Spring 2017

A Delphi Study of Aviation Maintenance Experts' Recommendations for a Model School Curriculum

Fred D. Dyen
Old Dominion University

A DELPHI STUDY OF AVIATION MAINTENANCE EXPERTS' RECOMMENDATIONS FOR A MODEL SCHOOL CURRICULUM

by

Fred D. Dyen
B.A., June 1970, Santa Clara University
M.S., May 1986, University of Alaska Juneau

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

EDUCATION

OLD DOMINION UNIVERSITY
May 2017

Approved by;

_____
Thomas W. Bean (Chair)

_____
Peter B. Baker (Member)

_____
Philip A. Reed (Member)

ABSTRACT

A DELPHI STUDY OF AVIATION MAINTENANCE EXPERTS' RECOMMENDATIONS FOR A MODEL SCHOOL CURRICULUM

Fred D. Dyen
Old Dominion University, 2017
Chair: Dr. Thomas W. Bean

The program described in this paper is the essential first step in reviving and reinitiating the delivery of aviation maintenance technology instruction. The demand for aviation maintenance technicians (AMTs) is rapidly increasing and there is a need to provide as many as 679,000 AMTs over the next 20 years (Boeing, 2016). Given the high cost of certification, new aviation maintenance schools are unlikely to be certificated in the near future, and ramping up the existing schools to meet the anticipated demand is unlikely without incorporating attractive cost-effective measures such as competency-based and distance education.

The purpose of this study is to develop a model curriculum for aviation maintenance technician schools (AMTSs) based upon three federal documents: {Notice of Proposed Rulemaking (NPRM) on Aviation Maintenance Technician Schools, dated 10/02/2015, Advisory and Rulemaking Committees Review Part 147 (Aviation Maintenance Technician Schools Curriculum and Operating Requirements) dated 12/08/2008, and FAA AMT testing standards (draft dated 02/17/2017)}. The model encapsulates college credits and respective clock hour times associated with common subject area groupings within the guidelines of one college credit minimum for each course, approximately 1900 hours of instruction, and recommended objectives for each course. The Delphi methodology was used to collect data from a group of aviation maintenance technology education and regulatory experts.

Keywords: Delphi study, aviation maintenance, aviation technicians, technology instruction, technician schools, curriculum development, certification.

This thesis is dedicated in memory of my daughter Kiana, without whose inspiration I would never have started and to my aviation colleagues throughout the country who have been supportive of my research, providing me encouragement and support.

ACKNOWLEDGEMENTS

There are many people who have contributed to the successful completion of this dissertation. I extend many, many thanks to my committee members for their patience and hours of guidance on my research and editing of this manuscript. The tireless efforts of my major advisor, Dr. Bean deserves special recognition. I am especially thankful for Dr. Reed's introduction to the Delphi Method, Dr. Baker's steadfast encouragement, and Dr. Overbaugh's foresight in assisting my transfer to Curriculum and Instruction.

NOMENCLATURE

AC	Advisory Circular
ACS	Airman Certification Standards
AFS	Aircraft Flight Standards
ARAC	Aviation Rulemaking Advisory Committee
AMT	Aviation Maintenance Technician
AMTS	Aviation Maintenance Technician School
ATEC	Aviation Technical Education Council
CBT	Computer-based Training
DE	Distance Education
DL	Distance Learning
EAMTC	European Aviation Maintenance Training Committee
eLMS	electronic Learning Management System
FAA	Federal Aviation Administration
FSIMS	Flight Standards Information Management System
FSDO	Flight Standards District Office
NPRM	Notice of Proposed Rulemaking
OpSpec	Operational Specification
PAI	Principal Avionics Inspector
PMI	Principal Maintenance Inspector
SME	Subject Matter Expert
URL	Uniform Resource Locator
WBT	Web-based Training

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The need for aviation maintenance technicians (AMTs) is rapidly increasing, with an estimated demand for as many as 609,000 AMTs over the next 20 years (Boeing, 2016). The program described in this dissertation offers an essential first step in reviving and reinitiating the delivery of aviation maintenance technology training through the efforts of the Federal Aviation Administration (FAA) § 147 Aviation Rulemaking Advisory Committee final report (Thompson, 2008), the FAA Notice of Proposed Rulemaking (NPRM) Aviation Maintenance Technician Schools, (2015), and the Aviation Certification Standards (ACS) Aviation Rulemaking Advisory Committee Aviation Maintenance Technician (AMT) Working Group: Recommendations for AMT ACS (FAA, 2017). Given the high cost of certification, new aviation maintenance schools are unlikely to be certificated in the near future, and increasing enrollment at schools that have already been certificated to meet this anticipated demand is unfeasible without incorporating cost-effective measures such as distance education (Lombardo, 2015) and competency-based curriculum (Dyen and Hall, 2016).

The purpose of this study is to develop a model 21st century aviation maintenance technician training curriculum. This curriculum encapsulates college credits (with FAA respective seat times) associated with common subject area groupings within the regulatory guidelines that include recommended objectives for each course, provisions for competency-based learning and distance education. Given the regulatory nature of aviation maintenance education, competency-based curriculum and the distance delivery of aviation maintenance instruction will be delineated, monitored (surveilled), and evaluated by the Federal Aviation Administration (FAA).

Statement of Problem

According to the FAA, currently there are 178 aviation maintenance technician schools (AMTSs) (http://av-info.faa.gov/MaintenanceSchool.asp) with over 166 different curriculums. Previous curriculum guides have all been based upon the FAA mandated 1900 hour minimum and none have addressed specific time distributions or credit suggestions for any of the current 44 subject areas. The purpose of this study is to define common subject area groupings, a model college credit distribution based upon respective times, Carnegie unit guidelines, typical educational restrictions, federal guidelines, and specific objectives for each course and subject area for a 14 Code of Federal Regulations § 147 curriculum.

There are a number of assumptions that must be considered before a model curriculum can be developed including which federal document should take priority regarding the selection of the subject areas, typical state credit and time limitations for certificate programs and degrees, Carnegie unit guidelines, desirability of asynchronous distance delivery inclusion, and formalization of objective criteria.

Currently the FAA has four different documents which are inconsistent regarding subject areas, yet all deal with aviation maintenance technology training curriculum. The four documents are the current FAA regulation 14 Code of Federal Regulations (CFR) § 147 (Aviation Maintenance Technician Schools, 1962); aviation rulemaking advisory committee, final report (Thompson, 2008); the recent FAA notice of proposed rulemaking for § 147 AMTS (Aviation Maintenance Technician Schools, 2015); and the aviation certification standards aviation maintenance technician working group draft recommendations for AMT ACS (FAA, 2017). Imbedded in the ARAC final report and the NPRM are curriculum enhancements which include

provisions for distance education, competency based education, and a transition to college credits from “seat time” accountability.

Once a set of guiding criteria has been established, it will be possible for a group of aviation maintenance training experts to establish a model curriculum with specific course objectives for each subject area likely to be in the revision of 14 CFR § 147.

Background and Significance

The extraordinary demand for aviation maintenance technicians is necessitated by the projected growth of global economies and the anticipated delivery of tens of thousands of new commercial jetliners over the next 20 years. According to the 2016 Boeing Pilot and Technician Outlook “the aviation industry will need to supply more than two million new aviation personnel – 617,000 commercial pilots, 679,000 maintenance technicians, and 814,000 cabin crew.” (p. 1). This is in sharp contrast to the Bureau of Labor report that predicts minimal change over the next 10 years (Bureau of Labor Statistics, 2016), and a national study by Government Accountability Office (GAO, 2014) which found inconclusive evidence regarding anticipated demand for aviation maintenance technicians. This may be explained in part by the concern that the Bureau of Labor statistics do not distinguish from certificated or non-certificated aviation maintenance technicians (Ban, Jones, & Uselton, 2014), whereas Boeing and all other aviation employers typically hire and employ primarily FAA-certificated technicians.

The need for qualified technicians will be mitigated by increases in airplane reliability and maintenance inspection intervals; however, meeting the demand will require educational innovations. In North America, the technician demand is expected to be 127,000 as shown in Figure 1.

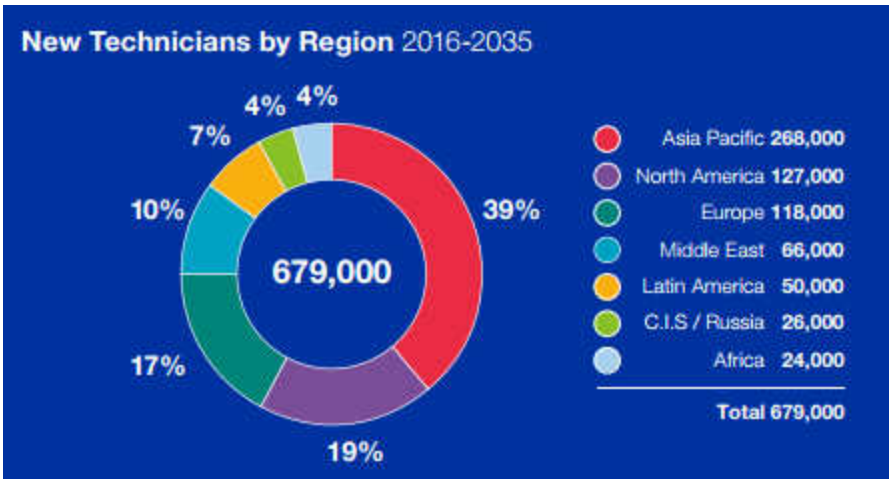


Figure 1. Technician Outlook: New Technicians by region 2016 - 2035. From *2016 Pilot and Technician Outlook,* by Boeing Commercial Airplanes, p. 8.

While Aviation Maintenance Technician Schools (AMTSs) have long been concerned about meeting the demand of the aviation industry, three factors have hindered this effort. The first and perhaps most far reaching impediment has been the outdated FAA maintenance technical school regulations. The study upon which the regulations were primarily based recommended that "the FAA establish a system to periodically survey this industry for the purpose of updating this curriculum" (Allen, 1966). The current regulation (14 Code of Federal Regulation (CFR) § 147) has not been significantly revised since 1970, including mandated hours of instruction or the curricular subject area requirements (ATEC, 2016). The aviation industry needs an educated and competent technician that can maintain modern aircraft, yet the AMTS have been forced (by FAA regulation) to teach students from a curriculum developed around the Douglas DC-6, including such specialized subjects as dope and fabric, aircraft welding, and pressure carburetors. These regulatory constraints have hindered educational innovation by mandating outdated material be covered and restricting such endeavors as competency-based and distance education initiatives (ATEC, 2016; Aviation Safety, (GAO), 2003; Goldsby & Soulis, 2002).

The second limitation has been the lack of industry support. Many aviation maintenance schools lack the funds to purchase new-generation aircraft and/or the resources to support them. This creates a disconnect between the older aircraft and components schools have available for instruction and the modern models and avionics systems students are expected to service on the job. "More than 90% of the critical skills that an aviation maintenance technician uses are acquired through on-the-job training (OJT)" according to Walter, (2000), a statistic that does not bode well of AMTSs, but serves to illustrate this disconnect.

The third impediment has been the misclassification of aviation maintenance technicians as unskilled workers. The Bureau of Labor Statistics' (BLS) Standard Occupational Classification system currently categorizes all aviation maintenance workers as "aircraft mechanics and service technicians" without regard to certification or specialization (ATEC; 2016, Ban, Jones, & Uselton; 2014, Watson, 2013). This has lead the BLS to project the AMT job outlook dramatically different than Boeing's projections "Employment of aircraft and avionics equipment mechanics and technicians is projected to show little or no change from 2014 to 2024" (Bureau of Labor Statistics, 2016).

Research Questions

1. What is the ideal common subject area groupings given the subject matter proposed in the three listed Federal documents?
    - Notice of Proposed Rulemaking (NPRM) on Aviation Maintenance Technician Schools, dated 10/02/2015.
    - Advisory and Rulemaking Committees Review § 147 (Aviation Maintenance Technician Schools Curriculum and Operating Requirements) dated 12/08/2008.

- FAA aviation certification standards (ACS) aviation maintenance technician working group draft recommendations.

2. What are the ideal credits and respective times associated with the selected courses derived from question 1 given the limitations of 1 college credit minimum, ~ 1900 hours, and the Carnegie unit guidelines?
3. What are the best objectives for each of the subject areas (and courses) identified above?

Research Question 1 (*What are the ideal common subject area groupings given the subject matter proposed in the three listed Federal documents?)* The subject areas from the three documents will be considered and finalized into one representative list that reflects the aviation maintenance training expert's recommendation. The subject areas will then be grouped as necessary (and recommended) to balance the basic assumptions inherent in designing a model curriculum.

Research Question 2. (*What are the ideal credits and respective times associated with the selected courses derived from question 1 given the limitations of 1 college credit minimum, ~ 1900 hours, and the Carnegie unit guidelines?)* A set of courses with respective college credits/clock hours will be drawn from the subject areas developed in response to research question 1. Minimum credits will be one of the considerations given state requirements at the certificate and associate degree level.

Research Question 3. (*What are the best objectives for each of the subject areas (and courses) identified above?)* Current objectives from 14 CFR § 147 appendices B, C, and D will be combined with the objectives from the ARAC final report and the ACS aviation maintenance technician working group draft recommendations, re-written and considered by subject area. The

group of aviation maintenance training experts will agree on the validity of each group of objectives.

The context for this research is the development of a model curriculum that will guide current (and future) AMTSs into the transition of providing a modern aviation maintenance technician training curriculum that can utilize college credits, competency-based learning, distance learning, and prepare for adaptations of simulations, augmented reality, et cetera.

Limitations

The researcher imposed the following limitations on this study:

1. The research included feedback from a small number of national aviation maintenance experts. For this study, experts were drawn from five groups or organizations and selected based upon their status as experienced aviation professionals with direct experience with 14 CFR § 147. Selection bias may have been an issue with regard to the § 147 network (Okoli & Pawlowski, 2004).
    (1) Members of the FAA § 147 aviation rulemaking advisory committee on aviation maintenance technician schools' curriculum and operating requirements.
    (2) Members of the FAA § 147 working group on implementing the ARAC recommendations that do not require specific rule change.
    (3) AMTS § 147 directors, coordinators, and/or faculty.
    (4) Aviation Technician Education Council current or past board members.
    (5) Former FAA inspectors with AMTS oversight.
    (6) Senior aviation maintenance technicians.

2. This survey research captured the recommendations of the participants after nearly a half century of static regulations governing aviation maintenance training during tremendous advancements in all aspects of aviation including glass panels, fly-by-wire aircraft, unmanned aerial systems, human factors, et cetera. While aviation is a dynamic field, some frustration stemming from governmental inaction regarding maintenance training may have affected the feedback and it is expected responses might vary in a less restrictive environment.
3. The feedback of participants may have been biased by their personal involvements with the FAA, institutional history, or educational preferences.
4. The written survey communicated limited information as it employed ratings and rankings which led to consensus. Any reasons for individual differences in opinions are beyond the latitude of this study.

Assumptions

The researcher assumed the following points to be true throughout the data collection and analysis for this study:

1. Participants would draw upon their background and experience dealing with the FAA and 14 CFR § 147 aviation maintenance technician schools and aviation maintenance training and promote their informed opinions of the relevant concerns inherent in developing a model curriculum. Their responses would constitute their personal viewpoint.
2. Aviation industry professionals would make recommendations based upon their content knowledge and the information and skills that technicians would need to be productive. Aviation education professional would make recommendations

based upon their knowledge of the industry needs, institutional concerns, and experience with student knowledge and skill retention and transfer (Day, Arthur, Jr., & Gettman, 2001).

3. The recommendations of all of the participants would be equally important. Each expert would have a minimum of 10 years of aviation industry or educational experience and their recommendations would apply equally to a model curriculum.
4. The content and design of the model aviation maintenance training curriculum may vary in emphasis with the physical location and particular institution. Participants will successfully represent the minimum training requirements necessary to develop the knowledge and skills required for an entry level aviation maintenance technician.

Procedures

The researcher's goal was to design a model aviation maintenance technology curriculum that would meet the needs of the aviation industry and the educational institutions that provide technician training while providing guidance to the FAA in developing regulations to support modern aviation maintenance training. The research was conducted concurrently with many AMTSs considering how to implement the changes implied by the FAA NPRM for § 147 and the FAA's finalizing (and hopefully harmonizing) 14 CFR 147 regulations, developing Advisory Circular 147-3C, rewriting Operational Specifications, and FAA Order 8900.1 Flight Standards Information Systems (FSIMS). This descriptive study utilized surveys consisting of quantitative ratings and feedback to answer the research questions. Aviation industry experts, AMTSs directors and coordinators, ATEC board members, and former FAA inspectors with § 147

oversight will likely produce varying recommendations. According to Green (2014), "Delphi studies have been useful in educational settings in forming guidelines, standards, and in predicting trends" (p. 1).

A panel of 30 aviation experts were recruited for this study. Twelve aviation industry members, including seven who had previously served on the ARAC with no direct AMTS affiliation, fifteen AMTS directors/ coordinators/ and/or faculty, five who served on the ARAC, and three former FAA inspectors with § 147 oversite were selected. All of the participants had a minimum of 10 years of aviation background and in addition to the participants who were involved in the ARAC, many had served on the FAA § 147 working group, and/or served on the ATEC board of directors. One research expert was recruited to help interpret data from the surveys, verify the results, and insure reliability. This individual had considerable expertise with survey data.

Various state regulations regarding certificate and associate degree programs, definitions of the Carnegie unit, former FAA guidance on distance education, and a recent roundtable discussion with the FAA on competency-based education were consulted regarding the basic assumptions to be considered. A review of literature on trends and best practices regarding these items and implementation in the European Aviation Safety Agency (EASA) was then performed (Guidelines and recommendations on eLearning, 2013). The information from these resources were considered and developed into the queries to develop the working curriculum model assumptions providing the framework and focusing future discussions. The World Wide Web was utilized to facilitate "(1) convenience, elimination of paperwork and mailings, and (3) an attempt to utilize current technology…" (Colton & Hatcher, 2004).

In addition to soliciting demographic information from the participants, the round one questionnaire surveyed the basic assumptions necessary to determine the framework for the model curriculum. One of the first assumptions considered concerned the translation of 1900 hours into a minimum number of college credits, based primarily on the Carnegie Unit. References to scholarly articles were provided for the participants' consideration. Given state and college guidelines, limiting course offerings to a 1 credit minimum, along with inclusion of asynchronous distance delivery flexibility and competency-based education was also ranked. The FAA's current regulation, 14 CFR § 147, the ARAC final report, the FAA's NPRM on § 147, and the ACS aviation maintenance technician working group draft recommendations were considered for guidance on the selection of the most appropriate subject areas to be included in the model curriculum. One final assumption was queried, based on the FAA utilization of odd numbered course consideration. Participants were given the opportunity to add their own suggestions for each of the queries and add any relevant assumptions they felt should be included to establish a model curriculum. The questionnaire was available to participants using SurveyMonkey (Gill, Leslie, Grech, & Latour, 2013, Thompson, Lewalle, Sherman, & Hibbert, 2009) initially and an email was sent to each participant with a link and instructions (and reminders as necessary) to complete the survey within two weeks. The researcher then collected, collated, and ranked the responses.

The survey for round two included how the subject areas should be classified into sections and how credits might be distributed based upon the minimum number of credits derived from round one. Traditionally, the FAA has utilized five sections, general, airframe structures, airframe systems and components, powerplant theory and maintenance, and powerplant systems and components. The participants were asked to consider the traditional

section classification along with three other options, namely (1) general, airframe, and powerplant (as put forward by the ARAC final report, (2) general, airframe, powerplant, and combined systems and components (which would include subject areas common to both airframe and powerplant (fuel, fire, instruments, and electrical systems), and (3) the traditional classification with the addition of a combined systems and components section. Additionally, round two consisted of establishing the subject areas drawn from the ARAC final report, the FAA NPRM, and the FAA airmen certification standards draft document. While there has been some consensus between these three documents, there are areas of disagreement, specifically with regard to titles and depth of coverage. There are nine subject areas in the general, five in the airframe, and four in the powerplant that require resolution between the reference documents. That's 18 subject areas unresolved out of a possible 44 or slightly over 30 percent of the subject areas that required consensus before a model curriculum could be established. A document comparing the subject areas utilized in the three referenced documents was prepared with shaded areas depicting areas of non-agreement, illustrated for the respondent's reference. Similar to round one, participants had the option to include alternate suggestions. The researcher collected, collated, and ranked the responses.

Round three of the survey consisted of combining similar subject areas and establishing the subject area times and credits that will comprise the curriculum. The survey instrument was switched from SurveyMonkey to Qualtrics Survey Software for round 3 and subsequent rounds to minimize the restriction of ten survey questions inherent in the basic SurveyMonkey option. The participants were asked to select whether or not specific subject areas could be combined for the Model AMT curriculum. Subject areas that were agreed upon in the previous round were utilized and comprised of eleven combinations of proposed similar subject areas with the option

for experts to add or modify those suggestions. The participants were encouraged to keep in mind the basic assumptions derived from round one and consider a sample model of an AMT curriculum with suggested specific times for theory (lecture), lab, and credits, utilizing the block times (course hours and credits) derived from round two. Courses that could be taught by distance delivery were color coded in blue and comprised slightly over one half of the curriculum. In addition to presenting the entire model AMT curriculum for review, the curriculum was separated into three sections, general, airframe, and powerplant for participant's approval, disapproval, or modification. The results of round three included the finalized subject areas combinations and times. As before, the researcher collected, collated, and ranked the responses.

Round four consisted of establishing the course titles that will comprise the curriculum. There were three distinct categories that the subject areas fall into: (1) many of the single subject areas lend themselves to course titles. Little disagreement was found with these 11 areas. (2) Five combinations of subject areas were determined to fall into a similar category with the combinations of areas lending themselves to a course name. (3) A new name was needed for seven somewhat esoteric combinations. In some cases, the predominant name of the course could be used, whereas in other it made more sense to select a descriptive combination. Participants were requested to approve or disapprove the course titles with the option of providing alternative suggestions. Edits were made to the list of course titles based on the results of the vote, comments on the voting ballot, and correspondence.

Objectives for each subject area were the focus of the final round. Criteria for each type of objective were presented as follows (Morrison, Ross, Kemp, & Kalman, 2010). For behavioral objectives, the criteria will include an action verb, subject content reference that describes the

content addressed by the objective, the level of achievement, and conditions of performance. Cognitive objectives will include a statement of general instructional objective and one or more samples of the specific types of performance that indicate mastery of the objective. Psychomotor domain objectives will consist of an action verb, subjective content reference that describes the content addressed by the objective, the level of achievement, and the conditions of performance. The last type of objective, affective domain objective specifies behavior indirectly by inferring from what the instructor can observe such as identifying the cognitive component or thought that describes the attitude or identifying a behavior that when observed would represent the attitude. Upon conclusion of this round, a complete set of objectives was available. As before the researcher collected, collated, and ranked the responses.

Definition of Terms

The following definitions are included to provide a clear and concise understanding of terms used throughout this study.

Alternate Delivery: The combination of multiple approaches to learning that is facilitated by the effective use of different modes of delivery and training resources.

Blended Delivery: The combination of multiple approaches to learning that is facilitated by the effective use of different modes of delivery and training resources

Competency-based Education: Refers to systems of instruction, assessment, grading, and academic reporting that are based on students demonstrating that they have learned the knowledge and skills they are expected to learn as they progress through their education.

Competency-Based Training: Training delivered and evaluated based upon the amount of training each individual needs to achieve “mastery” of required tasks. Competency may be achieved at different rates for different people and the amount of elapsed time between training

events that competency is maintained also varies individually and must be considered. Competency-based training varies from prescriptive training in that it recognizes that one size cannot fit all.

Data Collection and Feedback: Data collection and analysis assesses the skill and knowledge of the individual and crew and monitors the health of the training program. The data element provides a continuous feedback loop allowing for rapid adjustments when performance indicators warrant action and, in conjunction with other factors, helps determine the correct intervals between training events.

*Distance Education***:** Distance education courses that require physical on-site participation for any reason (i.e., taking examinations) can be referred to blended or hybrid courses of study. Distance learning is known by other terms such as e-learning, home study, self-guided training, virtual classroom, distributed training, computer-based training (CBT), web-based training (WBT), and others.

*Distance learning***:** A method of delivering education and instruction, often on an individual basis, to students who are not physically present with an instructor in a traditional setting such as a classroom. Distance learning enables participation access to learning when the source of information and the learners are separated physically by time, or distance, or both. (FAA Order 8900.1, 2-1448, 2015).

Knowledge Levels A - Be Familiar: Familiar with basic facts, terms/principle elements of the subject. Instruction by classroom, blended, or distance learning as approved.

Knowledge Levels B – Knows: Knows general principles, facts, and terms about the subject. Can explain the basic operation of component/system/concept. Instruction by classroom, blended, or distance learning as approved.

Knowledge Levels C – Understands: Understands the principles, facts, and terms about the subject. Can apply this understanding to the subject to the subject and troubleshoot/analyze/resolve problems. Instruction by classroom, blended or distance learning as approved.

Instructional Hour: The educational unit hour, as used by an AMTS, that consists of a time period of 50 to 60 minutes. This instructional time period conforms to the existing practices at many education institutions.

Skill Level 1 – No Skill: No skill demonstration required.

Skill Level 2 – Competent: Be able to find and interpret maintenance data and information, and perform basic operations using appropriate data, tools, and equipment. Limited practical application.

Skill Level 3 – Proficient: Perform skill operations to a simulated return-to-service standard using appropriate data, tools, and equipment. Maintenance and inspections are performed in accordance with acceptable or approved data. High degree of practical application.

Teaching Level 1:

1. Knowledge of general principles, but no practical application.
2. No development of manipulative skill.
3. Instruction by lecture, demonstration, and discussion.

Teaching Level 2:

1. Knowledge of general principles, and limited practical application.
2. Development of sufficient manipulative skill to perform basic operations.
3. Instruction by lecture, demonstration, discussion, and limited practical application.

Teaching Level 3:

1. Knowledge of general principles, and performance of a high degree of practical application.
2. Development of sufficient manipulative skills to simulate return to service.
3. Instruction by lecture, demonstration, discussion, and a high degree of practical application.

Train to Proficiency: Train to proficiency provides for the variations of individual learning rates. It allows for additional exposure to task until the mechanic is proficient and competency is achieved.

Unit Instructional Hour: When the classroom method of delivery is utilized, instruction unit hour shall not be less than 50 minutes in length. When an alternative method of delivery is utilized, the instructional period is the time necessary for the learning objective (knowledge, skill, performance) to be accomplished by the student under instruction.

Summary and Overview

Directors, coordinators, and instructors in aviation maintenance technician schools spend a great deal of time and effort redesigning the curriculum mandated by the FAA in 14 CFR § 147. To date there are 178 AMTSs, each with their own individual curriculum with great variation. The only two exceptions are the Aviation Institute of Maintenance which operates 11 AMTSs from Chesapeake, Virginia to Oakland, California and maintains the same curriculum throughout (D. Wiggins, personal communication, September 30, 2016) and Pittsburg Institute of Technology which operates three AMTSs with identical curriculums (G. Holye, personal communication, September 30, 2016). The FAA has requested a model curriculum (K. Morgan, personal communication, April 12, 2016) and is in the middle of a regulatory revision to § 147

(Aviation Maintenance Technician Schools, 2015). The development of this model aviation maintenance technology curriculum has the potential to provide major guidance to the FAA prior to the regulatory release slated for the late 2017 and a starting point for AMTSs administrators to develop a better training curriculum adaptable to the 21st century needs of the aviation community.

In Chapter II of this study a review of literature focused on the advantages of distance learning including the challenges presented by the FAA and competency-based education, especially as applied to technical instructions. Trends in these areas, especially with regard to EASA § 147 training schools were examined and evaluated for adaptation in this country. Recommendations from the Aviation Technician Education Council (ATEC) and European Aviation Maintenance Training Committee (EAMTC) were also presented.

Chapter III presents the methods and procedures employed to develop the model aviation maintenance technology curriculum. The background of the aviation expert participants and their enlistment are covered. The researcher outlined the data to be collected and the methods employed in its compilation. Details of the Delphi method as a research tool in educational research and the design of each round of surveys will also be presented.

Chapter IV presents the results from each round of the study and the conclusions reached by the research. The results are supported by the data which will be detailed for review.

Chapter V provides an appraisal of the study as a whole, detailing the design and selection criteria of the individual subject areas, section selection, clock and credit hour breakdown and totals. The researcher used the results to present conclusions and recommendations for implementing and modifying this curriculum into an AMTS.

CHAPTER II

REVIEW OF LITERATURE

One of the unique aspects of aviation maintenance education is the regulatory impact mandated by the government. In this country, the certification of mechanics is controlled by 14 CFR § 65 and mechanic training requirements are set forth in 14 CFR § 147.Essentially there are three considerations that an AMTS must consider when setting forth a training curriculum. First there is the regulation (14 CFR § 147) that must be met before the FAA will certify a school. Second there is the aviation industry that requires certificated individuals who are able to return aircraft to service and further perform the duties required of maintenance technicians. Third there are the institutional, state, and accrediting agency guidelines that must be adhered to. The focus of this study is to develop a model aviation maintenance technician training curriculum that will be in compliance with anticipated FAA regulations as evidenced by the FAA notice of proposed rulemaking and FAA draft airmen certification standards. Additional considerations were to be given to generic state, school, and accrediting body guidelines.

This review of literature will cover topics on the use of the Delphi method in educational research, distance learning, and competency-based education in technical education, with regard to aviation maintenance training. The purpose of this chapter is to present the reader with a contextual understanding of the Delphi method and how distance and competency-based education can be incorporated into the model curriculum. A review of distance education is provided along with a definition of distance education and distance learning. Competency-based education will be covered as it applies to specific FAA regulations.

Distance education

The theory of distance education is delineated in the following definition by Simonson, Smaldino, Albright, & Zvacek (2014): "Distance education is defined as institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors" (p. 32). This definition includes four major elements: 1) the concept that distance education is institutionally based; 2) the teacher and student are separated, usually by both time and geography; 3) interaction, while a critical element, is extended to the material, teacher, and other learners; and 4) interactive telecommunications is broadly defined to include communication with all forms of media from non-electronic to electronic telecommunication systems.

The definition of distance education noted above contrasts sharply with the FAA's definition, and until recently, did not differentiate between distance education and distance learning. According to Keegan (1996), "'Distance education' is a suitable term to bring together both the teaching and learning elements of this field of education. The relationship of 'distance teaching' and 'distance learning' may be illustrated as shown in Figure 2."

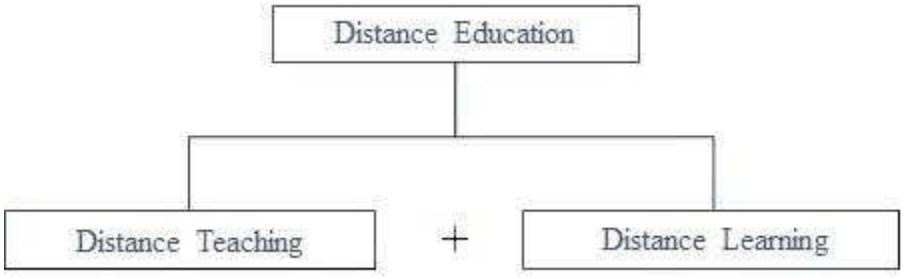


Figure 2. Relationship of distance teaching to distance education. From *Foundations of Distance Education,* by D. Keegan, 1996, p. 38.

Cohen, Eimicke, Kamlet, and Pearson (1998) note that most literature defines distance education "as an approach to learning in which:

- teacher and learner are separated by space and/or time;

- the interaction between teacher and learner takes place via a technology link; and
- students are evaluated by an educational organization." (p. 180)

This definition is in keeping with the literature (Keegan, 1996; Moore, 2013; Moore & Kearsley, 2011) and includes popular elements with which most students, both current and prospective, would agree.

Purpose

One of the few changes the FAA granted in the previous half century was to allow computer-based training within Aviation Maintenance Technician Schools (AMTSs), following a Notice of Proposed Rulemaking (NPRM) in 1992 (Federal Register, 1992). While there has been a tremendous increase in the distance delivery of general coursework nationwide, aviation maintenance training has not embraced this trend. The FAA has provided these official definitions:

> **Distance Education.** Distance education courses that require physical on-site participation for any reason (i.e., taking examinations) can be referred to as blended or hybrid courses of study. Distance learning is known by other terms such as e-learning, home study, self-guided training, virtual classroom, distributed training, computer-based training (CBT), web-based training (WBT), and others.
>
> **Distance Learning.** A method of delivering education and instruction, often on an individual basis, to students who are not physically present with an instructor in a traditional setting such as a classroom. Distance learning enables participation access to learning when the source of information and the learners are separated physically by time, or distance, or both. (FAA Order 8900.1, 2-1448, 2015).

The FAA currently allows distance education for the operations (i.e., pilot) side of the agency, according to FAA Order 8900.1 Flight Standards Information Management System (FSIMS), Volume 3, Chapter 56, Section 6 (2015):

> Besides the proven effectiveness of modern training products, distance learning affords a low-cost alternative to classroom ground training, an alternative that is timely and appropriate in today's challenging economic environment. The use of new technology and alternative training methods can, and often does, improve the quality of training. However, alternative training must meet or exceed the training standards that it is intended to replace.

There is reason to be hopeful. Not only did the FAA release Advisory Circular (AC) 147-3B (2015), containing Appendix 11, "Alternative to Classroom Training," which details how an educational entity can be approved during or after initial 14 CFR § 147 Aviation Maintenance Technician School Certification, but this language is likely to be encapsulated in the revision AC 147-3C. The essential criteria for distance learning include the following:

(1) How the distance learning program will be administered;

(2) A description of the examination and testing process;

(3) Methods for ensuring the integrity of student work and compliance with FAA minimum standards, as listed in §147 appendices A, B, C, and D;

(4) Procedures for proctoring computer-based exams in a remote location;

(5) Procedures to ensure distance learning course records are kept in compliance with the approved curriculum;

(6) A description of the technology hardware and software to be utilized;

(7) Proper identification of courses available through distance learning;

(8) A sophisticated electronic Learning Management System (eLMS) to track all aspects of the distance learning program, including attendance, participation, and performance (including comparisons to traditional classroom test scores and completion rates); and

(9) FAA "read only" access to the eLMS (to facilitate surveillance). (Appendix 11, 1-3).

While the FAA has issued this AC, guidance for the principal maintenance inspectors (PMI) and principal avionics inspectors (PAI), to approve distance education as published in FSIMS is contradictory, does not follow the AC, and consequently a hiatus still exists throughout much of the nation. The representative inspectors at the Flight Standards District Offices (FSDO) of the FAA have been given the directive that "Initial implementation of distance learning by an AMTS should be approved cautiously" (FAA Order 8900.1, 2015).

Coincidentally, two AMTS programs have been approved for distance learning at this time, Spartan College of Aeronautics and Technology has been approved for the asynchronous distance delivery of their lecture-based curriculum (R. Goertzen, personal conversation, February 10, 2016) and Blue Ridge Community College (BRCC) for synchronous distance delivery of part of their curriculum (Dyen, 2016).

Over the past 30 years online education has become a major force in higher education, with phenomenal growth rates (Allen & Seaman, 2010; Lokken, 2008; Pew Research Center, 2011). The effect on educational institutions has been dramatic with many faculty and administrators scrambling to meet the increasing demand for online courses. In fact, one of the most significant changes to education in the last decade has been distance education (Simonson, 2012). Several impediments to online distance education have centered on the lack of preparation

of the student to engage in distance learning and questions concerning the integrity of assessment. Learners require not only technical proficiency, but also motivation to succeed in distance delivered courses (Simonson, Smaldino, Albright, & Zvacek, 2003; Willis & Lockee, 2004).

Since student motivation has a powerful effect on attrition and completion rates according to Friedman and Mandel (2011), one aspect of successful distance education should precede enrollment: learner readiness. One of the quickest ways to demoralize a student, destroy their motivation, and set them up for failure is to place the learner in a position they are totally unprepared for and unlikely to succeed. All too often this is exactly what happens with new distance education students in our colleges and universities today. Many prospective students lack independent learning skills in addition to lacking technical expertise that is required by most online courses (Berge, 1998; Dupin-Bryant, 2004).

In addition to quality instruction and student preparedness, another factor in successful online courses is student engagement. Numerous studies have produced conclusive evidence that distance delivery is capable of providing effective instruction (Blackwood & Trent, 1968; Clark, 1989). According to Moore, Thompson, Quigley, Clark, & Goff, 1990) distance education using interactive electronic media is effective, as measured by achievement, attitude, and cost-effectiveness. In the case of aviation maintenance, with a limited number of aviation maintenance technician schools located only within the U. S., the cost effectiveness of distance education becomes self-evident. Specific evidence of educational effectiveness and learner perceptions and attitudes remains to be determined.

Distance education compels the student to take on considerable responsibility for their own learning. Each student must log onto the online classroom as an individual. Once logged in,

learning guidance is provided and interaction assured from the instructor and other learners, however, without intense individual interest and intrinsic motivation, engagement and learning are likely to diminish (Bye, Pushkar, & Conway, 2007). Satisfied learners report higher levels of participation, motivation, and learning gains (Allen, Burrell, Bourhis & Timmerman, 2007; Gallager-Lepak, Reilly, & Killion, 2009; Young & Bruce, 2011).

Faculty are reluctant to teach online courses without some assurance of honesty by the online learners. This factor has been handled in two primary ways in the past. Virtually all schools have developed academic honesty policies with various methods of monitoring and enforcement resulting in minimal success and centered on the honesty of the individual learner. Additionally, schools have engaged in establishing an extensive network of proctors that will administer course assessment on site under stringent guidelines laid out by the host institution. While not ideal, the combination of these methods has provided a mechanism for continued operation.

While the value and legitimacy of online education is generally uncontested (U.S. Department of Education, 2009), the following concerns continue to arise: (1) who is actually taking the course, learning the material, submitting the work, and completing the assessments; and (2) are unauthorized resources accessed during assessments, such as cell phones, textbooks, Google searches, class notes, etc.? Cheating has been considered a serious problem by teachers and educational administrators since time immemorial, but more so since the rapid growth of informational technology. Since Whitley (1998) found that over 70% of college students reported cheating during their postsecondary education, numerous studies (Miller, Shoptaugh, & Wooldridge, 2011; Salahi Yekta, Lupton, & Maboudi, 2011; Yazici, Yazici, & Erdem 2011)

indicate the problem has not diminished in subsequent years, nor is academic dishonesty restricted to this country.

There are three technological approaches to remote proctoring that attempt to address the concern of assuring academic integrity. The first approach can be found in commercial testing services such as Computer Assisted Testing Service (CATS) or PSI Online (formerly LaserGrade). These two are the only testing services approved by the FAA for knowledge tests. While either of these or similar testing centers have safeguards that can assure integrity, they add additional expense, require alternate transportation and time commitments that diminish many of the advantages of online distance education. These two providers have been vetted by and selected by the FAA for the complement of written tests that were formerly administered at FAA Air Carrier District Offices (ACDOs), FSDO, and General Aviation District Offices (GADOs).

The second approach is available from a variety of firms including Software Secure, and Kryterion, Inc. Software Secure incorporates a two-fold learner authentication procedure, a browser lockdown product and a 360 degree web camera with microphone that captures the entire assessment experience in a recording of video and audio. In addition to providing a reviewable monitoring system, Software Securexam incorporates a "suspicious events" algorithm that captures audiovisual clips of suspicious activity during any assessment and makes this available as a separate recording. The learner is authenticated by use of a snapshot of the individual along with a fingerprint prior to commencing the assessment. This is a pedagogically and philosophically sound approach as noted by Dunn, Meine, & McCarley, (2010) and Cole, Cocran, & Troboy, (2010), endorsed by multiple institutions, but prohibitively expensive. Kryterion, Inc. utilizes authentication via facial recognition software, keystroke rhythms, and a webcam that captures a limited view of the learner. The limitations inherent in the keystroke

analytics and the limited field of view provided by a conventional webcam are acceptable limitations from my perspective, cost effective for the student, and endorsed by Distance Education Subgroup 2, § 147 Working Group (S. Douglas, personal communication, January 18, 2012).

The third approach is championed by the majority of colleges and universities throughout the country and involves using existing testing centers. The advantage of utilizing an existing testing center is the minimization of expense to the student. For example in the Virginia Community College System (VCCS), which has 23 colleges on 40 campuses across the Commonwealth, there is no charge to a VCCS student at any one of the 40 testing centers. Given the limitations of the remote proctoring software currently available coupled with the increased cost to the student, many community colleges have elected to eliminate the computer remote proctor option for written and practical testing centers, or testing centers located at other schools, colleges, and universities, and/or libraries.

The focus of research in distance education has shifted to a more learner-centered approach (Simonson, Schlosser, & Orellana, 2011). This trend coupled with distance education research that is theory-based and methodologically sound (Simonson, 2012, Hirumi, 2005), has promoted the acceptance of distance education and its increased credibility. One of the more definitive studies (Means, Toyama, Murphy, Bakia, & Jones, 2009), stated, ‘‘The meta-analysis found that, on average, students in online learning conditions performed better than those receiving face-to-face instruction’’ (ix).

Barriers to distance education

While not all AMTSs will be interested or capable of providing a distance education option, many will be able to take advantage of this educational avenue, provided the model curriculum is carefully crafted to lend itself to distance learning. It is critical to note that the

number of §147 AMTS had decreased from 220 schools in 1993 (McGrath & Waguespack, 1999) to the current total 0f 178. According to Berge and Muilenburg (2000), the strongest barriers to distance education, from a delivery perspective, in order were:

1. Increased time commitment.
2. Lack of money to implement distance education programs.
3. Organizational resistance to change.
4. Lack of shared vision for distance education in the organization.
5. Lack of support staff to help course development.
6. Lack of strategic planning for distance education.
7. Slow pace of implementation.
8. Faculty compensation/incentives
9. Difficulty keeping up with technological changes.
10. Lack of technology-enhanced classrooms, labs, or infrastructure. (3-4)

It is interesting to note that the most significant barrier to aviation maintenance distance education did not make Berge and Builenburg's top 10 list, specifically - outside agency (FAA) resistance. Chen (2009), similarly found that items two, one, and eight (in the list above) were primary barriers to the implement of distance education by institutions.

In addition to barriers that arise from an educational provider, individual learners face obstacles in distance education classes as well. While distance education is very likely the fastest growing area of education, it provides significant challenges, especially for the student unfamiliar with the process (Fojtik, 2015). Correlation studies by Middlesex Community College, Argosy University, J. Sargeant Reynolds Community College, and North Central Michigan College (SmarterMeassure, 2015) and Geiger, Morris, Suboez, Shattuck, and Viterito

(2014) indicate a significant relationship between the factors evaluated by the SmarterMeasure™ assessment tool and student success indicated by course completion and final course grade. Two major differences exist between these correlation studies and this study: 1) the previous studies considered students in a wider range of courses, and 2) there was no minimum score required of participants limiting enrollment in selected courses. In an effort to minimize individual learner barriers, the two AMTs that have been approved by the FAA to teach specific subjects using distance education (Spartan College of Aeronautics and Technology and Blue Ridge Community College) have elected the SmarterMeasures assessment to eliminate unprepared students as well as foster better preparation for students admitted into the distance learning AMT program. Along the theme of improving distance learning for the learner, Garrison, Anderson, and Archer (2000) developed a Community of Inquiry framework based on how generative learning can enhance instruction and improve learning in a distance environment.

Competency-based Education

For years the aviation industry has lamented the perceived poor preparation of AMTS graduates. Additionally, the AMTS have complained about the micromanagement by FAA Principal Maintenance Inspectors (PMIs) and Principal Avionics Inspectors (PAIs) that spend the majority of their surveillance time checking and cross-checking attendance records.

The common denominator in all these changes is the need to have an adaptable aviation maintenance training system that will not only maintain but greatly improve the competency of the initial AMTS graduate. To accomplish this challenging goal, it is necessary to examine maintenance training in the context of both the current time-based philosophy as well as emerging changes in system educational philosophy. Modernized approaches to aviation

maintenance training systems, policies, and procedures can then be examined and a mitigation strategy devised.

Current regulatory and system environment for maintenance training

FAA Advisory Circular 120-16F (Allen, 2012) noted "studies have shown that it may be better to train to a competency-based standard (§ 10-7). The previous year, the FAA published their report on training hours requirement review (Babbitt, 2011) which delineated the following definitions:

> **Competency-Based Training:** Training delivered and evaluated based upon the amount of training each individual needs to achieve "mastery" of required tasks. Competency may be achieved at different rates for different people and the amount of elapsed time between training events that competency is maintained also varies individually and must be considered. Competency-based training varies from prescriptive training in that it recognizes that one size cannot fit all.
>
> **Train to Proficiency**: Train to proficiency provides for the variations of individual learning rates. It allows for additional exposure to task until the mechanic is proficient and competency is achieved.
>
> **Data Collection and Feedback:** Data collection and analysis assesses the skill and knowledge of the individual and crew and monitors the health of the training program. The data element provides a continuous feedback loop allowing for rapid adjustments when performance indicators warrant action and, in conjunction with other factors, helps determine the correct intervals between training events.

The FAA aircraft mechanic's oral and practical test(s) are outcome-based examinations. Before being issued any airframe and/or powerplant certificate, all applicants must demonstrate the

minimum level of knowledge and skills for the certificate or rating sought. Skill tests are significant as they measure the applicant's ability to logically think and objectively apply their knowledge, while demonstrating the physical skills that enable them to carry out aircraft maintenance in a professional and safe manner. Satisfactory demonstration of each skill test is evidence the applicant meets the acceptable degree of competency for the certificate or rating sought (FAA, 2012).

Compliance with these procedures makes certain that airman applicants meet a satisfactory level of competency and workmanship required for certification. Every applicant is required to demonstrate a minimum satisfactorily competency level, regardless of their previous education background. The adoption of competency based training by an AMTS would allow the training and the practical test standards to align.

Obstacles to improved maintenance training

The debate on aviation maintenance education and training between the FAA, industry, and AMTSs has too often been concerned with structures and delivery with little concerned over content and outcomes. Foremost among the obstacles is the pace of change when employing conventional rulemaking approaches to solve aviation safety issues. Rulemaking processes in the FAA are cumbersome and time consuming as a result of administrative requirements prescribed under law. In an era where flight technology product cycle times are measured in months, rulemaking cycle times measured in years do not provide an effective tool. For example, the major revision to Title 14 Code of Federal Regulation (CFR) § 147 has been a nine-year undertaking from conception to the present and, as yet there is no new rule. (2007-2016).

On the other hand, there are other effective tools for creating guidelines, standards, and certification methods within the scope of the current CFRs. For example, conventional tools such

as advisory circulars (AC), practical test standards (PTS), and other methods already exist. Additionally, the FAA and Industry § 147 Aviation Rulemaking Advisory Committee (ARAC) Recommendations Review Team looked at the ARAC recommendations and determined which recommendations would not require rule change. This approach was used to create the framework for distance education and the development of operations specifications for § 147. Even current non-regulatory tools such as AC's and PTS's have limitations.

Another obstacle to changing the current maintenance training approach is the resource constraints faced by FAA in undertaking major new initiatives. The agency is faced with increasing requirements and slow or no resource growth. In this instance the solution is based on a partnership with industry and other organizations and greater leverage of existing resources. For example, with respect to research needs the FAA can take advantage of its own general aviation center of excellence (COE) program.

The participation of the aviation maintenance training community will be crucial in implementing change in maintenance training. The difficulties in dealing with a variety of educational institutions is mitigated, however, by the fact that they are all inspected at least every year. Additionally, many of the FAA-approved AMTSs are members of the Aviation Technician Education Council which has developed a good relationship with the FAA and provides a means to reach many of these institutions with educational materials or other tools.

Finally, it must be recognized that communicating a new training approach to the general aviation community at large may be difficult and may meet with cultural or other resistance. In this case the opportunity rests with challenging the community to engage in partnership with the FAA to create a new construct. There are many organizations that the FAA will work with in taking the first steps and in developing incentives for the larger general aviation community to

benefit from change. The following material will outline an approach for creating even more flexible and timely methods.

The FAA proposes to include an option for competency-based training utilizing minimum credit hours based on typical higher education accreditation criteria. The minimum number of credit hours (equivalent to 1,900 training hours) would total 43 credit hours. This would be the combined credit hours for Airframe and Powerplant requirements, which include a minimum of 10 credit hours for the General curriculum, 18 credit hours for the Airframe curriculum, and 15 credit hours for the Powerplant curriculum. Each school would have the option to be approved for either an instructional hour curriculum or a credit hours curriculum, but not both.

Essentially, competency-based or personalized learning in aviation maintenance training would realize a transition away from seat time, in favor of a structure that creates flexibility, allows students to progress as they demonstrate mastery of academic content and manipulative skills, regardless of time, place, or pace of learning. Competency-based strategies provide flexibility in the way that credit can be earned or awarded, and provide students with personalized learning opportunities. These strategies include online and blended learning, dual enrollment and early college high schools, project-based and community-based learning, and credit recovery, among others. This type of learning leads to better student engagement because the content is relevant to each student and tailored to their unique needs. It also leads to better student outcomes because the pace of learning is customized to each student.

By enabling students to master skills at their own pace, competency-based learning systems help to save both time and money. Depending on the strategy pursued, competency-based systems also create multiple pathways to certification, make better use of technology,

support new staffing patterns that utilize teacher skills and interests differently, take advantage of learning opportunities outside of school hours and walls, and help identify opportunities to target interventions to meet the specific learning needs of students. Each of these presents an opportunity to achieve greater efficiency and increase productivity.

FAA Approval Considerations

Although 14 CFR § 147 AMTS curriculums historically have provided a specified number of maintenance training hours to ensure students have the competencies needed for their jobs, studies have shown that it may be better to train to a competency-based standard. Competency based training this type of training does not depend on a defined schedule or for a specific number of hours. Rather, each individual is evaluated on what training he or she needs based on approved curriculum content and FAA (Airman Certification Standards (ACS). These evaluations standards are then used to identify those personnel who retain a high level of subject competence and who may not require a particular block of instruction. Conversely, those individuals who require more training can also be identified using the same criteria. Training to competence permits you to tailor training programs to the specific requirements of the individual student and curriculum requirements.

The AMTS should use competency-based training to raise a student's level of competence to that level required by the FAA curriculum and applicable FAA Practical Test Standard (PTS). The AMTS must have documented procedures to determine when an individual is enrolled in competency based training and the AMTS must determine the need for this type of training through pre- or post-student testing evaluation.

If an AMTS elects to utilize competency-based training, it should specifically address any lack of competence by an enrolled student and provide for additional training in those areas

of demonstrated deficiencies. In some instances, competency-based training may consist of an appropriately authorized instructor reviewing individual student's performance (PTS) and knowledge test in the specific areas of the FAA required curricula content.

Competency based training may focus on one individual or a small group. An AMTS may use competency based training in all areas of the FAA approved curriculum requirements based on an individual, or groups mastery of the specific FAA Airman Certification Standard (ACS) as aligned to the 147 approved corresponding curriculum requirement. For those circumstances where an AMTS identifies a competency deficiency through the competency based training evaluation of the students or group of students ACS mastery requirements, the AMTS must show how a student or group of students will be reintroduced to the FAA approved curriculum and ACS standards. The AMTS should orient competency improvement training toward correcting personnel competence deficiencies that have been identified through the approved curriculum testing process and ACS standard evaluations.

A sample § 147 AMTS Competency-based procedure for a typical course in Ignition and Starting Systems is depicted in Figure 3 as a summation of the competency-based course in a pictorial view. Perhaps the most important change to the curriculum centers on the basis of assessment from content and skills to skills and underpinning knowledge (Smith, 2010).as defined by the latest iteration of the ACS.

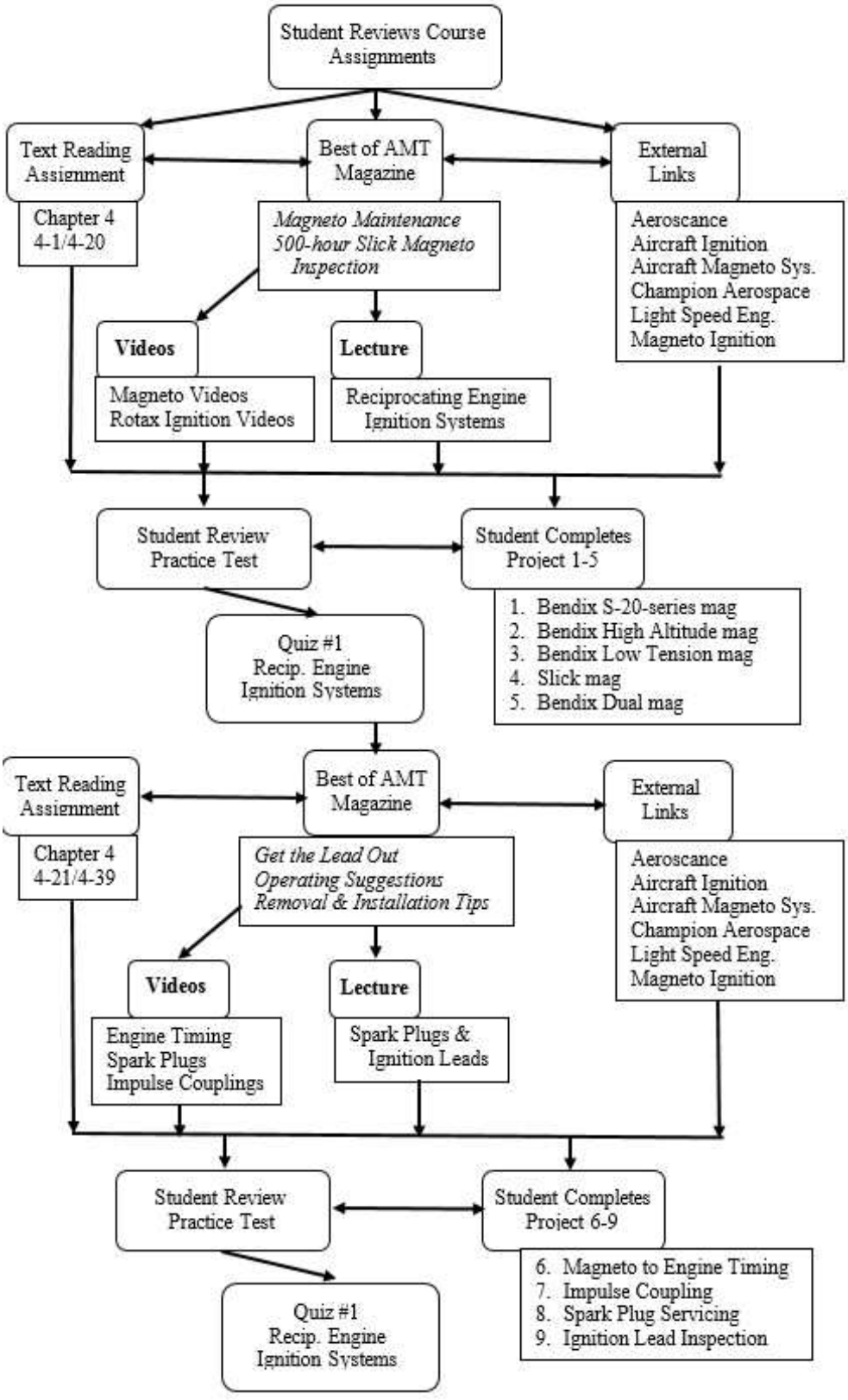


Figure 3. § 147 Competency-based flowchart for ignition and starting systems.

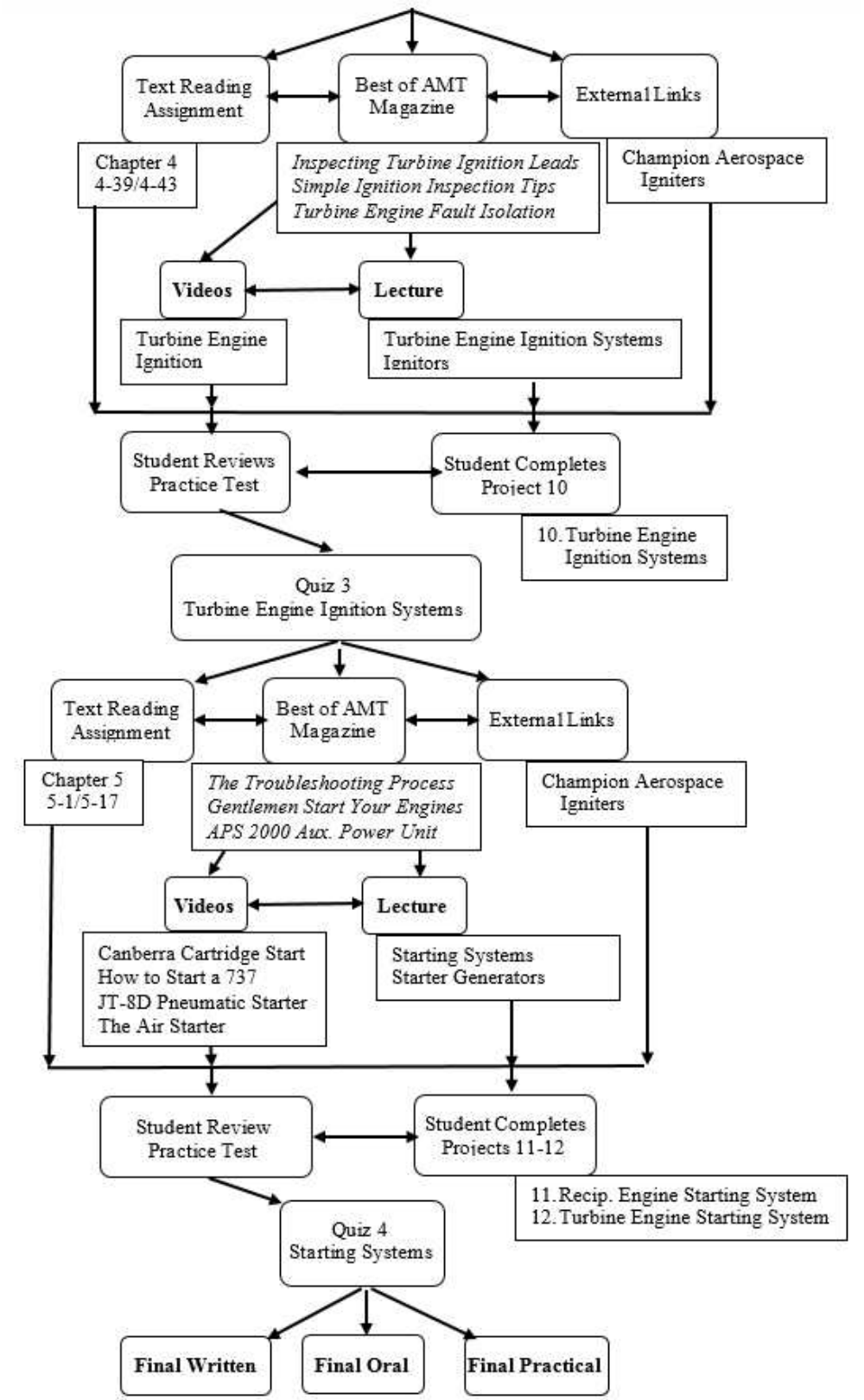


Figure 3. § 147 Competency-based flowchart for ignition and starting systems (continued).

The Carnegie Unit

According to Silva, White and Toch (2015)

> In higher education, students receive "credit hours," a metric derived from the Carnegie Unit and based on the number of "contact hours" students spend in class per week in a given semester. A typical three-credit course, for example, meets for three hours per week over a fifteen-week semester. A student, then, might earn fifteen credit hours per semester (fifteen is standard full-time registration for a semester, thirty for an academic year) en route to a four-year bachelor's degree requiring a total of 120 credits. (p. 8)

A credit hour is a unit of measure that gives value to the level of instruction, academic rigor, and time requirements for a course taken at an educational institution. At its most basic, a credit hour is a proxy measure of a quantity of student learning. The higher education community has long used the credit hour, as defined by the ''Carnegie unit,'' as part of a process to establish a standard measure of faculty workloads, costs of instruction, and rates of educational efficiencies, as well as a measure of student work for transfer students. A credit hour for purposes of § 147 is an institutionally established equivalency that reasonably approximates some minimum amount of student work reflective of the amount of work expected in a Carnegie unit. A school that chooses to use a credit hour curriculum would be required to determine the clock-to-credit-hour conversion requirements and credit hours to be awarded for coursework under that option.

Credit hours are an educational method of quantifying an amount of learning for the purpose of charging a monetary fee. A credit is not only an instructional hour, but an amount of learning within that allotted time frame. If a student does not reach the required amount of

learning (competency) within the allotted time frame the student does not earn the credit, regardless of the hours. This holds true in any educational area of study.

The Federal definition of a credit hour stems from 34 CFR § 600.2 and states

Credit Hour: Except as provided in 34 CFR 668.8(k) and (l), a credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than –

(1) One hour of classroom or direct faculty instruction and a minimum of two hours of out of class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or

(2) At least the equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

ATEC response to the FAA NPRM included the following (Maguire, 2016).

> "The antiquated hour/credit requirement puts too much emphasis on the time a student spends in a classroom seat at the expense of the skills he or she actually gains. Industry is in desperate need of a competency-based standard, free of specific hour/credit requirements, which will allow industry to transition away from seat time in favor of a structure that creates flexibility, and allows students to progress as they demonstrate mastery of subject matter, regardless of time, place, or pace of learning."

One example extrapolated from Los Angeles Southwest College (2016) is shown below.

Table 1

The Carnegie unit: How to calculate student contact hours

Course Type	**Unit Value**	**Lecture Hours per**		**Lab Hours per**		**By Arrangement Hours per**		**Homework Hours per**	
		Week	Sem	Week	Sem	Week	Sem	Week	Sem
LECTURE ONLY COURSES; HOMEWORK REQUIRED									
Lecture	1 unit	1	15					2	30
Lecture	2 units	2	30					4	60
Lecture	3 units	3	45					6	90
LABORATORY ONLY COURSE; NO HOMEWORK OR OTHER OUTSIDE WORK									
Lab	1 unit			3	45				
Lab	0.5 unit			1.5	22.5				
COURSES WITH BY ARRANGEMENT LAB HOURS; HOMEWORK REQUIRED TO MAKE UP THE DIFFERENCE									
Lecture (w/ by arr.)	1 unit	1	15			2	30		
Lecture (w/ by arr.)	1 unit	1	15			1	15	1	15
Lab (all by arr.)	1 unit					3	45		
Lecture (w/ by arr.)	3 units	3	45			2	30	4	60
Lecture	1.5 units	1.5	22.5			2	30	1	15

Utilizing the FAA minimum of 1900 hours with one half of the clock hours lecture and the other half laboratory, and assuming the maximum time of eight hours per day and 40 hours per week it would take approximately 48 weeks to complete the curriculum. Drawing from a national limitation imposed by many colleges and universities that a student cannot earn more than one credit per week, the limit would be 48 credits, rather than the 43 credits noted in the FAA NPRM. Any other calculation from Table 1 above would render a much higher minimum unless the assumption were made that both lecture and laboratory hours required no outside preparation, study, or homework. Clearly this is an untenable position.

Summary

One of the initial steps in developing a model AMT curriculum was to look at the practical limitations and restrictions from the regulatory agency (FAA) and the educational entities that provide the training. In addition to providing updated course material on next generation aircraft and systems, it is imperative that the delivery methods are focused on current educational research and practices as well. These considerations formed the rationale for developing a set of assumptions to guide the curricular revisions. Defining and securing expert approval for these assumptions was the first step in initiating this study as seen in the following chapter on methodology.

CHAPTER III

METHODOLOGY

The overall objective of this research is to develop a model aviation maintenance training curriculum that would provide a guide for both the FAA in developing the revisions to 14 CFR § 147 and for local AMTS to redesign their training curricula to bring them in line with the 21st century. The literature and responses from the aviation educational experts were incorporated toward this goal. This chapter details the methodology that was incorporated in this study. Participant selection including their background, survey design, and data selection procedures are detailed here.

Participants

While the aviation industry has long recognized that aviation maintenance training is woefully behind the times (Dillingham, 2003; Blakely, 2008), the FAA has finally made a similar determination noting "that the current school curriculums are dated and do not provide students with the skills necessary for maintaining modern aircraft (Aviation Maintenance Technician Schools, 2015). It is apparent from this notice of proposed rulemaking that now is the time to begin rethinking how an aviation maintenance training curriculum might be improved with regard to content and delivery. Who is better equipped to address these concerns than the aviation experts who have worked persistently over the past decade to effect changes in § 147?

This study draws on the expertise of these individuals utilizing a Delphi approach. The Delphi is an appropriate approach when expert opinion is sought from a group of experts (Ziglio, 1996; Somerville, 2008). It has proven especially useful "in educational settings in forming guidelines, standards, and in predicting trends" (Green, 2014, p 1). According to Patton (1990), key experts in a subject field should be queried to determine the latest thoughts and to inform

policy makers. One of the more critical elements in the Delphi method according to Okoli and Pawlowski, (2004) is the selection of qualified experts.

The number of optimum participants that should be included in a Delphi study varies from one half dozen to a dozen members (Hogarth, 1978; Mitchell, 1991; Clayton, 1997) to more than 15 members (Ziglio, 1996; Gordon, 1994). Participants that are in more homogeneous group tend to function effectively with smaller numbers in comparison to less homogeneous groups that benefit from a larger group of participants. Regardless of the number of participants, the critical consideration according to Colton and Hatcher (2004) is that participants should be "experts with relevant experience, stakeholders that are directly affected, and facilitators in the field under study" (p. 184).

Participants chosen for this study came primarily from two groups: the aviation industry and aviation educational professionals. The goal was to identify national aviation experts who fell into one of the following groups: (1) ARAC members, (2) § 147 working group, (3) § 147 AMTS director/professor, (4) ATEC director, (5) former FAA officials familiar with § 147 or (6) senior aviation technicians. Members from each of these groupings meet the requirements noted above and most of the individual participants recruited for this study represented two or more of the groupings. 30 aviation maintenance experts were recruited from a prospective pool of 33. The vast majority of these experts have a minimum of 10 years' experience with several approaching over 40 years of background.

Design

Because the purpose is to develop a model aviation maintenance curriculum, the research is descriptive in nature. According to Rowe and Wright (2001) the Delphi method is based on the principle that decisions from a well-defined group of experts is more accurate than those from an unstructured group. While interviews were considered for this study, their use was discounted due to associated costs in time and travel, the desire to consult national experts, the predictive need for interaction, and the appeal to provide some closure to the efforts of former individuals who had labored on the part of § 147 change for years. Colton and Hatcher (2004) concluded "The online Delphi was proven to be an excellent tool in establishing content validity" p. 183). Rowe and Wright (1999) have characterized the four essential elements of the Delphi method as follows:

1. Anonymity of Delphi participants: allows the participants to freely express their opinions without undue social pressures to conform from others in the group. Decisions are evaluated on their merit, rather than who has proposed the idea.
2. Iteration: allows the participants to refine their views in light of the progress of the group's work from round to round.
3. Controlled feedback: informs the participants of the other participant's perspectives, and provides the opportunity for Delphi participants to clarify or change their views.
4. Statistical aggregation of group response: allows for a quantitative analysis and interpretation of data.

While other researcher's hold that these key elements can be modified (Adler & Ziglio, 1996; Delbeq, Van de Ven, & Gustafsum, 1975; Linstone & Turloff, 1975), I have elected to

incorporate them in this Web-based Delphi as a more cost-effective, interactive, and a more flexible approach (shown in Figure 4). A subject matter expert (SME) was used to assist with analyzing the data to assure consistency, accuracy, and reliability.

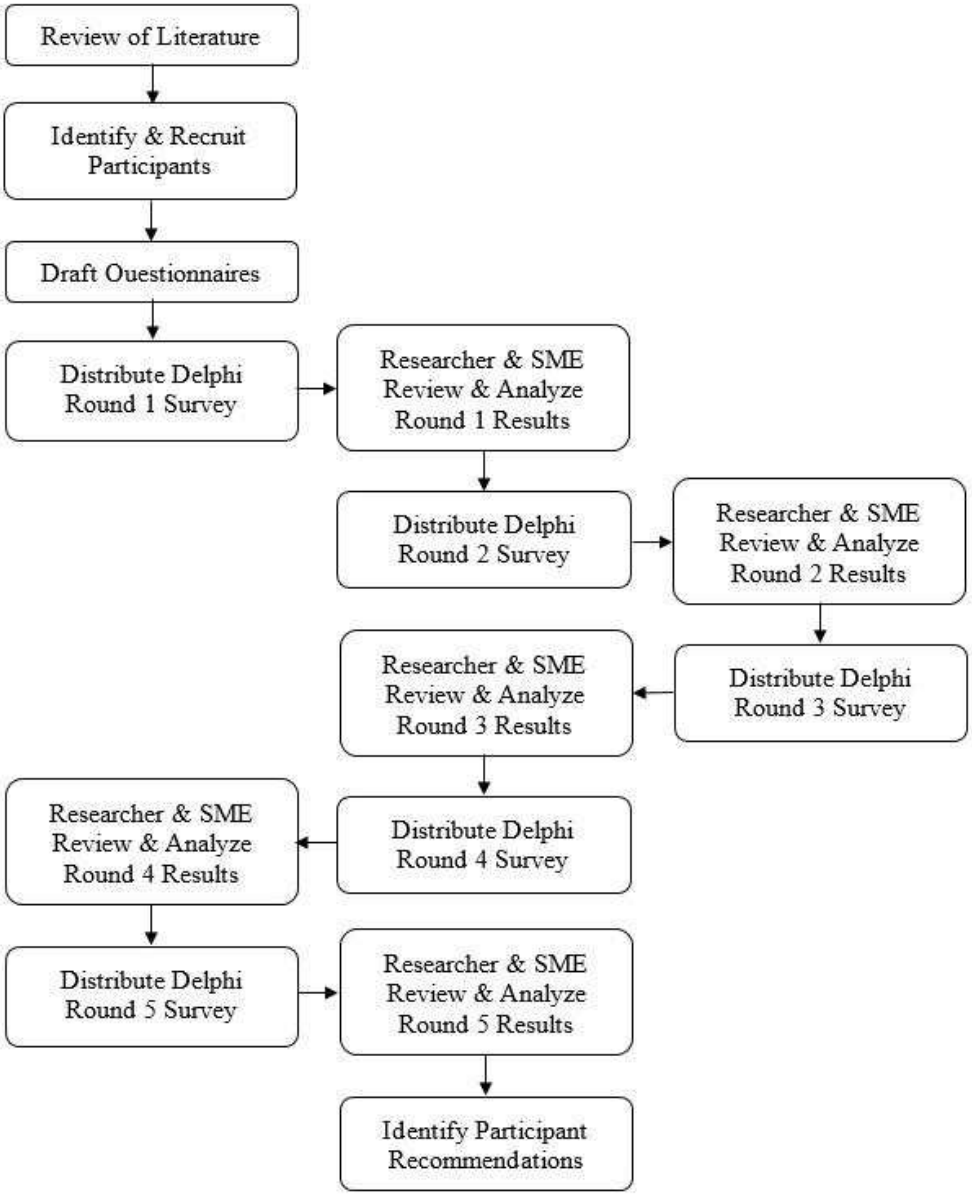


Figure 4. Web-based Delphi Procedure.

Recruit and Identify Participants

Potential participants were solicited from the individuals who had expressed a particular interest in aviation maintenance training by either previously or currently involved in the FAA §

147 Aviation Rulemaking Advisory Committee or the FAA § 147 working group on implementing the ARAC recommendations that do not require specific rule change, the FAA aviation certification standards aviation rulemaking advisory committee aviation maintenance technician working group, the aviation technician education council board of directors, former FAA inspectors with § 147 responsibility or familiarity, and senior aviation maintenance technicians. All participants were invited to take part in the research by telephone followed by an email. From an initial pool of 33 participants, 30 responded positively and agreed to participate.

Develop Initial Questionnaire

The initial questionnaire for round 1 included demographic information, deemed important for influencing policy decisions (Stevenson, 2010) as well as the basic assumptions for the model curriculum. Those assumptions include determining what the minimum number of credits for the aviation maintenance curriculum should be. The FAA noted in the § 147 NPRM (2015) that the minimum number of credits would be 43. This number could only be derived by dividing the 1900 hours of instruction by 45 hours equals 1 credit and rounding up. This calculation utilizes the assumption that aviation maintenance instruction (either lecture or laboratory) would require no outside reading, preparation, or other student effort. The participants were provided with a brief summary of the history and application of the Carnegie unit as applied in higher education including reference to various state, college, and university restrictions regarding credit evaluations. The first assumption was to determine a minimum number of post-secondary credits to be assigned to the curriculum assuming the 1900 hour minimum.

The second assumption involved asynchronous distance education. This is not to imply that all teaching by an AMTS will include distance education, but rather a contention that the

curriculum be designed in such a manner that a portion of the coursework could be delivered by distance at the discretion of the institution. For example, a course in metallic structures could be designed as a 160 hour lecture and laboratory course as is commonly taught in many AMTSs today. Another option would be to arrange the curriculum to offer an 80 hour lecture course in metallic structures along with an 80 hour "hands on" course in metallic structures laboratory. This would facilitate the AMTS in offering the lecture course as either a face-to-face or distance delivered course.

The third assumption included competency-based instruction as an intrinsic part of the curriculum design. The FAA has already embraced competency-based training as evidenced by advisory circular 120-16F (2012) for air carrier maintenance programs. In addition, the ATEC board of directors meet with several FAA officials from Aircraft Flight Standards (AFS)-300 to discuss inclusion of a competency-based rule in § 147 (Warren, 2016).

The forth assumption stemmed from the restriction that many state, colleges, and universities have that a course may not be less than one credit. While many AMTSs are not restricted by this contention, it is prevalent enough throughout the country to be included.

The fifth assumption stemmed from the fact that the FAA has defined 44 subject areas in a variety of documents that must be taught in an FAA-approved § 147 curriculum. Given some agreed upon minimum number of credits between 43 and 52, the assumption regarding asynchronous distance delivery inclusion, the time requirement for individual classes, and the restriction of one credit minimum, it will be necessary to combine subject areas into common groupings. For example, maintenance forms and records, maintenance publications, mechanic privileges and limitations, and human factors are often combined into a class titled "Federal Aviation Regulations" by many AMTSs.

The next three assumptions concerned the relative weight that should be given to the three FAA guiding documents, namely the § 147 ARAC final report, the FAA § 147 NPRM, and the FAA ACS regarding subject area inclusions and titles. While there is some agreement between the three documents, approximately one third of the subject areas listed in each do not agree. While this is somewhat surprising, given that all three documents came from the same federal agency, it is understandable given the nine year span between the inception of the ARAC report (2008) and the ACS (2017) coupled with the difference in oversight AFS-300, based in Washington D.C. for the ARAC report and the NPRM and AFS-600, based in Oklahoma City, Oklahoma for the ACS. For any model AMT curriculum, agreement on the subject area titles needs to be consistent. The subject areas of disagreements are shown below in Table 2.

Table 2

Subject areas of disagreement

ARAC	**NPRM**	**ACS**
	GENERAL	
Fundamental Electricity/Electronics	Fundamental Electricity & Electronics	Basic Electricity
Aircraft Drawing	Aircraft Drawing	Aircraft Technical Graphics
Corrosion	Cleaning & Corrosion Control	Cleaning & Corrosion Control
Not incorporated.	Mathematics	Mathematics
Maintenance Forms, Records, & Publications	Maintenance Forms, Records, & Publications	Regulations, Publications, & Recordkeeping
Physics for Aviation	Physics for Aviation	Aviation Physics
Foreign Object Elimination (FOE)	Foreign Object Elimination (FOE)	*Incorporated in* Ground Operations and Servicing
Inspection Concepts & Techniques	Inspection Concepts & Techniques	Inspections
Alerts, Cautions, and Warning Indications	Alerts, Cautions, and Warning Indications	*Incorporated in* Regulations, Publications, and Recordkeeping

Table 2 (continued)

Subject areas of disagreement

	AIRFRAME	
Incorporated in Corrosion	*Incorporated in* Cleaning and Corrosion Control	Aircraft Finishes
Flight Controls	Flight Controls	Assembly and Rigging
Environmental Systems	Environmental Systems	Cabin Atmosphere Control Systems
Airframe Fire Protection Systems	Airframe Fire Protection Systems	Fire Protection Systems
Water & Waste Systems	Water & Waste Systems	*Incorporated in* Cabin Atmosphere Control Systems
	POWERPLANT	
Incorporated in Fuel Metering Systems	*Incorporated in* Fuel Metering Systems	Engine Fuel Systems
Reciprocating Engine Induction & Cooling Systems	Reciprocating Engine Induction & Cooling Systems	Induction & Airflow Systems Engine Cooling Systems

The ninth assumption is for ease of use and concerns a standardized method of course numbering. The convention suggested is to use odd numbers starting at 101 for general lecture or lecture/laboratory courses and 201 for airframe and powerplant lecture courses. Even numbers would be used for laboratory courses, starting at 102 for general and 202 for airframe and powerplant. This convention will allow all of the participants to be on the same page without reference to the particular course numbering system they may be familiar with.

The last assumption was centered about subject area grouping in sections. There are three suggested groupings based upon the (1) ARAC report and NPRM, (2) the ACS and current § 147 regulations, and (3) a new grouping designed to avoid redundancy with a series of system and component courses (specifically airframe and engine electrical systems, airframe and engine fuel systems, airframe and engine instrument systems, and airframe and engine fire protection systems). This last section grouping is currently used by several AMTSs to avoid teaching many specific topics twice (once in the airframe curriculum and then again in the powerplant

curriculum) and has been adopted because so few AMT students select to complete just one certificate.

Distribute Round 1 Survey

The first survey included demographic questions, the 10 assumptions, and is presented in Appendix D. The first set of questions asks participants to provide information regarding their age, gender, ethnicity, education, aviation experience, and § 147 affiliation. This information was solicited to describe the background, expertise, and experience of the group. The second set of questions requested the participants to evaluate the assumptions that would provide the framework for developing a model aviation maintenance training curriculum. Each of the first nine assumptions were categorized using a five point Likert scale (Hsu & Stanford, 2007), with (1) unnecessary, (2) not important, (3) important, (4) very important, and (5) extremely important. The last assumption was ranked in order of the expert's preference. Instructions were included to weight the importance of each assumption and additionally, blank spaces were provided for each participant to add comments or suggest a modified or new assumption. References were provided that refer to information on the Carnegie unit, and each of the three FAA documents (§ 147 ARAC final report, § 147 NPRM, and § 147 ACS).

Round 1 survey was designed in SurveyMonkey. An email was sent to each participant encouraging them to reference the documents located in the Google Site entitled ***Model § 147 curriculum*** and complete the first round of the study. Responses were requested within eight days. Each participant was able to log on to SurveyMonkey and their responses were confidential. These responses were either replicated in total, or when summarized, the summation was verified for accuracy by a subject matter expert (SME). Email reminders were

sent on the sixth day and a follow-up phone or text message was sent on the eight day to any participant who did not complete the survey.

Round 1 Review and Analysis

The results of the survey were downloaded into Microsoft Excel. The mean age group and years of aviation experience were computed using the "MEAN" function. Minimum, maximum, and standard deviation values for each category were determined using the appropriate functions. Counts for individuals by gender, ethnicity, education, and § 147 affiliation were computed using the "COUNT" function.

Responses for each of the assumptions (2 through 9) were copied into Excel and quantified as follows: (1) = unnecessary, (2) = not important, (3) = important, (4) = very important, and (5) = extremely important. The initial assumption regarding the minimum number of credits will be computed using the "COUNT" function. Additional suggested assumptions by the participants will be reviewed with the SME and incorporated for consideration by the participants. The last assumption was designed to facilitate redundancy avoidance in the model curriculum by grouping courses into sections. Table 3 denotes several options that have been utilized by either the FAA or various AMTS. The option listed under AMTS takes subject areas that are found in both airframe and powerplant, such as electrical systems, fuel systems, fire protection systems, and instrument systems (Dyen, 2016). The advantage of this subject area combination is to minimize teaching the same or similar curriculums twice, such as alternators which are covered in both airframe electrical and powerplant electrical. The disadvantage of this combination would be for the few students who are seeking only a single certificate; however, in many cases this has only resulted in an additional one to three additional credits. Each of these options was ranked by the participants and that ranking distributed.

Table 3

Section distributions

CURRENT § 147	NPRM/ACS	AMTS
General Airframe Structures Airframe Systems & Components Powerplant Theory & Maintenance Powerplant System & Components	General Airframe Powerplant	General Airframe Powerplant Combined Systems & Components

All comments were posted anonymously for additional consideration and review by the participants. Any assumptions put forth by more than 50% of the participants were included for consideration. The use of a Google site for all participants enhanced the experience and by providing a more flexible approach (Colton & Hatcher, 2004).

Design and Distribute Round 2 Survey

The ranked list of assumptions from Round 1 were used to guide the development of the model aviation maintenance training curriculum. A clear determination was reached regarding the use of 48 credits in the first round; however, there was no clear indication of how subject areas could be divided into sections. Four options with additional clarification were added to the survey for the second round. Round 2 Survey attempted to clarify the breakdown of credit and "seat times' from the following options depicted in Table 4.

Table 4

Hours and credit distributions

Option	Section Titles	Times	Credits	Reference
1.	General	450	12	NPRM &
	Airframe	800	20	ARAC
	Powerplant	650	16	
2.	General	450	11	NPRM &
	Airframe	680	18	ARAC w/
	Powerplant	570	14	Combined
	Combined Systems & Components	200	5	
3.	General	450	12	Current
	Airframe Structures	400	10	§ 147 &
	Airframe Systems & Components	400	10	ACS
	Powerplant Theory & Maintenance	250	6	
	Powerplant Systems & Components	400	10	
4.	General	450	11	Current
	Airframe Structures	240	12	§ 147 &
	Airframe Systems & Components	240	6	ACS w/
	Powerplant Theory & Maintenance	200	8	Combined
	Powerplant Systems & Components		6	
	Combined Systems & Components		5*	
5.	**Other**			

* Based upon 120 hours airframe and 80 hours powerplant

Again, the questionnaire was prepared using SurveyMonkey and the link distributed by email as well as available in the Model § 147 Curriculum Site/Delphi Survey Access. Reference the survey in Appendix E. The instructions were similar to those used for the last assumption in Round 1; that is a ranking was requested with an option to include the participant's own suggestion if the choices were inadequate or lacking in any way. The initial email request to complete the survey within a week was followed up with a second email after the fifth day and a phone call/text message after the eight day as a reminder to non-responsive participants.

Round 2 Review and Analysis

Opinions from the participants were used to solidify the overview of the curriculum in terms of section selection, seat times, and credit distribution. It was anticipated that in addition to the survey, a discussion may be needed to assist the participants to reach consensus. In general

this proved to be unnecessary. Participants were directed to send their comments to the researcher and they were posted to the web site developed for the Delphi Survey. Once the framework of the curriculum was established with regard to the subject area titles, sections, and credit hours, the subsequent rounds were initiated.

The first question addressed by the participants in Round 2 was how to distribute the subject areas into sections with appropriate clock hours and credits. Four options were offered along with the flexibility to offer additional suggestions. The next thirteen series of questions concerned the specific titles of subject areas that were unresolved as the three FAA reference documents (ARAC, NPRM, and ACS) do not agree with regard to subject areas. Only disputed subject area titles were considered and each title was referenced with its origin, either the ARAC, NPRM, or the ACS. In fact over one quarter of the subject areas are not aligned. In order to develop a model curriculum this area of disagreement must be resolved. Each of 11 subject areas were presented and the participants asked to rank their selection based upon the listings from the ARAC, NPRM, and ACS. The questionnaire for the subject area resolution are included in Appendix F. As before, an initial email request to complete the survey within a week was followed up with a second email after the fifth day and a phone call/text message after the eight day as a reminder to non-responsive participants. Those subject areas not selected by half of the experts were discarded with the selected subject area titles put forward into Round 3. (Okoli & Pawolowski, 2004).

Design, Distribute Round 3 Survey

Round three consisted of establishing and sorting of subject areas, credits, lecture, and lab times by the participants. The round three survey was intended to determine specific combinations of subject areas that will comprise the model aviation maintenance training

curriculum. In order to comply with the assumptions that no course will be less than 1 credit hour, the curriculum be designed to allow for distance delivery, and the limitation of 48 credits equally 1900 hours, it was imperative that subject areas be combined. Another of the overriding assumptions was the combination of similar subject areas. The first part of the third survey listed 11 combinations of subject areas. The participants were requested to approve or disapprove each combination. Additionally, if the expert disagreed with the combination, each had the option to provide an explanation, and/or suggestions for modification or other combinations.

The second part of the survey was to review a model AMT draft curriculum with specific times (lecture and laboratory) and credit hours broken down in the three areas of general, airframe, and powerplant using Option 1 from Table 4 as determined in Round 2. The participants were again asked to approve or disapprove each section individually, with the option to provide an explanation, and/or suggestion for modification or other combination. To simplify data acquisition, minimize the number of surveys, and ensure that all respondents participate fully in future surveys a switch was made from SurveyMonkey to Qualtrics Survey Software for Round 3 and subsequent rounds. The reason for this change was two-fold. First the limitation of SurveyMonkey's initial availability of a maximum of ten survey questions. This required the researcher to use two surveys for round one and round two. Secondly, the researcher discovered that his institution had invested in Qualtrics Survey Software and permission was secured to utilize the software, primarily because of the perceived benefit of the research to the college.

Round 3 Review and Analysis

The subject area combinations were incorporated into Qualtrics Survey Software and the individual rankings calculated and distributed on the Google Site Model § 147 Curriculum. This round was designed to provide resolution of the subject areas combinations with a high degree of

confidence. In addition, the model AMT curriculum with section lecture and laboratory times and credit hour distribution was distributed for review with suggestions for subject area combinations in three iterations, general, airframe, and powerplant.

While there was little disagreement among the participants, the one area that the experts disagreed on concerned the combining of lubrication systems and fire detection and protection systems. While these two subject areas have little in common (as indicated by one third of the participants), neither subject contains sufficient material to warrant a two credit course offering (one credit each for lecture and laboratory). One-third of the experts indicated approval for the combination with no comments, with the remaining third indicated a variety of course combinations with no consensus on where fire detection and protection systems was best situated. Two experts suggested that the subject area be included with overheat and fire detection, protection, and suppression systems; however, this suggestion conflicts with the previous consensus to separate the curriculum into general, airframe, and powerplant sections.

The decision to retain the combination of lubrication systems and fire detection and protection systems was predicated upon the last set of responses in the survey regarding the distribution of subject area times and credits for the powerplant section where the vast majority of experts approved of the suggested combination.

Design and Distribute Round 4 Survey

Round four consisted of establishing course titles that will comprise the model curriculum. A sample of a possible listing is included in Appendix G. In Round 4 the participants were asked to select whether or not a specific subject areas can become course titles. For the additional subject areas that were combined by agreement, participants were asked to either approve the suggested course title or suggest a new one. Subject areas were broken into three

areas: (1) single subject areas = course name; (2) combined subject areas = course name; and (3) new name needed for the courses combining several subject areas. The tables listed in Appendix G indicate those options.

As with the previous round, the questionnaire was prepared using Qualtrics Survey Software and the link distributed by email as well as available in the Model § 147 Curriculum Site/Delphi Survey Access. The instructions were similar to those used for Round 3; that is, the participants were again asked to approve or disapprove each course title individually, with the option to provide an explanation, and/or suggestion for modification or other option. The initial email request to complete the survey within a week was followed up with a second email after the fifth day and a phone call/text message after the eight day as a reminder to non-responsive participants.

Round 4 Review and Analysis

Since the course titles utilized (subject areas determined in Round 3) were incorporated into Oualtrics Survey Software, the individual rankings were calculated and distributed on the Google Site Model § 147 Curriculum. This round provided resolution of the combination of similar subject areas with a high degree of confidence. The course titles for the combined subject areas, were accepted by the majority of the participants with the subject area combination of (1) maintenance forms, records, and publications, (2) human factors, and (3) inspection concepts and techniques drawing the least agreement and consequently the most comments. Human factors drew the majority of the comments with two of the experts noting that human factors should be a stand-alone course, two other experts noted that human factors are not generally regulatory, and one expert noted that human factors should be included in ALL curricula. While 67 percent of the participants agreed with Federal Aviation Regulations as the course title for the three subject

areas, the rest of the course titles drew between 77 and 96 percent agreement with the average agreement among the experts of 89 percent. For course titles where single subject areas equaled the course title, the experts were in new total agreement at 96 percent of the respondents in accord. Agreement diminished where the combined subject areas equaled the course name to 86 percent. The lowest area of agreement could be found where the experts were asked to respond to a new name for the course where two or more subject areas were combined. This led to a low of 80 percent agreement. The course titles were all moved forward into the model AMT curriculum as presented.

Design, Distribute Round 5 Survey

Round 5 consisted of developing the objectives for each subject area. While most of the objectives will be behavior objects, it is important that each objective be written concisely and accurately. Guidance will be drawn from Morrison, Ross, Kalman, and Kemp (2010) as follows:

1. Behavioral objective
    - » Action verb
    - » Subject content reference that describes the content addressed by the objective.
    - » Level of achievement
    - » Conditions of performance
2. Cognitive Objective
    - » Statement of general instructional objective
    - » One or more samples of the specific types of performance that indicate mastery of the objective
    3. Psychomotor domain objective

- » Action verb.
- » Subject content reference that describes the content addressed by the objective.
- » Level of achievement.
- » Conditions of performance.

4. Affective Domain Objective
   - » Specify behavior indirectly by inferring from what the instructor can observe.
     1. Identify the cognitive component or "thought" that describes the attitude.
     2. Identify a behavior that when observed would represent the attitude.

Objectives are located in Appendix H, I, and J. This may appear to be the most daunting of the rounds given the number of objectives; however, since many of these have been codified in regulation or developed by the ARAC or ACS, they should be familiar to the participants and less controversial. The instructions were similar to those used for the previous rounds; that is a ranking was requested with an option to include the participant's own suggestion if the choices were inadequate or lacking in any way. The initial email request to complete the survey within a week was followed up with a second email after the fifth day and a phone call/email message after the eight day as a reminder to non-responsive participants.

Round 5 Review and Analysis

The course objectives presented to the participants were drawn from the current 14 CFR § 147 Appendix B, C, and D, the ARAC final report, and the ACS draft document. The

objectives for each subject area were incorporated into Qualtrics Survey Software and the participants asked to accept, reject, or modify them. The individual responses were calculated and distributed on the Google Site Model § 147 Curriculum with modifications incorporated as needed. This round provided a set of course objectives for each subject area with a high degree of confidence that can serve as the basis for an AMTS to incorporate into any course by combining the objects for each subject area represented. It was intentionally designed to provide a model for the FAA to utilize for incorporation into 14 CFR § 147 Operational Specifications (OpSpecs).

Summary

This chapter outlined the methods and procedures utilized in this research. The study comprised the use of a Web-based Delphi method to design a model aviation maintenance training curriculum within the confines of proposed Federal regulations using as a guide the current and proposed § 147 regulations, the final report of the ARAC, and the draft document of the ACS.

The participants represented aviation experts from both industry and academia with a vested interest in aviation maintenance education. Thirty-three individuals were contacted and 30 elected to participate in the study. The Web-based Delphi approach was used to facilitate accommodating the national aviation experts, by minimizing the amount of time needed to respond and eliminating the necessity for travel to engage in face-to-face deliberations. The experts were chosen because of their previous involvement in a variety of endeavors to improve and update aviation maintenance education. Restraints were imposed based upon the initial assumptions that comprised Round 1 of the study. The experts were asked to consolidate subject areas from three conflicting FAA documents in an effort to put forward the most important and

common sense elements (defined subject areas) for the model curriculum in Round 2. Further definition of the model was determined in Round 3 by determining sections for subject area grouping with respective times and credit hour determinations. Round 4 was used to clarify a workable combination of subject areas into typical college courses with appropriate titles. The final Round of the study clarified and enumerated the subject area objectives for the model curriculum.

Chapter IV presents the findings for this study. The recommendations for the model curriculum section, subject areas, course titles, times and credits are presented from the aviation experts. This model is available as recommendations for individual AMTSs to incorporate as desired.

CHAPTER IV

RESULTS

Participants and Demographics

Former members of the specific FAA focus groups, including Aviation Maintenance Technician Schools Curriculum and Operating Requirements Working Group (§ 147 Aviation Rule Advisory Committee {ARAC}), FAA § 147 working group on implementing the ARAC recommendations that do not require specific rule change, and the FAA aviation certification standards aviation rulemaking advisory committee were initially contacted and asked to serve as subject matter experts. Additional professional colleagues were recruited from current and past members of the aviation technician education council board of directors, along with former FAA inspectors with § 147 responsibility or familiarity, and senior aviation technicians. The researcher directly invited 33 experts via email and telephone between January 18th and January 26th, 2017. This included four invitations extended by the researcher at the behest of several of the preliminary contacted experts. Of the 33 experts contacted 30 agreed to participate (90.9%).

The link for Round 1 was sent by email initially on January 26th and participants were given eight days to complete the survey. Email reminders were sent out on the sixth day and again on the final day. There were 30 experts who completed the demographic information; however only 26 participated in Round 1. There were 26 males and 4 females who completed the demographic survey. The participants were requested to identify their ethnicity and the group consisted of 26 White, 1 Hispanic or Latino, 2 from multiple races, and 1 who responded human. Predominantly the experts were in the 55 - 65 year age group (12), with 1 expert each in the 25 - 44 and 75 or older, 10 from 45 – 54, and 6 from 65 – 74. Over 75 percent of the experts (23) had 25 years or more experience in aviation, with only 1 expert with 10 – 14 years, and the remaining experts evenly divided between 15 – 19 years and 20 – 24 years of experience. Specific

educational degrees included the majority (14) possessing a master's degree, 1 with a doctorate, 9 holding a bachelor's degree, 4 with associate degrees, and 2 with some college, but no degree. Perhaps one of the most important demographic experience, in addition to the number of years of experience in aviation, was the § 147 affiliation. The participants were asked to check all that applied and 14 were former members of the FAA § 147 Aviation Rulemaking Advisory Committee (ARAC), 15 former members of the FAA §147 Working Group on implementing the ARAC recommendation that did not require rule change, 17 past or current director/coordinator/faculty at an FAA §147 AMTS, 10 past or current board members of the Aviation Technician Education Council, 3 that were past FAA airworthiness inspectors with § 147 oversite responsibility, and 13 with extensive other aviation experience.

Round 1

Model Curriculum Assumptions

The intent of the first round was to reach agreement from the experts on the foundation of the assumptions that would guide the development of the model § AMT curriculum. The survey included a variety of assumptions that the participants were asked to respond to with the opportunity for additional input if the participants found the information lacking in any way.

26 experts completed portions of the Round 1 survey. After participants completed the demographic questions, they were asked to rate the suggested assumptions on a five point Likert scale. Responses were weighted as Extremely Important (5), Very Important (4), Important (3), Not Important (2), and Unnecessary (1).The first assumption queried was the minimum number of credits that the AMT curriculum should consist of. While only 25 participants responded to the first assumption, 60% of the experts noted that the minimum number should be either 48 or 49 credits with 60% of those favoring 48 credits. Only 8% of the experts agreed with the FAA minimum of 43 credits noted in the § 147 NPRM, page 10, while 32% suggested an alternative

number of credits varying from mandating no credits to 73 credit hours. These extremes were discounted as unworkable.

The remaining assumptions were evaluated by 26 participants and are summarized in Table 5. The assumptions that had a median rating of 4 were selected as curriculum assumptions with the exception of course numbering convention and the subject area grouping.

Table 5

Round 1 expert feedback on curriculum assumptions

Assumption	Median Rating	Minimum Rating	Maximum Rating
Asynchronous Distance Education	4	2	5
Limit individual courses to 1 credit.	4	1	5
Common subject areas combined as necessary	4	0	5
Curriculum Design based on § 147 NPRM	3	0	5
Curriculum Design based on ARAC	3	0	5
Curriculum Design based on ACS	4	0	5
Odd # courses = lecture or lecture/laboratory Even # courses = laboratory	2	1	4
Subject Area Grouping NPRM & ARAC	4	2	5
Subject Area Grouping NPRM/ARAC + Sys & Comp	4	2	5
Subject Area Grouping Current § 147 & ACS	4	2	5

The course numbering convention was adopted to serve only as guidance as 46% of the participants ranked it either very important or important, whereas only 19% ranked course numbering as unnecessary. The remaining 35% ranked it as not important. The final assumption dealt with subject area grouping. Since the participants were evenly split on this, with approximately 30% selecting each of the first three options and the remaining 10% selecting other with no clarification, subject area groupings were re-evaluated in Round 2. Table 6 depicts the summary of findings from Delphi Survey Round 1 viewing the mode or most frequently selected response.

Table 6

Round 1 expert feedback - most frequently selected response

Survey Question	Mode/Most Frequently Selected Response
AMTS Curriculum Credit Minimum	48 credits minimum
Asynchronous Distance Education	Very Important
Common Subject Groupings	Very Important
Individual Courses Limited to 1 Credit	Important
Common Subject Areas Combined	Very Important
Curriculum Based on FAA § 147	Very Important
Curriculum Based on FAA ARAC Report	Important
Curriculum Based on FAA ACS	Extremely Important
Odd # Courses = Lecture or Lecture/Lab Even # Courses = Laboratory	Important

The curriculum assumptions that were adopted by Round 1 that were used to guide future deliberations and included the following:

1. The model AMTS curriculum will consist of 48 credits with no course less than 1 credit.
2. The curriculum will allow for the delivery of asynchronous distance education.
3. Common subject areas will be grouped together.
4. Subject areas will be based **primarily** upon the FAA Airman Certification Standards (ACS) for General, Airframe, and Powerplant.
5. Odd numbers will be used to designate lecture courses or lecture/laboratory courses that could be taught total via distance.
6. Even numbers will be used to designate laboratory courses.

Round 2

The objective of Round 2 was to solidify the division of the curriculum into sections (as the FAA has defined them for the past 55 years). Four options were offered to the participants and were drawn from various combinations of the ARAC report, the NPRM, and the latest

revision of the draft ACS. In addition to the section distribution, specific subject areas were grouped underneath each section with titles, hours, and credits shaded in for reference only. Participants were requested to rank their selection of the four options. In addition to the section distribution, participants were given two primary choices for each of 13 disputed subject area titles along with the option of providing any additional nomenclature. Each of the subject area titles were requested to be ranked as well.

An email was sent with the survey links to the participants on February 6, 2017 along with the guidance (instructions for completing the survey) and a link to any necessary reference information with the request that the survey be completed by February 12, 2017. Participants were given just under a week to complete the survey and email reminders were sent out on the fifth and last day. There were 28 participants who responded to the survey regarding AMTS Curriculum Sections, General and Airframe subject areas and 29 participants who responded to the AMTS Powerplant Curriculum subject areas.

Curriculum Sections

Seventy-four percent of the experts selected the AMTS Curriculum Summary that included the section choice of General, Airframe, and Powerplant as their first (48%) or second (26%) selection. The only other choice that showed a preponderance of opinion was the AMTS Curriculum Summary that included the section choice of General, Airframe Structures, Airframe Systems and Components, Powerplant Theory and Maintenance, Powerplant Systems and Components, and Combined Systems and Components with 31% of the experts selecting this as their first choice. The expert's selection is shown in the chart as Figure 5.

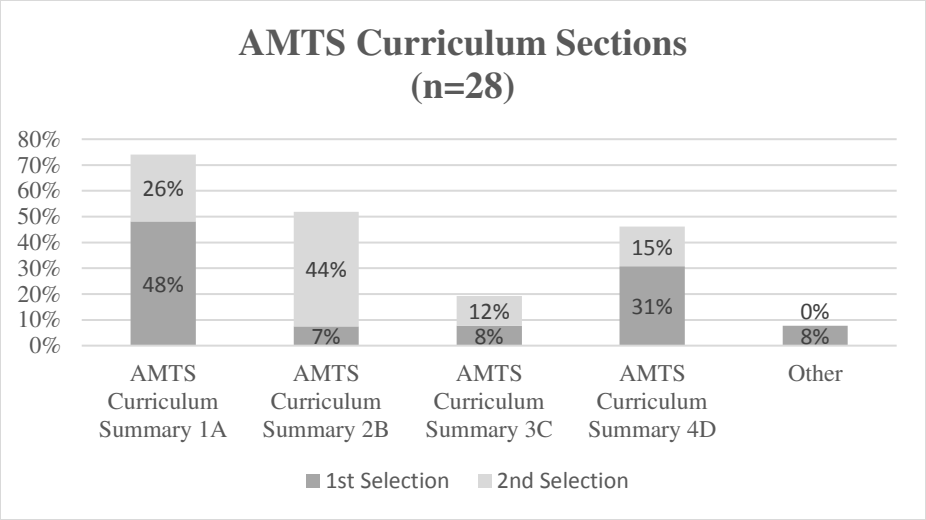


Figure 5. AMTS Curriculum Sections.

The number of hours and credit distribution for each section were drawn primarily from the ARAC report and the NPRM, depicted in Table 7.

Table 7

Section Distribution with hours and credit distributions

Section Titles	**Times**	**Credits**	**Reference**
General	450	10	NPRM &
Airframe	800	18	ARAC
Powerplant	650	15	

Subject Area Titles

Subject area title consolidation was restricted to those subject areas that differed in the three federal documents (ARAC, NPRM, and ACS). It is interesting to note, that while the majority of experts in Round 1 agreed that the ACS was extremely important, they were somewhat evenly divided regarding the subject area titles, with just over 38% of the choices favoring the ACS and the remainder (62%) selected from the ARAC and/or NPRM. Table 8 depicts the summary of findings from Delphi Survey Round 2 viewing the mode or most

frequently selected response along with the reference document that the subject area title was derived from.

Table 8

Round 2 expert feedback - most frequently selected response

Survey Question	Mode/Most Frequently Selected Response	Reference
Select the subject area title you prefer	Fundamental Electricity and Electronics	ARAC & NPRM
	Aircraft Technical Graphics	ACS
	Cleaning & Corrosion Control	ACS & NPRM
	Maintenance Forms, Records & Publications	ARAC & NPRM
	Physics for Aviation	ARAC & NPRM
	Inspection Concepts & Techniques	ARAC & NPRM
	Flight Controls	ARAC & NPRM
	Environmental Systems	ARAC & NPRM
	Overheat & Fire Detection, Protection, and Suppression Systems	ACS
	Engine Fire Detection and Protection Systems	ACS
	Reciprocating Engine Induction & Cooling Systems	ARAC & NPRM
	Turbine Engine Air Systems	ACS
	Engine Fuel Systems	ARAC & NPRM
		ACS

Since the remaining subject areas were generally identical between the three federal documents or found in both the NPRM and the ACS (Mathematics) or subject areas that were previously incorporated into other areas in the ACS (Foreign Object Elimination, Alerts, Cautions, and Warning Indications, and Water and Waste Systems) they were not included in the survey. The curriculum sections, with times, credits, and subject areas titles selected by the participants were determined and summarized in Table 9.

Table 9

AMTS Curriculum Summary

SECTION		SUBJECT AREA	
I.	**General** **450 hours** **12 credits**	A.	Fundamental Electricity and Electronics
		B.	Aircraft Technical Graphics
		C.	Weight and Balance
		D.	Fluid Lines and Fittings
		E.	Materials, Hardware and Processes
		F.	Ground Operation and Servicing
		G.	Cleaning and Corrosion Control
		H.	Mathematics
		I.	Maintenance Forms, Records, and Publications
		J.	Physics for Aviation
		K.	Inspection Concepts and Techniques
		L.	Human Factors
II.	**Airframe** **800 hours** **20 credits**	A.	Metallic Structures
		B.	Non-Metallic Structures
		C.	Aircraft Finishes
		D.	Welding
		E.	Flight Controls
		F.	Airframe Inspection
		G.	Landing Gear Systems
		H.	Hydraulic and Pneumatic Systems
		I.	Environmental Systems
		J.	Aircraft Instrument Systems
		K.	Communication and Navigation Systems
		L.	Aircraft Fuel Systems
		M.	Aircraft Electrical Systems
		N.	Ice and Rain Control Systems
		O.	Overheat and Fire Detection, Protection, and Suppression Systems
		P.	Rotorcraft Fundamentals
III.	**Powerplant** **650 hours** **18 credits**	A.	Reciprocating Engines
		B.	Turbine Engines
		C.	Engine Inspection
		D.	Engine Instrument Systems
		E.	Engine Fire Detection and Protection Systems
		F.	Engine Electrical Systems
		G.	Lubrication Systems
		H.	Ignition and Starting Systems
		I.	Fuel Metering Systems
		J.	Engine Fuel Systems
		K.	Reciprocating Engine Induction and Cooling Systems
		L.	Turbine Engine Air Systems
		M.	Engine Exhaust and Reverser Systems
		N.	Propellers

Round 3

Subject Area Combinations

Delphi Round 3 had the greatest participation of the experts with 30 participants responding to the survey. Participants were notified on February 16, 2017 and asked to complete round 3 survey by February 24. An email reminder was sent out on the fifth day with a final reminder on the date the response was due. Round 3 consisted on determining which subject areas could be reasonably combined into the three sections of the curriculum: general, airframe, and powerplant keeping in mind the assumptions that had been previously developed. At this point the titles of the subject areas were defined in round 2 and not subject to reconsideration. As shown in figure 6, the percentage of the participants agreeing with the combination of subject areas exceeded 57 percent with the exception of combination of lubrication systems and engine fire detection and protection systems.

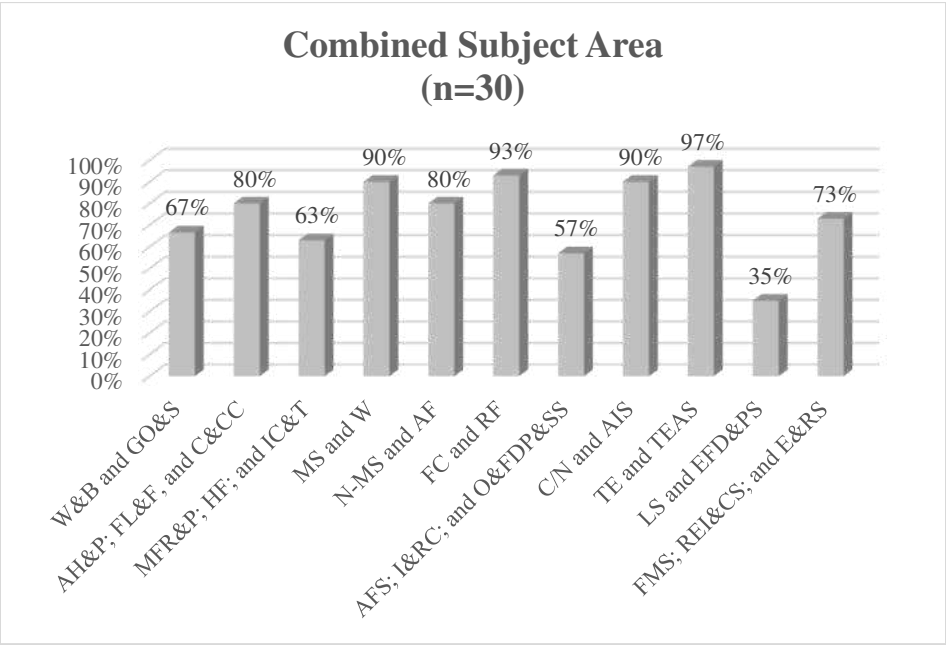


Figure 6. Combined subject areas.
Note: Subject area titles abbreviated for clarity.

Since the comments for combining lubrication systems and engine fire detection and protection systems showed little or no agreement and the consensus of the experts as shown in Figure 7 was 73 percent for the presentation of the powerplant subject area (which contained the subject area combination of lubrication and engine fire detection and protection systems), this combination was forwarded to the next round. The general accord of the experts regarding the model AMT curriculum is depicted by Figure 7 AMT curriculum selection below, with no section less than 70 percent.

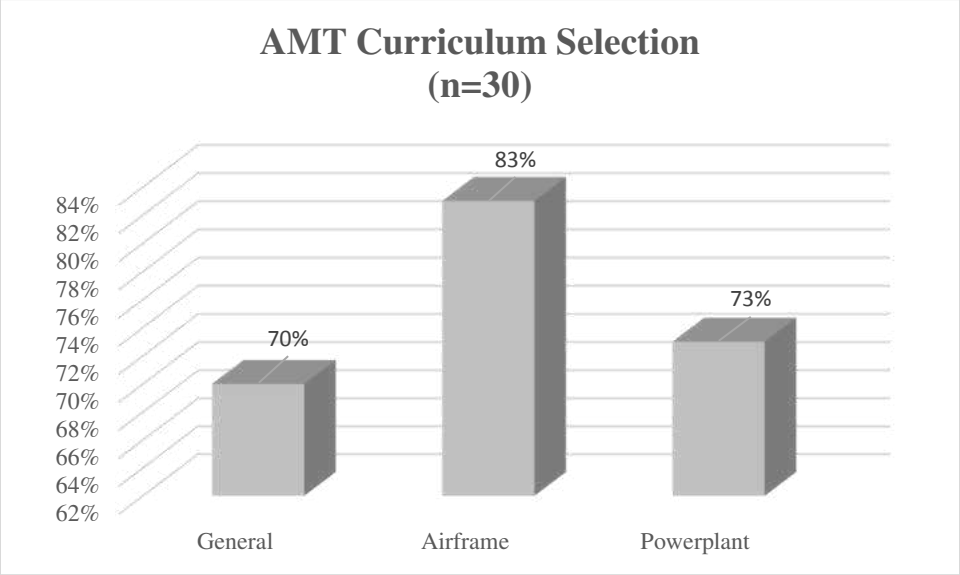


Figure 7. AMT curriculum selection.

The experts provided numerous comments to express objections regarding specific combinations of subject areas. The majority of these reflected the desire to have individual subject areas stand alone, without being combined with any other subject. While laudable, the problem with this approach is that with over 40 subject areas and the assumptions previously agreed upon, specifically (1) the minimum number of credits established at 48, and (2) the necessity to provide a curriculum focused on competency with the ability to be distance

delivered, the concept of stand-alone subject areas is unworkable. The model AMT curriculum with sections and subject areas is depicted in Table 10.

Table 10

AMT model curriculum with subject areas, tines, and credit hours

COURSE #	TITLE	TIMES			
		Theory	Lab	Total	Credit
GENERAL AIRFRAME AND POWERPLANT		**225**	**225**	**450**	**12.0**
AMT 101	Fundamental Electricity and Electronics	60	60	120	3.0
AMT 103	Aircraft Technical Graphics	20	20	40	1.0
AMT 105	Weight & Balance; Ground Operations & Servicing	40		40	1.0
AMT 106	Weight & Balance; Ground Operations & Servicing Lab		40	40	1.0
AMT 107	Aircraft Material, Hardware, & Processes; Fluid Lines & Fittings; Cleaning & Corrosion Control	60		60	2.0
AMT 108	Aircraft Material, Hardware, & Processes; Fluid Lines & Fittings; Cleaning & Corrosion Control Lab		60	60	2.0
AMT 109	Mathematics; Physics for Aviation	20	20	40	1.0
AMT 111	Maintenance Forms, Records, & Publications; Human Factors; Inspection Concepts &Techniques	25	25	50	1.0
AIRFRAME		**380**	**420**	**800**	**20.0**
AMT 221	Metallic Structures; Welding	60		60	1.0
AMT 222	Metallic Structures; Welding Lab		80	80	2.0
AMT 223	Non-Metallic Structures	60		60	1.0
AMT 224	Non-Metallic Structures Lab		80	80	2.0
AMT 225	Flight Controls; Rotorcraft Fundamentals	40		40	1.0
AMT 226	Flight Controls; Rotorcraft Fundamentals Lab		40	40	1.0
AMT 227	Airframe Inspection	20		20	1.0
AMT 228	Airframe Inspection Lab		40	40	1.0
AMT 229	Landing Gear Systems	40		40	1.0
AMT 230	Landing Gear Systems Lab		40	40	1.0
AMT 231	Hydraulic & Pneumatic Systems	40		40	1.0
AMT 232	Hydraulic & Pneumatic Systems Lab		40	40	1.0
AMT 233	Environmental; Aircraft Fuel; Ice and Rain Control; Overheat & Fire Detection, Protection, & Suppression Systems	40		40	1.0
AMT 234	Environmental, Aircraft Fuel; Ice and Rain Control; Overheat & Fire Detection, Protection, & Suppression Systems Lab		40	40	1.0
AMT 235	Communication/Navigation; Airframe Instrument Systems	40		40	1.0
AMT 236	Communication/Navigation; Airframe Instrument Systems Lab		40		1.0
AMT 237	Aircraft Electrical Systems	40		40	1.0
AMT 238	Aircraft Electrical Systems Lab		40	40	1.0

Table 10 (continued)

AMT model curriculum with subject areas, times, and credit hours

COURSE #	TITLE	TIMES			
		Theory	Lab	Total	Credit
POWERPLANT		**310**	**340**	**650**	**16.0**
AMT 241	Aircraft Reciprocating Engines	45		45	1.0
AMT 242	Aircraft Reciprocating Engines Lab		50	50	1.0
AMT 243	Turbine Engines; Turbine Air Systems	45		45	1.0
AMT 244	Turbine Engines; Turbine Air Systems Lab		50	50	1.0
AMT 245	Engine Inspection	20		20	1.0
AMT 246	Engine Inspection Lab		40	40	1.0
AMT 247	Lubrication Systems; Engine Fire Detection & Protection Systems	40		40	1.0
AMT 248	Lubrication Systems; Engine Fire Detection & Protection Systems Lab		40	40	1.0
AMT 249	Ignition & Starting Systems	40		40	1.0
AMT 250	Ignition & Starting Systems Lab		40	40	1.0
AMT 251	Fuel Metering; Reciprocating Engine Induction & Cooling, Exhaust, and Reverser Systems	40		40	1.0
AMT 252	Fuel Metering; Reciprocating Engine Induction & Cooling, Exhaust, and Reverser Systems Lab		40	40	1.0
AMT 253	Engine Electrical Systems	40		40	1.0
AMT 254	Engine Electrical Systems Lab		40	40	1.0
AMT 255	Propellers	40		40	1.0
AMT 256	Propellers Lab		40	40	1.0

Round 4

Course Titles

Delphi Round 4 had 27 participants, which was not unexpected as several of the experts had commitments out of the country and were unable to complete the survey. Participants were notified on February 28, 2017 and asked to complete round 4 survey by March 8, 2017. An email reminder was sent out on the fifth day with a final reminder on the date the response was due. Round 4 consisted on determining which course titles could reasonably represent the previous agreement of subject area combinations. At this point the combinations of the subject areas were defined in round 3 and not subject to reconsideration.

The experts considered titles for three different types of courses: (1) course titles for courses which consisted of single subject areas, (2) combined subject areas where the course title

equaled the combined names of the subject areas, and (3) combined subject areas where a new name was needed for the course. The first area presented the least controversial name selection and near unanimous agreement as shown in Figure 8 single subject area equals course name with an average of 93 percent of the experts in agreement.

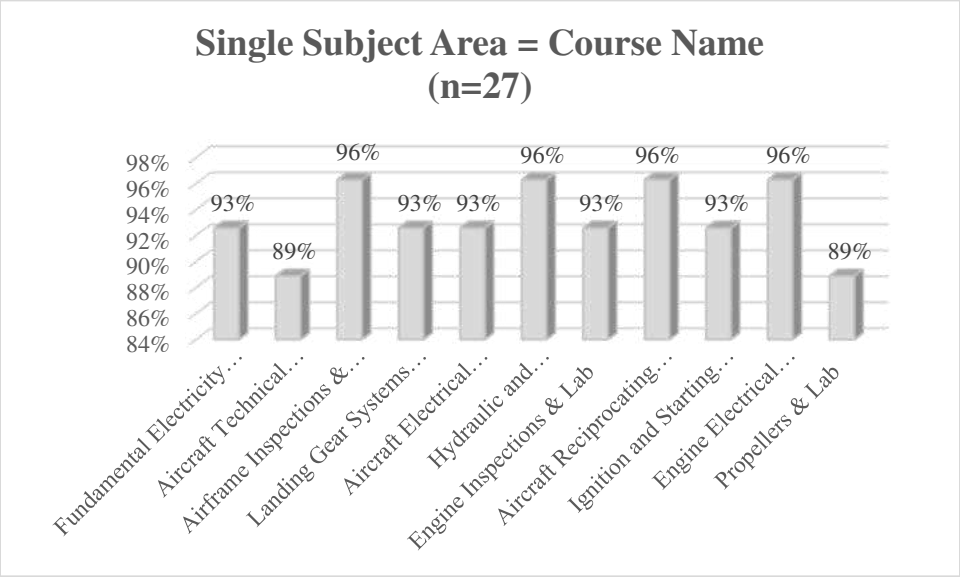


Figure 8. Single subject area equals course name.

The second area consisted of courses where the subject areas were combined, yet traditionally or conveniently lent themselves to a course name that was crafted from the combined subject areas. In general each of the courses in this category consisted of only two subject areas. While the agreement among the experts declined in comparison to the first concentration of courses, it was still significant at 86 percent agreement as shown in Figure 9 average agreement among experts.

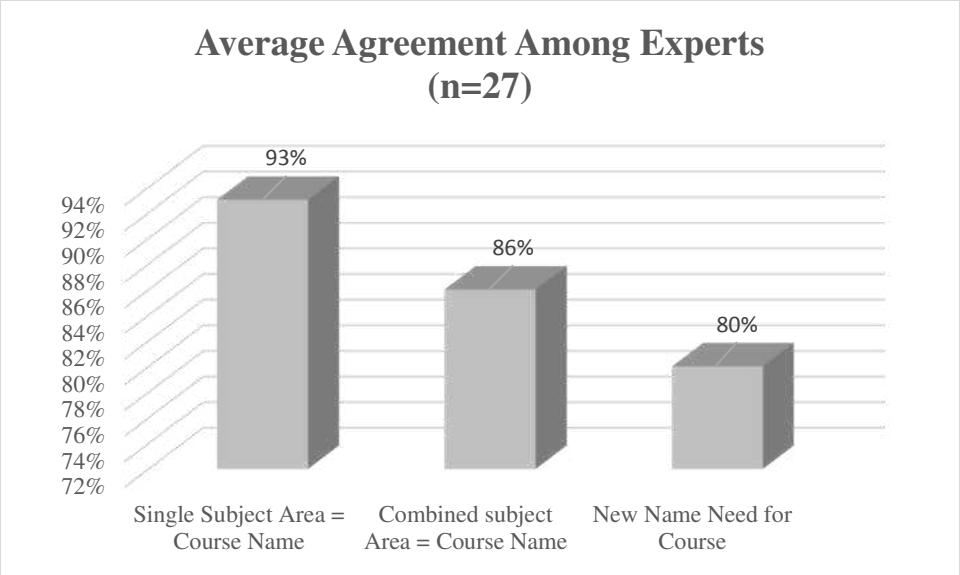


Figure 9. Average agreement among experts.

The second area presented the fewest number of courses under consideration as shown in Figure 10 combined subject area equals course name with an average of 86 percent of the experts in agreement.

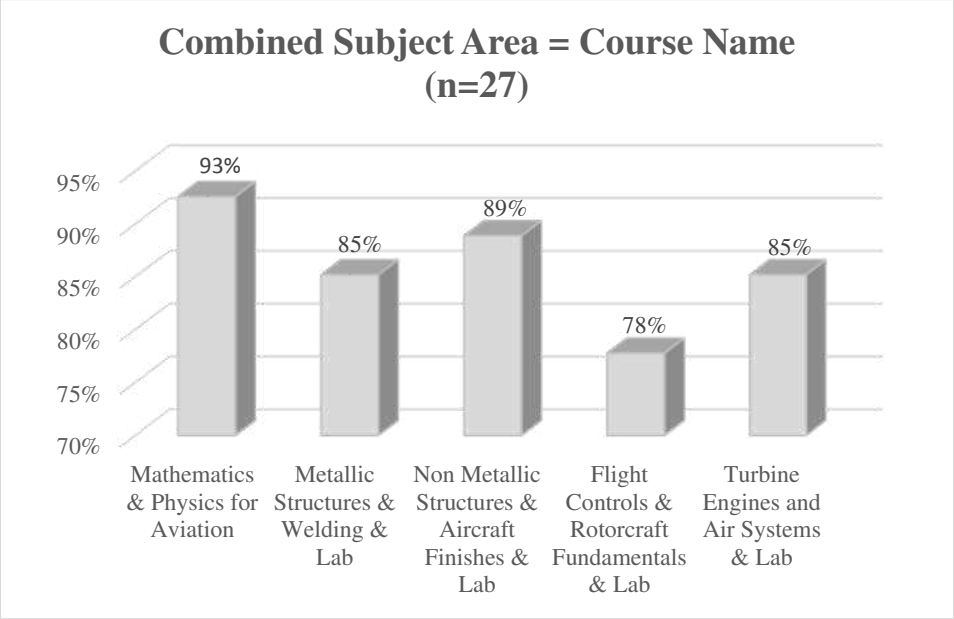


Figure 10. Combined subject area equals course name.

The final area of round 4 consisted of courses where two or more subject areas were combined and a new course name was necessary as merely combining the subject areas was impractical for standard course naming convention. In general each of the courses in this category consisted of an average of three subject areas, with two containing four subject areas and one with five. While the agreement among the experts declined in comparison to the first two areas, it was still significant at 80 percent agreement as shown in Figure 10 new name need for course.

The results of round 4 when combined with the previous three rounds allowed for the development of a matrix for the model AMT curriculum with specific clock hour times as well as college credit in a standard FAA format of sections (general, airframe, and powerplant) and collegiate course titles (see Table 11 model AMT curriculum with course titles times, and credit hours on page 88 for details).

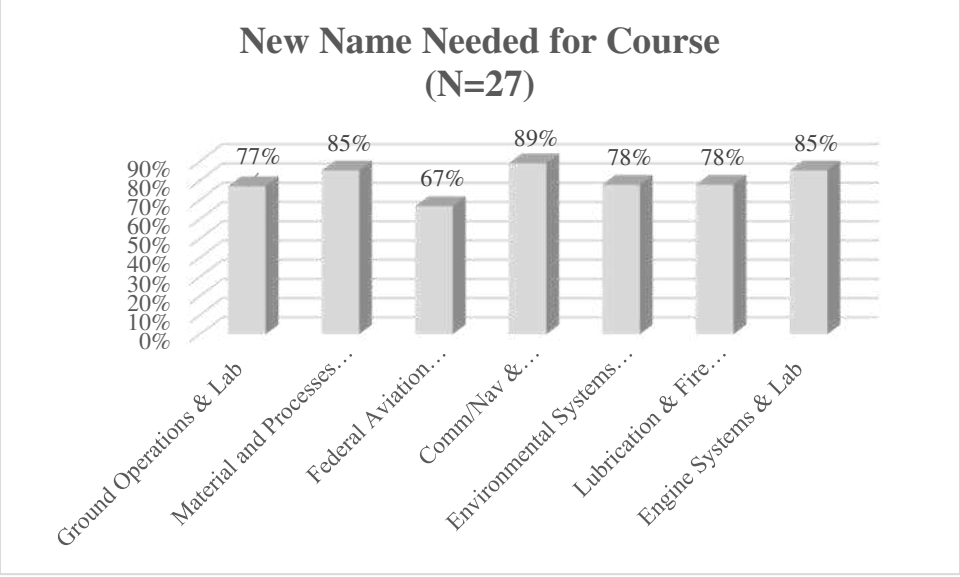


Figure 11. New course name needed.

Round 5

Subject Area Objectives

Participants were notified on February 28, 2017, the same time as round 4 and asked to complete round 5 survey by March 8, 2017. The rationale for requesting the participants to complete both round 4 and 5 stemmed from the fact that the two rounds were not interdependent, that is, both round 4 and 5 responses were based on round 3. An email reminder was sent out on the fifth day with a final reminder on the date the response was due. Round 5 consisted of determining which subject area objectives could reasonably represent the previous agreement of subject area combinations, drawn from the airmen testing standards developed in the ACS.

Only 21 participants completed round 5, the most daunting of the rounds as it required the participant to review over 100 pages of objectives in addition to several reference articles on objectives. The experts considered objectives for the three sections, general, airframe, and powerplant as well as three areas within each subject area: (1) knowledge based objectives, (2) affective domain objectives, and (3) psychomotor objectives. In general the experts were in agreement with the objectives for each subject area, which were specifically chosen to align with the ACS. The reason for this was twofold. First, most of the experts were familiar with the ACS as it has been presented in its various draft forms over the past year by the FAA, and several trade organizations including ARSA and ATEC. The second reason for adhering to specific subject areas, rather than the course names selected by the experts in Round 4 was to allow for the FAA to consider adopting these objectives in the operational specifications for 14 CFR § 147 and for the various AMTS to mix and match subject areas as necessary to match their own course selections.

The general subject areas included only one area where the experts were less than 95 percent in agreement, specifically aircraft technical graphics. The two comments noted that the title does not describe what the curricula covers and the other expert noted that the preferred title should be aircraft technical communications. Neither comment was directly germane to the charge of round 5, which was to consider the specific objectives, not the title of the specific subject area. The average agreement of the experts for the objectives included in the general section was 98 percent and the specifics are detailed in Figure 11 general subject area objectives. The general subject area objectives can be located in Appendix I on pages 119 to 148.

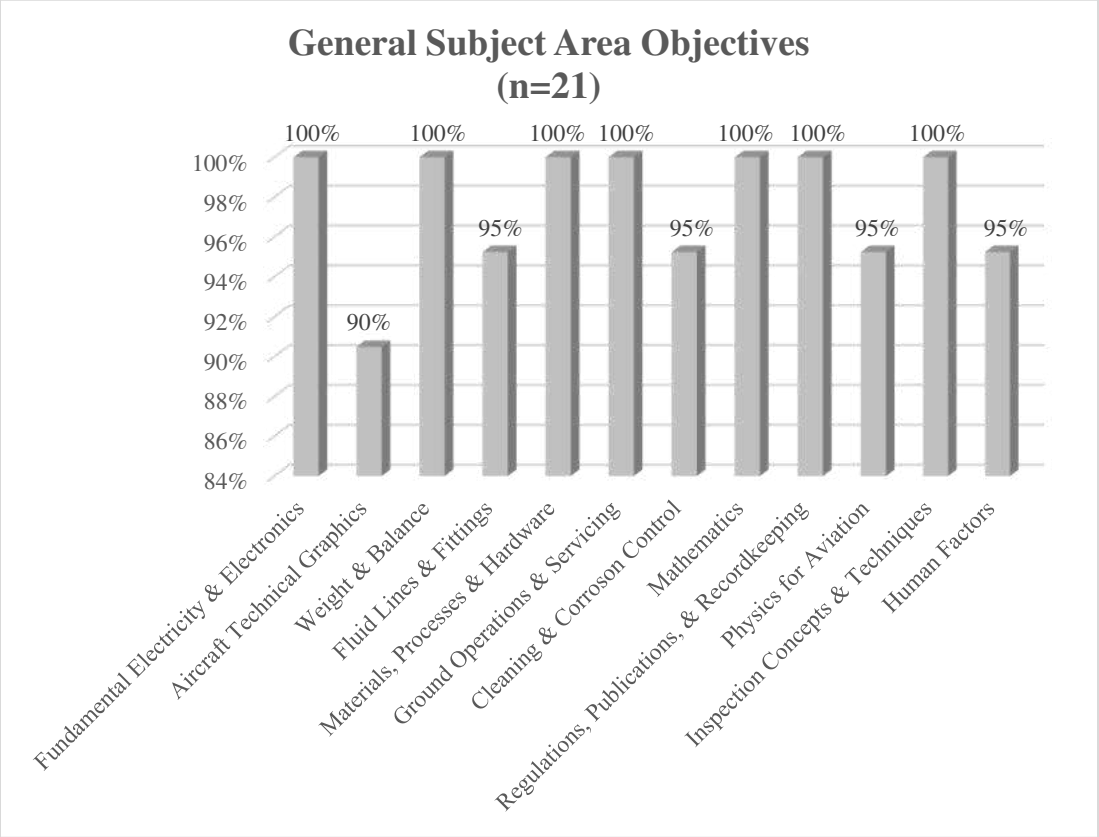


Figure 12. General subject area electives.

The airframe subject areas again included only one area where the experts were less than 95 percent in agreement, specifically non-metallic structures. The two comments noted wood and

fabric are not required and the other expert noted only the words: bonded structures. Neither comment was directly germane to the charge of round 5, which was to consider the specific objectives, not the title of the specific subject area. It should further be noted that while the ARAC report and the NPRM did eliminate wood and fabric, the ACS, that is the testing standard included both areas. It seems incumbent upon a school to teach subjects that the technician will be expected to have some mastery in. The average agreement of the experts for the objectives included in the airframe section was 97 percent and the specifics are detailed in Figure 12 airframe subject area objectives. The airframe subject area objectives can be located in Appendix J on pages 149 to 182.

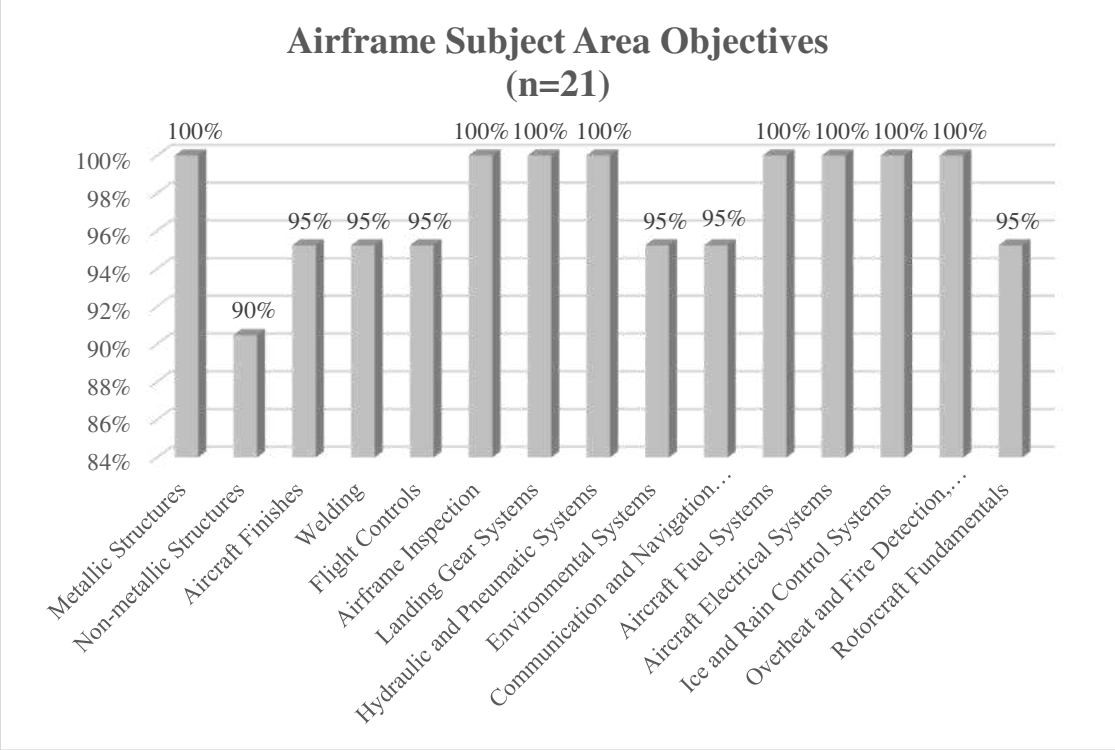


Figure 13. Airframe subject area electives.

The powerplant subject areas again included no areas where the experts were less than 95 percent in agreement. The average agreement of the experts for the objectives included in the

powerplant section was 98 percent and the specifics are detailed in Figure 13 powerplant subject area objectives. The powerplant subject area objectives can be located in Appendix K on pages 183 to 212.

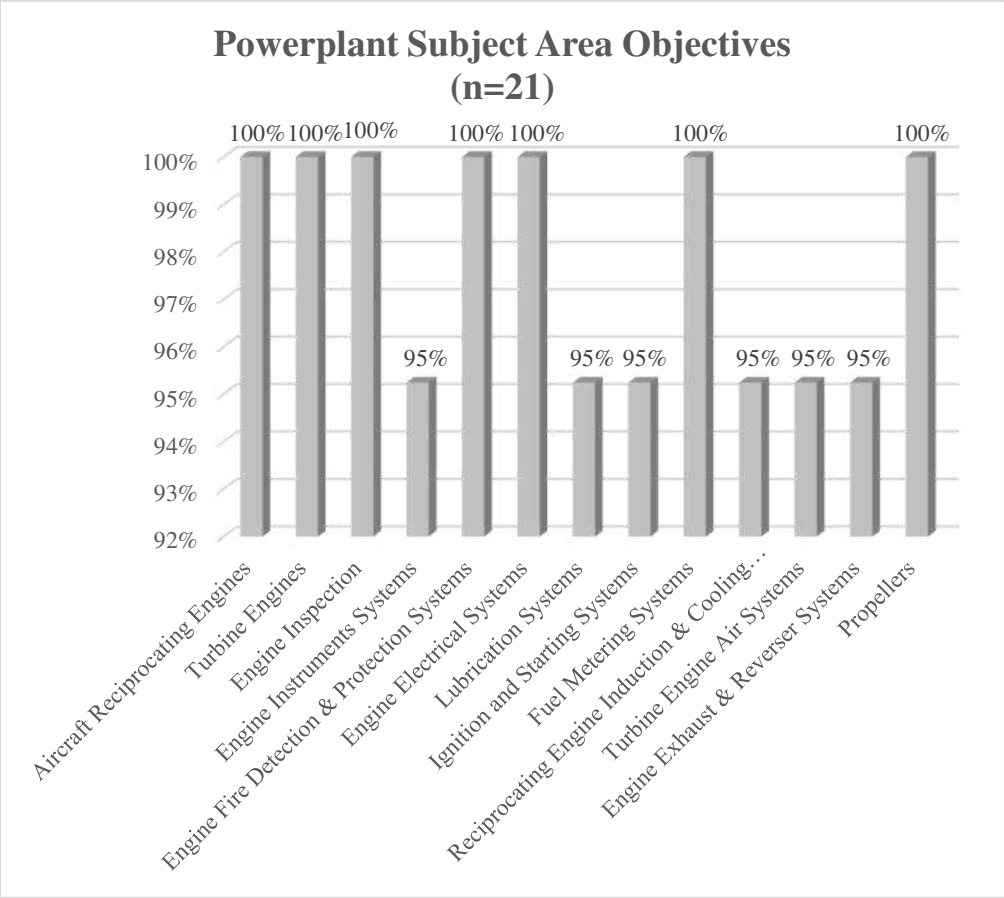


Figure 14. Powerplant subject area electives.

Summary

The results of the five rounds of Delphi surveys clearly indicate the aviation maintenance expert's preference for combining the best elements of the three federal documents as indicated from the source of sections and subject areas selection. The areas of least agreement were centered in deriving individual course names from the arbitrary subject area combinations, even though there was general consensus generally in excess of two thirds. The one of area of near

unanimous agreement was the proposed objectives, which, hopefully, will provide a framework for the FAA to use as the basis for operational specifications to 14 CFR § 147.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Recommendations for Model Aviation Maintenance Technician Curriculum

The recommendations for a model aviation maintenance technician curriculum are established from the following assumptions agreed upon by the majority of the aviation maintenance experts consulted during the first Delphi Round 1 and summarized below.

1. The model AMTS curriculum will consist of a minimum of 1900 clock hours and 48 credits with no course less than 1 credit.
2. The curriculum will allow for the delivery of asynchronous distance education and incorporate competency based training in the overall design.
3. Common subject areas will be grouped together.
4. Subject areas will be based primarily, but not exclusively upon the FAA Airman Certification Standards (ACS) for General, Airframe, and Powerplant.
5. For convenience, odd numbers will be used to designate lecture courses or lecture/laboratory courses that could be taught total via distance and even numbers will be used to designate laboratory courses.

Recommendations for Subject Areas

Drawing from the various federal documents including the current Title 14 Code of Federal Regulations § 147 Appendix B, C, and D; the Advisory and Rulemaking Committees Review Part 147 (Aviation Maintenance Technician Schools Curriculum and Operating Requirements); the Notice of Proposed Rulemaking (NPRM) on Aviation Maintenance Technician Schools; and FAA Aviation Mechanic General, Airframe, Powerplant Airmen Certification Standards (draft) the following subject areas are recommended as categorized in Table 10 (reprinted below).

Table 10 (reprinted)

AMT model curriculum with subject areas, tines, and credit hours

COURSE #	TITLE	TIMES			
		Theory	Lab	Total	Credit
GENERAL AIRFRAME AND POWERPLANT		**225**	**225**	**450**	**12.0**
AMT 101	Fundamental Electricity and Electronics	60	60	120	3.0
AMT 103	Aircraft Technical Graphics	20	20	40	1.0
AMT 105	Weight & Balance; Ground Operations & Servicing	40		40	1.0
AMT 106	Weight & Balance; Ground Operations & Servicing Lab		40	40	1.0
AMT 107	Aircraft Material, Hardware, & Processes; Fluid Lines & Fittings; Cleaning & Corrosion Control	60		60	2.0
AMT 108	Aircraft Material, Hardware, & Processes; Fluid Lines & Fittings; Cleaning & Corrosion Control Lab		60	60	2.0
AMT 109	Mathematics; Physics for Aviation	20	20	40	1.0
AMT 111	Maintenance Forms, Records, & Publications; Human Factors; Inspection Concepts &Techniques	25	25	50	1.0
AIRFRAME		**380**	**420**	**800**	**20.0**
AMT 221	Metallic Structures; Welding	60		60	1.0
AMT 222	Metallic Structures; Welding Lab		80	80	2.0
AMT 223	Non-Metallic Structures	60		60	1.0
AMT 224	Non-Metallic Structures Lab		80	80	2.0
AMT 225	Flight Controls; Rotorcraft Fundamentals	40		40	1.0
AMT 226	Flight Controls; Rotorcraft Fundamentals Lab		40	40	1.0
AMT 227	Airframe Inspection	20		20	1.0
AMT 228	Airframe Inspection Lab		40	40	1.0
AMT 229	Landing Gear Systems	40		40	1.0
AMT 230	Landing Gear Systems Lab		40	40	1.0
AMT 231	Hydraulic & Pneumatic Systems	40		40	1.0
AMT 232	Hydraulic & Pneumatic Systems Lab		40	40	1.0
AMT 233	Environmental; Aircraft Fuel; Ice and Rain Control; Overheat & Fire Detection, Protection, & Suppression Systems	40		40	1.0
AMT 234	Environmental, Aircraft Fuel; Ice and Rain Control; Overheat & Fire Detection, Protection, & Suppression Systems Lab		40	40	1.0
AMT 235	Communication/Navigation; Airframe Instrument Systems	40		40	1.0
AMT 236	Communication/Navigation; Airframe Instrument Systems Lab		40		1.0
AMT 237	Aircraft Electrical Systems	40		40	1.0
AMT 238	Aircraft Electrical Systems Lab		40	40	1.0
POWERPLANT		**310**	**340**	**650**	**16.0**
AMT 241	Aircraft Reciprocating Engines	45		45	1.0
AMT 242	Aircraft Reciprocating Engines Lab		50	50	1.0
AMT 243	Turbine Engines; Turbine Air Systems	45		45	1.0
AMT 244	Turbine Engines; Turbine Air Systems Lab		50	50	1.0
AMT 245	Engine Inspection	20		20	1.0
AMT 246	Engine Inspection Lab		40	40	1.0
AMT 247	Lubrication Systems; Engine Fire Detection & Protection Systems	40		40	1.0
AMT 248	Lubrication Systems; Engine Fire Detection & Protection Systems Lab		40	40	1.0
AMT 249	Ignition & Starting Systems	40		40	1.0
AMT 250	Ignition & Starting Systems Lab		40	40	1.0
AMT 251	Fuel Metering; Reciprocating Engine Induction & Cooling, Exhaust, and Reverser Systems	40		40	1.0
AMT 252	Fuel Metering; Reciprocating Engine Induction & Cooling, Exhaust, and Reverser Systems Lab		40	40	1.0
AMT 253	Engine Electrical Systems	40		40	1.0
AMT 254	Engine Electrical Systems Lab		40	40	1.0
AMT 255	Propellers	40		40	1.0
AMT 256	Propellers Lab		40	40	1.0

The subject areas depicted in Table 10 directly addresses research question 1 - *What are the ideal common subject area groupings given the subject matter proposed in the three listed Federal documents?*

Recommendations for Sections

In keeping primarily with the recommendations of the 2008 report of the FAA Advisory and Rulemaking Committees Review Part 147 (Aviation Maintenance Technician Schools Curriculum and Operating Requirements) and the recent FAA Notice of Proposed Rulemaking (NPRM) on Aviation Maintenance Technician Schools three sections are adopted for inclusion in the model AMT curriculum: general, airframe, and powerplant. These sections (general, airframe, and powerplant) are clearly indicated in **bold** Table 10 on page 83.

Recommendations for Course Titles, Credit and Times

The recommendations for specific course titles, with suggested clock hours and credit for each course is depicted in Table 11 found on the page 85. The layout of the courses, times, and credit hour distribution coupled with the basic assumptions summarized above directly addresses research question 2 - *What are the ideal credits and respective times associated with the selected courses derived from question 1 given the limitations of 1 college credit minimum, ~ 1900 hours, and the Carnegie unit guidelines?*

Recommendations for Objectives

The recommendations for subject area objectives can be located in appendix H for general subject areas, appendix I for airframe subject areas, and appendix j for powerplant subject areas and addresses research question 3 - *What are the best objectives for each of the subject areas (and courses) identified above?*

Table 11

AMT Model curriculum with course times, and credit hours

COURSE #	TITLE	TIMES			Credit
		Theory	Lab	Total	
GENERAL AIRFRAME AND POWERPLANT		**225**	**225**	**450**	**12.0**
AMT 101	Fundamental Electricity and Electronics	60	60	120	3.0
AMT 103	Aircraft Technical Graphics	20	20	40	1.0
AMT 105	Ground Operations	40		40	1.0
AMT 106	Ground Operations Lab		40	40	1.0
AMT 107	Material and Processes	60		60	2.0
AMT 108	Material, and Processes Lab		60	60	2.0
AMT 109	Mathematics and Physics for Aviation	20	20	40	1.0
AMT 111	Federal Aviation Regulations	25	25	50	1.0
AIRFRAME		**300**	**380**	**680**	**18.0**
AMT 221	Metallic Structures and Welding	60		60	1.0
AMT 222	Metallic Structures and Welding Lab		80	80	2.0
AMT 223	Non-Metallic Structures	60		60	1.0
AMT 224	Non-Metallic Structures Lab		80	80	2.0
AMT 225	Flight Controls and Rotorcraft Fundamentals	40		40	1.0
AMT 226	Flight Controls and Rotorcraft Fundamentals Lab		40	40	1.0
AMT 227	Airframe Inspection	20		20	1.0
AMT 228	Airframe Inspection Lab		40	40	1.0
AMT 229	Landing Gear Systems	40		40	1.0
AMT 230	Landing Gear Systems Lab		40	40	1.0
AMT 231	Hydraulic and Pneumatic Systems	40		40	1.0
AMT 232	Hydraulic and Pneumatic Systems Lab		40	40	1.0
AMT 233	Environmental Systems	40		40	1.0
AMT 234	Environmental Systems Lab		40	40	1.0
AMT 235	Comm/Nav and Instrument Systems	40		40	1.0
AMT 236	Comm/Nav and Instrument Systems Lab		40		1.0
AMT 237	Aircraft Electrical Systems	40		40	1.0
AMT 238	Aircraft Electrical Systems Lab		40	40	1.0
POWERPLANT		**310**	**340**	**650**	**16.0**
AMT 241	Aircraft Reciprocating Engines	45		45	1.0
AMT 242	Aircraft Reciprocating Engines Lab		50	50	1.0
AMT 243	Turbine Engines and Air Systems	45		45	1.0
AMT 244	Turbine Engines and Air Systems Lab		50	50	1.0
AMT 245	Engine Inspection	20		20	1.0
AMT 246	Engine Inspection Lab		40	40	1.0
AMT 247	Lubrication and Fire Systems	40		40	1.0
AMT 248	Lubrication and Fire Systems Lab		40	40	1.0
AMT 249	Ignition & Starting Systems	40		40	1.0
AMT 250	Ignition & Starting Systems Lab		40	40	1.0
AMT 251	Engine Systems	40		40	1.0
AMT 252	Engine Systems Lab		40	40	1.0
AMT 253	Engine Electrical Systems	40		40	1.0
AMT 254	Engine Electrical Systems Lab		40	40	1.0
AMT 255	Propellers	40		40	1.0
AMT 256	Propellers Lab		40	40	1.0

Overall Model Curriculum Recommendations

The AMT model curriculum was designed so that it could be easily adapted by an individual AMTS to meet their specific curricular needs. Several examples of the adaptability would include an AMTS that seldom sees any students pursuing a single certificate could elect to arrange the curriculum with the following sections, general, airframe, powerplant, and combined systems and components. This would then allow that AMTS to combine the following airframe and powerplant subject areas: electrical, fuel, fire detection and protection, and instrument systems into four basic courses, each with a lecture and laboratory component. A second example might include an AMTS that specializes in "bush" operations that elects to emphasize welding and aircraft covering might choose to increase both the times and credits for those subject areas. A third example would be an AMTS that elects to group the courses into five sections, title each section as a course and teach the entire curriculum as general, airframe structures, airframe systems and components, powerplant theory and maintenance, and powerplant systems and components.

Another value to this research is to provide guidance to any AMTS that wishes to modernize their AMT curriculum, not only to comply with the anticipated regulatory change forecast by the NPRM, but with the intent of updating maintenance training to meet the demands of the 21st century allowing for both competency-based and distance delivery of the subject matter. The FAA anticipated that each AMTS would need a minimum of "320 hours for a manager and 80 hours for an administrative assistant for the initial revision and 32 hours for a manager and 8 hours for an administrative assistant for subsequent revisions" (Notice of proposed rulemaking, 2015, p. 33). It is estimated that this study should pair that total down by over 75 percent.

One of the foremost intentions of this research was to provide guidance to the FAA AFS-300, flight standards service – aircraft maintenance division that is charged with implementing any changes to 14 CFR § 147. Due to manpower shortages, AFS-300 personnel have not been directly involved in the development of the Airmen Certification Standards, and this has led, in part, to the disconnect that is evident between the three documents, the ARAC report, the NPRM, and the ACS. This research has attempted to shed light upon the logical format to reconcile those discrepancies.

The careful, thorough, and expert based curriculum that has emerged from this study should provide a framework for the FAA to consider in updating the regulation that governs aviation maintenance training, specifically, 14 CFR § 147 and associated Operational Specifications A001, A002, A003, A004, A005, A006, A007, A012, A013, A025, A026, B002, B003, and B004 (FAA, 2014). A draft of this dissertation was sent to the manager and deputy assistant manager, aircraft maintenance division (AFS-300), as well as the supervisory aviation safety inspector charged with preparing the revision to 14 CFR § 147 on March 15, 2017 and the final copy of the dissertation will be forwarded to the same individuals with a request for inclusion to the docket for public inspection.

The recommendations will be made available for all ATEC member aviation maintenance technician schools along with a set of suggested projects arranged by subject area in the form of a curriculum guide for new AMTSs to prepare documentation acceptable to FAA to assist in establishing a new aviation maintenance training program and existing AMTSs to revise their curriculums to begin incorporating 21st century training elements and methodology.

Future Research

One area of future research will be the clarification of specific subject areas when the FAA releases the final rule change to 14 CFR § 147. It will be interesting to note whether the agency retains the subject areas in the rule within the appendices as the NPRM is currently drafted (pp. 67-69) or removes them completed as petitioned by virtually all of the aviation alphabet groups, including ATEC, ARSA, and the entire STEM coalition (Maguire, 2016). A second area of research that was beyond the scope of this research would be to take a look at the amount of time that each of the 178 AMTS devotes to each subject area. This would be valuable information and would allow a set of norms to be established nationwide. Only one study has approached any consideration of this (Dyen, 2014) and that study concentrated on specific objectives in a limited number of subject areas, in selected leading (top tier) AMTSs. Finally, it would be interesting as well as incumbent upon the aviation maintenance industry to conduct a study comparing the cost of complying with the new 14 CFR § 147 regulation with the cost estimates prepared and distributed in the NPRM and the projected costs in the actual regulation.

References

Allen, J. M. (2012). *Advisory Circular 120-16F: Air carrier maintenance program*, Washington D.C.: Federal Aviation Administration.

Allen, D. (1966). *A national study of the aviation mechanics occupation,* University of California, Los Angeles, CA.

Allen, I.E. & Seaman, J., (2010). Class differences: Online education in the United States, Babson Park, MA: Babson Survey Research Group.

Allen, M., Burrell, J. N., Bourhis, J., & Timmerman, E., (2007). Literature of satisfaction, *Handbook of distance education,* 2nd ed., ed. M.G. Moore, 149-156. Mahwah, NJ: Erlbaum.

Aviation Maintenance Technician Schools, 14 C.F.R. § 147 (1962).

Aviation Maintenance Technician Schools, 81 Fed. Reg. 59674–59690 (proposed October 2, 2015).

Aviation Safety. (2003). *FAA Needs to Update the Curriculum and Certification Requirements for Aviation Mechanics,* (GAO Publication No. 03-317). Washington, D.C.: U.S. Government Printing Office.

ATEC (Aviation Technician Education Council), (2016). *Legislative priorities.* Retrieved from http://www.atec-amt.org/uploads/1/0/7/5/10756256/atec-legislativepriorities-20160608.pdf

Babbitt, J. R. (2011). *Report on training hours requirement review*: P.L. 111-216, Section 209, Washington D.C.: Federal Aviation Administration.

Ban, M., Jones, C. & Uselton, E., (2014). *Policy solutions for a stronger technical workforce,* College of William and Mary, Williamsburg, VA.

Berge, Z. L. (1998). Barriers to online teaching in post-secondary institutions: Can policy changes fix it? *The Online Journal of Distance Learning Administration, 1*(2) Summer 1998.

Berge, Z., & Muilenburg, L. (2000). Barriers to distance education as perceived by managers and administrators: Results of a survey. In M. Clay (Ed.), *Distance learning administration annual 2000.* Baltimore, MD: University of Maryland.

Blackwood, H, & Trent, C. (1968). A comparison of the effectiveness of face-to-face and remote teaching in communicating education information to adults, Manhatten, KS: Kansas State University, Cooperative Extension Service.

Blakley, M. C., (2008). Launching the 21st century American aerospace workforce, aerospace industries association, Arlington, VA: AIA.

Boeing Commercial Airplanes. (2016). *2016 Pilot and Technician Outlook*. (Report Number 301430), retrieved from http://www.boeing.com/commercial/market/long-term-market/pilot-and-technician-outlook/

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Aircraft and Avionics Equipment Mechanics and Technicians, retrieved from http://www.bls.gov/ooh/installation-maintenance-and-repair/aircraft-and-avionics-equipment-mechanics-and-technicians.htm.

Burke, J. B., Hansen, J. H., Houston, W. R., & Johnson, C. (1975). Criteria for describing and assessing competency programmes.

Bye, D., Pushkar, D., & Conway, M, (2007). Motivation, interested and positive affect in traditional undergraduate students, *Adult Educational Quarterly, 57*(2), 141-158.

Chen, B. (2009). Barriers to adoption of technology-mediated distance education in higher-education institutions. *Quarterly Review of Distance Education, 10*(4), 333–338.

Clark, G. C., (1989). Distance education in United States schools, *The Computing Teacher 16*(6), 11.

Clayton, M. J. (1997). Delphi: A technique to harness expert opinion for critical decision-making tasks in education. *Educational Psychology, 17*(4), 373-384.

Cohen, S., Eimicke, W. Kamlet, M., and Pearson R. (1998, February). The information resource management program: A case study in distance education. *Journal of Public Affairs Education, 4*(3), 179-192.

Cole, T. L., Cochran, L., & Troboy, K. (2012). Efficiency in assessment: can trained student interns rate essays as well as faculty members? *International Journal for the Scholarship of Teaching and Learning*, *6*(2), 6.

Colton, S. & Hatcher, T., (2004). The web-based Delphi research technique as a method for content validation in HRD and adult education*, Academy of Human Resources Development International Conference (AHPD),* 183−189.

Day, E. A., Arthur Jr, W., & Gettman, D. (2001). Knowledge structures and the acquisition of a complex skill. *Journal of applied psychology*, *86*(5), 1022.

Delbeq, A., Van de Ven, A., & Gustafson, D. H. (1975). *Group techniques for program planning: A guide to nominal group and Delphi processes*. Glenview, USA: Scott, Foresman and Company.

Dillingham, G. L., (2003). FAA needs to update the curriculum and certification requirements for aviation mechanics, United States General Accounting Office Report to the ranking

democratic member, committee on transportation and infrastructure, House of Representatives, GAO-03-317.

Dunn, T. P., Meine, M. F., & McCarley, J. (2010). The remote proctor: An innovative technological solution for online course integrity. *International Journal of Technology, Knowledge & Society*, *6*(1).

Dupin-Bryant, P. A., (2004). Pre-entry variables related to retention in online distance education, *American Journal of Distance Education, 18*(4). 199-206.

Dyen, F. D., (2014). Current objective implementation in part 147 aviation maintenance technician schools, *ATEC Journal 36(*1) 13-23.

Dyen, F. D., (2016). 14 CFR Part 147 Curriculum Manual, (Flight Standards District Office AEA #21), Richmond, VA.

Dyen, F. D. & Hall, E., (2016). *Competency-based education in part 147 aviation maintenance technician schools*, Manuscript submitted for publication.

Federal Aviation Administration, (2012). *Air Carrier Maintenance Programs*, (Advisory Circular 120-16F), Washington D.C.: Federal Aviation Administration.

Federal Aviation Administration, (2012). Aviation Mechanic General Practical Test Standards: FAA-S-8081-26A (with change 1 – April 27, 2015), Washington D.C.: Federal Aviation Administration.

Federal Aviation Administration, (2012). Aviation Mechanic Airframe Practical Test Standards: FAA-S-8081-27A (with changes 1 – April 27, 2015 & 2 – September 29, 2015), Washington D.C.: Federal Aviation Administration.

Federal Aviation Administration, (2012). Aviation Mechanic General Practical Test Standards: FAA-S-8081-28A (with change 1 – April 27, 2015), Washington D.C.: Federal Aviation

Administration.

Federal Aviation Administration, (2014). Crediting distance learning as a component of ground training for flightcrew members, *Flight Standards Information Management System (FSIMS), 3*(56), 3-4436.

Federal Aviation Administration, (2014). Evaluate Part 147 aviation maintenance technician school's curriculum/revision and instructor qualifications, *Flight Standards Information Management System (FSIMS), 2*(12), 2-1448.

Federal Aviation Administration, (2014). Operations Specifications A001, A002, A003, A004, A005, A006, A007, A012, A013, A025, A026, B002, B003, and B004 for Part 147, *Notice N8900.278,* Washington D.C.: Federal Aviation Administration.

Federal Aviation Administration, (2015). Evaluate Part 147 aviation maintenance technician school's curriculum/revision and instructor qualifications, *Flight Standards Information Management System (FSIMS), 2*(12), 2-1450.

Federal Aviation Administration, (2015). Advisory circular 147-3B, *Certification and operation of aviation maintenance technician schools,* Washington D.C.: Federal Aviation Administration.

Federal Aviation Administration, (2017). Aviation mechanic general, airframe, powerplant airman certification standards, Washington D.C.: Federal Aviation Administration.

Fojtik, R. (2015). Comparison of Full-Time and Distance Learning. *Procedia-Social and Behavioral Sciences*, *182*, 402-407.

Friedman, B.A. and Mandel, R. G. (2011-2012). Motivation predictors pf college student academic performance and retention, *J. College Student Retention, 13*(1), 1-15.

Gallager-Lepak, S., Reilly, J., & Killion, C.M. (2009). Nursing student perceptions of

community in online learning, *Contempory Nurse, 32*(1-2), 133-146.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of distance education*, *15*(1), 7-23.

Geiger, L.A., Morris, D., Suboez, S. I., Shattuck, K, & Viterito, A., (2014). Effect on student readiness on student success in online courses, *Internet Learning Journal, 3*(1), 73-84.

Gill, F. J., Leslie, G. D., Grech, C., & Latour, J. M. (2013). Using a web-based survey tool to undertake a Delphi study: Application for nurse education research. *Nurse Education Today*, *33*(11), 1322-1328.

Goldsby, R.P. & Soulis, A.S., (2002). *Optimization of aviation maintenance personnel training and certification*, Washington D.C.: Federal Aviation Administration.

Gordon, T. J. (1994). *The Delphi method*. Washington, DC: American Council for the United Nations University.

Green, R. A., (2014). The Delphi technique in education research. *SAGE Open, 4*(2), 2158244014529773.

Government Accountability Office, (2014). *Aviation Workforce: Current and Future Availability of Aviation Engineering and Maintenance Professionals,* (14-237), 10, Washington, D.C.

Guidance material and best practices for the implementation of competency-based training in maintenance, (2011). International Air Transport Association.

Guidelines and recommendations on eLearning, GR 1003, (2013). European Aviation Maintenance Training Committee.

Hogarth, R. M. (1978). A note on aggregating opinions. *Organizational Behavior and Human Performance*, *21*(1), 40-46.

Hirumi, A. (2005). In search of quality: An analysis of e-learning guidelines and specifications. *Quarterly Review of Distance Education*, *6*(4), 309.

Hsu, C. C., & Sandford, B. A. (2007). The Delphi technique: making sense of consensus. *Practical assessment, research & evaluation*, *12*(10), 1-8.

Institutional Eligibility Under the Higher Education Act of 1965 as amended, 79 Fed. Reg. 65006, (Oct. 31, 2014) (to be codified at 34 C.F.R. pts. 600).]

Keegan, D. (1996). *Foundations of distance education*. Psychology Press.

Lokken, F. (2008). Distance education survey results: Tracking the impact of eLearning at community colleges, Washington, D.C.: Instructional Technology Council.

Lombardo, D. A., (2015). Aviation industry short on qualified maintenance technicians, *Business Aviation AINonline,* retrieved from *http://www.ainonline.com/aviation-news/business-aviation/2015-06-16/group-seeks-new-classification-maintenance-techs*.

Los Angeles Southwest College, (2016). *"Definition of "credit hour" – the Carnegie unit: How to calculate student contact hours,* retrieved from http://www.lasc.edu/students/Credit%20Hour%20Definition%20for%20LASC.pdf

Maguire, C., (2016). *Aviation maintenance technician school notice of proposed rulemaking docket,* ID: FAA-2015-3901; ID: FAA-2015-3901-0001; FR 2015-24841.

Marozzi, M. (2014). Testing for concordance between several criteria. *Journal of Statistical Computation and Simulation*, *84*(9), 1843-1850.

McGrath, R. N. & Waguespack, B. P. (1999). The airline maintenance mechanic educational infrastructure: Supply, demand, and evolving industry structure, *Journal of Aviation/Aerospace Education and Research, 8(3),* 33-43.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. *US Department of Education*.

Miller, A., Shoptaugh, C., & Wooldridge, J. (2011). Reasons not to cheat, academic-integrity responsibility, and frequency of cheating. *The Journal of Experimental Education*, *79*(2), 169-184.

Mitchell, V. W. (1991). The Delphi technique: An exposition and application. *Technology Analysis & Strategic Management, 3*(4), 333-358.

Moore, Michael Grahame, ed. *Handbook of distance education*. Routledge, 2013.

Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. Cengage Learning.

Moore, M.G., Thompson, M. M., Quigley, B. A., Clark, G. C., &Goff, G.G., (1990). The effects of distance learning: a summary of literature (Research Monograph No. 2), University Park, PA: American Center for the Study of Distance Education.

Morrison, G. R., Ross, S. M., Kemp, J. E., & Kalman, H. (2010). *Designing effective instruction*. John Wiley & Sons.

Okoli, C., & Pawlowski, S. D. (2004). The Delphi method as a research tool: an example, design considerations and applications. *Information & management*, *42*(1), 15-29.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. (2nd ed.). Newbury, CA: Sage.

Pew Research Center, (2011). The digital revolution and higher education: College presidents, public differ on value of online learning, retrieved from http://www.pewinternet.org/~/media/Files/Reports/2011/PIP-Online-Learning.pdf.

Rowe, G., & Wright, G. (2001). Expert opinions in forecasting: the role of the Delphi technique. In *Principles of forecasting: A handbook of researchers and practitioners,* Boston: Kluwer Academic Publishers.

Salahi Yekta, A., Lupton, R., & Khadem Maboudi, A. A. (2011). Attitudes, perceptions, and tendencies of the Iranian students in medical fields towards cheating and academic dishonesty. *Journal of Paramedical Sciences*, *1*(4), 2265-2265.

Silva, E., White, T., & Toch, T. (2015). The Carnegie Unit: A Century-Old Standard in a Changing Education Landscape. *Carnegie Foundation for the Advancement of Teaching*.

Simonson, M. (2012). Teaching and learning at a distance: Foundations of Distance Education. Boston, MA: Pearson.

Simonson, M., Schlosser, C., & Orellana, A. (2011). Distance education research: A review of the literature. *Journal of Computing in Higher Education*,*23*(2-3), 124-142.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2014). *Teaching and learning at a distance*. Information Age Pub.

SmarterMeasure, (2015). Assessment summary, retrieved from http://www.smartermeasure.com/smartermeasure/assets/File/resources/SampleReport.html

SmarterMeasure, (2015). Comparison to SmarterMeasure averages, retrieved from http://www.smartermeasure.com/smartermeasure/assets/File/resources/SampleReport.html

SmarterMeasure, (2015). Research results from individual schools, retrieved from http://www.smartermeasure.com/research/research-results/

Smith, E. (2010). A review of twenty years of competency-based training in the Australian vocation education and training systems, *International Journal of Training and Development, 14*(1), 54-64.

Somerville, J. A. (2008). Effective use of the Delphi process in research: Its characteristics, strengths and limitations. *Corvallís (Oregon). Recuperado http://iasomervílle. com/wocontent/uploads/201*, *1*(08).

Stevenson, E. V. (2010). *Some initial methodological considerations in the development and design of Delphi surveys*, Cardiff, UK: Low Carbon Research Institute.

Thomson, R., Lewalle, P., Sherman, H., Hibbert, P., Runciman, W., & Castro, G. (2009). Towards an international classification for patient safety: a Delphi survey. *International Journal for Quality in Health Care*, *21*(1), 9-17.

Thompson, R. E., (2008). Part 147 Aviation maintenance technician school's curriculum and operating requirements working group final report, Washington D.C.: Federal Aviation Administration.

Walter, D. (2000). Competency-based on-the-job training for aviation maintenance and inspection–a human factors approach. *International Journal of Industrial Ergonomics*, *26*(2), 249-259.

Warren, R., (2016). *Aviation Technician Education Council and Federal Aviation Administration Summary of Oral Communications re § 147,* ID: FAA-2015-3901; ID: FAA-2015-3901-0092.

Watson, A.L., (2013). Implementing the 2010 standard occupational classification in the occupational employment statistics program, *Monthly Lab. Rev., 136,* 36-49.

Whitley, B. E. (1998). Factors associated with cheating among college students: A review. *Research in higher education*, *39*(3), 235-274.

Willis, L. L., & Lockee, B. B. (2004). A pragmatic instructional design model for distance learning. *International Journal of Instructional Media*, *31*(1), 9.

Yazici, A., Yazici, S., & Erdem, M. S. (2011). Faculty and student perceptions on college cheating: Evidence from Turkey. *Educational Studies*, *37*(2), 221-231.

Ziglio, E. (1996). The Delphi method and its contribution to decision-making. In M. Adler & E. Ziglio (Eds.), *Gazing into the oracle: The Delphi method and its application to social policy and public health*, London, England: Jessica Kingsley.

APPENDIX A

INVITATION TO PARTICIPANTS

January 18, 2016

Dear _____:

You have been identified as a subject matter expert in aviation maintenance education. You meet the criterion of having at least five years of experience working as an aviation maintenance technician with an FAA mechanic's certificate with airframe and powerplant rating approved to teach in a 14 CFR part 147 aviation maintenance technician school (AMTS), have served on the FAA Aviation Rulemaking Advisory Committee (ARAC) on part 147, the FAA part 147 Aviation Maintenance Technician School Advisory Working Group, the Aviation Technician Education Council Board of Directors, or the FAA with part 147 oversight responsibilities.

Your participation is requested in a five to six round Delphi study that will focus on identifying the ideal common subject area groupings for a competency-based part 147 AMTS curriculum, college credit distribution for those subject areas, and the best objectives for each subject areas. You will be asked to select from suggested items for these three areas or rate them on a Likert-type scale, keeping in mind the use of college credits rather than "seat time" with emphasis on a hybrid delivery system utilizing asynchronous distance delivery and face-to-face presentations. All involvement will take place online via the SurveyMonkey web site.

Your participation in this process will help to shape a model part 147 AMTS curriculum that will equip students with an understanding of the subject matter and insure a skill set required of aviation maintenance technicians. Though your input would be a valuable contribution to this process, your participation in this study will be totally voluntary throughout the duration of the study. Should you choose to be involved in this study for any length of time, your identification will remain completely confidential. If you choose to agree to participate, you will receive a survey that will include basic questions on your professional background. You will be asked to return the survey within one week. You will be reminded throughout this process that your involvement is completely voluntary and that you can feel free to depart the study at any time. You will receive no direct benefit by participating. If you decide to agree to contribute your time and input to this study, please respond by September 30, 2016.

Please feel free to forward this message to anyone who might be interested.

Thank you for your consideration,

Fred D. Dyen
Candidate, Education
Old Dominion University

Thomas Bean, Ph.D.
Professor, Teaching and Learning
Old Dominion University

APPENDIX B

HUMAN SUBJECTS INFORMED CONSENT 101

Researcher: Fred D. Dyen

Study: Aviation maintenance experts' recommendations for a model 14 CFR part 147 curriculum.

I am asking for your voluntary participation in this research study being conducted as part of a dissertation. Please reference the information concerning this study below. If you agree to participate, please sign your name below.

Purpose of the study: The purpose of this study is to define common subject area groupings, ideal college credit distribution based upon respective times, Carnegie unit guidelines, typical educational restrictions, and Federal guidelines, and specific objectives for each subject area.

Your involvement: You will be asked to participate in five to six rounds of a Delphi study by completing surveys, which will be made available over the internet. The Round 1 survey will ask you for demographic information, including age, current employment, years of experience, highest education earned in aviation or a related field, and the type of part 147 involvement or oversight. Round 1 questions will ask participants to rate the assumptions for this study of relative importance of three federal documents (the ARAC Final Report, FAA NPRM on part 147, and FAA Airman Certification Standards), inclusion of asynchronous distance education, limiting individual courses to 1 credit minimum, utilizing 39 hours combined lecture/lab = 1 credit, and consideration of redundancy avoidance on a five-point Likert scale. You will also be able to submit your own suggestions for items you deem worthy of inclusion. In Round 2 you will be provided ranked lists of each guiding assumption analyzed with their median scores from Round 1. You will be asked to rank a list of sections with specific subject area groupings, times, and credits on a five-point Likert scale. In Round 3 you will be asked to select the titles of subject areas drawing from the same three federal documents, which are incongruous, noted above. In Round 4 you will be asked to sort subject areas into course titles with lecture and lab times and corresponding credit hours. In Round 5 you will be asked to rank an updated list of objectives for each of the subject areas (and course) on a five-point Likert scale. If agreement is reached by the panel, the study will end. If not, one more round, identical to Round 5 will be conducted. Each group's rankings will be checked for consensus for each category (assumptions, section and subject area groupings, and objectives). Categories that reach consensus will be deemed complete whereas those that are not in agreement in Round 5 will be carried over into a final Round 6.

Potential risks to you: There are no identifiable risks to you as a result of your participation.

Benefits: There are no foreseeable benefits to you as a result of your participation in this study.

Confidentiality procedures: Your name will not be recorded in the research data but will be replaced by an untraceable identifier which will be tied only to your location. All data will be kept in a password-protected database existing only on the researcher's laptop. This computer will also be password-protected.

APPENDIX B

HUMAN SUBJECTS INFORMED CONSENT 102

Participation and withdrawal: Your participation in this study is completely voluntary. If you choose to participate in this study, you may withdraw at any time by notifying the researcher.

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should contact Dr. Edwin Gomez, Chair of the Darden College of Education Human Subjects Review Committee, Old Dominion University, at egomez@odu.edu. 168

If you have any questions, please feel free to contact:

Fred D. Dyen
Principal Researcher
(540) 453-2306
fdyen001@odu.edu

Dr. Thomas Bean
Responsible Project Investigator
(757) 683-3283
tbean@odu.edu

Consent: I completely understand all the information presented about my voluntary participation in this study and agree to my involvement.

_____ Subject printed name

_____ Subject signature/date

Investigator's Statement: I certify that I have explained to this participant the nature and purpose of this research, including benefits, risks, costs, and any experimental procedures. I have described the rights and protections afforded to human subjects and have done nothing to pressure, coerce, or falsely entice this subject into participating. I am aware of my obligations under state and federal laws, and promise compliance. I have answered the participant's questions and have encouraged him/her to ask additional questions at any time during the course of this study. I have witnessed the above signature(s) on this consent form.

_____ Researcher printed name

_____ Researcher signature/date

APPENDIX C

SUMMARY OF THE STUDY 103

January 16, 2016

Dear _____:

Thank you for agreeing to share your insight in this study on identifying the common subject area groupings, ideal credits, respective times, and objectives associate with those subject areas for the development of an ideal 14 CFR part 147 curriculum. We are appreciative of your time and efforts and feel that your input will be most valuable in this endeavor. If you know of others who might also qualify as subject matter experts in software development and have at least five years of experience as a professional in aviation maintenance education or oversight, please consider sending contact information to the researcher at fdyen001@odu.edu.

Overview of the Study

AVIATION MAINTENANCE EXPERTS' RECOMMENDATIONS FOR A MODEL 14 CFR PART 147 CURRICULUM

Purpose: Aviation maintenance technician schools have traditionally been developed around a rigorous set of regulations established by the FAA in 1962 (14 CFR, 1962), with the technical emphasis on a DC-6 and very little change in the ensuing half century. The FAA attempted to fast track changes to 14 CFR part 147 with the establishment of the Aviation Rulemaking Advisory Committee (ARAC) in 2007 to address the issue that the current part 147 minimum curriculum is inadequate for someone to immediately work on complex aircraft (81 FR, 2007). Unfortunately, the eleven recommendations of ARAC have not been adopted; however, the FAA did issue a notice of proposed rulemaking (NPRM) last year (81 FR, 2015), and the latest indication is that the final rule will not be issued until sometime in the second or third quarter of 2017 (F. Moore, personal conversation, September 11, 2016).

Currently there are 178 aviation maintenance technician schools (AMTSs) with over 150 different curriculums. Previous curriculum guides have all been based upon the FAA mandated 1900 hour minimum and none have addressed specific time distributions or credit suggestions for any of the current 44 subject areas. The purpose of this study is to define common subject area groupings, a model college credit distribution based upon respective times, Carnegie unit guidelines, typical educational restrictions, federal guidelines, and specific objectives for each course and subject area for a 14 Code of Federal Regulations part 147 curriculum.

There are a number of assumptions that must be considered before a model curriculum can be developed including which federal document should take priority regarding the selection of the subject areas, typical state credit and time limitations for certificate programs and degrees, Carnegie unit guidelines, desirability of asynchronous distance delivery inclusion, and formalization of objective criteria.

Instructions: This research will consist of five to six rounds of a Delphi study. You will access each round via the SurveyMonkey web site. The link for the Round 1 questionnaire will be made

available to you by email. You will first be asked to provide some demographic information about yourself. You will **not** be asked for your name. This information is being collected to summarize the background and expertise of the professionals in this study. Remember that all identifiable information collected will be kept strictly confidential.

The second part of the Round 1 survey will present ten assumptions of potential criteria that will guide the establishment of the model curriculum. You will be asked to rate the applicability of each of these assumption regarding their relative importance on a five-point Likert scale. You will also be given the opportunity to submit your own assumptions for consideration, in the event that you feel an important guiding element is missing. Insert any additional suggestions in the blank fields provided. If you would like to submit more than three, please send an email message to fdyen001@odu.edu. You will also be asked to rate the applicability of any new entries using the Likert scale and to explain your entry so your suggestion can be described to other participants in this study.

When you have completed the study, please submit your responses. The SurveyMonkey resource will keep your responses anonymous. Once all questionnaires have been submitted by the study's participants, the responses will be aggregated and the researcher will consult with a research subject matter expert for verification of the results. Once there is agreement on the results and new entries provided by participants, the Round 2 survey will be created and distributed in the same way as in Round 1. In Round 2 you will be provided ranked lists of each guiding assumption analyzed with their median scores from Round 1. You will be asked to rank a list of sections with specific subject area groupings, times, and credits on a five-point Likert scale. In Round 3 you will be asked to select the titles of subject areas drawing from three documents, which are incongruous (The ARAC Final Report, the FAA NPRM, and the Airmen Certification Standards). In Round 4 you will be asked to sort subject areas into course titles with lecture and lab times and corresponding credit hours. In Round 5 you will be asked to rank an updated list of objectives for each of the subject areas (and course) on a five-point Likert scale. If agreement is reached by the panel, the study will end. If not, one more round, identical to Round 5 will be conducted. Each group's rankings will be checked for consensus for each category (assumptions, section and subject area groupings, and objectives). Categories that reach consensus will be deemed complete whereas those that are not in agreement in Round 5 will be carried over into a final Round 6.

Thank you again for agreeing to participate in this study. Your time and input are very much valued. Should you have any issues or concerns, please feel free to contact Fred D. Dyen at fdyen001@odu.edu, office phone at (540) 453-2306, or by cell phone or text at (314) 753-1356.

APPENDIX C

SUMMARY OF THE STUDY

Fred D. Dyen
Ph.D. Candidate, Education
Old Dominion University
fdyen001@odu.edu

Dr. Thomas Bean
Professor, Literacy/Reading
Old Dominion University
tbean@odu.edu

References

14 C.F.R. § 147 (1962).

81 FR 32390–32392 (June 12, 2007).

81 FR 59674–59690 (October 2, 2015).

APPENDIX D

ROUND 1 SURVEY 106

January 18, 2017

Dear _____:

Thank you for agreeing to participate in this Delphi survey on developing a competency based 14 CFR part 147 model aviation maintenance technology curriculum for the 21st century. We are appreciative of your time and efforts and feel that your input will be most valuable in this endeavor. Below you will find a link to the Survey for Round 1.

This questionnaire round is the first of up to six rounds of the survey. Please try to answer all questions, even though we do not expect you to have in depth knowledge of all of them. You will have the opportunity to revise your answers with subsequent rounds of the survey. In these surveys, you will be asked to develop priorities among the current course nomenclature, allotted time, and credit assigned. Most of the questions can be answered with only a single selection. Where appropriate, a space is also provided for you to comment on the underlying reasons for your responses.

- In formulating your responses, you are not expected to assess the feasibility or cost of data collection for the indicators.

Once I have received responses from all participants, I will collate and summarize the findings and formulate the second questionnaire. You should receive this in the next month. We assure you that your participation in the survey and your individual responses will be strictly confidential to the research team and will not be divulged to any outside party, including other participants.

Part 1 asks some questions about your background. This information is being collected to characterize the experience level of the group and will be report in aggregate only. Your information will be kept confidential.

Part 1 Demographic Data

1. Age

- ☐ 25-44 years old
- ☐ 45-54 years old
- ☐ 55-64 years old
- ☐ 65-74 years old
- ☐ 75 years or older

2. Gender

- ☐ Male
- ☐ Female

3. Ethnicity origin

- White
- Hispanic or Latino
- Black or African American
- American Indian or Alaskan Native
- Asian / Pacific Islander
- From multiple races

4. **Education**

- High school graduate, diploma or the equivalent (e.g.: GED)
- Some college, but no degree or certificate
- College / Trade / Technical / Vocational training (certificate)
- Associate degree
- Bachelor's degree
- Master's degree
- Doctorate degree

5. **Aviation Experience**

- less than 10 years
- 10-14years
- 15-19 years
- 20-24 years old
- 25 years or more

6. Part 147 Aviation Affiliation (check **all** that apply)

- Aviation Rulemaking Advisory Committee (ARAC)
- FAA Part 147 Working Group
- Aviation Technician Education Council Board Member (past or current)
- Part 147 Aviation Maintenance Technician School (AMTS) Director/Coordinator/Faculty (past or current)
- FAA Airworthiness Inspector (past or current)

Part 2 - Developing a Competency-based 14 CFR Part 147 aviation maintenance technology curriculum

Part 2 of the questionnaire lists assumptions that must be considered prior to beginning development of the model aviation maintenance technology curriculum. The survey forms part of the development of courses based upon three federal documents:

1. FAA Notice of Proposed Rulemaking (NPRM) on Aviation Maintenance Technician Schools (Docket No. FAA 2015-3901; Notice No. 15-10).
2. Aviation Rulemaking Advisory Committee, Part 147 Aviation Maintenance Technician Schools Curriculum and Operating Requirements Working Group, Final Report.
3. FAA Airman Certification Standards: AMG-ACS-20160803, AMA-ACS-20160721, and AMP-ACS-20160817.

Below is a set of assumptions for developing an FAA-approved AMTS curriculum. The assumptions need to be vetted and that is the purpose of this first questionnaire. Consider the

three documents noted on page one, should a particular emphasis be given to one of these. Please rate each of the assumptions in terms of its value in providing a workable ideal part 147 curriculum to AMTSs where 1 indicates it is *unimportant* and 5 indicates it is *extremely important* (circle your choice).

ASSUMPTION NAME AND DESCRIPTION	**Rating (1=unimportant-5=extremely important)** **1 2 3 4 5**
1. **AMTS Curriculu**m (loosely based upon Carnegie Unit @ 39 hours combined lecture/lab = 1 college credit). @ 40 hours combined lecture/lab = 1 college credit). FAA determination in the NPRM Consider what the **minimum** number of credits should be.	**~49 Credit** **1 2 3 4 5** **~48 Credits** **1 2 3 4 5** **~42 Credits** **1 2 3 4 5** **___Other** **1 2 3 4 5**
2. **Asynchronous distance education** inherent in design.	1 2 3 4 5
3. **Common subject** groupings.	1 2 3 4 5
4. Individual courses limited to **1 credit minimum**. Many states do not allow ½ credit offerings at the post-secondary level.	1 2 3 4 5
5. **Common subject** groupings.	1 2 3 4 5
6. Course subject matter based upon **FAA NPRM**.	1 2 3 4 5
7. Course subject matter based upon **ARAC part 147 Final Report**.	1 2 3 4 5
8. Course subject matter based upon FAA Airmen **Certification Standards** for General, Airframe, and Powerplant.	1 2 3 4 5
9. Odd **numbered course consideration** will be lecture or lecture/lab and even numbered courses will be lab only. This convention is primarily for discussion purposes.	1 2 3 4 5

APPENDIX D

ROUND 1 SURVEY

10. Rank the following options

___ **Option 1** This selection is based on the current layout of the ARAC and NPRM.
General
Airframe
Powerplant

___ **Option 2** This selection is a modification of option 1 to facilitate **redundancy avoidance**, courses will be grouped in four "Sections" instead of three, namely:
General
Airframe
Powerplant
Combined Systems and Components (comprised of the following subject areas -
a. Airframe and Powerplant Electrical Systems
b. Airframe and Powerplant Fuel Systems
c. Airframe and Powerplant Fire Protection Systems
d. Airframe and Powerplant Instrument Systems

___ **Option 3** This selection is based upon the current 14 CFR Part 147, Appendix B, C, & D. and the ACS.
General
Airframe Structures
Airframe Systems and Components
Powerplant Theory and Maintenance
Powerplant Systems and Components

___ **Option 4** Other

APPENDIX E

ROUND 2 SURVEY

Continuing with the development of a model aviation maintenance training curriculum, round 2 will consist of establishing and sorting of the curriculum sections with appropriate times and credits. Based upon the results from Round 1, consider the following options

NAME AND DESCRIPTION				Ranking (1=first choice-4=last choice)
Option	**Section Titles**	**Times**	**Credits**	
1	General	450	10	**1 2 3 4**
	Airframe	800	18	
	Powerplant	650	15	
2	General	450	11	**1 2 3 4**
	Airframe	680	18	
	Powerplant	570	14	
	Combined Systems & Components	200	5*	
3	General	450	12	**1 2 3 4**
	Airframe Structures	400	10	
	Airframe Systems & Components	400	10	
	Powerplant Theory & Maintenance	250	6	
	Powerplant Systems & Components	400	10	
4	General	450	11	**1 2 3 4**
	Airframe Structures	240	12	
	Airframe Systems & Components	240	6	
	Powerplant Theory & Maintenance	300	8	
	Powerplant Systems & Components	270	6	
	Combined Systems & Components	200	5*	
Other				**1 2 3 4**

Select the subject area title you prefer	**(1=first choice-2=last choice)**
2. Basic Electricity (ACS)	**1 2**
Fundamental Electricity and Electronics (ARAC and NPRM)	**1 2**
Other	**1 2**
3. Aircraft Technical Graphics (ACS)	**1 2**
Aircraft Drawing (ARAC and NPRM)	**1 2**
Other	**1 2**
4. Cleaning and Corrosion Control (ACS and NPRM)	**1 2**
Corrosion (ARAC)	**1 2**
Other	**1 2**
5. Regulations, Publications and Recordkeeping (ACS)	**1 2**
Maintenance Forms Records, and Publications (ARAC and NPRM)	**1 2**
Other	**1 2**
6. Aviation Physics (ACS)	**1 2**
Physics for Aviation (ARAC and NPRM)	**1 2**
Other	**1 2**
7. Inspections (ACS)	**1 2**
Inspection Concepts and Techniques (ARAC and NPRM)	**1 2**
Other	**1 2**
8. Assembly and Rigging (ACS)	**1 2**
Flight Controls (ARAC and NPRM)	**1 2**
Other	**1 2**
9. Cabin Atmosphere Control Systems (ACS)	**1 2**
Environmental Systems (ARAC and NPRM)	**1 2**
Other	**1 2**

10.	Overheat and Fire Detection, Protection, and Suppression Systems (ACS)	**1 2**
	Airframe Fire Protection Systems (ARAC and NPRM)	**1 2**
	Other	**1 2**
11.	Engine Fire Detection and Protection Systems (ACS)	**1 2**
	Engine Fire Protection Systems (ARAC and NPRM)	**1 2**
	Other	**1 2**
12.	Induction and Airflow Systems (ACS)	**1 2**
	Reciprocating Engine Induction and Cooling Systems and Turbine Engine Air Systems (ARAC and NPRM)	**1 2**
	Other	**1 2**
13.	Engine Fuel Systems (ACS)	**1 2**
	Incorporated into Fuel Metering Systems (ARAC and NPRM)	**1 2**
	Other	**1 2**
14.	Engine Cooling systems (ACS)	**1 2**
	Reciprocating Engine Induction and Cooling Systems (ARAC and NPRM)	**1 2**
	Other	**1 2**

* Based upon 120 hours airframe and 80 hours powerplant

APPENDIX F

ROUND 3 SURVEY

Continuing with the development of a model aviation maintenance training curriculum, this round will consist of establishing the subject area times and credits that will comprise the curriculum. In Round 3 you will first be asked to select whether or not specific subject areas can be combined for the Model AMT curriculum. The titles of subject areas were those agreed upon by the experts. Initially, those combinations include the following:

Select whether you agree the subject areas can be combined.	**(1=agree 2=disagree)**
1. Weight and Balance Ground Operations and Servicing	**1 2**
2. Aircraft Material, Hardware, and Processes Fluid Lines and Fittings Cleaning and Corrosion Control	**1 2**
3. Maintenance Forms, Records, & Publications Human Factors Inspection Concepts and Techniques	**1 2**
4. Metallic Structures Welding	**1 2**
5. Flight Controls Rotorcraft Fundamentals	**1 2**
6. Environmental Systems Aircraft Fuel Systems Ice and Rain Control Systems Overheat & Fire Detection, Protection, & Suppression Systems	**1 2**
7. Communication/Navigation Systems Aircraft Instrument Systems	**1 2**
8. Turbine Engines Turbine Engine Air Systems	**1 2**
9. Lubrication Systems Engine Fire Detection and Protection Systems	**1 2**
10. Fuel Metering Systems Reciprocating Engine Induction & Cooling Systems Exhaust and Reverser Systems	**1 2**

Keep in mind when reviewing the subject areas combined above and the AMT Model Curriculum with specific times the following assumptions from the results of Round 1:

1. The model AMTS curriculum will consist of 48 credits with no course less than 1 credit.
2. The curriculum will allow for the delivery of asynchronous distance education.
3. Common subject areas will be grouped together.
4. Subject areas will be based **primarily** upon the FAA Airman Certification Standards (ACS) for General, Airframe, and Powerplant.
5. Odd numbers will be used to designate lecture courses or lecture/laboratory courses that could be taught total via distance.
6. Even numbers will be used to designate laboratory courses.

A Sample Model AMT Curriculum can be found on the next page. I have broken down the second Survey for Round 3 into three parts, General, Airframe, and Powerplant. If you have other suggestions for the AMT Model Curriculum, please feel free to modify the curriculum on

the next page (it is in MS Word), email it to me, and I'll post it for review and/or additional consideration. Subject areas in blue can be taught via asynchronous distance delivery.

COURSE #	TITLE	TIMES			
		Theory	Lab	Total	Credit
GENERAL AIRFRAME AND POWERPLANT		**225**	**225**	**450**	**12.0**
AMT 101	Fundamental Electricity and Electronics	60	60	120	3.0
AMT 103	Aircraft Technical Graphics	20	20	40	1.0
AMT 105	Weight & Balance; Ground Operations & Servicing	40		40	1.0
AMT 106	Weight & Balance; Ground Operations & Servicing Lab		40	40	1.0
AMT 107	Aircraft Material, Hardware, & Processes; Fluid Lines & Fittings; Cleaning & Corrosion Control	60		60	2.0
AMT 108	Aircraft Material, Hardware, & Processes; Fluid Lines & Fittings; Cleaning & Corrosion Control Lab		60	60	2.0
AMT 109	Mathematics; Physics for Aviation	20	20	40	1.0
AMT 111	Maintenance Forms, Records, & Publications; Human Factors; Inspection Concepts &Techniques	25	25	50	1.0
AIRFRAME		**300**	**380**	**680**	**18.0**
AMT 221	Metallic Structures; Welding	60		60	1.0
AMT 222	Metallic Structures; Welding Lab		80	80	2.0
AMT 223	Non-Metallic Structures	60		60	1.0
AMT 224	Non-Metallic Structures Lab		80	80	2.0
AMT 225	Flight Controls; Rotorcraft Fundamentals	40		40	1.0
AMT 226	Flight Controls; Rotorcraft Fundamentals Lab		40	40	1.0
AMT 227	Airframe Inspection	20		20	1.0
AMT 228	Airframe Inspection Lab		40	40	1.0
AMT 229	Landing Gear Systems	40		40	1.0
AMT 230	Landing Gear Systems Lab		40	40	1.0
AMT 231	Hydraulic & Pneumatic Systems	40		40	1.0
AMT 232	Hydraulic & Pneumatic Systems Lab		40	40	1.0
AMT 233	Environmental; Aircraft Fuel; Ice and Rain Control; Overheat & Fire Detection, Protection, & Suppression Systems	40		40	1.0
AMT 234	Environmental, Aircraft Fuel; Ice and Rain Control; Overheat & Fire Detection, Protection, & Suppression Systems Lab		40	40	1.0
AMT 235	Communication/Navigation; Airframe Instrument Systems	40		40	1.0
AMT 236	Communication/Navigation; Airframe Instrument Systems Lab		40		1.0
AMT 237	Aircraft Electrical Systems	40		40	1.0
AMT 238	Aircraft Electrical Systems Lab		40	40	1.0

APPENDIX F

ROUND 3 SURVEY

COURSE #	TITLE	TIMES			
		Theory	Lab	Total	Credit
POWERPLANT		**310**	**340**	**650**	**16.0**
AMT 241	Aircraft Reciprocating Engines	45		45	1.0
AMT 242	Aircraft Reciprocating Engines Lab		50	50	1.0
AMT 243	Turbine Engines; Turbine Air Systems	45		45	1.0
AMT 244	Turbine Engines; Turbine Air Systems Lab		50	50	1.0
AMT 245	Engine Inspection	20		20	1.0
AMT 246	Engine Inspection Lab		40	40	1.0
AMT 247	Lubrication Systems; Engine Fire Detection & Protection Systems	40		40	1.0
AMT 248	Lubrication Systems; Engine Fire Detection & Protection Systems Lab		40	40	1.0
AMT 249	Ignition & Starting Systems	40		40	1.0
AMT 250	Ignition & Starting Systems Lab		40	40	1.0
AMT 251	Fuel Metering; Reciprocating Engine Induction & Cooling, Exhaust, and Reverser Systems	40		40	1.0
AMT 252	Fuel Metering; Reciprocating Engine Induction & Cooling, Exhaust, and Reverser Systems Lab		40	40	1.0
AMT 253	Engine Electrical Systems	40		40	1.0
AMT 254	Engine Electrical Systems Lab		40	40	1.0
AMT 255	Propellers	40		40	1.0
AMT 256	Propellers Lab		40	40	1.0

APPENDIX G

ROUND 4 SURVEY

Continuing with the development of a model aviation maintenance training curriculum, this round will consist of establishing the course titles that will comprise the curriculum. In Round 4 you will first be asked to select whether or not specific subject areas can become course titles. For the additional subject areas that were combined by agreement, you will be asked to either approve the suggested course title or suggest a new one. Subject areas were broken into three areas: (1) single subject areas = course name; (2) combined subject areas = course name; and (3) new name needed for the courses combining several subject areas. The tables below indicate those options:

Single Subject areas = Course Name	**(1=agree 2=disagree)**
Fundamental Electricity and Electronics	**1 2**
Aircraft Technical Graphics	**1 2**
Airframe Inspections & Lab	**1 2**
Landing Gear Systems & Lab	**1 2**
Aircraft Electrical Systems & Lab	**1 2**
Hydraulic & Pneumatic Systems & Lab	**1 2**
Engine Inspections & Lab	**1 2**
Aircraft Reciprocating Engines &Lab	**1 2**
Ignition and Starting Systems & Lab	**1 2**
Engine Electrical Systems & Lab	**1 2**
Propellers & Lab	**1 2**

Combined Subject Area = Course Name	**(1=agree 2=disagree)**
Mathematics & Physics for Aviation	**1 2**
Metallic Structures and Welding & Lab	**1 2**
Non Metallic Structures and Aircraft Finishes & Lab	**1 2**
Flight Controls and Rotorcraft Fundamentals & Lab	**1 2**
Turbine Engines and Air Systems & Lab	**1 2**

New Name Needed for Course		**(1=agree 2=disagree)**
Subject Areas	**Suggested Course Name**	
Weight & Balance Ground Operations & Servicing	Ground Operations & Lab	**1 2**
Aircraft Material, Hardware, & Processes Fluid Lines & Fittings Cleaning & Corrosion Control	Material and Processes & Lab	**1 2**
Maintenance Forms, Records, & Publications Human Factors Inspection Concepts & Techniques	Federal Aviation Regulations	**1 2**
Communication and Navigation Systems Aircraft Instrument Systems	Comm/Nav and Instrument Systems & Lab	**1 2**
Environmental Systems Aircraft Fuel Systems Ice & Rain control Systems Overheat & Fire Detection, Protection, & Suppression Systems	Environmental Systems & Lab	**1 2**
Lubrication Systems Engine Fire Detection and Protection Systems	Lubrication and Fire Systems & Lab	**1 2**
Fuel Metering Systems Reciprocating Engine Induction & Cooling Systems Exhaust & Reverser Systems	Engine Systems & Lab	**1 2**

APPENDIX G

ROUND 4 SURVEY

COURSE #	TITLE	TIMES			
		Theory	Lab	Total	Credit
GENERAL AIRFRAME AND POWERPLANT		**225**	**225**	**450**	**12.0**
AMT 101	Fundamental Electricity and Electronics	60	60	120	3.0
AMT 103	Aircraft Technical Graphics	20	20	40	1.0
AMT 105	Ground Operations	40		40	1.0
AMT 106	Ground Operations Lab		40	40	1.0
AMT 107	Materials and Processes	60		60	2.0
AMT 108	Materials and Processes Lab		60	60	2.0
AMT 109	Mathematics and Physics for Aviation	20	20	40	1.0
AMT 111	Federal Aviation Regulations	25	25	50	1.0
AIRFRAME		**380**	**420**	**800**	**20.0**
AMT 221	Metallic Structures	60		60	2.0
AMT 222	Metallic Structures Lab		80	80	2.0
AMT 223	Non-Metallic Structures	60		60	2.0
AMT 224	Non-Metallic Structures Lab		60	60	2.0
AMT 225	Flight Controls and Rotorcraft Fundamentals	40		40	1.0
AMT 226	Flight Controls and Rotorcraft Fundamentals Lab		40	40	1.0
AMT 227	Airframe Inspection	20		20	1.0
AMT 228	Airframe Inspection Lab		40	40	1.0
AMT 229	Landing Gear Systems	40		40	1.0
AMT 230	Landing Gear Systems Lab		40	40	1.0
AMT 231	Hydraulic and Pneumatic Systems	40		40	1.0
AMT 232	Hydraulic and Pneumatic Systems Lab		40	40	1.0
AMT 233	Environmental Systems	40		40	1.0
AMT 234	Environmental Systems Lab		40	40	1.0
AMT 235	Comm/Nav and Instrument Systems	40		40	1.0
AMT 236	Comm/Nav and Instrument Systems Lab		40	40	1.0
AMT 237	Aircraft Electrical Systems	40		40	1.0
AMT 238	Aircraft Electrical Systems Lab		40	40	1.0
POWERPLANT		**310**	**340**	**650**	**16.0**
AMT 241	Aircraft Reciprocating Engines	45		45	1.0
AMT 242	Aircraft Reciprocating Engines Lab		50	50	1.0
AMT 243	Turbine Engines	45		45	1.0
AMT 244	Turbine Engines Lab		50	50	1.0
AMT 245	Engine Inspection	20		20	1.0
AMT 246	Engine Inspection Lab		40	40	1.0
AMT 247	Lubrication Systems and Propellers	40		40	1.0
AMT 248	Lubrication Systems and Propellers Lab		40	40	1.0
AMT 249	Ignition and Starting Systems	40		40	1.0
AMT 250	Ignition and Starting Systems Lab		40	40	1.0
AMT 251	Fuel Metering Systems	40		40	1.0
AMT 252	Fuel Metering Systems Lab		40	40	1.0
AMT 261	Aircraft Electrical Systems	40		40	2.0
AMT 262	Aircraft Electrical Systems Lab		40	40	1.0
AMT 263	Aircraft Fuel, Fire, and Instrument Systems	40		40	1.0
AMT 264	Aircraft Fuel, Fire, and Instrument Systems Lab		40	40	1.0

1010 hours available for distance delivery.

APPENDIX H

ROUND 5 SURVEY

Concluding the development of a model aviation maintenance training curriculum, this round will consist of establishing the objectives that will comprise the curriculum. In Round 5 you will first be asked to review the FAA-S-ACS-1 Aviation Mechanic Genera, Airframe, Powerplant Airman Certification Standards. For each subject area title listed in the ACS that changed by agreement, you will find the agreed upon subject area title in ***bold***. In general, it should be relatively easy to locate the certification standards in the Table of Contents pages iv and v. The specific objectives for each of these subject areas are listed in the three files:

1. PROPOSED GENERAL SUBJECT AREAS OBJECTIVES 0217.DOCX
2. PROPOSED AIRFRAME SUBJECT AREAS OBJECTIVES 0217.DOCX
3. PROPOSED POWERPLANT SUBJECT AREA OBJECTIVES 0217.DOCX

Section	ACS Subject Area	Model AMT Curriculum Subject Area	(1=agree 2=disagree)	
General	Basic Electricity	***Fundamental Electricity and Electronics***	**1**	**2**
	Aircraft Technical Graphics	Aircraft Technical Graphics	**1**	**2**
	Weight and Balance	Weight and Balance	**1**	**2**
	Fluid Lines and Fittings	Fluid Lines and Fittings	**1**	**2**
	Materials, Hardware, and Processes	Materials, Hardware, and Processes	**1**	**2**
	Ground Operations and Servicing	Ground Operations and Servicing	**1**	**2**
	Cleaning and Corrosion Control	Cleaning and Corrosion Control	**1**	**2**
	Mathematics	Mathematics	**1**	**2**
	Regulations, Publications, and Recordkeeping	Fluid Lines and Fittings	**1**	**2**
	Aviation Physics	***Physics for Aviation***	**1**	**2**
	Inspections	***Inspection Concepts & Techniques***	**1**	**2**
	Human Factors	Human Factors	**1**	**2**
Airframe	Metallic Structures	Metallic Structures	**1**	**2**
	Non-Metallic Structures	Non-Metallic Structures	**1**	**2**
	Aircraft Finishes	Aircraft Finishes	**1**	**2**
	Welding	Welding	**1**	**2**
	Assembly and Rigging	***Flight Controls***	**1**	**2**
	Airframe Inspection	Airframe Inspection	**1**	**2**
	Landing Gear Systems	Landing Gear Systems	**1**	**2**
	Hydraulic and Pneumatic Systems	Hydraulic and Pneumatic Systems	**1**	**2**
	Cabin Atmosphere Control Systems	***Environmental Systems***	**1**	**2**
	Communication and Navigation Systems	Communication and Navigation Systems	**1**	**2**
	Aircraft Fuel Systems	Aircraft Fuel Systems	**1**	**2**
	Aircraft Electrical Systems	Aircraft Electrical Systems	**1**	**2**
	Ice and Rain Control Systems	Ice and Rain Control Systems	**1**	**2**
	Overheat and Fire Detection, Protection, and Suppression Systems	Overheat and Fire Detection, Protection, and Suppression Systems	**1**	**2**
	Rotorcraft Fundamentals	Rotorcraft Fundamentals	**1**	**2**

APPENDIX H

ROUND 5 SURVEY

Section	ACS Subject Area	Model AMT Curriculum Subject Area	(1=agree 2=disagree)
Powerplant	Aircraft Reciprocating Engines	Aircraft Reciprocating Engines	**1 2**
	Turbine Engines	Turbine Engines	**1 2**
	Engine Inspection	Engine Inspection	**1 2**
	Engine Instruments Systems	Engine Instruments Systems	**1 2**
	Engine Fire Detection and Protection Systems	Engine Fire Detection and Protection Systems	**1 2**
	Engine Electrical Systems	Engine Electrical Systems	**1 2**
	Lubrication Systems	Lubrication Systems	**1 2**
	Ignition and Starting Systems	Ignition and Starting Systems	**1 2**
	Fuel Metering Systems	Fuel Metering Systems	**1 2**
	Induction and Engine Airflow Systems	***Reciprocating Engine Induction and Cooling Systems***	**1 2**
		Turbine Engine Air Systems	**1 2**
	Engine Cooling Systems	Engine Cooling Systems	**1 2**
	Engine Exhaust and Reverser Systems	Engine Exhaust and Reverser Systems	**1 2**
	Propellers	Propellers	**1 2**

APPENDIX I

GENERAL OBJECTIVES

A. Fundamental Electricity and Electronics (*Basic Electricity*)

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of electron theory the learner will be able to define electric current, explain the nature of matter, and differentiate between conventional flow versus electron flow without major error and include all basic concepts without major error or omission.	Be familiar A	No skill 1
To demonstrate an understanding of magnetism the learner will be able to note the characteristics of magnetic fields noting all six properties without major error and include all basic concepts without major error or omission.	Be familiar A	No skill 1
To demonstrate an understanding of capacitance in a circuit the learner will be able to define capacitance, note the unit of measurement, give an example of use, and explain how capacitance is measured including all basic concepts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inductance in a circuit the learner will be able to define capacitance, note the unit of measurement, give an example of use, and explain how inductance is measured including all basic concepts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of AC electrical circuits the learner will be able to note the elements of a AC circuit and define each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of DC electrical circuits the learner will be able to note the elements of a DC circuit and define each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Ohm's law the learner will state and explain Ohm's law, present an equation, and define each element without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Kirchoff's current law and Kirchoff's voltage law the learner will be able to define each element, delineate common DC circuit theory terms and explain how to apply Kirchoff's law without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of voltage, the learner will be able to explain that the voltage actually measures the amount of energy (as supplied by a power source) which each coulomb of charge can transfer as it passes through resistance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of current the learner will be able to explain that an electric current is flow of electrical charge that is often carried by moving electrons in a wire, by ions in an electrolyte, or by both ions and electrons such as in a plasma and given a schematic and/or circuit without a noted current value without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of resistance the learner will be able to explain that resistance is an electrical quantity that measures how the device or material reduces the electric current flow through it, and measured in units of ohms (Ω) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of power the learner will be able to explain that electric power is the rate, per unit time, at which electrical energy is transferred by an electric circuit, the unit of power is the watt, one joule per second, and electric power is usually produced by electric generators, but can also be supplied by sources such as electric batteries without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of series circuits the learner will be able to explain the current through each of the components is the same, and the voltage across the circuit is the sum of the voltages across each component. In a parallel circuit, the voltage across each of the components is the same, and the total current is the sum of the currents through each component without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of parallel circuits the learner will be able to explain that a parallel circuits has two or more paths for current to flow through, voltage is the same across each component of the parallel circuit and the sum of the currents through each path is equal to the total current that flows from the source without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft batteries the learner will be able to explain without major error the various composition of batteries used in aircraft and note the characteristics of each, including lead acid, Nicad, lithium ion, gel cell, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of transformers the learner will be able to explain without major error that electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields and that transformers are used to increase or decrease the alternating voltages in electric power applications without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of circuit continuity the learner will be able to note that in electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit) and explain a continuity test without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of controlling devices including switches and relays the learner will be able to distinguish between (1) a switch - an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another and a relay - is a switch that is operated by electricity without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of protective devices including fuses and circuit breakers the learner will be able to describe the purpose of a protection device and distinguish between a fuse and circuit breaker including noting the basic types of circuit breakers without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of resistor types and color coding the learner will be able to explain the electronic color code used to indicate the values or ratings of resistors without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of semiconductors, including diodes, transistors, and integrated circuits the learner will be able to explain that semiconductors are crystalline or amorphous solids with distinct electrical characteristics that can display a range of useful properties such as passing current more easily in one direction than the other, showing variable resistance, and sensitivity to light or heat without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of digital logic, including RAM, ROM, NVRAM, AND-gate, Or-gate, inverter, flip-flop the learner will be able to explain that logic gates are primarily implemented using diodes or transistors acting as electronic switches without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of binary numbers the learner will be able to explain that in mathematics and digital electronics, a binary number is a number expressed in the binary numeral system or base-2 numeral system which represents numeric values using two different symbols: typically 0 (zero) and 1 (one). The base-2 system is a positional notation with a radix of 2.without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of electrostatic discharge the learner will be able to explain that *e*lectrostatic discharge *(*ESD*)* is the sudden flow of electricity between two electrically charged objects caused by contact, an electrical short, or dielectric breakdown, that a buildup of static electricity can be caused by tribocharging or by electrostatic induction, and enumerate how ESD is dissipated in aircraft without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of electrical circuit drawings the learner will be able to provide or distinguish between pictorial and schematic electrical circuit diagrams without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety precautions to be employed when taking voltage, current, resistance and capacitance measurements the learner will be able to enumerate the risks and properly demonstrate proper safety practices.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing handling and storage of different type batteries (lead acid, NiCad, lithium ion, gel cell, etc.), the learner will be able to enumerate the risks and properly demonstrate proper safety practices.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety factors when dealing with high-voltage circuits such as found in strobe lighting the learner will be able to enumerate the risks and properly demonstrate proper safety practices.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety precautions to be employed when connecting or disconnecting a battery the learner will be able to enumerate the risks and properly demonstrate proper procedures for connecting and disconnecting aircraft batteries.	Understands & applies C	Competent 2
To demonstrate the skill to perform a circuit continuity test the learner will be able to test the continuity of a circuit without error using a schematic and multimeter.	Understands C	Proficient 3
To demonstrate the skill to measure voltage the learner will be able to measure voltage at several points in a circuit without error using a schematic and multimeter.	Understands C	Proficient 3
To demonstrate the skill to measure current the learner will be able to measure current at several points in a circuit without error using a schematic and multimeter.	Understands C	Proficient 3
To demonstrate the skill to measure resistance the learner will be able to measure resistance at several points in a circuit without error using a schematic and multimeter.	Understands C	Proficient 3
To demonstrate the skill to test a switch or relay the learner will be able to test a switch or relay and determine its condition in a given circuit using a multimeter without major error.	Understands C	Proficient 3
To demonstrate the skill to test a fuse or circuit breaker the learner will be able to test a fuse or circuit breaker and determine its condition in a given circuit using a multimeter.	Understands C	Proficient 3
To demonstrate the skill to read and interpret aircraft electrical circuit diagrams, symbols, including solid state devices and logic functions the learner will be able to answer questions regarding an electrical schematic or an aircraft component or system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a circuit the learner will be able to follow or prepare and/or follow a troubleshooting chart for an electrical schematic or circuit.	Understands C	Proficient 3
To demonstrate the skill to identify symbols used in electrical and electronic schematic the learner will be able to locate and identify grounds, shields, resistors, capacitors, fuses, circuit breakers, batteries, diodes, transistors, and integrated circuits on electrical and electronic schematics without major error.	Understands C	Proficient 3
To demonstrate the skill to test for short-circuit and open-circuit conditions, the learner will be able to locate and identify short circuit and open circuits in an electrical system without major error.	Understands C	Proficient 3
To demonstrate the skill to measure voltage drop across a resister, the learner will be able to measure the voltage drop across a given resistor within .1 volt.	Understands C	Proficient 3
To demonstrate the skill to determine or measure for open electrical circuits, the learner will be able to correctly identify an open circuit without error.	Understands C	Proficient 3
To demonstrate the skill to inspect an aircraft battery the learner will be able to correctly inspect an aircraft battery (lead acid, Nicad, lithium ion, and gel cell) in accordance with manufacturer's recommendations.	Understands C	Proficient 3

To demonstrate the skill to service an aircraft battery the learner will be able to correctly service an aircraft battery (lead acid, Nicad, lithium ion, and gel cell) in accordance with manufacturer's recommendations.	Understands C	Proficient 3

B Aircraft Technical Graphics (*Aircraft Drawing*)

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of drawings, blueprints, sketches and/or system schematics including commonly used lines, symbols and terminology the learner will be able to explain the purpose of a drawing, sketch, and schematics including describing or sketching basic lines, symbols and drawing terminology without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of repair or alteration of an aircraft system or component(s) using drawings/blueprints and/or system schematics the learner will be explain the purpose of a repair or alteration including parts and processes needed as detailed with reference to a drawing/blueprint of the repair without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the inspection of an aircraft system or component(s) using drawings/blueprints and/or schematics the learner will be able to explain the importance aircraft drawings/blueprints and/or schematics in the verification of proper aircraft system installations or components without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the terms used in conjunction with aircraft drawings/blueprints and/or system schematics the learner will be able to define and explain common terms associated with aircraft drawings/blueprints and/or system schematics without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing plus or minus tolerances as depicted on aircraft drawings, the learner will be able to explain how to identify and assess out of tolerance aircraft parts and note what might be the result from the use of those parts in aircraft or components without major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the use of manufacture's specifications for design of alterations and repairs, the learner will be able to explain how to identify and assess improper repairs and alterations and note what might be the result of a selected aircraft repair or alteration that was not properly performed.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing and ensuring that the drawing or schematic is the one that is applicable to the particular aircraft by model and serial number the learner will be able to note how to ascertain the applicability of the drawing or schematic is correct and note the consequences of matching an unapproved drawing or schematic with a particular aircraft model and serial number.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the identification of correct version and applicability of drawing to be used the learner will be able to note how to the proper drawing can be determined and note the consequences of using an unapproved drawing on aircraft safety, serviceability, and airworthiness.	Understands & applies C	Competent 2
To demonstrate the ability to draw a sketch of a major repair or alteration, the learner will be able to produce a sketch of a major repair or alteration from sample documentation suitable for inclusion on FAA Form 337, Block 8 without major error.	Understands C	Proficient 3
To demonstrate the ability to identify the meaning of lines and symbols used in an aircraft drawing the learner will identify a minimum of 5 out of 7 lines and/or symbols selected by the instructor on an aircraft drawing, without major error.	Understands C	Proficient 3

To demonstrate the ability to interpret dimensions used in an aircraft drawing the learner will be able to determine the dimensions on an aircraft drawing selected by the instructor and identify a 5 out of 7 dimensions selected by the instructor on an aircraft drawing, without major error.	Understands C	Proficient 3
To demonstrate the ability to identify changes on an aircraft drawing the learner will be able to locate the revision block on an aircraft drawing and note the date, revision number, draftsman, approving individual and briefly note the pertinent details of the revision without major error.	Understands C	Proficient 3
To demonstrate the ability to determine material requirements from an aircraft drawing the learner will be able to locate the list of materials on an aircraft drawing and note the quantity of each item without major error.	Understands C	Proficient 3
To demonstrate the ability to interpret graphs and charts, the learner will be able to use a variety of aircraft graphs and charts locating information requested by the instructor without major error.	Understands C	Competent 2

C. Weight and Balance

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of commonly used terminology such as datum, arm, moment (positive or negative), tare, ballast, and residual fuel/oil, the learner will explain and/or define these concepts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the purpose of weighing or reweighing an aircraft, the learner will be able to note the basic principle of aircraft weight and balance control, emphasizing its importance and note examples of documentation by the aircraft manufacture and FAA that ensure the aircraft weight and balance records contain the proper data without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of weighing procedures the learner will be able to explain how an aircraft is leveled, weighed, and empty weight data calculated without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of procedures for calculation of the following: arm, moment (positive or negative), center of gravity or moment index the learner will be able to describe how to calculate the empty weight center of gravity and empty weight without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the purpose and application of weight and CG limits the learner will be able to explain the rationale for forward and aft CG limits as well as maximum weight without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the purpose of determining center of gravity the learner will be able to explain how the center of gravity of an aircraft is determined during the weighing process without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of adverse loading considerations and how to calculate if adverse loading will cause an out of limit condition the learner will be able to detail what the results will be of adverse loading of an aircraft both forward and aft of the center of gravity range without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of determining the proper empty weight configuration the learner will be able to note the three important elements of weight and balance, the weighing of the aircraft, the maintaining of weight and balance records, and the proper loading of the aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of proper ballast placement the learner will be able to explain typical scenarios which would require the use of ballast and where and how ballast should be secured without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing situations that can lead to unsafe conditions when jacking an aircraft; i.e. jacking the aircraft in an area that is susceptible to wind gusts the learner will be able to locate the applicable information and note the precautions necessary to safely jack an aircraft.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the dangers of weighing an aircraft without following recommended procedures the learner will be able to note the possible unsafe conditions that might occur when deviation from the manufacturer's procedures when weighing an aircraft.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the improper use of scales the learner will be able to note the damage that might occur or the effect of inaccurate scale readings when improperly using scales to weigh an aircraft.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the adverse aerodynamic effect of CG that is forward or aft of CG limits the learner will be able to detail the aircraft performance degradation that occurs with each condition.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the adverse aerodynamic and performance effects of weight in excess of limits the learner will be able to detail the aircraft performance degradation that occurs with an overweight aircraft.	Understands & applies C	Competent 2
To demonstrate the skill research and explain the procedures for weighing an aircraft the learner will be able to detail the procedures involved in weighing an aircraft including preparing, leveling, and weighing the aircraft, calculating the center of gravity and empty weight, and preparing a weight and balance report without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform weight and balance calculations the learner will be able to calculate the empty weight center of gravity and empty weight given sample weight and balance problems and correctly solve 7 out of 10 problems.	Understands C	Proficient 3
To demonstrate the skill to calculate ballast/weight shift and required weight location the learner will be able to calculate the required ballast/weight shift and required weight shift location required to bring an aircraft into the proper weight and balance envelope given a sample weight shift problem and correctly solve ballast/weight shift problems and given 10 problems solve 7 out of 10	Understands C	Proficient 3
To demonstrate the skill to calculate ballast/weight shift the learner will be able to calculate the required weight shift required to bring an aircraft into the proper weight and balance envelope given a sample weight shift problem and correctly solve ballast/weight shift problems and given 10 problems solve 7 out of 10	Understands C	Proficient 3
To demonstrate the skill to check aircraft weighing scales for calibration the learner will be able to verify the calibration date, condition for use, zero the scale, and with a known weight verify the reading without major error.	Understands C	Proficient 3
To demonstrate the skill to calculate weight and balance data for an aircraft after an equipment change the learner will be able to calculate the empty weight center of gravity and empty weight and given sample weight and balance problems solve 7 out of 10.	Understands C	Proficient 3
To demonstrate the skill to compute forward and aft loaded center of gravity the learner will be able to determine the forward and aft loaded center of gravity given appropriate weight and balance data for a specific aircraft and given 10 problems, solve 7 out of 10.	Understands C	Proficient 3
To demonstrate the skill to create a maintenance record for a weight and balance change the learner will prepare a maintenance record in accordance to 14 CFR § 43.9.	Understands C	Proficient 3
To demonstrate the skill to compute the empty weight and empty weight CG of an aircraft the learner will be able to calculate the empty weight and EWCG of an aircraft given pertinent data without error.	Understands C	Proficient 3

To demonstrate the skill to calculate the moment of an item of equipment the learner will be able to calculate the moment given the item, arm or location with reference to the datum without major error.	Understands C	Proficient 3
To demonstrate the skill to identify tare items the learner will be able to list sample items that are typically used for tare in addition to explaining what tare is and its use in aircraft weight and balance without major error.	Understands C	Proficient 3
To demonstrate the skill to locate weight and balance information the learner will be able to locate appropriate weight and balance information given a specific aircraft, TCDS, Aircraft Specification, and/or Aircraft Listing, and aircraft records without major error.	Understands C	Proficient 3
To demonstrate the skill to locate datum the learner will, given a specific aircraft, TCDS, Aircraft Specification, and/or Aircraft Listing and aircraft, note the location and/or identify the datum of the aircraft without major error.	Understands C	Proficient 3
To demonstrate the skill to locate the baggage compartment placarding requirements for an aircraft the learner will, given a specific aircraft, TCDS, Aircraft Specification, and/or Aircraft Listing and aircraft POH/AFM, list the placard(s) required in the baggage compartment(s) without major error.	Understands C	Proficient 3
To demonstrate the skill to revise an aircraft equipment list after equipment change the learner will be able to enter the new equipment, weight, arm, and/or moment as appropriate for equipment on an existing equipment list without major error.	Understands C	Proficient 3
To demonstrate the skill to calculate the change needed to correct an overweight or out of balance condition the learner will consult the manufacturer's data, if available, and make a determination of the correction option(s) available to correct the out of balance condition without major error.	Understands C	Proficient 3
To demonstrate the skill to determine an aircraft's CG range using aircraft specifications and type certificate data sheets the learner will be able to list the aircraft's CG rang using aircraft specifications, type certificate data sheets, and/or aircraft listings without major error.	Understands C	Proficient 3
To demonstrate the skill to calculate a weight change and complete required records the learner will be able to calculate a change to aircraft weight and balance records and complete the forms including weight and balance form, equipment list, and maintenance record entry without major error.	Understands C	Proficient 3

D. Fluid Lines and Fittings

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of tubing and hose materials the learner will be able to list the type of materials used for aircraft tubing and give examples of the use of each and list the type of materials used for aircraft hose and give examples of the use of each without major error.	Knows B	No skill 1
To demonstrate an understanding of tubing and hose applications the learner will list several types of tubing and hose uses without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of tubing and hose sizes the learner will note how tubing is sized in comparison to how hose is size, noting the nominal dimensions of common aircraft tubing and hose without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of tubing and hose fittings the learner will list the major types of fittings, noting the major distinguishing characteristics of each, including material, color, and dimensions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of flexible hose identification the learner will note the specifications, construction, proof pressure, application, identification, and temperature range of low, medium, and high pressure hose without major error or omission.	Knows B	No skill 1

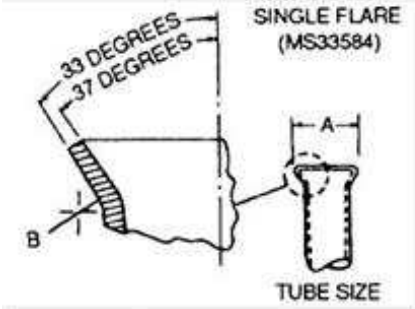
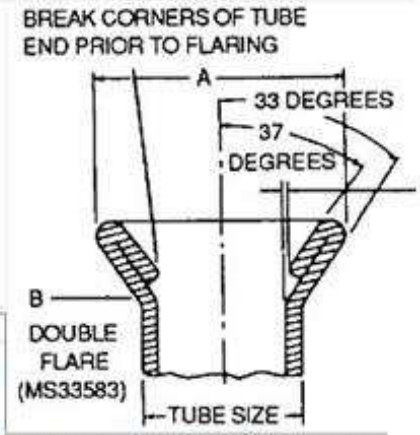
APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of rigid line fabrication techniques/practices the learner will be able to explain the guidance involved in installing rigid fluid lines regarding material selection, flaring, component placement, beading, and length without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rigid line installation techniques/practices the learner will be able to explain the guidance involved in installing rigid fluid lines regarding material selection, wall thickness, support, and placement without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of flexible hose fabrication techniques/practices the learner will be able to explain the guidance involved in material selection, inside diameter, fitting component placement and compatibility, and length without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of flexible hose installation techniques/practices the learner will be able to explain the guidance involved in installing flexible fluid lines regarding material selection, inside diameter, support, and placement without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the importance of using a torque wrench when securing fluid hose and line fittings the learner will be able to explain the rationale for proper torqueing of fluid lines and fittings without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the use of torque seal or similar witness techniques after installing critical fluid hose and line fittings the learner will be able to explain why and how torque seal or similar witness techniques are utilized in fluid lines and fittings without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigates risks, encompassing proper system configuration prior to and during maintenance. i.e. all pressures depleted and system tagged prior to disassembly or maintenance the learner will be able to list and follow the appropriate safety precautions that should be followed when servicing aircraft systems involving fluid lines and fittings without omission or major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigates risks, encompassing the proper use of required safety equipment and gear the learner will be able to identify and demonstrate the proper use of personal and shop safety equipment and gear without omission or major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigates risks, encompassing the use of approved materials and components the learner will be able to identify and use approved materials and components without omission or major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigates risks, encompassing observing minimum bend radius when fabricating rigid lines and installing flexible hoses the learner will be able to identify, verify, and install fabricated rigid and/or flexible lines with minimum bend radii without major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigates risks, encompassing identifying the hazards associated with a twisted hose the learner will be able to distinguish a hoses' lay line, point out if a given hose is properly or improperly installed, and note the problems associated with improper installation.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigates risks, encompassing identifying when a fitting has loosened or a hose has moved out-of-position the learner will be able to explain common signs and provide corrective measures for loose fittings or mispositioned hoses without error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigates risks, encompassing the proper use of tools while applying torque to a fluid line (i.e. the use of a second back-up wrench to prevent the line from twisting during the torque of the line) the learner will be able to explain the rationale for and/or demonstrate proper use of tools while applying torque to a fluid line (i.e. the use of a second back-up wrench to prevent the line from twisting during the torque of the line) for without error.	Understands & applies C	Competent 2

APPENDIX I

GENERAL OBJECTIVES

To demonstrate the skill to fabricate an aircraft tube the learner will fabricate an aircraft tube to a drawing or sketch within 1/16" in length and 5º of tube angle according to the drawing provided and within 1º flare angle, and within specification for flare size: **MS33584 Single Flare** **MS33583 Double Flare**   Tubing / Size, inch. / Flare Style 5052-0 / 1/8 / double 5052-0 / 3/16 / double 5052-0 / 1/4 / double 5052-0 / 5/16 / double 5052-0 / 3/8 / double 5052-0 / 1/2 / double 5052-0 / 5/8 / single 5052-0 / 3/4 / single 5052-0 / 1 / single 6061 / all sizes / single steel tubing / all sizes / single Tube Size Outside Diameter, Inch / B Radius, Inch 1/8 / 0.032 3/16 / 0.032 1/4 / 0.032 5/16 / 0.032 3/8 / 0.046 1/2 / 0.062 5/8 / 0.062 3/4 / 0.062	Understands C	Proficient 3
To demonstrate the skill to install an aircraft rigid line the learner will be able to properly install an aircraft rigid line as directed by the instructor in accordance with a supplied drawing/sketch and/or instructions without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to install an aircraft flexible hose the learner will be able to properly install an aircraft flexible hose as directed by the instructor in accordance with a supplied drawing/sketch and/or instructions without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform a rigid line or flexible hose inspection the learner will be able to inspect an aircraft rigid line or flexible hose in accordance with manufacturer's instruction or FAA Advisory Circular guidance for placement, length, chafing, support, age, leakage, and deterioration without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify installation and security requirements for tubing and hose the learner will be able to note whether a selection of hoses and/or fittings are properly installed without major error or omission of defect.	Understands C	Proficient 3
To demonstrate the skill to identify fluid and air lines and fittings the learner will be able to identify fluid lines and fittings with appropriate references without major error.	Understands C	Proficient 3
To demonstrate the skill to fabricate a flare on tubing the learner will be able to flare (either single or double) a selected tube within 1º flare angle and within specification for flare size without major error.	Understands C	Proficient 3
To demonstrate the skill to install a flareless-fitting-tube connection the learner will be able to install a flareless fitting to a selected tube in accordance with Mil Spec 33566 without major error.	Understands C	Proficient 3

E. Aircraft Material, Hardware, and Processes

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of materials commonly used in aircraft and their general application the learner will be to list various aircraft material classifications, including aircraft metals and nonmetallic aircraft materials and note common types of each and correctly list a minimum of 10 commonly used aircraft metals and 10 commonly used nonmetallic aircraft materials and note where each is typically utilized without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the heat treatment processes, using DD or "icebox" rivets the learner will be able to list the heat treating procedures (heat, soak, cool (quench in this case), the storage procedure, and life limit of an "icebox " rivet without major error.	Knows B	No skill 1
To demonstrate an understanding of forces placed on aircraft materials the learner will be able to list and define bending, compression, deformation, delamination, fatigue, shear, stress, strain, tension, thermal expansion, torsion, yield strength, and yield limit correctly identifying and defining a minimum of forces without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hardware commonly used in aircraft including bolts, nuts, rivets, screws, pins, washers, turnlock fasteners, cables, cable fittings, and rigid line couplings the learner will be able to correctly describe a minimum of 18 out of 25 items of aircraft hardware including bolts, nuts, screws, pins, washers, turnlock fasteners, cables, cable fittings, and rigid line couplings with appropriate AN, MS, and/or NAS nomenclature.	Knows B	No skill 1
To demonstrate an understanding of safety wire and safety clip requirements and techniques the learner will be to properly safety a variety of fasteners and turn buckles without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of precision measurement and precision measurement tools, principles and procedures the learner will be to describe how to use common precision measurement equipment including bore gauges, calipers, depth gauges, dial indicators, height gauges, hole gauges, machinist levels, micrometer calipers, squares and combination sets without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of visible characteristics of acceptable and/or unacceptable welds the learner will be able to describe the characteristics of an airworthy weld without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of non-destructive testing methods as appropriate for various materials the learner will be able to describe the applicability of visual inspection, magnetic particle inspection, liquid penetrant inspection, eddy current inspection, ultrasonic inspection and radiographic inspection giving examples of each without error or omission.	Knows B	No skill 1
To demonstrate an understanding of the use of torque wrenches the learner will be able to describe the use and proper care (including calibration) of toque wrenches without error or omission.	Knows B	No skill 1
To demonstrate an understanding of wet vs. dry torque the learner will be able to describe the difference in fastener preparation for wet vs. dry torque including typical applications without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of running vs. breakaway torque the learner will be able to describe the difference between running vs. breakaway torque without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of the suitability and compatibility of materials and hardware used for maintenance the learner will be able to explain how aircraft material and hardware can be identified, verified, and certified including enumerating the safety concerns involved in installing unapproved materials and/or hardware in an aircraft repair or alteration without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the relationship between torque and fastener preload the learner will be able to explain that the preload target can be achieved by a variety of methods: typically in aircraft, by applying a measured torque to the bolt or by measuring bolt extension noting the remaining 10% of the applied torque does useful work in stretching the bolt and providing the preload without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the concepts of troubleshooting in aircraft maintenance the learner will be able to describe the concepts of troubleshooting problems in aircraft maintenance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the procedures involved in troubleshooting a problem the learner will be able to describe the procedures (steps) used in troubleshooting without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how to prioritize the troubleshooting procedure the learner will be able to describe the prioritization utilized in troubleshooting without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of identifying observed symptoms accurately the learner will be able to describe techniques used in observing and relaying information regarding observed symptoms without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inadequate preload in highly stressed threaded fasteners the learner will be able to describe what happens when a highly stressed threaded fastener is tightened with inadequate preload without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the precautions to ensure adequate preload when installing highly stressed threaded fasteners the learner will be able to list the precautions that must be taken to insure adequate preload when installing highly stressed threaded fasteners without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft inspection methods and tools the learner will be able to describe the myriad of non-destructive and destructive inspection methods including the necessary tools for each without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks encompassing the proper use personal protective equipment (PPE), the learner will be able to note what type of personal protective equipment (PPE) is appropriate for use in a minimum of 5 hazardous environments an aviation maintenance technician is likely to encounter, and explains the effects of improper use of PPE in each including proper fit concerns without major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing the consequences of improper torque, the learner will be able to note common torque mistakes including use of out of calibration torque wrenches, improper torque from mishandling equipment or misreading specifications and safety concerns resulting from these errors.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing the identification of threaded fasteners for damaged threads or damaged cadmium plating, the learner will be able to detail how to inspect threaded fasteners and note the safety concerns resulting from the installation of damaged fasteners without major error or omission.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing any misunderstanding and misapplication of torqueing techniques on critical highly-stressed fasteners the learner will be able to explain the result(s) that might result from a selected repair or alteration where critical highly stressed fasteners were improperly torqued.	Understands & applies C	Competent 2

APPENDIX I

GENERAL OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks encompassing the consequences of using suspected unapproved parts (SUPS) the learner will be able to explain how aircraft material and hardware can be identified, verified, and certified including enumerating the safety concerns involved in installing unapproved materials and/or hardware in an aircraft repair or alteration.	Understands & applies C	Competent 2
To demonstrate the skill to install safety wire on nuts, bolts, turnbuckles and airframe or engine components the learner will be able to install safety wire on 7 out of 10 components correctly.	Understands C	Proficient 3
To demonstrate the skill to properly torque aircraft hardware the learner will be able to locate the torque specifications for a selected fastener, secure the correct torque wrench, properly apply the torque to the fastener, and return the torque wrench to its proper resting setting without major error, within the tolerance provided (if any) of 7 out of 10 fasteners.	Understands C	Proficient 3
To demonstrate the skill to the learner will be able to perform a visual inspection of various welds the learner will be able to inspect welds to determine airworthiness in accordance with manufacturer's or Advisory Circular guidance without major error.	Understands C	Proficient 3
To demonstrate the skill to identify aircraft materials and hardware based upon manufacturer's markings the learner will be able to correctly identify a minimum of 7 out of 10 aircraft materials (both metallic and non-metallic) and 7 out of 10 items of aircraft hardware from samples.	Understands C	Proficient 3
To demonstrate the skill to select and install aircraft bolts the learner will be able to select and install the correct aircraft bolts in an aircraft or component in the proper direction in accordance with the appropriate maintenance considerations detailed in the IPC and/or aircraft drawing correctly.	Understands C	Proficient 3
To demonstrate the skill to make precision measurements with a micrometer that has a vernier scale the learner will be able to measure an aircraft component with the vernier micrometer within .0001"	Understands C	Proficient 3
To demonstrate the skill to check the concentricity of a shaft the learner will be able to set a shaft in the lathe or a set of "V" blocks, measure the alignment (runout or out of round) with a dial indicator, compare to a set of specifications and determine serviceability without major error.	Understands C	Proficient 3
To demonstrate the skill to identify aircraft control cable part number the learner will be able to locate the correct part number in appropriate reference for an aircraft control system and be able to identify the cable by size, characteristics, nomenclature, and material without major error.	Understands C	Proficient 3
To demonstrate the skill to fabricate a cable assembly using a swaged end fitting the learner will be able to select the proper fitting for the cable provided, the correct tooling, and successfully swage, inspect, and verify a cable fitting to airworthy standards.	Understands C	Proficient 3
To demonstrate the skill to select the correct aluminum alloy for a structural repair the learner will be able to consult the appropriate structural repair manual, chapter, or Advisory Circular for a given repair and determine the proper aluminum alloy to be used without major error.	Understands C	Proficient 3
To demonstrate the skill to identify rivets by physical characteristics the learner will be able to identify 7 out of 10 rivets by diameter, length, material and AN or MS number.	Understands C	Proficient 3
To demonstrate the skill to determine suitability of materials for aircraft repairs the learner will be able to correctly identify a given assortment of 10 commonly used aircraft metals and 10 commonly used nonmetallic aircraft materials and note where each is typically utilized without major error.	Understands C	Proficient 3
To demonstrate the skill to distinguish between heat-treated and non-heat-treated aluminum alloys the learner will be able to correctly identify annealed aluminum alloy from heat treated or work hardened alloy by feel and designation without major error.	Understands C	Proficient 3

To demonstrate the skill to determine required torque value of given item the learner will be able to locate the required torque for 7 out of 10 fasteners by reference to appropriate technical data.	Understands C	Proficient 3
To demonstrate the skill to check for proper calibration of a micrometer the learner will be able to determine the current calibration date and when the micrometer caliper must be recalibrated or retired from use without major error.	Understands C	Proficient 3

F. Ground Operations and Servicing

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of aircraft towing procedures the learner will be able to detail and explain and include all basic procedural steps and equipment to tow a small general aviation aircraft and a large transport category aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft securing procedures the learner will be to explain how to properly secure land, sea, and ski planes delineating the material, advantages and disadvantages of each, and security to the earth without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aviation fueling procedures the learner will be able to explain how to fuel a general aviation aircraft with wing and/or fuselage tanks and a transport category or commuter aircraft with single point fueling provisions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of airport operation procedures and ATC communications the learner will be able to describe the various operational areas of an airport including distinguishing between movement and non-movement areas, severity categories, be able to define pilot deviation, operation error, operational deviation and vehicle pedestrian deviation, and communicate with ATC without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of starting, ground operating, and/or taxiing procedures the learner will be able to explain how to verify the area around the aircraft is clear, note other safety precautions that should be observed, summarize how to start and taxi a small general aviation aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the types/classes of fire extinguishers and procedures the learner will be able to list the types of fire extinguisher and note the common types of materials that each will extinguish, Class A, Class B, Class C, and Class D fires without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft oil, hydraulic and pneumatic, deicing etc. servicing procedures the learner will be articulate where the servicing procedures for an aircraft can be located and give a brief explanation of the fluids used, dispensing equipment involved, and precautions necessary to avoid errors without omission.	Knows B	No skill 1
To demonstrate an understanding of oxygen system servicing procedures the learner will be able to distinguish between aviators breathing oxygen and industrial oxygen and note servicing precautions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the characteristics of aviation gasoline and/or turbine fuels, including basic types and means of identification the learner will be note the distinguishing characteristics of aviation fuel and explain the means of identification including color, odor, hose and truck symbols, and nozzle dispensing sizes and shapes without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fuel additives commonly used in the field the learner will be able to explain the commonly used fuel additives including TCP, anti-icing, and anti-microbial additives including common usage (which is used in avgas and/or jet fuel) without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of the use of automobile fuel in aircraft engines the learner will be able to distinguish between TCDS and STC approvals and what is required for the use of automotive fuel in general aviation aircraft by noting specific examples, explain Textron Lycoming Service Instruction 1070S applicability, and note typical restrictions regarding ethanol without major error or omission without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of jacking and securing procedures the learner will be able to utilize the TCDS, Aircraft Specifications, or Aircraft Listings, the Pilot's Operating Handbook or FAA-approved Aircraft Flight Manual to locate the appropriate jacking and securing procedures for an aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of tool and hardware accountability the learner will be able to explain the importance of a tool control program including tool control, shadow box/board, tether and a method of accounting for all new and used hardware use in aircraft maintenance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of physical entry and personnel control the learner will be to identify the relationship of basic facts and state general principles about physical entry into both flight hardware and FOD designated areas without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of material handling the learner will be to identify the relationship of basic facts and state general principles related to material handling without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of parts protections s the learner will be to identify the relationship of basic facts and state general principles related to parts protection including FOD barrier, FOD barrier removal, and electrostatic discharge (ESD) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hazardous materials, Safety Data Sheets (SDS), and personal protective equipment (PPE) the learner will be able to identify the basic facts and terms related to the handling, control and disposal of hazardous material including management of, use and handling of, and disposition of hazardous materials without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of wildlife and environmental effects the learner will be able to identify the basic facts and terms related to wildlife and environment issues that are major causes of Foreign Object Damage without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of foreign object damage effects the learner will be able to identify the relationship of basic facts and state general principles related to FOD effects including costs and life without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks encompassing the dangers associated with starting, ground operating, and/or taxiing aircraft and procedures for preventing, minimizing or otherwise managing any of them, the learner will be able to explain the result(s) that might result from out of tolerance aircraft parts without major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, associated with the consequences of using contaminated fuel the learner will be able to explain the result(s) that might result from using contaminated fuel without omission or major error.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks associated with the consequences of using the incorrect fuel the learner will be able to articulate the possible results of misfueling a reciprocating powered or turbine powered aircraft with the incorrect fuel and how to identify and remedy the situation in each type of misfueling.	Understands & applies C	Competent 2

APPENDIX I

GENERAL OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks encompassing the dangers associated with starting a turbine aircraft engine and engine run-up the learner will be able to note the areas of concern in front of and to the rear of the aircraft, the problems associated with hung and hot starts, fire, and other hazards as well as corrective and preventive measures.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing oxygen system safety practices/precautions the learner will be able to list the typical safety practices and note pitfalls commonly associated with servicing aircraft oxygen systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing the cautions involved in preparing to tow an aircraft. i.e. brakes, clearance for large aircraft, etc. the learner will be able to note the cautions involved in preparing to tow an aircraft, including brakes, clearance for large aircraft, maximum turn radius, etc.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing the ground operations of piston aircraft engines with cowling removed the learner will be able to note the major result of operating an uncowled piston engine including the likely resultant color change a factory painted the cylinder would experience.	Understands & applies C	Competent 2
To demonstrate the skill to identify procedures for securing an aircraft the learner will be able to locate the procedures, secure an assigned aircraft properly using airport supplied tie down rings, and instructor supplied ropes or chains without major error.	Understands C	Proficient 3
To demonstrate the skill to identify procedures for towing an aircraft the learner will be able to locate the procedures, hook up a tow bar, note the turning radius limits, and move the aircraft as directed without damage.	Understands C	Proficient 3
To demonstrate the skill to follow a start-up checklist for an aircraft reciprocating or turbine engine the learner will be able to locate the appropriate information, follow the directions, and be able to start and operate a reciprocating or turbine engine as assigned without major error.	Understands C	Proficient 3
To demonstrate the skill to prepare an aircraft for engine starting the learner will be able to verify the aircraft is properly serviced, the area secured, appropriate safety equipment is present, and the check list is available and followed without major error.	Understands C	Proficient 3
To demonstrate the skill to use appropriate hand signals for the movement of aircraft the learner will be able to demonstrate any of the hand signals in the airman's information manual for aircraft (fixed wing or rotorcraft) without major error.	Understands C	Proficient 3
To demonstrate the skill to identify procedures for fueling an aircraft the learner will be able to locate the fueling procedures in the appropriate pilot's operating handbook, FAA-approved flight manual, or manufacturer's service information without major error	Understands C	Proficient 3
To demonstrate the skill to inspect an aircraft fuel system for water contamination the learner will be able to take a sample from an aircraft fuel tank and distinguish the presence of water contamination without major error.	Understands C	Proficient 3
To demonstrate the skill to walk-through the procedures for extinguishing fires in an engine induction system during starting the learner will be able to locate the procedures for extinguishing an engine induction fire and delineate the appropriate action from a set of scenarios.	Understands C	Competent 2
To demonstrate the skill to connect an external auxiliary power unit the learner will be able to connect a supplied external auxiliary power unit to an aircraft without major error.	Understands C	Proficient 3
To demonstrate the skill to identify different grades of aviation gasoline the learner will be able to distinguish by color, 80/87, 100LL, 100/130, and automotive gasoline from supplied samples without major error.	Understands C	Competent 2

To demonstrate the skill to identify procedures for and walk-through steps to secure a helicopter for high-wind conditions the learner will be able to locate the procedures, secure an assigned helicopter properly using airport supplied tie down rings, instructor supplied ropes or chains, and helicopter specific blade securing equipment without major error.	Understands C	Proficient 3
To demonstrate the skill to identify procedures for and walk-through steps to secure a turbine-powered aircraft after engine shutdown the learner will be able to locate the procedures, secure an assigned aircraft properly using airport supplied tie down rings, instructor supplied ropes or chains, chocks, and propeller securing covers as required.	Understands C	Proficient 3
To demonstrate the skill to locate jacking and mooring points the learner will be able to locate the jacking and mooring points without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate jacking procedures the learner will be able to locate the jacking procedures without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to select an approved fuel for an aircraft the learner will be able to locate the appropriate information in the aircraft specifications, type certificate data sheets, aircraft listing, supplemental type certificate data, pilot's operating handbook, and/or FAA-approved flight manual and determine the approved fuel without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to carry out a foreign object elimination control procedure related to a maintenance task the learner will be able to locate the FOD control procedures and execute those procedures without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to describe foreign object elimination control systems in a maintenance setting the learner will be able to describe typical FOE procedure common to a maintenance setting without major error or omission.	Understands C	Proficient 3

G. Cleaning and Corrosion Control

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of aircraft washing procedures the learner will be able to detail the procedures involved to clean an aircraft and explain how to wash an aircraft without major error and include all basic concepts and areas of concern without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of corrosion theory and causation the learner will be describe corrosion is a natural process, which converts a refined metal to a more stable form, such as its oxide, hydroxide, or sulfide and it is the gradual destruction of materials (usually metals) by chemical and/or electrochemical reaction with their environment without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the types and effects of corrosion the learner will be list a minimum of 7 types of corrosion that are common to aircraft components and note the effects of each type without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of an understanding of corrosion prone areas in aircraft the learner will be note a minimum of 7 corrosion prone areas of an aircraft including exhaust trail areas, battery compartments and battery vent openings, lavatories and galleys, bilge areas, wheel wheels and landing gear, external skin areas, water entrapment areas, electronic package compartments, and other areas without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of an understanding of corrosion preventive maintenance procedures the learner will be able to explain corrosion preventive maintenance procedures including surface maintenance, cleaning procedures including cleaning compounds, and preservation procedures including surface treatment, sealants, paint finishes and touch-up procedures without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of an understanding of corrosion identification and inspection the learner will be to explain and identify types of corrosion from descriptions, pictures, or samples without major error or omission.	Knows B	Competent 2
To demonstrate an understanding of an understanding of corrosion removal and treatment procedures the learner will be explain how to remove various types of corrosion from aircraft and aircraft components as assigned by the instructor and how to treat those areas to prevent future corrosion without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of an understanding of various kinds of Corrosion Preventive Compounds (CPCs), such as waxy sealants, thin-film dielectrics, etc., and the selection of optimal CPCs the learner will be list a variety of CPCs and note when each should be used without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the selection of optimal CPC the learner will be able to list criterial for selection of the optimal CPC for a specific aircraft and given conditions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of an understanding of frequency of CPC treatment the learner will be explain when CPCs should be applied to an aircraft given specific environmental conditions without major error without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of use of high-pressure application equipment (i.e., fogging) the learner will be able to explain how high pressure application equipment is used to apply CPCs without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the improper use of cleaners on aluminum or composite materials the learner will be able to list how the improper use of cleaners on aluminum or composite materials could degrade the integrity of the material without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of dissimilar metals causing accelerated corrosion, and role of things like cadmium plating to mitigate this risk the learner will be able to describe how dissimilar metal corrosion can be minimized without error or omission.	Knows B	No skill 1
To demonstrate an understanding of conversion coatings the learner will be able to describe how and when conversion coating should be applied to aircraft surfaces without error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks encompassing improper use or lack of use of appropriate personal protective equipment (PPE) when handling solvents the learner will be able to describe the health hazards and risks involved in the improper or lack of use of PPEs in hazardous aircraft maintenance environments.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing improper use or lack of use of appropriate personal protective equipment (PPE) when handling corrosion treatment materials learner will be able to explain and demonstrate the proper use of PPE for cleaning operations.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing identifying health concerns when using paints and solvents learner will be able to explain and detail the health concerns when using paints and solvents pointing out common errors.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing hazards associated with improper ventilation learner will be able to explain and demonstrate the use of proper ventilation.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing the identifying the proper materials and processes to be used for cleaning or corrosion treatment on a given part or structure to prevent causing further damage the learner will be able to explain, identify, and demonstrate the use of proper materials and processes to be used for cleaning or corrosion treatment on a given part or structure to prevent causing further damage.	Understands & applies C	Competent 2

To demonstrate the skill to perform a portion of an aircraft corrosion inspection the learner will be able to locate the appropriate reference(s) and perform a portion of an aircraft corrosion inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to identify and select aircraft corrosion prevention/cleaning materials the learner will be able to locate the appropriate reference(s), identify, and select the appropriate aircraft corrosion prevention/cleaning materials without major error.	Understands C	Proficient 3
To demonstrate the skill to apply aircraft corrosion prevention/coating materials the learner will be able to locate the appropriate reference(s) and apply aircraft corrosion prevention/coating materials without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect finishes and identify defects the learner will be able to locate the appropriate reference(s), inspect finishes, and identify defects without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect an aircraft compartment the learner will be able to locate the appropriate reference(s) and inspect an aircraft compartment without major error.	Understands C	Proficient 3
To demonstrate the skill to identify procedures to clean and protect plastics the learner will be able to locate the appropriate reference(s) and identify procedures to clean and protect plastics without major error.	Understands C	Proficient 3

H. Mathematics

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of areas of various geometrical shapes the learner will be able to describe the applicable formula for the each of the following common two dimensional shapes: triangles, squares, rectangles, trapezoid, diamond, pentagon, hexagon, octagon, circle, and ellipse major error or omission.	Knows B	No skill 1
To demonstrate an understanding of volumes of various geometrical shapes the learner will be able to describe the applicable formula for the each of the following common three dimensional shapes: cube, pyramid, cone, cylinder, sphere, and torus without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of definitions/descriptions of geometrical terms, including but not limited to any of the following: polygon, pi, diameter, radius, acute, circumference, equilateral, isosceles, obtuse, and hypotenuse the learner will be able to define or describe 7 out of 10 geometric terms without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of ratio problems, including examples of where or how they may be used in relation to aircraft maintenance or system(s) operation the learner will be able to explain a ratio with respect to aircraft maintenance or system(s) operation as instructed without major error or omission: id est. problems involving compression ratio, aspect ratio, air-fuel ratio, glide ratio, gear ratio, and/or speed ratio.	Knows B	No skill 1
To demonstrate an understanding of proportion problems, including examples of where or how they may be used in relation to aircraft maintenance or system(s) operation the learner will be able to explain the concept that a proportion is two ratios that have been set equal to each other; a proportion is an equation that can be solved without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of percentage problems, including examples of where or how they may be used in relation to aircraft maintenance or system(s) operation the learner will be able to explain how to solve percentage problems including expressing a decimal number as a percentage, expressing a percentage as a decimal number, expressing a fraction as a percentage, finding a percentage of a given number, finding what percentage one number is of another and/or finding a number when a percentage of it is known without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of algebraic operations, including examples of where or how they may be used in relation to aircraft maintenance the learner will be able to explain algebraic problems with respect to aircraft maintenance or system(s) operation without major error.	Knows B	No skill 1
To demonstrate an understanding of conditions or areas where metric conversion may be necessary the learner will be able to explain how to find and use conversion factors to convert values from the conventional (U.S. or English) system into the metric system (International System of Units –SI) and vice versa without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of scientific (exponential) notation, decimal notation, fractional notation, and conversion between these various forms of numeric notation the learner will be able to explain how to convert from one form of notation to another without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of precision and rounding the learner will be able to explain how to round a numerical value means replacing it by another value that is approximately equal but has a shorter, simpler, or more explicit representation using conventional methods without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks encompassing the failure to use the precedence of algebraic operations when solving an algebraic equation the learner will be able to explain the result(s) that might result from inaccurate solutions.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks encompassing the failure to maintain the correct positive or negative integer in mathematical operations the learner will be able to note precautions and safety concerns when calculating weight and balance, aircraft, engine, propeller, rotor, or life limited part times.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the implications of rounding numbers when precision is needed the learner will be able to note precautions and safety concerns when calculating weight and balance, aircraft, engine, propeller, rotor, or life limited part times and other mathematical calculations when precision is called for.	Understands & applies C	Competent 2
To demonstrate the skill to determine the square root of given numbers to the learner will be able define and solve the concept that a square root of a number *a* is a number *y* such that $y^2 = a$; in other words, a number *y* whose *square* (the result of multiplying the number by itself without major error.	Understands C	Proficient 3
To demonstrate the skill to compute the volume of a cylinder the learner will be able to locate and apply the formula to compute the volume of a cylinder and calculate an engine C.I.D without major error.	Understands C	Proficient 3
To demonstrate the skill to compute the area of a wing the learner will be able to locate and apply the formula for the area of a wing = span x mean chord without major error.	Understands C	Proficient 3
To demonstrate the skill to calculate the volume of a shape; such as a baggage compartment or fuel tank the learner will be able to compute the volume of three-dimensional solids such as a rectangular solid, cube, cylinder, sphere and cone, select the appropriate formula(s) and solve for volume using conversion factors as necessary without major error.	Understands C	Proficient 3
To demonstrate the skill to convert fractional numbers to decimal equivalents the learner will be able to convert fractional numbers to decimal equivalents without major error.	Understands C	Proficient 3
To demonstrate the skill to compare two numerical values using ratios the learner will be able to compare two numerical values using ratio without major error.	Understands C	Proficient 3
To demonstrate the skill to compute compression ratio the learner will be able to calculate the compression ratio of 7 out of 10 engines given the bore, stroke, and clearance volume of each cylinder.	Understands C	Proficient 3

To demonstrate the skill to compute the torque value change when using a torque wrench with an extension the learner will be able to correctly calculate the torque value change in 7 out of 10 torque situations when given a specific torque (either to be applied or was applied), torque wrench length, and extension direction and length.	Understands C	Proficient 3

I. Regulations, Publications and Recordkeeping

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of privileges and limitations of a mechanic certificate the learner will be able to locate and explain the privileges of an aviation maintenance technician as set forth in 14 CFR § 65 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of recent experience requirements and how to re-establish once lost the learner will be able to locate and explain the recent experience requirements of an aviation maintenance technician as set forth in 14 CFR § 147 including an example without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the meaning of a maintenance record entry for approval for return to service after repairs and/or alterations the learner will be able to locate and explain the meaning of approval for return to service after repairs and/or alterations by an aviation maintenance technician as set forth in 14 CFR § 65 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the meaning of a maintenance record entry for approval for return to service after inspection the learner will be able to locate and explain the meaning of approval for return to service after inspection by an aviation maintenance technician as set forth in 14 CFR § 65 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the use of FAA maintenance recordkeeping forms (e.g., FAA Forms 337, 8010-4, 8100-2, 8050-3 and 8130-3) the learner will be able to locate and explain the recordkeeping forms set forth in 14 CFR § 43 & 91, AC 43-9C & 43.9-1F, Malfunction and Defect Report (8010-4), Standard Airworthiness Certificate (8100-2), Aircraft Registration (8050-3), and Authorized Release Certificate, Airworthiness Approval Tag (8130-3) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of maintenance terminology as defined in 14 CFR part 1 (e.g. time in service, maintenance, preventive maintenance, major alteration, major repair, minor alteration and minor repair) the learner will be able to locate and explain the meaning any maintenance term or abbreviation contained in 14 CFR § 1 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the criteria and responsibility for determining whether a repair or alteration is major or minor the learner will be able to locate and explain the meaning of repair or alteration as major or minor as set forth in 14 CFR § 1 and 43 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the regulatory framework including general subject matter of the relevant parts of 14 CFR the learner will be able to locate and explain the regulatory framework including general subject matter of the relevant parts of 14 CFR without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of agency publications and guidance materials including type certificate data sheets (TCDS), advisory circulars, and airworthiness directives the learner will be able to locate and explain specific information from type certificate data sheets, aircraft specifications, aircraft listings, advisory circulars, and airworthiness directives without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of alternative methods of Airworthiness Directives compliance the learner will be able to locate and explain when and who to contact to secure an alternative method of compliance (AMOC) for an AD note without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of manufacturer publications including maintenance manuals, service bulletins, maintenance alerts, and master minimum equipment list the learner will be able to locate and explain information contained in manufacturer publications including maintenance manuals, illustrated parts manuals, service information, maintenance alerts, and master minimum equipment without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of FAA databases and resources available including type certificate data sheets and supplemental type certificates the learner will be able to locate and explain specific information from of FAA databases and resources available including type certificate data sheets and supplemental type certificates without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Type Certificate Data Sheets (TCDS) non-regulatory and non-compulsory status the learner will be able to locate and explain TCDS information without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of compliance requirements for manufacturer specified methods, techniques, and practices the learner will be able to explain the compliance requirements for manufacturer specified methods, techniques, and practices without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of compliance requirements for manufacturer specified maintenance and inspection intervals the learner will be able to explain the compliance requirements for manufacturer specified maintenance and inspection intervals are NOT compulsory unless included in an FAA-approved Airworthiness Limitations section of the MM or part of an operation specification under § 121 or 135 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of service bulletins and compliance requirements with service bulletins the learner will be able to explain that service bulletins are only required by 14 CFR under three conditions, (1) they are part of an AD note, (2) they are a mandatory part of a TCDS, or (3) they are part of a specific operation specification such as § 121 or 135 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of FAA-approved maintenance data including maintenance manuals and other methods, techniques and practices acceptable by the administrator the learner will be able to explain these procedures are acceptable but NOT compulsory, and alternative acceptable methods, techniques and practices may be used in aircraft maintenance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the difference between approved data and acceptable data, and when each is required the learner will be able to give examples of both approved and acceptable data and clearly identify where each is required without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of FAA airworthiness limitations the learner will be able to explain the use of FAA airworthiness limitations without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of alert, caution, and warning indications; understand the basic definition of warnings, cautions, and notes that are used in maintenance and operating manuals the learner will be able to list typical aircraft alert, caution, and warning indications differentiating each and define notes that are used in maintenance and operating manuals without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inoperative equipment the learner will be able to explain how inoperative equipment can be dealt with in accordance with a minimum equipment list and Title 14 CFR §91.213(d) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of discrepancy records or placards the learner will be able to explain how discrepancy records and/or placards are properly utilized without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of the use of useable on codes in parts manuals the learner will be able to explain how codes are used in IPCs to determine applicability of parts for specific aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of determining the serial number effectivity of an item the learner will be able to explain how specific serial numbers are depicted in an IPC without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of limitations of a certificate and/or rating the learner will be able to describe the limitations of a mechanic's certificate with either or both ratings without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of basic definition of warnings, cautions, and notes that are used in maintenance and operating manuals the learner will be able to define warnings, cautions, and notes that are used in maintenance and operating manuals without major repair or omission.	Knows B	No skill 1
To demonstrate an understanding of length of and practical experience required for certificate eligibility the learner will be able to explain 14 CFR §65.77(a) & (b) without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards that can result from incomplete or inaccurate documentation the learner will be able to list safety and economic concerns that might result from incomplete or inaccurate documentation without major omission.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the use of Safety Data Sheets (SDS) the learner will be able to locate and explain the use of SDSs including identification, hazard threshold, protection required, first aid, and resource contact without major error or omission.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing being complacent during documentation phase of maintenance procedures the learner will be able to note the problems and pitfalls that might occur due to complacency during documentation phase of maintenance procedures and demonstrate diligence to avoid the problems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the understand the consequences of not adhering to warnings, cautions, or notes as they are used in maintenance and operational manuals the learner will adhere to all warning, cautions, and notes and be able to describe specific problems that might occur if these warnings, cautions, and notes are ignored.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the possible consequences of neglecting to correctly determine if a component is applicable to a given aircraft the learner will be able to demonstrate and/or explain how to correctly determine if a component is applicable to a given aircraft and note the possible legal and safety consequences of failing to make a proper determination.	Understands & applies C	Competent 2
To demonstrate the ability to the learner will be able to utilize FAA Form 337 or 8130-3 based on a given set of facts (e.g., 100-hour inspection, serviceable part installation, applicable airworthiness directive, applicable service bulletin, etc.) the learner will be able to utilize FAA Form 337 or 8130-3 without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to check accuracy of a completed FAA Form 337 or 8130-3 the learner will be able to review a completed FAA Form 337 or 8130-3 and determine if it is correct, complete, and in accordance with applicable regulations without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to determine aircraft airworthiness by examining maintenance record entries the learner will be able to review aircraft maintenance record entries and determine if they are correct, complete, and in accordance with applicable regulations without major error or omission.	Understands C	Proficient 3

APPENDIX I

GENERAL OBJECTIVES

To demonstrate the ability to prepare an airworthiness directives list for a specific airframe, engine and/or propeller and determine applicability by make, model, and serial number the learner will be able to locate the information and complete a master AD list for a specific airframe, engine and/or propeller and determine applicability by make, model, and serial number without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to compare an equipment list for an aircraft, listing all equipment installed the learner will be able to locate and refer to an existing equipment list and aircraft and determine the accuracy of a current equipment list for a specific aircraft without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to locate applicable FAA aircraft specifications and/or FAA type certificate data sheet for an aircraft or component the learner will be able to locate the applicable FAA type certificate data sheet, aircraft specification, or listing for an aircraft, engine, and/or propeller. Additionally, the learner will be able to note specific components called out in any of the documents without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to locate aircraft flight control travel limits the learner will be able to locate and determine the correct aircraft flight control travel limits using aircraft specifications, type certificate data sheets, aircraft specifications, and/or pilot operating handbook and/or FAA-approved flight manual without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to determine applicability of an airworthiness directive the learner will be able to locate and determine the applicability of an airworthiness directive for a specific aircraft, engine, propeller, and/or appliance without major error.	Understands C	Proficient 3
To demonstrate the ability to check a technical standard order part for the proper markings the learner will be able to locate the proper markings on a TSO'd part and verify whether the markings are in compliance with applicable regulations without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to use a manufacturer's illustrated parts catalog to locate a specific part number the learner will be able to locate a manufacturer's IPC and specific part number for a component without major error.	Understands C	Proficient 3
To demonstrate the ability to locate supplemental type certificates applicable to a specific aircraft the learner will be able to locate the STCs that are applicable to a specific aircraft without major error or omission.	Understands C	Proficient 3
To demonstrate the ability to determine the conformity of aircraft instrument range markings and/or placarding the learner will be able to locate the aircraft specifications, type certificate data sheets, aircraft listings, and/or pilot operating handbook and/or FAA-approved flight manual and determine the accuracy of an instrument's range markings without major error.	Understands C	Proficient 3
To demonstrate the ability to determine approved replacement parts for installation on a given aircraft the learner will be able to locate and refer to aircraft specifications, type certificate data sheets, aircraft listings and/or FAA Form 337 to determine the proper replacement part for installation on a given aircraft without major error.	Understands C	Proficient 3
To demonstrate the ability to determine maximum allowable weight of a specific aircraft the learner will be able to locate and refer to aircraft specifications, type certificate data sheets, aircraft listings and/or FAA Form 337 to determine maximum allowable weight of a specific aircraft without major error	Understands C	Proficient 3
To demonstrate the ability to determine whether a given repair or alteration is major or minor the learner will be able to locate and refer to aircraft specifications, type certificate data sheets, aircraft listings, and 14 CFR § 1 & 43, Appendix A to determine whether a given repair or alteration is major or minor without major error.	Understands C	Proficient 3
To demonstrate the ability to locate mechanic address change notification procedures the learner will be able to locate in 14 CFR § 65 mechanic address change notification procedures without major error.	Understands C	Proficient 3

To demonstrate the ability to lookup applicable CFR section(s) that answers questions posed regarding FAA mechanic privileges and limitations the learner will be able to locate and address questions regarding FAA mechanic privileges and limitations with reference to 14 CFR § 65 without major error.	Understands C	Proficient 3
To demonstrate the ability to determine whether manufacturer's service instructions are required by regulation or not the learner will be able to determine whether a specific manufacturer's service letter, bulletin, or instruction is mandatory without major error.	Understands C	Proficient 3
To demonstrate the ability to list the various sources of approved data and of acceptable data the learner will be able to list common types of approved data and acceptable data and note uses for each without major error.	Understands C	Proficient 3
To demonstrate the ability to explain the requirements for a major repair/alteration and a minor repair/alteration the learner will be able to note that approved data is required for major repair/alteration and the aircraft may be returned to service by a repair station, a technician holding an inspection authorization, or other FAA approval, whereas acceptable data is required for minor repair/alteration and the aircraft can be returned to service by an appropriately rated technician without major error.	Understands C	Proficient 3
To demonstrate the ability to explain the difference between "approved data" and "acceptable data" the learner will be able to note that approved date is required for major repair/alteration, and acceptable data is required for minor repair/alteration without major error.	Understands C	Proficient 3
To demonstrate the ability to write a 100-hour inspection aircraft maintenance record entry the learner will be able to prepare a 100-hour inspection maintenance record entry in accordance with 14 CFR §43.11 without error.	Understands C	Proficient 3

J. Aviation Physics

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of matter and energy the learner will be define matter as any substance that has mass and takes up space, or as any substance made up of atoms, thus excluding other energy phenomena or waves such as light or sound and energy as a property of objects which can be transferred to other objects or converted into different forms without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of work, power, force, and motion the learner will be define work as acting there is a displacement of the point of application in the direction of the force, power as the rate of doing *work*. It is the amount of energy consumed per unit time, force as any interaction that, when unopposed, will change the *motion* of an object, and motion as a change in position of an object with respect to time without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of simple machines and mechanics the learner will be able to explain that a simple machine is a mechanical device that changes the direction or magnitude of a force and can be defined as the simplest mechanisms that use mechanical advantage (also called leverage) to multiply force. Usually the term refers to the six classical simple machines including the lever, wheel and axle, pulley, inclined plane, wedge, and screw without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of heat and pressure the learner will be to define heat as energy that spontaneously passes between a system and its surroundings in some way other than through work or the transfer of matter and pressure as the force applied perpendicular to the surface of an object per unit without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Bernoulli's principle the learner will be able to explain that an increase in the speed of a fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of Newton's law of motion the learner will be able to state and explain Newton's law of motion that describe the relationship between a body and the forces acting upon it and its motion in response to those forces: (1) In an inertial reference frame, an object either remains at rest or continues to move at a constant velocity, unless acted upon by a net force; (2) in an inertial reference frame, the sum of the forces **F** on an object is equal to the mass *m* of that object multiplied by the acceleration **a** of the object: **F** = *m***a**; and (3) when one body exerts a force on a second body, the second body simultaneously exerts a force equal in magnitude and opposite in direction on the first body without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Boyle's gas law the learner will be define Boyle's law as at constant temperature, the product of the pressure and volume of a given mass of an ideal gas in a closed system is always constant or in mathematical terms: $P \propto \frac{1}{V}, or\ PV = k_1, or\ P_1V_1 = P_2V_2$ without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Charles' gas law the learner will be to define Charles' law as for a given mass of an ideal gas at constant pressure, the volume is directly proportional to its absolute temperature, assuming in a closed system or in mathematical terms: $V \propto T, or\ {}^{V}/_{T} = k_2, or\ V_1T_1 = V_2T_2$ without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Gay-Lussac's gas law the learner will be able to define Gay-Lussac's law as a given mass and constant volume of an ideal gas, the pressure exerted on the sides of its container is directly proportional to its absolute temperature or in mathematical terms: $P \propto T, or\ {}^{P}/_{T} = k_3, or\ {}^{P_1}/_{T_1} = {}^{P_2}/_{T_2}$ without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the combined and ideal gas law or the learner will be able to define the general gas equation as the relationship between the pressure, volume, and temperature for a fixed mas (quantity) of gas or in mathematical terms: $pV = k_5T, or\ {}^{p_1V_1}/_{T_1} = {}^{p_2V_2}/_{T_2}$ without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fluid mechanics the learner will be able to define fluid mechanics as the branch of physics that studies the mechanics of fluids (liquids, gases, and plasmas) and the forces on them without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the theory of flight (aerodynamics) the learner will be able to identify the four aerodynamic forces of flight (weight, lift, drag, and thrust), as well as the relationships between them without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of standard atmosphere and factors affecting atmospheric conditions the learner will be able to note standard reference conditions of temperature and pressure (15º C (288.15 K; 59 º F) and 101.325 kPa (760 mmHg, 29.921 "Hg) and that the atmosphere is divided into concentric layers or levels consisting of the troposphere, stratosphere, ionosphere, and the exosphere, transition through these layers is gradual and without sharply defined boundaries without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of primary and secondary aircraft flight controls the learner will be able to list the primary and secondary flight controls and note the axis upon which control is applied. Primary flight controls: lateral axis controlled by elevator, horizontal stabilizer, or ruddervators; longitudinal axis controlled by ailerons; and vertical axis controlled by the rudder or ruddervators. Secondary flight controls include tabs (trim, anti-servo, and balance), flaps, leading edge slots and slats, airbrakes, and spoilers without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of additional aerodynamic devices including vortex generators, wing fences, and stall strips the learner will be able to explain the purpose of these aerodynamic devices including vortex generators, wing fences, and stall strips without major error or omission.	Knows B	No skill 1

To demonstrate an understanding of the relationship between temperature, density, weight, and volume the learner will be able to define and distinguish between temperature, density, weight, and volume without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the change in aircraft and engine performance due to density altitude the learner will be able to describe the effect on performance air density has on an aircraft, effecting lift, drag, engine performance, and propeller thrust.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the effect a repair can have on contour of a flight surface the learner will be able to detail the effect a repair can have on aerodynamics, balance, and strength.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the improper use of performance/testing data the learner will be able to properly use performance/testing data and note the adverse effect improper data can have on aircraft airworthiness.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards associated with using incorrect units (e.g., Celsius vs. Fahrenheit) the learner will be able to properly use correct units and note the adverse effect improper units can have on aircraft airworthiness.	Understands & applies C	Competent 2
To demonstrate the skill to the learner will be able to convert temperature from Celsius to Fahrenheit or Fahrenheit to Celsius the learner will be able to convert 7 out of 10 temperatures from Celsius to Fahrenheit and Fahrenheit to Celsius.	Understands C	Proficient 3
To demonstrate the skill to determine density altitude the learner will be able to locate the applicable charts and/or graphs and determine 7 out of 10 density altitudes using given specific conditions.	Understands C	Proficient 3
To demonstrate the skill to determine pressure altitude the learner will be able to locate the applicable charts, graphs, altimeter, and/or aircraft and determine pressure altitude using given specific conditions without major error to within 10'.	Understands C	Proficient 3
To demonstrate the skill to calculate force, area, or pressure in a specific application the learner will be able to locate and apply the correct formula to the conditions given and calculate force, area, or pressure as assigned in 7 out of 10 problems.	Understands C	Proficient 3
To demonstrate the skill to demonstrate the mechanical advantage of various types of levers the learner will be able to define, classify, and explain levers: (Class 1) fulcrum in the middle: the effort is applied on one side of the fulcrum and the resistance (or load) on the other side, for example, a seesaw, a crowbar or a pair of scissors. Mechanical advantage may be greater than, less than, or equal to 1; (Class 2) Resistance (or load) in the middle: the effort is applied on one side of the resistance and the fulcrum is located on the other side, for example, a wheelbarrow, a nutcracker, a bottle opener or the brake pedal of a car. Mechanical advantage is always greater than 1; and (Class 3) Effort in the middle: the resistance (or load) is on one side of the effort and the fulcrum is located on the other side, for example, a pair of tweezers or the human mandible. Mechanical advantage is always less than 1 without major error.	Understands C	Proficient 3
To demonstrate the skill to design an inclined plane on paper, indicating the mechanical advantage the learner will be able to design and solve a variety of problems which require the use of an inclined plane without major error.	Understands C	Proficient 3
To demonstrate the skill to identify changes in pressure and velocity as a fluid passes through a venturi the learner will be able to determine the pressure and velocity changes in a venturi for a given set of conditions without major error.	Understands C	Proficient 3

K. Mechanic Privileges and Limitations – *See Regulations, Publications and Recordkeeping*

L. Inspections

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of measuring tools including calipers, micrometers and gauges the learner will be to Identify, describe the uses, proper care and use of precision measuring tools, including micrometer calipers; vernier, dial, and digital calipers; dial indicators; small hole and telescoping gauges; etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of calibration and tool accuracy the learner will be explain what tools and equipment should be calibrated and checked for accuracy in an aircraft maintenance facility including typical calibration times without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of nondestructive testing the learner will be list the six common types of non-destructive testing, note an example of the use, and describe the basic principles of each method including visual, magnetic particle, liquid penetrant, eddy current, ultrasonic, and radiography without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft inspection programs the learner will be to describe 100-hour/annual, progressive, approved, continuous, altimeter, transponder, and special inspection programs including the basic elements, approval basis, typical intervals, and type of aircraft that utilize each inspection type without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of eddy-current inspection the learner should be able to explain the basic principles of eddy-current inspection including the advantages, limitations, and the basic steps without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of ultra-sonic inspection the learner should be able to explain the basic principles of ultra-sonic inspection including the advantages, limitations, and the basic steps without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of liquid penetrant inspection the learner should be able to explain the basic principles of liquid penetrant inspection including the advantages, limitations, and the basic steps without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the risk of damage due to magnetic particles the learner should be able to properly inspect an aircraft component using magnetic particle and detail the precautions that must be taken to avoid damage and properly demagnetize any airworthy or repairable component.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing inaccurate use of precision measuring instruments the learner should be able to properly demonstrate the use of precision measuring instruments and describe the problems associated with the improper use of such precision measuring instruments on aircraft and their components.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing calibration requirements for precision measuring instruments the learner should be able to verify calibration dates and requirements and note inaccuracies that might occur if the requirements are not followed.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the appropriate use of inspection techniques the learner should be able to demonstrate the properly use of inspection techniques and describe the results of improper inspection techniques.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the risks associated with swapping components as a part of troubleshooting the learner should be able to follow accepted practices when swapping components as a part of troubleshooting and note what might happen if indiscriminate component swapping was utilized.	Understands & applies C	Competent 2

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions to be taken to prevent damage to aircraft components and/or test equipment when performing tests using an ohmmeter the learner should be able to	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing inadequate troubleshooting procedures the learner should be able to demonstrate proper troubleshooting procedures and detail the risks associated with improper troubleshooting procedures.	Understands & applies C	Competent 2
To demonstrate the skill to use calipers the learner will be able to measure 7 out of 10 aircraft components with a digital, dial, or vernier caliper to within .001".	Understands C	Proficient 3
To demonstrate the skill to use micrometers the learner will be able to measure 7 out of 10 aircraft components with a vernier micrometer to within .0001" or standard micrometer caliper to within .001".	Understands C	Proficient 3
To demonstrate the skill to use measurement gauges the learner will be able to measure 7 out of 10 aircraft components with a dial, bore, and or thickness gauge to within 1% accuracy of the tolerance of the gauge.	Understands C	Proficient 3
To demonstrate the skill to perform a visual inspection the learner will be able to perform a visual inspection using visible light and/or a magnifying glass or bore scope without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a dye penetrant inspection the learner will be able to perform a dye penetrant inspection using water-washable, post emulsified, and/or solvent based liquid penetrant equipment without major error.	Understands C	Proficient 3
To demonstrate the skill to describe a magnetic particle inspection the learner will be able to describe and/or perform a magnetic particle inspection using a portable yoke, portable magnetic particle machine, or a wet horizontal unit without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect aircraft for compliance with an AD the learner will be able to the learner will be able to locate and determine the applicability of an airworthiness directive for an aircraft, engine, propeller, and/or appliance without major error.	Understands C	Proficient 3
To demonstrate the skill to identify NDT methods for composite, surface metal and subsurface metal defects the learner will be able to locate the appropriate reference and select the correct NDT method for inspecting a given composite, surface metal, and subsurface metal for possible defects without major error.	Understands C	Proficient 3

M. Human Factors

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of safety culture and organizational factors the learner will be describe the elements incumbent in a safety culture and note the organization factors that influence and affect a safety culture without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of human error principles the learner will be explain that approximately 75 – 80% of all aviation accidents are the result of human error (~ 12% are maintenance related and can have lethal consequences) and explain three types of human error: (1) omission: not performing an act or task; (2) commission: accomplishing a task incorrectly; and (3) extraneous: performing a task not authorized without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of event investigation the learner will be describe the sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability without major error or omission.	Knows B	No skill 1

APPENDIX I

GENERAL OBJECTIVES

To demonstrate an understanding of human performance and limitations the learner will be list such concerns as fatigue, deadline pressure, stress, distractions, poor communication skills, complacency, and lack of information which can affect their performance and safety while performing maintenance practices without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of physical and social environment the learner will be identify the physical environment including temperature, humidity, lighting, noise control, cleanliness, and workplace design and social/organizational including personnel, supervision, labor-management relations, pressure, crew structure, company size, profitability, morale, and corporate culture without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of communication/reporting of hazards the learner will be explain how important communication/reporting of hazards is between the AMT and management, pilots, parts suppliers, aircraft servicers, etc., that accurate, complete information be exchanged to ensure that all work is completed without any step being omitted including the importance of recordkeeping without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of teamwork and leadership the learner will explain how important teamwork and leadership is in the aviation maintenance workplace without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of professionalism and integrity the learner will be list the major considerations and qualifications that should be included in a definition of professionalism including: (1) professionalism exists only when a service is performed for someone or for the common good, (2) professionalism is achieved only after extended training and preparation, (3) professionalism is performance based on study and research, (4) professionalism is reasoning logically and accurately, (5) professionalism is making good judgment decisions, (6) professionalism is not limiting actions and decisions to standard patterns and practices, (7) professionalism demands a code of ethics, (8) professionalism is being true to one's values and ethics and to those being served.	Knows B	No skill 1
To demonstrate an understanding of shift and task turnover the learner will be list the concerns regarding lack of communication, lack of teamwork, and fatigue can have on aircraft airworthiness regarding shift and task turnover without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the conditions/precautions for unsafe acts the learner will be list 9 of the "Dirty Dozen" including for each a description of how to minimize the risk without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the use of safety goggles, respirators, hearing protection, safety shoes, and other protective equipment and devices the learner will be list common PPEs including for each under what circumstances would they be worn without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing failure to report hazards the learner will be able to detail the rationale for reporting hazards and note the ensuing problems on aviation safety when those hazards are unreported.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing fatigue management and fitness for duty the learner will be able to explain that physical, emotional, and mental fatigue can reduce or impair cognitive ability, decision-making, reaction time, coordination, speed, strength, balance, alertness and attention without major error or omission. Additionally the learner should be able to note that mitigation includes looking for symptoms of fatigue in one's self and in others, have work check by others, even if an inspector sig off is not required, void complex tasks during the bottom of your circadian rhythm, and sleep and exercise daily.	Understands & applies C	Competent 2

To demonstrate the ability to identify, assess, and mitigate risks, encompassing maintenance-induced failure the learner will be able to define MIFs including physiological and psychological factors which contribute to human error and explain how to minimize these errors.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the common causes of maintenance-induced failures failure the learner will be able to identify the contributing factors to MIFs (recognition failures, memory failures, skill-based slips, rule based mistakes, knowledge-based failures, and violations) and explain how to minimize these errors.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing non-invasive condition-monitoring technologies the learner will be able to explain that CM is the process of monitoring a parameter of condition in aircraft in order to identify a significant change which is indicative of a developing fault in order to minimize the effect.	Understands & applies C	Competent 2
To demonstrate the skill to file an Aviation Safety Reporting System (ASRS) report the learner will be able to file an ASRS given pertinent information without major error.	Understands C	Proficient 3
To demonstrate the skill to brief a shift turnover for continuity of work the learner will be able to prepare a shift turnover report given pertinent information without major error.	Understands C	Proficient 3
To demonstrate the skill to communicate a discrepancy found in a colleague's work the learner will be able to prepare a discrepancy report given pertinent information without major error.	Understands C	Proficient 3
To demonstrate the skill to use protective safety equipment the learner will utilize appropriate PPE as necessary without major error or omission.	Understands C	Proficient 3

O. Alerts, Cautions, and Warning Indications See Regulations, Publications and Recordkeeping

APPENDIX J

AIRFRAME OBJECTIVES

A. Metallic Structures

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of types of inspection/testing of sheet metal structures the learner will be able to list the types of inspection/testing for aircraft sheet metal structures including destructive and non-destructive inspections without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of types of sheet metal defects the learner will be able to list the various types of sheet metal defects a technician is likely to encounter in aircraft sheet metal without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of selection of sheet metals the learner will be able to explain how to select aircraft sheet metal for a repair or alteration without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of layout and/or forming of sheet metal the learner will be able to explain the common methods of sheet metal layout and/or forming for aircraft construction, repair, and alteration without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of selecting sheet metal rivets and hardware the learner will be able to explain how sheet metal rivets and hardware are sized, their nomenclature, strength, and how they are selected without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding heat treatment of aluminum the learner will be able to explain how aluminum is heat treated including critical temperature, soak times, quenching procedures and medium, solution and precipitation heat treatment without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rivet layout the learner will be able to explain how rivet layout can be achieved including rivet spacing, edge distance, pitch, and gauge without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rivet installation the learner will be able to explain how to properly install rivets including proper techniques and common errors to avoid without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of maintenance safety practices/ precautions for sheet metal, and/or composite materials/structures, and/or windows the learner will be able to explain the basic maintenance safety practices/precautions for aircraft sheet metal, and/or composite materials/structures, and/or window repair and/or replacement without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the consequences of improper selection of repair materials the learner will be able to locate and utilize proper repair materials, and describe the problems associated with the improper selection of repair materials.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing maintenance safety practices/precautions for sheet metal structures the learner will be able to detail the safety practices/precautions inherent in working with aircraft sheet metal structures and note the problems and concerns that might result from not adhering to standard practices.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing using appropriate personal protective equipment to prevent injury when working with sheet metal structures the learner will be able to list typical personal protective equipment (PPEs), describe the use of each, and properly utilize PPEs as warranted.	Understands & applies C	Competent 2
To demonstrate the skill to install and remove conventional rivets the learner will be able to locate appropriate reference(s) and install and remove conventional rivets without major error.	Understands C	Proficient 3

To demonstrate the skill to inspect sheet metal the learner will be able to locate appropriate reference(s) and inspect aircraft sheet metal without major error.	Understands C	Proficient 3
To demonstrate the skill to select and install special fasteners the learner will be able to locate appropriate reference(s), select, and install special fasteners without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to properly use Manufacturer's Structure Repair Manual the learner will be able to locate appropriate reference(s) and properly use Manufacturer's Structure Repair Manual without major error.	Understands C	Competent 2
To demonstrate the skill to prepare and install a patch to repair an aircraft or component the learner will be able to locate appropriate reference(s), prepare, and install a patch to repair an aircraft or component and without major error.	Understands C	Proficient 3
To demonstrate the skill to make a drawing of a repair including the number of rivets and size of sheet metal required the learner will be able to locate appropriate reference(s) and make a drawing of a repair including the number of rivets and size of sheet metal required without major error.	Understands C	Proficient 3
To demonstrate the skill to remove a patch that was installed with rivets the learner will be able to locate appropriate reference(s) and remove a patch that was installed with rivets without major error.	Understands C	Proficient 3
To demonstrate the skill to trim and form a piece of sheet metal to fit a prepared area the learner will be able to locate appropriate reference(s) and trim and form a piece of sheet metal to fit a prepared area within .015".	Understands C	Proficient 3
To demonstrate the skill to fabricate a complex aluminum part in accordance with a drawing the learner will be able to locate appropriate reference(s) and fabricate a complex aluminum part in accordance with a drawing within the tolerances specified on the drawing.	Understands C	Proficient 3
To demonstrate the skill to determine a rivet pattern for a specific repair given pitch, gauge, and edge distance the learner will be able to locate appropriate reference(s) and determine a rivet pattern for a specific repair given pitch, gauge, and edge distance without major error.	Understands C	Proficient 3
To demonstrate the skill to countersink holes in sheet metal to .010" tolerance the learner will be able to locate appropriate reference(s) and countersink holes in sheet metal to .010" tolerance without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a repair on a damaged aluminum sheet the learner will be able to locate appropriate reference(s) and perform a repair on a damaged aluminum sheet without major error.	Understands C	Proficient 3
To demonstrate the skill to utilize approved data, determine if damage is repairable or the item must be replaced the learner will be able to locate appropriate reference(s) and utilizing approved data, determine if damage is repairable or the item must be replaced without major error.	Understands C	Proficient 3

B. Non-Metallic Structures

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of wood structures the learner will be able to list the inspection techniques, tools and practices for wood structures without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of wood structures the learner will be able to note the effects of moisture/humidity on wood without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of wood structures the learner will be able to list the types and/or general characteristics of wood used in aircraft structures without major error or omission.	Familiar A	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of wood structures the learner will be able to note the permissible substitutes and/or other materials used in the construction and repair of wood structures without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of wood structures the learner will be able to list acceptable wood defects without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of wood structures the learner will be able to list non-acceptable wood defects without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of wood structures the learner will be able to explain wood repair techniques and practices without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the factors used in determining the proper type covering materials without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the types of approved aircraft covering material without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the seams commonly used without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the covering textile terms without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the structure surface preparation without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the covering methods commonly used without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the covering means of attachment without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the areas on aircraft covering most susceptible to deterioration without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the aircraft covering preservation/restoration without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the inspection of aircraft covering without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of aircraft covering the learner will be able to explain the covering repair techniques and practices without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain inspection/testing of composite structures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain types of composite structure defects without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain composite structure fiber, core, and/or matrix materials without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain composite materials storage practices and shelf life without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain composite structure repair methods, techniques, and practices without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain window inspection/types of defects without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain window material storage and handling without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain window installation procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain care and maintenance of windows without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain window temporary and/or permanent repairs without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of composite and plastic structures and materials the learner will be able to explain maintenance safety practices/precautions for composite materials/structures, and/or windows without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards associated with using the wrong type of glue for wood structure repairs the learner will be able to describe the problems associated with wood glue failure including safety concerns associate with this type of improper repair technique.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of improper composite structure repairs the learner will be able to identify and assess improper composite structure repairs including corrective action.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with improper PPE use the learner will be able to list typical personal protective equipment (PPEs), describe the use of each, and properly utilize PPEs as warranted.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the factors involved to produce accurate aircraft drawings, including acceptable tolerances the learner will be able to note the rationale for producing and utilizing accurate aircraft drawings as well as demonstrating appropriate selection and discriminating assessments.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the importance of correct measuring and mixing of materials associated with composite construction the learner will be able to locate, explain, and demonstrate correct measuring and mixing of composite materials.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the use of materials that are not part of an approved repair system the learner will be able to identify and distinguish between proper and unapproved materials including storage methods.	Understands & applies C	Competent 2
To demonstrate the skill to select and install fasteners on composite structures the learner will be able to locate appropriate reference(s), select, and install fasteners on composite structures without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect and repair fiberglass the learner will be able to locate appropriate reference(s), inspect, and repair fiberglass without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect composite, plastic, or glass-laminated structures the learner will be able to locate appropriate reference(s), inspect composite, plastic, or glass-laminated structures without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect acrylic type windshields the learner will be able to locate appropriate reference(s) and inspect acrylic type windshields without major error.	Understands C	Proficient 3
To demonstrate the skill to identify window enclosure materials the learner will be able to locate appropriate reference(s) and to identify window enclosure materials without major error.	Understands C	Proficient 3

To demonstrate the skill to prepare composite surface for painting the learner will be able to locate appropriate reference(s) and prepare composite surface for painting without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect pilot seat and seatbelt to include technical standard order (TSO) markings the learner will be able to locate appropriate reference(s) and to inspect pilot seat and seatbelt including technical standard order (TSO) markings without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a tap test on composite material the learner will be able to located references and perform a tap test on composite material without major error.	Understands C	Proficient 3
To demonstrate the skill to locate procedures for applying fabric the learner will be able to located and explain the procedures for applying fabric without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate and explain repair standard dimensions the learner will be able to locate appropriate references and explain repair standard dimensions without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate and explain repair procedures for elongated bolt holes the learner will be able to locate appropriate references and explain repair procedures for elongated bolt holes without major error or omission.	Understands C	Proficient 3

C. Aircraft Finishes

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of protection of airframe structures the learner will be able to explain how aircraft structures can be protected by polishing or painting without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of primer materials the learner will be able to explain the various types and uses of primer materials including precautions and concerns without error or omission.	Knows B	No skill 1
To demonstrate an understanding of topcoat materials the learner will be able to explain the various types of topcoat materials including precautions, concerns, and suitability without error or omission.	Knows B	No skill 1
To demonstrate an understanding of surface preparation for a desired finishing material the learner will be able to describe typical surface preparations for specific finishing material without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the effects of ambient conditions on finishing materials the learner will be able to describe the effects high humidity and temperature have on finishing materials as well as inadequate air quality controls without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the effects of improper surface preparation on finishing materials the learner will be able to describe the effects that improper surface preparation can have on finishing materials including corrosion and top coat deterioration without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the regulatory requirements for registration markings the learner will be able to describe the reference 14 CFR § 45 and note the location, size, and type of characters required to comply with current regulations without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inspection of aircraft finishes the learner will be able to describe typical inspection criteria for aircraft finishes without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the safety practices/precautions when using finishing materials the learner will be able to describe typical safety concerns including environmental and PPEs without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of fungicidal, butyrate, and/or nitrate dopes the learner will be able to describe the characteristics of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of finishing materials application techniques and practices the learner will be able to how finishing materials are properly applied detailing typical techniques and practices without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of control surface balance considerations after refinishing the learner will be able to describe when control surfaces require balancing after refinishing without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards associated with identifying the health concerns when using paints and solvents the learner will be able to demonstrate and/or describe the health concerns including how to mitigate and minimize the risks to the technician and others.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards associated with identifying and using the appropriate personal protective equipment (PPEs) for working with paints and solvents the learner will be able to demonstrate and/or describe the appropriate PPEs to be utilized when working with paints and solvents.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the consequences of improper application of or incompatible finishing materials the learner will be able to identify and notate the consequences of improper application of or incompatible finishing materials on aircraft components.	Understands & applies C	Competent 2
To demonstrate the skill to determine the location and/or size requirements for aircraft registration numbers the learner will be able to locate the appropriate reference and explain the location and/or size requirements for aircraft registration numbers without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to prepare a composite surface for painting the learner will be able to prepare a composite surface for painting without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify finishing materials and appropriate thinners the learner will be able to identify selected finishing materials and appropriate thinners without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to layout and mask an aircraft identification marking (“N” number) the learner will be able to layout and mask an aircraft identification marking (“N” number) as assigned without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to prepare a metal surface for painting the learner will be able to prepare a metal surface for painting without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to determine what paint system can be used on a given aircraft the learner will be able to locate the appropriate reference and list which paint system can be used on a specific aircraft without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to apply etch solution and conversion coating the learner will be able to locate, prepare, and apply the etch solution and conversion coating using appropriate PPEs without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to determine if control surfaces require rebalancing the learner will be able to locate the appropriate reference information and determine whether rebalancing a specific control surface is required without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify types of protective finishes the learner will be able to locate the appropriate reference information and determine the types of protective finishes from various samples without major error or omission.	Understands C	Proficient 3

D. Welding

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of flame welding gasses the learner will be able to explain gas welding is accomplished by heating the ends or edges of metal parts to a molten state with a high temperature flame utilizing oxygen and either acetylene or hydrogen gas without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of storage/handling of welding gasses the learner will be able to explain how oxygen, acetylene, hydrogen, helium, argon, and or CO_2 are properly stored, handled, and transported without error or omission.	Knows B	No skill 1
To demonstrate an understanding of flame welding practices and techniques the learner will be able to explain torch tip selection, typical torch angles, distances and techniques, filler rod, types of flames (carburizing, neutral, and oxidizing), typical gas pressures, and safety precautions without error or omission.	Knows B	No skill 1
To demonstrate an understanding of inert-gas welding practices and techniques the learner will be able to describe TIG welding current configurations (AC, +DC, and –DC) and uses, shielding gases and purposes, electrode types and tip shapes, typical arc angles, distances, and techniques, and equipment without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the purpose and types of shielding gasses the learner will be able to explain the types of shielding gasses used in TIG and MIG welding and the purpose of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the characteristics of acceptable welds the learner will be able to explain acceptable weld characteristics in terms of height, width, blending, and heat affected area without error or omission.	Knows B	No skill 1
To demonstrate an understanding of the characteristics of unacceptable welds the learner will be able to explain typical weld problems including undercutting, lack of penetration, porosity, lack of fusion, splatter, warpage, cracks, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the types of steel tubing welding repairs the learner will be able to describe formed steel patch plates, split sleeve reinforcement, finger patches, inner sleeve repair, tube replacement, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the procedures for weld repairs the learner will be able to explain reference to manufacturer's structural repair or advisory circular 43.13-1B, change 1, Chapter 4 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of soldering preparation, types of solder, and/or flux usage the learner will be able to explain how to prepare a joint for soldering, various types of solder, flux, and flux usage without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of welding and/or soldering safety practices/precautions the learner will be able to describe the various types of personal protective equipment for welding and soldering, along with the safety practices, precautions, and procedures that should be observed without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety procedures for compressed gas bottles the learner will be able to demonstrate and/or explain the typical safety precautions for compress gas bottles.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety procedures in the use of electric welding equipment the learner will be able to demonstrate and/or note the safety procedures required in the use of electric welding equipment.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the factors associated with the issuance of a "Hot Work" permit the learner will be able to define "Hot work", explain, and or demonstrate how to test for flammable gases in the work area before starting any hot work.	Understands & applies C	Competent 2

To demonstrate the skill to inspect and check welds the learner will be able to locate appropriate reference(s) and inspect and check welds and determine their return to service status without major error.	Understands C	Proficient 3
To demonstrate the skill to solder aircraft wire and connectors the learner will be able to solder an aircraft wire and/or connector without major error.	Understands C	Proficient 3

E. Assembly and Rigging (*Flight Controls*)

Objective	Knowledge Level	Skill Level
To demonstrate an understanding control cables the learner will be able to explain the material, designation, and construction of aircraft control cables without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of control cable maintenance the learner will be able to explain control cable maintenance including installation, inspection, tension, replacement, repair, and use of rigging fixtures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of cable connectors the learner will be able to explain the use of thimbles, nicopress sleeves, swaged terminals and ends, AN 5-tuck splice, turn buckles, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of cable guides the learner will be able to explain pulleys, guards, fairleads, and pressure seals without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of control stops the learner will be able to explain the purpose and typical location of control stops without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of push pull tubes the learner will be able to explain how push pull tubes to transfer cockpit inputs to control system movement without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of torque tubes the learner will be able to explain how a torque tube transmits an angular or twisting motion in opposite directions when needed in a control system without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of bell cranks the learner will be able to explain where bell cranks are typically located and how they function without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of flutter and flight control balance the learner will be able to explain what causes flutter and how flight control balance minimizes flutter without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rigging of airplane flight controls the learner will be able to explain rigging concerns and procedures of airplane primary and secondary controls without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rigging of rotorcraft flight controls the learner will be able to explain rigging concerns and procedures of rotorcraft main and tail rotor flight controls, including track and balance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of airplane flight controls and/or stabilizer systems the learner will be able to describe vertical and horizontal stabilizers, horizontal stabilators, and a V-tail empennage without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rotorcraft flight controls and/or stabilizer systems the learner will be able to explain that a fin or pylon is also a common feature on rotorcraft similar to a vertical stabilizer on the empennage of an airplane without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the use of and correct interpretation of a cable tension chart the learner will be able to locate, demonstrate and/or correctly interpret an aircraft cable tension chart.	Understands & applies C	Competent 2

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the possible consequences of improperly rigging aircraft flight controls the learner will be able to identify proper flight control rigging tools, procedures, and findings and delineate consequences of improper flight control rigging on aircraft performance and safety.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the selection and use of lifting equipment used to move aircraft components into place for assembly the learner will be able to identify acceptable lifting equipment and /or demonstrate the proper use of such lifting equipment.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the importance of maintaining a calibration schedule for cable tension meters and other rigging equipment the learner will be able to locate, identify, and /or verify proper calibration schedule for cable tension meters and other rigging equipment.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the correct use and interpretation of cable tensiometers the learner will be able to detail the problems associated with incorrect cable tensiometer interpretation and/or demonstrate proper cable tehsiometer technique.	Understands & applies C	Competent 2
To demonstrate the skill to locate and explain the procedures needed to rig a helicopter the learner will be able to locate appropriate reference(s) and the procedures needed to rig a helicopter without major error.	Understands C	Proficient 3
To demonstrate the skill to identify fixed-wing aircraft rigging adjustment locations the learner will be able to locate appropriate reference(s) and identify fixed-wing aircraft rigging adjustment locations without major error.	Understands C	Proficient 3
To demonstrate the skill to identify control surfaces that provide movement about an aircraft's axes the learner will be able to locate appropriate reference(s) and identify control surfaces that provide movement about an aircraft's axes without major error.	Understands C	Proficient 3
To demonstrate the skill to locate leveling methods and procedures the learner will be able to locate appropriate reference(s) and leveling methods and procedures without major error.	Understands C	Proficient 3
To demonstrate the skill to verify alignment of an empennage the learner will be able to locate appropriate reference(s) and verify alignment of an empennage without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a primary and secondary flight control surface the learner will be able to locate appropriate reference(s) and inspect a primary and secondary flight control surface without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and/or reinstall a primary flight control surface the learner will be able to locate appropriate reference(s), remove, and/or reinstall a primary flight control surface and without major error.	Understands C	Proficient 3
To demonstrate the skill to assemble aircraft components the learner will be able to locate appropriate reference(s) and assemble aircraft components without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect primary control cables the learner will be able to locate appropriate reference(s) and inspect primary control cables without major error.	Understands C	Proficient 3
To demonstrate the skill to install swaged cable terminals the learner will be able to locate appropriate reference(s) and install swaged cable terminals within manufacturer’s specifications.	Understands C	Proficient 3
To demonstrate the skill to remove and reinstall a primary flight control cable the learner will be able to locate appropriate reference(s), remove, reinstall, and rig a primary flight control within manufacturer’s specifications.	Understands C	Proficient 3
To demonstrate the skill to adjust push-pull flight control systems the learner will be able to locate appropriate reference(s) and adjust push-pull flight control systems within manufacturer’s specifications.	Understands C	Proficient 3

To demonstrate the skill to balance a flight control surface the learner will be able to locate appropriate reference(s) and balance a flight control surface within manufacturer's specifications.	Understands C	Proficient 3
To demonstrate the skill to determine allowable axial play limits for a flight control bearing the learner will be able to locate appropriate reference(s) and determine allowable axial play limits for a flight control bearing within manufacturer's specifications.	Understands C	Proficient 3

F. Airframe Inspection

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of inspection requirements the learner will be able to explain 100- hour, annual, progressive, continuous, and approved inspection requirements with reference to 14 CFR § 43 and 91 without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of maintenance recordkeeping requirements the learner will be able to explain maintenance recordkeeping requirements with reference to 14 CFR § 43 and 91 including temporary and permanent records, status of life limited parts, times, major alterations and repairs, weight and balance records, inspection status, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the requirements for complying with airworthiness directives the learner will be able to explain the requirements for complying with airworthiness directives without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of compliance with service letters, service bulletins, or instructions for continued airworthiness the learner will be able to explain the requirements for complying with service letters, service bulletins, or instructions for continued airworthiness without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the misinterpretation of inspection instructions which can lead to over or under maintenance being performed the learner will be able to demonstrate and/or explain the proper interpretation of inspection instructions.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing identifying the limitations of visual inspection and where its use would not be applicable the learner will be able to identify, enumerate, and or demonstrate the limitations of visual inspection.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations when performing radiographic inspections the learner will be able to identify and enumerate the appropriate safety considerations required with performing radiographic inspections.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the selection and use of the proper checklist and other maintenance publications the learner will be able to explain, identify and/or utilize the proper checklists and/or other maintenance publications.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing incorrect maintenance record documentation the learner will be able to explain, identify and/or utilize proper maintenance documentation.	Understands & applies C	Competent 2
To demonstrate the skill to accomplish an airframe conformity check the learner will be able to locate appropriate reference(s) and accomplish an airframe conformity check without major error.	Understands C	Proficient 3
To demonstrate the skill to perform an airframe inspection to include a records check the learner will be able to locate appropriate reference(s) and perform an airframe inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a portion of a 100-hour/annual inspection in accordance with part 43, appendix D the learner will be able to locate appropriate	Understands C	Proficient 3

reference(s) and perform a portion of a 100-hour/annual inspection in accordance with part 43, appendix D without major error.		
To demonstrate the skill to perform a portion of the conformity inspection on an airframe the learner will be able to locate appropriate reference(s) and perform a portion of the conformity inspection on an airframe without major error.	Understands C	Proficient 3
To demonstrate the skill to enter results of a 100-hour inspection in a maintenance record the learner will be able to locate appropriate reference(s) and enter results of a 100-hour inspection in a maintenance record without major error.	Understands C	Proficient 3
To demonstrate the skill to determine compliance with a particular airworthiness directive the learner will be able to locate appropriate reference(s) and determine compliance with a particular airworthiness directive without major error.	Understands C	Proficient 3
To demonstrate the skill to provide a checklist for conducting a 100-hour inspection the learner will be able to locate appropriate reference(s) and provide a checklist for conducting a 100-hour inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to determine if any additional inspections are required during particular 100 hour; i.e. 300 hour filter replacement the learner will be able to locate appropriate reference(s) and determine if any additional inspections are required during particular 100 hour; i.e. 300 hour filter replacement without major error.	Understands C	Proficient 3

G. Landing Gear Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of fixed landing gear systems the learner will be able to explain basic aircraft fixed conventional and tricycle landing gear systems including wheels, skis, and pontoons without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of retractable landing gear systems the learner will be able to explain basic aircraft retractable conventional and tricycle landing gear systems including wheels, skis, amphibious floats, and amphibious without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fixed landing gear components the learner will be able to list and describe the major components of fixed conventional and tricycle landing gear systems including wheels, skis, and pontoons without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of retractable landing gear components the learner will be able to list and describe the major components of retractable conventional and tricycle landing gear systems including wheels, skis, amphibious floats, and amphibious without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of landing gear strut servicing/lubrication the learner will be able to explain how to service spring/oil and air/oil landing gear struts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of steering systems the learner will be able to explain freely pivoting tailwheels, tailwheel steering linkage, freely pivoting nosewheel steering, nosewheel steering linkage, rudder steering, tiller steering, and differential braking without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of landing gear and warning system inspection, check and servicing the learner will be able to list and describe the major components used in landing gear warning systems including their inspection and servicing without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of brake assembly inspection the learner will be able to list and describe the various types of aircraft brake assemblies including mechanical, expander tube, disc brakes (including floating, fixed, dual, multiple, and segmented rotor) including their inspection without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of anti-skid system components and operation the learner will be able to list and describe the major components and operation of anti-skid systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of wheel construction the learner will be able to explain aircraft wheel construction including tube-type and tubeless wheels, wheel bearings, tie bolts, key and key screws, fusible plugs and balance weights without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of brake construction the learner will be able to explain aircraft brake construction including expanding tube-type single, dual, and multiple disc, and segmented rotor brakes without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of tire construction the learner will be able to explain aircraft tire construction including the tire bead, carcass plies, tread, sidewall, and markings of radial and bias ply tires without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of tire storage, care, and/or servicing the learner will be able to explain how aircraft tires should be stored, cared for, and/or properly service without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of position indicators the learner will be able to list and describe the various types of landing gear position indicators used on aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of brake actuating systems the learner will be able to list and describe the basic operation and components of a brake actuating system without error or omission.	Knows B	No skill 1
To demonstrate an understanding of skid shoe and tube inspection the learner will be able to list and describe the basic inspection of skid shoe and tube without error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing landing gear and/or tire and wheel safety practices/precautions the learner will be able to identify and enumerate tire and/or wheel safety practices and the risks associated with not following appropriate safety practices and observing all precautions.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards association with improper use of aircraft jacks the learner will properly use aircraft jacks and/or describe the possible results of improper use of aircraft jacks.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards association with high pressure gasses and fluids correctly the learner will be able to identify and enumerate strut or system disassembly safety practices, procedures, and the risks associated with not following appropriate safety practices and procedures involving properly relieving pressure prior to strut or system disassembly.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the storage and handling of hydraulic fluids the learner will be able to describe hazards and/or demonstrate proper techniques associated with the storage and handling of hydraulic fluids.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing correctly relieving pressure prior to strut or system disassembly the learner will be able to describe the risks and/or demonstrate proper pressure relieving prior to strut or system disassembly.	Understands & applies C	Competent 2
To demonstrate the skill to inspect and service a landing gear the learner will be able to locate appropriate reference(s), inspect, and service an aircraft landing gear without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect, check and service an anti-skid system the learner will be able to locate appropriate reference(s), inspect, check, and service an aircraft antiskid system without major error.	Understands C	Proficient 3

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate the skill to locate procedures for checking operation of an anti-skid warning system the learner will be able to locate appropriate reference(s) and without major error.	Understands C	Proficient 3
To demonstrate the skill to locate troubleshooting procedures for an anti-skid system the learner will be able to locate appropriate reference(s) and troubleshooting procedures for an anti-skid system without major error.	Understands C	Proficient 3
To demonstrate the skill to jack aircraft the learner will be able to locate appropriate reference(s) and jack an aircraft without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a landing gear retraction the learner will be able to locate appropriate reference(s) and perform a landing gear retraction without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect wheels, brakes and tires the learner will be able to locate appropriate reference(s) and inspect wheels, brakes and tires without major error.	Understands C	Proficient 3
To demonstrate the skill to install brake lining(s) or brake assembly the learner will be able to locate appropriate reference(s) and install brake lining(s) or brake assembly without major error.	Understands C	Proficient 3
To demonstrate the skill to service landing gear and/or oil shock strut the learner will be able to locate appropriate reference(s) and service landing gear and/or oil shock strut without major error.	Understands C	Proficient 3
To demonstrate the skill to bleed air from a hydraulic brake system the learner will be able to locate appropriate reference(s) and bleed air from a hydraulic brake system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot hydraulic brake systems the learner will be able to locate appropriate reference(s) and troubleshoot hydraulic brake systems without major error.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and/or install a wheel brake assembly the learner will be able to locate appropriate reference(s) and remove, inspect, and/or install a wheel brake assembly	Understands C	Proficient 3
To demonstrate the skill to inspect a tire for defects the learner will be able to locate appropriate reference(s) and inspect a tire for defects without major error.	Understands C	Proficient 3
To demonstrate the skill to locate tire storage practices the learner will be able to locate appropriate reference(s) and tire storage practices without major error.	Understands C	Proficient 3
To demonstrate the skill to replace air/oil shock strut air valve the learner will be able to locate appropriate reference(s) and replace air/oil shock strut air valve without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an air/oil shock strut the learner will be able to locate appropriate reference(s) and to troubleshoot an air/oil shock strut without major error.	Understands C	Proficient 3
To demonstrate the skill to service a nosewheel shimmy damper the learner will be able to locate appropriate reference(s), service and/or replace a nosewheel shimmy damper without major error.	Understands C	Proficient 3
To demonstrate the skill to adjust nosewheel steering system the learner will be able to locate appropriate reference(s) and adjust nosewheel steering system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect landing gear alignment the learner will be able to locate appropriate reference(s) and inspect landing gear alignment without major error.	Understands C	Proficient 3
To demonstrate the skill to replace master brake cylinder packing seals the learner will be able to locate appropriate reference(s) and replace master brake cylinder packing seals without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot landing gear retract system the learner will be able to locate appropriate reference(s) and troubleshoot landing gear retract system without major error.	Understands C	Proficient 3

To demonstrate the skill to troubleshoot aircraft steering system the learner will be able to locate appropriate reference(s) and troubleshoot aircraft steering system without major error.	Understands C	Proficient 3
To demonstrate the skill to identify landing gear position system components the learner will be able to locate appropriate reference(s) identify landing gear position system components and without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot landing gear position and/or warning systems the learner will be able to locate appropriate reference(s) and troubleshoot landing gear position and/or warning systems without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect landing gear position indicating system the learner will be able to locate appropriate reference(s) and inspect landing gear position indicating system without major error.	Understands C	Proficient 3
To demonstrate the skill to repair landing gear position indicating systems the learner will be able to locate appropriate reference(s) and repair landing gear position indicating systems without major error.	Understands C	Proficient 3
To demonstrate the skill to describe the sequence of operation for a landing gear warning system the learner will be able to locate appropriate reference(s) and describe the sequence of operation for a landing gear warning system without major error.	Understands C	Proficient 3
To demonstrate the skill to remove, install, and/or adjust a landing gear down-lock switch the learner will be able to locate appropriate reference(s), remove, install, and/or adjust a landing gear down-lock switch without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a brake for serviceability the learner will be able to locate appropriate reference(s) and inspect a brake for serviceability without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot nosewheel shimmy the learner will be able to locate appropriate reference(s) and troubleshoot nosewheel shimmy without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect tube landing gear for damage and determine if the skid is serviceable the learner will be able to locate appropriate reference(s), inspect tube landing gear for damage, and determine if the skid is serviceable without major error.	Understands C	Proficient 3

H. Hydraulic and Pneumatic Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of hydraulic system components the learner will be able to list and describe the basic components utilized in aircraft hydraulic systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hydraulic system fluids the learner will be able to locate appropriate reference(s), list, and/or describe the various types of aircraft hydraulic fluids (vegetable-based, mineral-based, polyalphaolefins, and phosphate ester-hydraulic fluid) including usage without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hydraulic system operation the learner will be able to explain how an aircraft hydraulic system functions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hydraulic system servicing requirements the learner will be able to explain how to service an aircraft hydraulic system noting the servicing requirements without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hydraulic system inspection, check, servicing and troubleshooting the learner will be able to explain how to inspect, check, service, and troubleshoot an aircraft hydraulic system without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of pneumatic system types the learner will be able to explain aircraft pneumatic system types without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of pneumatic system components the learner will be able to explain aircraft pneumatic system components without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of pneumatic system servicing requirements the learner will be able to explain the servicing requirements of an aircraft pneumatic system without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of servicing, function, and/or operation of accumulators the learner will be able to list and describe the types, servicing, function, and/or operation of aircraft accumulators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the types of hydraulic/pneumatic seals and/or fluid/seal compatibility the learner will be able to list and describe the types of hydraulic/pneumatic seals and/or fluid/seal compatibility without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hydraulic systems servicing the learner will be able to explain how to service an aircraft hydraulic system without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of pneumatic systems servicing the learner will be able to explain how to service an aircraft pneumatic system without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing correctly relieving system pressure prior to system servicing or disassembly the learner will be able to demonstrate and/or describe proper system pressure release prior to system servicing or disassembly.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards association with high pressure gasses and fluids the learner will be able to demonstrate and/or describe proper high pressure gas and/or fluid safety procedures.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the storage and handling of hydraulic fluids the learner will be able to describe hazards and/or demonstrate proper techniques associated with the storage and handling of hydraulic fluids.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing correctly relieving pressure prior to strut or system disassembly the learner will be able to describe the risks and/or demonstrate proper pressure relieving prior to strut or system disassembly.	Understands & applies C	Competent 2
To demonstrate the skill to identify different types of hydraulic fluids the learner will be able to locate appropriate reference(s), list, and/or identify the various types of aircraft hydraulic fluids (vegetable-based, mineral-based, polyalphaolefins, and phosphate ester-hydraulic fluid) including usage without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify different packing seals the learner will be able to locate appropriate reference(s) and identify different aircraft hydraulic system packing seals without major error.	Understands C	Proficient 3
To demonstrate the skill to install seals in a hydraulic component the learner will be able to locate appropriate reference(s) and install seals in a hydraulic component without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and install a selector valve the learner will be able to locate appropriate reference(s) and install a selector valve without major error.	Understands C	Proficient 3
To demonstrate the skill to check a pressure regulator and adjust as necessary the learner will be able to locate appropriate reference(s), check, and/or adjust a pressure regulator as necessary without major error.	Understands C	Proficient 3
To demonstrate the skill to remove, clean, and install a hydraulic system filter the learner will be able to locate appropriate reference(s), remove, clean, and install a hydraulic system filter and without major error.	Understands C	Proficient 3

To demonstrate the skill to service a hydraulic system accumulator the learner will be able to locate appropriate reference(s) and service a hydraulic system accumulator without major error.	Understands C	Proficient 3
To demonstrate the skill to service a hydraulic system reservoir the learner will be able to locate appropriate reference(s) and service a hydraulic system reservoir without major error.	Understands C	Proficient 3
To demonstrate the skill to remove, install, and check an engine-driven hydraulic pump the learner will be able to locate appropriate reference(s), remove, install, and check an engine-driven hydraulic pump and without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot hydraulic power system the learner will be able to locate appropriate reference(s) and troubleshoot hydraulic power system without major error.	Understands C	Proficient 3
To demonstrate the skill to purge air from a hydraulic system the learner will be able to locate appropriate reference(s) and purge air from a hydraulic system without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and/or install a system pressure relief valve the learner will be able to locate appropriate reference(s), remove, and/or install a system pressure relief valve and without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a hydraulic power system leak the learner will be able to locate appropriate reference(s) and troubleshoot a hydraulic power system leak without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a pneumatic power system leak the learner will be able to locate appropriate reference(s) and troubleshoot a pneumatic power system leak without major error.	Understands C	Proficient 3
To demonstrate the skill to service pneumatic brake system air bottles the learner will be able to locate appropriate reference(s) and service pneumatic brake system air bottles without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a pneumatic air bottle for condition and determine service life (hydrostatic testing) the learner will be able to locate appropriate reference(s), inspect a pneumatic air bottle for condition, and determine service life (hydrostatic testing) without major error.	Understands C	Proficient 3
To demonstrate the skill to adjust a pneumatic power system relief valve the learner will be able to locate appropriate reference(s) and adjust a pneumatic power system relief valve without major error.	Understands C	Proficient 3
To demonstrate the skill to locate fluid servicing instructions and identify/select fluid for a given aircraft the learner will be able to locate appropriate reference(s) and identify/select fluid for a given aircraft without major error.	Understands C	Proficient 3
To demonstrate the skill to identify and explain proper installation procedures for a seal, backup ring, and/or gasket the learner will be able to locate the appropriate reference(s), identify components, and explain the proper installation procedures for a seal, backup ring, and/or gasket without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate and explain procedures for checking pneumatic/bleed air overheat warning systems the learner will be able to locate the appropriate reference(s), identify components, and explain the procedures for checking pneumatic/bleed air overheat warning systems without major error or omission.	Understands C	Proficient 3

I. Environmental Systems (*Cabin Atmosphere Control Systems*)

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of pressurization systems the learner will be able to explain the types of aircraft pressurization systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of bleed air heating the learner will be able to explain how bleed air heating functions without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of aircraft instrument cooling the learner will be able to explain how aircraft instrument are cooled without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding exhaust heat exchanger and/or system component(s) function, operation, and/or inspection procedures the learner will be able to list and describe aircraft exhaust heat exchanger and/or system component(s) function, operation, and/or inspection procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of combustion heater and/or system component(s) function, operation, and/or inspection procedures the learner will be able to list and describe aircraft combustion heater and/or system component(s) function, operation, and/or inspection procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of vapor-cycle system and/or system component(s) operation, servicing and/or inspection procedures the learner will be able to list and describe aircraft vapor-cycle system and/or system component(s) operation, servicing and/or inspection procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of air-cycle system and/or system component(s) operation and/or inspection procedures the learner will be able to list and describe air-cycle system and/or system component(s) operation, servicing and/or inspection procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of cabin pressurization and/or system component(s) operation and/or inspection procedures the learner will be able to list and describe cabin pressurization system and/or system component(s) operation, servicing and/or inspection procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of types of oxygen systems and/or oxygen system component(s) operation the learner will be able to list and describe the types of oxygen systems and/or oxygen system component(s) operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of oxygen systems maintenance procedures the learner will be able to list and describe the basic elements of oxygen systems maintenance procedures without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing oxygen system maintenance procedures and safety precautions the learner will be able to identify and enumerate oxygen system maintenance procedures and safety precautions, procedures, and the risks associated with not following appropriate safety practices and procedures	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing environmental precautions for dealing with Freon refrigeration the learner will be able to identify and enumerate environmental precautions and safety practices for dealing with Freon refrigeration and the personal and environmental risks associate with not following appropriate environmental practices.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety precautions when handling, or performing maintenance, on chemical oxygen generating systems the learner will be able to identify, demonstrate, and/or enumerate the safety precautions when handling, or performing maintenance, on chemical oxygen generating systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety precautions associated with the storage, handling and use of compressed gas cylinders the learner will be able to identify, demonstrate, and/or enumerate the safety precautions associated with the storage, handling and use of compressed gas cylinders.	Understands & applies C	Competent 2
To demonstrate the skill to inspect, check, service and troubleshoot an oxygen system the learner will be able to locate the appropriate reference(s), inspect, check, service and troubleshoot an oxygen system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate procedures for troubleshooting a cabin heater the learner will be able to locate the appropriate reference(s) and procedures for troubleshooting a cabin heater without major error.	Understands C	Proficient 3

To demonstrate the skill to locate and explain the procedures for protecting a refrigerant (vapor-cycle) system from contamination during replacement of a component the learner will be able to locate the appropriate reference(s) and explain the procedures for protecting a refrigerant (vapor-cycle) system from contamination during replacement of a component without major error.	Understands C	Proficient 3
To demonstrate the skill to locate sources of contamination in a refrigerant system the learner will be able to locate the appropriate reference(s) and sources of contamination in a refrigerant system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate the procedures for checking a combustion heater fuel system for leaks the learner will be able to locate the appropriate reference(s) and the procedures for checking a combustion heater fuel system for leaks without major error.	Understands C	Proficient 3
To demonstrate the skill to identify and describe the units in a refrigerant system in relation to each other the learner will be able to locate the appropriate reference(s), identify, and describe the units in a refrigerant system in relation to each other without major error.	Understands C	Proficient 3
To demonstrate the skill to locate the servicing procedures for a vapor-cycle air conditioning system the learner will be able to locate the appropriate reference(s) and the servicing procedures for a vapor-cycle air conditioning system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate the inspection requirements for a cabin heater system equipped with an exhaust heat exchanger the learner will be able to locate the appropriate reference(s) and the inspection requirements for a cabin heater system equipped with an exhaust heat exchanger without major error.	Understands C	Proficient 3
To demonstrate the skill to locate the procedures for inspecting an outflow valve in a pressurization system the learner will be able to locate the appropriate reference(s) and the procedures for inspecting an outflow valve in a pressurization system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate operating instructions for a refrigerant system the learner will be able to locate the appropriate reference(s) and operating instructions for a refrigerant system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate instructions for the inspection of a pressurization system the learner will be able to locate the appropriate reference(s) and instructions for the Inspection of a pressurization system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an air-cycle air conditioning system the learner will be able to locate the appropriate reference(s) and troubleshoot an air-cycle air conditioning system without major error.	Understands C	Proficient 3

J. Aircraft Instrument Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of annunciator indicating systems and the meaning of warning, caution, and advisory lights the learner will be able to list and describe various types of annunciator indicating systems and the meaning of warning, caution, and advisory lights without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of magnetic compass operation the learner will be able to list and describe the types of magnetic compasses including how they operate, variation, deviation, and typical errors (angle of dip, acceleration, turning, and turbulence) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of magnetic compass swinging procedures the learner will be able to explain how to swing a compass for both conventional and tricycle gear aircraft without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of pressure indicating instruments the learner will be able to list and describe pressure measuring instruments including pressure sensing devices (bourdon tube, aneroid, bellows, and pressure diaphragms), specific engine, and airframe instruments without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of temperature indicating instruments the learner will be able to list and describe non-electric, electric, and thermocouple temperature indicating instruments including specific engine and airframe instruments without major error or omission	Knows B	No skill 1
To demonstrate an understanding of position indication sensors and instruments the learner will be able to explain synchro-type remote indicating instrument systems including DC Selsyn and AC Synchro systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of gyroscopic instruments the learner will be able to explain the basic gyroscopic instruments including electric, vacuum, and pressure sources without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of direction indicating instruments the learner will be able to explain direction indicating instruments including compasses (magnetic, vertical, remote indicating, flux gate, and solid state magnetometers), and directional gyros without major error or omission	Knows B	No skill 1
To demonstrate an understanding of instrument pneumatic systems the learner will be able to explain instrument pneumatic systems (vacuum and pressure) without major error or omission	Knows B	No skill 1
To demonstrate an understanding of pitot static system the learner will be able to explain the pitot static system and associate instruments without major error or omission	Knows B	No skill 1
To demonstrate an understanding of fuel quantity indicating systems the learner will be able to list and describe the components and operation of sight gauges, mechanical, electrical, and electronic fuel quantity indicating systems without major error or omission	Knows B	No skill 1
To demonstrate an understanding of range markings the learner will be able to list and describe range marking colors and application procedures without major error or omission	Knows B	No skill 1
To demonstrate an understanding of electronic displays the learner will be able to explain aircraft electronic displays without major error or omission	Knows B	No skill 1
To demonstrate an understanding of electrostatic sensitive devises the learner will be able to explain electrostatic sensitive devises without major error or omission	Knows B	No skill 1
To demonstrate an understanding of built in test equipment the learner will be able to explain BITE without major error or omission	Knows B	No skill 1
To demonstrate an understanding of central maintenance computer system the learner will be able to explain CMCS without major error or omission	Knows B	No skill 1
To demonstrate an understanding of electronic flight instrument system the learner will be able to explain EFIS without major error or omission	Knows B	No skill 1
To demonstrate an understanding of engine indication and crew alerting system the learner will be able to explain ICAS without major error or omission	Knows B	No skill 1
To demonstrate an understanding of heads-up guidance system the learner will be able to explain heads-up guidance system without major error or omission	Knows B	No skill 1
To demonstrate an understanding of 14 CFR § 43 and/or 91 requirements for static system checks the learner will be able to 14 CFR § 43 and/or 91 requirements for static system checks including which entity can perform such checks without major error or omission	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing using caution not to exceed the instrument limitations during testing which can lead to instrument failure the learner will be able to utilize proper procedures and/or describe the pitfalls of exceeding he instrument limitations during testing.	Understands & applies C	Competent 2

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the consequences of not taking appropriate actions in response to a warning or caution annunciator light the learner will be able to explain the results of ignoring a warning or caution annunciator light on aircraft longevity and airworthiness.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety precautions to be taken when performing maintenance on equipment identified as electrostatic sensitive the learner will be able to identify, demonstrate, and/or explain the safety precautions to be taken when performing maintenance on equipment identified as electrostatic sensitive.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the handling precautions for mechanical gyros or instruments containing mechanical gyros the learner will be able to identify, demonstrate, and/or explain the handling precautions for mechanical gyros or instruments containing mechanical gyros.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions for performing pitot/static systems test to prevent instrument damage the learner will be able to identify, demonstrate, and/or explain precautions for performing pitot/static systems test to prevent instrument damage.	Understands & applies C	Competent 2
To demonstrate the skill to perform a static system pressure system leak test the learner will be able to locate the appropriate resources(s) and perform a static system pressure system leak test without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and install instruments the learner will be able to locate the appropriate resources(s), remove, and install instruments without major error.	Understands C	Proficient 3
To demonstrate the skill to install range marks on an instrument glass the learner will be able to locate the appropriate resources(s) and install range marks on an instrument glass without major error.	Understands C	Proficient 3
To demonstrate the skill to determine barometric pressure using an altimeter the learner will be able to locate the appropriate resources(s) and determine barometric pressure using an altimeter without major error.	Understands C	Proficient 3
To demonstrate the skill to check for proper indication of a manifold pressure gage the learner will be able to locate the appropriate resources(s) and check for proper indication of a manifold pressure gage without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a magnetic compass the learner will be able to locate the appropriate resources(s) and inspect a magnetic compass without major error.	Understands C	Proficient 3
To demonstrate the skill to locate procedures for troubleshooting a vacuum operated instruments the learner will be able to locate the appropriate resources(s) and procedures for troubleshooting a vacuum operated instruments without major error.	Understands C	Proficient 3
To demonstrate the skill to select proper altimeter for installation on a given aircraft the learner will be able to locate the appropriate resources(s) and select proper altimeter for installation on a given aircraft without major error.	Understands C	Proficient 3
To demonstrate the skill to check a heated pitot tube for proper installation the learner will be able to locate the appropriate resources(s), and check a heated pitot tube for proper installation without major error.	Understands C	Proficient 3
To demonstrate the skill to identify exhaust gas temperature system components the learner will be able to locate the appropriate resources(s) and identify exhaust gas temperature system components without major error.	Understands C	Proficient 3
To demonstrate the skill to service a vacuum system filter the learner will be able to locate the appropriate resources(s) and service a vacuum system filter without major error.	Understands C	Proficient 3

To demonstrate the skill to check an altimeter system for certification for instrument flight rules (IFR) the learner will be able to locate the appropriate resources(s) and check an altimeter system for certification for instrument flight rules (IFR)without major error.	Understands C	Proficient 3
To demonstrate the skill to adjust gyro/instrument air pressure the learner will be able to locate the appropriate resources(s) and adjust gyro/instrument air pressure to within manufacturer's specifications.	Understands C	Proficient 3
To demonstrate the skill to describe the effects of gyro precession on a directional gyro system the learner will be able to locate the appropriate resources(s) and describe the effects of gyro precession on a directional gyro system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain the purpose of an aircraft's alternate air (static) source the learner will be able to locate the appropriate resources(s), identify, and explain the purpose of an aircraft's alternate air (static) source without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain the adjustment procedures for a stall warning system the learner will be able to locate the appropriate resources(s), identify, and explain the adjustment procedures for a stall warning system without major error.	Understands C	Proficient 3

K. Communication and Navigation Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of radio operating principles the learner will be able to explain radio operating principles including aircraft and operator approval criteria without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of radio components the learner will be able to list and describe typical aircraft radio components without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of antennas the learner will be able to list and describe typical types of aircraft communication and navigation antennas without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of antenna inspection requirements the learner will be able to explain antenna inspection requirements without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of antenna mounting in the pressure vessel area of a pressurized aircraft the learner will be able to explain antenna mounting concerns/precautions in the pressure vessel area of a pressurized aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of interphone and intercom systems the learner will be able to explain aircraft interphone and intercom systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of systems including very high frequency (VHF), high frequency (HF), intercom, and SATCOM the learner will be able to list and describe components of systems including very high frequency (VHF), high frequency (HF), intercom, and SATCOM without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft communication addressing and reporting system (ACARS) the learner will be able to explain ACARS without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of audio integrating system (AIS) the learner will be able to explain AIS without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of emergency locator transmitter (ELT) the learner will be able to explain ELT without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of automatic direction finder (ADF) the learner will be able to explain ADF without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of very high frequency omnidirectional (VOR) the learner will be able to explain VOR without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of distance measuring equipment (DME) the learner will be able to explain DME without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of instrument landing system (ILS) the learner will be able to explain ILS without major error or omission.	Knows B	No skill 1
To demonstrate an understanding global positioning system (GPS) the learner will be able to explain GPS without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inertial navigation system (INS) the learner will be able to explain INS without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of traffic alert and collision warning system (TCAS) the learner will be able to explain TCAS without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of weather radar the learner will be able to explain weather radar without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of ground proximity warning systems (GPWS) the learner will be able to explain ground proximity warning systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of warning systems the learner will be able to explain aircraft warning systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of auto-pilot theory, components and operation the learner will be able to explain auto-pilot theory, components and operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of auto-throttle theory, components, and operation the learner will be able to explain auto-throttle theory, components and operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of stability augmentation the learner will be able to explain stability augmentation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of antennas and antenna inspection requirements the learner will be able to antennas and antenna inspection requirements explain without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Automatic Dependent Surveillance Broadcast (ADS-B) the learner will be able to explain ADS-B without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Radio Altimeter (RA) he learner will be able to explain radio altimeters without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing using caution when testing ELT systems so as not to not give false signals to the ATC system the learner will be able to properly test and/or explain the caution to be exercised when testing ELT systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions to be taken when performing maintenance on high power/high frequency systems such as weather radar and SATCOM the learner will be able to locate, explain, and/or demonstrate the precautions to be taken when performing maintenance on high power/high frequency systems such as weather radar and SATCOM.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing improper wire harness routing and interference consequences the learner will be able to locate, explain, and/or demonstrate proper wire harness routing and interference avoidance.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety and interference considerations when mounting antennas the learner will be able to locate, explain, and/or demonstrate the safety and interference considerations when mounting antennas.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing electro-static discharge considerations the learner will be able to locate, explain, and/or demonstrate electro-static discharge considerations.	Understands & applies C	Competent 2

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing correctly reading a wiring diagram so as to not damage a component or system the learner will be able to locate, explain, and/or demonstrate how to correctly read a wiring diagram avoiding damage to a component.	Understands & applies C	Competent 2
To demonstrate the skill to locate operating instructions for an autopilot system the learner will be able to locate appropriate reference(s) and operating instructions for an autopilot system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate autopilot inspection procedures the learner will be able to locate appropriate reference(s) and autopilot inspection procedures without major error.	Understands C	Proficient 3
To demonstrate the skill to list autopilot major components the learner will be able to locate appropriate reference(s) and list autopilot major components without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and identify navigation and/or communication antennas the learner will be able to locate appropriate reference(s) and identify navigation and/or communication antennas without major error.	Understands C	Proficient 3
To demonstrate the skill to check very high frequency (VHF) communications for operation the learner will be able to locate appropriate reference(s) and check very high frequency (VHF) communications for operation without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a coaxial cable installation for security the learner will be able to locate appropriate reference(s) and inspect a coaxial cable installation for security without major error.	Understands C	Proficient 3
To demonstrate the skill to check an emergency locator transmitter for operation the learner will be able to locate appropriate reference(s) and check an emergency locator transmitter for operation without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect ELT batteries for expiration date the learner will be able to locate appropriate reference(s) and inspect ELT batteries for expiration date without major error.	Understands C	Proficient 3
To demonstrate the skill to locate proper ELT testing procedures the learner will be able to locate appropriate reference(s) and test an ELT for proper operation without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect electronic equipment mounting base for security and condition the learner will be able to locate appropriate reference(s), inspect electronic equipment mounting base for security, and condition without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect electronic equipment shock mount bonding jumpers for resistance the learner will be able to locate appropriate reference(s) and inspect electronic equipment shock mount bonding jumpers for resistance without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect static discharge wicks for security and/or resistance the learner will be able to locate appropriate reference(s) and inspect static discharge wicks for security and/or resistance without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a radio installation for security the learner will be able to locate appropriate reference(s) and inspect a radio installation for security without major error.	Understands C	Proficient 3
To demonstrate the skill to locate installation procedures for antennas including mounting and coaxial connections the learner will be able to locate appropriate reference(s) and installation procedures for antennas including mounting and coaxial connections without major error.	Understands C	Proficient 3
To demonstrate the skill to make a list of required placards for communication and navigation avionics equipment the learner will be able to locate appropriate reference(s) and list the required placards for communication and navigation avionics equipment without major error.	Understands C	Proficient 3

To demonstrate the skill to locate troubleshooting procedures for a takeoff warning system the learner will be able to locate appropriate reference(s) and troubleshooting procedures for a takeoff warning system without major error.	Understands C	Proficient 3

L. Aircraft Fuel Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of fuel system types the learner will be able to list and describe the various aircraft fuel system types without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of components including filters and selector valves the learner will be able to list and describe aircraft fuel system components including filters and selector valves without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft fuel tanks the learner will be able to list and describe the various types of aircraft fuel tanks without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fuel flow the learner will be able to explain fuel flow for gravity and pressure feed aircraft fuel systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fuel transfer and defueling the learner will be able to explain aircraft fuel transfer and defueling operations without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of fuel dump systems the learner will be able to explain aircraft fuel dump systems requirements and operations without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards associated with fuel system maintenance the learner will be able to locate appropriate reference(s) and procedures for fuel system maintenance enumerating the hazards and risks associated with improper fuel system maintenance.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing understanding the risks of fuel system contamination and prevention procedures the learner will be able to locate appropriate reference(s) and procedures regarding fuel system contamination and prevention enumerating the hazards and risks associated with fuel system contamination.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions to be taken during fuel system maintenance in case of a spill the learner will be able to locate appropriate reference(s) and procedures enumerating spill procedures.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions/considerations that should be taken when performing fuel system maintenance requiring fuel tank entry the learner will be able to locate appropriate reference(s) and procedures enumerating the hazards and risks associated with fuel system maintenance requiring fuel tank entry.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing observing proper procedure and cautions when defueling aircraft for maintenance the learner will be able to locate appropriate reference(s) and procedures enumerating the hazards and risks associated with defueling.	Understands & applies C	Competent 2
To demonstrate the skill to inspect, check, troubleshoot, or repair a fuel system the learner will be able to locate appropriate reference(s), inspect, check, troubleshoot, and/or repair a fuel system and without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a metal fuel tank the learner will be able to locate appropriate reference(s) and inspect a metal fuel tank without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a bladder fuel tank the learner will be able to locate appropriate reference(s) and inspect a bladder fuel tank without major error.	Understands C	Proficient 3

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate the skill to inspect an integral fuel tank the learner will be able to locate appropriate reference(s) and inspect an integral fuel tank without major error.	Understands C	Proficient 3
To demonstrate the skill to check manually operated fuel valves for proper operation and/or leaks the learner will be able to locate appropriate reference(s), check manually operated fuel valves for proper operation, and/or inspect for leaks without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a fuel valve problem the learner will be able to locate appropriate reference(s) and troubleshoot a fuel valve problem without major error.	Understands C	Proficient 3
To demonstrate the skill to drain fuel system sumps the learner will be able to locate appropriate reference(s) and drain fuel system sumps without major error.	Understands C	Proficient 3
To demonstrate the skill to service a fuel system strainer the learner will be able to locate appropriate reference(s) and service a fuel system strainer without major error.	Understands C	Proficient 3
To demonstrate the skill to determine the increment of calibration of a direct reading fuel indicating system the learner will be able to locate appropriate reference(s) and determine the increment of calibration of a direct reading fuel indicating system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a remote indicating fuel quantity system the learner will be able to locate appropriate reference(s) and inspect a remote indicating fuel quantity system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate fuel system operating instructions the learner will be able to locate appropriate reference(s) and fuel system operating instructions without major error.	Understands C	Proficient 3
To demonstrate the skill to locate fuel system inspection procedures the learner will be able to locate appropriate reference(s) and fuel system inspection procedures without major error.	Understands C	Proficient 3
To demonstrate the skill to locate fuel system crossfeed procedures the learner will be able to locate appropriate reference(s) and fuel system crossfeed procedures without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain fuel system required placards the learner will be able to locate appropriate reference(s) and explain fuel system required placards without major error.	Understands C	Proficient 3
To demonstrate the skill to locate fuel system defueling procedures the learner will be able to locate appropriate reference(s) and fuel system defueling procedures without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot fuel pressure warning system the learner will be able to locate appropriate reference(s) and troubleshoot fuel pressure warning system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate troubleshooting procedures for fuel temperature systems the learner will be able to locate troubleshooting procedures for fuel temperature systems appropriate reference(s) and without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and/or install a fuel quantity transmitter the learner will be able to locate appropriate reference(s), remove, and/or install a fuel quantity transmitter without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot fuel quantity indicating system the learner will be able to locate appropriate reference(s) and troubleshoot fuel quantity indicating system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot aircraft fuel systems the learner will be able to locate appropriate reference(s) and troubleshoot aircraft fuel systems without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and install a fuel selector valve the learner will be able to locate appropriate reference(s), remove, and install a fuel selector valve without major error.	Understands C	Proficient 3

M. Aircraft Electrical Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of generators the learner will be able to explain that in a generator the magnetic field is generated by a stationary permanent magnet and an armature) rotated within the field (permanent magnet is assisted by a field coil), brushes and a commutator, rectifying the alternating current to DC for use in the aircraft and internal windings can be series wound, parallel (shunt) wound, or compound wound without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of DC generation systems the learner will be able to explain that generator controls for low-output generators including the three unit control panel and high-output generators including carbon pile voltage regulators, differential reverse current relays, and flight engineer or copilot as current limiter without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of DC power distribution systems the learner will be able to explain how a DC generator or alternator functions including the regulating system, buss, fuses, wiring, avionics bus, and other load circuits without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of alternators the learner will be able to explain that an alternator uses a rotating magnetic field (rotor) in a stationary coil (stator) to generate electricity, often rectified to DC with a rectifier bridge circuit without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of AC generation systems the learner will be able to explain two unit control panel, constant speed drives, bus power control unit (BPCU) and generator control unit (GCU) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of AC power distribution systems the learner will be able to explain how a AC generator or alternator functions including the bus power control unit (BPCU) and generator control unit (GCU) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of starter generators the learner will be able to explain that a single-component starter and generator used on many of the smaller gas-turbine engines, used as a starter, and when the engine is running, its circuitry is shifted so that it acts as a generator without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of Constant Speed Drive (CSD) systems and/or system components the learner will be able to explain the operation of vibratory type, carbon pile, and solid state voltage regulators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of voltage regulators the learner will be able to explain the operation of vibrator type, carbon pile, and solid state voltage regulators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of over voltage and over current voltage protection the learner will be able to explain the operation of over voltage and over current voltage components without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inverter systems the learner will be able to explain how inverter systems work and their function in aircraft electrical systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft wiring sizes, types and selection the learner will be able to explain the American wire gauge (AWG), selection factors for wire (mechanical strength, allowable power loss, and heat), and wire types without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft wiring shielding the learner will be able to explain what metal braid is and its function in aircraft electrical systems without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of the use of derating factors in switch selection the learner will be able to explain what a derating factor is and how it is used in switch selection without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft lightning protection the learner will be able to explain how aircraft are protecting from damage due to lightning strikes such as lightning diverters on radomes, conductive metals are used to bond lights to the wingtips, surge protection devices, shield wiring, conductive mesh, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft bonding the learner will be able to explain electrical bonding is the practice of intentionally electrically connecting all exposed metallic items not designed to carry electricity in an aircraft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of aircraft lightning systems the learner will be able to explain an aircraft lightning protection system is designed to protect a structure from damage due to lightning strikes by intercepting such strikes and safely passing their extremely high currents to ground and includes a network of air terminals, bonding conductors, and ground electrodes designed to provide a low impedance path to ground for potential strikes without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of using the aircraft maintenance manual, develop a troubleshooting plan for an electrical charging system failure the learner will be able to locate the aircraft maintenance manual and point out or develop a troubleshooting plan for an electrical charging system failure without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of what flight deck effect might result from a shorted circuit and why the learner will be able to explain various flight deck effects that might result from a shorted circuit and why without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing using caution when testing/troubleshooting electrical systems or components to avoid damage to the system or components the learner will be able to exercise caution when testing/troubleshooting electrical systems or components and/or describe why caution when testing/troubleshooting electrical systems or components is imperative.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions when connecting or disconnecting external power the learner will be able to exercise caution when connecting or disconnecting external power and/or explain the reasons why.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the personal safety steps that should be taken when performing maintenance on energized circuits/systems the learner will be able to exercise caution when performing maintenance on energized circuits/systems and/or explain the reasons why.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions to take when performing maintenance in areas containing aircraft wiring to prevent wiring damage the learner will be able to exercise caution when performing maintenance in areas containing aircraft wiring and/or explain the reasons why.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety concerns when routing and securing wires and wire bundles the learner will be able to exercise caution when routing and securing wires and wire bundles and/or explain the reasons why.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the use of the wrong size wire in an electrical circuit the learner will be able to use the proper size wire and/or explain the problems that might result if the improper size wire were installed.	Understands & applies C	Competent 2

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards created by the incorrect selection or installation of wire terminals the learner will be able to use the proper wire terminals and/or explain the problems that might result if improper wire terminals were installed.	Understands & applies C	Competent 2
To demonstrate the skill to inspect aircraft wiring to verify installation and routing the learner will be able to locate appropriate reference(s), inspect, aircraft wiring, verify proper installation, and routing without major error.	Understands C	Proficient 3
To demonstrate the skill to perform wire terminating and splicing the learner will be able to locate appropriate reference(s) and perform wire terminating and splicing without major error.	Understands C	Proficient 3
To demonstrate the skill to perform build-up and repair of connectors the learner will be able to locate appropriate reference(s), perform build-up, and repair of connectors without major error.	Understands C	Proficient 3
To demonstrate the skill to read wiring circuits and diagrams the learner will be able to locate appropriate reference(s) and read wiring circuits and diagrams without major error.	Understands C	Proficient 3
To demonstrate the skill to solder aircraft wiring the learner will be able to locate appropriate reference(s) and solder aircraft wiring without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an airframe electrical circuit the learner will be able to locate appropriate reference(s) and troubleshoot an airframe electrical circuit without major error.	Understands C	Proficient 3
To demonstrate the skill to install, check and service airframe electrical wiring, switches, and protective devises the learner will be able to locate appropriate reference(s), install, check and service airframe electrical wiring, switches, and protective devises and without major error.	Understands C	Proficient 3
To demonstrate the skill to secure wire bundles the learner will be able to locate appropriate reference(s) and secure wire bundles without major error.	Understands C	Proficient 3
To demonstrate the skill to determine an electrical load in a given aircraft system the learner will be able to locate appropriate reference(s) and determine an electrical load without major error.	Understands C	Proficient 3
To demonstrate the skill to install bonding jumpers the learner will be able to locate appropriate reference(s) and install bonding jumpers without major error.	Understands C	Proficient 3
To demonstrate the skill to check output voltage of a direct current (DC) generator the learner will be able to locate appropriate reference(s) and check output voltage of a direct current (DC) generator without major error.	Understands C	Proficient 3
To demonstrate the skill to check the resistance of an electrical system component the learner will be able to locate appropriate reference(s) and check the resistance of an electrical system component without major error.	Understands C	Proficient 3
To demonstrate the skill to check generator brush spring tension and/or serviceability the learner will be able to locate appropriate reference(s), check generator brush spring tension, and/or serviceability without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect and check anti-collision, position, and/or landing lights for proper operation the learner will be able to locate appropriate reference(s), inspect, check anti-collision, position, and/or landing lights for proper operation without major error.	Understands C	Proficient 3
To demonstrate the skill to identify components in an electrical system the learner will be able to locate appropriate reference(s) and identify components in an electrical system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a DC electrical system supplied by an alternating current (AC) electrical system the learner will be able to locate appropriate reference(s) and troubleshoot a DC electrical system supplied by an alternating current (AC) electrical system without major error.	Understands C	Proficient 3

To demonstrate the skill to identify components in an electrical schematic where AC is rectified to a DC voltage the learner will be able to locate appropriate reference(s) and identify components in an electrical schematic where AC is rectified to a DC voltage without major error.	Understands C	Proficient 3
To demonstrate the skill to visually identify and describe operation of components in a constant speed drive (CSD) or integrated drive generator (IDG) the learner will be able to locate appropriate reference(s), visually identify, and describe operation of components in a constant speed drive (CSD) or integrated drive generator (IDG) without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an aircraft system or component using an aircraft drawing the learner will be able to locate appropriate reference(s) and troubleshoot an aircraft system or component without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a continuity test to verify the condition of a conductor and explain a normal test result and one indicating a fault the learner will be able to locate appropriate reference(s) and perform a continuity test to verify the condition of a conductor and explain a normal test result and one indicating a fault without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a test on a conductor for a short to ground and explain a normal test result and one indicating a fault the learner will be able to perform a test on a conductor for a short to ground and explain a normal test result and one indicating a fault without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a test on a conductor for a short to other conductors and explain a normal test result and one indicating a fault the learner will be able to perform a test on a conductor for a short to other conductors and explain a normal test result and one indicating a fault without major error.	Understands C	Proficient 3
To demonstrate the skill to investigate an intermittent electric trim failure the learner will be able to locate appropriate reference(s) and investigate an intermittent electric trim failure without major error.	Understands C	Proficient 3

N. Ice and Rain Control Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of aircraft icing causes/effects the learner will be able to explain types of ice (clear, rime, and glime), causes of ice formation, and hazards associated with aircraft icing without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of ice detection systems the learner will be able to explain how an ice detector alerts the flight crew of icing conditions, on some aircraft, automatically activates ice protection systems, and may have one or more detectors without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of anti-ice systems and components the learner will be able to explain common anti-icing systems (thermal pneumatic, thermal electric, and chemical), location of typical anti-icing components, and the purpose of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of de-ice systems and components the learner will be able to explain common de-ice systems (turbine engine bleed air and pneumatic deice boots), location of typical de-ice components, and the purpose of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of wiper blade, pneumatic, and repellant rain control systems the learner will be able to explain types of blade, pneumatic, and repellant rain control systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of anti-icing and/or de-icing system maintenance the learner will be able to explain types of anti-icing and/or de-icing system maintenance without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of the types of rain removal systems and/or operating characteristics the learner will be able to explain the types of rain removal systems and/or operating characteristics without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of possible damage to system components during system testing or maintenance the learner will be able to properly test or maintain system components without damage and/or describe how possible component damage can be avoided during system testing or maintenance	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the storage and handling of deicing fluids the learner will be able to locate procedures for, explain, and/or properly store and handle deicing fluids.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the selection and use of appropriate cleaning materials for heated windshields the learner will be able to locate procedures for, explain, and/or properly use appropriate cleaning materials for heated windshields.	Understands & applies C	Competent 2
To demonstrate the skill to inspect or operationally check pitot-static anti-ice system the learner will be able to locate appropriate reference(s) and inspect or operationally check pitot-static anti-ice system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect or operationally check deicer boots the learner will be able to locate appropriate reference(s) and inspect or operationally check deicer boots without major error.	Understands C	Proficient 3
To demonstrate the skill to clean a pneumatic deicer boot the learner will be able to locate appropriate reference(s) and properly clean a pneumatic deicer boot without major error.	Understands C	Proficient 3
To demonstrate the skill to check an electrically-heated pitot tube system the learner will be able to locate appropriate reference(s) and check an electrically-heated pitot tube system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain the procedures for troubleshooting an electrically-heated pitot tube system the learner will be able to locate appropriate reference(s) and explain the procedures for troubleshooting an electrically-heated pitot tube system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect thermal anti-ice systems the learner will be able to locate appropriate reference(s) and explain the procedures for troubleshooting an electrically-heated pitot tube system without major error.	Understands C	Proficient 3
To demonstrate the skill to check an electrically-heated windshield the learner will be able to locate appropriate reference(s) and check an electrically-heated windshield without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect an electrically-operated windshield wiper system the learner will be able to locate appropriate reference(s) and inspect an electrically-operated windshield wiper system without major error.	Understands C	Proficient 3
To demonstrate the skill to check an electrically or hydraulically-operated windshield wiper system the learner will be able to locate appropriate reference(s) and check an electrically or hydraulically-operated windshield wiper system without major error.	Understands C	Proficient 3
To demonstrate the skill to replace blades on a windshield wiper system the learner will be able to locate appropriate reference(s) and replace blades on a windshield wiper system without major error.	Understands C	Proficient 3
To demonstrate the skill to check pneumatic rain removal system the learner will be able to locate appropriate reference(s) and check pneumatic rain removal system without major error.	Understands C	Proficient 3
To demonstrate the skill to check a rain repellent system the learner will be able to locate appropriate reference(s) and check a rain repellent system without major error.	Understands C	Proficient 3

To demonstrate the skill to locate inspection procedures for chemical rain protection of a windscreen the learner will be able to locate appropriate reference(s) and inspection procedures for chemical rain protection of a windscreen without major error.	Understands C	Proficient 3

O. Overheat and Fire Detection, Protection, and Suppression System (*Airframe Fire Protection Systems*)

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of types of fires the learner will be able to explain the five types of fires by class including Class A – ordinary combustibles such as paper, wood, plastic, etc.; Class B – flammable liquids such as paraffin, petrol, oil, etc.; Class C – energized electrical equipment; and Class D – combustible metals such as aluminum, magnesium, titanium, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of engine fire zones the learner will be able to explain designated fire zones as: (1) engines and auxiliary power unit (APU); (2) cargo and baggage compartments; (3) lavatories on transport aircraft; (4) electronic bays; (5) wheel wells; and (6) bleed air ducts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fire detection and warning systems the learner will be able to explain that a fire detection system should signal the presence of a fire. Units of the system are installed in locations where there are greater possibilities of a fire. Three detector system types in common use are the thermal switch, thermocouple, and the continuous loop without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fire detection system maintenance and inspection the learner will be able to explain the detector, alarm, and test circuit of each major type of fire detection system including general system maintenance, test, and inspection requirements without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of smoke detection systems the learner will be able to explain that smoke detection system monitors the lavatories and cargo baggage compartments in strategic locations for the presence of smoke, which is indicative of a fire condition, they collect air for sampling are mounted in the compartments where the type of fire anticipated is expected to generate a substantial amount of smoke before temperature changes are sufficient to actuate a heat detection system., and two common types used are light refraction and ionization without error or omission.	Knows B	No skill 1
To demonstrate an understanding of carbon monoxide detection systems the learner will be able to explain that carbon monoxide detectors are used in aircraft cabins and cockpits, most often found on reciprocating engine aircraft with exhaust shroud heaters and on aircraft equipped with a combustion heater, and are generally either portable or panel mounted electronic or chemical devices without error or omission.	Knows B	No skill 1
To demonstrate an understanding of fire extinguishing agents and types of extinguishing systems the learner will be able to explain extinguishing agents and the type (class) fires for which each is appropriate, including (1) water—class A; (2) carbon dioxide—class B or C; (3) dry chemicals—class A, B, or C;.(4) halons—only class A, B, or C; (5). specialized dry powder—class D without major error or omission	Knows B	No skill 1
To demonstrate an understanding of fire extinguishing system maintenance requirements the learner will be able to explain containers, discharge valve, pressure indication, two-way check valves, discharge indicators, and fire switches maintenance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fire extinguishing system inspection requirements the learner will be able to explain containers, discharge valve, pressure indication, two-way check valves, discharge indicators, and fire switches inspection requirements without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of using appropriate caution to avoid personal injury when working on or testing fire extinguishing systems the learner will be able to explain cautions necessary to avoid personal injury when working on or testing fire extinguishing systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the hazards of electro-static discharge the learner will be able to explain the hazards of electro-static discharge without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the hazards of fire suppressant systems the learner will be able to explain hazards of fire suppressant systems without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing using appropriate caution to avoid personal injury when working on or testing fire extinguishing systems the learner will be able to use caution and/or explain appropriate cautionary procedures to be employed when working on or testing fire extinguishing systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing using appropriate caution to avoid personal injury when working on or testing fire extinguishing systems the learner will be able to use caution and/or explain appropriate caution to avoid personal injury when working on or testing fire extinguishing systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards of electro-static discharge the learner will be able to display evidence of electro-static discharge hazard awareness or describe the hazards inherent in electro-static discharge.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards of fire suppressant systems the learner will be able to display evidence of fire suppressant systems hazards or describe the hazards inherent in fire suppressant systems.	Understands & applies C	Competent 2
To demonstrate the skill to troubleshoot an aircraft fire detection and extinguishing system the learner will be able to locate appropriate reference(s) and troubleshoot an aircraft fire detection and extinguishing system without major error.	Understands C	Proficient 3
To demonstrate the skill to determine proper container pressure for an installed fire extinguisher system the learner will be able to locate appropriate reference(s) and determine proper container pressure for an installed fire extinguisher system	Understands C	Proficient 3
To demonstrate the skill to identify maintenance procedures for fire detection and/or extinguishing system(s) and/or system component(s) the learner will be able to locate appropriate reference(s) and without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect and/or check a smoke and/or toxic gas detection system tube system the learner will be able to locate appropriate reference(s), inspect, and/or check a smoke and/or toxic gas detection system tube system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain inspection procedures for carbon monoxide detectors the learner will be able to locate and explain appropriate reference(s) and inspection procedures for carbon monoxide detectors without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain procedures for checking a smoke detection system the learner will be able to locate appropriate reference(s) and explain procedures for checking a smoke detection system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain the procedures for inspecting a thermal switch fire detection system the learner will be able to locate and explain appropriate reference(s) and procedures for inspecting a thermal switch fire detection system without major error.	Understands C	Proficient 3

To demonstrate the skill to inspect fire protection system cylinder the learner will be able to locate appropriate reference(s) and inspect fire protection system cylinder and check for hydrostatic test date without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a fire detection/protection system the learner will be able to locate appropriate reference(s) and inspect a fire detection/protection system without major error.	Understands C	Proficient 3
To demonstrate the skill to check a fire detection/protection system the learner will be able to locate appropriate reference(s) and check a fire detection/protection system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a fire-extinguisher bottle discharge cartridge the learner will be able to locate appropriate reference(s) and inspect a fire-extinguisher bottle discharge cartridge without major error.	Understands C	Proficient 3
To demonstrate the skill to check a fire-extinguisher bottle discharge circuit the learner will be able to locate appropriate reference(s) and check a fire-extinguisher bottle discharge circuit without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect fire-extinguisher bottle or cylinder for hydrostatic test date the learner will be able to locate appropriate reference(s), inspect fire-extinguisher bottle or cylinder for hydrostatic test date, and determine serviceability without major error.	Understands C	Proficient 3

P. Rotorcraft Fundamentals

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of rotorcraft aerodynamics the learner will be able to explain the basic aerodynamics of rotary wings, the fundamental performance characteristics of helicopters during hovering, climbing, descending, and forward flight without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of flight controls the learner will be able to describe and explain the components, location, and operation of the collective pitch control. cyclic pitch control, and anti-torque controls without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of transmissions the learner will be able to explain that the transmission system transfers power from the engine to the main rotor, tail rotor, and other accessories during normal flight conditions, note the main components (main rotor system, tail rotor drive system, clutch, and freewheeling unit) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rigging rotary wing aircraft the learner will be able to explain rigging concerns and procedures of rotorcraft main and anti-torque rotor flight controls, including track and balance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of design and operation of rotor systems the learner will be able to list and describe the types of rotor systems including the operation, advantages, and limitations of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of flutter and flight control balance the learner will be able to explain that flutter is the rapid and uncontrolled oscillation of a flight control surface on an aircraft that is caused by a dynamically unbalanced condition without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of rotor blade tracking the learner will be able to explain how to track a main and tail rotor blade without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the types of rotorcraft rotor systems the learner will be able to explain the various types including the main rotor and tail rotor or ducted fan or NOTAR system, counterrotating dual rotor system (tandem, coaxial, intermeshing, or transverse) and quadcopter rotor systems are the most common without major error or omission.	Knows B	No skill 1

APPENDIX J

AIRFRAME OBJECTIVES

To demonstrate an understanding of rotor vibrations the learner will be able to explain rotor vibrations affect a rotory wing aircraft without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the dangers of working around helicopter blades during ground operations such as balancing and tracking the learner will be able to locate procedures for and/or explain the dangers of working around helicopter blades during ground operations such as balancing and tracking.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety procedures when working around operating rotor blades the learner will be able to locate procedures for and/or explain safety procedures when working around operating rotor blades.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing damage to rotor blades due to maintenance that can render the blades unairworthy the learner will be able to locate procedures for and/or explain the types of maintenance induced damage that can render the blade unairworthy.	Understands & applies C	Competent 2
To demonstrate the skill to locate causes of vertical vibration in a two blade helicopter rotor system the learner will be able to locate appropriate reference(s) and causes of vertical vibration in a two blade helicopter rotor system without major error.	Understands C	Proficient 3
To demonstrate the skill to locate helicopter rotor blade tracking procedures the learner will be able to locate appropriate reference(s) and helicopter rotor blade tracking procedures without major error.	Understands C	Proficient 3

APPENDIX K

POWERPLANT OBJECTIVES

A. Reciprocating Engines

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of types of engines the learner will be able to explain the various characteristics of aircraft engine in terms of cylinder arrangement, cooling system, fuel utilized, ignition types (spark vs. compression ignition), and differentiate between reciprocating, rotary, and electric engines without major error or omission	Knows B	No skill 1
To demonstrate an understanding of engine operating principles/theory of operation the learner will be able to explain the operating principles of internal combustion engines including the two- and four-stoke cycles, (spark and compression ignition), eccentric rotor (rotary or Wankel), and electric engines without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of compression combustion engine operating principles/theory of operation the learner will be able to explain two and four stroke compression ignition operating principles without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of horizontally opposed engine construction and internal components the learner will be able to explain the basic construction design and note the major components without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of radial engine construction and internal component differences the learner will be able to explain the basic construction design and note the major components without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of storage and preservation the learner will be able to explain how aircraft engines can be stored and preserved differentiating between temporary and permanent storage procedures without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of engine performance the learner will be able to explain how to calculate engine performance including indicated and brake horsepower, brake specific fuel consumption, etc. without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations need to be taken when performing maintenance which requires moving the propeller on a reciprocating engine with magnetos installed the learner will be able to detail the safety and physical concerns that must be taken into account when performing maintenance which requires moving the propeller on a reciprocating engine with magnetos installed without major error or omission.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations in preparation and during the ground operation of a reciprocating engine the learner will be able to detail and/or demonstrate the detail the safety considerations in preparation and during the ground operation of a reciprocating engine.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the actions that should be taken in the event of an engine fire during an engine run the learner will be able to detail and/or demonstrate the actions that should be taken in the event of an engine fire during an engine run.	Understands & applies C	Competent 2
To demonstrate the skill to remove, inspect and install cylinder assembly the learner will be able to remove, inspect and determine condition, and reinstall a cylinder assembly using appropriate references, techniques, and practices without major error.	Understands C	Proficient 3
To demonstrate the skill to ground operate and troubleshoot reciprocating engine the learner will be able to perform a pre-start inspection, start, operate, shut down and secure a reciprocating engine without major error.	Understands C	Proficient 3
To demonstrate the skill to install piston and/or knuckle pin(s the learner will be able to verify measurements, service bulletin and/or airworthiness directive applicability and install piston and/or knuckle pin without error.	Understands C	Proficient 3

To demonstrate the skill to identify the parts of a cylinder the learner will be able to identify the parts of cylinder including cylinder barrel, cylinder head, intake and exhaust ports, valve guides and seats, studs, spark plug helicoil or bushing, primer or injection port, cylinder head temperature port, and/or rocker arm bushings or supports without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify the parts of a crankshaft the learner will be able to identify the parts of a crankshaft including main and crankpin journals, flange, taper, or splines, counterweight(s), dynamic dampeners, keyway, dowel pin(s), bushings, oil holes, sludge tubes, slinger ring, and/or welch plugs without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify and inspect various types of bearings the learner will be able to distinguish between plain, roller, ball, and needle bearings and inspection criteria for each without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check and/or rig cable and push-pull engine controls the learner will be able to inspect and/or rig an engine cable and/or push-pull control for proper travel and springback or cushion without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect engine mounts the learner will be able to inspect engine mounts and determine their condition without major error.	Understands C	Proficient 3
To demonstrate the skill to demonstrate engine starting procedures the learner will be able to perform a pre-start inspection, verify proper safety precautions, and start an aircraft engine following the manufacturer's procedures without major error.	Understands C	Proficient 3
To demonstrate the skill to locate top dead-center position of a piston the learner will be able to locate top dead center position of the piston in cylinder number 1 of an engine using appropriate tools, and/or references without error to within 1/2º.	Understands C	Proficient 3
To demonstrate the skill to check cylinder compression with differential compression tester the learner will be able to perform a compression check on a cylinder and determine return to service status based upon the manufacturer's recommendations without major error.	Understands C	Proficient 3
To demonstrate the skill to determine what considerations need to be taken when performing an engine run the learner will be able to locate the appropriate reference(s) and list the considerations necessary when performing an engine run without major error.	Understands C	Proficient 3

B. Turbine Engines

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of engine operating principles/ theory of operation the learner will be able to explain how turbine engines intake air, compress it, spray fuel in the hot compressed air which vaporises, ignites the fuel and then burns continuously, the hot exhaust expands quickly and exists the combustion chambers driving a turbine which in turns rotates the compressor without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of types of engines the learner will be able to explain the differences between the turbojet, turboprop, turbofan (low- and high-bypass, and turboshaft engine including advantages and disadvantages of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of engine terms and definitions the learner will be able to explain basic turbine engine components, including terms and definitions associate with each without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of checks necessary to verify proper operation the learner will be able to explain the type of checks required to verify proper engine operation including starting, power, and shutdown assessments without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of turbine engine troubleshooting procedures the learner will be able to explain basic turbine engine troubleshooting procedures including manufacturer's recommendations, data collection, data review and analyzing, the use of fix-it diagrams, powerplant charts, mechanical drawings, and troubleshooting charts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of procedures required after the installation of a turbine engine the learner will be able to explain the references required along with the detailing the basic inspection procedures required after the installation of a turbine engine without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of causes for turbine engine performance loss the learner will be able to list the common causes for turbine engine performance loss including internal mechanical problems in the engine itself and external causes such as damage outside the engine such as fuel pump problems, fuel contamination, or entirely external factors such volcanic ash, bird strikes or weather conditions like precipitation or icing without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine inlet ducts the learner will be able to describe the turbine engine inlet ducts including their placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine centrifugal compressors the learner will be able to describe a turbine engine centrifugal compressor including its placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine axial-flow compressors the learner will be able to describe the turbine engine axial-flow compressors including their placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine turbofans the learner will be able to describe the turbine engine turbofans including their placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine turbine and compressor blade design and attachment the learner will be able to describe turbine engine turbine and compressor blade design including their attachment and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine diffuser section the learner will be able to describe the turbine engine diffuser section including its placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine combustion section the learner will be able to describe the turbine engine combustion section including its placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine turbine section the learner will be able to describe the turbine engine turbine section including its placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of turbine engine exhaust the learner will be able to describe the turbine engine exhaust including its placement and function without major error.	Knows B	No skill 1
To demonstrate an understanding of bearings the learner will be able to explain the types of antifriction bearings typically used in turbine engines including ball, roller, preformed sleeve and slipper bearings, noting the characteristics, advantages, and disadvantages of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of seals the learner will be able to explain the various types of oil seals used including the labyrinth, helical, and carbon seals including characteristics and use without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of accessory drives the learner will be able to explain the various functions of the accessory section of the gas turbine engine, noting the primary and secondary functions and noting the typical accessory components without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of bleed air systems the learner will be able to explain what produces blead air, where it is commonly taken from, and note the uses of engine bleed air without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the differences between turboprop, turbofan, and turboshaft engines the learner will be able to explain the difference between single spool and two spool turboprop engines, the use of the propeller reduction gear and the common differences between turboprop, turbofan, and turboshaft engines without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of storage and preservation the learner will be able to explain how turbine aircraft engines can be stored and preserved differentiating between temporary and permanent storage procedures without major error.	Knows B	No skill 1
To demonstrate an understanding of auxiliary power unit(s) the learner will be able to explain the purposes, location, and uses of APUs on modern aircraft without error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations that should be taken when operating a turbine engine the learner will be able to detail the safety and physical concerns that must be taken into account when running an aircraft turbine engine.	Understands C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions should be taken when performing maintenance on a turbine engine ignition system the learner will be able to detail the safety and physical concerns that must be taken into account when performing maintenance on a turbine engine.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the actions to be taken in the event of an engine nacelle fire the learner will be able to detail the safety and physical concerns that must be taken into account when confronted with an engine nacelle fire	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the actions to be taken in the event of a tailpipe fire the learner will be able to detail the safety and physical concerns that must be taken into account when confronted with a tailpipe fire.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with foreign object damage (FOD) the learner will be able to detail the safety and physical concerns that must be taken into account regarding the hazards associated with foreign object damage (FOD).	Understands & applies C	Competent 2
To demonstrate the skill to ground operate and troubleshoot turbine engine the learner will be able to perform a pre-start inspection, start, operate, shut down and secure a turbine engine without major error.	Understands C	Proficient 3
To demonstrate the skill to identify characteristics of different turbine compressors the learner will be able to identify characteristics of axial flow, centrifugal flow, and mixed flow compressors without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify types of turbine blades the learner will be able to identify the various types of turbine blades without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify major components of turbine engines the learner will be able to identify the major components of turbine engines including inlet compressor, diffuser, combustion chamber, turbine, exhaust, and accessory sections without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify airflow direction and pressure changes in turbojet engines the learner will be able to point out and describe the airflow direction and pressure changes that take place in a turbojet engine without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and install a fuel nozzle in a turbine engine the learner will be able to locate the appropriate reference(s) remove, clean, inspect, and reinstall a fuel nozzle in a turbine engine without major error.	Understands C	Proficient 3

To demonstrate the skill to inspect combustion liners the learner will be able to locate the appropriate reference(s) and inspect combustion liner without major error.	Understands C	Proficient 3
To demonstrate the skill to locate procedures for the adjustment of a fuel control unit the learner will be able to locate the appropriate reference(s) and point out where adjustments would be made including the procedures to follow on a fuel control unit without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform turbine engine inlet guide vane and compressor blade inspection the learner will be able to locate appropriate reference(s) and tools, and inspect a turbine inlet guide vane and/or compressor blade and determine their condition without major error.	Understands C	Proficient 3
To demonstrate the skill to locate the installation or removal procedures of a turbine engine the learner will be able to locate appropriate reference(s), tools, and procedures for the installation and/or removal of a turbine engine without major error.	Understands C	Proficient 3
To demonstrate the skill to locate procedures for trimming a turbine engine the learner will be able to locate appropriate reference(s), tools, and procedures for trimming a turbine engine without major error.	Understands C	Proficient 3
To demonstrate the skill to identify damaged turbine blades the learner will be able to locate appropriate reference(s), tools, and procedures for the inspection of turbine blades and identify turbine blades with damage without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify causes for engine performance loss the learner will be able to locate appropriate reference(s) for engine performance loss without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify damaged inlet nozzle guide vanes the learner will be able to locate appropriate reference(s), tools, and procedures for the inspection of inlet guide vanes and identify guide vanes with damage without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect the first two stages of a turbine fan or compressor for foreign object damage the learner will be able to locate appropriate reference(s), tools, and procedures for the inspection of turbine fan or compressor for FOD and identify damage without major error or omission.	Understands C	Proficient 3

C. Engine Inspection

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of inspection and maintenance record requirements and entries the learner will be able to explain the inspection status required for aircraft under 14 CFR § 43, 91, 121, and/or 135 as applicable and the maintenance record requirements under each part without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the identification of life limited parts and their replacement interval the learner will be able to explain how to identify life limited parts and their replacement interval without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of special inspections required after a potentially damaging event, including but not limited to any of the following: over speed, sudden stoppage, or over temperature the learner will be able to explain the requirement for special inspections including over speed, sudden stoppage, or over temperature without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of conformity inspections in accordance with FAA approved data, such as, type certificate data sheet (TCDS) and supplemental type certificates (STCs) the learner will be able to explain the need for and the references required for conformity inspection without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of inspecting an aircraft engine for service bulletin compliance the learner will be able to explain the need to inspect an aircraft engine for service bulletin compliance without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of inspecting aircraft turbine engine for records time left on any life limited parts the learner will be able to explain the need to inspect an aircraft turbine engine for records time left on any life limited parts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how to perform an over temperature inspection the learner will be able to explain the procedures involved in an aircraft engine over temperature inspection without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how to perform an over torque inspection the learner will be able to explain the procedures involved in an aircraft engine over torque inspection without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how to perform an over speed inspection the learner will be able to explain the procedures involved in an aircraft engine over speed inspection without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how to determine conformity of installed spark plugs or igniters the learner will be able to explain the procedure to determine if the spark plugs or igniters are approved for a specific engine without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how to determine 100-hour inspection procedures the learner will be able to explain the 100-hour inspection procedures without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety precautions that should be followed when performing a compression test on a reciprocating engine the learner will be able to locate appropriate reference(s), demonstrate, and/or explain the safety precautions that should be followed when performing a compression test on a reciprocating engine.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations for personnel performing maintenance on an operating reciprocating engine the learner will be able to locate appropriate reference(s), demonstrate, and/or explain the safety considerations for personnel performing maintenance on an operating reciprocating engine	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations for personnel performing maintenance on an operating turbine engine the learner will be able to locate appropriate reference(s), demonstrate, and/or explain the safety considerations for personnel performing maintenance on an operating turbine engine.	Understands & applies C	Competent 2
To demonstrate the skill to perform a compression check the learner will be able to perform either direct or differential compression checks on an engine and determine return to service status based upon the manufacturer's recommendations without major error.	Understands C	Proficient 3
To demonstrate the skill to accomplish a powerplant conformity check the learner will be able to locate appropriate reference(s) and conduct a powerplant conformity check without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform a powerplant inspection to include a records check the learner will be able to locate appropriate reference(s) and conduct a powerplant inspection without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect an engine for compliance with applicable ADs the learner will be able to locate appropriate reference(s) and conduct a powerplant inspection for airworthiness compliance without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify an engine by type without reference material other than the data plate the learner will be able to locate the data plate and determine the engine type without major error.	Understands C	Proficient 3

To demonstrate the skill to determine engine conformity with engine specifications or type certificate data sheet the learner will be able to locate appropriate reference(s) and determine engine conformity to the engine listing, specification, and/or TCDS without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to construct a checklist for a 100-hour inspection on an engine the learner will be able to develop and/or compare a 100-hour engine inspection checklist to 14 CFR §43 Appendix D without error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform a portion of the 100-hour inspection on an engine the learner will be able to locate the appropriate checklist and reference(s) and conduct a 100-hour or portion thereof on an engine without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check engine controls for proper operation the learner will be able to locate appropriate reference(s) and check engine controls for proper springback or cushion, proper operation, and full travel without major error.	Understands C	Proficient 3
To demonstrate the skill to identify what type and where fluids may leak the learner will be able to identify fluid connections by fluid and note where possible leaks might occur without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect aircraft engine accessories for conformity the learner will be able to locate appropriate reference(s) and determine engine accessories that are eligible on an engine and verify the installation for return to service without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect aircraft engine for service bulletin compliance the learner will be able to locate the appropriate reference(s) and determine service bulletin compliance without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect aircraft turbine engine for records for time or cycle time left on any life limited parts the learner will be able to locate appropriate reference(s) for any life limited parts, review the turbine engine records, and determine the time or cycle time remaining on any life limited components without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform an over temperature inspection the learner will be able to locate appropriate reference(s) and tools and conduct an over temperature inspection without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform an engine over torque inspection the learner will be able to locate appropriate reference(s) and tools and conduct an over torque inspection without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform an aircraft engine over speed inspection the learner will be able to locate appropriate reference(s) and tools and conduct an over speed inspection without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to determine conformity of installed spark plugs or igniters the learner will be able to locate appropriate reference(s), tools and ignitors and determine the conformity of such components without major error or omission.	Understands C	Proficient 3

D. Engine Instrument Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of types of fuel flow indicating systems the learner will be able to explain fuel flow indicators (fuel pressure gauges calibrated in flow) typically used on reciprocating engine fuel injection systems and true fuel flow indicators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of temperature measuring systems the learner will be able to explain non-electric (including bimetallic thermometers and bourdon tubes) versus electric temperature measuring indicators (including electric resistance thermometers, ratiometer electrical resistance thermometers, and thermocouple temperature indicators) without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of understanding of tachometers the learner will be able to explain mechanical and electric tachometers including components and operating principles without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of manifold pressure the learner will be able to explain calibration of analog and digital MAP gauges and typical readings of normally aspirated versus turbo or supercharged engines without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of pressure measuring systems the learner will be able to explain the use of pressure measuring instruments in the flight and engine group including bourdon tube, pressure diaphragm, aneroid, bellows pressure sensing devices, and solid-state micro technology pressure sensors without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of position indicating system the learner will be able to explain the pitot-static system instruments (airspeed, altimeter, and vertical speed indicator), angle of attach indicator, and gyroscopic instruments (attitude indicator, directional gyro, and turn coordinator) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of torque meter the learner will be able to explain that torque is a twisting force applied to a shaft and the torque meter measures power applied to the shaft on turboprop and turboshaft engines which are designed to produce torque for driving a propeller, and are calibrated in percentage units, foot-pounds, or psi without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of engine pressure ratio the learner will be able to explain that the engine pressure ratio (EPR) is a differential pressure gauge that compares the pressure at the inlet of the engine with that at the outlet to indicate the thrust developed by the engine without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of engine indicating and crew alerting system the learner will be able to explain that an engine indicating and crew alerting system (EICAS) is a two-monitor, two-computer system with a display select panel designed to monitor the aircraft systems for the pilot with full time primary engine parameters (EPR, N1, EGT), advisories, and warning on the top (primary monitor), and secondary engine parameters, non-engine system status, and maintenance diagnosis (when the aircraft is on the ground) are displayed on the bottom screen, with color coding and message prioritizing without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of full authority digital engine controls (FADEC) the learner will be able to explain that a FADEC is a system consisting of a digital computer, called an "electronic engine controller" (EEC) or "engine control unit" (ECU), and its related accessories that control all aspects of aircraft engine performance. FADECs have been produced for both piston engines and jet engines without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of electronic centralized aircraft monitoring the learner will be able to explain that an electronic centralized aircraft monitor (ECAM) is a system, developed by Airbus that monitors aircraft functions, relays them to the pilots, and produces messages detailing failures and in certain cases, lists procedures to undertake to correct the problem without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of range markings the learner will be able to explain that the colors used as range markings are red (indicates maximum and minimum ranges), yellow (indicates caution), green (indicates normal), blue or white (used on airspeed indicators to define specific conditions), and markings can be in the form of an arc or a radial line without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the considerations to avoid damage to the instrument or indicating system the learner will be able to display adequate techniques when working on instruments or indicating systems and/or describe how damage can be avoided.	Understands & applies C	Competent 2

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety considerations associated with improper calibrated or indicating engine instruments the learner will be able to appropriate reference(s), display adequate techniques, and/or explain the safety considerations associated with improper calibrated or indicating engine instruments.	Understands & applies C	Competent 2
To demonstrate the skill to inspect, check and troubleshoot an engine instrument system the learner will be able to locate appropriate reference(s) and inspect, check and troubleshoot an engine instrument system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a fuel flow and/or low fuel pressure indicating system the learner will be able to locate appropriate reference(s) and troubleshoot a fuel flow and/or low fuel pressure indicating system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and/or install a fuel-flow transmitter the learner will be able to locate appropriate reference(s) and remove, inspect, and/or install a fuel-flow transmitter without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and/or install fuel flow gage the learner will be able to locate appropriate reference(s) and remove, inspect, and/or install a fuel-flow gage without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify various components installed on an engine the learner will be able to locate appropriate reference(s) and identify various components without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check fuel flow transmitter power supply the learner will be able to locate appropriate reference(s) and inspect a fuel flow transmitter power supply without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect tachometer markings for accuracy the learner will be able to locate appropriate reference(s) and inspect tachometer markings without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform resistance measurements of thermocouple indication system the learner will be able to locate appropriate reference(s) and perform resistance measurements of thermocouple indication system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and/or install turbine engine exhaust gas temperature (EGT) harness the learner will be able to locate appropriate reference(s) and remove, inspect, and/or install turbine engine exhaust gas temperature (EGT) harness without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a turbine engine pressure ratio (EPR) system the learner will be able to locate appropriate reference(s) and troubleshoot a turbine engine pressure ratio (EPR) system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a tachometer system the learner will be able to locate appropriate reference(s) and troubleshoot a tachometer system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to replace a cylinder head temperature thermocouple the learner will be able to locate appropriate reference(s) and replace a cylinder head temperature thermocouple without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect EGT probes the learner will be able to locate appropriate reference(s) and inspect EGT probes without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate and inspect engine low fuel pressure warning system components the learner will be able to locate appropriate reference(s) and inspect engine low fuel pressure warning system components without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check aircraft engine manifold pressure gage for proper operation the learner will be able to locate appropriate reference(s) and inspect an aircraft engine manifold pressure gage for proper operation without major error or omission.	Understands C	Proficient 3

To demonstrate the skill to inspect a leaking manifold pressure system the learner will be able to locate appropriate reference(s) and inspect a leaking manifold pressure system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to repair a low oil pressure warning system the learner will be able to locate appropriate reference(s) and repair a low oil pressure warning system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an EGT indicating system the learner will be able to locate appropriate reference(s) and troubleshoot an EGT indicating without major error or omission.	Understands C	Proficient 3

E. Engine Fire Detection and Protection Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of types of fires the learner will be able to explain the five types of fires by class including Class A – ordinary combustibles such as paper, wood, plastic, etc.; Class B – flammable liquids such as paraffin, petrol, oil, etc.; Class C – energized electrical equipment; and Class D – combustible metals such as aluminum, magnesium, titanium, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of engine fire zones the learner will be able to explain designated fire zones as: (1) engines and auxiliary power unit (APU); (2) cargo and baggage compartments; (3) lavatories on transport aircraft; (4) electronic bays; (5) wheel wells; and (6) bleed air ducts without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of a fire detection warning system operation the learner will be able to explain that a fire detection system should signal the presence of a fire. Units of the system are installed in locations where there are greater possibilities of a fire. Three detector system types in common use are the thermal switch, thermocouple, and the continuous loop without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of a fire detection system maintenance and inspection requirements the learner will be able to explain the detector, alarm, and test circuit of each major type of fire detection system including general system maintenance, test, and inspection requirements without major error or omission.	Knows B	Competent 2
To demonstrate an understanding of fire extinguishing agents the learner will be able to explain extinguishing agents and the type (class) fires for which each is appropriate, including (1) water—class A; (2) carbon dioxide—class B or C; (3) dry chemicals—class A, B, or C;.(4) halons—only class A, B, or C; (5). specialized dry powder—class D without major error or omission	Knows B	No skill 1
To demonstrate an understanding of fire extinguishing types of systems and operation the learner will be able to explain CO_2 and halogenated hydrocarbon fire extinguishing systems including containers, discharge valve, pressure indication, two-way check valves, discharge indicators, and fire switches operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fire extinguishing system maintenance and inspection the learner will be able to explain containers, discharge valve, pressure indication, two-way check valves, discharge indicators, and fire switches inspection and maintenance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the safety considerations when working with container blow-out cartridges the learner will be able to describe the safety considerations when working with container blow-out cartridges without major error or omission.	Understands C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with extinguishing agents the learner will be able to show regard for and/or enumerate the various hazards associated with extinguishing agents.	Understands & applies C	Competent 2

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions to take when performing maintenance on circuits associated with fire bottle squibs the learner will be able to show regard for and/or enumerate the precautions to take when performing maintenance on circuits associated with fire bottle squibs.	Understands & applies C	Competent 2
To demonstrate the skill to inspect, check, service, troubleshoot and repair an engine fire detection and extinguishing system the learner will be able to locate appropriate reference(s) and tools and inspect, check, service, troubleshoot and repair an engine fire detection and extinguishing system as indicated without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify fire detection sensing units of the learner will be able to identify thermocouple, thermal switch, Fenwall, Kidde, and/or pneumatic continuous loop components without error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect a fire detection continuous loop system the learner will be able to locate appropriate reference(s) and inspect a Fenwall, Kidde, and/or pneumatic continuous loop fire detection system without error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect fire detection thermal switch or thermocouple system the learner will be able to locate appropriate reference(s) and inspect a thermal switch and/or thermocouple system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate and explain troubleshooting process for a fire detection system the learner will be able to locate the appropriate reference(s) and explain the troubleshooting process for a fire detection system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect and explain the purpose of engine fire extinguisher system blowout plugs the learner will be able to locate the appropriate reference(s) and explain the purpose of the thermal discharge indicator (red disk) and yellow disk discharge indicator without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect turbine engine fire extinguisher agent container pressure the learner will be able to locate the appropriate reference(s) and determine the contain pressure and status of a turbine engine fire extinguisher agent without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check fire extinguisher discharge circuit the learner will be able to locate the appropriate reference(s) and inspect a fire extinguisher discharge circuit without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a fire protection system the learner will be able to locate the appropriate reference(s) and troubleshoot a fire protection system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect a fire extinguisher container discharge cartridge the learner will be able to locate the appropriate reference(s) and inspect a fire extinguishing container discharge cartridge without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect fire extinguisher system for hydrostatic test requirements the learner will be able to locate the appropriate reference(s), the latest hydrostatic test date, and determine whether the container meets return to service status without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check flame detectors for operation the learner will be able to locate the appropriate reference(s) and inspect flame detectors for proper operation without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to check operation of master caution press-to-test and troubleshoot faults the learner will be able to locate the appropriate reference(s), inspect master caution press-to-test, and troubleshoot faults for proper operation without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to identify continuous-loop fire detection system components the learner will be able to locate the appropriate reference(s) and identify continuous-loop fire detection system components without major error or omission.	Understands C	Proficient 3

F. Engine Electrical Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of types of generators the learner will be able to explain that in a generator the magnetic field is generated by a stationary permanent magnet and an armature) rotated within the field (permanent magnet is assisted by a field coil), brushes and a commutator, rectifying the alternating current to DC for use in the aircraft and internal windings can be series wound, parallel (shunt) wound, or compound wound without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of alternators the learner will be able to explain that an alternator uses a rotating magnetic field (rotor) in a stationary coil (stator) to generate electricity, often rectified to DC with a rectifier bridge circuit without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of types of starter-generators the learner will be able to explain that the starter-generator starting system is similar to direct cranking electrical system except that after functioning as a starter, they contain a second series of windings that allow it to switch to a generator after the engine has reached a self-sustaining speed without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of understanding of voltage regulators the learner will be able to explain the operating of vibratory type, carbon pile, and solid state voltage regulators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of over-voltage and over current protection the learner will be able to explain the various methods used for overvoltage and over current protection without error or omission.	Knows B	No skill 1
To demonstrate an understanding of DC generation systems the learner will be able to explain generator controls for low-output generators including the three unit control panel and high-output generators including carbon pile voltage regulators, differential reverse current relays, and flight engineer or copilot as current limiter without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of AC generation systems the learner will be able to explain two unit control panel, constant speed drives, bus power control unit (BPCU) and generator control unit (GCU) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the procedure for locating the correct electrical cable/wire size needed to fabricate a cable/wire the learner will be able to explain the three basic types of electrical harnesses used: (1) high temperature (rigid) > 800º F., (2) high temperature (flexible) 500º F. - 800º F.; and (3) standard construction < 500º F.; the three main connector families: (1) M83723; D38999; and (3) M5015; and preferred wire using a “hybrid” insulation either (1) T-K-T (Teflon-Kapton-Teflon) preferred; (2) pure Teflon (PTFE); or (3) pure Kapton (Polyimide) often shielded and chafe protected without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of parallel a dual-generator electrical system the learner will be able to explain the typical process to connect two generators in parallel including the use of a single or multiple voltage regulators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of over-voltage protection the learner will be able to explain the various methods used for overvoltage protection without error or omission.	Knows B	No skill 1
To demonstrate an understanding of annunciator indicating systems and the meaning of warning, caution, and advisory lights the learner will be able to explain the purpose and various components found in a typical annunciator indicating systems and the meaning of warning, caution, and advisory lights without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of CSD and IDG systems and components the learner will be able to explain the purpose and various components found in of CSD and IDG systems without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of improper polarity when performing electrical system maintenance the learner will be able to determine the proper polarity for batteries and/or GPUs utilized in electrical system maintenance and enumerate the safety concerns and problems that might ensue if components are connected with reverse polarity.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the consequences of not taking appropriate actions in response to a warning or caution annunciator light the learner will be able to determine and explain the consequences of not taking appropriate actions in response to a warning or caution annunciator light.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety precautions that should be take when performing maintenance on energized aircraft circuits/systems the learner will be able to explain and/or demonstrate the safety precautions that should be take when performing maintenance on energized aircraft circuits/systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety concerns with routing and security of wiring near flammable fluid lines the learner will be able to explain and/or demonstrate the safety concerns with routing and security of wiring near flammable fluid lines.	Understands & applies C	Competent 2
To demonstrate the skill to inspect, check, and service engine electrical wiring, switches, and protective devices the learner will be able to locate appropriate reference(s) and inspect, check, and service engine electrical wiring, switches, and protective devices without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to use publications to determine replacement part numbers the learner will be able to locate appropriate reference(s) and determine replacement part numbers without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to replace an engine-driven generator or alternator the learner will be able to locate appropriate reference(s) and replace an engine-driven generator or alternator without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to service an engine-driven DC generator in accordance with manufacturer's instructions the learner will be able to locate appropriate reference(s) and to service an engine-driven DC generator in accordance with manufacturer's instructions without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect an engine-driven generator or alternator the learner will be able to locate appropriate reference(s) and inspect an engine-driven generator or alternator without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a voltage regulator in an aircraft electrical generating system the learner will be able to locate appropriate reference(s) and troubleshoot a voltage regulator without major error or omission.	Understands C	Proficient 3
To demonstrate the skill repair an engine direct-drive electric starter the learner will be able to locate appropriate reference(s) and repair an engine direct-drive electric starter without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a direct-drive electric starter system the learner will be able to locate appropriate reference(s) and troubleshoot a direct-drive electric starter system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect an electrical system cable the learner will be able to locate appropriate reference(s), tools, and inspect an electrical system cable without major error.	Understands C	Proficient 3
To demonstrate the skill to determine wire size for engine electrical system the learner will be able to locate appropriate reference(s) and determine wire size for engine electrical system without major error.	Understands C	Proficient 3
To demonstrate the skill to repair a broken engine electrical system wire the learner will be able to locate appropriate reference(s) and repair a broken engine electrical system wire without major error.	Understands C	Proficient 3

To demonstrate the skill to replace a wire bundle lacing the learner will be able to locate appropriate reference(s) and replace a wire bundle lacing without major error.	Understands C	Proficient 3
To demonstrate the skill to explain an electrical system related to a powerplant using a schematic or wiring diagram the learner will be able to locate appropriate reference(s) and identify and explain an engine system electrical wiring schematic without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to fabricate a bonding jumper the learner will be able to locate appropriate reference(s) and fabricate a bonding jumper without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a turbine engine starter generator the learner will be able to locate appropriate reference(s) and inspect a turbine engine starter generator without major error.	Understands C	Proficient 3
To demonstrate the skill to fabricate solderless terminals the learner will be able to locate appropriate reference(s), tools, and fabricate solderless terminals without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect engine electrical connectors the learner will be able to locate appropriate reference(s) and engine electrical connectors without major error.	Understands C	Proficient 3

G. Lubrication Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of the functions and characteristics of engine oils the learner will be able to explain the functions and characteristics of engine oils for reciprocating engines (spark and compression ignition) and turbine engines without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the types and grades of engine oil the learner will be able to explain the types and grades of engine oils for reciprocating engines (spark and compression ignition) and turbine engines without major error or omission	Knows B	No skill 1
To demonstrate an understanding of understanding of lubrication system operation and components the learner will be able to explain the operation of the lubrication system, list, and describe the function of various lubrication components including reservoirs, suction screens, oil pump(s), oil filters, pressure relief valves, bypass valves, oil cooler, oil temperature control valve, oil pressure gauge, oil temperature gauge, etc. without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of wet-sump system the learner will be able to explain a wet-sump lubrication system operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of dry-sump system the learner will be able to explain a dry-sump lubrication system operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of chip detectors the learner will be able to explain that magnetic chip detectors are used in the oil system to detect and catch ferrous (magnetic) particles present in the oil, are placed in several locations but generally are in the scavenge lines for each scavenge pump, oil tank, and in the oil sumps, and inspected during maintenance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the reasons for changing engine lubricating oil at specified intervals the learner will be able to list the reasons for changing engine lubricating oil at specified intervals without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the reasons for excessive oil consumption without evidence of oil leaks in a reciprocating and/or turbine aircraft engine the learner will be able to list the reasons for excessive oil consumption without evidence of oil leaks in a reciprocating and/or turbine aircraft engine without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with use of improper or mixing engine oils the learner will be able to demonstrate proper oil handling procedures and/or describe the hazards associated with use of improper or mixing engine oils.	Understands & applies C	Competent 2

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate the ability to identify, assess, and mitigate risks, encompassing the storage and handling of engine lubricants the learner will be able to demonstrate proper lubrication storage and handling procedures and/or describe how to properly store and handle engine lubricants.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the handling, storage, and disposal of used lubricating oil the learner will be able to demonstrate and/or explain proper handling, storage and lubricating oil disposal procedures.	Understands & applies C	Competent 2
To demonstrate the skill to inspect and service a lubrication system the learner will be able to inspect and service an aircraft engine lubrication system without major error.	Understands C	Proficient 3
To demonstrate the skill to determine the correct type of oil for a specific engine the learner will be able to locate the appropriate reference(s) and determine the correct type and grade of oil for a specific engine without error.	Understands C	Proficient 3
To demonstrate the skill to identify turbine engine oil filter bypass indicator the learner will be able to locate the appropriate reference(s) and identify turbine engine oil filter bypass indicator without error.	Understands C	Proficient 3
To demonstrate the skill to determine approved oils for different climatic temperatures the learner will be able to locate the appropriate reference(s) and determine approved oils for different climatic temperatures without error.	Understands C	Proficient 3
To demonstrate the skill to describe procedures for obtaining oil samples the learner will be able to locate the appropriate reference(s) and describe procedures for obtaining oil samples without error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect an oil filter or screen the learner will be able to locate the appropriate reference(s) and inspect an oil filter or screen from a specific engine without error.	Understands C	Proficient 3
To demonstrate the skill to check engine oil pressure the learner will be able to locate the appropriate reference(s) and check engine oil pressure without error.	Understands C	Proficient 3
To demonstrate the skill to perform an oil pressure adjustment the learner will be able to locate the appropriate reference(s) and perform an oil pressure adjustment on a specific engine without error.	Understands C	Proficient 3
To demonstrate the skill to identify oil system components the learner will be able to locate the appropriate reference(s) and identify oil system components without error.	Understands C	Proficient 3
To demonstrate the skill to replace an oil system component the learner will be able to locate the appropriate reference(s) and replace an oil system component on a specific engine without error.	Understands C	Proficient 3
To demonstrate the skill to identify oil system flow the learner will be able to locate the appropriate reference(s) and identify oil system flow on a specific engine without error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an engine oil pressure malfunction the learner will be able to locate the appropriate reference(s) and troubleshoot an engine oil pressure malfunction without error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an engine oil temperature system the learner will be able to locate the appropriate reference(s) and troubleshoot an engine oil temperature system without error.	Understands C	Proficient 3
To demonstrate the skill to determine the process to investigate the cause of metal found in an oil filter the learner will be able to locate the appropriate reference(s) and determine the process to investigate the cause of metal found in an oil filter without error.	Understands C	Proficient 3

H. Ignition and Starting Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of spark engine ignition system theory the learner will be able to explain that ignition systems must deliver a high-tension spark across the electrodes of each spark plug in each cylinder of the engine in the correct firing order, at a predetermined number of degrees ahead of the top dead center position of the piston, as measured by crankshaft travel in degrees of rotation, the spark occurs in the cylinder, the potential output voltage of the system must be adequate to arc the gap in the spark plug electrodes under all operating conditions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of spark plug theory the learner will be able to explain that the function of the spark plug in an ignition system is to conduct a short impulse of high-voltage current through the wall of the combustion chamber, spark plugs operate at extreme temperatures, electrical pressures, and very high cylinder pressures, and the three main components of a spark plug are the electrode, insulator, and outer shell without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of shower of sparks and impulse coupling the learner will be able to explain that both provide a hot, retarded spark for starting the engine, the Shower of Sparks ignition system **is a** patented ignition system for reciprocating engines. An induction vibrator sends pulsating DC into a set of retard breaker points on one of the magnetos whereas the impulse coupling is a spring-loaded coupling between a magneto shaft and the drive gear inside the engine, which locks the magnet so it cannot turn during engine starts, the spring in the coupling winds up as the crankshaft continues to turn, and when the piston is ear top center, the coupling releases and spins the magnet, producing a hot and retarded spark without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of three electrical circuits of a magneto system the learner will be able to describe the magnetic, primary, and secondary electrical circuits detailing the components of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of solid state ignition systems the learner will be able to explain that solid state is a broad term applied to any engine's ignition system which uses electronic devices such as diodes, transistors, silicon controlled rectifiers or other semiconductors in place of one or more standard ignition component without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of full authority digital engine controls the learner will be able to explain that a FADEC is a solid-state digital electronic ignition and electronic sequential port fuel injection system with only one moving part that consists of the opening and closing of the fuel injector. FADEC continuously monitors and controls ignition, timing, and fuel mixture/delivery/injection, and spark ignition as an integrated control system. FADEC monitors engine operating conditions (crankshaft speed, top dead center position, the induction manifold pressure, and the induction air temperature) and then automatically adjusts the fuel-to-air ratio mixture and ignition timing accordingly for any given power setting to attain optimum engine performance without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of engine starters with Bendix or right-angle drive the learner will be able to explain the basic operating principles of direct drive starters using Bendix drives and those using right-angle drives including listing the basic components of each without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of magneto system components the learner will be able to list the major components of a high and low tension aircraft magneto system as well as the dual magneto without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of magneto system operation the learner will be able to explain aircraft magneto operation including the primary, secondary, and magnetic circuits, e-gap, and internal magneto timing without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of starters the learner will be able to describe and explain the various types of aircraft engine starters including hand propping, inertia starters, direct electric starters, pneumatic/cartridge starting systems, and starter-generators without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of turbine engine igniter systems the learner will be able to list and describe the major components of a high- and low-tension capacitor discharge ignition system and explain how each operates without major error or omission.	Knows B	No skill 1
To demonstrate an understanding high tension magneto systems the learner will be able to list and describe the major components of a high tension magneto ignition system and explain how it operates without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of low tension magneto systems the learner will be able to list and describe the major components of a low tension magneto ignition system and explain how it operates without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing hazards associated with advanced and retarded ignition timing (piston engine) the learner will be able to discuss the problems associated with advanced and retarded ignition timing on a piston engine from a safety and operational perspective without major error or omission.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions for performing maintenance on a turbine engine ignition system the learner will be able to exhibit proper precautions and/or discuss the possible results of performing maintenance on a turbine engine ignition system without taking adequate precautions.	Understands & applies C	Competent 2
To demonstrate the skill to repair and time magneto internally the learner will be able to locate the appropriate reference(s), repair, and time an engine magneto internally without the manufacture's specifications.	Understands C	Proficient 3
To demonstrate the skill to time magneto to engine the learner will be able to locate the appropriate reference(s) and time an engine magneto to an engine within the manufacture's specifications.	Understands C	Proficient 3
To demonstrate the skill to remove, clean and install spark plug the learner will be able to locate the appropriate reference(s) and remove, clean and install spark plug(s) without major error.	Understands C	Proficient 3
To demonstrate the skill to perform an ignition system operational check and inspection the learner will be able to locate the appropriate reference(s), perform an ignition system operational check, and determine return to service status without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect, troubleshoot and repair an ignition system the learner will be able to locate the appropriate reference(s) and inspect, troubleshoot and repair an ignition system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect, check and troubleshoot an electrical starting system the learner will be able to locate the appropriate reference(s) and inspect, check and troubleshoot an electrical starting system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect magneto breaker points the learner will be able to locate the appropriate reference(s) and inspect magneto breaker points without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect an ignition harness the learner will be able to locate the appropriate reference(s), inspect an ignition harness, and determine return to service status without major error.	Understands C	Proficient 3

To demonstrate the skill to check serviceability of condensers the learner will be able to locate the appropriate reference(s), check serviceability of condensers, note the capacitance, and determine if the capacitance is within the manufacturer's specification without major error.	Understands C	Proficient 3
To demonstrate the skill to check ignition coils the learner will be able to locate the appropriate reference(s), inspect ignition coil(s), and determine return to service status without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot ignition switch circuit the learner will be able to locate the appropriate reference(s) and troubleshoot ignition switch circuit without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect and check gap of spark plugs the learner will be able to locate the appropriate reference(s), inspect, and check (and adjust if necessary) the gap of spark plugs within the manufacturer's specification.	Understands C	Proficient 3
To demonstrate the skill to identify the correct spark plugs used for replacement installation the learner will be able to locate the appropriate reference(s) and identify the correct spark plugs used for replacement installation without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a turbine or reciprocating engine ignition system the learner will be able to locate the appropriate reference(s) and troubleshoot a turbine or reciprocating engine ignition system (as assigned) without major error.	Understands C	Proficient 3
To demonstrate the skill to identify the correct ignitor plug and replace turbine engine igniter plugs the learner will be able to locate the appropriate reference(s), identify the correct ignitor plug, and replace turbine engine igniter plugs without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot turbine engine igniters the learner will be able to locate the appropriate reference(s) and troubleshoot turbine engine igniters without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect turbine engine ignition system the learner will be able to locate the appropriate reference(s) and inspect turbine engine ignition system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect igniters the learner will be able to locate the appropriate reference(s) and inspect igniters without major error.	Understands C	Proficient 3

I. Fuel Metering Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of engine mixture requirements the learner will be able to explain the various types of fuel/air mixtures including mixture requirements for various power settings without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of float carburetor theory, components, operation, and adjustments the learner will be able to explain float carburetor systems including float, main metering, idle, acceleration, mixture control, and economizer (power enrichment) systems; list major float carburetor components, describe float carburetor operation, and note bench and field adjustments without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of pressure carburetor adjustments the learner will be able to explain bench and field pressure carburetor adjustments without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of continuous flow fuel injection theory, components, operation, troubleshooting and adjustment the learner will be able to explain Continental Motors, Precision, and Rotax fuel injection system operation, components, troubleshooting and adjustments without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of full authority digital engine controls the learner will be able to explain that a FADEC is a solid-state digital electronic ignition and electronic sequential port fuel injection system with only one moving part that consists of the opening and closing of the fuel injector. FADEC continuously monitors and controls ignition, timing, and fuel mixture/delivery/injection, and spark ignition as an integrated control system. FADEC monitors engine operating conditions (crankshaft speed, top dead center position, the induction manifold pressure, and the induction air temperature) and then automatically adjusts the fuel-to-air ratio mixture and ignition timing accordingly for any given power setting to attain optimum engine performance without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of hydromechanical system design and components the learner will be able to explain that hydromechanical fuel controls have two sections, computing and metering, to provide the correct fuel flow for the engine, has no electronic interface assisting in computing or metering the fuel flow, is generally driven by the gas generator gear train of the engine to sense engine speed and senses other mechanical engine parameters such as compressor discharge pressure, burner pressure, exhaust temperature, and inlet air temperature and pressure without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fuel nozzles and manifold the learner will be able to explain the purpose and operation of turbine engine fuel nozzles and manifold without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of fuel nozzle design and operation the learner will be able to explain fuel nozzle design and that the fuel nozzles inject fuel into the combustion area in a highly atomized, precisely patterned spray so that burning is completed evenly, in the shortest possible time, and in the smallest possible space and it is very important that the fuel be evenly distributed and well centered in the flame area within the liners without error or omission.	Knows B	No skill 1
To demonstrate an understanding of the components of a turbine engine fuel system the learner will be able to list and explain the components of a turbine engine fuel system without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety precautions to consider when trimming a turbine engine fuel control the learner will be able to locate the appropriate reference(s), list, and or demonstrate the safety precautions to consider when trimming a turbine engine fuel control.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the safety precautions to be considered when adjusting reciprocating engine idle speed and mixture the learner will be able to locate the appropriate reference(s), list, and or demonstrate the safety precautions to be considered when adjusting reciprocating engine idle speed and mixture.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with improperly adjusted or miss-trimmed fuel metering system the learner will be able to locate the appropriate reference(s) and describe the hazards associated with improperly adjusted or miss-trimmed fuel metering system	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the handling, storage, and shipping of fuel metering system components that have been in service and may contain fuel the learner will be able to locate the appropriate reference(s), list, and or demonstrate the proper handling, storage, and shipping of fuel metering system components.	Understands & applies C	Competent 2
To demonstrate the skill to inspect, troubleshoot, and repair a fuel metering system the learner will be able to locate the appropriate reference(s) and inspect, troubleshoot, and repair a fuel metering system without major error.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and install a turbine engine fuel nozzle the learner will be able to locate the appropriate reference(s) and remove, inspect, and install a turbine engine fuel nozzle without major error.	Understands C	Proficient 3

To demonstrate the skill to identify carburetor components the learner will be able to locate the appropriate reference(s) and identify carburetor components without major error.	Understands C	Proficient 3
To demonstrate the skill to interpret diagram showing fuel and air flow through float-type and/or pressure type carburetor the learner will be able to locate the appropriate reference(s) and interpret diagram showing fuel and air flow through float-type and/or pressure type carburetor without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and/or install a main metering jet in a carburetor. Level 3) the learner will be able to locate the appropriate reference(s) and remove and/or install a main metering jet without major error.	Understands C	Proficient 3
To demonstrate the skill to service a carburetor fuel inlet screen the learner will be able to locate the appropriate reference(s) and service a carburetor fuel inlet screen without major error.	Understands C	Proficient 3
To demonstrate the skill to identify carburetor air-bleed system the learner will be able to locate the appropriate reference(s) and identify carburetor air-bleed system without major error.	Understands C	Proficient 3
To demonstrate the skill to check the float level on a float-type carburetor the learner will be able to locate the appropriate reference(s), check, and/or set the float level on a float-type carburetor to within manufacturer's specifications.	Understands C	Proficient 3
To demonstrate the skill to inspect float needle and/or seat in a float-type carburetor the learner will be able to locate the appropriate reference(s) and inspect float needle and/or seat in a float-type carburetor without major error.	Understands C	Proficient 3
To demonstrate the skill to identify, remove, and/or install a float-type carburetor the learner will be able to locate the appropriate reference(s) and identify, remove, and/or install a float-type carburetor (including rigging) without major error.	Understands C	Proficient 3
To demonstrate the skill to adjust idle speed and/or mixture the learner will be able to locate the appropriate reference(s) and adjust idle speed and/or mixture to within manufacturer's specification.	Understands C	Proficient 3
To demonstrate the skill to describe the conditions that may result in turbine engine RPM overspeed the learner will be able to locate the appropriate reference(s) and to describe the conditions that may result in turbine engine RPM overspeed without major error.	Understands C	Proficient 3
To demonstrate the skill to set or position fuel metering cockpit controls for engine start the learner will be able to locate the appropriate reference(s) and set or position fuel metering cockpit controls for engine start without major error.	Understands C	Proficient 3
To demonstrate the skill to locate trimming procedures for a hydromechanical fuel control the learner will be able to locate the appropriate reference(s) and locate procedures to set part-power and install the stop on a turbine engine hydromechanical fuel control without major error.	Understands C	Proficient 3
To demonstrate the skill to adjust the fuel injection system on a reciprocating engine the learner will be able to locate the appropriate reference(s) and properly adjust a fuel injection system on a reciprocating engine without error.	Understands C	Proficient 3
To demonstrate the skill to trimming the fuel control on a turbine engine the learner will be able to locate the appropriate reference(s) and properly adjust a turbine engine fuel control without error.	Understands C	Proficient 3

J. Engine Fuel Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of inspection requirements for an engine fuel system the learner will be able to explain the inspection requirements for an engine fuel system without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of checks of fuel systems to verify proper operation the learner will be able to explain the fuel systems checks necessary to verify proper operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of troubleshooting an engine fuel system the learner will be able to describe the troubleshooting requirements for an engine fuel system without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the procedure for inspection of an engine driven fuel pump for leaks and security the learner will be able to describe the inspection of an engine driven fuel pump for leaks and security of mounting without error or omission.	Knows B	No skill 1
To demonstrate an understanding of the function and/or operation of one or more types of fuel pumps the learner will be able to explain the function and/or operation of an engine-driven, manual, and/or electric fuel pump without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the function and/or operation of one or more types of fuel valves the learner will be able to explain the function and/or operation of one or more types of fuel valves without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the function and/or operation of engine fuel filters the learner will be able to explain the function and/or operation of engine fuel filters without major error.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing safety considerations during fuel system maintenance the learner will be able to display appropriate safety concerns and/or describe the pertinent safety precautions to be used during fuel system maintenance.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the handling, storage, and shipping of engine fuel system components that have been in service and may contain fuel the learner will be able to display appropriate safety concerns and/or describe the proper handling, storage, and shipping of engine fuel system components that have been in service and may contain fuel.	Understands & applies C	Competent 2
To demonstrate the skill to identify components of an engine fuel system the learner will be able to locate the appropriate reference(s) and identify components of an engine fuel system without major error.	Understands C	Proficient 3
To demonstrate the skill to remove and/or install an engine-driven fuel pump the learner will be able to locate the appropriate reference(s) and remove and/or install an engine-driven fuel pump without major error.	Understands C	Proficient 3
To demonstrate the skill to check a remotely operated fuel valve the learner will be able to locate the appropriate reference(s) and inspect a remotely operated fuel valve without major error.	Understands C	Proficient 3
To demonstrate the skill to rig a remotely operated fuel valve the learner will be able to locate the appropriate reference(s) and properly rig a remotely operated fuel valve without major error	Understands C	Proficient 3
To demonstrate the skill to inspect a main fuel filter assembly for leaks the learner will be able to locate the appropriate reference(s) and inspect a main fuel filter assembly for leaks without major error	Understands C	Proficient 3
To demonstrate the skill to check fuel boost pumps for correct pressure the learner will be able to locate the appropriate reference(s) and check fuel boost pumps for correct pressure without major error	Understands C	Proficient 3
To demonstrate the skill to inspect fuel boost pump the learner will be able to locate the appropriate reference(s) and inspect a fuel boost pump without major error	Understands C	Proficient 3
To demonstrate the skill to locate and identify a turbine engine fuel heater the learner will be able to locate the appropriate reference(s) and identify a turbine engine fuel heater without major error	Understands C	Proficient 3

To demonstrate the skill to check fuel pressure warning light function the learner will be able to locate the appropriate reference(s) and check fuel pressure warning light function without major error	Understands C	Proficient 3
To demonstrate the skill to adjust fuel pump fuel pressure the learner will be able to locate the appropriate reference(s) and adjust fuel pump fuel pressure within the manufacturer's specifications.	Understands C	Proficient 3
To demonstrate the skill to inspect engine fuel system fluid lines and/or components the learner will be able to locate the appropriate reference(s) and inspect engine fuel system fluid lines and/or components without major error	Understands C	Proficient 3
To demonstrate the skill to troubleshoot abnormal fuel pressure the learner will be able to locate the appropriate reference(s) and troubleshoot abnormal fuel pressure without major error	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a turbine engine fuel heater system the learner will be able to locate the appropriate reference(s) and troubleshoot a turbine engine fuel heater system without major error	Understands C	Proficient 3
To demonstrate the skill to remove, clean, and/or replace an engine fuel strainer the learner will be able to locate the appropriate reference(s) and remove, clean, and/or replace an engine fuel strainer without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot engine fuel pressure fluctuation the learner will be able to locate the appropriate reference(s) and to troubleshoot engine fuel pressure fluctuation without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect fuel selector valve the learner will be able to locate the appropriate reference(s) and inspect fuel selector valve without major error.	Understands C	Proficient 3
To demonstrate the skill to determine correct fuel nozzle spray pattern the learner will be able to locate the appropriate reference(s) and determine whether the fuel nozzle spray pattern is within manufacturer's specifications without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and identify fuel selector placard the learner will be able to locate the appropriate reference(s) and identify fuel selector placard without major error.	Understands C	Proficient 3

K. Reciprocating Engine Induction and Cooling Systems

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of reciprocating engine induction system design the learner will be able to explain reciprocating engine induction system design including listing the components and placement without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of induction system icing, causes, and effects the learner will be able to explain the causes and effects of induction system icing including throttle, carburetor, and impact ice and noting the types of ice that can form without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of superchargers the learner will be able to explain single and two speed engine-driven supercharges, external turbo-superchargers, and turbo-compounding without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of turbochargers the learner will be able to explain turbo normalizing, turbo-supercharging, including components and operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of turbocharger controls the learner will be able to explain fixed, manual, and automatic turbocharger controls including components, typical nomenclature, and operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of cooling system design and components the learner will be able to explain air and liquid cooling systems including noting the major components utilized in each system without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of inspection and maintenance requirements of a cooling system the learner will be able to explain the inspection and maintenance requirements of cooling systems without major error or omission.	Knows B	Competent 2
To demonstrate an understanding of required inspection on an engine cooling system the learner will be able to explain the required inspection on an engine cooling system without major error or omission.	Knows B	Competent 2
To demonstrate an understanding of operation of cowl flaps, and how cooling is accomplished the learner will be able to explain cowl flaps operation including cooling features and parameters without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of proper engine baffle and seal installation the learner will be able to explain proper engine baffle and seal installation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of operation of a heat exchanger the learner will be able to explain how a heat exchanger operates without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the function and operation of an augmentor cooling system the learner will be able to explain how an augmentor cooling system functions and operates without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of cooling of rotorcraft engine cooling systems the learner will be able to explain how a rotorcraft engine cooling systems operates including noting typical components without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of performing maintenance on hot induction and/or airflow system components the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the concerns inherent in maintenance on hot induction and/or airflow system components.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the ground operation of aircraft engines for maintenance purposes the learner will be able to locate appropriate reference(s), properly demonstrate appropriate maintenance procedures and/or describe the hazards associated with the ground operation of aircraft engines for maintenance purposes.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of performing maintenance on hot cooling system components the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the concerns inherent in maintenance on hot cooling system components.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with a damaged or improperly installed cooling system the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the hazards associated with a damaged or improperly installed cooling system.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the ground operation of aircraft engines for maintenance purposes the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the hazards associated with the ground operation of aircraft engines for maintenance purposes.	Understands & applies C	Competent 2
To demonstrate the skill to inspect a carburetor preheat system the learner will be able to locate appropriate reference(s) and inspect a carburetor preheat system without major error.	Understands C	Proficient 3
To demonstrate the skill to check a carburetor heater box shutter for full travel the learner will be able to locate appropriate reference(s) and inspect a carburetor heater box shutter for full travel without major error.	Understands C	Proficient 3
To demonstrate the skill to check carburetor heat the learner will be able to locate appropriate reference(s) and inspect carburetor heat system including proper rigging, travel, wear, and other defects without major error.	Understands C	Proficient 3

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate the skill to identify probable location of induction ice the learner will be able to locate appropriate reference(s) and identify probable location of induction ice without major error.	Understands C	Proficient 3
To demonstrate the skill to service an induction air filter the learner will be able to locate appropriate reference(s) and service an induction air filter without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a turbocharger for exhaust leaks and security the learner will be able to locate appropriate reference(s) and inspect a turbocharger for exhaust leaks and security without major error.	Understands C	Proficient 3
To demonstrate the skill to check a turbocharger for operation the learner will be able to locate appropriate reference(s) and inspect a turbocharger for operation without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect an induction system for obstruction the learner will be able to locate appropriate reference(s) and inspect an induction system for obstruction without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect an air intake manifold for leaks the learner will be able to locate appropriate reference(s) and inspect an air intake manifold for leaks without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot engine that idles poorly the learner will be able to locate appropriate reference(s) and to troubleshoot engine that idles poorly without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot engine that fails to start the learner will be able to locate appropriate reference(s) and troubleshoot engine that fails to start without major error.	Understands C	Proficient 3
To demonstrate the skill to identify components of a turbocharger induction system the learner will be able to locate appropriate reference(s) and identify components of a turbocharger induction system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a carburetor heat system the learner will be able to locate appropriate reference(s) and to troubleshoot a carburetor heat system without major error.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and/or install a turbocharger the learner will be able to locate appropriate reference(s) and remove, inspect, and/or install a turbocharger without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a carburetor air inlet duct attachment the learner will be able to locate appropriate reference(s) and inspect a carburetor air inlet duct attachment without major error.	Understands C	Proficient 3
To demonstrate the skill to perform an induction system inspection the learner will be able to locate the appropriate reference(s) and perform an induction system inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a cooling system inspection the learner will be able to locate the appropriate reference(s) and perform a cooling system inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to repair a cylinder baffle the learner will be able to locate the appropriate reference(s) and a repair cylinder baffle without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect cylinder head baffle plates the learner will be able to locate the appropriate reference(s) and inspect cylinder head baffle plates without major error.	Understands C	Proficient 3
To demonstrate the skill to check cowl flap travel the learner will be able to locate the appropriate reference(s) and inspect cowl flap travel without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect cylinder cooling fins the learner will be able to locate the appropriate reference(s) and inspect cylinder cooling fins without major error.	Understands C	Proficient 3

To demonstrate the skill to troubleshoot a cowl flap system the learner will be able to locate the appropriate reference(s) and trouble troubleshoot a cowl flap system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot an engine cooling system the learner will be able to locate the appropriate reference(s) and troubleshoot an engine cooling system without major error.	Understands C	Proficient 3
To demonstrate the skill to identify exhaust augmentor cooled engine components the learner will be able to locate the appropriate reference(s) and identify exhaust augmentor cooled engine components without major error.	Understands C	Proficient 3
To demonstrate the skill to identify rotorcraft engine cooling components the learner will be able to locate the appropriate reference(s) and identify rotorcraft engine cooling components without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot rotorcraft engine cooling system the learner will be able to locate the appropriate reference(s) and troubleshoot rotorcraft engine cooling system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect rotorcraft engine cooling system the learner will be able to locate the appropriate reference(s) and inspect rotorcraft engine cooling system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect engine exhaust augmentor cooling system the learner will be able to locate the appropriate reference(s) and inspect engine exhaust augmentor cooling system without major error.	Understands C	Proficient 3

L. Turbine Engine Air Systems

To demonstrate an understanding of engine anti-ice system the learner will be able to explain thermal engine anti-ice as system used to prevent the formation of ice on an aircraft engine inlet by flowing heated air without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of compressor bleed the learner will be able to explain bleed air is used for antiicing the inlet ducts, cooling the turbine inlet guide vanes and first stage turbine blades, and also used for certain airframe functions without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of compressor/turbine case cooling the learner will be able to explain how a compressor and/or turbine case is cooled without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how turbine engine cooling is accomplished the learner will be able to explain how turbine engine cooling is accomplished without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of how engine bearings and other parts on turbine engines are cooled the learner will be able to explain how engine bearings and other parts on turbine engines are cooled without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of performing maintenance on hot induction and/or airflow system components the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the concerns inherent in maintenance on hot induction and/or airflow system components.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the ground operation of aircraft engines for maintenance purposes the learner will be able to locate appropriate reference(s), properly demonstrate appropriate maintenance procedures and/or describe the hazards associated with the ground operation of aircraft engines for maintenance purposes.	Understands & applies C	Competent 2
To demonstrate the skill to identify turbine engine air intake ice protected areas the learner will be able to locate appropriate reference(s) and without major error.	Understands C	Proficient 3

To demonstrate the skill to troubleshoot turbine engine air inlet ice protection system the learner will be able to locate appropriate reference(s) and trouble troubleshoot turbine engine air inlet ice protection system without major error.	Understands C	Proficient 3
To demonstrate the skill to identify turboprop engine ice and rain protection system components the learner will be able to locate appropriate reference(s) and identify turboprop engine ice and rain protection system components without major error.	Understands C	Proficient 3
To demonstrate the skill to identify location of turbine engine insulation blankets the learner will be able to locate the appropriate reference(s) and identify the location of turbine engine insulation blankets without major error.	Understands C	Proficient 3
To demonstrate the skill to identify turbine engine cooling air flow the learner will be able to locate the appropriate reference(s) and identify turbine engine cooling air flow without major error.	Understands C	Proficient 3

M. Engine Exhaust and Reverser Systems

Objective	**Knowledge Level**	**Skill Level**
To demonstrate an understanding of exhaust system and/or nozzle design the learner will be able to explain the construction and purpose of an exhaust system and/or nozzle design without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of cabin and carburetor heat the learner will be able to explain cabin and carburetor heat systems including listing the components without major error or omission	Knows B	No skill 1
To demonstrate an understanding of mufflers the learner will be able to explain the purpose, construction, materials, and location of aircraft mufflers (exhaust heat exchangers) without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of noise suppressors the learner will be able to explain turbine engine noise suppressors without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of design and operation of thrust reversers the learner will be able to explain the design and operation of mechanical blocker and aerodynamic thrust reversers without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards of performing maintenance on hot system components the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the concerns inherent in maintenance on hot system components.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the precautions and potential hazards of operating turbine engine reversing systems the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the precautions and potential hazards of operating turbine engine reversing systems.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the potential hazards of operating reciprocating engines with exhaust systems leaks the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the potential hazards of operating reciprocating engines with exhaust systems leaks.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the dangers associated with exhaust system failures the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the dangers associated with exhaust system failures.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with the ground operation of aircraft engines for maintenance purposes the learner will be able to properly demonstrate appropriate maintenance procedures and/or describe the hazards associated with the ground operation of aircraft engines for maintenance purposes.	Understands & applies C	Competent 2

To demonstrate the skill to perform an exhaust system inspection the learner will be able to locate appropriate reference(s) and exhaust system inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to identify the type of exhaust system on a particular aircraft the learner will be able to locate appropriate reference(s) and identify the type of exhaust system on a particular aircraft without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect exhaust system components the learner will be able to locate appropriate reference(s) and inspect exhaust system components without major error.	Understands C	Proficient 3
To demonstrate the skill to explain how to repair exhaust system components the learner will be able to locate appropriate reference(s) and explain how an exhaust system component should be repaired without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to inspect reciprocating engine exhaust system the learner will be able to locate appropriate reference(s) and inspect reciprocating engine exhaust system without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect exhaust system internal baffles or diffusers the learner will be able to locate appropriate reference(s) and inspect exhaust system internal baffles without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect exhaust heat exchanger the learner will be able to locate appropriate reference(s) and inspect an exhaust heat exchanger without major error.	Understands C	Proficient 3
To demonstrate the skill to perform a heat exchanger collector tube leak test the learner will be able to locate appropriate reference(s) and perform a heat exchanger collector tube leak test without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a turbine engine exhaust nozzle the learner will be able to locate appropriate reference(s) and inspect a turbine engine exhaust nozzle without major error.	Understands C	Proficient 3
To demonstrate the skill to explain how to check turbine thrust reverser system the learner will be able to locate appropriate reference(s) and explain how to inspect a turbine thrust reverser system without major error.	Understands C	Proficient 3
To demonstrate the skill to explain how to troubleshoot a thrust reverser system the learner will be able to locate appropriate reference(s) and explain how to troubleshoot a thrust reverser system without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot exhaust muffler heat exchanger the learner will be able to locate appropriate reference(s) and troubleshoot exhaust muffler heat exchanger without major error.	Understands C	Proficient 3
To demonstrate the skill to identify an exhaust system leak and explain the appropriate repair procedure the learner will be able to locate appropriate reference(s) and identify an exhaust system leak and explain the appropriate repair procedure without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to locate procedures for performing exhaust system leak checks the learner will be able to locate appropriate reference(s) and procedures for performing exhaust system leak checks without major error.	Understands C	Proficient 3

N. Propellers

Objective	Knowledge Level	Skill Level
To demonstrate an understanding of propeller theory of operation including forces and aerodynamic factors the learner will be able to explain basic propeller theory including purpose, blade shape, pitch distribution, forces acting on a propeller, and efficiency without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of types of propellers and blade design the learner will be able to list the various types of propellers and the basis of propeller design without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of pitch control the learner will be able to explain how propeller pitch is changed in fix blade angle, ground adjustable, aeromatic, two position, and constant speed propellers without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of operation, synchronizing and ice protection the learner will be able to describe the operation of both synchronizing, de-icing and anti-icing systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of reciprocating engine constant speed propellers and governors the learner will be able to explain how a governor controls constant speed propeller operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of turbine engine propellers and governors the learner will be able to explain how a governor controls constant speed, feathering, and/or reversing turbine engine propeller operation without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of operation of turbine engine propellers the learner will be able to explain how turbine engine propellers operated without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of operation of turbine engine governor design, construction, and operation the learner will be able to explain how turbine engine governor are designed, constructed, and operate without major error or omission.	Familiar A	No skill 1
To demonstrate an understanding of checks necessary to verify proper operation of a propeller systems the learner will be able to explain what static and operational checks are necessary to verify proper operation of propeller systems without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of procedures for proper application of propeller lubricants the learner will be able to explain procedures for proper application of propeller lubricants when the propeller is apart for servicing and when the propeller is installed and operational without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the installation or removal of a propeller the learner will be able to explain how to remove and install various propellers including on a tapered or splined shaft as well a flanged crankshaft or propeller shaft without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of measurement of blade angle with a propeller protractor the learner will be able to explain how to measure a blade angle with a digital and standard propeller protractor without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of repairs classified as major repairs on an aluminum propeller the learner will be able to list typical major repairs to an aluminum propeller without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of reference data for reducing the diameter of a type certificated propeller the learner will be able to explain where to locate and utilize the manufacturer's reference data as well as airframe listings, specifications, and/or type certificate data sheets without error or omission.	Knows B	No skill 1
To demonstrate an understanding of operation of propeller system component(s) the learner will be able to list and describe major propeller system components without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of propeller governor components and operation the learner will be able to list propeller governor components and explain how a propeller governor operates without major error or omission.	Knows B	No skill 1

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate an understanding of the theory and operation of various types of constant speed propellers the learner will be able to explain the constant speed propeller theory and explain the operation of constant speed propellers including those using various (different) forces to go to high and low blade angles without error or omission	Knows B	No skill 1
To demonstrate an understanding of the function and operation of propeller synchronizing systems the learner will be able to explain how various synchronizer systems function and operate without major error or omission.	Knows B	No skill 1
To demonstrate an understanding of the function and operation of propeller ice control systems the learner will be able to explain how propeller anti-ice and deice systems work without major error or omission.	Knows B	No skill 1
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with working around an operational propeller the learner will be able to demonstrate appropriate safety precautions and/or describe the dangers involved in working around aircraft propellers.	Understands & applies C	Competent 2
To demonstrate the ability to identify, assess, and mitigate risks, encompassing the hazards associated with improper propeller maintenance the learner will be able to demonstrate appropriate safety precautions and/or describe the hazards associated with improper propeller maintenance.	Understands & applies C	Competent 2
To demonstrate the skill to remove and install an aircraft engine propeller the learner will be able to locate appropriate reference(s) and remove and install an aircraft engine propeller without major error.	Understands C	Proficient 3
To demonstrate the skill to check blade tracking the learner will be able to locate appropriate reference(s) and check blade tracking without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect an aircraft propeller for airworthiness the learner will be able to locate appropriate reference(s) and inspect an aircraft propeller for airworthiness without major error.	Understands C	Proficient 3
To demonstrate the skill to measure blade angle with a propeller protractor the learner will be able to locate appropriate reference(s) and measure blade angle with a propeller protractor to within .1º.	Understands C	Proficient 3
To demonstrate the skill to repair an aluminum alloy propeller blade the learner will be able to locate appropriate reference(s) and repair an aluminum alloy propeller blade to manufacturer's recommended limits and contour.	Understands C	Proficient 3
To demonstrate the skill to perform propeller lubrication the learner will be able to locate appropriate reference(s) and properly lubricate a propeller without major error.	Understands C	Proficient 3
To demonstrate the skill to locate and explain the procedures for balancing a fixed-pitch propeller the learner will be able to locate appropriate reference(s) and explain the procedures for balancing a fixed-pitch propeller without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to remove, inspect, and/or install a propeller governor the learner will be able to locate appropriate reference(s) and remove, inspect, and/or install a propeller governor without major error.	Understands C	Proficient 3
To demonstrate the skill to check track of a propeller the learner will be able to locate appropriate reference(s) and check track of a propeller without major error.	Understands C	Proficient 3
To demonstrate the skill to adjust a propeller governor the learner will be able to locate appropriate reference(s) and adjust a propeller governor within manufacturer's specifications.	Understands C	Proficient 3
To demonstrate the skill to determine propeller blade pitch angle the learner will be able to locate appropriate reference(s) and determine propeller blade pitch angle within manufacturer's tolerance.	Understands C	Proficient 3
To demonstrate the skill to determine propeller critical range of operation the learner will be able to locate appropriate reference(s) and determine propeller critical range of operation without major error.	Understands C	Proficient 3

APPENDIX K

POWERPLANT OBJECTIVES

To demonstrate the skill to describe the operation of a propeller the learner will be able to locate appropriate reference(s) and describe the operation of a propeller without major error.	Understands C	Proficient 3
To demonstrate the skill to inspect a wooden propeller metal tipping the learner will be able to locate appropriate reference(s) and inspect a wooden propeller metal tipping without major error.	Understands C	Proficient 3
To demonstrate the skill to check propeller blade feather angle the learner will be able to locate appropriate reference(s) and check propeller blade feather angle within .5º.	Understands C	Proficient 3
To demonstrate the skill to repair metal propeller leading edges, trailing edges or tips that have nicks, scratches, and cuts and determine what minor propeller alterations are acceptable using the appropriate reference(s) the learner will be able to locate appropriate reference(s), repair metal propeller leading edges, trailing edges or tips that have nicks, scratches, and cuts and determine what minor propeller alterations are acceptable without major error.	Understands C	Proficient 3
To demonstrate the skill to clean an aluminum alloy propeller the learner will be able to locate appropriate reference(s) and clean an aluminum alloy propeller without major error.	Understands C	Proficient 3
To demonstrate the skill to explain how to inspect a turboprop propeller system the learner will be able to locate appropriate reference(s) and explain how to inspect a turboprop propeller system without major error or omission.	Understands C	Proficient 3
To demonstrate the skill to perform a 100-hour inspection on a propeller the learner will be able to locate appropriate reference(s) and perform a 100-hour inspection without major error.	Understands C	Proficient 3
To demonstrate the skill to troubleshoot a turboprop propeller system the learner will be able to locate appropriate reference(s) and troubleshoot a turboprop propeller system without major error.	Understands C	Proficient 3
To demonstrate the skill to repair anti-icing or de-icing system on a propeller the learner will be able to locate appropriate reference(s) and repair anti-icing or de-icing system without major error.	Understands C	Proficient 3

Job Title:

Professor, Aviation Maintenance Technology 06-2013/Present

Associate Professor Aviation Maintenance Technology 07-2009/06-2013

Assistant Professor Aviation Maintenance Technology 12-2006/06-2009

Blue Ridge Community College, Weyers Cave, VA.

- Develop FAA-approved § 147 Aviation Maintenance Technician School (AMTS).
- Secure Virginia Community College System approval for the following:
  - Aviation Maintenance Technology courses.
  - Certificate Program:
    - Airframe.
    - Powerplant.
  - A.A.S. Degree Program – Aviation Maintenance Technology.
- Initiate/coordinate FAA Light Sport Repairman Maintenance training program.
- Establish Career Studies Certificate programs for:
  - Light Sport Mechanics
  - Flight Instructors
  - Commercial Pilots
- Secure equipment and facilities.
- Implement, teach, and manage AMT and Light Sport Repairman Maintenance programs.
- Recruit students for the AMT and Light Sport Repairman Maintenance programs.
- Provide liaison between Blue Ridge Community College and aviation community.
- Advisor for Blue Ridge Community College's AMT students.
- Develop additional aviation programs to complement and enhance the AMTS.
- Secure FAA approval for Distance Learning Beta Test 2012-2014.
- Principal applicant for BRCC FAA 333 UAV Exemption.

Adjunct Professor

07-01-1987 to Present University of Alaska Fairbanks, Center for Distance Education, Fairbanks, Alaska

- Teach Aviation Professional Piloting Distance Education courses for Professional Piloting program.
- Teach Technology and Society for Center for Distance Education

Experience:

Director of Education/Curriculum Development

09-08-2005 to 06-30-2006 WyoTech Oakland, California, Oakland, CA
07-01-2006 to 12-14-2006 Corinthian Colleges, Inc. Santa Ana, CA

- Manage student handoff from Enrollment
- Admissions, Registration, Scheduling
- Satisfactory Academic Progress:
  - Attendance
  - Grades
  - Matriculation
  - Graduation
- Oversight of Student Satisfaction and Retention.
- Faculty Recruitment, Orientation, Course Assignments, Management, Professional Development and Evaluation.
- Curriculum Implementation and Control.
- Regulatory Compliance.
- File maintenance.
- Submissions (AIR, Self-Study, Program Approvals).
- Accreditation readiness, Accreditation visits.
- Compliance with Academic Policy and Procedure.
- Collaboration on Program and Policy Development.
- Equipment, Facilities and Course Materials.
- Supervision of Education/Academic Staff.
- Local Articulation and Partnership Agreements.
- Collaborate on Planning, Budget, Overall visibility of Management Team.

Experience:

Director of the Aviation Maintenance Institute

08-15-2002 to 06-30-2005 Saint Louis University St. Louis, Missouri Parks College of Engineering, Aviation and Technology

- Direct Aviation Maintenance Institute, including budget, advertising and marketing, and faculty scheduling, oversight, and evaluation.
- Revised entire Aviation Maintenance Technology curriculum in accordance with Title 14 Code of Federal Regulations (CFR) § 147.
- Developed updated one-year A&P Certificate Program with Internet courses.
- Teach in Engineering Technology Program.
- Recruit students for the Aviation Maintenance Institute.
- Provide liaison between SLU and aviation community.
- Advisor for SLU's Aviation Maintenance Technology students.
- Interim Parks College Webmaster and Safety Officer.

Associate Professor

07-01-1987 to 06-30-2002 University of Alaska Fairbanks, Fairbanks, Alaska

- Teach Aviation Maintenance Technology, Aviation/Professional Piloting, and Technology courses, as assigned.
- Revised and maintain entire Aviation Maintenance Technology curriculum in accordance with Title 14 Code of Federal Regulations (CFR) § 147.
- Coordinate Aviation Maintenance Technology, Aviation/Professional Piloting, Drafting, and Technology programs.
- Provide liaison between UAF and aviation community.
- General Manager of University Propeller, Title 14 CFR § 145 Repair Station.
- Established the only FAA-approved Title 14 CFR § 147 Web-based courses.
- Faculty Advisor in UAF's Advising Center, primarily responsible for advising Interdisciplinary and Bachelor of Technology students in addition to general advising.
- Lead Faculty for Early Warning Alert Program [a UAF initiative to identify at risk students (primarily freshman) and provide recommendations on summary data as well as recommendations for future efforts and improvements.}
- Union Representative for Alaska Community Colleges' Federation of Teachers

Community College Teacher

1981–1987 Tanana Valley Community College Fairbanks, AK

- Taught Aviation and Airframe and Powerplant courses.
- Department Head for Aviation Industries

Adjunct Faculty

1976–1981 Northwest Community College Nome, AK

- Designed and taught a variety of Aviation courses, both maintenance and ground school.

Industrial Arts Teacher

1976–1981 Nome Public Schools Nome, AK
1973-1974

- Taught a variety of vocational subjects in the regional high school.
- Worked with special education students in vocational courses.

Director of Maintenance

1979–1980 Bering Air, Inc. Nome, AK

- Establish and monitor a Title 14 CFR §135 Maintenance Program for a variety of "bush" aircraft.
- Responsible for scheduling and conducting all maintenance, test flying, and interfacing with the FAA.

Pilot/Mechanic

1974–1979 Foster Aviation Nome, AK

- Worked part-time in summers and weekends maintaining a variety of "bush" aircraft.
- Part-time line pilot.

Education:

1970	Santa Clara University Santa Clara, CA	B.A., Political Science
1976	Northrup University, Inglewood, CA	Certificate Airframe & Powerplant
1986	University of Alaska Juneau, Juneau, AK	M.S., Vocational Education
2002	University of Alaska Fairbanks, Fairbanks, AK	Counseling Licensure Program

2009 – Present PhD Candidate in Curriculum and Instruction at Old Dominion University

Courses Taught/ Developed:

- Aircraft Drawing
- Aircraft Electrical Systems
- Aircraft Electrical Systems Laboratory
- Aircraft Fuel, Fire, and Instrument Systems
- Aircraft Fuel, Fire, and Instrument Systems Laboratory
- Airframe Inspections
- Airframe Inspections Laboratory
- Airframe Testing
- Aviation Science for Mechanics
- Aviation Science for Mechanics Laboratory
- Basic Electricity
- Basic Mathematics
- Commercial Ground Instruction
- Computer Aided Design with Unigraphics I
- Computer Aided Design with Unigraphics II
- Drafting Co-op Work Experience
- Engineering Shop Practices
- Exhaust Systems
- Federal Aviation Regulations
- Fire Protection Systems
- Flight Instructor Ground School
- Fuel Metering Systems
- Fuel Metering Systems Laboratory
- Ground Operations and Servicing
- Induction Systems
- Instrument Systems
- Internship in Technology
- Inspection Authorization Preparation
- Introduction to Aviation Safety
- Introduction to UAVs
- Introduction to Skis
- Light Sport Aircraft Airplane Class
- Light Sport Aircraft Airplane Maintenance Training
- Light Sport Aircraft Engines and Propellers
- Light Sport Aircraft General Airframe
- Light Sport Aircraft Regulations
- Light Sport Airplane
- Lubrication Systems
- Lubrication Systems and Propellers
- Lubrication Systems and Propellers Laboratory

Courses Taught/ Developed:	• Materials and Processes • Materials and Processes Laboratory • Metallic Structures • Metallic Structures Laboratory • Non-Metallic Structures • Non-Metallic Structures Laboratory • Powerplant Cooling Systems • Powerplant Electrical Systems • Powerplant Inspection • Powerplant Inspection Laboratory • Powerplant Testing • Preventive Maintenance for Pilots • Private Pilot Ground School • Private Pilot Flight Training • Propellers • Reciprocating Engine Theory • Reciprocating Engines • Reciprocating Engines Laboratory • Rotax 912 Specialty Service • Rotax 912 Specialty Maintenance • Seaplane Flight Training • Technology and Society • Weight and Balance
University Service	• Chair, BRCC Automotive Technology Assistant Professor Screening Committee, 2016. • Member, BRCC Student Retention Subcommittee, 2015-Current. • Member, BRCC, Faculty Senate Executive Committee, 2015-Current. • Member, BRCC Release Time Subcommittee, 2014-Current. • STEM Takes Flight Scholarship Reviewer, 2014 • Transforming STEM Higher Education Conference, 2014 • International Exchange Program with the Netherlands, 2013-2014 • Member UVa-NEH Bridging Cultures, 2013-2015 • Member, Dual Credit Committee, 2013-2014 • Delegate, College Board Chinese Bridge Delegation, 2013 • Chair, BRCC AMT Instructional Assistant Screening Committee, 2013 • Chair, BRCC AMT Associate Instructor Screening Committee, 2012 • Member, FAA Part 147 Working Group, 2011-Present. • Board Member, Aviation Technician Education Council, 2011-Present • Member, BRCC Instructional Technology Committee, 2008 - Present • Member, BRCC Faculty Senate Executive Committee, 2007-2010. • Member, Screen Committee for AMT Instructional Assistant, 2007. • Member, Greater Saint Louis Flight Instructor's Association, 2002-Present. • Member, Greater Saint Louis Maintenance Accident Prevention Counselors, 2002-2005. • Co-coordinator (sponsored with FAA) for monthly Aviation Maintenance, Symposiums, 1986-2002. • Participant, Project Safe Flight, 1997-2002. • Coordinator for Annual Aviation Maintenance Symposium, 1989-1992. • Technical Advisor to Aviation Community, 1981-present. • FAA Designated Accident Prevention Counselor, 1983-2005. • FAA Designated Mechanic Examiner, 1981-2002.

- Bering Straight School District-wide Career Fair, 1992.
- BP/ARCO Education Fair, 1992.
- Charter Member Fairbanks EAA Chapter.
- International Aviation Maintenance Foundation Delegate to People's Republic of China, 1988.
- Spring Aircraft Preflight Clinic, 1986.
- General Manager, University Propeller, FAA Certificated Repair Station #UPRR456K, 1989-2002.
- Tanana Valley Campus Union (ACCFT) Representative, 1997-2002.
- Coordinator, Aviation Maintenance Technology (formerly Airframe and Powerplant Program, Tanana Valley Campus, 1992-2002.
- Coordinator, Drafting Technology Program, 1996-2001.
- Coordinator, Aviation Technology Program, 1996-2002.
- Chair, Student Outcomes and Assessment Committee, 1997-1999.
- Member, Faculty Oversight and Appeals Committee, 1997-1999.
- Coordinator, Faculty Council, College of Rural Alaska, 1992-1994.
- Coordinator, Industrial and Service Technology Division, College of Rural Alaska, 1992-1997.
- Member, Selection Committee for Tanana Valley Campus Director, 1994.
- Member, Selection Committee for University of Alaska Usabelli Teaching Award, 1994-1997.
- Co-chair, Selection Committee for Airframe and Powerplant faculty, 1993.
- Member, Selection Committee for Diesel/Heavy Duty Equipment faculty, 1993.
- Member, Joint Faculty Senate/College of Rural Alaska Committee on Course/Instructor Approval Procedures, 1993.
- Chair, Selection Committee for Aviation Technology faculty, 1992.
- Member, Selection Committee for Tech-Prep Coordinator, 1992.
- Member, Vice Chancellor for Academic Affairs Review Committee, 1992.
- Representative, Faculty Senate, 1990-1992.
- Department Head, Trade and Industry Department, 1988-1990.
- Chair, Selection Committee for Aviation Technology faculty, 1989.
- Member, Selection Committee for School of Career and Continuing Education Dean, 1988.
- Co-convener for Faculty Governance, UAF Constitutional Convention, 1988.
- Delegate to UAF Constitutional Convention, 1988.
- Member, Ad Hoc Committee on Promotion and Tenure, 1988-1989.
- Alternate, Faculty Senate, 1988-1990.
- Member, UAF Level I Institutional Restructuring Advisory Council, 1987-1988.
- Member, UAF Level II Committee on Promotion and Tenure, 1987-1988.
- Co-chair, UAF Level III Task Force on Vocation Education, 1987-1988.
- Member, UAF Academic Council, 1987-1988.
- Member, School of Career and Continuing Education Curriculum Committee, 1987-1988.
- Department Head, Aviation Industries, 1986-1988.
- President-elect, Community Colleges Rural Education and Extension (CCREE) Assembly, 1987.
- Chair, Faculty Affairs Committee, CCREE Assembly, 1985-1987.
- Chair, Tanana Valley Community College Curriculum Committee, 1986.
- Member, CCREE Assembly, 1983-1987.
- Member, University of Alaska General Assembly, 1983-1987.
- Member, Tanana Valley Community College, Curriculum Committee, 1984-86.
- Department Head, Airframe and Powerplant Program 1982-1984.

University Service:

Professional Development:

- Aviation Technician Education Council IA Renewal, 03/31-04/04/2017
- Freedom Aviation IA Renewal Course 03/16/2017
- AOPA Flight Instructor Refresher Course, 02/25-26/2017
- CPR/AED/First Aid, 12/15/2016
- Freedom Aviation IA Renewal Course 03/17/2016
- Rotax iRMT 912 Series Heavy Maintenance Course, 01/17-19/2016.
- Rotax iRMT 912iS Series Installation Course, 01/15/2016.
- Rotax iRMT 9 Series Maintenance Specialty Course, 01/13-14/2016.
- Rotax iRMT 9 Series Service Specialty Course, 01/11-12/2016.
- Southwest 737NG Familiarization Course, 08/03-14/2015
- NASA STEM Takes Flight Faculty workshop, 06/03-05/2015.
- Aviation Technician Education Council IA Renewal, 04/12-14/2015.
- AOPA Flight Instructor Refresher Course, 12/20/2014
- Continental Motors Centurion Maintenance Seminar, 12/02-04/2014
- EAMTC Instructor Seminar – EAMTC, 05/27-28/2014
- Inspection Authorization Renewal – AMT Society, 04/04/2014
- Working Healthy – 8 Steps for Protecting Your Health, 03/03/2014
- CPR/AED/First Aid, 02/28/2014
- The Impact of Tire Maintenance on Aircraft Safety, 01/13/2014
- Maintenance Error Avoidance, 01/07/2014
- Pneumatic Systems, 12/09/2013
- Fatigue Countermeasure Training, 12/09/2013
- Human Factors Primer for Aviation Mechanics, 12/06/2013
- SnapOn Meter Certification, 09/17/2013
- Continental Motors Factory Training, 03/15/2013
- AOPA Flight Instructor Refresher Clinic, 02/17/2013
- Michelin Certified Tire Expert Program Level 2, 12/20/2012
- Michelin Certified Tire Expert Program Level 1, 12/20/2012
- Pneumatic Systems for Maintenance Professionals, 11/26/2012
- Working Healthy – 8 Steps for Protecting Your Health, 11/26/2012
- Failure to Follow Procedures – Landing Gear Failure, 11/26/2012
- Failure to Follow Procedures – Installation, 11/23/2012
- Failure to Follow Procedures – Inspections, 11/23/2012
- EAMTC Instructor Seminar,, 05/27-28/2014
- Fatigue Countermeasure Training, 11/23/2012
- Dirty Dozen – Human Error in Aircraft Maintenance, 11/21/2012
- Eddy Current Testing, 10/15/2012
- Ultrasonic Testing, 10/15/2012
- Advanced Composite Structural Repair, 10/09/2012
- Strengthening AMT Programs, 04/17/2012
- Aircraft Maintenance Documentation for AMTs. 01/01/2012
- NIDA Corporation, Pro ILE Learning Management System, 06/01-02/2011.
- Rotax 912/914 Service School, Aero Technical Institute, 07/11-12/2009.
- Aviation Technician Education Conference, 04/19-21/2009.
- IA Renewal, FAA Richmond FSDO, 03/14/2009.
- CFI Renewal, Aviation Supplies and Academics, Inc., 01/19/2009.
- CPR/AED – Adult, American Red Cross, 05/12/2008.
- Aviation Technician Education Conference, 04/06/-08/2008.
- IA Renewal, FAA Richmond FSDO, 03/29/2008.
- IA Renewal, FAA & Fairmont State , 02/23/2008
- Teaching and Learning Online Workshop, Summer 2007
- CPR/AED – Adult, American Red Cross, 06/26/2007.
- Standard First Aid, American Red Cross, 06/26/2007.

Professional Development:

- CFI Renewal, Greater Saint Louis Flight Instructor Association, 01/21/2007.
- IA Renewal, Saint Louis Aviation Maintenance Safety Counselors, 1/19/2007.
- FAA Industry Training Standards, FAA, 11/11/2006.
- Academic Dean and DOE Basic Training Workshop, CCI, 01/2006.
- Harassment Training, CCI 11/2005.
- High Impact Hiring and eSeries 6, CCI, 11/2005.
- Situational Leadership II, CCI, 11/2005.
- Managing 90/10, CCI, 10/2005.
- Performance Coaching, CCI, 10/2005.
- Prevention of Workplace Harassment and Discrimination, CCI, 09/2005.
- Flight Instructor Refresher Course, 02/2005.
- Human Factors in Aviation, SLU, 2005.
- Mill Manufacturing Processes NX, EDS, 2005.
- Practical Applications of Unigraphics, EDS, 2004.
- FAA Technical Airman Examiner Standardization, 2002.
- Teledyne Continental Factory Reciprocating Engine School, 1999.
- FAA Technical Airman Examiner Standardization, 1998.
- FAA Suspected Unapproved Parts Seminar, 1998.
- Textron Lycoming Piston Engine Service School, 1997.
- Inspection Authorization Renewal, Aviation & Electronic Schools, 1996.
- General Radio Operators Course, Aviation & Electronic Schools, 1986.
- FAA Technical Airman Examiner Standardization, 1996.
- FAA Technical Airman Examiner Standardization, 1993.
- FAA Inspection Authorization Refresher Program, 1993.
- FAA Approved Parts Seminar, 1993.
- Ultrasonic Testing, Krautkramer-Branson, 1993.
- Flight Instructor Refresher Course, Bill Phelps' Airline Ground Schools, 1993.
- Eddy Current Testing, Zetec, Inc. 1992.
- Customer Training School, Loctite Corporation, 1992.
- Tech-Prep Seminar, State of Alaska Department of Education, 1992.
- FAA Technical Airman Examiner Standardization, 1991.
- FAA Inspection Authorization Refresher Program, 1991.
- Vocational Internship in Propellers, University of Alaska Anchorage, 1990.
- Alaska Anti-drug Program Consortium Managers Workshop, 1990.
- Propeller Repairman Training, Embry-Riddle Aeronautical University, 1989.
- FAA Technical Airman Examiner Standardization, 1989.
- FAA Inspection Authorization Refresher Program, 1989.
- Flight Instructor Refresher Course, AOPA Air Safety Foundation
- 1989.UAF Hazard Communication Program, 1989.
- UAF Laboratory Instructor Training, 1989.
- FAA Technical Airman Examiner Standardization, 1987.
- FAA Inspection Authorization Refresher Program, 1987.
- Flight Instructor Refresher Course, AOPA Air Safety Foundation, 1987.
- FAA Technical Airman Examiner Standardization, 1985.
- FAA Inspection Authorization Refresher Program, 1985.
- Flight Instructor Refresher Course, AOPA Air Safety Foundation, 1985.
- FAA Technical Airman Examiner Standardization, 1983.
- FAA Inspection Authorization Refresher Program, 1983.
- Flight Instructor Refresher Course, Roy Beech and Associates, 1983.
- FAA Initial Maintenance Airman Examiner Standardization, 1981.
- Magnetic Particle & Liquid Penetrant Inspection, Magnaflux Corporation, 1981.

Current PhD Coursework	• Dissertation, Fall 2017 • Dissertation, Fall 2016 • Dissertation, Spring 2016 • Dissertation, Fall 2015 • Dissertation Seminar, Summer 2015 • Independent Study – Occupational Education, Fall 2014 • Occupational/Technical Education, Spring 2014 • Occupational/Technical Education, Fall 2013 • Instructional Design Theory, Fall 2012 • Human Performance Assessment, Summer 2012 • Research Residence in Instruction Design and Technology, Spring 2012 • Instructional Gaming, Spring 2012 • Advanced Research Design & Analysis, Fall 2011 • Human Performance Technology, Fall 2011 • Qualitative Research in Education, Summer 2011 • Designing Online Instruction, Summer 2011 • Linear Models in Ed Research, Spring 2011 • Trends/Issues Instructional Design/Technology, Spring 2011 • Applied Statistics/Data in Education, Fall 2010 • Advanced Instruction Design Technique, Fall 2010 • Foundations of Distance Education, Spring 2010 • Cognition & Instructional Design, Spring 2010 • Instructional Tech Product Evaluation, Fall 2009 • Instructional Systems Design, Spring 2009
Professional Affiliations:	• Association for Educational Communications and Technology. • Aircraft Owners and Pilots Association. • Alaska Community Colleges' Federation of Teachers. • American Association of University Professors. • American Society for Non-Destructive Testing. • Experimental Aircraft Association. • International Aviation Maintenance Foundation. • Professional Aviation Maintenance Association
Research \Interests:	• **Safety** • **Distance Education** • **Competency-based Aviation Education** • **Student Retention** • **Non Destructive Testing** • **Aircraft Modification**

Certificates:

Federal Aviation Administration Certificates:

- Mechanic, Airframe and Powerplant Ratings, #3035770.
- Inspection Authorization, #3035770.
- Designated Mechanic Examiner, #536486860 (1981-2002).
- Propeller Repairman, #2422163 (1988-2002).
- Ground Instructor, Advance and Instrument Ratings, #3035770.
- Designated Mechanic Examiner, #536486860 (1981-2002).
- Propeller Repairman, #2422163 (1988-2002).
- Ground Instructor, Advance and Instrument Ratings, #3035770.
- Commercial Pilot, Single-engine Land and Sea, Multi-engine Land Instrument Ratings, #3035770.
- Flight Instructor, Single-engine, Instrument, Airplane Ratings, #3035770.
- Remote Pilot: small Unmanned Aircraft Systems, #3035770.

Federal Communication Commission Certificates:

- General Radio Telephone Operator.
- Restricted Radio Telephone Operator.

Rotax

- RFSC iRMT 912 Series Service Specialty
- RFSC iRMT 912 Series Maintenance Specialty
- RSCF iRMT 912iS Series Installation Course
- RSCF iRMT 912 Series Heavy Maintenance Specialty

State of Alaska Certificate:

- Type A Teaching Certificate.
- Type C Counseling Certificate.

National Academic Advising Association:

- Academic Advising Summer Institute.

Other Achievements:

Supplemental Type Certificates Issued:

- Bellanca Model 14-19-2, Oil Filter
- Bellanca Model 14-19-2, Auxiliary Fuel Tank
- Textron Lycoming Model O-320, Oil filter Adapter
- Piper Model PA-18-150, Oil Filter Installation
- Hartzell HC-C2YK/R Propeller Installation on Cessna 172 Series
- Hartzell HC-C2YK/R Propeller Installation on Cessna 175 Series

Numerous (200+) miscellaneous FAA "Field Approvals

FAA Awards

- Diamond Award 2@
- Ruby Award 1@
- Gold Award 3@
- Silver Award 8@
- Bronze Award 3@

UAF Academic Advising Center, Advisor of the Year, 1997-1998

Aviation Technician Education Council – Instructor of the Year 2012-2013

BRCC International Fellow 2013-2014