

AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



FOR
ENGINEERING
(3E5X1)
MODULE 15
MANUAL DRAFTING

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Career Field Education and Training Plan (CFETP) references from 1 April 02 version.

OPR: HQ AFCESA/CEOF
(SMSgt Pat Abbott)
Supersedes AFQTP 3E5X1-14, 1 May 01

Certified by: HQ AFCESA/CEOF
(CMSgt Myrl F. Kibbe)
Pages: 18/Distribution F

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**AIR FORCE QUALIFICATION TRAINING PACKAGES
FOR
ENGINEERING
(3E5X1)**

INTRODUCTION

Before starting this AFQTP, refer to and read the "[AFQTP Trainer/Trainee Guide](#)."

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. **It is important for the trainer and trainee to understand** that an AFQTP **does not** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

Core task:

AFQTP completion
Hands-on certification

Diamond task:

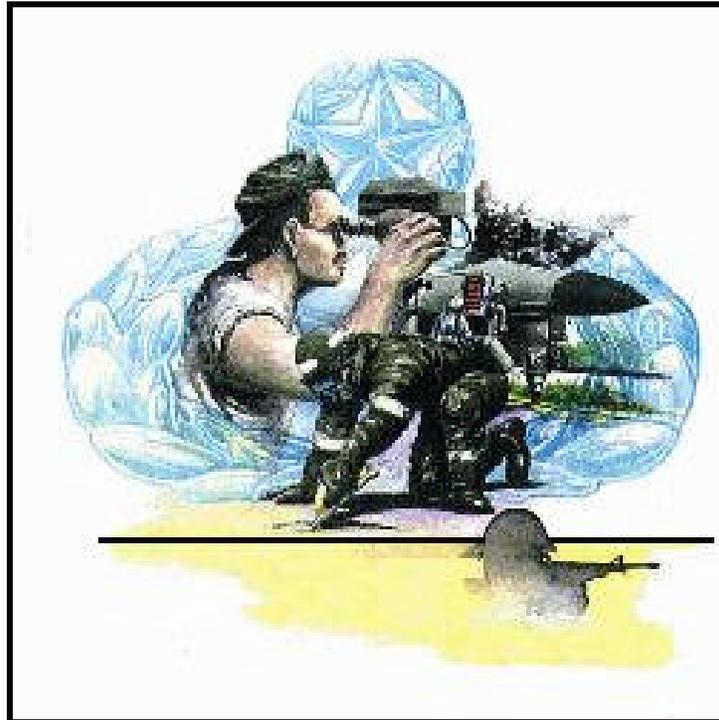
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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MANUAL DRAFTING

MODULE 15

AFQTP UNIT 1

PERFORM FUNDAMENTAL DRAFTING PRACTICES (15.1.)

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PERFORM FUNDAMENTAL DRAFTING PRACTICES
Task Training Guide

STS Reference Number/Title:	15.1 Perform fundamental (manual) drafting practices.
Training References:	<ol style="list-style-type: none"> 1. Career Development Course (CDC) 3E551B Engineering Journeyman, Volume 1, Unit 1, <i>Drafting Practices and Principles</i>. 2. Local Procedures.
Prerequisites:	<ol style="list-style-type: none"> 1. Possess as a minimum a 3E531 AFSC. 2. Review local procedures. 3. Complete CDC 3E551B Engineering Journeyman, Volume1, Unit 1, <i>Drafting Practices and Principles</i>.
Equipment/Tools Required:	<ol style="list-style-type: none"> 1. Drawing board. 2. T-square/parallel bar. 3. Set of triangles. 4. Scales. 5. Pencils. 6. Ink. 7. Protractor. 8. Erasers. 9. Compass.
Learning Objective:	Given the equipment, trainee will be able to perform basic steps and procedures in manual drafting.
Samples of Behavior:	The trainee will be able to perform fundamental drafting procedures.
Note:	

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PERFORM FUNDAMENTAL (MANUAL) DRAFTING PRACTICES

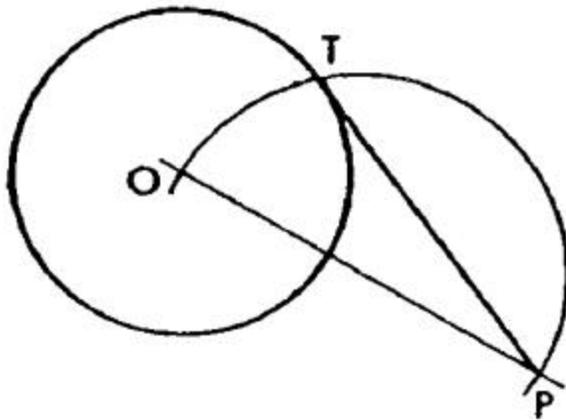
1. Background. Drafting is one of the most important communication methods you use as an Engineering Apprentice, Journeyman or Craftsman. Drafting must convey the same meaning to everyone. Drafting has drastically become quick and easy with Computer Aided Drafting (CAD). Why do we need to learn the fundamentals of drafting when we have CAD which will do it all for us at the click of a mouse? The answer should be obvious. A draftsman can learn CAD quite easily while not any computer genius can grasp drafting symbology, principles, theories, or methods. Look at CAD as a tool, not a discipline. Additionally, CAD cannot be used to its maximum potential without a firm grasp of drafting principles. By mastering drafting fundamentals, you will be able to prepare plan sheets for others to interpret and additionally, interpret the plans of others.

2. Drafting Fundamentals.

2.1. To perform basic drafting fundamentals, follow these steps:

Step 1: Line tangent to a circle from an outside point (Figure 1).

Figure 1. Tangent Circle



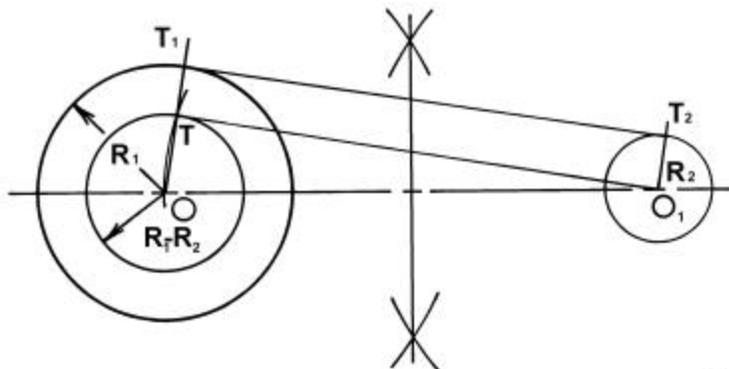
1.1. Draw a construction line from P to O, the center of the circle. Then bisect this line.

1.2. Using $\frac{1}{2}$ of the line PO, strike an arc, which cuts the given circle at T.

1.3. Draw the line PT, which is the required tangent line.

Step 2: A line tangent to two circles (Figure 2).

Figure 2. Tangent Two Circles



2.1. From center point O, draw a circle with a radius equal to R_1 minus R_2 . R_1 and R_2 can be any values you chose.

2.2. Draw a tangent from this new circle to O_1 , using method described in Step 4.

2.3. Extend line OT until it intersects circle O at T_1 .

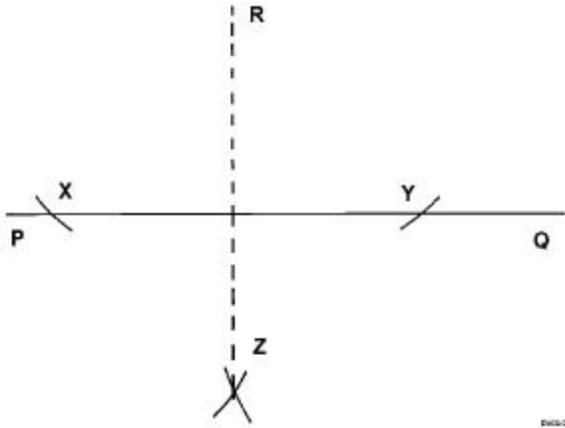
2.4. Draw a line parallel to OT from center O_1 to intersect the second circle at T_2 .

2.5. Draw line T_1, T_2 , which is the required tangent.

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Step 3: Constructing perpendicular lines (Figure 3).

Figure 3. Constructing a Perpendicular



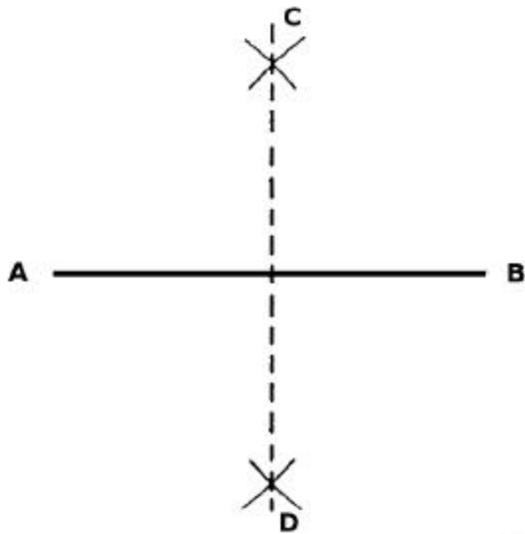
3.1. Using **R** as a center, swing an arc of any radius (greater than the distance from **R** to the line) to cut line **PQ** at **X** and **Y**.

3.2. Using **X** and **Y** as center, swing identical arcs, which intersect below line **PQ** at point **Z**.

3.3. A straight line connecting **R** to **Z** is the required perpendicular.

Step 4: Bisecting a line (Figure 4).

Figure 4. Bisecting a Line



4.1. Adjust your compass to a radius greater than one-half the length of the given line.

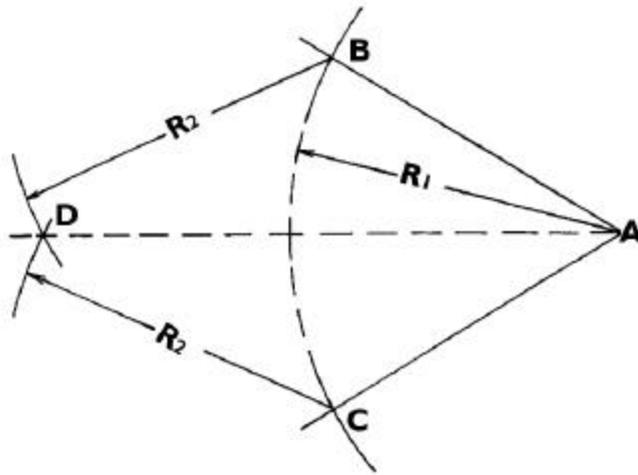
4.2. Without changing the compass setting, draw intersecting arcs above and below the line using the end points of the line as the center points for the arcs.

4.3. Connect the two intersection points of the arcs, **C** and **D**, with a straight line.

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Step 5: Bisecting an angle (Figure 5).

Figure 5. Bisecting a Angle



5.1. Using the vertex of the angle, point A, as the center from which to swing an arc of any radius, cut the legs of the angle with short arcs to get points B and C.

5.2. Using B and C as centers, swing identical arcs that intersect as D.

5.3. Draw AD, the bisector of angle BAC.

2.2. To perform basic drafting project, follow these steps:

Step 1: Select drawing media. Determination of media depends on the purpose of the project. Vellum (tracing paper) is used mostly for sketch work, and polyester drafting film (Mylar) is a more durable product. Other drawing medias, i.e., white paper, manila paper, and green paper, are all good for pencil or ink drawings.

Step 2: Select size of drawing paper. The drawing paper should accommodate the drawing without being crowded or wasteful. Consider the size, type, and number of objects to be drawn, quantity of notes, border, and title block.

Sheet size	Engineering Standard	Architectural Standard
A	8 ½ x 11	9 x 12
B	11 x 17	12 x 18
C	17 x 22	18 x 24
D	22 x 34	24 x 36
E	28 x 40	30 x 42

Step 3: Select basic drafting equipment. Equipment consists of a drawing board, T-square/parallel bar, set of triangles, scales, pencils, ink, protractor, erasers, irregular curves, and a set of drafting instruments.

Step 4: Draw to scale a plot plan of your building. Show the boundaries of a construction site (using your existing building) and the location of the building in relation to these boundaries.

Step 5: Draw to scale a floor plan of your office.

5.1. Begin by determining overall size of the project, appropriate paper size, and correct drawing scale.

5.2. Show walls and furniture in proper orientation and at a consistent scale.

Step 6: Draw a detail plan of a door jam for the door to your office. Show the detail of the door with a greater level of precision than the small scale drawing of the office.

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**REVIEW QUESTIONS
FOR
PERFORM FUNDAMENTAL (MANUAL) DRAFTING PRACTICES**

QUESTION	ANSWER
1. Computer Aided Drafting has eliminated the need to know the fundamentals of manual drafting?	a. True. b. False.
2. Which type of media is most commonly used for sketch work?	a. White paper. b. Manila paper. c. Vellum. d. Mylar.
3. What item is NOT part of basic drafting equipment?	a. Pencils. b. 100' tape. c. Triangles. d. Protractor.
4. What sheet size would represent 22" x 34"?	a. A. b. B. c. C. d. D.

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PERFORM FUNDAMENTAL (MANUAL) DRAFTING PRACTICES

PERFORMANCE CHECKLIST

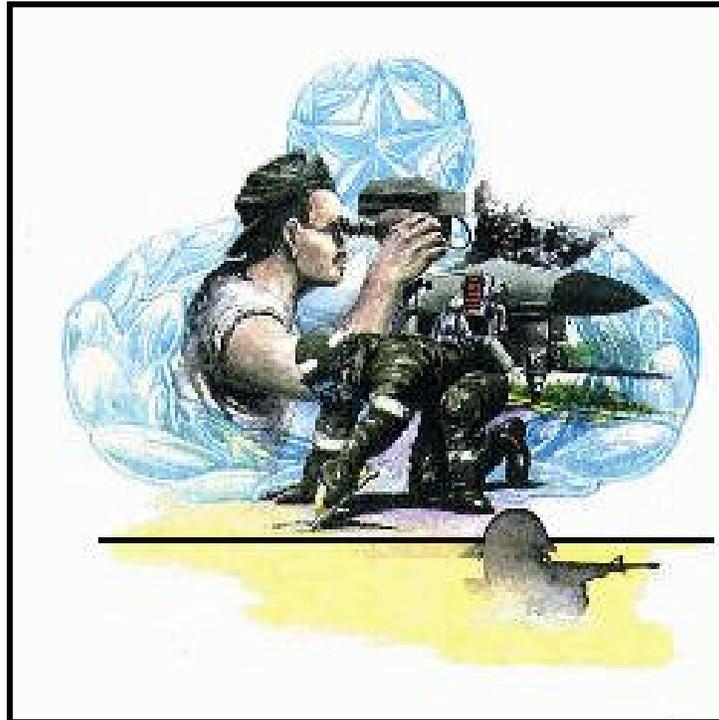
INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE....	YES	NO
1. select correct drawing media?		
2. given project data, calculate size of drawing media?		
3. select basic drafting equipment to start a drawing?		
4. draw a plot plan?		
5. draw a floor plan?		
6. draw a detail?		

FEEDBACK: Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.

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MANUAL DRAFTING

MODULE 15

AFQTP UNIT 2

**IDENTIFY/SELECT BASIC AMERICAN NATIONAL
STANDARDS INSTITUTE (ANSI) SYMBOLS (15.2.)**

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**IDENTIFY/SELECT BASIC AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
SYMBOLS**

Task Training Guide

STS Reference Number/Title:	15.2. - Identify/select basic American National Standards Institute (ANSI) symbols.
Training References:	<ol style="list-style-type: none"> 1. Career Development Course (CDC) 3E551B Engineering Journeyman, Volume 1, Unit 5, Section 5-2, <i>CAD/GIS Standards</i>. 2. Architectural Graphic Standards, Wiley, John & Sons, Incorporated.
Prerequisites:	<ol style="list-style-type: none"> 1. Possess as a minimum a 3E531 AFSC. 2. Review the Architectural Graphic Standards. 3. Complete CDC 3E551B Engineering Journeyman, Volume 1, Unit 5-2, Section 5-2, <i>CAD/GIS Standards</i>.
Equipment/Tools Required:	<ol style="list-style-type: none"> 1. Architectural Graphic Standards, Wiley, John & Sons, Incorporated 2. Set of contract drawings to identify ANSI symbols 3. Project scenario for selecting ANSI symbols
Learning Objective:	Given the equipment, trainee will be able to identify basic steps and procedures in using ANSI Standards.
Samples of Behavior:	The trainee will be able to locate and utilize fundamental drafting procedures.
Notes:	

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IDENTIFY/SELECT BASIC ANSI SYMBOLS

1. Background. For years, Architectural Graphic Standards has been the standard design reference for architects, builders, and engineers. Standards are written so that when you pick up a drawing from one base, and compare it to another base, the symbols, colors and so on represent the same thing on both drawings. The benefits of CAD standardization: consistent CAD products for customers, uniform requirements for architect-engineer deliverables, sharing of products and expertise, and collection, manipulation, and exchange of database information. This way one drawing symbol has one meaning to everyone.

2. To identify/select basic ANSI symbols, follow these steps:

Step 1: Using Architectural Graphic Standards, identify architectural, electrical, and mechanical symbols used in a basic floor plan.

Step 2: Select appropriate architectural, electrical, and mechanical symbols used in a basic floor plan.

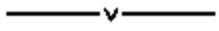
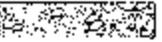
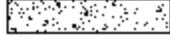
- 2.1. Select appropriate ANSI Symbol to designate ... (any architectural feature).
- 2.2. Select appropriate ANSI Symbol to designate ... (any electrical feature).
- 2.3. Select appropriate ANSI Symbol to designate ... (any mechanical feature).

NOTE:

1. Trainee should have copy of AGS for exercise. Trainer should request the trainee to find the symbol in the AGS.
2. After using AGS, the trainee should then be quizzed using a set of working construction drawings.

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**REVIEW QUESTIONS
FOR
IDENTIFY/SELECT BASIC ANSI SYMBOLS**

QUESTION	ANSWER
1. Architectural Graphic Standards has been the standard design for many years?	a. True. b. False.
2. Which of the following is the symbol for a triplex receptacle?	a.  b.  c.  d. 
3. Which of the following is the symbol for a vacuum line?	a.  b.  c.  d. 
4. Which of the following is the symbol for condensate pump?	a.  b.  c.  d. 
5. Which of the following is the symbol for lightweight concrete?	a.  b.  c.  d. 

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IDENTIFY/SELECT BASIC ANSI SYMBOLS

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

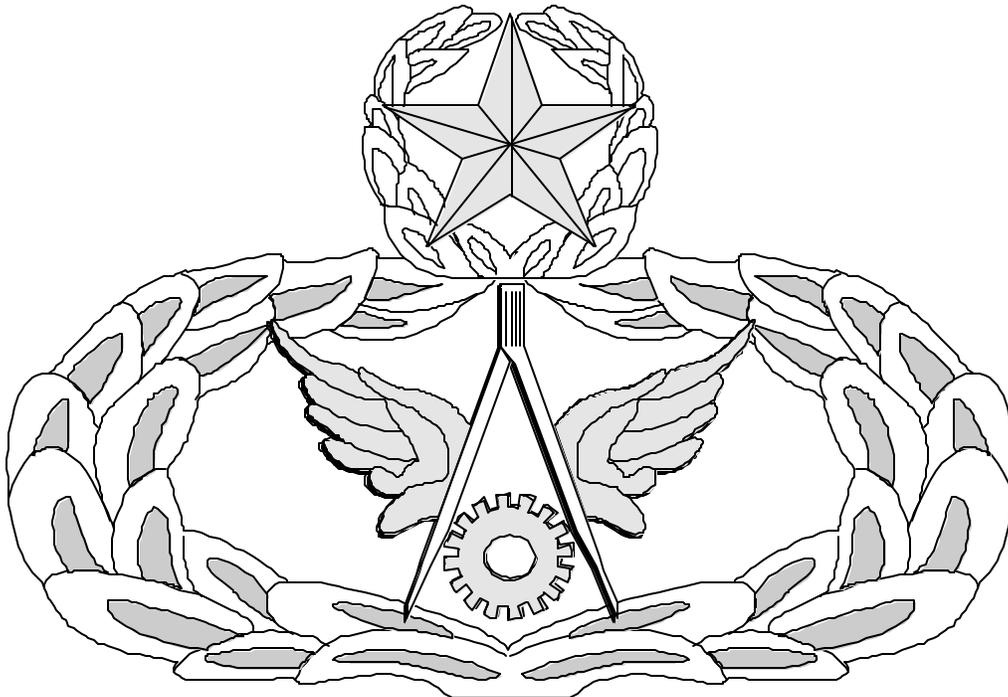
DID THE TRAINEE....	YES	NO
1. identify standard architectural symbols?		
2. 2. select appropriate ANSI symbol to designate?		

FEEDBACK: Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



FOR
ENGINEERING
(3E5X1)

MODULE 15
MANUAL DRAFTING

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Key-1

**PERFORM FUNDAMENTAL DRAFTING PRACTICES
(3E5X1-15.1.)**

QUESTION	ANSWER
1. Computer Aided Drafting has eliminated the need to know the fundamentals of manual drafting?	b. False.
2. Which type of media is most commonly used for sketch work?	c. Vellum.
3. What item is NOT part of basic drafting equipment?	b. 100' tape.
4. What sheet size would represent 22" x 34"?	d. D.

**IDENTIFY/SELECT BASIC ANSI SYMBOLS
(3E5X1-15.2.)**

QUESTION	ANSWER
1. Architectural Graphic Standards has been the standard design for many years?	a. True.
2. Which of the following is the symbol for a triplex receptacle?	c.
3. Which of the following is the symbol for a vacuum line?	a.
4. Which of the following is the symbol for condensate pump?	a.
5. Which of the following is the symbol for lightweight concrete?	d.

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MEMORANDUM FOR HQ AFCESA/CEOF
139 Barnes Drive Suite 1
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

Module # and title _____

2. Identify improvement/correction section(s):

<input type="checkbox"/> STS Task Reference	<input type="checkbox"/> Performance Checklist
<input type="checkbox"/> Training Reference	<input type="checkbox"/> Feedback
<input type="checkbox"/> Evaluation Instructions	<input type="checkbox"/> Format
<input type="checkbox"/> Performance Resources	<input type="checkbox"/> Other
<input type="checkbox"/> Steps in Task Performance	

3. Recommended changes--use a continuation sheet if necessary.

4. You may choose to call in your recommendations to DSN 523-6322 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.
5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position