interphones and static discharge devices, aircraft VOR, ILS, LORAN, Radar beacon transponders, flight management computers, and

GPWS. (1)

Troubleshoot central maintenance parameter and system computer. 8 3 3 4

Operational check crew alerting systems (examples: EFIS, EICAS and 27 4 3 3
ECAM).

147 Areas and Sub Areas	**Overall**			
	%	**F**	**C**	**D**

Operational test ACARS (Airborne Communication and Reporting 18 3 2 3
System) link function.

Operational test of cockpit voice recorder. 34 3 2
2

Troubleshoot voice or data communication systems. 38 3 3 3

Operational check caution and warning systems. 35 4 3 3

Troubleshoot dependent reference systems such as VOR and ILS. 22 3 3 4

Inspect and check static discharge wicks. 59 4 2 1

Troubleshoot ACARS (Airborne Communication and Reporting 18 2 2 3
System) link function.

Test navigation systems. 25 3 3 3

Test communication systems. 46 4 3 2

Replace central maintenance system components. 7 2 3 3

Repair or replace voice or data communication system components. 39 3 3 3

Repair or replace static discharger wicks and mounts. 49 2 2 2

Repair or replace electronic display components. 28 3 3 3

Repair or replace components associated with DME, transponder, radar 25 3 3 3
or other pulse systems.

Remove and install flight control trim motors. 41 2 4 3

Troubleshoot radar system. 23 3 3 4

Perform EFIS (Electronic Flight Instrumentation System) test. 24 3 3 3

Certify transponder and altitude reporting equipment. 18 3 4 3

Check navigation system annunciators for operation. 28 4 3 3

Functional check flight management system. 20 3 3 3

40. Inspect and repair antenna and electronic equipment installations. (2)

Install racks, controls, connections, antennas and associated electrical 47 3 3 3
components.

Inspect electronic equipment blowers and flow sensors. 31 3 3 2

Repair or replace electronic display components. 28 3 3 3

Repair or replace electronic system components. 37 4 3 3

Replace or repair antennas. 38 2 3 2

F. Aircraft Fuel Systems

41. Check and service fuel dump systems. (1)

Inspect fuel distribution components (pumps, valves, controls). 42 3 3 2

Defuel aircraft. 38 3 2 2

42. Perform fuel management transfer, and defueling. (1)

Defuel aircraft. 38 3 2 2

Test fuel transfer system. 37 3 3 2

43. Inspect, check, and repair pressure fueling systems. (1)

44. Repair aircraft fuel system components. (2)

Inspect fuel distribution components (pumps, valves, controls). 42 3 3 2

Troubleshoot fuel control problems. 33 3 4 4

Rig shut-off valves. 19 2 4 3

Replace fuel distribution system components. 42 2 3 3

Repair or replace fuel system plumbing. 42 2 3 3

45. Inspect and repair fluid quantity indicating systems. (2)

Troubleshoot capacitance-based fuel indicating system. 33 2 3 4

Calibrate capacitance type fuel quantity indication systems. 29 2 3 4

Repair or replace fuel measurement components. 33 2 3 3

Troubleshoot float-based fuel indicating system. 19 2 3 3

Perform fuel quantity test. 37 3 3 2

147 Areas and Sub Areas Overall

% F C D

46. Troubleshoot, service, and repair fluid pressure and temperature warning

systems. (2)

Repair or replace fuel system warning devices. 25 2 3 3

47. Inspect, check, service, troubleshoot, and repair aircraft fuel systems. (3)

Analyze fuel tank for microbiological contamination. 21 2 3 2

Check fuel tanks for water. 45 4 3 1

Troubleshoot fuel tank leaks. 36 2 3 3

Functional test fuel distribution system. 46 3 3 2

Identify and control bacteria in fuel tanks. 21 2 3 2

Perform fuel quantity test. 37 3 3 2

Repair bladder type fuel tank leaks. 17 1 3 3

Repair integral fuel tank leaks. 34 2 3 3

Service each fuel tank sump to remove water and inspect tank valve. 34 3 3 2

Troubleshoot fuel distribution system. 40 2 3 3

G. Aircraft Electrical Systems

48. Repair and inspect aircraft electrical system components; crimp and splice wiring to manufacturers' specifications; and repair pins and sockets of aircraft connectors. (2)

Operational test escape slides or liferafts. 19 1 4 2

Troubleshoot exterior lighting systems. 45 3 2 2

Repair printed circuit board. 17 2 3 4

Repair or replace exterior aircraft lighting. 48 4 2 2

Operational test of cabin emergency lighting. 43 4 3 2

Perform wiring modifications. 31 2 3 3

49. Install, check, and service airframe electrical wiring, controls, switches,

indicators, and protective devices. (3)

Inspect wire bundles. 47 4 3 2

Troubleshoot electrical distribution and switching. 34 3 3 4

Troubleshoot aircraft electrical wiring and connectors. 39 3 3 4

Replace electrical circuit protection devices. 34 2 3 3

Replace buss switching and control devices. 29 2 3 3

Repair or replace aircraft electrical wiring and connectors. 39 3 3 3

Repair damaged wiring and connectors. 47 3 3 3

Operational check standby power or emergency generation system. 51 3 3 3

Functional test electrical switching and distribution. 40 4 3 3

Perform failure analysis on electrical power systems. 32 3 3 4

50.a. Inspect, check, troubleshoot, service, and repair alternating and direct current

electrical systems. (3)

Replace aircraft generator. 40 2 3 3

Troubleshoot AC/DC power generation system. 39 3 3 4

Replace transformers, rectifiers and electrical filters. 26 2 3 3

Operational check DC and AC generating systems. 46 3 3 3

Replace solid state inverters. 26 1 3 2

Troubleshoot electrically operated mechanical components (example: 63 4 4 4

electric landing gear actuator).

Operational check aircraft battery charging system. 56 3 3 2

50.b. Inspect, check, and troubleshoot constant speed and integrated speed drive

generators. (1)

Replace CSD (Constant Speed Drive) or IDG (Integrated Drive 27 2 3 3

Generator).

Service IDG (Integrated Drive Generator) oil level. 32 3 3 2

H. Position and Warning Systems

51. Inspect, check, and service speed and configuration warning systems, electrical

brake controls, and anti-skid systems. (2)

Repair landing gear wiring and switches. 31 2 3 3

147 Areas and Sub Areas **Overall**

	%	F	C	D
Repair or replace anti-skid system components.	39	2	3	3
Troubleshoot anti-skid system.	36	2	3	3
Modify or alter landing gear assembly.	18	1	4	4
Troubleshoot landing gear control and actuating systems.	42	2	4	3
Functional test anti-skid system.	43	3	3	3
Troubleshoot brake system.	37	3	3	3

52. Inspect, check, troubleshoot, and service landing gear position indicating and warning systems. (3)

	%	F	C	D
Troubleshoot retractable gear system.	36	2	4	3
Functional test brake system.	44	3	3	2
Functional test emergency gear extension system.	40	3	4	3
Troubleshoot landing gear position indication and warning systems.	39	2	4	3
Repair or replace landing gear position indication and warning components.	36	2	4	3
Functional test anti-skid system.	43	3	3	3
Modify or alter landing gear assembly.	18	1	4	4
Repair landing gear wiring and switches.	31	2	3	3
Troubleshoot landing gear control and actuating systems.	42	2	4	3

I. Ice and Rain Control Systems

53. Inspect, check, troubleshoot, service, and repair airframe ice and rain control systems. (2)

	%	F	C	D
Repair or replace scoops and leading edge anti-ice components.	30	2	3	3
Repair or replace de-ice boot.	11	2	3	3
Inspect windshield ice or rain removal systems.	35	3	3	2
Troubleshoot ice, rain or fog removal systems.	39	2	3	3
Inspect air scoops and leading edge ice control systems.	37	4	3	2
Repair or replace windshield ice, rain or fog removal system	41	2	3	3
Functional check electrical ice, rain or fog removal systems.	36	3	3	2
Replace electrical de-ice boots.	19	1	3	3

J. Fire Protection Systems

54. Inspect, check, and service smoke and carbon monoxide detection systems. (10

	%	F	C	D
Replace smoke detection components.	40	2	3	2
Troubleshoot fire detection circuits.	37	2	4	3

Inspect fire detection elements for connections and security. 34 3 3 2

Test passenger or cargo smoke detection system. 41 3 3 2

55. Inspect, check, service, troubleshoot, and repair aircraft fire detection and

extinguishing systems. (3)

Troubleshoot fire extinguishing and control systems. 33 2 4 3

Functional test fire protection system. 36 4 4 2

Inspect extinguishers and fire bottles. 38 4 3 2

Inspect fire extinguishing system. 32 3 3 2

Repair or replace fire detection/protection components. 48 3 4 3

Operational check fire detection system. 36 4 3 2

Powerplant Curriculum Subjects

Powerplant Systems and Components

A. Reciprocating Engines

1. Inspect and repair a radial engine. (1)

Inspect radial piston engine. 1 1 3 3

2. Overhaul reciprocating engine. (2)

Perform internal repairs to opposed piston engines. 2 1 4 4

3. Inspect, check, service, and repair reciprocating engines and engine installations. (3)

Inspect opposed piston engine. 5 4 3 3

Operational check engine. 35 4 4 4

147 Areas and Sub Areas Overall

% F C D

Inspect engine mounts. 44 3 4 3

Service piston engine. 5 3 3 2

4. Install, troubleshoot, and remove reciprocating engines. (3)

Troubleshoot opposed piston engine. 4 3 4 4

B. Turbine Engines

5. Overhaul turbine engine. (2)

Replace or overhaul hot section. 19 3 4 4

Perform internal repairs to engine. 18 3 4 4

6. Inspect, check, service, and repair turbine engines and turbine engine. (3)

Perform borescope inspection. 18 3 4 3

Troubleshoot turboprop engine. 10 3 4 4

Operational check engine. 35 4 4 4

Inspect engine mounts. 44 3 4 3

Blend fan blades. 25 2 3 3

Inspect fan blades for FOD (Foreign Object Damage). 36 4 3 2

Service turbine engine. 33 4 3 2

7. Install, troubleshoot, and remove turbine engines. (3)

Replace jet engine. 26 2 5 4

Troubleshoot jet engine. 29 3 4 4

Replace turboprop engine. 8 2 5 4

C. Engine Inspection

8. Perform powerplant conformity and airworthiness inspections. (3)

Inspect engine and components for security and leaks. 42 4 3 3

A. Engine Instrument Systems

9. Trouble shoot, service, and repair electrical and mechanical fluid rate-of-flow

indicating systems. (2)

10. Inspect, check, service, troubleshoot, and repair electrical and mechanical engine

temperature, pressure, and r.p.m. indicating systems. (3)

Troubleshoot engine indicating problems. 40 3 3 3

Troubleshoot electronic engine indicating systems. 34 3 3 3

Repair or replace engine indicating components. 39 3 3 3

Operational check crew alerting systems (examples: EFIS, EICAS and 27 4 3 3
ECAM).

B. Engine Fire Protection

11. Inspect, check, service, troubleshoot, and repair engine fire detection and

extinguishing systems. (3)

Inspect engine fire loop. 43 3 3 2

Troubleshoot fire detection circuits. 37 2 4 3

Repair or replace fire detection/protection components. 48 3 4 3

Operational check fire detection system. 36 4 3 2

Inspect fire extinguishing system. 32 3 3 2

Inspect fire detection elements for connections and security. 34 3 3 2

Inspect extinguishers and fire bottles. 38 4 3 2

Functional test fire protection system. 36 4 4 2

Troubleshoot fire extinguishing and control systems. 33 2 4 3

C. Engine Electrical Systems

12. Repair engine electrical system components. (2)

13. Install, check, and service engine electrical wiring, controls, switches, indicators,

and protective devices. (3)

Troubleshoot aircraft electrical wiring and connectors. 39 3 3 4

Replace electrical circuit protection devices. 34 2 3 3

Repair or replace aircraft electrical wiring and connectors. 39 3 3 3

Perform wiring modifications. 31 2 3 3

Perform failure analysis on electrical power systems. 32 3 3 4

147 Areas and Sub Areas **Overall**

% **F** **C** **D**

Functional test electrical switching and distribution. 40 4 3 3

Troubleshoot electrical distribution and switching. 34 3 3 4

D. Lubrication Systems

14. Identify and select lubricants. (2)

15. Repair engine lubrication system components. (2)

Drain and replace oil in piston engine. 4 3 3 1

Inspect chip detectors and/or oil filters. 40 4 3 2

Replace engine filters. 34 3 3 2

Replace turbine and jet oil filter elements. 37 3 3 2

Service engine and scavenger oil. 39 4 3 2

Service scavenge filter. 29 3 3 2

Drain and flush oil tank. 31 3 3 2

16. Inspect, check, service, troubleshoot, and repair engine lubrication systems. (3)

Drain and flush oil tank. 31 3 3 2

Service scavenge filter. 29 3 3 2

Service engine and scavenger oil. 39 4 3 2

Replace turbine and jet oil filter elements. 37 3 3 2

Replace engine filters. 34 3 3 2

Drain and replace oil in piston engine. 4 3 3 1

Inspect chip detectors and/or oil filters. 40 4 3 2

E. Ignition and Starting

17. Overhaul magneto and ignition harness. (2)

Inspect booster starting systems. 12 3 3 3

Repair or replace high tension ignition system components. 39 3 3 2

18. Inspect, service, troubleshoot, and repair reciprocating and turbine engine

ignition systems and components. (2)

Repair or replace high tension ignition system components. 39 3 3 2

Inspect high-tension ignition systems. 35 3 3 2

Inspect booster starting systems. 12 3 3 3

Repair or replace ignition components. 42 3 3 2

Troubleshoot ignition problems. 37 2 3 3

Inspect battery ignition systems. 20 3 3 3

19.a. Inspect, service, troubleshoot, and repair turbine engine electrical starting

systems. (3)

Remove or install ignitor plug. 39 3 3 2

Remove and install starter. 40 3 3 2

Remove or install excitor box. 35 2 3 2

19.b. Inspect, service, and troubleshoot turbine engine pneumatic starting systems. (1)

Troubleshoot ignition problems. 37 2 3 3

F. Fuel Metering Systems

20. Troubleshoot and adjust turbine engine fuel metering systems and electronic

engine fuel controls. (1)

Remove and install fuel control unit. 28 2 4 4

Functional test fuel control system. 28 3 4 3

21. Overhaul carburetor. (2)

Repair or replace fuel control components. 35 3 4 3

22. Repair engine fuel metering system components. (2)

Repair or replace fuel control components. 35 3 4 3

23. Inspect, check, service, troubleshoot, and repair reciprocating and turbine engine

fuel metering systems. (3)

Replace engine filters. 34 3 3 2

Troubleshoot fuel control problems. 33 3 4 4

Troubleshoot fuel distribution system. 40 2 3 3

Replace fuel distribution system components. 42 2 3 3

147 Areas and Sub Areas **Overall**

% F C D

Remove and install fuel pump. 38 2 4 3

Remove and install fuel filter. 41 3 3 2

Inspect fuel distribution components (pumps, valves, controls). 42 3 3 2

Repair or replace fuel system warning devices. 25 2 3 3

G. Engine Fuel Systems

24. Repair engine fuel system components. (2)

Inspect fuel distribution components (pumps, valves, controls). 42 3 3 2

Remove and install fuel filter. 41 3 3 2

Remove and install fuel pump. 38 2 4 3

Repair or replace fuel system warning devices. 25 2 3 3

Replace engine filters. 34 3 3 2

Replace fuel distribution system components. 42 2 3 3

Troubleshoot fuel distribution system. 40 2 3 3

25. Inspect, check, service, troubleshoot, and repair engine fuel systems. (3)

Repair or replace fuel system plumbing. 42 2 3 3

Test fuel transfer system. 37 3 3 2

H. Induction and Engine Airflow systems

26. Inspect, check, troubleshoot, service, and repair engine ice and rain control systems. (2)

Repair bleed air ducting systems. 42 2 3 3

Functional check pneumatic ice or fog removal systems. 32 3 3 2

27. Inspect, check, service, troubleshoot and repair heat exchangers, superchargers, and turbine engine airflow and temperature control systems. (1)

Functional check pneumatic system. 38 3 3 3

Repair or replace pneumatic system controls, ducts, valves, lines and other components. 40 3 3 3

Troubleshoot pneumatic system. 44 3 3 3

28. Inspect, check, service, and repair carburetor air intake and induction manifolds. (3)

I. Engine Cooling Systems

29. Repair engine cooling system components. (2)

30. Inspect, check, troubleshoot, service, and repair engine cooling systems. (3)

Repair or replace pneumatic system controls, ducts, valves, lines and other components. 40 3 3 3

Service engine and scavenger oil. 39 4 3 2

J. Engine Exhaust and Reverser Systems

31. Repair engine exhaust system components. (3)

32.a. Inspect, check, troubleshoot, service, and repair engine exhaust systems. (3)

32.b. Troubleshoot and repair engine thrust reverser systems and related components. (1)

Repair or replace thrust reversers. 24 2 3 3

Operational test thrust reversers. 38 3 3 3

K. Propellers

33. Inspect, check, service, and repair propeller synchronizing and ice control systems. (1)

Functional check prop heat. 10 3 3 2

Service bleed valve propeller governor. 2 1 3 3

Service gear reduction section. 13 3 4 3

Troubleshoot propeller heat. 9 3 3 3

Troubleshoot propeller synchronization. 7 1 3 3

34. Identify and select propeller lubricants. (2)

Lubricate propeller. 7 3 3 2

35. Balance propellers. (1)

Rig propeller blades. 5 3 4 3

36. Repair propeller control system components. (2)

Service bleed valve propeller governor. 2 1 3 3

147 Areas and Sub Areas Overall

% F C D

Service gear reduction section. 13 3 4 3

37. Inspect, check, service, and repair fixed-pitch, constant-speed, and feathering

propellers, and propeller governing systems. (3)

Inspect propellers for damage. 10 4 3 2

Operational check fixed and constant speed propellers. 7 3 3 2

Overhaul prop assembly. 2 1 4 4

Service bleed valve propeller governor. 2 1 3 3

Tear down and build-up prop assembly. 2 1 4 4

Troubleshoot constant speed propeller. 6 2 3 3

Adjust governor. 7 2 3 3

38. Install, troubleshoot, and remove propellers. (3)

Rig propeller blades. 5 3 4 3

Tear down and build-up prop assembly. 2 1 4 4

Replace propeller assembly. 9 2 4 3

Troubleshoot constant speed propeller. 6 2 3 3

Replace propeller. 11 3 4 3

39. Repair aluminum alloy propeller blades. (3)

Replace propeller assembly. 9 2 4 3

Replace propeller. 11 3 4 3

Rig propeller blades. 5 3 4 3

Tear down and build-up prop assembly. 2 1 4 4

Troubleshoot constant speed propeller. 6 2 3 3

L. Unducted Fans

40. Inspect and troubleshoot unducted fan systems and components. (1)

Inspect fan blades for FOD (Foreign Object Damage). 36 4 3 2

Troubleshoot turboprop engine. 10 3 4 4

Service turbine engine. 33 4 3 2

Operational check engine. 35 4 4 4

Inspect engine mounts. 44 3 4 3

Blend fan blades. 25 2 3 3

Perform borescope inspection. 18 3 4 3

M. Auxiliary Power Units

41. Inspect, check, service, and troubleshoot turbine-driven auxiliary power units. (1)

Troubleshoot turboprop engine. 10 3 4 4

Blend fan blades. 25 2 3 3

Inspect engine mounts. 44 3 4 3

Inspect fan blades for FOD (Foreign Object Damage). 36 4 3 2

Operational check engine. 35 4 4 4

Perform borescope inspection. 18 3 4 3

Service turbine engine. 33 4 3 2

5. Comparison to Proposed FAR Part 66 Transport Curriculum

5.1 Introduction

The NPRM for Part 66 includes a proposal to revise the certification structure of AMTs. As outlined in the proposal, a single "Aviation Maintenance Technician" certificate will replace the existing "Airframe and Powerplant" certificates. An added "transport" endorsement will allow the holder of the new AMT certificate to return Part 25 and Part 29 aircraft to service.

In order to obtain the transport endorsement to the AMT certificate, additional coursework beyond what is required in FAR Part 147 will have to be completed. The subjects for which AMT schools must provide instruction are listed in the NPRM for Part 66 and is known as the transport curriculum. This chapter provides a comparison between the results of this study and the transport curriculum.

5.2 Development and Structure of the Transport Curriculum

The transport curriculum was developed by a subcommittee of the Aviation Rulemaking Advisory Committee (ARAC) that was responsible for creating the proposal for Part 66. The curriculum covers topics that are of significant importance to technicians working in the commercial aviation industry.

Specifically, the transport curriculum contains 39 subject areas. A corresponding number of hours of instruction is specified for each subject area for a total of 573 hours of instruction. The section of the NPRM for Part 66 which contains the transport curriculum is furnished in Appendix C.

The structure of the transport curriculum is very different from the structure of FAR Part 147. The subject areas listed are topics to be covered, but do not indicate specific areas of competency that must be achieved. In addition, the transport curriculum is meant to build upon the FAR Part 147 curriculum. The topics covered do not necessarily constitute an independent program of training.

5.3 Comparison to Transport Curriculum

A listing of relevant tasks from the current job task analysis is provided for each item listed in the transport curriculum. This grouping of tasks provides a method to compare the results of the job task analysis with the proposed transport curriculum.

Each item is listed with the number of hours of instruction required. Under each item, the applicable tasks are listed from the current job task analysis. The overall results for percent response (%) and the median value for frequency (F), criticality (C) and difficulty to learn (D) are listed for each task. The overall results include all surveys for all industry segments. The results for each individual industry segment are also provided.

Overall

Code Objective JTA Task Hours % F C D

Subject Area I –Advanced Electronics

EE01 Built-in test equipment 8

EE02 Analog, digital, and discrete signals 16

I Replace buss switching and control devices . 29% 2 3 3

ML	53%	2	4	3	MB	13%	3	3	3	RG	52%	2	3	3
LG	30%	2	4	3	SG	70%	2	3	2	CP	76%	1	3	3

I Replace solid state inverters. 26% 1 3 2

ML	42%	1	3	3	MB	10%	2	3	2	RG	50%	2	3	3
LG	36%	2	3	2	SG	67%	1	3	2	CP	87%	1	3	2

EE03 Electrostatic devices (ESD) 4

EE04 Linear voltage differential transducers (LVDT) and radial voltage differential transducers (RVDT) 8

EE05 Coaxial cable repairs, splices, and terminations 16

EE06 Wiring and schematic diagrams, ATA 20 Specifications 20

EE07 Test Equipment 24

I Test electronic instrumentation systems. 22% 3 3 3

ML 38% 3 3 3 MB 12% 3 3 3 RG 20% 4 3 3

LG 36% 3 3 3 SG 26% 3 3 3 CP 56% 2 3 3

EE08 Wiring connectors, and plug installation and repair 16

I Functional test electrical switching and distribution. 40% 4 3 3

ML 74% 4 4 3 MB 16% 4 3 3 RG 65% 4 3 3

LG 52% 4 3 3 SG 90% 4 3 3 CP 98% 2 3 3

I Inspect wire bundles. 47% 4 3 2

ML 61% 3 3 3 MB 27% 4 3 2 RG 66% 3 3 2

LG 66% 4 3 2 SG 92% 4 3 2 CP 95% 3 3 2

I Install racks, controls, connections, antennas and associated electrical components. 47% 3 3 3

ML 51% 3 3 3 MB 31% 3 3 3 RG 47% 2 3 3

LG 59% 3 3 3 SG 67% 2 3 2 CP 67% 1 3 3

I Perform wiring modifications. 31% 2 3 3

ML 40% 1 4 4 MB 13% 3 3 3 RG 48% 2 3 3

LG 49% 3 3 3 SG 85% 2 3 3 CP 79% 1 3 4

I Repair damaged wiring and connectors. 47% 3 3 3

ML 63% 3 4 3 MB 25% 4 3 3 RG 72% 3 3 2

LG 68% 3 3 3 SG 95% 3 3 2 CP 98% 2 3 3

I Repair or replace aircraft electrical wiring and connectors. 39% 3 3 3

ML 59% 3 4 3 MB 15% 4 3 3 RG 67% 3 3 3

LG 57% 3 3 3 SG 96% 3 3 2 CP 95% 2 3 3

I Repair or replace electronic system components. 37% 4 3 3

ML 62% 4 3 3 MB 15% 4 3 3 RG 58% 3 4 3

LG 52% 4 3 3 SG 80% 3 3 3 CP 87% 2 3 3

I Replace electrical circuit protection devices. 34% 2 3 3

ML 56% 2 4 3 MB 13% 3 3 3 RG 54% 2 3 2

LG 44% 3 3 2 SG 84% 2 3 2 CP 93% 1 3 3

I Replace transformers, rectifiers and electrical filters. 26% 2 3 3

ML 45% 2 4 3 MB 12% 2 3 2 RG 42% 2 3 3

LG 30% 2 3 2 SG 63% 2 3 2 CP 56% 1 3 2

Overall

Code Objective JTA Task Hours % F C D

I Troubleshoot aircraft electrical wiring and connectors . 39% 3 3 4

ML 65% 3 4 4 MB 15% 4 4 4 RG 70% 3 3 3

LG 54% 3 3 3 SG 91% 3 3 3 CP 95% 2 3 4

EE09 Synchronization theory, differential resolvers, and transolvers 8

EE10 Autopilot, flight director, autoland, and autothrottle systems 24

I Operational check flight control and landing systems. 50% 4 4 4

ML 61% 4 4 4 MB 32% 4 4 4 RG 56% 3 4 3

LG 53% 4 4 3 SG 62% 4 4 3 CP 98% 2 3 3

I Operational test autothrottle. 16% 2 3 3

ML 48% 2 3 3 MB 6% 3 3 3 RG 17% 2 4 3

LG 17% 3 3 3 SG 3% 1 2 1 CP 30% 1 3 3

I Replace automatic flight control, autopilot or all-weather landing systems 32% 3 4 4

components.

ML 48% 3 4 4 MB 19% 3 4 4 RG 45% 2 4 4

LG 41% 3 4 3 SG 53% 2 3 3 CP 67% 1 3 3

I Rig or check autopilot flight control actuators and servos. 32% 2 4 3

ML 52% 2 4 4 MB 15% 2 4 4 RG 38% 2 4 3

LG 53% 3 4 3 SG 54% 2 3 3 CP 65% 1 4 3

I Troubleshoot autopilot. 27% 3 4 4

ML 49% 4 4 4 MB 14% 3 4 5 RG 26% 3 3 4

LG 40% 3 4 4 SG 46% 2 3 4 CP 76% 1 3 4

I Troubleshoot autothrottle. 26% 2 3 4

ML 52% 2 3 4 MB 17% 2 4 4 RG 25% 2 4 4

LG 22% 1 4 4 SG 20% 1 3 4 CP 35% 1 3 3

EE11 Inertial navigation systems (INS) and global positioning systems 24
(GPS)

I Troubleshoot dependent reference systems such as VOR and ILS . 22% 3 3 4

ML 35% 3 3 3 MB 12% 3 4 4 RG 21% 3 4 4

LG 34% 3 3 4 SG 35% 3 3 3 CP 49% 1 3 3

EE12 Engine indication and crew alert systems (EICAS), Electronic flight
information systems (EFIS), bad Electronic horizontal situation
indicators (EHSI) 16

I Functional test EFIS (Electronic Flight Instrumentation System). 25% 3 3 3

ML 51% 4 4 3 MB 13% 3 4 3 RG 28% 4 3 3

LG 40% 3 3 3 SG 13% 2 3 3 CP 63% 2 3 3

I Operational check crew alerting systems (examples: EFIS, EICAS and ECAM). 27% 4 3 3

ML 66% 4 3 3 MB 13% 3 4 3 RG 32% 4 3 3

LG 34% 3 3 3 SG 11% 2 3 2 CP 51% 3 3 3

I Perform EFIS (Electronic Flight Instrumentation System) test. 24% 3 3 3

ML 52% 4 3 3 MB 11% 3 4 3 RG 17% 3 3 3

LG 38% 3 3 3 SG 19% 2 3 3 CP 68% 3 3 3

EE13 Gyroscopes (Laser and Conventional) 6

I Repair or replace sensitive position sensing devices (examples: gimbl e 22% 2 4 3

gyroscopes, laser ring gyros).

ML 35% 2 4 4 MB 13% 3 4 3 RG 23% 2 4 3

LG 27% 2 3 3 SG 33% 2 3 3 CP 66% 1 3 3

EE14 Flight management systems (FMS) 8

I Remove and install air data computer. 23% 3 3 3

ML 40% 3 4 3 MB 12% 3 3 2 RG 19% 2 4 3

LG 40% 3 3 2 SG 21% 1 3 2 CP 67% 1 3 3

Overall

Code Objective JTA Task Hours % F C D

I Repair or replace electronic display components . 28% 3 3 3

ML 51% 3 3 3 MB 15% 3 3 3 RG 50% 3 3 2

LG 32% 3 3 3 SG 30% 2 3 3 CP 67% 1 3 3

I Replace central maintenance system components. 7% 2 3 3

ML 35% 2 3 3 MB 4% 2 3 3 RG 0% 0 0 0

LG 0% 0 0 0 SG 0% 0 0 0 CP 0% 0 0 0

I Troubleshoot central maintenance parameter and system computer. 8% 3 3 4

ML 39% 3 3 4 MB 5% 2 3 4 RG 0% 0 0 0

LG 0% 0 0 0 SG 0% 0 0 0 CP 0% 0 0 0

I Troubleshoot intersystem data exchange problems. 18% 2 3 4

ML 37% 2 3 4 MB 9% 3 4 4 RG 18% 1 3 4

LG 26% 3 3 4 SG 24% 1 3 4 CP 36% 1 3 4

EE15 Instrument warning systems and comparators 4

I Functional test aircraft warning systems. 55% 4 4 3

ML 87% 4 4 3 MB 32% 4 4 3 RG 73% 4 4 2

LG 73% 4 3 3 SG 93% 4 3 2 CP 100 3 3 3

I Operational check caution and warning systems. 35% 4 3 3

ML 66% 4 4 3 MB 14% 4 4 3 RG 56% 5 4 2

LG 48% 3 3 3 SG 74% 4 3 2 CP 87% 3 3 2

I Troubleshoot central air data collection and distribution system. 22% 2 4 4

ML 39% 3 4 4 MB 14% 3 4 3 RG 25% 2 3 3

LG 31% 2 4 4 SG 11% 1 3 3 CP 46% 1 3 4

EE16 VHF, HF, and satellite communication systems; Flight and cockpit voice recorders 16

I Operational test of cockpit voice recorder. 34% 3 2 2

ML 65% 4 2 2 MB 17% 3 2 2 RG 58% 4 2 1

LG 43% 3 2 2 SG 27% 1 2 2 CP 64% 1 2 2

I Repair or replace voice or data communication system components. 39% 3 3 3

ML 51% 3 3 3 MB 31% 3 3 3 RG 39% 2 3 3

LG 39% 3 3 3 SG 32% 2 2 3 CP 61% 1 3 3

EE17 Windshear alerting systems 3

EE18 Traffic Alert and Collision Avoidance System (TCAS) 3

EE19 Airline communications addressing and reporting system (ACARS) 2

I Operational test ACARS (Airborne Communication and Reporting System) link function. 18% 3 2 3

ML 48% 3 2 2 MB 11% 3 2 3 RG 14% 1 3 3

LG 19% 3 3 3 SG 9% 2 3 2 CP 22% 1 3 3

I Test communication systems. 46% 4 3 2

ML 71% 2 3 3 MB 60% 4 3 3 RG 32% 4 3 3

LG 49% 4 3 2 SG 49% 4 3 2 CP 42% 4 3 2

I Troubleshoot ACARS (Airborne Communication and Reporting System). 18% 2 2 3

ML 43% 3 2 3 MB 11% 2 2 3 RG 21% 2 3 3

LG 20% 3 3 3 SG 13% 1 3 4 CP 14% 1 3 4

I Troubleshoot voice or data communication systems. 38% 3 3 3

ML 51% 3 3 3 MB 30% 3 3 3 RG 28% 3 3 3

LG 40% 3 3 3 SG 35% 1 3 3 CP 59% 1 3 3

EE20 Aeronautical Radio, Incorporated (ARINC) definitions and standards 3

Overall

Code Objective JTA Task Hours % F C D

Subject Area II – Composites

CR01 Damage assessment and Structural Repair Manual 12

CR02 Fasteners and fastener substitution 8

CR03 Adhesives, sealants, and compounds 4

CR04 Overlay repairs 8

I Prepare and install patch (composite, fabric, metal). 39% 3 3 3

ML	40%	2	3	3	MB	35%	4	3	3	RG	31%	3	3	3
LG	44%	2	3	3	SG	70%	2	3	3	CP	54%	1	3	3

I Repair skin. 34% 2 3 3

ML	33%	1	4	4	MB	28%	3	3	3	RG	30%	3	3	3
LG	44%	2	3	3	SG	63%	2	3	3	CP	51%	1	3	3

CR05 Hot bonding 16

CR06 Honeycomb structures 8

I Repair or replace honeycomb structure. 26% 2 3 3

ML	27%	1	4	4	MB	22%	3	3	3	RG	27%	3	3	3
LG	35%	2	3	3	SG	22%	1	3	4	CP	36%	1	3	4

I Repair or replace plastics and fiberglass. ` 36% 3 3 3

ML	31%	1	3	3	MB	30%	3	3	3	RG	37%	3	3	3
LG	42%	2	3	3	SG	65%	2	2	2	CP	63%	1	3	3

CR07 Composite materials 6

I Identify delamination or disbonding of carbon composites. 41% 3 3 3

ML	51%	3	3	3	MB	38%	3	3	3	RG	36%	3	3	3
LG	42%	3	3	3	SG	24%	1	3	2	CP	56%	1	3	3

I Repair carbon composites. 16% 2 3 4

ML	21%	1	3	4	MB	11%	3	3	4	RG	12%	2	3	4
LG	28%	2	3	4	SG	10%	1	3	5	CP	15%	1	3	4

Subject Area III – Structural Repair

SM01 Corrosion detection and treatment 6

I Clean or remove surface deposits or material. 42% 4 2 2

ML	39%	3	2	2	MB	38%	4	2	2	RG	49%	3	2	1
LG	45%	3	2	2	SG	62%	3	2	1	CP	74%	2	2	1

I Identify types of corrosion such as fretting, interangular, granular, etc. 48% 3 3 3

ML 37% 3 3 3 MB 46% 4 3 3 RG 52% 3 3 3

LG 53% 3 3 3 SG 65% 3 3 3 CP 64% 1 3 4

I Inspect cable routing, pulleys, turnbuckles or flight control components . 45% 3 4 3

ML 68% 3 4 3 MB 28% 3 4 3 RG 59% 3 4 3

LG 51% 3 4 3 SG 80% 4 4 2 CP 90% 2 4 3

I Inspect for general corrosion, corrosion under lap joints, etc . 50% 4 3 2

ML 61% 3 3 3 MB 38% 4 3 2 RG 62% 3 3 2

LG 56% 4 3 2 SG 81% 3 3 2 CP 90% 3 3 3

I Remove corrosion and repair surrounding area. 50% 3 3 3

ML 30% 2 3 3 MB 53% 4 3 3 RG 46% 2 3 3

LG 53% 3 3 2 SG 73% 2 3 2 CP 68% 1 3 3

Code Objective JTA Task Overall Hours % F C D

SM02 Damage assessment 12

I Inspect flight control surface for damage. 48% 4 4 2

ML 77% 5 4 3 MB 31% 4 4 3 RG 64% 4 4 2

LG 49% 4 3 2 SG 78% 4 3 2 CP 85% 4 3 2

SM03 Fasteners and fastener substitution 8

I Replace loose or missing fasteners. 54% 4 3 2

ML 66% 3 3 2 MB 45% 4 3 2 RG 56% 4 3 2

LG 56% 3 3 2 SG 81% 3 2 1 CP 80% 2 3 2

SM04 Blueprint reading 8

SM05 Engineering orders 4

SM06 Control surface balancing 4

I Adjust, align or rig flight control components. 46% 3 5 4

ML 63% 2 5 4 MB 32% 3 5 4 RG 58% 3 5 4

LG 51% 3 4 3 SG 76% 3 5 3 CP 85% 1 4 3

I Balance control surfaces. 28% 2 4 3

ML 30% 1 5 4 MB 16% 2 4 3 RG 46% 1 4 3

LG 41% 2 4 3 SG 61% 1 4 3 CP 41% 1 4 3

I Check control surface balance. 29% 1 4 3

ML 34% 1 5 4 MB 16% 2 4 3 RG 48% 1 4 3

LG 42% 2 4 3 SG 63% 1 4 3 CP 41% 1 4 3

SM07 Typical stringer splice and lap joint repair 16

SM08 Material specifications 4

SM09 Repair layout 16

SM10 Cold working, shot peening, roto peening, and heat treating 8

Subject Area IV – Powerplants and Systems

PP01 Electronic controls and thrust management systems 16

I Repair or replace thrust reversers. 24% 2 3 3

ML 56% 2 4 3 MB 15% 3 4 3 RG 2% 2 3 4

LG 33% 3 3 3 SG 14% 1 3 3 CP 74% 1 3 3

I Troubleshoot electrically operated mechanical components (example: electric landing gear actuator). 63% 4 4 4

ML 84% 4 4 4 MB 38% 4 4 4 RG 76% 4 4 4

LG 63% 3 4 3 SG 88% 4 4 3 CP 95% 3 4 4

PP02 Blade damage assessment 8

I Blend fan blades. 25% 2 3 3

ML 56% 2 4 3 MB 16% 3 3 3 RG 16% 2 4 3

LG 34% 2 3 2 SG 14% 1 3 3 CP 41% 1 3 3

I Inspect fan blades for FOD (Foreign Object Damage). 36% 4 3 2

ML 75% 5 4 2 MB 17% 4 3 2 RG 55% 4 4 2

LG 47% 4 3 2 SG 33% 4 3 2 CP 90% 4 3 2

I Refinish composite blades. 11% 1 4 4

ML 20% 1 5 4 MB 7% 1 4 4 RG 8% 3 3 3

LG 7% 1 4 3 SG 15% 1 4 4 CP 8% 1 3 4

Overall

Code Objective JTA Task Hours % F C D

PP03 Jet blast safety 2

PP04 Auxiliary power unit (APU) systems and interface 16

I Operational check APU (Auxiliary Power Unit). 42% 3 3 3

ML	84%	4	3	3	MB	31%	3	3	3	RG	30%	4	2	3
LG	39%	3	3	3	SG	19%	2	3	3	CP	74%	2	2	2

I Operational check standby power or emergency generation system . 51% 3 3 3

ML	74%	4	3	3	MB	36%	3	3	3	RG	58%	3	3	2
LG	46%	3	3	3	SG	36%	3	3	2	CP	87%	2	3	3

I Operational test thrust reversers. 38% 3 3 3

ML	75%	3	3	3	MB	30%	3	4	3	RG	4%	2	3	2
LG	38%	3	3	2	SG	20%	2	3	2	CP	82%	2	3	3

I Perform failure analysis on electrical power systems. 32% 3 3 4

ML	67%	3	4	4	MB	12%	3	4	4	RG	55%	3	3	3
LG	36%	3	3	3	SG	67%	3	3	3	CP	80%	2	4	4

I Repair or replace APU (Auxiliary Power Unit). 39% 2 3 3

ML	72%	3	3	3	MB	30%	2	3	3	RG	37%	2	3	3
LG	33%	2	3	3	SG	19%	1	2	4	CP	61%	1	3	3

I Replace aircraft generator. 40% 2 3 3

ML	76%	2	4	3	MB	12%	2	3	3	RG	69%	3	3	2
LG	46%	3	3	2	SG	77%	3	3	2	CP	87%	1	3	2

I Service and operate APU (Auxiliary Power Unit). 43% 4 3 2

ML	79%	5	3	2	MB	34%	3	3	2	RG	32%	4	3	2
LG	39%	2	3	3	SG	19%	3	3	2	CP	77%	3	2	3

I Troubleshoot AC/DC power generation system. 39% 3 3 4

ML	64%	3	3	4	MB	18%	3	4	4	RG	65%	3	3	4
LG	39%	2	3	3	SG	74%	2	3	3	CP	90%	1	3	4

PP05 Borescope 16

I Perform borescope inspection. 18% 3 4 3

ML	25%	2	5	4	MB	6%	2	4	4	RG	25%	3	4	3
LG	35%	3	3	3	SG	43%	2	3	3	CP	61%	1	4	4

Subject Area V – Safety and Environment

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EV02 Aircraft safety practices 4

EV03 Hazardous material handling 8

EV04 Ramp and airport safety 4

EV05 Confined space entry 3

EV06 Parts handling and certification
8

EV07 Basic troubleshooting principles 24

EV08 Extended-range operations with two-engine airplanes (ETOPS) 4

EV09 Occupational Safety and Health Administration (OHSA) regulations 8

Overall
Code Objective JTA Task Hours % F C D

Subject Area VI -- Publications

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MP02 Maintenance manuals 8

MP03 Fault reporting manual (FRM) and fault isolation manual (FIM) 4

MP04 Minimum equipment list (MEL), Configuration deviation list 6
(CDL), and Dispatch deviation Planning/Parts Guide (DDPG)

MP05 Structural repair manual (SRM) 16

MP06 General maintenance manual (GMM) 8

MP07 Cold weather operations manual 8

MP08 Component overhaul manual 4

MP09 Weight and balance 3

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6. Survey of Industry Training

6.1 Introduction

Industry training is defined as training that occurs after an AMT has acquired an A&P certificate and is employed. Typically such training is provided at the direction and expense of the employer. The employer has several different motivations for providing the training which are discussed in connection with the types of training offered and the source of that training.

This chapter discusses some findings based on which focus on defining broad trends and basic categories of training. The first section reviews the forces that motivate facilities to provide training for their technicians. The next section classifies the types of training. Next, the kinds of training providers in the industry are discussed. The final section describes the typical trends in training for each segment of the industry.

6.2 Motivations to Provide Training

6.2.1 Aircraft Type

General familiarization with an aircraft type is by far the most widespread motivation for training with the industry. If a facility pursues training on an aircraft type it will do so for one of two reasons. Either the facility maintains a number of aircraft of the same type or the facility is an authorized service representative of an aircraft manufacturer.

Facilities maintain a number of aircraft of the same type if they operate a large number of identical or similar aircraft or if they are a Part 145 repair facility which services one or more relatively homogenous markets. Training in these situations is essentially a customer-based demand--the owners/users of the aircraft being repaired demand certain minimal training qualifications of the repair facility.

Being a service representative is a slightly different condition since the manufacturer usually stipulates some kind of recurrency requirement, such a certain number of technicians are trained and qualified to work on whole fleet every 2 years. The repair station must fulfill the recurrency requirement even if the manufacturer introduces no new aircraft type. This is a supplier demand--which is not independent from customer demand since maintaining one’s status as a factory authorized repair facility has economic implications.

The recurrency requirement based on being a service representative is interesting because in facilities where no such recurrency requirement exists, the training pattern for technicians is observably different. For instance, in facilities with no external recurrency motivation, the technicians will take most of their training all at once (aside from a later introduction of a new aircraft type).

With regard to facility types, it is important to notice what kinds of facilities maintain homogeneous fleets or are service representatives. Clearly the major airlines, but also large general aviation facilities fit the profile. However, if the fleet of aircraft that a facility maintains is not homogenous, then the facility has little economic incentive to engage in in-depth training. Both Part 91 operators and large general aviation facilities that do not yet maintain a large homogeneous fleet of aircraft, seldom engage in manufacturer classes.

6.2.2 Specialization

Within larger maintenance facilities, technicians often move between component shops, overhaul hangars and line maintenance. The shop receiving the new technician is generally motivated to provide the new technician with some training on the product maintained or the equipment used. The sources of this training are divided evenly between in-house classes, OJT, and manufacturer classes.

For a few facilities, a technician must pass a testing qualification in order to enter new a shop. Such movement often motivates the entering technician to obtain the necessary information, sometimes through voluntary or self-training.

In facilities where OJT records are kept they are considered valuable for the first month a technician is in a new shop. These records are used to assign tasks and build an experience base into the new technician. However, after the first few months no one has incentive to keep up the records and very few facilities continue to keep track of OJT after this time.

6.2.3 Technology

The development of new technology, (e.g., composites, fly-by-wire, titanium) has engendered significant speculation about ongoing training. It appears that most technicians have been gradually introduced to whatever maintenance that accompanies these technologies and have absorbed the new tasks without official training. Some facilities have special shops for composites and titanium welding and initially they have trained someone to run these shops--but official classes are seldom used--if they even exist.

The one exception to the failure of new technology to initiate training concerns inspectors.

The one group of technicians for which new technology does initiate training is inspectors. Most facilities rapidly train inspectors and tech reps on new technologies. There may be some regulatory reasons for some of this pattern, but it is also a favorite technique of many companies to train a few technicians formally and have them pass on the skills informally.

6.2.4 Airworthiness Directives (ADs)

For line and overhaul technician, ADs occasionally generate training in order to either recognize developing problems or perform a modification. If the modification or inspection affects a fleet of a significant size (e.g., 737s) then a relatively large number of the technicians may be trained on how to accomplish the modification or inspection.

Because many modifications are completed over a relatively short period, facilities often elect to train only a few mechanics on the required process. In many cases the entire fleet can be modified before a significant number of mechanics can be trained. In other cases there is an economic disincentive to train all mechanics on tasks that will not be performed after the modification is complete.

6.2.5 Improved Productivity

Very few facilities perform formal time and productivity studies on particular tasks. Instead this information is kept informally by leads and crew chiefs who know exactly who is or is not proficient at performing particular tasks. Some facilities attempt to bring slower people up to speed with either in-house classes or with informal OJT concentration. Often this process in informal and no records are kept. However, underperforming technicians are not generally selected for expensive manufacturer training, perhaps since they may not be able to adequately understand, retain, and pass along the knowledge gained at such classes.

6.2.6 Safety

An increasing percentage of training classes is directed toward personal safety in the work environment. These classes are important, but they are also distinct from other training classes which focus directly on aviation technology.

6.3 Basic Classification of Training Courses in the Industry

6.3.1 Orientation

Orientation training is usually a mandatory program for all new-hires at a facility. The purpose of this type of training is to acclimate the new technician to the culture of the company--company procedures, policies, and paperwork the company requires. Some basic concepts about safety (hazardous materials that are used, potentially dangerous procedures) are also covered.

Most airlines have a formal session (while they wait for the final results of the drug test) when a technician begins work at a company. Smaller, general aviation facilities may not have a formal program of orientation training, but this function is usually accomplished by pairing the new-hire with an experienced technician.

6.3.2 Environmental Training

Several regulations enacted in recent years require facilities to train and retrain employees to identify hazardous materials, to properly handle hazardous materials and how to safely deal with emergency situations that may or may not involve hazardous materials. Most facilities provide training in these areas yearly. The training material is usually videotaped and does not change significantly from year to year. Environmental training is often included in the initial orientation training.

6.3.3 Type Training

Most technicians working at large facilities complete general familiarization training on a particular aircraft type before they work unsupervised on that type of aircraft. The primary objective of this type of training is to offer a general overview of the systems and details unique to that particular aircraft type.

6.3.4 Systems

Systems training covers either an entire system on an aircraft (such as engine, landing gear, air conditioning) or a particular component type of that system. Most facilities offer some sort of systems training in response to problems in the facility, or a desire to have more people better qualified on a particular system.

6.3.5 Refresher or Update Training

Refresher training is intended to review the basics of a certain type of aircraft, system or component as well as bring the technicians up-to-date on any problems or new advances. Facilities that perform factory-authorized maintenance usually have a requirement that a minimum number of technicians attend refresher training over a specified time period.

6.3.6 Certification Training

Certification training is used to qualify people to perform some specialty tasks or work with certain types of hazardous materials. One type of certification training offered by the airlines is taxi and run-up training--the technician is certified by the airline to operate the aircraft on the ground for the purpose of taxiing the aircraft or performing an engine run. Similarly, working with certain types of hazardous materials, such as freon, requires certification by the EPA. A major source of certification training comes from required inspection items (RII) that are tasks that a general maintenance manual specifies as needing to be performed or inspected by specially qualified/certified inspectors. In order to maintain enough qualified inspectors some recurrent training is required.

6.4 Sources of Training

6.4.1 On-the-job

All facilities have on-the-job training (OJT). At a smaller facility, this is the primary form of training. Also, OJT is used widely when a manufacturer is no longer producing that particular type of aircraft or is out of business. Larger facilities use OJT as a type of reinforcement to formal training received in the classroom. Some of these larger facilities have a formal OJT program that keeps records on what type of tasks a technician has learned on-the-job.

6.4.2 In-house

At smaller facilities where many different types of aircraft are serviced, most formal training is offered in-house. In these cases, the instructor of the class is either the director of maintenance or someone on staff who is skilled on the subject material. At many facilities, a library of videotapes supplements in-house training. Several manufacturers provide videos on various subjects for a particular aircraft.

At larger facilities, especially the airlines, there is an entire staff dedicated to training. The training staff actually decides what courses are offered and designs the curriculum for them. Also, computer based training (CBT), which is used to reinforce what was learned in class occasionally supplements the classes. The growth of CBT has lead to entire classes and even class sequences being organized around computers. However, at this point in time CBT plays a minor role in post-certification training.

6.4.3 Manufacturer/Vendor

Almost all facilities have technicians who have been to manufacturer training. Facilities that own a model of an aircraft (either as an airline or corporate), usually attend a general familiarization class off-site before they service an aircraft. Some of the vendors host classes on-site.

6.4.4 Third Party

Some in-house and manufacturer training is contracted out to third party training providers. These organizations can cover any type of training. Some manufacturers contract with these providers to complete all of their training. Also, some facilities contract these providers for only a few specialized subject material classes.

6.4.5 Government

Finally, some training is delivered directly by government agencies. The EPA offers classes for any hazardous material that they require someone to be certified to use. The FAA offers seminars through its local FSDO offices on various issues. The most common type of FAA training is for people to become or remain qualified as inspectors.

6.5 Training Patterns

6.5.1 Major Airline - Part 121

In a single year, the airlines will typically train a little less than 20% of their work force. The bulk of this training (perhaps >80%) will be type training for new hires. The remaining training will be a mix of small classes on ADs and advanced training on systems primarily for tech reps and selected technicians. When an airline introduces a new type of aircraft, a significant short term increase in training results in almost 100% of the work force receiving training on that type of aircraft. Occasionally, an airline will introduce a special program (e.g., avionics training) that may raise the percentage trained another 10% per year.

Labor contracts can also be linked to certain local training patterns. For example, at some facilities minimal systems training is offered technicians with less than 20 years experience, since contracts often stipulate that those with the most seniority have priority to receive training.

Our unconfirmed estimates based on interviews with technicians is that over a 10 year period almost all technicians will receive at least two weeks (80hrs) of training. Over a five year period, many technicians will receive one week of training. However, less than half of the technicians may receive training in an arbitrarily selected two year period. If continued investigation confirms this, then calculating recurrent training time over two year segments as has been proposed for Part 66 may be more of a hardship for the airlines than expected.

6.5.2 Large General Aviation

If a repair station holds a service contract with a manufacturer, the contract usually stipulates some significant training requirements. In practice facilities usually exceed these requirements with the result that 20-50% of the technicians per year at the facility receive formal training. The bulk of this training is type training and update training (advanced type training); although a higher percentage of these technicians (than airline technicians) will take specialized systems classes.

Most of the classes taken by these technicians are at least two weeks long. While many, though not nearly all, of the technicians take classes every two years, virtually all technicians take at least two weeks of training (80 hrs) over a five year period. As with the airlines, the number of training hours is not as important as how often they are calculated. If the requirements are calculated over five years there will little change in the current structure. By contrast, having a training requirement calculated over a two year period would require more frequent training than what is currently practiced.

If a facility does not have a service contract with a particular manufacturer, regardless of its size, it has little motivation to support a training department or send technicians to a third-party training vendor. A larger facility will invest in some specialty classes, but a smaller facility may not invest in any training. In spite of the current absence of training, we find almost universal acceptance for requiring some kind of recurrency training, from both the owners/managers of the facilities as well as the technicians.

6.5.3 Small General Aviation

Like repair stations that do not have service contracts, small general aviation facilities lack service contracts and seldom invest in formal training. And yet, like the repair stations most owners, managers, and technicians support some kind of recurrent training requirement.

The main issue for the owners/managers of small general aviation facilities is probably not hours, or even how often the hours are calculated; rather, what will count as training. If the training can be packaged in a media that the facility can operate with a great deal of flexibility, then the "cost" of the training is greatly reduced. This is because the facilities report that it is critical to their business practice to be able to provide instant "on call" service to a customer. Thus, the owners/managers of these facilities feel it would be very onerous on them if they have to stop the operation of their shop because technicians are "in class" for a day or two. They are also concerned about the high cost of sending a technician to a training provider. They seem much less concerned about the number of hours--with some remarking that 8 hours per year seems barely enough.

6.5.4 Corporate

NBAA surveys indicate that on average each corporate technician receives one week of training per year. Data gathered from the interviews corroborate this information and suggest that most corporate technicians receive more than just one week of training. Technicians at corporate facilities are trained more than any other segment of the industry.

6.6 Summary

The following table outlines the overall results of the interviews related to industry training. The results are listed for each segment. The maximum amount of training is a description of the training program provided by the facility that offers the most training in a particular segment. The minimum amount of training is a description of the training program provided by the facility that offers the least amount of training in a particular segment. Typical training is a description of a training program that is most prevalent in a particular segment.

Table 6-1. Summary of Industry Training

Type of Facility	Max. Training	Min. Training	Typical Training

Major Airline/Line	Annual refresher courses driven by problem situations (8-24 hrs). Formal OJT program.	Dictated by union contract (at least 4 hrs/ yr.), mostly for leads. Informal OJT program.	Training on new fleet type, system, or new methods as necessary. In-house training department. Computer based training programs.
Major Airline/Base	Training from vendors, manufacturers and in-house training department. Usually held at end of D-check. At least 40 hours per year.	Course every year in areas that require recurrent training (e.g., de-icing, hazmat). Little recurrent training in back shops if not required.	Same as above. More training for AMTs working in hangar/dock. Less training for those in specialized back shops.
Regional Airline	Formal OJT program, outside training for supervisors twice a year, videotape library, at least one, 4 day training program every two years.	Training from manufacturer and vendors. Formal OJT program. Annual 2 hr. class and required inspection items.	Training coordinator who arranges classes. Most classes provided from external sources. Several in-house resources available.
Lg. Gen. Aviation	Training by third party provider and manufacturer. Formal OJT program. In-house seminars based on shop floor needs. Videotape library.	Occasional training provided by third party provider and manufacturer, as needed.	No in-house training department. Informal OJT. Some training from external sources as needed or required.
Sm. Gen. Aviation	20% of work force attend formal training classes by third party provider.	None, other than IA renewal if required and informal OJT.	Training only as specifically required. Informal OJT.
Corporate	All attend 2 weeks training by third party provider or manufacturer once a year.	At least one week of training per year from manufacturer.	At least one week of training per year from manufacturer.

7. Implications for AMT Training

7.1 Introduction

From a functional perspective, the completion of the job task analysis is not an end in itself. Rather it is the means to one or more ends which are of direct value. The data collected in this JTA should have implications that can be expected to lead to significant improvements in the ability of AMTs to carry out their assigned responsibilities. Thus, the primary objective relates to the need for reforming the educational programs that are responsible for the training that AMTs receive. This can be viewed as dealing with the constraints that influence and limit the processes of curriculum reform. In this regard, there are two important constraints that will be examined.

One constraint pertains to the rules and regulations that govern the certification of the AMT programs of study. The current requirements for certification of schools, based on the Allen Study which is more than twenty years old, act so as to limit the potential for curriculum reform. In addition, the schools are necessarily faced with the need to continue to respond to the impact of technological developments as they lead to further revisions to the job responsibilities assigned to AMTs. In some respects, schools need to be able to anticipate the future and to approach the problem of curriculum reform on a continuing and experimental basis. They need to be encouraged to be innovative. As one aspect of this need for continuing improvements, changes are having an impact not only on the work performed by AMTs but also on the availability of new developments in the field of technical education. For example, there are interesting developments taking place in the use of computer based training (CBT). These need to be evaluated and incorporated into a revised program of study when appropriate.

There is another set of regulations that act as a constraint on the ability of schools to innovate and carry out reforms. These regulations concern the approach taken to evaluate the competence of AMTs leading to their initial certification. One is in the form of a written test, primarily in the form of yes-no or multiple-choice questions. The second part is directed toward the ability of a student to perform certain tasks. There is a need to review this approach to evaluation from at least two perspectives. First, it is advisable that the content of these tests be reviewed in order to bring them up-to-date. Second, there is the need to consider alternative approaches to evaluating student performance. Finally, there is again the challenge of keeping up-to-date with the continuing impact of technological change.

Next, there is the need to recognize that the programs of study offered at AMT schools are the first step in a continuing process of training, with the second part of the training being the responsibility of the companies that employ the AMTs. The completion of a two-year program of study can be viewed as providing the new AMT with "a license to learn." In this regard, the basic programs of instructions should provide the AMT with a sound foundation for learning from subsequent experience and from more formal approaches to continuing education carried out by employers.

Finally, there is the question of how educational programs should take into account the variability that exists across the different segments that make up the total aviation industry. At the present time, courses of study are designed in order to satisfy all segments of the industry.

In attempting to take into account the industry's variability, we are proposing the possibility of a core curriculum, appropriate for all students, plus some opportunity for specialization in order to satisfy some of the unique characteristics of the different industry segments. In addition, we are assuming that it is not particularly feasible to expand the length of these programs of study. Thus, the recommendations are based on maintaining two-year programs, which can be completed in 1900-2000 hours. In some respects, the recommendations have been influenced by the FAR Part 66 proposal which have introduces the AMT-T endorsement, designed to meet the needs of the transport industry. However, we will also discuss the possibility of other forms of specialization directed toward the remaining segments of the industry.

7.2 Curriculum Reform

It is important to begin with a brief review of existing programs offered by AMT schools. Typically these are defined as programs to be completed in 1900-2000 credit hours. They are accredited as long as they can be shown to satisfy the set of requirements outlined in FAR Part 147. However, schools organize their programs into a series of courses with a typical program made up of a total of approximately 24 courses. Part 147 is defined in considerable detail such that the schools have to demonstrate that this smaller number of courses can cover the detailed listing of skills.

We are proposing that we develop a set of guidelines to be followed by individual schools as they attempt to reform their programs and introduce changes. As an additional reason in support of this approach, the individual schools must be able to respond to unique features of the context within which they operate. Some of these features relate to the institutional context within which each school operates. Are they a public or private institution? Do they operate as part of a two-year technical institute or as part of a four-year system? More importantly, each school needs to respond to the realities concerning the students that they attract and the job market or markets which are likely to employ their graduates? For example, some institutions may expect most of their graduates to be hired by one of the major airlines. With other institutions, graduates may be more likely to work in the field of general aviation, whether small or large.

Given these considerations as background, the approach to the development of these guidelines can be summarized as follows.

A. The guidelines identify a core curriculum of study, which is a set of courses that is pertinent to all segments of the industry. The content of these courses would provide the student with an appropriate foundation for continuing to learn from their experiences on the job.

B. The guidelines should support and justify the elimination from existing programs of certain types of material in order to make possible the identification of a core curriculum. This should apply to material that is no longer of value because of being out-of-date or material that may be of interest to some segments of the industry but not to all.

C. Hopefully, we want each school to review its current course offerings in order to bring it up-to-date while, at the same time, improving on the organization of what remains. For example, there may be duplications to be eliminated. There may also be revisions designed to cover pertinent material with greater effectiveness as well as efficiency.

D. There should be additional guidelines to support the use of the 500 hours that remain after having completed the definition of a 1500 hour core curriculum. Within this 500 hours, there should be opportunities for students to specialize. In this regard, we do not see it as our responsibility to define these 500 hours. That should be the responsibility of the schools and of the aviation industry. However, we can make reference to certain options that are already under discussion. These might include the following:

> a) Specialization designed to meet the needs of the transport sector. This would probably emphasize advanced work on turbines and on avionics. This option might resemble the proposals made under the head of Part 66 and could lead to the establishment of an AMT-T designation.
>
> b) Another specialization might focus primarily on the needs of general aviation and include substantial material on propeller-driven and reciprocating engines.
>
> c) Other areas of specialization might be designed to emphasize newer technologies such as avionics, NDT, and composite materials.

E. In addition, there is the objective of emphasizing preparation for continuing education and on-the-job training. In principle, the core curriculum should lay a foundation for future learning. In this regard, there is the need for courses that support transfer of training from the basic school programs. For example, all turbine forms of propulsion have much in common, at least from a functional perspective, even though there are significant differences in how these functions are performed when two or more propulsion systems are being compared. In the core curriculum, one can emphasize what is common and that can be used at a later time as a foundation for learning about newer but related forms of propulsion.

7.3 Implications for AMT Schools

In this section, how the results of the JTA might be applied to an existing curriculum in order to identify a possible core curriculum is illustrated. As the basis for this example, we have chosen an existing curriculum from an established AMT program. The curriculum has been made available with the permission of the school.

7.3.1 Review of a Sample Curriculum

As a first step, the complete program makes use of 24 courses representing 1930 credit hours. The courses are grouped under three major headings: General Curriculum (430 hours), Airframe Curriculum (750 hours), and Powerplant Curriculum (750 hours). The total set of courses can be described in the form of a flow chart as given in Figure 7-1.

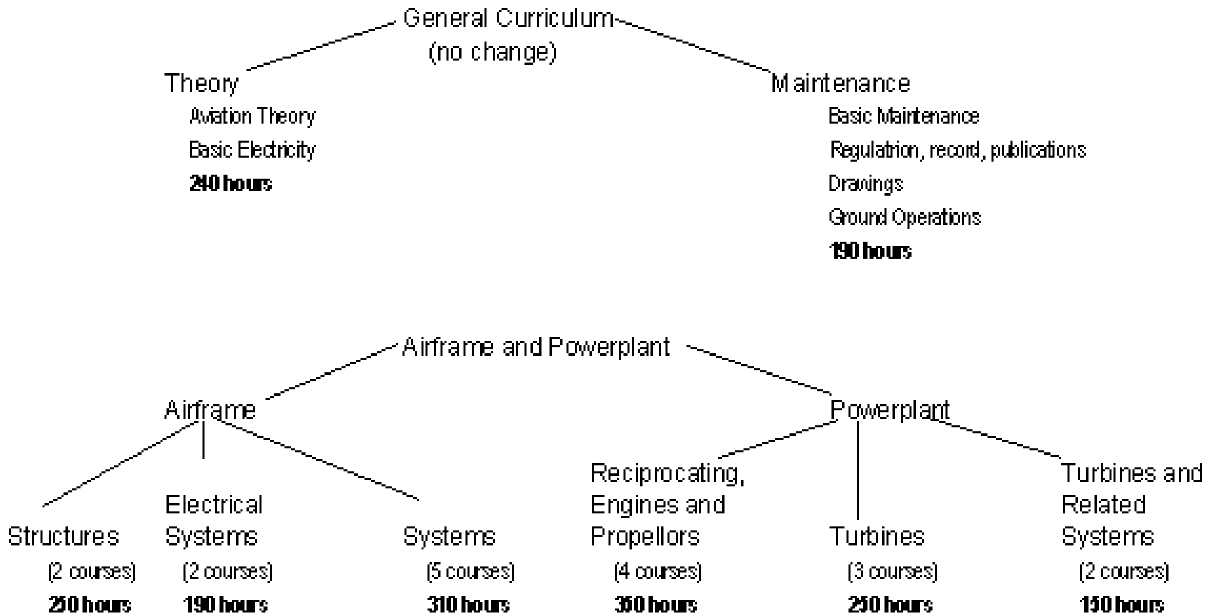

Figure 7-1. Representative Current Curriculum

Given the existing curriculum, how can it be simplified in order to construct a core set of courses to be completed in approximately 1500 hours? In applying some guidelines leading to simplification, we have dealt separately with the three major components that make up the present curriculum.

7.3.1.1 General Curriculum

Under this heading, students receive a general introduction to relevant theory and to the practice of maintenance. Based on our data, all of these topics should remain in a core curriculum. Although we have suggested that there be no change, it is likely that a school could condense the material being covered somewhat in order to accomplish a modest reduction in hours.

7.3.1.2 Airframe Curriculum

- Eliminate completely from the structures courses the emphasis on working with wood, dope, and fabric. This material may still need to be covered in a specialization for smaller general aviation facilities.
- Simplify and condense the material covered under welding and soldering. Students need some introductory understanding of these topics but large-scale work in these areas seems to be the responsibility of individuals who learn to specialize on the job.

Then the specific recommendations for the existing courses are as follows:

- Combine the two structures courses into a single course for a reduction from 250 hours to 150 hours.

- Combine the three systems courses that deal with Fluid Power Systems, Fuel Systems, and Gear Systems into a single course that emphasizes fundamentals and a basic functional understanding of these systems. Implication is that students will develop detailed skills in these areas from on-the-job training dealing with specific examples of these systems. This would involve a reduction from 150 hours to 100 hours.

- Continue the four courses in Environmental Controls, Aircraft Instruments and Electronics, Aircraft Electrical, and Rigging Systems, but with some consolidation of material and an emphasis on principles. The data indicate that AMTs need an understanding of these systems and the ability to inspect and service but not to trouble-shoot or repair. These changes would involve a reduction from 350 hours to 250 hours. Note these four courses might be repackaged in the form of 2 or 3 courses.

Summary. With these changes, the material presently covered in 750 hours would be covered in 500 hours.

7.3.1.3 Powerplant Curriculum

It is in this area that our results are quite clear. Although there is a need for some general understanding of turbines, reciprocating engines, and propellers, there is no need for the current emphasis on detailed understanding as part of a core curriculum. For example, AMTs who work in general aviation, particularly small general aviation, work extensively with propellers and reciprocating engines. But this emphasis is inappropriate for those employed by the major airlines. This leads to the following recommendations.

- Replace the four courses on propellers and reciprocating engines with a two course sequence that emphasizes fundamental understanding. This would involve a reduction from 350 hours to 180 hours.

- Along similar lines, replace the three courses on turbines and the two courses on systems with two courses that would introduce theory and principles along with material on systems. Note that the systems covered in this curriculum relate primarily to turbine-driven aircraft. This would lead to a reduction from 750 hours to 530 hours.

A summary of this proposed core curriculum is given in Figure 7-2. The overall savings in hours can be summarized in the following table.

Figure 7-2. Core Curriculum Chart

Having completed this illustration of a possible reduction from 1930 hours to 1470 hours, we have in effect defined a possible set of core offerings, leaving 460 hours to be used as the basis for one or more specializations. We will leave to the individual schools the responsibility for defining options that could provide students with an opportunity to specialize.

7.4 Implications for Regulatory Changes.

There are any number of vocations and/or professions in which the problems of establishing and enforcing standards are of considerable importance. This often involves two related procedures. First, programs of study must be approved and second, there will exist some procedures for evaluating the competence of those individuals who complete the professions of medicine, law, engineering, and teaching in the public schools. Thus, in the field of engineering, education programs are periodically evaluated for purposes of accreditation and graduates must also take another set of exams in order to be certified (licensed) as a professional engineer. Medical and law schools are accredited by an appropriate supervisory body while doctors and lawyers must also pass another set of exams in order to be licensed and/or certified. In similar fashion, programs for training teachers in some specialty - such as primary or secondary education - have to be accredited while graduates of those programs are expected to pass some form of examination in order to be certified. As with other vocations and/or professions, schools for training maintenance personnel must be regulated (i.e., accredited) while the graduates of these schools are expected to pass certain tests in order to be licensed.

At the same time, as we begin to discuss approaches to be undertaken by the FAA in introducing changes into the appropriate set of regulations, it is worth noting that in many fields including medicine, law, teaching, and engineering one discovers considerable dissatisfaction with current approaches to certification. At best, they seem like a necessary burden in spite of their imperfections. But can new approaches to certification be developed that would be less detailed and would place less emphasis on memorization of facts? In addition, one has to assume that schools need to have opportunities to modify their programs of study, partly in order to be innovative in responses to new approaches to the teaching of technical material. In addition, there is the challenge of responding to the demands of changing technology. For all of these reasons, one needs to consider the possibility of permitting and encouraging schools to adjust their offerings on a continuing basis and for a system of regulations to support such adjustments.

With these comments as background, we want to consider two possible approaches to revising Part 147 that would be compatible with our proposed emphasis on a core curriculum, along with limited opportunities for students to specialize. One might be viewed as a conservative or limited approach in that it would maintain the current structure of Part 147 while introducing only a minimum number of changes. The second approach would be more far-reaching although it would be following precedents which have been introduced in other fields. It would represent a substantial number of changes and would have important implication for long-run reform.

7.4.1 A Conservative Approach

This approach would leave unchanged the philosophy to certification that is currently being followed and would introduce changes only when absolutely necessary. It would depend primarily on a careful editing of the existing Part 147. This would involve eliminating references to material that would no longer be covered and making appropriate changes in emphasis to the remaining material. By way of illustration, let us return to our discussion of a possible core curriculum as discussed in the previous section. Using this example, what changes Part 147 would be needed in order to support the necessary revisions and reforms? These changes would include the following.

1. Leave without change the requirements that apply under the heading of "General Curriculum" on the assumption that the courses included under this heading would remain relatively unchanged. This applies primarily to Appendix B to Part 147, General Curriculum subjects. The specific areas of skill covered included the following:

    A. Basic Electricity

    B. Aircraft Drawings

    C. Weight and Balance

    D. Fluid Lines and Fittings

    E. Materials and Processes

    F. Ground Operation and Servicing

    G. Cleaning and Corrosion Control

    H. Mathematics

    I. Maintenance forms and Records

    J. Basic Physics

    K. Maintenance Publications

    L. Mechanic Privileges and Limitations

2. Several changes would be introduced under the heading of "Airframe Structures" which is described in Appendix C to Part 147. The main changes would include the following.

A. Wood structures - to be eliminated

B. Aircraft covering - to be condensed

C. Welding - to be simplified and condensed

Currently, in our example curriculum, these skills are covered in two courses, Aircraft Structures I and II. Our proposed changes would eliminate the above three items. Thus permitting the two existing courses to be combined into a single course.

The final recommendation involved combining the three systems courses that deal with Fluid Power Systems, Fuel Systems, and Gear Systems into a single course. At present, these courses cover a number of skills listed under Part 147. This condensation could be accomplished primarily by condensing material and reducing the skill level to be achieved from 3 to 1. In effect, one would be de-emphasizing skills at level 3 involving a knowledge of general principles along with the development "...of enough manipulative skill so that the student could perform the task competently as an entry level aviation maintenance technician." As an alternative, there would be an emphasis on the acquisition of general principles.

3. Finally, there are changes to be introduced under the heading of "Powerplant" which is described in Appendix D of Part 147. The main changes would include the following.

- Currently, there are four courses on propellers and reciprocating engines taught primarily at level 3. These could be replaced by a two course sequence that would emphasize fundamental understanding of principles and would decrease the emphasis on manipulative skills.
- In similar fashion, the three courses on turbines plus two courses on related systems could be replaced by two courses. Again this would involve an increased emphasis on a fundamental understanding of principles with a decreased emphasis on the mastery of specific skills.

With this emphasis on principles, one would be building a foundation for additional advanced specialization or as part of additional training to be obtained on the job.

In summary, with these limited changes to Part 147, it should be possible to support curriculum change leading to the identification of a core curriculum. Additional amendments would be needed in order to support the development of areas of specialization. In this respect, one option might be directed toward the needs of the transport industry and the possibility of an AMT-T license.

A second option could be geared towards the interests of general aviation. A given school might choose to support both of these options, given the availability of resources while schools might choose to support one of these options, but not both.

7.4.1.1 Possible Additions to the Curriculum

There are three topics that fall under the heading of technological change that are deserving of increased emphasis. Hopefully, this could be accomplished by additions to some of the existing courses. These are topics that are receiving increasing attention in the aviation industry although they are not as yet skills that are frequently being performed by AMTs.

1. Electronic Systems. At the present time, in our sample curriculum, this important area is covered to a limited extent in three separate courses. They are:

A. Basic Electricity

B. Aircraft Electrical Systems

C. Airframe Instruments and Electronics

This subject is deserving of an increase in emphasis, particularly with respect to the topics of analog and digital representations and fault-location in a complex system. Since the material is currently scattered among at least three subjects, one should consider the possibility of an advanced course that would deal with the subject matter in a more coherent fashion and at an advanced level.

D. Composite Materials.

At the present time, this topic receives only limited mention under the heading of Aircraft Structures, along with Wood Structures, Fabric, and Fiberglass. There is a need for significant changes in order to do justice to this important topic and one that is deserving of increased attention.

E. Computer Applications.

This is a topic that receives little explicit attention although the use of computer is being widespread throughout the industry. For example, component manuals are being delivered in the form of CDs that can only be accessed through the use of computers. Systems troubleshooting particularly with electronic components is more and more being supported with the aid of a computer and specialized software. Training is more and more being supported with the aid of computer simulations and Computer Based Instruction (CBT). As these applications become more complex, it is all the more important that students develop some familiarity with computers so that they can take advantage of the new technologies.

7.4.2 A New Approach to Certification

By way of introduction, it will be helpful to review the new approach to accreditation that has recently been adopted in the field of engineering by the Accreditation Board for Engineering and Technology (ABET). This is the board that is responsible for the accreditation of engineering schools and other programs in Technology. We will try to summarize their new approach as described in the ABET Vision Statement.

Let us begin this review with a quotation from this ABET statement that describes what they are trying to avoid.

> "The current accreditation criteria are too long and by their very nature encourage a rigid, bean-counting approach that stifles innovations."

On the positive side, their recommendations for action are as follows:

> "Engineering accreditation should be based on ongoing institutional processes for defining educational objectives, evaluating achievement of objectives, and improvement of educational effectiveness with periodic external audits of the process by ABET."

> "Criteria should specify a limited set of educational objectives for any engineering program and a limited 'floor' of curriculum content. Completed objective, curricula to achieve them, and processes to evaluate achievement would be defined by the institution."

Finally, there is the recognition that some schools would need help in defining a program leading to continuous evaluation and improvement. The relevant statement is the "The Engineering Accreditation Commission should provide advice to institutions attempting to define the needed measurements and outcomes." Although an emphasis on performance evaluation is not explicitly mentioned, it seems clear that new approaches for the evaluation of student performance would be quite consistent with the proposals being made.

How might this new paradigm to certification be modified so as to apply to the certification of AMT schools? For the moment, let us assume that the following long-range approach to certification of schools by the FAA would apply primarily to existing programs that are currently certified.

- Each school would be expected to develop a program designed to support an emphasis on continuous program improvement.
- More specifically, each school would be expected to specify a set of educational objectives, and a plan for what it hopes to accomplish over a limited period of time, on the order of 2-3 years.

- This plan would cover two separate components. The first would deal with the identification of a core curriculum appropriate for all segments of the aviation industry. A second would deal with an approach to specialization designed to fit the needs of each individual school.
- In addition, the school would be expected to have in place a process for evaluating progress in achieving those objectives (continuous feedback) and a process for introducing changes as needed.
- Details of the curriculum would be the responsibility of the school, but a description of the curriculum would be available for inspection by the FAA. Very likely, the description of the curriculum would be at a more abstract level, as a definition of course requirements. Of necessity, the material to be covered in each course would have to be defined by the school but this level of detail would not be part of the review and evaluation.
- As much as possible, the schools would be encouraged to emphasize evaluation in terms of student performance on realistic problems. Very likely, this might make more extensive use of the computer simulations that are being developed for use in both training as well as evaluation of student achievement.

7.4.3 Implication for Certification of AMTs

Having completed this discussion of possible revisions for the certification of AMT schools, there is the related issue of possible revisions to the certification of AMTs. Since the discussion of changes to the relevant set of rules, i.e. FAR Part 65, are currently in process, a more complete discussion of possible revisions needs to be undertaken after conclusions are reached about the replacement of Part 65 with the proposed Part 66. Nevertheless, we can identify two alternative approaches to revision which parallel our discussion of revisions to FAR Part 147.

- One approach involving a minimum of change would have to take into account any changes introduced into Part 147. Under the heading of a conservative approach, we have identified a number of changes that would have to be introduced.
- Eliminate references to material that would no longer be required in a possible core curriculum.
- Modify the Part 147 reference to material that was being condensed or when the level of competence was being reduced.
- In effect, these changes to Part 65 would be needed in order to support the emphasis on a core curriculum.
- Finally, there would need to be added some provisions that would support some areas of specialization.

Under the heading of a more radical or long-range approach, one would want to change Part 65 in order to place much greater emphasize on performance or competency - based forms of evaluation. Very likely this would rely heavily on the increasing availability of Automated Classroom Presentations and of Computer-based Instruction.

7.5 Implications for Industry Training

One often thinks of education as something that takes place only in schools and underestimates the extent to which education continues on the job. More realistically, one can view the initial education received by an AMT as primarily laying a foundation of education that will continue throughout one's career. Some of the subsequent education is informal, acquired through on-the-job experience. Some is more formal, particularly as one learns about a new type of aircraft or about new forms of technology.

More specifically, one might want to view the partnership of schools with industry as a kind of division of labor. Then, what is needed by industry so that they can build upon the knowledge that an AMT has already acquired? This knowledge would appear to fall under at least two headings. Under one heading would appear the necessary "tools" including the ability to use a computer and to locate information from a manual. Under another heading, there would appear the knowledge of principles that apply to the understanding of major systems and subsystems.

With respect to learning on-the-job, we are assuming that industries will be making increasing use of general familiarization courses that will deal with a specific system, whether a complete aircraft or a major component. General familiarization courses are making use of computer simulations and computer based instruction. Hopefully, the schools would provide graduates with the tools and basic understandings needed to profit from the additional training.

However, the details of such a partnership or division of labor would have to be worked out as the end product of planning involving representatives from both schools and industry.

8. Index

9. Appendix A

9.1 Rank Order of JTA Tasks by: Overall Percent Response; Overall Frequency; Overall Criticality; Overall Difficulty to Learn

9.1.1 JTA Tasks Ordered by Overall Percent Response

Description	Percent	Avg Frequency	Avg Criticality	Avg Difficulty
Troubleshoot electrically operated mechanical components (example: electric landing gear actuator).	63.1%	3.48	3.76	3.48
Inspect and check static discharge wicks.	59.3%	3.55	2.25	1.66
Operational check aircraft battery charging system.	55.6%	3.09	3.10	2.38
Perform a general interior or exterior visual inspection.	55.6%	4.18	3.00	2.11
Visually inspect parts or components to detect surface cracks with dye penetrant.	55.4%	2.53	3.47	2.60
Inspect for loose rivets, defects, disbonds, cracks, etc.	55.3%	4.10	3.32	2.38
Functional test aircraft warning systems.	55.1%	3.75	3.71	2.59
Repair or replace hydraulic components.	54.8%	3.09	3.58	2.82
Replace loose or missing fasteners.	53.8%	3.57	2.60	2.10

Operational check pressurization system.	52.8%	2.87	3.19	2.83
Repair or replace pressurization system components.	52.4%	2.59	3.15	2.74
Inspect components for loose connections.	51.8%	4.20	3.32	2.09
Operational check standby power or emergency generation system.	50.6%	3.11	3.31	2.60
Operational check flight control and landing systems.	50.4%	3.43	3.94	3.52
Remove corrosion and repair surrounding area.	50.4%	2.98	3.03	2.77
Inspect for general corrosion, corrosion under lap joints, etc.	50.1%	3.34	3.17	2.46
Repair small cracks by stop drilling.	49.3%	2.83	2.49	1.92
Check for leaks in hydraulic system.	48.8%	3.85	3.27	2.16
Change primary flight control servos or actuators.	48.7%	2.34	4.09	3.22
Repair or replace static discharger wicks and mounts.	48.6%	2.42	2.20	1.76
Identify types of corrosion such as fretting, interangular, granular, etc.	48.2%	3.21	3.09	2.78
Check pressure of tires.	48.1%	3.99	2.84	1.42
Repair or replace fire detection/protection components.	48.1%	2.46	3.62	2.63
Functional check air conditioning and pressurization systems.	48.0%	3.07	3.01	2.84
Repair or replace exterior aircraft lighting.	47.8%	3.36	2.42	1.75
Inspect flight control surface for damage.	47.7%	3.83	3.69	2.46
Lubricate required flight control components (hinges, rollers, pinions, gears).	47.5%	3.30	2.89	1.75
Perform a detailed dimensional inspection.	47.5%	3.31	3.36	2.69
Repair damaged wiring and connectors.	47.5%	3.06	3.40	2.64
Check clogging indicators on filters.	47.4%	3.52	3.16	1.86
Remove and replace tires or brakes.	47.3%	3.37	3.51	2.41
Service hydraulic system.	47.2%	3.69	3.17	1.95
Inspect wire bundles.	47.1%	3.32	3.17	2.27
Install racks, controls, connections, antennas and associated electrical components.	47.0%	2.82	3.15	2.79
Inspect hinge bearings for condition and excessive play.	46.7%	3.19	3.58	2.51
Inspect cargo and passenger doors.	46.3%	3.61	3.42	2.53
Functional test hydraulic system.	46.1%	3.63	3.42	2.55
Operational check DC and AC generating systems.	46.1%	3.38	3.37	2.85
Test communication systems.	46.0%	3.50	2.86	2.50
Troubleshoot flight control systems.	46.0%	2.61	4.04	3.62
Adjust, align or rig flight control components.	45.9%	2.73	4.40	3.79

Operational check air conditioning system.	45.9%	3.06	2.54	2.53
Inspect flight control cables for tension, fraying, nicks or crimps.	45.8%	3.05	3.97	2.73

Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Bleed hydraulic system pressure.	45.7%	3.50	2.79	2.05
Functional test fuel distribution system.	45.7%	2.90	3.31	2.45
Service tires.	45.4%	3.76	2.90	1.67
Remove and replace flight instruments (airspeed indicator, altimeter, VSI, etc.).	45.2%	2.78	3.55	2.68
Replace tire or wheel assemblies.	45.2%	3.37	3.43	2.24
Troubleshoot exterior lighting systems.	45.2%	3.33	2.52	2.16
Inspect honeycomb and laminated structure.	45.1%	2.99	3.14	2.61
Perform an intensive visual inspection of a zone or system.	45.0%	3.69	3.43	2.75
Check fuel tanks for water.	44.9%	3.63	3.11	1.54
Inspect access door latches and hinge attachments.	44.9%	3.53	3.16	2.32
Operational test flight controls and actuators.	44.9%	3.32	3.88	2.77
Inspect plastics and fiberglass.	44.8%	3.63	2.79	2.19
Fabricate replacement brackets, panels or small parts.	44.7%	3.17	2.77	2.85
Inspect cable routing, pulleys, turnbuckles or flight control components.	44.7%	3.06	3.89	2.76
Drill or ream structure or component.	44.5%	3.29	3.04	2.75
Repair structure or component by riveting.	44.4%	3.04	3.19	2.93
Check flight control travel.	44.3%	2.88	3.78	2.85
Troubleshoot pneumatic system.	44.3%	2.68	3.20	3.07
Lubricate landing gear components (bearings, hinges, pivots, up/downlocks, etc).	44.2%	3.20	2.71	1.71
Service shock struts.	44.1%	2.81	3.07	2.38
Change flight control surfaces.	44.0%	2.35	4.32	3.38
Repair hydraulic system leaks.	44.0%	2.92	3.48	2.65
Functional test brake system.	43.8%	3.36	3.55	2.50
Inspect engine mounts.	43.8%	3.03	3.88	2.64
Service hydraulic accumulator.	43.7%	3.09	3.09	2.09
Inspect passenger and crew oxygen system components.	43.5%	3.27	3.25	2.30
Repair, replace or polish windows or windscreens.	43.4%	2.27	3.30	2.72
Operational test of cabin emergency lighting.	43.3%	3.59	2.88	1.94
Service doors, windows and movable components with appropriate lubricant.	43.3%	3.06	2.41	1.81
Inspect engine fire loop.	43.0%	2.97	3.55	2.24

Service and operate APU (Auxiliary Power Unit).	42.8%	3.47	2.72	2.48
Functional test retractable gear.	42.7%	2.72	3.93	2.92
Troubleshoot cabin pressurization system and/or ECS System.	42.7%	2.63	3.35	3.31
Visually inspect wing structure.	42.7%	3.70	3.51	2.47
Functional test anti-skid system.	42.6%	2.91	3.24	2.63
Troubleshoot landing gear control and actuating systems.	42.4%	2.29	3.78	3.41
Clean or remove surface deposits or material.	42.2%	3.33	2.23	1.84
Repair bleed air ducting systems.	42.2%	2.45	3.17	2.69
Inspect fuel distribution components (pumps, valves, controls).	42.1%	2.98	3.41	2.51
Replace fuel distribution system components.	42.1%	2.15	3.40	2.72
Operational check APU (Auxiliary Power Unit).	41.9%	3.29	2.71	2.62
Inspect engine and components for security and leaks.	41.7%	3.89	3.62	2.71
Repair or replace fuel system plumbing.	41.7%	2.02	3.46	2.66
Repair or replace ignition components.	41.7%	2.60	3.28	2.48
Visually inspect landing gear, wheel wells, and doors.	41.7%	3.79	3.28	2.36
Replace regulator, masks or oxygen bottles.	41.2%	2.53	3.20	2.27
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Remove and install flight control trim motors.	40.9%	1.98	3.71	3.06
Test passenger or cargo smoke detection system.	40.9%	3.16	3.40	2.14
Remove and install fuel filter.	40.8%	3.08	3.32	2.17
Service nose gear assemblies.	40.8%	2.78	3.20	2.43
Inspect aircraft interior areas.	40.7%	3.86	2.37	1.99
Repair or replace windshield ice, rain or fog removal system components.	40.7%	2.24	3.33	2.72
Identify delamination or disbonding of carbon composites.	40.5%	2.96	3.27	2.97
Operational test lift dumpers, air brakes, or spoilers.	40.5%	3.20	3.55	2.64
Service passenger oxygen system.	40.4%	3.36	3.21	2.08
Remove and install starter.	40.3%	2.62	2.93	2.29
Repair or replace pneumatic system controls, ducts, valves, lines and other components.	40.3%	2.66	3.15	2.69
Inspect chip detectors and/or oil filters.	40.2%	3.42	3.27	2.14
Functional test electrical switching and distribution.	40.1%	3.42	3.42	2.95
Troubleshoot engine indicating problems.	40.0%	2.81	3.47	3.32
Replace smoke detection components.	39.9%	2.27	3.29	2.11
Troubleshoot fuel distribution system.	39.8%	2.22	3.34	3.09

Troubleshoot pressurized hydraulic system (1,000-3,000 psi).	39.7%	2.91	3.56	3.05
Functional test emergency gear extension system.	39.5%	2.67	3.88	2.74
Replace aircraft generator.	39.5%	2.36	3.39	2.61
Repair or replace engine indicating components.	39.4%	2.79	3.33	2.70
Repair or replace voice or data communication system components.	39.4%	2.81	2.77	2.77
Service engine and scavenger oil.	39.4%	3.78	3.26	1.89
Paint parts or surfaces.	39.3%	3.07	1.95	1.89
Prepare and install patch (composite, fabric, metal).	39.3%	2.84	3.22	3.18
Leak check pitot static system.	39.2%	2.78	3.62	3.11
Remove or install ignitor plug.	39.2%	2.76	3.17	2.24
Troubleshoot aircraft electrical wiring and connectors.	39.2%	3.22	3.52	3.57
Troubleshoot ice, rain or fog removal systems.	39.1%	2.40	3.37	2.94
Repair or replace aircraft electrical wiring and connectors.	38.9%	2.98	3.45	2.87
Repair or replace high tension ignition system components.	38.8%	2.52	3.26	2.45
Rig doors and emergency evacuation systems.	38.8%	2.34	3.79	3.43
Troubleshoot AC/DC power generation system.	38.8%	2.64	3.50	3.53
Troubleshoot landing gear position indication and warning systems.	38.8%	2.36	3.75	3.25
Repair or replace anti-skid system components.	38.7%	2.29	3.39	2.96
Inspect body skin and lower body surface.	38.6%	3.64	3.00	2.34
Repair or replace APU (Auxiliary Power Unit).	38.6%	2.23	2.99	3.22
Operational test thrust reversers.	38.5%	2.99	3.36	2.70
Replace or repair antennas.	38.2%	2.17	2.77	2.20
Functional check pneumatic system.	38.1%	2.96	3.10	2.67
Troubleshoot voice or data communication systems.	38.1%	2.86	2.86	3.08
Repair or replace landing gear control and actuating system components.	38.0%	2.23	3.76	3.08
Service and inspect air/vapor cycle cooling system.	38.0%	2.66	2.61	2.56
Defuel aircraft.	37.9%	2.53	2.16	1.93
Inspect extinguishers and fire bottles.	37.9%	3.52	3.39	1.87
Troubleshoot and repair air/vapor cycle conditioning system.	37.7%	2.58	2.73	3.06
Remove and install fuel pump.	37.6%	2.26	3.86	3.09
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Inspect air scoops and leading edge ice control systems.	37.4%	3.47	3.31	2.24

Troubleshoot brake system.	37.4%	2.52	3.45	2.93
Detailed inspection of landing gear assemblies and subassemblies.	37.3%	3.38	3.72	2.87
Replace turbine and jet oil filter elements.	37.3%	3.14	3.33	2.14
Perform stall warning test.	37.2%	3.13	3.63	2.50
Repair minor sheet metal defects or damage to control surfaces.	37.1%	2.74	3.32	3.13
Perform fuel quantity test.	37.0%	2.75	3.16	2.46
Troubleshoot fire detection circuits.	36.8%	2.31	3.67	3.06
Troubleshoot ignition problems.	36.8%	2.39	3.33	2.92
Inspect fan blades for FOD (Foreign Object Damage).	36.5%	3.91	3.61	2.36
Repair or replace electronic system components.	36.5%	3.39	3.39	3.00
Replace or clean engine components.	36.5%	3.48	3.40	2.78
Test fuel transfer system.	36.5%	2.70	3.01	2.34
Operational check fire detection system.	36.2%	3.59	3.59	2.14
Repair or replace landing gear position indication and warning components.	36.2%	2.21	3.62	2.92
Troubleshoot retractable gear system.	36.2%	2.30	3.78	3.41
Troubleshoot fuel tank leaks.	36.1%	2.44	3.11	2.71
Functional check electrical ice, rain or fog removal systems.	36.0%	2.97	3.31	2.42
Functional test fire protection system.	35.6%	3.55	3.76	2.22
Repair or replace plastics and fiberglass.	35.6%	2.63	2.71	2.66
Troubleshoot anti-skid system.	35.6%	2.29	3.34	3.27
Remove or install excitor box.	35.5%	2.24	3.22	2.30
Inspect windshield ice or rain removal systems.	35.4%	3.04	2.99	2.29
Operational check caution and warning systems.	35.4%	3.60	3.53	2.61
Operational check engine.	35.3%	3.64	3.93	3.47
Inspect high-tension ignition systems.	35.2%	2.97	3.28	2.47
Repair air/vapor cycle conditioning system.	35.0%	2.48	2.70	2.91
Overhaul, repair or replace landing gear.	34.6%	2.07	3.97	3.44
Repair or replace fuel control components.	34.6%	2.61	3.84	3.14
Rig nose gear steering.	34.5%	1.93	3.60	3.32
Repair or replace attach points or tracks for control surfaces.	34.4%	2.09	3.97	3.20
Repair or replace sheetmetal frame sections and fittings, fairings or stringers.	34.3%	2.63	3.57	3.43
Repair integral fuel tank leaks.	34.2%	2.23	3.18	2.93
Repair skin.	34.2%	2.52	3.51	3.27

Inspect fire detection elements for connections and security.	34.1%	3.04	3.47	2.23
Service each fuel tank sump to remove water and inspect tank valve.	34.0%	3.24	3.03	1.93
Troubleshoot electronic engine indicating systems.	33.7%	2.61	3.43	3.27
Replace electrical circuit protection devices.	33.6%	2.39	3.34	2.57
Replace engine filters.	33.6%	3.27	3.13	1.91
Troubleshoot electrical distribution and switching.	33.6%	2.84	3.49	3.56
Operational test of cockpit voice recorder.	33.5%	3.15	2.15	1.81
Troubleshoot fire extinguishing and control systems.	33.5%	2.40	3.71	2.85
Service turbine engine.	33.4%	3.95	3.44	2.18
Replace pitot/static system components.	33.2%	2.25	3.60	2.82
Repair or replace fuel measurement components.	32.6%	2.10	3.29	2.82
Troubleshoot fuel control problems.	32.6%	2.56	3.97	3.69
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Functional check pneumatic ice or fog removal systems.	32.5%	2.73	3.40	2.50
Troubleshoot capacitance-based fuel indicating system.	32.5%	2.23	3.41	3.54
Repair or install a device by soldering.	32.4%	2.82	3.08	2.57
Service IDG (Integrated Drive Generator) oil level.	32.4%	3.18	3.15	2.24
Prepare surface and prime.	32.3%	2.89	2.23	1.97
Replace doors.	32.2%	1.84	3.64	3.18
Perform failure analysis on electrical power systems.	32.1%	2.93	3.54	3.54
Inspect fire extinguishing system.	31.8%	3.20	3.55	2.19
Replace automatic flight control, autopilot or all-weather landing systems components.	31.8%	2.72	3.75	3.55
Rig or check autopilot flight control actuators and servos.	31.8%	2.22	3.85	3.47
Inspect electronic equipment blowers and flow sensors.	31.3%	2.74	2.70	2.36
Perform wiring modifications.	31.0%	2.47	3.51	3.29
Repair landing gear wiring and switches.	31.0%	2.15	3.53	2.87
Clean electronic equipment cooling filters.	30.7%	2.48	2.22	1.55
Drain and flush oil tank.	30.6%	2.55	3.05	2.07
Repair or replace scoops and leading edge anti-ice components.	29.9%	2.32	3.38	2.71
Service scavenge filter.	29.4%	3.00	3.22	2.19
Maintain batteries.	29.2%	2.93	2.98	2.13
Replace buss switching and control devices.	29.2%	2.31	3.53	2.87

Check control surface balance.	29.0%	1.87	4.06	3.22
Calibrate capacitance type fuel quantity indication systems.	28.7%	2.19	3.46	3.43
Troubleshoot jet engine.	28.7%	3.06	4.17	4.05
Remove and install fuel control unit.	28.5%	2.19	4.07	3.50
Functional test fuel control system.	28.4%	2.82	3.80	3.16
Repair or replace electronic display components.	28.2%	2.51	3.23	2.68
Check navigation system annunciators for operation.	27.9%	3.44	3.20	2.69
Balance control surfaces.	27.5%	1.93	4.06	3.22
Fabricate flexible or rigid lines and attach connectors.	27.5%	1.98	3.54	2.91
Troubleshoot autopilot.	27.4%	2.91	3.50	4.13
Replace CSD (Constant Speed Drive) or IDG (Integrated Drive Generator).	27.1%	2.09	3.40	2.95
Operational check crew alerting systems (examples: EFIS, EICAS and ECAM).	26.6%	3.47	3.48	3.07
Swing (calibrate) compass system.	26.5%	1.90	3.23	2.80
Replace jet engine.	26.3%	2.33	4.46	3.75
Replace solid state inverters.	26.3%	1.80	3.13	2.42
Troubleshoot flight instruments.	26.2%	3.03	3.64	3.52
Replace transformers, rectifiers and electrical filters.	26.1%	2.19	3.20	2.68
Repair or replace honeycomb structure.	25.9%	2.29	3.24	3.31
Troubleshoot autothrottle.	25.8%	2.11	3.47	3.70
Repair or replace fuel system warning devices.	25.4%	1.95	3.37	2.80
Functional test EFIS (Electronic Flight Instrumentation System).	25.3%	3.22	3.49	3.18
Blend fan blades.	25.0%	2.36	3.44	2.73
Repair or replace components associated with DME, transponder, radar or other pulse systems.	24.9%	2.82	3.25	3.01
Perform an x-ray or similar non-destructive inspection of skin or structure.	24.8%	2.08	3.84	3.42
Test navigation systems.	24.7%	3.17	3.50	3.28
Certify pitot and static system.	24.4%	2.67	3.82	3.19
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Fabricate control cables.	24.4%	1.73	4.24	3.32
Perform EFIS (Electronic Flight Instrumentation System) test.	24.1%	3.17	3.42	3.08
Repair or replace thrust reversers.	24.0%	2.33	3.50	3.18
Remove and install air data computer.	23.2%	2.48	3.49	2.69
Troubleshoot radar system.	23.0%	2.65	3.28	3.51
Test electronic instrumentation systems.	22.4%	3.10	3.39	3.27

Troubleshoot central air data collection and distribution system.	22.2%	2.43	3.63	3.46
Repair or replace vacuum driven flight instrument components.	22.0%	2.23	3.35	2.75
Repair or replace sensitive position sensing devices (examples: gimble gyroscopes, laser ring gyros).	21.9%	2.39	3.64	3.14
Clean or remove paint or coatings from parts or skin using stripping agents or chemical bath.	21.8%	2.14	2.28	2.11
Troubleshoot vacuum system.	21.7%	2.06	3.35	2.97
Troubleshoot dependent reference systems such as VOR and ILS.	21.6%	2.96	3.51	3.51
Analyze fuel tank for microbiological contamination.	21.3%	2.38	2.90	2.04
Repair or replace central air data collection and distribution components.	21.3%	2.44	3.59	3.11
Identify and control bacteria in fuel tanks.	21.2%	2.19	2.80	2.09
Functional check flight management system.	20.3%	2.88	3.33	3.36
Inspect battery ignition systems.	20.2%	2.86	3.16	2.53
Replace or overhaul hot section.	19.3%	2.71	4.25	3.87
Troubleshoot float-based fuel indicating system.	19.1%	1.87	3.25	2.83
Replace electrical de-ice boots.	19.0%	1.85	3.50	2.94
Rig shut-off valves.	19.0%	2.13	3.63	3.07
Operational test escape slides or liferafts.	18.8%	2.17	3.55	2.39
Troubleshoot vacuum driven flight instruments.	18.5%	2.21	3.39	3.12
Certify transponder and altitude reporting equipment.	18.4%	2.92	3.55	3.35
Perform internal repairs to engine.	18.3%	2.87	4.21	3.83
Repair or install a part by soldering.	18.3%	2.29	2.89	2.43
Troubleshoot intersystem data exchange problems.	18.1%	2.40	3.49	3.77
Troubleshoot ACARS (Airborne Communication and Reporting System).	17.9%	2.46	2.59	3.10
Operational test ACARS (Airborne Communication and Reporting System) link function.	17.8%	2.73	2.35	2.64
Perform a magnetic particle inspection.	17.8%	2.54	3.55	2.83
Perform borescope inspection.	17.8%	2.53	3.77	3.42
Modify or alter landing gear assembly.	17.6%	1.80	3.84	3.58
Repair printed circuit board.	17.4%	2.33	3.30	3.70
Repair or replace vacuum pumps, hoses and connectors.	17.2%	2.03	3.22	2.51
Repair bladder type fuel tank leaks.	16.6%	1.56	3.52	3.26
Operational test autothrottle.	16.0%	2.43	3.23	3.16
Paint control surfaces.	16.0%	1.84	2.32	2.30
Repair carbon composites.	15.6%	2.16	3.42	3.68

Perform eddy current or ultrasound inspection on skin or structure.	13.4%	2.08	3.51	3.48
Service gear reduction section.	13.1%	2.81	3.72	2.83
Inspect booster starting systems.	11.8%	2.52	3.29	2.64
Service fluid in compass system.	11.6%	1.35	2.86	2.36
Repair or replace de-ice boot.	11.1%	2.17	3.08	2.66
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Refinish composite blades.	10.5%	1.88	3.91	3.59
Replace propeller.	10.5%	2.49	4.01	2.85
Troubleshoot turboprop engine.	10.4%	2.87	3.92	3.80
Functional check prop heat.	10.1%	3.15	2.99	1.99
Inspect propellers for damage.	9.8%	3.78	3.46	2.12
Replace propeller assembly.	9.1%	2.43	4.00	2.90
Perform repairs by brazing.	8.9%	1.42	3.09	2.95
Perform repairs using gaseous welding.	8.8%	1.57	3.17	3.26
Troubleshoot propeller heat.	8.8%	2.50	3.01	2.60
Dress nicks and irregularities in propeller.	8.3%	2.79	3.05	2.27
Hydrostatically test high pressure oxygen cylinders.	8.1%	1.91	3.52	2.80
Troubleshoot central maintenance parameter and system computer.	8.1%	2.71	3.34	3.57
Perform repairs using arc or spot welding.	8.0%	1.52	3.19	3.38
Replace turboprop engine.	7.5%	2.03	4.44	3.75
Lubricate propeller.	7.3%	2.78	2.90	1.83
Operational check fixed and constant speed propellers.	7.3%	3.04	3.39	2.53
Replace central maintenance system components.	7.1%	2.45	3.21	3.12
Adjust governor.	6.7%	2.14	3.37	2.89
Troubleshoot propeller synchronization.	6.7%	1.91	2.57	3.19
Replace or rejuvenate fabric covered and doped surfaces.	6.6%	1.52	3.25	3.16
Troubleshoot constant speed propeller.	5.6%	2.19	3.40	3.10
Rig propeller blades.	4.8%	2.41	3.77	3.06
Service piston engine.	4.7%	3.02	3.28	2.22
Inspect opposed piston engine.	4.6%	3.18	3.58	2.84
Troubleshoot opposed piston engine.	4.4%	2.79	3.53	3.41
Drain and replace oil in piston engine.	4.1%	2.95	3.01	1.73
Tear down and build-up prop assembly.	2.4%	1.84	4.04	3.57
Perform internal repairs to opposed piston engines.	2.3%	1.80	4.00	3.51
Service bleed valve propeller governor.	2.3%	1.98	3.53	2.64

Overhaul prop assembly.	1.9%	1.69	4.08	3.69
Inspect radial piston engine.	1.5%	1.62	3.24	2.90
Inspect fabric covered and doped surfaces.	0.7%	1.75	3.38	2.38
Inspect wood structure.	0.5%	1.42	3.83	3.17
Repair, replace or construct wood structures.	0.3%	1.00	3.33	3.00

9.1.2 JTA Tasks Ordered by Overall Frequency

Description	Percent	Avg Frequency	Avg Criticality	Avg Difficulty
Inspect components for loose connections.	51.8%	4.20	3.32	2.09
Perform a general interior or exterior visual inspection.	55.6%	4.18	3.00	2.11
Inspect for loose rivets, defects, disbonds, cracks, etc.	55.3%	4.10	3.32	2.38
Check pressure of tires.	48.1%	3.99	2.84	1.42
Service turbine engine.	33.4%	3.95	3.44	2.18
Inspect fan blades for FOD (Foreign Object Damage).	36.5%	3.91	3.61	2.36
Inspect engine and components for security and leaks.	41.7%	3.89	3.62	2.71
Inspect aircraft interior areas.	40.7%	3.86	2.37	1.99
Check for leaks in hydraulic system.	48.8%	3.85	3.27	2.16
Inspect flight control surface for damage.	47.7%	3.83	3.69	2.46
Visually inspect landing gear, wheel wells, and doors.	41.7%	3.79	3.28	2.36
Inspect propellers for damage.	9.8%	3.78	3.46	2.12
Service engine and scavenger oil.	39.4%	3.78	3.26	1.89
Service tires.	45.4%	3.76	2.90	1.67
Functional test aircraft warning systems.	55.1%	3.75	3.71	2.59
Visually inspect wing structure.	42.7%	3.70	3.51	2.47
Perform an intensive visual inspection of a zone or system.	45.0%	3.69	3.43	2.75
Service hydraulic system.	47.2%	3.69	3.17	1.95
Inspect body skin and lower body surface.	38.6%	3.64	3.00	2.34
Operational check engine.	35.3%	3.64	3.93	3.47
Check fuel tanks for water.	44.9%	3.63	3.11	1.54
Functional test hydraulic system.	46.1%	3.63	3.42	2.55
Inspect plastics and fiberglass.	44.8%	3.63	2.79	2.19
Inspect cargo and passenger doors.	46.3%	3.61	3.42	2.53
Operational check caution and warning systems.	35.4%	3.60	3.53	2.61
Operational check fire detection system.	36.2%	3.59	3.59	2.14
Operational test of cabin emergency lighting.	43.3%	3.59	2.88	1.94
Replace loose or missing fasteners.	53.8%	3.57	2.60	2.10

Description	Percent	Avg Frequency	Avg Criticality	Avg Difficulty
Functional test fire protection system.	35.6%	3.55	3.76	2.22
Inspect and check static discharge wicks.	59.3%	3.55	2.25	1.66
Inspect access door latches and hinge attachments.	44.9%	3.53	3.16	2.32
Check clogging indicators on filters.	47.4%	3.52	3.16	1.86
Inspect extinguishers and fire bottles.	37.9%	3.52	3.39	1.87
Bleed hydraulic system pressure.	45.7%	3.50	2.79	2.05
Test communication systems.	46.0%	3.50	2.86	2.50
Replace or clean engine components.	36.5%	3.48	3.40	2.78
Troubleshoot electrically operated mechanical components (example: electric landing gear actuator).	63.1%	3.48	3.76	3.48
Inspect air scoops and leading edge ice control systems.	37.4%	3.47	3.31	2.24
Operational check crew alerting systems (examples: EFIS, EICAS and ECAM).	26.6%	3.47	3.48	3.07
Service and operate APU (Auxiliary Power Unit).	42.8%	3.47	2.72	2.48
Check navigation system annunciators for operation.	27.9%	3.44	3.20	2.69
Operational check flight control and landing systems.	50.4%	3.43	3.94	3.52
Functional test electrical switching and distribution.	40.1%	3.42	3.42	2.95
Inspect chip detectors and/or oil filters.	40.2%	3.42	3.27	2.14
Repair or replace electronic system components.	36.5%	3.39	3.39	3.00
Detailed inspection of landing gear assemblies and subassemblies.	37.3%	3.38	3.72	2.87
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Operational check DC and AC generating systems.	46.1%	3.38	3.37	2.85
Remove and replace tires or brakes.	47.3%	3.37	3.51	2.41
Replace tire or wheel assemblies.	45.2%	3.37	3.43	2.24
Functional test brake system.	43.8%	3.36	3.55	2.50
Repair or replace exterior aircraft lighting.	47.8%	3.36	2.42	1.75
Service passenger oxygen system.	40.4%	3.36	3.21	2.08
Inspect for general corrosion, corrosion under lap joints, etc.	50.1%	3.34	3.17	2.46
Clean or remove surface deposits or material.	42.2%	3.33	2.23	1.84
Troubleshoot exterior lighting systems.	45.2%	3.33	2.52	2.16
Inspect wire bundles.	47.1%	3.32	3.17	2.27
Operational test flight controls and actuators.	44.9%	3.32	3.88	2.77
Perform a detailed dimensional inspection.	47.5%	3.31	3.36	2.69
Lubricate required flight control components (hinges, rollers, pinions, gears).	47.5%	3.30	2.89	1.75
Drill or ream structure or component.	44.5%	3.29	3.04	2.75
Operational check APU (Auxiliary Power Unit).	41.9%	3.29	2.71	2.62

Inspect passenger and crew oxygen system components.	43.5%	3.27	3.25	2.30
Replace engine filters.	33.6%	3.27	3.13	1.91
Service each fuel tank sump to remove water and inspect tank valve.	34.0%	3.24	3.03	1.93
Functional test EFIS (Electronic Flight Instrumentation System).	25.3%	3.22	3.49	3.18
Troubleshoot aircraft electrical wiring and connectors.	39.2%	3.22	3.52	3.57
Identify types of corrosion such as fretting, interangular, granular, etc.	48.2%	3.21	3.09	2.78
Inspect fire extinguishing system.	31.8%	3.20	3.55	2.19
Lubricate landing gear components (bearings, hinges, pivots, up/downlocks, etc).	44.2%	3.20	2.71	1.71
Operational test lift dumpers, air brakes, or spoilers.	40.5%	3.20	3.55	2.64
Inspect hinge bearings for condition and excessive play.	46.7%	3.19	3.58	2.51
Inspect opposed piston engine.	4.6%	3.18	3.58	2.84
Service IDG (Integrated Drive Generator) oil level.	32.4%	3.18	3.15	2.24
Fabricate replacement brackets, panels or small parts.	44.7%	3.17	2.77	2.85
Perform EFIS (Electronic Flight Instrumentation System) test.	24.1%	3.17	3.42	3.08
Test navigation systems.	24.7%	3.17	3.50	3.28
Test passenger or cargo smoke detection system.	40.9%	3.16	3.40	2.14
Functional check prop heat.	10.1%	3.15	2.99	1.99
Operational test of cockpit voice recorder.	33.5%	3.15	2.15	1.81
Replace turbine and jet oil filter elements.	37.3%	3.14	3.33	2.14
Perform stall warning test.	37.2%	3.13	3.63	2.50
Operational check standby power or emergency generation system.	50.6%	3.11	3.31	2.60
Test electronic instrumentation systems.	22.4%	3.10	3.39	3.27
Operational check aircraft battery charging system.	55.6%	3.09	3.10	2.38
Repair or replace hydraulic components.	54.8%	3.09	3.58	2.82
Service hydraulic accumulator.	43.7%	3.09	3.09	2.09
Remove and install fuel filter.	40.8%	3.08	3.32	2.17
Functional check air conditioning and pressurization systems.	48.0%	3.07	3.01	2.84
Paint parts or surfaces.	39.3%	3.07	1.95	1.89
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Inspect cable routing, pulleys, turnbuckles or flight control components.	44.7%	3.06	3.89	2.76

Operational check air conditioning system.	45.9%	3.06	2.54	2.53
Repair damaged wiring and connectors.	47.5%	3.06	3.40	2.64
Service doors, windows and movable components with appropriate lubricant.	43.3%	3.06	2.41	1.81
Troubleshoot jet engine.	28.7%	3.06	4.17	4.05
Inspect flight control cables for tension, fraying, nicks or crimps.	45.8%	3.05	3.97	2.73
Inspect fire detection elements for connections and security.	34.1%	3.04	3.47	2.23
Inspect windshield ice or rain removal systems.	35.4%	3.04	2.99	2.29
Operational check fixed and constant speed propellers.	7.3%	3.04	3.39	2.53
Repair structure or component by riveting.	44.4%	3.04	3.19	2.93
Inspect engine mounts.	43.8%	3.03	3.88	2.64
Troubleshoot flight instruments.	26.2%	3.03	3.64	3.52
Service piston engine.	4.7%	3.02	3.28	2.22
Service scavenge filter.	29.4%	3.00	3.22	2.19
Inspect honeycomb and laminated structure.	45.1%	2.99	3.14	2.61
Operational test thrust reversers.	38.5%	2.99	3.36	2.70
Inspect fuel distribution components (pumps, valves, controls).	42.1%	2.98	3.41	2.51
Remove corrosion and repair surrounding area.	50.4%	2.98	3.03	2.77
Repair or replace aircraft electrical wiring and connectors.	38.9%	2.98	3.45	2.87
Functional check electrical ice, rain or fog removal systems.	36.0%	2.97	3.31	2.42
Inspect engine fire loop.	43.0%	2.97	3.55	2.24
Inspect high-tension ignition systems.	35.2%	2.97	3.28	2.47
Functional check pneumatic system.	38.1%	2.96	3.10	2.67
Identify delamination or disbonding of carbon composites.	40.5%	2.96	3.27	2.97
Troubleshoot dependent reference systems such as VOR and ILS.	21.6%	2.96	3.51	3.51
Drain and replace oil in piston engine.	4.1%	2.95	3.01	1.73
Maintain batteries.	29.2%	2.93	2.98	2.13
Perform failure analysis on electrical power systems.	32.1%	2.93	3.54	3.54
Certify transponder and altitude reporting equipment.	18.4%	2.92	3.55	3.35
Repair hydraulic system leaks.	44.0%	2.92	3.48	2.65
Functional test anti-skid system.	42.6%	2.91	3.24	2.63
Troubleshoot autopilot.	27.4%	2.91	3.50	4.13

Troubleshoot pressurized hydraulic system (1,000-3,000 psi).	39.7%	2.91	3.56	3.05
Functional test fuel distribution system.	45.7%	2.90	3.31	2.45
Prepare surface and prime.	32.3%	2.89	2.23	1.97
Check flight control travel.	44.3%	2.88	3.78	2.85
Functional check flight management system.	20.3%	2.88	3.33	3.36
Operational check pressurization system.	52.8%	2.87	3.19	2.83
Perform internal repairs to engine.	18.3%	2.87	4.21	3.83
Troubleshoot turboprop engine.	10.4%	2.87	3.92	3.80
Inspect battery ignition systems.	20.2%	2.86	3.16	2.53
Troubleshoot voice or data communication systems.	38.1%	2.86	2.86	3.08
Prepare and install patch (composite, fabric, metal).	39.3%	2.84	3.22	3.18
Troubleshoot electrical distribution and switching.	33.6%	2.84	3.49	3.56
Repair small cracks by stop drilling.	49.3%	2.83	2.49	1.92
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Functional test fuel control system.	28.4%	2.82	3.80	3.16
Install racks, controls, connections, antennas and associated electrical components.	47.0%	2.82	3.15	2.79
Repair or install a device by soldering.	32.4%	2.82	3.08	2.57
Repair or replace components associated with DME, transponder, radar or other pulse systems.	24.9%	2.82	3.25	3.01
Repair or replace voice or data communication system components.	39.4%	2.81	2.77	2.77
Service gear reduction section.	13.1%	2.81	3.72	2.83
Service shock struts.	44.1%	2.81	3.07	2.38
Troubleshoot engine indicating problems.	40.0%	2.81	3.47	3.32
Dress nicks and irregularities in propeller.	8.3%	2.79	3.05	2.27
Repair or replace engine indicating components.	39.4%	2.79	3.33	2.70
Troubleshoot opposed piston engine.	4.4%	2.79	3.53	3.41
Leak check pitot static system.	39.2%	2.78	3.62	3.11
Lubricate propeller.	7.3%	2.78	2.90	1.83
Remove and replace flight instruments (airspeed indicator, altimeter, VSI, etc.).	45.2%	2.78	3.55	2.68
Service nose gear assemblies.	40.8%	2.78	3.20	2.43
Remove or install ignitor plug.	39.2%	2.76	3.17	2.24
Perform fuel quantity test.	37.0%	2.75	3.16	2.46
Inspect electronic equipment blowers and flow sensors.	31.3%	2.74	2.70	2.36
Repair minor sheet metal defects or damage to control surfaces.	37.1%	2.74	3.32	3.13

Adjust, align or rig flight control components.	45.9%	2.73	4.40	3.79
Functional check pneumatic ice or fog removal systems.	32.5%	2.73	3.40	2.50
Operational test ACARS (Airborne Communication and Reporting System) link function.	17.8%	2.73	2.35	2.64
Functional test retractable gear.	42.7%	2.72	3.93	2.92
Replace automatic flight control, autopilot or all-weather landing systems components.	31.8%	2.72	3.75	3.55
Replace or overhaul hot section.	19.3%	2.71	4.25	3.87
Troubleshoot central maintenance parameter and system computer.	8.1%	2.71	3.34	3.57
Test fuel transfer system.	36.5%	2.70	3.01	2.34
Troubleshoot pneumatic system.	44.3%	2.68	3.20	3.07
Certify pitot and static system.	24.4%	2.67	3.82	3.19
Functional test emergency gear extension system.	39.5%	2.67	3.88	2.74
Repair or replace pneumatic system controls, ducts, valves, lines and other components.	40.3%	2.66	3.15	2.69
Service and inspect air/vapor cycle cooling system.	38.0%	2.66	2.61	2.56
Troubleshoot radar system.	23.0%	2.65	3.28	3.51
Troubleshoot AC/DC power generation system.	38.8%	2.64	3.50	3.53
Repair or replace plastics and fiberglass.	35.6%	2.63	2.71	2.66
Repair or replace sheetmetal frame sections and fittings, fairings or stringers.	34.3%	2.63	3.57	3.43
Troubleshoot cabin pressurization system and/or ECS System.	42.7%	2.63	3.35	3.31
Remove and install starter.	40.3%	2.62	2.93	2.29
Repair or replace fuel control components.	34.6%	2.61	3.84	3.14
Troubleshoot electronic engine indicating systems.	33.7%	2.61	3.43	3.27
Troubleshoot flight control systems.	46.0%	2.61	4.04	3.62
Repair or replace ignition components.	41.7%	2.60	3.28	2.48

Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Repair or replace pressurization system components.	52.4%	2.59	3.15	2.74
Troubleshoot and repair air/vapor cycle conditioning system.	37.7%	2.58	2.73	3.06
Troubleshoot fuel control problems.	32.6%	2.56	3.97	3.69
Drain and flush oil tank.	30.6%	2.55	3.05	2.07
Perform a magnetic particle inspection.	17.8%	2.54	3.55	2.83
Defuel aircraft.	37.9%	2.53	2.16	1.93
Perform borescope inspection.	17.8%	2.53	3.77	3.42
Replace regulator, masks or oxygen bottles.	41.2%	2.53	3.20	2.27

Visually inspect parts or components to detect surface cracks with dye penetrant.	55.4%	2.53	3.47	2.60
Inspect booster starting systems.	11.8%	2.52	3.29	2.64
Repair or replace high tension ignition system components.	38.8%	2.52	3.26	2.45
Repair skin.	34.2%	2.52	3.51	3.27
Troubleshoot brake system.	37.4%	2.52	3.45	2.93
Repair or replace electronic display components.	28.2%	2.51	3.23	2.68
Troubleshoot propeller heat.	8.8%	2.50	3.01	2.60
Replace propeller.	10.5%	2.49	4.01	2.85
Clean electronic equipment cooling filters.	30.7%	2.48	2.22	1.55
Remove and install air data computer.	23.2%	2.48	3.49	2.69
Repair air/vapor cycle conditioning system.	35.0%	2.48	2.70	2.91
Perform wiring modifications.	31.0%	2.47	3.51	3.29
Repair or replace fire detection/protection components.	48.1%	2.46	3.62	2.63
Troubleshoot ACARS (Airborne Communication and Reporting System).	17.9%	2.46	2.59	3.10
Repair bleed air ducting systems.	42.2%	2.45	3.17	2.69
Replace central maintenance system components.	7.1%	2.45	3.21	3.12
Repair or replace central air data collection and distribution components.	21.3%	2.44	3.59	3.11
Troubleshoot fuel tank leaks.	36.1%	2.44	3.11	2.71
Operational test autothrottle.	16.0%	2.43	3.23	3.16
Replace propeller assembly.	9.1%	2.43	4.00	2.90
Troubleshoot central air data collection and distribution system.	22.2%	2.43	3.63	3.46
Repair or replace static discharger wicks and mounts.	48.6%	2.42	2.20	1.76
Rig propeller blades.	4.8%	2.41	3.77	3.06
Troubleshoot fire extinguishing and control systems.	33.5%	2.40	3.71	2.85
Troubleshoot ice, rain or fog removal systems.	39.1%	2.40	3.37	2.94
Troubleshoot intersystem data exchange problems.	18.1%	2.40	3.49	3.77
Repair or replace sensitive position sensing devices (examples: gimble gyroscopes, laser ring gyros).	21.9%	2.39	3.64	3.14
Replace electrical circuit protection devices.	33.6%	2.39	3.34	2.57
Troubleshoot ignition problems.	36.8%	2.39	3.33	2.92
Analyze fuel tank for microbiological contamination.	21.3%	2.38	2.90	2.04
Blend fan blades.	25.0%	2.36	3.44	2.73
Replace aircraft generator.	39.5%	2.36	3.39	2.61

Troubleshoot landing gear position indication and warning systems.	38.8%	2.36	3.75	3.25
Change flight control surfaces.	44.0%	2.35	4.32	3.38
Change primary flight control servos or actuators.	48.7%	2.34	4.09	3.22
Rig doors and emergency evacuation systems.	38.8%	2.34	3.79	3.43
Repair or replace thrust reversers.	24.0%	2.33	3.50	3.18
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Repair printed circuit board.	17.4%	2.33	3.30	3.70
Replace jet engine.	26.3%	2.33	4.46	3.75
Repair or replace scoops and leading edge anti-ice components.	29.9%	2.32	3.38	2.71
Replace buss switching and control devices.	29.2%	2.31	3.53	2.87
Troubleshoot fire detection circuits.	36.8%	2.31	3.67	3.06
Troubleshoot retractable gear system.	36.2%	2.30	3.78	3.41
Repair or install a part by soldering.	18.3%	2.29	2.89	2.43
Repair or replace anti-skid system components.	38.7%	2.29	3.39	2.96
Repair or replace honeycomb structure.	25.9%	2.29	3.24	3.31
Troubleshoot anti-skid system.	35.6%	2.29	3.34	3.27
Troubleshoot landing gear control and actuating systems.	42.4%	2.29	3.78	3.41
Repair, replace or polish windows or windscreens.	43.4%	2.27	3.30	2.72
Replace smoke detection components.	39.9%	2.27	3.29	2.11
Remove and install fuel pump.	37.6%	2.26	3.86	3.09
Replace pitot/static system components.	33.2%	2.25	3.60	2.82
Remove or install excitor box.	35.5%	2.24	3.22	2.30
Repair or replace windshield ice, rain or fog removal system components.	40.7%	2.24	3.33	2.72
Repair integral fuel tank leaks.	34.2%	2.23	3.18	2.93
Repair or replace APU (Auxiliary Power Unit).	38.6%	2.23	2.99	3.22
Repair or replace landing gear control and actuating system components.	38.0%	2.23	3.76	3.08
Repair or replace vacuum driven flight instrument components.	22.0%	2.23	3.35	2.75
Troubleshoot capacitance-based fuel indicating system.	32.5%	2.23	3.41	3.54
Rig or check autopilot flight control actuators and servos.	31.8%	2.22	3.85	3.47
Troubleshoot fuel distribution system.	39.8%	2.22	3.34	3.09
Repair or replace landing gear position indication and warning components.	36.2%	2.21	3.62	2.92
Troubleshoot vacuum driven flight instruments.	18.5%	2.21	3.39	3.12

Calibrate capacitance type fuel quantity indication systems.	28.7%	2.19	3.46	3.43
Identify and control bacteria in fuel tanks.	21.2%	2.19	2.80	2.09
Remove and install fuel control unit.	28.5%	2.19	4.07	3.50
Replace transformers, rectifiers and electrical filters.	26.1%	2.19	3.20	2.68
Troubleshoot constant speed propeller.	5.6%	2.19	3.40	3.10
Operational test escape slides or liferafts.	18.8%	2.17	3.55	2.39
Repair or replace de-ice boot.	11.1%	2.17	3.08	2.66
Replace or repair antennas.	38.2%	2.17	2.77	2.20
Repair carbon composites.	15.6%	2.16	3.42	3.68
Repair landing gear wiring and switches.	31.0%	2.15	3.53	2.87
Replace fuel distribution system components.	42.1%	2.15	3.40	2.72
Adjust governor.	6.7%	2.14	3.37	2.89
Clean or remove paint or coatings from parts or skin using stripping agents or chemical bath.	21.8%	2.14	2.28	2.11
Rig shut-off valves.	19.0%	2.13	3.63	3.07
Troubleshoot autothrottle.	25.8%	2.11	3.47	3.70
Repair or replace fuel measurement components.	32.6%	2.10	3.29	2.82
Repair or replace attach points or tracks for control surfaces.	34.4%	2.09	3.97	3.20
Replace CSD (Constant Speed Drive) or IDG (Integrated Drive Generator).	27.1%	2.09	3.40	2.95
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Perform an x-ray or similar non-destructive inspection of skin or structure.	24.8%	2.08	3.84	3.42
Perform eddy current or ultrasound inspection on skin or structure.	13.4%	2.08	3.51	3.48
Overhaul, repair or replace landing gear.	34.6%	2.07	3.97	3.44
Troubleshoot vacuum system.	21.7%	2.06	3.35	2.97
Repair or replace vacuum pumps, hoses and connectors.	17.2%	2.03	3.22	2.51
Replace turboprop engine.	7.5%	2.03	4.44	3.75
Repair or replace fuel system plumbing.	41.7%	2.02	3.46	2.66
Fabricate flexible or rigid lines and attach connectors.	27.5%	1.98	3.54	2.91
Remove and install flight control trim motors.	40.9%	1.98	3.71	3.06
Service bleed valve propeller governor.	2.3%	1.98	3.53	2.64
Repair or replace fuel system warning devices.	25.4%	1.95	3.37	2.80
Balance control surfaces.	27.5%	1.93	4.06	3.22
Rig nose gear steering.	34.5%	1.93	3.60	3.32
Hydrostatically test high pressure oxygen cylinders.	8.1%	1.91	3.52	2.80

Troubleshoot propeller synchronization.	6.7%	1.91	2.57	3.19
Swing (calibrate) compass system.	26.5%	1.90	3.23	2.80
Refinish composite blades.	10.5%	1.88	3.91	3.59
Check control surface balance.	29.0%	1.87	4.06	3.22
Troubleshoot float-based fuel indicating system.	19.1%	1.87	3.25	2.83
Replace electrical de-ice boots.	19.0%	1.85	3.50	2.94
Paint control surfaces.	16.0%	1.84	2.32	2.30
Replace doors.	32.2%	1.84	3.64	3.18
Tear down and build-up prop assembly.	2.4%	1.84	4.04	3.57
Modify or alter landing gear assembly.	17.6%	1.80	3.84	3.58
Perform internal repairs to opposed piston engines.	2.3%	1.80	4.00	3.51
Replace solid state inverters.	26.3%	1.80	3.13	2.42
Inspect fabric covered and doped surfaces.	0.7%	1.75	3.38	2.38
Fabricate control cables.	24.4%	1.73	4.24	3.32
Overhaul prop assembly.	1.9%	1.69	4.08	3.69
Inspect radial piston engine.	1.5%	1.62	3.24	2.90
Perform repairs using gaseous welding.	8.8%	1.57	3.17	3.26
Repair bladder type fuel tank leaks.	16.6%	1.56	3.52	3.26
Perform repairs using arc or spot welding.	8.0%	1.52	3.19	3.38
Replace or rejuvenate fabric covered and doped surfaces.	6.6%	1.52	3.25	3.16
Inspect wood structure.	0.5%	1.42	3.83	3.17
Perform repairs by brazing.	8.9%	1.42	3.09	2.95
Service fluid in compass system.	11.6%	1.35	2.86	2.36
Repair, replace or construct wood structures.	0.3%	1.00	3.33	3.00

9.1.3 JTA Tasks Ordered by Overall Criticality

Description	Percent	Avg Frequency	Avg Criticality	Avg Difficulty
Replace jet engine.	26.3%	2.33	4.46	3.75
Replace turboprop engine.	7.5%	2.03	4.44	3.75
Adjust, align or rig flight control components.	45.9%	2.73	4.40	3.79
Change flight control surfaces.	44.0%	2.35	4.32	3.38
Replace or overhaul hot section.	19.3%	2.71	4.25	3.87
Fabricate control cables.	24.4%	1.73	4.24	3.32

Perform internal repairs to engine.	18.3%	2.87	4.21	3.83
Troubleshoot jet engine.	28.7%	3.06	4.17	4.05
Change primary flight control servos or actuators.	48.7%	2.34	4.09	3.22
Overhaul prop assembly.	1.9%	1.69	4.08	3.69
Remove and install fuel control unit.	28.5%	2.19	4.07	3.50
Balance control surfaces.	27.5%	1.93	4.06	3.22
Check control surface balance.	29.0%	1.87	4.06	3.22
Tear down and build-up prop assembly.	2.4%	1.84	4.04	3.57
Troubleshoot flight control systems.	46.0%	2.61	4.04	3.62
Replace propeller.	10.5%	2.49	4.01	2.85
Perform internal repairs to opposed piston engines.	2.3%	1.80	4.00	3.51
Replace propeller assembly.	9.1%	2.43	4.00	2.90
Inspect flight control cables for tension, fraying, nicks or crimps.	45.8%	3.05	3.97	2.73
Overhaul, repair or replace landing gear.	34.6%	2.07	3.97	3.44
Repair or replace attach points or tracks for control surfaces.	34.4%	2.09	3.97	3.20
Troubleshoot fuel control problems.	32.6%	2.56	3.97	3.69
Operational check flight control and landing systems.	50.4%	3.43	3.94	3.52
Functional test retractable gear.	42.7%	2.72	3.93	2.92
Operational check engine.	35.3%	3.64	3.93	3.47
Troubleshoot turboprop engine.	10.4%	2.87	3.92	3.80
Refinish composite blades.	10.5%	1.88	3.91	3.59
Inspect cable routing, pulleys, turnbuckles or flight control components.	44.7%	3.06	3.89	2.76
Functional test emergency gear extension system.	39.5%	2.67	3.88	2.74
Inspect engine mounts.	43.8%	3.03	3.88	2.64
Operational test flight controls and actuators.	44.9%	3.32	3.88	2.77
Remove and install fuel pump.	37.6%	2.26	3.86	3.09
Rig or check autopilot flight control actuators and servos.	31.8%	2.22	3.85	3.47

Modify or alter landing gear assembly.	17.6%	1.80	3.84	3.58
Perform an x-ray or similar non-destructive inspection of skin or structure.	24.8%	2.08	3.84	3.42
Repair or replace fuel control components.	34.6%	2.61	3.84	3.14
Inspect wood structure.	0.5%	1.42	3.83	3.17
Certify pitot and static system.	24.4%	2.67	3.82	3.19
Functional test fuel control system.	28.4%	2.82	3.80	3.16
Rig doors and emergency evacuation systems.	38.8%	2.34	3.79	3.43
Check flight control travel.	44.3%	2.88	3.78	2.85
Troubleshoot landing gear control and actuating systems.	42.4%	2.29	3.78	3.41
Troubleshoot retractable gear system.	36.2%	2.30	3.78	3.41
Perform borescope inspection.	17.8%	2.53	3.77	3.42
Rig propeller blades.	4.8%	2.41	3.77	3.06
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Functional test fire protection system.	35.6%	3.55	3.76	2.22
Repair or replace landing gear control and actuating system components.	38.0%	2.23	3.76	3.08
Troubleshoot electrically operated mechanical components (example: electric landing gear actuator).	63.1%	3.48	3.76	3.48
Replace automatic flight control, autopilot or all-weather landing systems components.	31.8%	2.72	3.75	3.55
Troubleshoot landing gear position indication and warning systems.	38.8%	2.36	3.75	3.25
Detailed inspection of landing gear assemblies and subassemblies.	37.3%	3.38	3.72	2.87
Service gear reduction section.	13.1%	2.81	3.72	2.83
Functional test aircraft warning systems.	55.1%	3.75	3.71	2.59
Remove and install flight control trim motors.	40.9%	1.98	3.71	3.06
Troubleshoot fire extinguishing and control systems.	33.5%	2.40	3.71	2.85
Inspect flight control surface for damage.	47.7%	3.83	3.69	2.46
Troubleshoot fire detection circuits.	36.8%	2.31	3.67	3.06

Repair or replace sensitive position sensing devices (examples: gimble gyroscopes, laser ring gyros).	21.9%	2.39	3.64	3.14
Replace doors.	32.2%	1.84	3.64	3.18
Troubleshoot flight instruments.	26.2%	3.03	3.64	3.52
Perform stall warning test.	37.2%	3.13	3.63	2.50
Rig shut-off valves.	19.0%	2.13	3.63	3.07
Troubleshoot central air data collection and distribution system.	22.2%	2.43	3.63	3.46
Inspect engine and components for security and leaks.	41.7%	3.89	3.62	2.71
Leak check pitot static system.	39.2%	2.78	3.62	3.11
Repair or replace fire detection/protection components.	48.1%	2.46	3.62	2.63
Repair or replace landing gear position indication and warning components.	36.2%	2.21	3.62	2.92
Inspect fan blades for FOD (Foreign Object Damage).	36.5%	3.91	3.61	2.36
Replace pitot/static system components.	33.2%	2.25	3.60	2.82
Rig nose gear steering.	34.5%	1.93	3.60	3.32
Operational check fire detection system.	36.2%	3.59	3.59	2.14
Repair or replace central air data collection and distribution components.	21.3%	2.44	3.59	3.11
Inspect hinge bearings for condition and excessive play.	46.7%	3.19	3.58	2.51
Inspect opposed piston engine.	4.6%	3.18	3.58	2.84
Repair or replace hydraulic components.	54.8%	3.09	3.58	2.82
Repair or replace sheetmetal frame sections and fittings, fairings or stringers.	34.3%	2.63	3.57	3.43
Troubleshoot pressurized hydraulic system (1,000-3,000 psi).	39.7%	2.91	3.56	3.05
Certify transponder and altitude reporting equipment.	18.4%	2.92	3.55	3.35
Functional test brake system.	43.8%	3.36	3.55	2.50
Inspect engine fire loop.	43.0%	2.97	3.55	2.24
Inspect fire extinguishing system.	31.8%	3.20	3.55	2.19
Operational test escape slides or liferafts.	18.8%	2.17	3.55	2.39
Operational test lift dumpers, air brakes, or spoilers.	40.5%	3.20	3.55	2.64

Perform a magnetic particle inspection.	17.8%	2.54	3.55	2.83
Remove and replace flight instruments (airspeed indicator, altimeter, VSI, etc.).	45.2%	2.78	3.55	2.68
Fabricate flexible or rigid lines and attach connectors.	27.5%	1.98	3.54	2.91
Perform failure analysis on electrical power systems.	32.1%	2.93	3.54	3.54
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Operational check caution and warning systems.	35.4%	3.60	3.53	2.61
Repair landing gear wiring and switches.	31.0%	2.15	3.53	2.87
Replace buss switching and control devices.	29.2%	2.31	3.53	2.87
Service bleed valve propeller governor.	2.3%	1.98	3.53	2.64
Troubleshoot opposed piston engine.	4.4%	2.79	3.53	3.41
Hydrostatically test high pressure oxygen cylinders.	8.1%	1.91	3.52	2.80
Repair bladder type fuel tank leaks.	16.6%	1.56	3.52	3.26
Troubleshoot aircraft electrical wiring and connectors.	39.2%	3.22	3.52	3.57
Perform eddy current or ultrasound inspection on skin or structure.	13.4%	2.08	3.51	3.48
Perform wiring modifications.	31.0%	2.47	3.51	3.29
Remove and replace tires or brakes.	47.3%	3.37	3.51	2.41
Repair skin.	34.2%	2.52	3.51	3.27
Troubleshoot dependent reference systems such as VOR and ILS.	21.6%	2.96	3.51	3.51
Visually inspect wing structure.	42.7%	3.70	3.51	2.47
Repair or replace thrust reversers.	24.0%	2.33	3.50	3.18
Replace electrical de-ice boots.	19.0%	1.85	3.50	2.94
Test navigation systems.	24.7%	3.17	3.50	3.28
Troubleshoot AC/DC power generation system.	38.8%	2.64	3.50	3.53
Troubleshoot autopilot.	27.4%	2.91	3.50	4.13
Functional test EFIS (Electronic Flight Instrumentation System).	25.3%	3.22	3.49	3.18
Remove and install air data computer.	23.2%	2.48	3.49	2.69

Troubleshoot electrical distribution and switching.	33.6%	2.84	3.49	3.56
Troubleshoot intersystem data exchange problems.	18.1%	2.40	3.49	3.77
Operational check crew alerting systems (examples: EFIS, EICAS and ECAM).	26.6%	3.47	3.48	3.07
Repair hydraulic system leaks.	44.0%	2.92	3.48	2.65
Inspect fire detection elements for connections and security.	34.1%	3.04	3.47	2.23
Troubleshoot autothrottle.	25.8%	2.11	3.47	3.70
Troubleshoot engine indicating problems.	40.0%	2.81	3.47	3.32
Visually inspect parts or components to detect surface cracks with dye penetrant.	55.4%	2.53	3.47	2.60
Calibrate capacitance type fuel quantity indication systems.	28.7%	2.19	3.46	3.43
Inspect propellers for damage.	9.8%	3.78	3.46	2.12
Repair or replace fuel system plumbing.	41.7%	2.02	3.46	2.66
Repair or replace aircraft electrical wiring and connectors.	38.9%	2.98	3.45	2.87
Troubleshoot brake system.	37.4%	2.52	3.45	2.93
Blend fan blades.	25.0%	2.36	3.44	2.73
Service turbine engine.	33.4%	3.95	3.44	2.18
Perform an intensive visual inspection of a zone or system.	45.0%	3.69	3.43	2.75
Replace tire or wheel assemblies.	45.2%	3.37	3.43	2.24
Troubleshoot electronic engine indicating systems.	33.7%	2.61	3.43	3.27
Functional test electrical switching and distribution.	40.1%	3.42	3.42	2.95
Functional test hydraulic system.	46.1%	3.63	3.42	2.55
Inspect cargo and passenger doors.	46.3%	3.61	3.42	2.53
Perform EFIS (Electronic Flight Instrumentation System) test.	24.1%	3.17	3.42	3.08
Repair carbon composites.	15.6%	2.16	3.42	3.68
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Inspect fuel distribution components (pumps, valves, controls).	42.1%	2.98	3.41	2.51
Troubleshoot capacitance-based fuel indicating system.	32.5%	2.23	3.41	3.54

Functional check pneumatic ice or fog removal systems.	32.5%	2.73	3.40	2.50
Repair damaged wiring and connectors.	47.5%	3.06	3.40	2.64
Replace CSD (Constant Speed Drive) or IDG (Integrated Drive Generator).	27.1%	2.09	3.40	2.95
Replace fuel distribution system components.	42.1%	2.15	3.40	2.72
Replace or clean engine components.	36.5%	3.48	3.40	2.78
Test passenger or cargo smoke detection system.	40.9%	3.16	3.40	2.14
Troubleshoot constant speed propeller.	5.6%	2.19	3.40	3.10
Inspect extinguishers and fire bottles.	37.9%	3.52	3.39	1.87
Operational check fixed and constant speed propellers.	7.3%	3.04	3.39	2.53
Repair or replace anti-skid system components.	38.7%	2.29	3.39	2.96
Repair or replace electronic system components.	36.5%	3.39	3.39	3.00
Replace aircraft generator.	39.5%	2.36	3.39	2.61
Test electronic instrumentation systems.	22.4%	3.10	3.39	3.27
Troubleshoot vacuum driven flight instruments.	18.5%	2.21	3.39	3.12
Inspect fabric covered and doped surfaces.	0.7%	1.75	3.38	2.38
Repair or replace scoops and leading edge anti-ice components.	29.9%	2.32	3.38	2.71
Adjust governor.	6.7%	2.14	3.37	2.89
Operational check DC and AC generating systems.	46.1%	3.38	3.37	2.85
Repair or replace fuel system warning devices.	25.4%	1.95	3.37	2.80
Troubleshoot ice, rain or fog removal systems.	39.1%	2.40	3.37	2.94
Operational test thrust reversers.	38.5%	2.99	3.36	2.70
Perform a detailed dimensional inspection.	47.5%	3.31	3.36	2.69
Repair or replace vacuum driven flight instrument components.	22.0%	2.23	3.35	2.75
Troubleshoot cabin pressurization system and/or ECS System.	42.7%	2.63	3.35	3.31
Troubleshoot vacuum system.	21.7%	2.06	3.35	2.97
Replace electrical circuit protection devices.	33.6%	2.39	3.34	2.57

Troubleshoot anti-skid system.	35.6%	2.29	3.34	3.27
Troubleshoot central maintenance parameter and system computer.	8.1%	2.71	3.34	3.57
Troubleshoot fuel distribution system.	39.8%	2.22	3.34	3.09
Functional check flight management system.	20.3%	2.88	3.33	3.36
Repair or replace engine indicating components.	39.4%	2.79	3.33	2.70
Repair or replace windshield ice, rain or fog removal system components.	40.7%	2.24	3.33	2.72
Repair, replace or construct wood structures.	0.3%	1.00	3.33	3.00
Replace turbine and jet oil filter elements.	37.3%	3.14	3.33	2.14
Troubleshoot ignition problems.	36.8%	2.39	3.33	2.92
Inspect components for loose connections.	51.8%	4.20	3.32	2.09
Inspect for loose rivets, defects, disbonds, cracks, etc.	55.3%	4.10	3.32	2.38
Remove and install fuel filter.	40.8%	3.08	3.32	2.17
Repair minor sheet metal defects or damage to control surfaces.	37.1%	2.74	3.32	3.13
Functional check electrical ice, rain or fog removal systems.	36.0%	2.97	3.31	2.42
Functional test fuel distribution system.	45.7%	2.90	3.31	2.45
Inspect air scoops and leading edge ice control systems.	37.4%	3.47	3.31	2.24
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Operational check standby power or emergency generation system.	50.6%	3.11	3.31	2.60
Repair printed circuit board.	17.4%	2.33	3.30	3.70
Repair, replace or polish windows or windscreens.	43.4%	2.27	3.30	2.72
Inspect booster starting systems.	11.8%	2.52	3.29	2.64
Repair or replace fuel measurement components.	32.6%	2.10	3.29	2.82
Replace smoke detection components.	39.9%	2.27	3.29	2.11
Inspect high-tension ignition systems.	35.2%	2.97	3.28	2.47
Repair or replace ignition components.	41.7%	2.60	3.28	2.48
Service piston engine.	4.7%	3.02	3.28	2.22

Troubleshoot radar system.	23.0%	2.65	3.28	3.51
Visually inspect landing gear, wheel wells, and doors.	41.7%	3.79	3.28	2.36
Check for leaks in hydraulic system.	48.8%	3.85	3.27	2.16
Identify delamination or disbonding of carbon composites.	40.5%	2.96	3.27	2.97
Inspect chip detectors and/or oil filters.	40.2%	3.42	3.27	2.14
Repair or replace high tension ignition system components.	38.8%	2.52	3.26	2.45
Service engine and scavenger oil.	39.4%	3.78	3.26	1.89
Inspect passenger and crew oxygen system components.	43.5%	3.27	3.25	2.30
Repair or replace components associated with DME, transponder, radar or other pulse systems.	24.9%	2.82	3.25	3.01
Replace or rejuvenate fabric covered and doped surfaces.	6.6%	1.52	3.25	3.16
Troubleshoot float-based fuel indicating system.	19.1%	1.87	3.25	2.83
Functional test anti-skid system.	42.6%	2.91	3.24	2.63
Inspect radial piston engine.	1.5%	1.62	3.24	2.90
Repair or replace honeycomb structure.	25.9%	2.29	3.24	3.31
Operational test autothrottle.	16.0%	2.43	3.23	3.16
Repair or replace electronic display components.	28.2%	2.51	3.23	2.68
Swing (calibrate) compass system.	26.5%	1.90	3.23	2.80
Prepare and install patch (composite, fabric, metal).	39.3%	2.84	3.22	3.18
Remove or install excitor box.	35.5%	2.24	3.22	2.30
Repair or replace vacuum pumps, hoses and connectors.	17.2%	2.03	3.22	2.51
Service scavenge filter.	29.4%	3.00	3.22	2.19
Replace central maintenance system components.	7.1%	2.45	3.21	3.12
Service passenger oxygen system.	40.4%	3.36	3.21	2.08
Check navigation system annunciators for operation.	27.9%	3.44	3.20	2.69
Replace regulator, masks or oxygen bottles.	41.2%	2.53	3.20	2.27
Replace transformers, rectifiers and electrical filters.	26.1%	2.19	3.20	2.68
Service nose gear assemblies.	40.8%	2.78	3.20	2.43

Troubleshoot pneumatic system.	44.3%	2.68	3.20	3.07
Operational check pressurization system.	52.8%	2.87	3.19	2.83
Perform repairs using arc or spot welding.	8.0%	1.52	3.19	3.38
Repair structure or component by riveting.	44.4%	3.04	3.19	2.93
Repair integral fuel tank leaks.	34.2%	2.23	3.18	2.93
Inspect for general corrosion, corrosion under lap joints, etc.	50.1%	3.34	3.17	2.46
Inspect wire bundles.	47.1%	3.32	3.17	2.27
Perform repairs using gaseous welding.	8.8%	1.57	3.17	3.26
Remove or install ignitor plug.	39.2%	2.76	3.17	2.24
Repair bleed air ducting systems.	42.2%	2.45	3.17	2.69
Service hydraulic system.	47.2%	3.69	3.17	1.95
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Check clogging indicators on filters.	47.4%	3.52	3.16	1.86
Inspect access door latches and hinge attachments.	44.9%	3.53	3.16	2.32
Inspect battery ignition systems.	20.2%	2.86	3.16	2.53
Perform fuel quantity test.	37.0%	2.75	3.16	2.46
Install racks, controls, connections, antennas and associated electrical components.	47.0%	2.82	3.15	2.79
Repair or replace pneumatic system controls, ducts, valves, lines and other components.	40.3%	2.66	3.15	2.69
Repair or replace pressurization system components.	52.4%	2.59	3.15	2.74
Service IDG (Integrated Drive Generator) oil level.	32.4%	3.18	3.15	2.24
Inspect honeycomb and laminated structure.	45.1%	2.99	3.14	2.61
Replace engine filters.	33.6%	3.27	3.13	1.91
Replace solid state inverters.	26.3%	1.80	3.13	2.42
Check fuel tanks for water.	44.9%	3.63	3.11	1.54
Troubleshoot fuel tank leaks.	36.1%	2.44	3.11	2.71
Functional check pneumatic system.	38.1%	2.96	3.10	2.67

Operational check aircraft battery charging system.	55.6%	3.09	3.10	2.38
Identify types of corrosion such as fretting, interangular, granular, etc.	48.2%	3.21	3.09	2.78
Perform repairs by brazing.	8.9%	1.42	3.09	2.95
Service hydraulic accumulator.	43.7%	3.09	3.09	2.09
Repair or install a device by soldering.	32.4%	2.82	3.08	2.57
Repair or replace de-ice boot.	11.1%	2.17	3.08	2.66
Service shock struts.	44.1%	2.81	3.07	2.38
Drain and flush oil tank.	30.6%	2.55	3.05	2.07
Dress nicks and irregularities in propeller.	8.3%	2.79	3.05	2.27
Drill or ream structure or component.	44.5%	3.29	3.04	2.75
Remove corrosion and repair surrounding area.	50.4%	2.98	3.03	2.77
Service each fuel tank sump to remove water and inspect tank valve.	34.0%	3.24	3.03	1.93
Drain and replace oil in piston engine.	4.1%	2.95	3.01	1.73
Functional check air conditioning and pressurization systems.	48.0%	3.07	3.01	2.84
Test fuel transfer system.	36.5%	2.70	3.01	2.34
Troubleshoot propeller heat.	8.8%	2.50	3.01	2.60
Inspect body skin and lower body surface.	38.6%	3.64	3.00	2.34
Perform a general interior or exterior visual inspection.	55.6%	4.18	3.00	2.11
Functional check prop heat.	10.1%	3.15	2.99	1.99
Inspect windshield ice or rain removal systems.	35.4%	3.04	2.99	2.29
Repair or replace APU (Auxiliary Power Unit).	38.6%	2.23	2.99	3.22
Maintain batteries.	29.2%	2.93	2.98	2.13
Remove and install starter.	40.3%	2.62	2.93	2.29
Analyze fuel tank for microbiological contamination.	21.3%	2.38	2.90	2.04
Lubricate propeller.	7.3%	2.78	2.90	1.83
Service tires.	45.4%	3.76	2.90	1.67

Lubricate required flight control components (hinges, rollers, pinions, gears).	47.5%	3.30	2.89	1.75
Repair or install a part by soldering.	18.3%	2.29	2.89	2.43
Operational test of cabin emergency lighting.	43.3%	3.59	2.88	1.94
Service fluid in compass system.	11.6%	1.35	2.86	2.36
Test communication systems.	46.0%	3.50	2.86	2.50
Troubleshoot voice or data communication systems.	38.1%	2.86	2.86	3.08
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Check pressure of tires.	48.1%	3.99	2.84	1.42
Identify and control bacteria in fuel tanks.	21.2%	2.19	2.80	2.09
Bleed hydraulic system pressure.	45.7%	3.50	2.79	2.05
Inspect plastics and fiberglass.	44.8%	3.63	2.79	2.19
Fabricate replacement brackets, panels or small parts.	44.7%	3.17	2.77	2.85
Repair or replace voice or data communication system components.	39.4%	2.81	2.77	2.77
Replace or repair antennas.	38.2%	2.17	2.77	2.20
Troubleshoot and repair air/vapor cycle conditioning system.	37.7%	2.58	2.73	3.06
Service and operate APU (Auxiliary Power Unit).	42.8%	3.47	2.72	2.48
Lubricate landing gear components (bearings, hinges, pivots, up/downlocks, etc).	44.2%	3.20	2.71	1.71
Operational check APU (Auxiliary Power Unit).	41.9%	3.29	2.71	2.62
Repair or replace plastics and fiberglass.	35.6%	2.63	2.71	2.66
Inspect electronic equipment blowers and flow sensors.	31.3%	2.74	2.70	2.36
Repair air/vapor cycle conditioning system.	35.0%	2.48	2.70	2.91
Service and inspect air/vapor cycle cooling system.	38.0%	2.66	2.61	2.56
Replace loose or missing fasteners.	53.8%	3.57	2.60	2.10
Troubleshoot ACARS (Airborne Communication and Reporting System).	17.9%	2.46	2.59	3.10
Troubleshoot propeller synchronization.	6.7%	1.91	2.57	3.19
Operational check air conditioning system.	45.9%	3.06	2.54	2.53

Troubleshoot exterior lighting systems.	45.2%	3.33	2.52	2.16
Repair small cracks by stop drilling.	49.3%	2.83	2.49	1.92
Repair or replace exterior aircraft lighting.	47.8%	3.36	2.42	1.75
Service doors, windows and movable components with appropriate lubricant.	43.3%	3.06	2.41	1.81
Inspect aircraft interior areas.	40.7%	3.86	2.37	1.99
Operational test ACARS (Airborne Communication and Reporting System) link function.	17.8%	2.73	2.35	2.64
Paint control surfaces.	16.0%	1.84	2.32	2.30
Clean or remove paint or coatings from parts or skin using stripping agents or chemical bath.	21.8%	2.14	2.28	2.11
Inspect and check static discharge wicks.	59.3%	3.55	2.25	1.66
Clean or remove surface deposits or material.	42.2%	3.33	2.23	1.84
Prepare surface and prime.	32.3%	2.89	2.23	1.97
Clean electronic equipment cooling filters.	30.7%	2.48	2.22	1.55
Repair or replace static discharger wicks and mounts.	48.6%	2.42	2.20	1.76
Defuel aircraft.	37.9%	2.53	2.16	1.93
Operational test of cockpit voice recorder.	33.5%	3.15	2.15	1.81
Paint parts or surfaces.	39.3%	3.07	1.95	1.89

9.1.4 JTA Tasks Ordered by Overall Difficulty

Description	Percent	Avg Frequency	Avg Criticality	Avg Difficulty
Troubleshoot autopilot.	27.4%	2.91	3.50	4.13
Troubleshoot jet engine.	28.7%	3.06	4.17	4.05
Replace or overhaul hot section.	19.3%	2.71	4.25	3.87
Perform internal repairs to engine.	18.3%	2.87	4.21	3.83
Troubleshoot turboprop engine.	10.4%	2.87	3.92	3.80
Adjust, align or rig flight control components.	45.9%	2.73	4.40	3.79
Troubleshoot intersystem data exchange problems.	18.1%	2.40	3.49	3.77

Replace jet engine.	26.3%	2.33	4.46	3.75
Replace turboprop engine.	7.5%	2.03	4.44	3.75
Repair printed circuit board.	17.4%	2.33	3.30	3.70
Troubleshoot autothrottle.	25.8%	2.11	3.47	3.70
Overhaul prop assembly.	1.9%	1.69	4.08	3.69
Troubleshoot fuel control problems.	32.6%	2.56	3.97	3.69
Repair carbon composites.	15.6%	2.16	3.42	3.68
Troubleshoot flight control systems.	46.0%	2.61	4.04	3.62
Refinish composite blades.	10.5%	1.88	3.91	3.59
Modify or alter landing gear assembly.	17.6%	1.80	3.84	3.58
Tear down and build-up prop assembly.	2.4%	1.84	4.04	3.57
Troubleshoot aircraft electrical wiring and connectors.	39.2%	3.22	3.52	3.57
Troubleshoot central maintenance parameter and system computer.	8.1%	2.71	3.34	3.57
Troubleshoot electrical distribution and switching.	33.6%	2.84	3.49	3.56
Replace automatic flight control, autopilot or all-weather landing systems components.	31.8%	2.72	3.75	3.55
Perform failure analysis on electrical power systems.	32.1%	2.93	3.54	3.54
Troubleshoot capacitance-based fuel indicating system.	32.5%	2.23	3.41	3.54
Troubleshoot AC/DC power generation system.	38.8%	2.64	3.50	3.53
Operational check flight control and landing systems.	50.4%	3.43	3.94	3.52
Troubleshoot flight instruments.	26.2%	3.03	3.64	3.52
Perform internal repairs to opposed piston engines.	2.3%	1.80	4.00	3.51
Troubleshoot dependent reference systems such as VOR and ILS.	21.6%	2.96	3.51	3.51
Troubleshoot radar system.	23.0%	2.65	3.28	3.51
Remove and install fuel control unit.	28.5%	2.19	4.07	3.50
Perform eddy current or ultrasound inspection on skin or structure.	13.4%	2.08	3.51	3.48
Troubleshoot electrically operated mechanical components (example: electric landing gear actuator).	63.1%	3.48	3.76	3.48

Operational check engine.	35.3%	3.64	3.93	3.47
Rig or check autopilot flight control actuators and servos.	31.8%	2.22	3.85	3.47
Troubleshoot central air data collection and distribution system.	22.2%	2.43	3.63	3.46
Overhaul, repair or replace landing gear.	34.6%	2.07	3.97	3.44
Calibrate capacitance type fuel quantity indication systems.	28.7%	2.19	3.46	3.43
Repair or replace sheetmetal frame sections and fittings, fairings or stringers.	34.3%	2.63	3.57	3.43
Rig doors and emergency evacuation systems.	38.8%	2.34	3.79	3.43
Perform an x-ray or similar non-destructive inspection of skin or structure.	24.8%	2.08	3.84	3.42
Perform borescope inspection.	17.8%	2.53	3.77	3.42
Troubleshoot landing gear control and actuating systems.	42.4%	2.29	3.78	3.41
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Troubleshoot opposed piston engine.	4.4%	2.79	3.53	3.41
Troubleshoot retractable gear system.	36.2%	2.30	3.78	3.41
Change flight control surfaces.	44.0%	2.35	4.32	3.38
Perform repairs using arc or spot welding.	8.0%	1.52	3.19	3.38
Functional check flight management system.	20.3%	2.88	3.33	3.36
Certify transponder and altitude reporting equipment.	18.4%	2.92	3.55	3.35
Fabricate control cables.	24.4%	1.73	4.24	3.32
Rig nose gear steering.	34.5%	1.93	3.60	3.32
Troubleshoot engine indicating problems.	40.0%	2.81	3.47	3.32
Repair or replace honeycomb structure.	25.9%	2.29	3.24	3.31
Troubleshoot cabin pressurization system and/or ECS System.	42.7%	2.63	3.35	3.31
Perform wiring modifications.	31.0%	2.47	3.51	3.29
Test navigation systems.	24.7%	3.17	3.50	3.28
Repair skin.	34.2%	2.52	3.51	3.27

Test electronic instrumentation systems.	22.4%	3.10	3.39	3.27
Troubleshoot anti-skid system.	35.6%	2.29	3.34	3.27
Troubleshoot electronic engine indicating systems.	33.7%	2.61	3.43	3.27
Perform repairs using gaseous welding.	8.8%	1.57	3.17	3.26
Repair bladder type fuel tank leaks.	16.6%	1.56	3.52	3.26
Troubleshoot landing gear position indication and warning systems.	38.8%	2.36	3.75	3.25
Balance control surfaces.	27.5%	1.93	4.06	3.22
Change primary flight control servos or actuators.	48.7%	2.34	4.09	3.22
Check control surface balance.	29.0%	1.87	4.06	3.22
Repair or replace APU (Auxiliary Power Unit).	38.6%	2.23	2.99	3.22
Repair or replace attach points or tracks for control surfaces.	34.4%	2.09	3.97	3.20
Certify pitot and static system.	24.4%	2.67	3.82	3.19
Troubleshoot propeller synchronization.	6.7%	1.91	2.57	3.19
Functional test EFIS (Electronic Flight Instrumentation System).	25.3%	3.22	3.49	3.18
Prepare and install patch (composite, fabric, metal).	39.3%	2.84	3.22	3.18
Repair or replace thrust reversers.	24.0%	2.33	3.50	3.18
Replace doors.	32.2%	1.84	3.64	3.18
Inspect wood structure.	0.5%	1.42	3.83	3.17
Functional test fuel control system.	28.4%	2.82	3.80	3.16
Operational test autothrottle.	16.0%	2.43	3.23	3.16
Replace or rejuvenate fabric covered and doped surfaces.	6.6%	1.52	3.25	3.16
Repair or replace fuel control components.	34.6%	2.61	3.84	3.14
Repair or replace sensitive position sensing devices (examples: gimble gyroscopes, laser ring gyros).	21.9%	2.39	3.64	3.14
Repair minor sheet metal defects or damage to control surfaces.	37.1%	2.74	3.32	3.13
Replace central maintenance system components.	7.1%	2.45	3.21	3.12
Troubleshoot vacuum driven flight instruments.	18.5%	2.21	3.39	3.12

Leak check pitot static system.	39.2%	2.78	3.62	3.11
Repair or replace central air data collection and distribution components.	21.3%	2.44	3.59	3.11
Troubleshoot ACARS (Airborne Communication and Reporting System).	17.9%	2.46	2.59	3.10
Troubleshoot constant speed propeller.	5.6%	2.19	3.40	3.10
Remove and install fuel pump.	37.6%	2.26	3.86	3.09
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Troubleshoot fuel distribution system.	39.8%	2.22	3.34	3.09
Perform EFIS (Electronic Flight Instrumentation System) test.	24.1%	3.17	3.42	3.08
Repair or replace landing gear control and actuating system components.	38.0%	2.23	3.76	3.08
Troubleshoot voice or data communication systems.	38.1%	2.86	2.86	3.08
Operational check crew alerting systems (examples: EFIS, EICAS and ECAM).	26.6%	3.47	3.48	3.07
Rig shut-off valves.	19.0%	2.13	3.63	3.07
Troubleshoot pneumatic system.	44.3%	2.68	3.20	3.07
Remove and install flight control trim motors.	40.9%	1.98	3.71	3.06
Rig propeller blades.	4.8%	2.41	3.77	3.06
Troubleshoot and repair air/vapor cycle conditioning system.	37.7%	2.58	2.73	3.06
Troubleshoot fire detection circuits.	36.8%	2.31	3.67	3.06
Troubleshoot pressurized hydraulic system (1,000-3,000 psi).	39.7%	2.91	3.56	3.05
Repair or replace components associated with DME, transponder, radar or other pulse systems.	24.9%	2.82	3.25	3.01
Repair or replace electronic system components.	36.5%	3.39	3.39	3.00
Repair, replace or construct wood structures.	0.3%	1.00	3.33	3.00
Identify delamination or disbonding of carbon composites.	40.5%	2.96	3.27	2.97
Troubleshoot vacuum system.	21.7%	2.06	3.35	2.97
Repair or replace anti-skid system components.	38.7%	2.29	3.39	2.96

Functional test electrical switching and distribution.	40.1%	3.42	3.42	2.95
Perform repairs by brazing.	8.9%	1.42	3.09	2.95
Replace CSD (Constant Speed Drive) or IDG (Integrated Drive Generator).	27.1%	2.09	3.40	2.95
Replace electrical de-ice boots.	19.0%	1.85	3.50	2.94
Troubleshoot ice, rain or fog removal systems.	39.1%	2.40	3.37	2.94
Repair integral fuel tank leaks.	34.2%	2.23	3.18	2.93
Repair structure or component by riveting.	44.4%	3.04	3.19	2.93
Troubleshoot brake system.	37.4%	2.52	3.45	2.93
Functional test retractable gear.	42.7%	2.72	3.93	2.92
Repair or replace landing gear position indication and warning components.	36.2%	2.21	3.62	2.92
Troubleshoot ignition problems.	36.8%	2.39	3.33	2.92
Fabricate flexible or rigid lines and attach connectors.	27.5%	1.98	3.54	2.91
Repair air/vapor cycle conditioning system.	35.0%	2.48	2.70	2.91
Inspect radial piston engine.	1.5%	1.62	3.24	2.90
Replace propeller assembly.	9.1%	2.43	4.00	2.90
Adjust governor.	6.7%	2.14	3.37	2.89
Detailed inspection of landing gear assemblies and subassemblies.	37.3%	3.38	3.72	2.87
Repair landing gear wiring and switches.	31.0%	2.15	3.53	2.87
Repair or replace aircraft electrical wiring and connectors.	38.9%	2.98	3.45	2.87
Replace buss switching and control devices.	29.2%	2.31	3.53	2.87
Check flight control travel.	44.3%	2.88	3.78	2.85
Fabricate replacement brackets, panels or small parts.	44.7%	3.17	2.77	2.85
Operational check DC and AC generating systems.	46.1%	3.38	3.37	2.85
Replace propeller.	10.5%	2.49	4.01	2.85
Troubleshoot fire extinguishing and control systems.	33.5%	2.40	3.71	2.85
Functional check air conditioning and pressurization systems.	48.0%	3.07	3.01	2.84

Inspect opposed piston engine.	4.6%	3.18	3.58	2.84
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Operational check pressurization system.	52.8%	2.87	3.19	2.83
Perform a magnetic particle inspection.	17.8%	2.54	3.55	2.83
Service gear reduction section.	13.1%	2.81	3.72	2.83
Troubleshoot float-based fuel indicating system.	19.1%	1.87	3.25	2.83
Repair or replace fuel measurement components.	32.6%	2.10	3.29	2.82
Repair or replace hydraulic components.	54.8%	3.09	3.58	2.82
Replace pitot/static system components.	33.2%	2.25	3.60	2.82
Hydrostatically test high pressure oxygen cylinders.	8.1%	1.91	3.52	2.80
Repair or replace fuel system warning devices.	25.4%	1.95	3.37	2.80
Swing (calibrate) compass system.	26.5%	1.90	3.23	2.80
Install racks, controls, connections, antennas and associated electrical components.	47.0%	2.82	3.15	2.79
Identify types of corrosion such as fretting, interangular, granular, etc.	48.2%	3.21	3.09	2.78
Replace or clean engine components.	36.5%	3.48	3.40	2.78
Operational test flight controls and actuators.	44.9%	3.32	3.88	2.77
Remove corrosion and repair surrounding area.	50.4%	2.98	3.03	2.77
Repair or replace voice or data communication system components.	39.4%	2.81	2.77	2.77
Inspect cable routing, pulleys, turnbuckles or flight control components.	44.7%	3.06	3.89	2.76
Drill or ream structure or component.	44.5%	3.29	3.04	2.75
Perform an intensive visual inspection of a zone or system.	45.0%	3.69	3.43	2.75
Repair or replace vacuum driven flight instrument components.	22.0%	2.23	3.35	2.75
Functional test emergency gear extension system.	39.5%	2.67	3.88	2.74
Repair or replace pressurization system components.	52.4%	2.59	3.15	2.74
Blend fan blades.	25.0%	2.36	3.44	2.73

Inspect flight control cables for tension, fraying, nicks or crimps.	45.8%	3.05	3.97	2.73
Repair or replace windshield ice, rain or fog removal system components.	40.7%	2.24	3.33	2.72
Repair, replace or polish windows or windscreens.	43.4%	2.27	3.30	2.72
Replace fuel distribution system components.	42.1%	2.15	3.40	2.72
Inspect engine and components for security and leaks.	41.7%	3.89	3.62	2.71
Repair or replace scoops and leading edge anti-ice components.	29.9%	2.32	3.38	2.71
Troubleshoot fuel tank leaks.	36.1%	2.44	3.11	2.71
Operational test thrust reversers.	38.5%	2.99	3.36	2.70
Repair or replace engine indicating components.	39.4%	2.79	3.33	2.70
Check navigation system annunciators for operation.	27.9%	3.44	3.20	2.69
Perform a detailed dimensional inspection.	47.5%	3.31	3.36	2.69
Remove and install air data computer.	23.2%	2.48	3.49	2.69
Repair bleed air ducting systems.	42.2%	2.45	3.17	2.69
Repair or replace pneumatic system controls, ducts, valves, lines and other components.	40.3%	2.66	3.15	2.69
Remove and replace flight instruments (airspeed indicator, altimeter, VSI, etc.).	45.2%	2.78	3.55	2.68
Repair or replace electronic display components.	28.2%	2.51	3.23	2.68
Replace transformers, rectifiers and electrical filters.	26.1%	2.19	3.20	2.68
Functional check pneumatic system.	38.1%	2.96	3.10	2.67
Repair or replace de-ice boot.	11.1%	2.17	3.08	2.66
Repair or replace fuel system plumbing.	41.7%	2.02	3.46	2.66
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Repair or replace plastics and fiberglass.	35.6%	2.63	2.71	2.66
Repair hydraulic system leaks.	44.0%	2.92	3.48	2.65
Inspect booster starting systems.	11.8%	2.52	3.29	2.64
Inspect engine mounts.	43.8%	3.03	3.88	2.64

Operational test ACARS (Airborne Communication and Reporting System) link function.	17.8%	2.73	2.35	2.64
Operational test lift dumpers, air brakes, or spoilers.	40.5%	3.20	3.55	2.64
Repair damaged wiring and connectors.	47.5%	3.06	3.40	2.64
Service bleed valve propeller governor.	2.3%	1.98	3.53	2.64
Functional test anti-skid system.	42.6%	2.91	3.24	2.63
Repair or replace fire detection/protection components.	48.1%	2.46	3.62	2.63
Operational check APU (Auxiliary Power Unit).	41.9%	3.29	2.71	2.62
Inspect honeycomb and laminated structure.	45.1%	2.99	3.14	2.61
Operational check caution and warning systems.	35.4%	3.60	3.53	2.61
Replace aircraft generator.	39.5%	2.36	3.39	2.61
Operational check standby power or emergency generation system.	50.6%	3.11	3.31	2.60
Troubleshoot propeller heat.	8.8%	2.50	3.01	2.60
Visually inspect parts or components to detect surface cracks with dye penetrant.	55.4%	2.53	3.47	2.60
Functional test aircraft warning systems.	55.1%	3.75	3.71	2.59
Repair or install a device by soldering.	32.4%	2.82	3.08	2.57
Replace electrical circuit protection devices.	33.6%	2.39	3.34	2.57
Service and inspect air/vapor cycle cooling system.	38.0%	2.66	2.61	2.56
Functional test hydraulic system.	46.1%	3.63	3.42	2.55
Inspect battery ignition systems.	20.2%	2.86	3.16	2.53
Inspect cargo and passenger doors.	46.3%	3.61	3.42	2.53
Operational check air conditioning system.	45.9%	3.06	2.54	2.53
Operational check fixed and constant speed propellers.	7.3%	3.04	3.39	2.53
Inspect fuel distribution components (pumps, valves, controls).	42.1%	2.98	3.41	2.51
Inspect hinge bearings for condition and excessive play.	46.7%	3.19	3.58	2.51
Repair or replace vacuum pumps, hoses and connectors.	17.2%	2.03	3.22	2.51
Functional check pneumatic ice or fog removal systems.	32.5%	2.73	3.40	2.50

Functional test brake system.	43.8%	3.36	3.55	2.50
Perform stall warning test.	37.2%	3.13	3.63	2.50
Test communication systems.	46.0%	3.50	2.86	2.50
Repair or replace ignition components.	41.7%	2.60	3.28	2.48
Service and operate APU (Auxiliary Power Unit).	42.8%	3.47	2.72	2.48
Inspect high-tension ignition systems.	35.2%	2.97	3.28	2.47
Visually inspect wing structure.	42.7%	3.70	3.51	2.47
Inspect flight control surface for damage.	47.7%	3.83	3.69	2.46
Inspect for general corrosion, corrosion under lap joints, etc.	50.1%	3.34	3.17	2.46
Perform fuel quantity test.	37.0%	2.75	3.16	2.46
Functional test fuel distribution system.	45.7%	2.90	3.31	2.45
Repair or replace high tension ignition system components.	38.8%	2.52	3.26	2.45
Repair or install a part by soldering.	18.3%	2.29	2.89	2.43
Service nose gear assemblies.	40.8%	2.78	3.20	2.43
Functional check electrical ice, rain or fog removal systems.	36.0%	2.97	3.31	2.42
Replace solid state inverters.	26.3%	1.80	3.13	2.42
Remove and replace tires or brakes.	47.3%	3.37	3.51	2.41
Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Operational test escape slides or liferafts.	18.8%	2.17	3.55	2.39
Inspect fabric covered and doped surfaces.	0.7%	1.75	3.38	2.38
Inspect for loose rivets, defects, disbonds, cracks, etc.	55.3%	4.10	3.32	2.38
Operational check aircraft battery charging system.	55.6%	3.09	3.10	2.38
Service shock struts.	44.1%	2.81	3.07	2.38
Inspect electronic equipment blowers and flow sensors.	31.3%	2.74	2.70	2.36
Inspect fan blades for FOD (Foreign Object Damage).	36.5%	3.91	3.61	2.36
Service fluid in compass system.	11.6%	1.35	2.86	2.36

Visually inspect landing gear, wheel wells, and doors.	41.7%	3.79	3.28	2.36
Inspect body skin and lower body surface.	38.6%	3.64	3.00	2.34
Test fuel transfer system.	36.5%	2.70	3.01	2.34
Inspect access door latches and hinge attachments.	44.9%	3.53	3.16	2.32
Inspect passenger and crew oxygen system components.	43.5%	3.27	3.25	2.30
Paint control surfaces.	16.0%	1.84	2.32	2.30
Remove or install excitor box.	35.5%	2.24	3.22	2.30
Inspect windshield ice or rain removal systems.	35.4%	3.04	2.99	2.29
Remove and install starter.	40.3%	2.62	2.93	2.29
Dress nicks and irregularities in propeller.	8.3%	2.79	3.05	2.27
Inspect wire bundles.	47.1%	3.32	3.17	2.27
Replace regulator, masks or oxygen bottles.	41.2%	2.53	3.20	2.27
Inspect air scoops and leading edge ice control systems.	37.4%	3.47	3.31	2.24
Inspect engine fire loop.	43.0%	2.97	3.55	2.24
Remove or install ignitor plug.	39.2%	2.76	3.17	2.24
Replace tire or wheel assemblies.	45.2%	3.37	3.43	2.24
Service IDG (Integrated Drive Generator) oil level.	32.4%	3.18	3.15	2.24
Inspect fire detection elements for connections and security.	34.1%	3.04	3.47	2.23
Functional test fire protection system.	35.6%	3.55	3.76	2.22
Service piston engine.	4.7%	3.02	3.28	2.22
Replace or repair antennas.	38.2%	2.17	2.77	2.20
Inspect fire extinguishing system.	31.8%	3.20	3.55	2.19
Inspect plastics and fiberglass.	44.8%	3.63	2.79	2.19
Service scavenge filter.	29.4%	3.00	3.22	2.19
Service turbine engine.	33.4%	3.95	3.44	2.18
Remove and install fuel filter.	40.8%	3.08	3.32	2.17
Check for leaks in hydraulic system.	48.8%	3.85	3.27	2.16

Troubleshoot exterior lighting systems.	45.2%	3.33	2.52	2.16
Inspect chip detectors and/or oil filters.	40.2%	3.42	3.27	2.14
Operational check fire detection system.	36.2%	3.59	3.59	2.14
Replace turbine and jet oil filter elements.	37.3%	3.14	3.33	2.14
Test passenger or cargo smoke detection system.	40.9%	3.16	3.40	2.14
Maintain batteries.	29.2%	2.93	2.98	2.13
Inspect propellers for damage.	9.8%	3.78	3.46	2.12
Clean or remove paint or coatings from parts or skin using stripping agents or chemical bath.	21.8%	2.14	2.28	2.11
Perform a general interior or exterior visual inspection.	55.6%	4.18	3.00	2.11
Replace smoke detection components.	39.9%	2.27	3.29	2.11
Replace loose or missing fasteners.	53.8%	3.57	2.60	2.10
Identify and control bacteria in fuel tanks.	21.2%	2.19	2.80	2.09
Inspect components for loose connections.	51.8%	4.20	3.32	2.09
Service hydraulic accumulator.	43.7%	3.09	3.09	2.09

Description	**Percent**	**Avg Frequency**	**Avg Criticality**	**Avg Difficulty**
Service passenger oxygen system.	40.4%	3.36	3.21	2.08
Drain and flush oil tank.	30.6%	2.55	3.05	2.07
Bleed hydraulic system pressure.	45.7%	3.50	2.79	2.05
Analyze fuel tank for microbiological contamination.	21.3%	2.38	2.90	2.04
Functional check prop heat.	10.1%	3.15	2.99	1.99
Inspect aircraft interior areas.	40.7%	3.86	2.37	1.99
Prepare surface and prime.	32.3%	2.89	2.23	1.97
Service hydraulic system.	47.2%	3.69	3.17	1.95
Operational test of cabin emergency lighting.	43.3%	3.59	2.88	1.94
Defuel aircraft.	37.9%	2.53	2.16	1.93
Service each fuel tank sump to remove water and inspect tank valve.	34.0%	3.24	3.03	1.93

Repair small cracks by stop drilling.	49.3%	2.83	2.49	1.92
Replace engine filters.	33.6%	3.27	3.13	1.91
Paint parts or surfaces.	39.3%	3.07	1.95	1.89
Service engine and scavenger oil.	39.4%	3.78	3.26	1.89
Inspect extinguishers and fire bottles.	37.9%	3.52	3.39	1.87
Check clogging indicators on filters.	47.4%	3.52	3.16	1.86
Clean or remove surface deposits or material.	42.2%	3.33	2.23	1.84
Lubricate propeller.	7.3%	2.78	2.90	1.83
Operational test of cockpit voice recorder.	33.5%	3.15	2.15	1.81
Service doors, windows and movable components with appropriate lubricant.	43.3%	3.06	2.41	1.81
Repair or replace static discharger wicks and mounts.	48.6%	2.42	2.20	1.76
Lubricate required flight control components (hinges, rollers, pinions, gears).	47.5%	3.30	2.89	1.75
Repair or replace exterior aircraft lighting.	47.8%	3.36	2.42	1.75
Drain and replace oil in piston engine.	4.1%	2.95	3.01	1.73
Lubricate landing gear components (bearings, hinges, pivots, up/downlocks, etc).	44.2%	3.20	2.71	1.71
Service tires.	45.4%	3.76	2.90	1.67
Inspect and check static discharge wicks.	59.3%	3.55	2.25	1.66
Clean electronic equipment cooling filters.	30.7%	2.48	2.22	1.55
Check fuel tanks for water.	44.9%	3.63	3.11	1.54
Check pressure of tires.	48.1%	3.99	2.84	1.42

10. Appendix B

10.1 FAR Part 147

PART 147--AVIATION MAINTENANCE TECHNICIAN SCHOOLS

Subpart A--General

Sec.

Subpart B--Certification Requirements

Subpart C--Operating Rules

Authority: 49 U.S.C. 106(g), 40113, 44701-44702, 44707-44709.

Source: Docket No. 1157, 27 FR 6669 July 13, 1962, unless otherwise noted.

Subpart A--General

Sec. 147.1 Applicability.

This part prescribes the requirements for issuing aviation maintenance technician school certificates and associated ratings and the general operating rules for the holders of those certificates and ratings.

Sec. 147.3 Certificate required.

No person may operate as a certificated aviation maintenance technician school without, or in violation of, an aviation maintenance technician school certificate issued under this part.

[Doc. No. 15196, 41 FR 47230, Oct. 28, 1976]

Sec. 147.5 Application and issue.

(a) An application for a certificate and rating, or for an additional rating, under this part is made on a form and in a manner prescribed by the Administrator, and submitted with--

(1) A description of the proposed curriculum;

(2) A list of the facilities and materials to be used;

(3) A list of its instructors, including the kind of certificate and ratings held and the certificate numbers; and

(4) A statement of the maximum number of students it expects to teach at any one time.

(b) An applicant who meets the requirements of this part is entitled to an aviation maintenance technician school certificate and associated ratings prescribing such operations specifications and limitations as are necessary in the interests of safety.

[Doc. No. 1157, 27 FR 6669, July 13, 1962, as amended by Amdt. 147-5, 57 FR 28959, June 29, 1992]

Sec. 147.7 Duration of certificates.

(a) An aviation maintenance technician school certificate or rating is effective until it is surrendered, suspended, or revoked.

(b) The holder of a certificate that is surrendered, suspended, or revoked, shall return it to the Administrator.

[Doc. No. 1157, 27 FR 6669, July 19, 1962, as amended by Amdt. 147-3, 41 FR 47230, Oct. 28, 1976]

Subpart B--Certification Requirements

Sec. 147.11 Ratings.

The following ratings are issued under this part:

(a) Airframe.

(b) Powerplant.

(c) Airframe and powerplant.

Sec. 147.13 Facilities, equipment, and material requirements.

An applicant for an aviation maintenance technician school certificate and rating, or for an additional rating, must have at least the facilities, equipment, and materials specified in Secs. 147.15 to 147.19 that are appropriate to the rating he seeks.

Sec. 147.15 Space requirements.

An applicant for an aviation maintenance technician school certificate and rating, or for an additional rating, must have such of the following properly heated, lighted, and ventilated facilities as are appropriate to the rating he seeks and as the Administrator determines are appropriate for the maximum number of students expected to be taught at any time:

(a) An enclosed classroom suitable for teaching theory classes.

(b) Suitable facilities, either central or located in training areas, arranged to assure proper separation from the working space, for parts, tools, materials, and similar articles.

(c) Suitable area for application of finishing materials, including paint spraying.

(d) Suitable areas equipped with washtank and degreasing equipment with air pressure or other adequate cleaning equipment.

(e) Suitable facilities for running engines.

(f) Suitable area with adequate equipment, including benches, tables, and test equipment, to disassemble, service, and inspect.

(1) Ignition, electrical equipment, and appliances;

(2) Carburetors and fuel systems; and

(3) Hydraulic and vacuum systems for aircraft, aircraft engines, and their appliances.

(g) Suitable space with adequate equipment, including tables, benches, stands, and jacks, for disassembling, inspecting, and rigging aircraft.

(h) Suitable space with adequate equipment for disassembling, inspecting, assembling, troubleshooting, and timing engines.

[Amdt. 147-2, 35 FR 5533, Apr. 3, 1970, as amended by Amdt. 147-5, 57 FR 28959, June 29, 1992]

Sec. 147.17 Instructional equipment requirements.

(a) An applicant for a mechanic school certificate and rating, or for an additional rating, must have such of the following instructional equipment as is appropriate to the rating he seeks:

(1) Various kinds of airframe structures, airframe systems and components, powerplants, and powerplant systems and components (including propellers), of a quantity and type suitable to complete the practical projects required by its approved curriculums.

(2) At least one aircraft of a type currently certificated by FAA for private or commercial operation, with powerplant, propeller, instruments, navigation and communications equipment, landing lights, and other equipment and accessories on which a maintenance technician might be required to work and with which the technician should be familiar.

(b) The equipment required by paragraph (a) of this section need not be in an airworthy condition. However, if it was damaged, it must have been repaired enough for complete assembly.

(c) Airframes, powerplants, propellers, appliances, and components thereof, on which instruction is to be given, and from which practical working experience is to be gained, must be so diversified as to show the different methods of construction, assembly, inspection, and operation when installed in an aircraft for use. There must be enough units so that not more than eight students will work on any one unit at a time.

(d) If the aircraft used for instructional purposes does not have retractable landing gear and wing flaps, the school must provide training aids, or operational mock-ups of them.

[Doc. No. 1157, 27 FR 6669, July 19, 1962, as amended by Amdt. 147-5, 57 FR 28959, June 29, 1992]

Sec. 147.19 Materials, special tools, and shop equipment requirements.

An applicant for an aviation maintenance technician school certificate and rating, or for an additional rating, must have an adequate supply of material, special tools, and such of the shop equipment as are appropriate to the approved curriculum of the school and are used in constructing and maintaining aircraft, to assure that each student will be properly instructed. The special tools and shop equipment must be in satisfactory working condition for the purpose for which they are to be used.

[57 FR 28959, June 29, 1992]

Sec. 147.21 General curriculum requirements.

(a) An applicant for an aviation maintenance technician school certificate and rating, or for an additional rating, must have an approved curriculum that is designed to qualify his students to perform the duties of a mechanic for a particular rating or ratings.

(b) The curriculum must offer at least the following number of hours of instruction for the rating shown, and the instruction unit hour shall not be less than 50 minutes in length--

(1) Airframe--1,150 hours (400 general plus 750 airframe).

(2) Powerplant--1,150 hours (400 general plus 750 powerplant).

(3) Combined airframe and powerplant--1,900 hours (400 general plus 750 airframe and 750 powerplant).

(c) The curriculum must cover the subjects and items prescribed in appendixes B, C, or D, as applicable. Each item must be taught to at least the indicated level of proficiency, as defined in appendix A.

(d) The curriculum must show--

(1) The required practical projects to be completed;

(2) For each subject, the proportions of theory and other instruction to be given; and

(3) A list of the minimum required school tests to be given.

(e) Notwithstanding the provisions of paragraphs (a) through (d) of this section and Sec. 147.11, the holder of a certificate issued under subpart B of this part may apply for and receive approval of special courses in the performance of special inspection and preventive maintenance programs for a primary category aircraft type certificated under Sec. 21.24(b) of this chapter. The school may also issue certificates of competency to persons successfully completing such courses provided that all other requirements of this part are met and the certificate of competency specifies the aircraft make and model to which the certificate applies.

[Doc. No. 1157, 27 FR 6669, July 13, 1962 as amended by Amdt. 147-1, 32 FR 5770 Apr. 11, 1967; Amdt. 147-5, 57 FR 28959, June 29, 1992; Amdt. 147-6, 57 FR 41370, Sept. 9, 1992]

Sec. 147.23 Instructor requirements.

An applicant for an aviation maintenance technician school certificate and rating, or for an additional rating, must provide the number of instructors holding appropriate mechanic certificates and ratings that the Administrator determines necessary to provide adequate instruction and supervision of the students, including at least one such instructor for each 25 students in each shop class. However, the applicant may provide specialized instructors, who are not certificated mechanics, to teach mathematics, physics, basic electricity, basic hydraulics, drawing, and similar subjects. The applicant is required to maintain a list of the names and qualifications of specialized instructors, and upon request, provide a copy of the list to the FAA.

[57 FR 28959, June 29, 1992]

Subpart C--Operating Rules

Sec. 147.31 Attendance and enrollment, tests, and credit for prior instruction or experience.

(a) A certificated aviation maintenance technician school may not require any student to attend classes of instruction more than 8 hours in any day or more than 6 days or 40 hours in any 7-day period.

(b) Each school shall give an appropriate test to each student who completes a unit of instruction as shown in that school's approved curriculum.

(c) A school may not graduate a student unless he has completed all of the appropriate curriculum requirements. However, the school may credit a student with instruction or previous experience as follows:

(1) A school may credit a student with instruction satisfactorily completed at--

(i) An accredited university, college, junior college;

(ii) An accredited vocational, technical, trade or high school;

(iii) A military technical school;

(iv) A certificated aviation maintenance technician school.

(2) A school may determine the amount of credit to be allowed--

(i) By an entrance test equal to one given to the students who complete a comparable required curriculum subject at the crediting school;

(ii) By an evaluation of an authenticated transcript from the student's former school; or

(iii) In the case of an applicant from a military school, only on the basis of an entrance test.

(3) A school may credit a student with previous aviation maintenance experience comparable to required curriculum subjects. It must determine the amount of credit to be allowed by documents verifying that experience, and by giving the student a test equal to the one given to students who complete the comparable required curriculum subject at the school.

(4) A school may credit a student seeking an additional rating with previous satisfactory completion of the general portion of an AMTS curriculum.

(d) A school may not have more students enrolled than the number stated in its application for a certificate, unless it amends its application and has

it approved.
(e) A school shall use an approved system for determining final course grades and for recording student attendance. The system must show hours of absence allowed and show how the missed material will be made available to the student.

[Amdt. 147-2, 35 FR 5534, Apr. 3, 1970, as amended by Amdt. 147-4, 43 FR 22643, May 25, 1978; Amdt. 147-5, 57 FR 28959, June 29, 1992]

Sec. 147.33 Records.

(a) Each certificated aviation maintenance technician school shall keep a current record of each student enrolled, showing--

(1) His attendance, tests, and grades received on the subjects required by this part;

(2) The instruction credited to him under Sec. 147.31(c), if any; and

(3) The authenticated transcript of his grades from that school.

It shall retain the record for at least two years after the end of the student's enrollment, and shall make each record available for inspection by the Administrator during that period.

(b) Each school shall keep a current progress chart or individual progress record for each of its students, showing the practical projects or laboratory work completed, or to be completed, by the student in each subject.

[Doc. No. 1157, 27 FR 6669, July 13, 1962]

Sec. 147.35 Transcripts and graduation certificates.

(a) Upon request, each certificated aviation maintenance technician school shall provide a transcript of the student's grades to each student who is graduated from that school or who leaves it before being graduated. An official of the school shall authenticate the transcript. The transcript must state the curriculum in which the student was enrolled, whether the student satisfactorily completed that curriculum, and the final grades the student received.

(b) Each school shall give a graduation certificate or certificate of completion to each student that it graduates. An official of the school shall authenticate the certificate. The certificate must show the date of graduation and the approved curriculum title.

[Doc. No. 1157, 27 FR 6669, July 13, 1962, as amended by Amdt. 147-5, 57 FR 28959, June 29, 1992]

Sec. 147.36 Maintenance of instructor requirements.

Each certificated aviation maintenance technician school shall, after certification or addition of a rating, continue to provide the number of instructors holding appropriate mechanic certificates and ratings that the Administrator determines necessary to provide adequate instruction to the students, including at least one such instructor for each 25 students in each shop class. The school may continue to provide specialized instructors who are not certificated mechanics to teach mathematics, physics, drawing, basic electricity, basic hydraulics, and similar subjects.

[Amdt. 147-5, 57 FR 28959, June 29, 1992]

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DAILY CFR (TM) Note

57 FR 28952, No. 125, June 29, 1992

SUMMARY: This amendment updates the regulations for certificating Aviation Maintenance Technician Schools (AMTS) to accommodate the increasing demand for maintenance technicians with higher levels of skill and knowledge. The amendment modifies portions of the rule that have been open to subjective judgments by the FAA and the AMTS industry and modifies the portions that specify the skill and knowledge requirements for an aviation maintenance technician. This amendment revises the core curriculum to ensure that AMTS graduates will be prepared to function in the current technological environment.

EFFECTIVE DATE: September 28, 1992.

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Sec. 147.37 Maintenance of facilities, equipment, and material.

(a) Each certificated aviation maintenance technician school shall provide facilities, equipment, and material equal to the standards currently required for the issue of the certificate and rating that it holds.

(b) A school may not make a substantial change in facilities, equipment, or material that have been approved for a particular curriculum, unless that change is approved in advance.

Sec. 147.38 Maintenance of curriculum requirements.

(a) Each certificated aviation maintenance technician school shall adhere to its approved curriculum. With FAA approval, curriculum subjects may be taught at levels exceeding those shown in Appendix A of this part.

(b) A school may not change its approved curriculum unless the change is approved in advance.

[Amdt. 147-2, 35 FR 5534, Apr. 3, 1970, as amended by Amdt. 147-5, 57 FR 28960, June 29, 1992]

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DAILY CFR (TM) Note

57 FR 28952, No. 125, June 29, 1992

SUMMARY: This amendment updates the regulations for certificating Aviation Maintenance Technician Schools (AMTS) to accommodate the increasing demand for maintenance technicians with higher levels of skill and knowledge. The amendment modifies portions of the rule that have been open to subjective judgments by the FAA and the AMTS industry and modifies the portions that specify the skill and knowledge requirements for an aviation maintenance technician. This amendment revises the core curriculum to ensure that AMTS graduates will be prepared to function in the current technological environment.

EFFECTIVE DATE: September 28, 1992.

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Sec. 147.38a Quality of instruction.

Each certificated aviation maintenance technician school shall provide instruction of such quality that, of its graduates of a curriculum for each rating who apply for a mechanic certificate or additional rating within 60 days after they are graduated, the percentage of those passing the applicable FAA written tests on their first attempt during any period of 24 calendar months is at least the percentage figured as follows:

(a) For a school graduating fewer than 51 students during that period--the national passing norm minus the number 20.

(b) For a school graduating at least 51, but fewer than 201, students during that period--the national passing norm minus the number 15.

(c) For a school graduating more than 200 students during that period--the national passing norm minus the number 10.

As used in this section, "national passing norm" is the number representing the percentage of all graduates (of a curriculum for a particular rating) of all certificated aviation maintenance technician schools who apply for a mechanic certificate or additional rating within 60 days after they are graduated and pass the applicable FAA written tests on their first attempt during the period of 24 calendar months described in this section.

[Amdt. 147-2, 35 FR 5534, Apr. 3, 1970, as amended by Amdt. 147-3, 41 FR 47230, Oct. 28, 1976]

Sec. 147.39 Display of certificate.

Each holder of an aviation maintenance technician school certificate and ratings shall display them at a place in the school that is normally accessible to the public and is not obscured. The certificate must be available for inspection by the Administrator.

Sec. 147.41 Change of location.

The holder of an aviation maintenance technician school certificate may not make any change in the school's location unless the change is approved in advance. If the holder desires to change the location he shall notify the

Administrator, in writing, at least 30 days before the date the change is contemplated. If he changes its location without approval, the certificate is revoked.

Sec. 147.43 Inspection.

The Administrator may, at any time, inspect an aviation maintenance technician school to determine its compliance with this part. Such an inspection is normally made once each six months to determine if the school continues to meet the requirements under which it was originally certificated. After such an inspection is made, the school is notified, in writing, of any deficiencies found during the inspection. Other informal inspections may be made from time to time.

Sec. 147.45 Advertising.

(a) A certificated aviation maintenance technician school may not make any statement relating to itself that is false or is designed to mislead any person considering enrollment therein.

(b) Whenever an aviation maintenance technician school indicates in advertising that it is a certificated school, it shall clearly distinguish between its approved courses and those that are not approved.

Appendix A to Part 147--Curriculum Requirements

This appendix defines terms used in Appendices B, C, and D of this part, and describes the levels of proficiency at which items under each subject in each curriculum must be taught, as outlined in Appendices B, C, and D.

(a) Definitions. As used in Appendices B, C, and D:

(1) "Inspect" means to examine by sight and touch.

(2) "Check" means to verify proper operation.

(3) "Troubleshoot" means to analyze and identify malfunctions.

(4) "Service" means to perform functions that assure continued operation.

(5) "Repair" means to correct a defective condition. Repair of an airframe or powerplant system includes component replacement and adjustment, but not component repair.

(6) "Overhaul" means to disassemble, inspect, repair as necessary, and check.

(b) Teaching levels.

(1) Level 1 requires:

(i) Knowledge of general principles, but no practical application.

(ii) No development of manipulative skill.

(iii) Instruction by lecture, demonstration, and discussion.

(2) Level 2 requires:

(i) Knowledge of general principles, and limited practical application.

(ii) Development of sufficient manipulative skill to perform basic operations.

(iii) Instruction by lecture, demonstration, discussion, and limited practical application.

(3) Level 3 requires:

(i) Knowledge of general principles, and performance of a high degree of practical application.

(ii) Development of sufficient manipulative skills to simulate return to service.

(iii) Instruction by lecture, demonstration, discussion, and a high degree of practical application.

(c) Teaching materials and equipment.

The curriculum may be presented utilizing currently accepted educational materials and equipment, including, but not limited to: calculators, computers, and audio-visual equipment.

[Amdt. 147-2, 35 FR 5534, Apr. 3, 1970, as amended by Amdt. 147-5, 57 FR 28960, June 29, 1992]

Appendix B to Part 147--General Curriculum Subjects

This appendix lists the subjects required in at least 400 hours in general curriculum subjects.

The number in parentheses before each item listed under each subject heading indicates the level of proficiency at which that item must be taught.

Teaching
level

a. Basic electricity

(2) 1. Calculate and measure capacitance and inductance.

(2) 2. Calculate and measure electrical power.

(3) 3. Measure voltage, current, resistance, and continuity.

(3) 4. Determine the relationship of voltage, current, and resistance in electrical circuits.

(3) 5. Read and interpret aircraft electrical circuit diagrams, including solid state devices and logic functions.

(3) 6. Inspect and service batteries.

b. Aircraft drawings

(2) 7. Use aircraft drawings, symbols, and system schematics.

(3) 8. Draw sketches of repairs and alterations.

(3) 9. Use blueprint information.

(3) 10. Use graphs and charts.

c. Weight and balance

(2) 11. Weigh aircraft.

(3) 12. Perform complete weight-and-balance check and record data.

d. Fluid lines and fittings

(3) 13. Fabricate and install rigid and flexible fluid lines and fittings.

e. Materials and processes

(1) 14. Identify and select appropriate nondestructive testing methods.

(2) 15. Perform dye penetrant, eddy current, ultrasonic, and magnetic particle inspections.

(1) 16. Perform basic heat-treating processes.

(3) 17. Identify and select aircraft hardware and materials.

(3) 18. Inspect and check welds.

(3) 19. Perform precision measurements.

f. Ground operation and servicing

(2) 20. Start, ground operate, move, service, and secure aircraft and identify typical ground operation hazards.

(2) 21. Identify and select fuels.

g. Cleaning and corrosion control

(3) 22. Identify and select cleaning materials.

(3) 23. Inspect, identify, remove, and treat aircraft corrosion and perform aircraft cleaning.

h. Mathematics

(3) 24. Extract roots and raise numbers to a given power.

(3) 25. Determine areas and volumes of various geometrical shapes.

(3) 26. Solve ratio, proportion, and percentage problems.

(3) 27. Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers.

i. Maintenance forms and records

(3) 28. Write descriptions of work performed including aircraft discrepancies and corrective actions using typical aircraft maintenance records.

(3) 29. Complete required maintenance forms, records, and inspection reports.

j. Basic physics

(2) 30. Use and understand the principles of simple machines; sound, fluid, and heat dynamics; basic aerodynamics; aircraft structures; and theory of flight.

k. Maintenance publications

(3) 31. Demonstrate ability to read, comprehend, and apply information contained in FAA and manufacturers' aircraft maintenance specifications, data sheets, manuals, publications, and related Federal Aviation Regulations, Airworthiness Directives, and Advisory material.

(3) 32. Read technical data.

l. Mechanic privileges and limitations

(3) 33. Exercise mechanic privileges within the limitations prescribed by Part 65 of this chapter.

[Amdt. 147-2, 35 FR 5534, Apr. 3, 1970, as amended by Amdt. 147-5, 57 FR 28960, June 29, 1992]

Appendix C to Part 147--Airframe Curriculum Subjects

This appendix lists the subjects required in at least 750 hours of each airframe curriculum, in addition to at least 400 hours in general curriculum subjects. The number in parentheses before each item listed under each subject heading indicates the level of proficiency at which that item must be taught.

I. Airframe Structures

Teaching level

a. Wood structures

(1) 1. Service and repair wood structures.

(1) 2. Identify wood defects.

(1) 3. Inspect wood structures.

b. Aircraft covering

(1) 4. Select and apply fabric and fiberglass covering materials.

(1) 5. Inspect, test, and repair fabric and fiberglass.

c. Aircraft finishes

(1) 6. Apply trim, letters, and touchup paint.

(2) 7. Identify and select aircraft finishing materials.

(2) 8. Apply finishing materials.

(2) 9. Inspect finishes and identify defects.

d. Sheet metal and non-metallic structures

(2) 10. Select, install and remove special fasteners for metallic, bonded, and composite structures.

(2) 11. Inspect bonded structures.

(2) 12. Inspect, test and repair fiberglass, plastics, honeycomb, composite, and laminated primary and secondary structures.

(2) 13. Inspect, check, service, and repair windows, doors, and interior furnishings.

(3) 14. Inspect and repair sheet-metal structures.

(3) 15. Install conventional rivets.

(3) 16. Form, lay out, and bend sheet metal.

e. Welding

(1) 17. Weld magnesium and titanium.

(1) 18. Solder stainless steel.

(1) 19. Fabricate tubular structures.

(2) 20. Solder, braze, gas-weld, and arc-weld steel.

(1) 21. Weld aluminum and stainless steel.

f. Assembly and rigging

(1) 22. Rig rotary-wing aircraft.

(2) 23. Rig fixed-wing aircraft.

(2) 24. Check alignment of structures.

(3) 25. Assemble aircraft components, including flight control surfaces.

(3) 26. Balance, rig, and inspect movable primary and secondary flight control surfaces.

(3) 27. Jack aircraft.

g. Airframe inspection

(3) 28. Perform airframe conformity and airworthiness inspections.

II. Airframe Systems and Components

Teaching level

a. Aircraft landing gear systems

(3) 29. Inspect, check, service, and repair landing gear, retraction systems, shock struts, brakes, wheels, tires, and steering systems.

b. Hydraulic and pneumatic power systems

(2) 30. Repair hydraulic and pneumatic power systems components.

(3) 31. Identify and select hydraulic fluids.

(3) 32. Inspect, check, service, troubleshoot, and repair hydraulic and pneumatic power systems.

c. Cabin atmosphere control systems

(1) 33. Inspect, check, troubleshoot, service, and repair heating, cooling, air conditioning, pressurization systems, and air cycle machines.

(1) 34. Inspect, check, troubleshoot, service, and repair heating, cooling, air-conditioning, and pressurization systems.

(2) 35. Inspect, check, troubleshoot, service and repair oxygen systems.

d. Aircraft instrument systems

(1) 36. Inspect, check, service, troubleshoot and repair electronic flight instrument systems and both mechanical and electrical heading, speed, altitude, temperature, pressure, and position indicating systems to include the use of built-in test equipment.

(2) 37. Install instruments and perform a static pressure system leak test.

e. Communication and navigation systems

(1) 38. Inspect, check, and troubleshoot autopilot, servos and approach coupling systems.

(1) 39. Inspect, check, and service aircraft electronic communication and navigation systems, including VHF passenger address interphones and static discharge devices, aircraft VOR, ILS, LORAN, Radar beacon transponders, flight management computers, and

GPWS.

(2) 40. Inspect and repair antenna and electronic equipment installations.

f. Aircraft fuel systems

(1) 41. Check and service fuel dump systems.

(1) 42. Perform fuel management transfer, and defueling.

(1) 43. Inspect, check, and repair pressure fueling systems.

(2) 44. Repair aircraft fuel system components.

(2) 45. Inspect and repair fluid quantity indicating systems.

(2) 46. Troubleshoot, service, and repair fluid pressure and temperature warning systems.

(3) 47. Inspect, check, service, troubleshoot, and repair aircraft fuel systems.

g. Aircraft electrical systems

(2) 48. Repair and inspect aircraft electrical system components; crimp and splice wiring to manufacturers' specifications; and repair pins and sockets of aircraft connectors.

(3) 49. Install, check, and service airframe electrical wiring, controls, switches, indicators, and protective devices.

(3) 50.a. Inspect, check, troubleshoot, service, and repair alternating and direct current electrical systems.

(1) 50.b. Inspect, check, and troubleshoot constant speed and integrated speed drive generators.

h. Position and warning systems

(2) 51. Inspect, check, and service speed and configuration warning systems, electrical brake controls, and anti-skid systems.

(3) 52. Inspect, check, troubleshoot, and service landing gear position indicating and warning systems.

i. Ice and rain control systems

(2) 53. Inspect, check, troubleshoot, service, and repair airframe ice and rain control systems.

j. Fire protection systems

(1) 54. Inspect, check, and service smoke and carbon monoxide detection systems.

(3) 55. Inspect, check, service, troubleshoot, and repair aircraft fire detection and extinguishing systems.

[Amdt. 147-2, 35 FR 5535, Apr. 3, 1970, as amended by Amdt. 147-5, 57 FR 28960, June 29, 1992]

Appendix D to Part 147--Powerplant Curriculum Subjects

This appendix lists the subjects required in at least 750 hours of each powerplant curriculum, in addition to at least 400 hours in general curriculum subjects.The number in parentheses before each item listed under each subject heading indicates the level of proficiency at which that item must be taught.

I. Powerplant Theory and Maintenance

Teaching level

a. Reciprocating engines

(1) 1. Inspect and repair a radial engine.

(2) 2. Overhaul reciprocating engine.

(3) 3. Inspect, check, service, and repair reciprocating engines and engine installations.

(3) 4. Install, troubleshoot, and remove reciprocating engines.

b. Turbine engines

(2) 5. Overhaul turbine engine.

(3) 6. Inspect, check, service, and repair turbine engines and turbine engine installations.

(3) 7. Install, troubleshoot, and remove turbine engines.

c. Engine inspection

(3) 8. Perform powerplant conformity and air worthiness inspections.

II. Powerplant Systems and Components

Teaching
level

a. Engine instrument systems

(2) 9. Troubleshoot, service, and repair electrical and mechanical fluid rate-of-flow indicating systems.

(3) 10. Inspect, check, service, troubleshoot, and repair electrical and mechanical engine temperature, pressure, and r.p.m. indicating systems.

b. Engine fire protection systems

(3) 11. Inspect, check, service, troubleshoot, and repair engine fire detection and extinguishing systems.

c. Engine electrical systems

(2) 12. Repair engine electrical system components.

(3) 13. Install, check, and service engine electrical wiring, controls, switches, indicators, and protective devices.

d. Lubrication systems

(2) 14. Identify and select lubricants.

(2) 15. Repair engine lubrication system components.

(3) 16. Inspect, check, service, troubleshoot, and repair engine lubrication systems.

e. Ignition and starting systems

(2) 17. Overhaul magneto and ignition harness.

(2) 18. Inspect, service, troubleshoot, and repair reciprocating and turbine engine ignition systems and components.

(3) 19.a. Inspect, service, troubleshoot, and repair turbine engine electrical starting systems.

(1) 19.b. Inspect, service, and troubleshoot turbine engine pneumatic starting systems.

f. Fuel metering systems

(1) 20. Troubleshoot and adjust turbine engine fuel metering systems

and electronic engine fuel controls.

(2) 21. Overhaul carburetor.

(2) 22. Repair engine fuel metering system components.

(3) 23. Inspect, check, service, troubleshoot, and repair reciprocating and turbine engine fuel metering systems.

g. Engine fuel systems

(2) 24. Repair engine fuel system components.

(3) 25. Inspect, check, service, troubleshoot, and repair engine fuel systems.

h. Induction and engine airflow systems

(2) 26. Inspect, check, troubleshoot, service, and repair engine ice and rain control systems.

(1) 27. Inspect, check, service, troubleshoot and repair heat exchangers, superchargers, and turbine engine airflow and temperature control systems.

(3) 28. Inspect, check, service, and repair carburetor air intake and induction manifolds.

i. Engine cooling systems

(2) 29. Repair engine cooling system components.

(3) 30. Inspect, check, troubleshoot, service, and repair engine cooling systems.

j. Engine exhaust and reserver systems

(2) 31. Repair engine exhaust system components.

(3) 32.a. Inspect, check, troubleshoot, service, and repair engine exhaust systems.

(1) 32.b. Troubleshoot and repair engine thrust reserver systems and related components.

k. Propellers

(1) 33. Inspect, check, service, and repair propeller synchronizing and ice control systems.

(2) 34. Identify and select propeller lubricants.

(1) 35. Balance propellers.

(2) 36. Repair propeller control system components.

(3) 37. Inspect, check, service, and repair fixed-pitch, constant-speed, and feathering propellers, and propeller governing systems.

(3) 38. Install, troubleshoot, and remove propellers.

(3) 39. Repair aluminum alloy propeller blades.

l. Unducted fans

(1) 40. Inspect and troubleshoot unducted fan systems and components.

m. Auxiliary power units

(1) 41. Inspect, check, service, and troubleshoot turbine-driven auxiliary power units.

(Sec. 6(c), Dept. of Transportation Act; 49 U.S.C. 1655(c))

[Amdt. 147-2, 35 FR 5535, Apr. 3, 1970, as amended by Amdt. 147-5, 57 FR 28961, June 29, 1992]

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11. Appendix C

11.1 Appendix A to Part 66 Aviation Maintenance Technician (Transport) Training Program Curriculum Requirements

(a) Form of training program outline. An applicant for approval as a training provider must submit a training program outline to the Administrator. The training program outline may be submitted in paper, electronic, or any other form that is acceptable to the Administrator; however, it shall include a table of contents. The table of contents must specify those subject areas taught in the program and the number of curriculum hours allotted to each subject area.

(b) Content of training program outline. The training program outline must contain all of subject area headings specified in this appendix; however, the headings are not required to be arranged in the outline exactly as listed in this appendix. Any arrangement of headings and subheadings will be satisfactory provided that the outline indicates that instruction will be provided in each subject area for at least the minimum number of hours specified in this appendix. Each general subject area of the outline shall be subdivided in detail, showing the items to be covered.

(c) Additional subject areas. Any training provider may include additional subjects that are not specified in this appendix in the training program outline; however, the number of hours allotted to training in each subject area must be specified. Hourly requirements devoted to additional subject areas not specified in this appendix are not included in the determination of a program's compliance with the minimum training requirements specified in this appendix.

(d) Minimum training program requirements. Unless approved by the Administrator in accordance with paragraph (h) of this appendix, the following subject areas and classroom hours for each subject area are considered the minimum training requirements for an aviation maintenance technician (transport) training program;

Subject Area	Classroom Hours
Advanced electronics	229
Composites	62
Structural repair	86
Powerplants and systems	58
Safety and environment	69
Publications	69
TOTAL HOURS	573

(e) Facilities, equipment, and material. An applicant for authority to conduct a training program leading to the issuance of the aviation maintenance technician (transport) certificate must have the following facilities, equipment, and materials:

(1) Facilities — Suitable classrooms, laboratories, and shop facilities, adequate to accommodate the largest number of students scheduled for attendance at any one time, must be provided. Such classrooms, laboratories, and shop facilities shall be properly heated, lighted, and ventilated.

(2) Equipment and materials — Suitable devices for the instruction of each student in the theoretical and practical aspects of the subjects contained in the training program shall be provided. This material may include, but shall not be limited to, acceptable textbooks, operations manuals, chalkboards, calculators, computers, and visual aids.

(f) Instructors. The number of instructors available for conducting the program of instruction shall be determined according to the needs and facilities of the applicant. However, the ratio of students per instructor in each shop class may not exceed 25 students per 1 instructor.

(g) Credit for previous training. A training provider may evaluate an entrant's previous training and, where the training is verifiable and comparable to portions of the training program, the training provider may, as each individual case warrants, allow credit for such training, commensurate with accepted training practices. Before credit is allowed, the individual requesting credit must pass an examination given by the training provider, which is equivalent to those examinations given by the training provider for the same subject in the training program. Where credit is allowed, the basis for the allowance, the results of any tests used to establish the credit, and the total hours credited must be incorporated as a part of the student's records, as specified in paragraph (i) of this appendix.

(h) Revision of training program.

(1) After initial approval of a training provider, the training provider may apply to the Administrator for a revision to the training program. Requests for the revision of a training program, which include modifications to the facilities, equipment, and material used, or a reduction in the number of hours of instruction provided to fewer than the specified minimum requirements, shall be accomplished in the same manner established for securing original approval of the training provider. Revisions must be submitted in such form that the revision can be readily included in the training program outline so that obsolete portions of the outline can be readily superseded by the revision.

(2) A modification of the training program, or a reduction in the number of hours of training provided to fewer than the specified minimum requirements, is based on improved training effectiveness because of the use of improved training methods and training aids, an increase in the quality of instruction, the use of special student entry requirements, the granting of credit for previous experience or training, or any combination thereof.

(3) The list of instructors may be revised at any time without request for approval, provided the minimum requirements are maintained and the local FAA principal maintenance inspector is notified of the revision.

(4) Whenever the Administrator finds that revisions are necessary for the continued adequacy of the training program, the training provider shall, after notification by the Administrator, make any changes in the training program, that the Administrator deems necessary.

(i) Student records and reports. Approval of a training provider may not be continued unless the training provider keeps an accurate record of each student, including a chronological log of all instruction, subjects covered, examinations, grades, and attendance records (including a record of the manner in which missed material was covered). To retain approval, a training provider also must prepare and transmit to the Federal Aviation Administration, not later than January 31 of each year, a report containing the following information:

(1) The names of all students graduated, student attendance records, and student grades for the program.

(2) The names of all students failed or dropped, together with school grades and reasons for dropping.

(3) Upon request, the Administrator may waive the reporting requirements specified in paragraphs (i)(1) and (2) of this appendix, for a training program that is part of an approved training course conducted under the following parts or subparts: part 121, subpart L; part 135, subpart J; or part 147 of this chapter.

(j) Statement of graduation and records of training completion. Each student who successfully completes a training program shall be given a statement of graduation.

Each student who completes a portion of a training program shall, upon request, be given a record of the training completed.

(k) Contracts or agreements.

(1) An approved training provider may contract with other persons to obtain suitable course work, curriculum, programs, instruction, aircraft, simulators, or other training devices or equipment.

(2) An approved training provider may contract with another person to conduct any portion or all of a training program. The approved training provider may not authorize that person to contract for the conduct of the program by a third party.

(3) In all cases, the approved training provider is responsible for the content and quality of the instruction provided.

(4) A copy of each contract authorized under this paragraph shall be retained by the approved training provider and is subject to review by the Administrator during the period of the contract and within 2 years after the termination of its provisions.

(l) Change of ownership, name, or location.

(1) Change of ownership — Approval of a training provider may not be continued after the ownership of the training program has changed. The new owner must obtain a new approval by following the procedures prescribed for original approval.

(2) Change in name — An approved training provider or program, changed in name but not changed in ownership, remains valid if the change is reported within 30 days by the training provider to the local Flight Standards District Office.

(3) Change in location — Approval for a training provider remains in effect even though the approved training provider changes location if the change is reported by the training provider to the local Flight Standards District Office within 30 days. Approval may, however, be withdrawn if, after inspection, the facilities, equipment, and material at the new location do not meet the requirements of paragraph (e) of this appendix.

(m) Cancellation of approval.

(1) Failure to meet or maintain any of the standards set forth in this appendix for the approval of a training provider shall be considered a sufficient reason for discontinuing approval of the training provider.

(2) If a training provider decides to cancel its approval voluntarily, the training provider shall send a letter requesting cancellation to the Administrator through the local Flight Standards District Office. The request shall contain the current letter of approval for the training provider.

(n) Duration. Unless an approved training provider is a certificate holder operating under part 121 or part 135 of this chapter, an aviation maintenance technician school certificated under part 147 of this chapter, or a repair station that performs work under § 145.2(a) of this chapter, the authority to operate a training program shall expire 24 months after the last day of the month in which the approval was issued. If the approved training provider is a certificate holder operating under part 121 or part 135 of this chapter, an aviation maintenance technician school certificated under part 147 of this chapter, or a repair station that performs work under § 145.2(a) of this chapter, the authority to operate a training program will remain effective for the duration of the holder's certificate.

(o) Renewal. Application for renewal of authority to conduct a training program shall be made by letter addressed to the Administrator through the local Flight Standards District Office at any time within 60 days before the expiration date of the current approval. Renewal of a training provider's approval will depend on the training program meeting established standards and the record of the training provider.