Federal Aviation Administration

Initial En Route Qualification Training

Instructor
Lesson 37
Radar Vectoring

Course 50148001

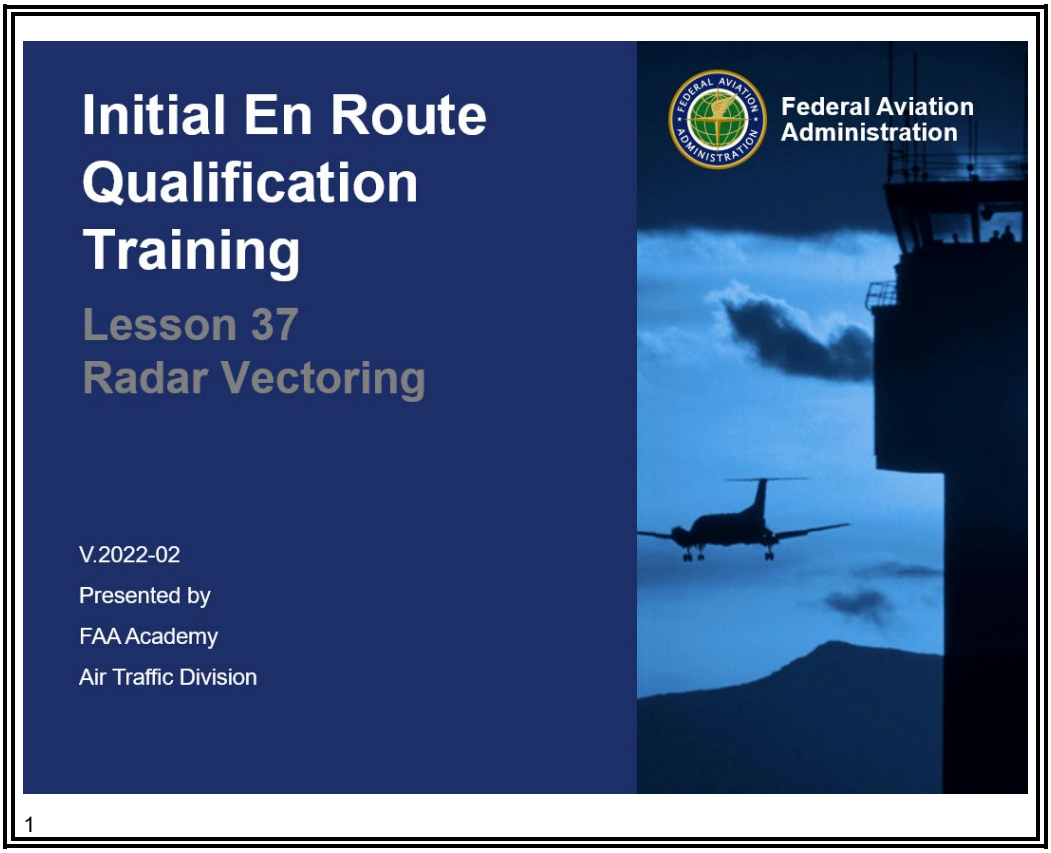
LESSON PLAN DATA SHEET

COURSE NAME:	INITIAL EN ROUTE QUALIFICATION TRAINING
COURSE NUMBER:	50148001
LESSON TITLE:	RADAR VECTORING
DURATION:	1+30 HOURS
DATE REVISED:	2022-02
VERSION:	V.2022-02
REFERENCE(S):	FAA ORDER JO 7110.65, AIR TRAFFIC CONTROL; FAA ORDER JO 7110.311, PROCEDURAL GUIDANCE FOR FAA ORDER JO 7110.65 FOLLOWING EN ROUTE AUTOMATION MODERNIZATION (ERAM) IMPLEMENTATION
HANDOUT(S):	NONE
EXERCISE(S)/ ACTIVITY(S):	NONE
END-OF-LESSON TEST:	YES *(REFER TO ELT37.PDF)*
PERFORMANCE TEST:	NONE
MATERIALS:	NONE
OTHER PERTINENT INFORMATION:	NONE

☞ ***NOTE:*** *As you prepare for this lesson, recall and be prepared to talk about examples and personal experiences that illustrate or explain the teaching points in the lesson.*

INTRODUCTION

Gain Attention

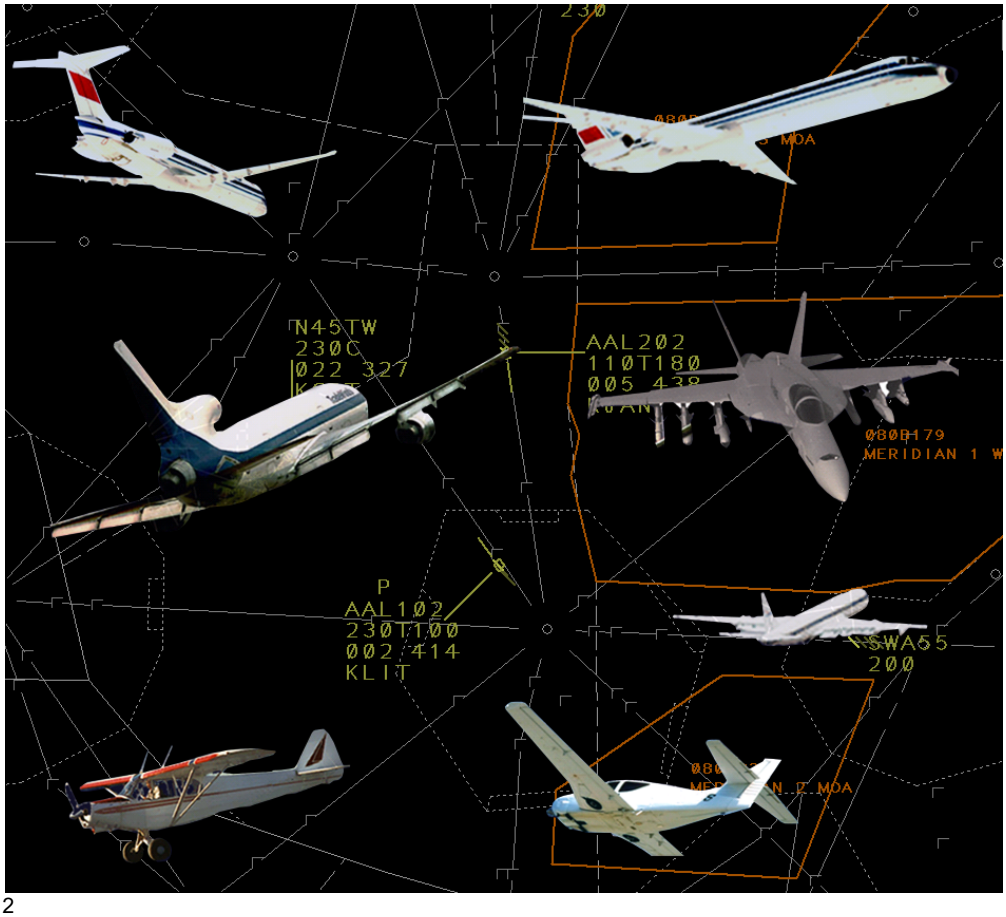


In the nonradar scenarios, you applied lateral separation in conjunction with vertical separation using crossing restrictions. In a radar environment, radar vectors are used, primarily by the Radar Controller, to achieve lateral separation between two aircraft without having to use vertical separation.

INTRODUCTION *(Continued)*

Opening Scenario

RADAR VECTORING



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Vectoring aircraft is a radar separation technique that can benefit both the pilot and the controller, resulting in a safe, orderly, and expeditious flow of traffic and reducing delays for both arrivals and departures.

Purpose

This lesson covers the reasons and methods for issuing vectors.

INTRODUCTION *(Continued)*

Lesson Objectives

LESSON OBJECTIVES

- On an End-of-Lesson Test and in accordance with FAA Orders JO 7110.65 and 7110.311, you will identify:
  - Reasons for issuing radar vectors
  - Procedures for issuing radar vectors

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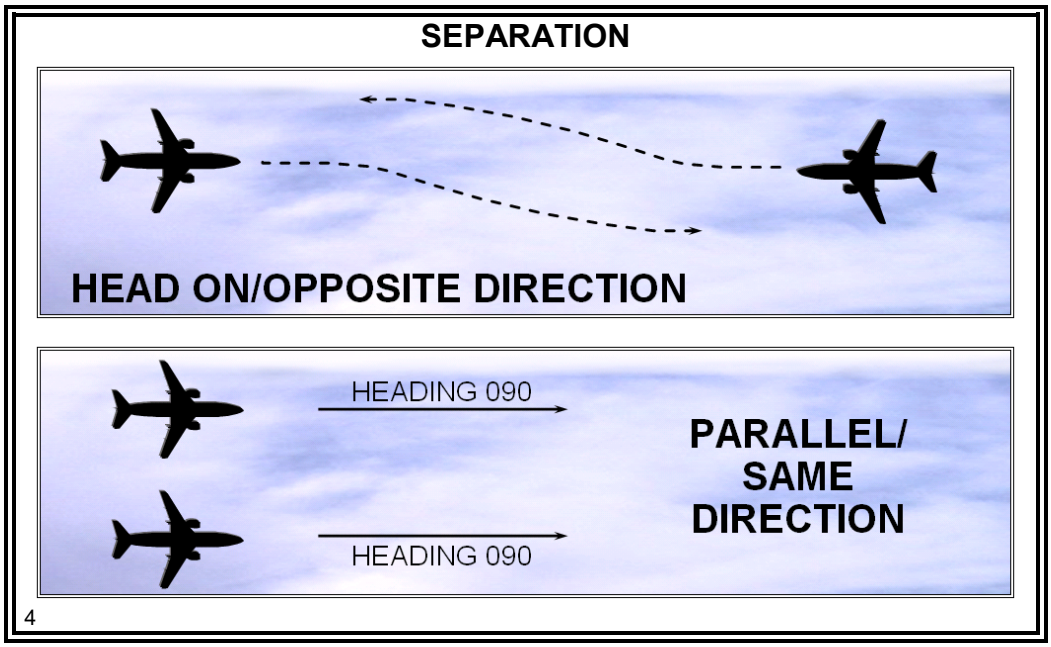
☞ ***NOTE:*** *Teach from graphic.*

VECTORING

Term
JO 7110.65, Pilot/Controller Glossary

A **vector** is a heading issued to an aircraft to provide navigational guidance by radar.

Reasons for Vectoring
JO 7110.65, par. 5-6-1



- Reasons for vectoring aircraft include:
  - Separation
    - From other aircraft
    - From airspace
  - Safety

    Example: When skydivers are making a jump, vector around jump aircraft.

GENERAL REQUIREMENTS

Minimum Altitude Definitions
JO 7110.65, Pilot/Controller Glossary

📖 **Minimum IFR Altitudes (MIAs)** are minimum altitudes for IFR operations as prescribed in 14 CFR, Part 91. These altitudes are published on aeronautical charts and prescribed in 14 CFR, Part 95 for airways and routes, and in 14 CFR, Part 97 for standard instrument approach procedures. If **no** applicable minimum altitude is prescribed in 14 CFR, Part 95 or 14 CFR, Part 97, the following minimum IFR altitude applies:

- In designated mountainous areas, 2,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown; or
- Other than mountainous areas, 1,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown; or
- As otherwise specified by the Administrator or assigned by ATC.

📖 **Minimum Vectoring Altitude (MVA)** is the lowest MSL altitude at which an IFR aircraft will be vectored by a radar controller, except as otherwise authorized for radar approaches, departures, and missed approaches. The altitude meets IFR obstacle clearance criteria. It may be lower than the published MEA along an airway or J-Route segment. It may be utilized for radar vectoring **only** upon the controller's determination that an adequate radar return is being received from the aircraft being controlled. Charts depicting Minimum Vectoring Altitudes are normally available to controllers, and **not** to pilots.

☞ ***NOTE:*** *MIAs and MVAs are the same in Aero Center.*

Application
JO 7110.65, par. 5-6-1

⊙ Vector aircraft at or above the MVA or MIA.

GENERAL REQUIREMENTS *(Continued)*

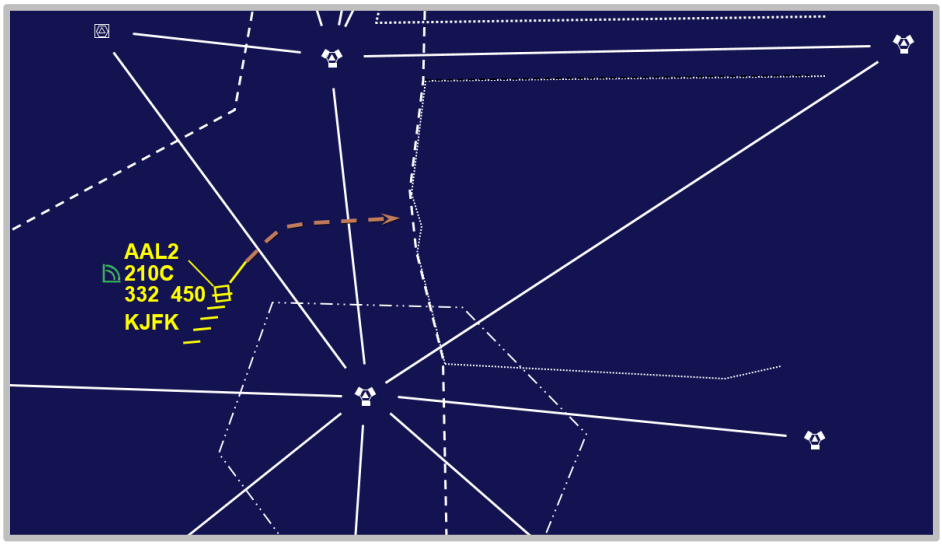
Conditions
JO 7110.65,
par. 5-6-1

⊙ IFR aircraft

- Vector an IFR aircraft if it is:
  - Within controlled airspace
  - At or above the appropriate minimum altitude
  - Within your area of jurisdiction, **unless** otherwise coordinated
  - Permitted to resume its own navigation within radar coverage

Items to Specify
JO 7110.65, par. 5-6-2

DIRECTION OF TURN SPECIFIED



Phraseology Example

"American Two, turn right heading zero seven zero, when able proceed direct Columbus."

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⊙ Vector aircraft by specifying:

- Direction of turn, if appropriate, and magnetic heading to be flown

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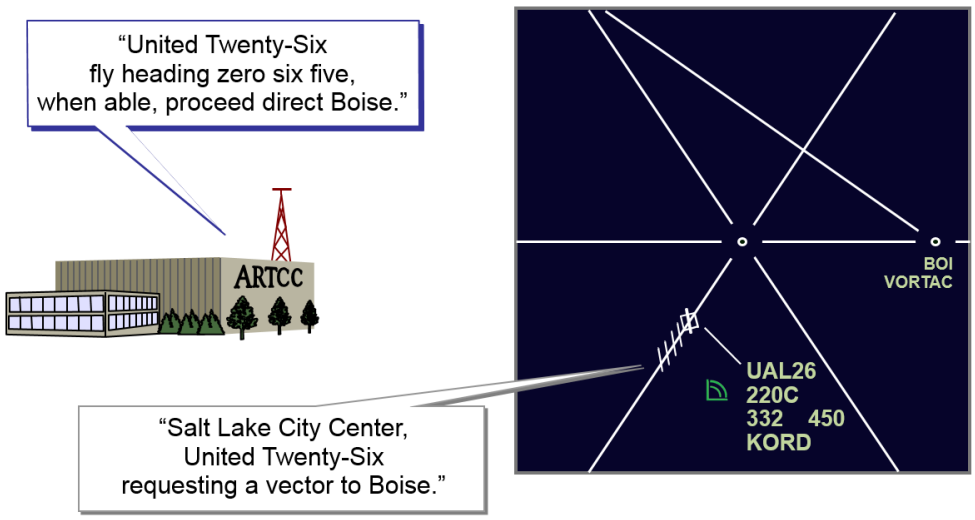
Items to Specify (Cont'd)
JO 7110.65, par. 5-6-2

✈ **Phraseology Example**

NO DIRECTION OF TURN SPECIFIED



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☞ ***NOTE:*** *Click twice to show dialogue.*

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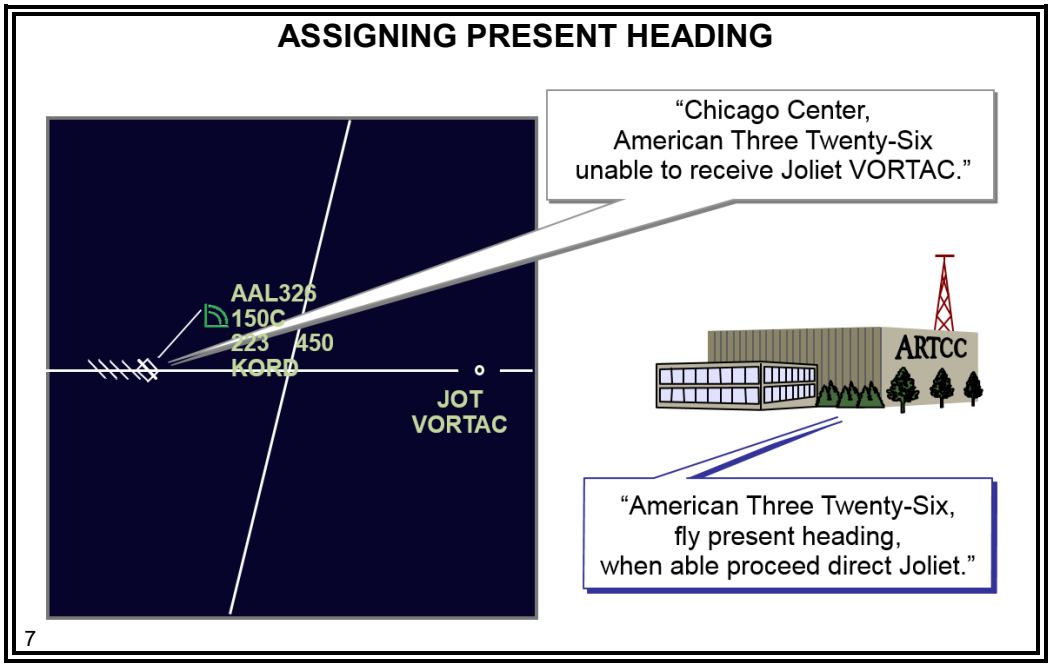
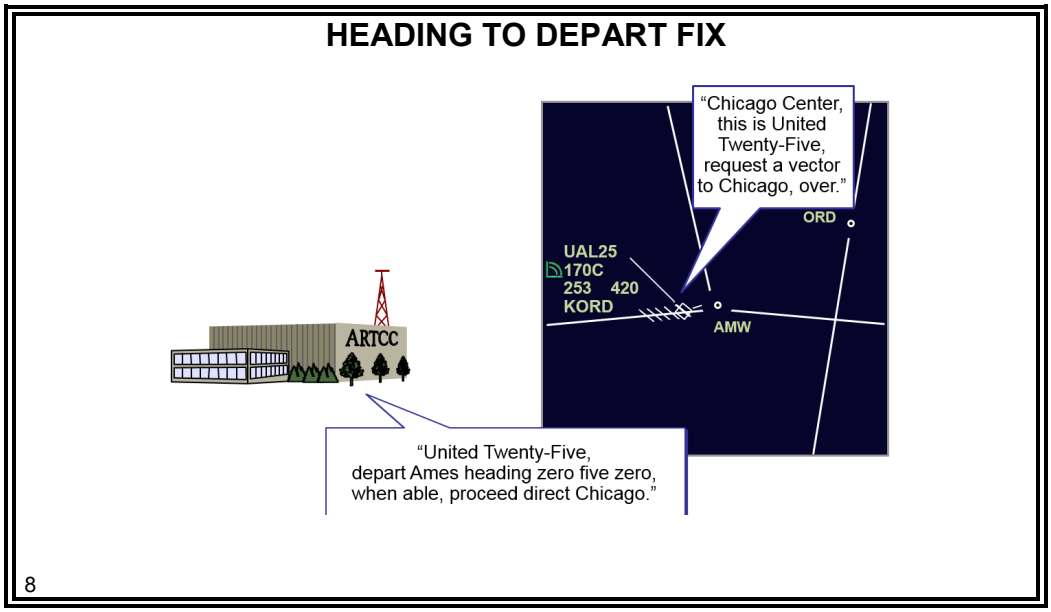
Items to Specify (Cont'd)
JO 7110.65, par. 5-6-2

Phraseology Examples



☞ ***NOTE:*** *Click twice to show dialogue.*

Phraseology Example



☞ ***NOTE:*** *Click twice to show dialogue.*

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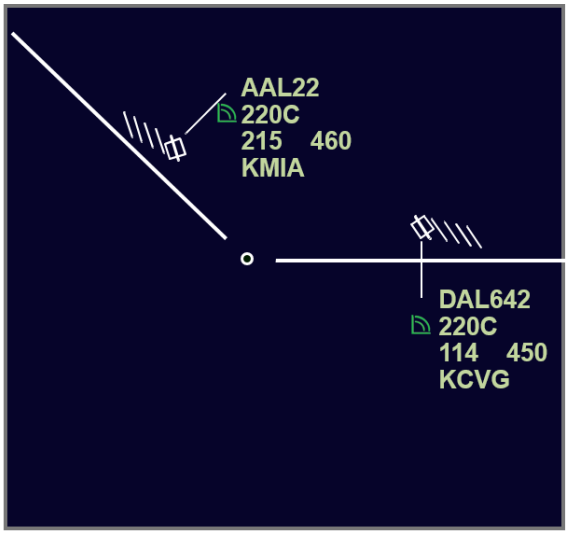
PROCEDURES *(Continued)*

Items to Specify (Cont'd)
JO 7110.65, par. 5-6-2

TURNING AN AIRCRAFT A SPECIFIED NUMBER OF DEGREES



✈ **Phraseology Example**

"American Twenty-Two, turn thirty degrees left, vector for traffic."

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- The number of degrees, in group form, to turn and direction of turn

⊙ When flight data processing is available

- Update the route of flight in the computer, unless:
  - Operational advantage is gained
  - Coordination is accomplished

Advising Pilots
JO 7110.65, par. 5-6-2

⊙ When initiating a vector, advise the pilot of the purpose.

⊙ Advise the pilot of what to expect when the vector is completed.

VECTORING TECHNIQUES

Issuing a Vector
JO 7110.65, par. 5-6-2

- Determine the appropriate heading based on these factors:
  - Wind
  - Weather
  - Traffic
  - Pilot requests
- If needed for spacing/separation, ensure an aircraft's heading by assigning it:
  - **Don't** assume an aircraft will continue on the same track without a heading assignment.

Good Controller Techniques

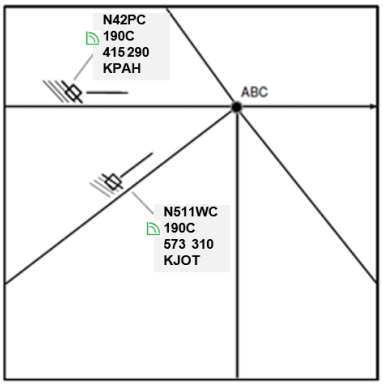
- Allow for increased compliance time and distance when aircraft is at:
  - Higher altitude
  - Greater airspeed
- Techniques
  - Utilize minimum heading changes
  - Turn slower aircraft behind faster aircraft if both are similar distances from converging points
- Consider these conditions to obtain desired track:
  - Effects of wind
  - Ground speed
  - Turning distance

VECTORING TECHNIQUES *(Continued)*

Knowledge Check

KNOWLEDGE CHECK

QUESTION: N42PC and N511WC are flying the same route after the ABC VORTAC. To provide longitudinal separation, which aircraft should be vectored behind the other? The winds at FL190 are 180080.



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☞ ***NOTE:*** *Click once to show answer.*

ANSWER: *N42PC should be vectored behind N511WC*

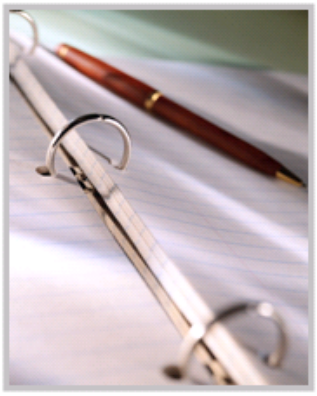
IN CONCLUSION

Lesson Review

LESSON REVIEW

The following topics were covered in this lesson:

- Vectoring
- General requirements
- Procedures
- Vectoring techniques



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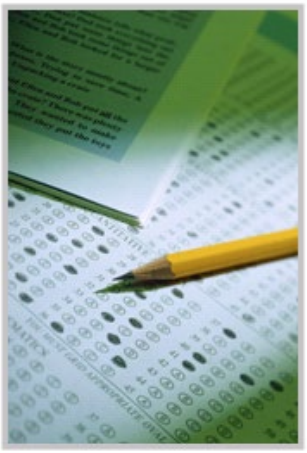
☞ ***NOTE:*** *Teach from graphic. Review and elaborate briefly on the points on the slide.*

End-of-Lesson Test

END-OF-LESSON TEST

Radar Vectoring



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