



**Federal Aviation  
Administration**

# **Initial En Route Qualification Training**

## **Lesson 37 Radar Vectoring**

**Course 50148001**

## LESSON PLAN DATA SHEET

<b>COURSE NAME:</b>	INITIAL EN ROUTE QUALIFICATION TRAINING
<b>COURSE NUMBER:</b>	50148001
<b>LESSON TITLE:</b>	RADAR VECTORING
<b>DURATION:</b>	1+30 HOURS
<b>DATE REVISED:</b>	2022-02
<b>VERSION:</b>	V.2022-02
<b>REFERENCE(S):</b>	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
<b>HANDOUT(S):</b>	NONE
<b>EXERCISE(S)/ ACTIVITY(S):</b>	NONE
<b>END-OF-LESSON TEST:</b>	YES
<b>PERFORMANCE TEST:</b>	NONE
<b>MATERIALS:</b>	NONE
<b>OTHER PERTINENT INFORMATION:</b>	NONE

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# INTRODUCTION

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## Initial En Route Qualification Training

### Lesson 37 Radar Vectoring

V.2022-02  
Presented by  
FAA Academy  
Air Traffic Division



Federal Aviation  
Administration



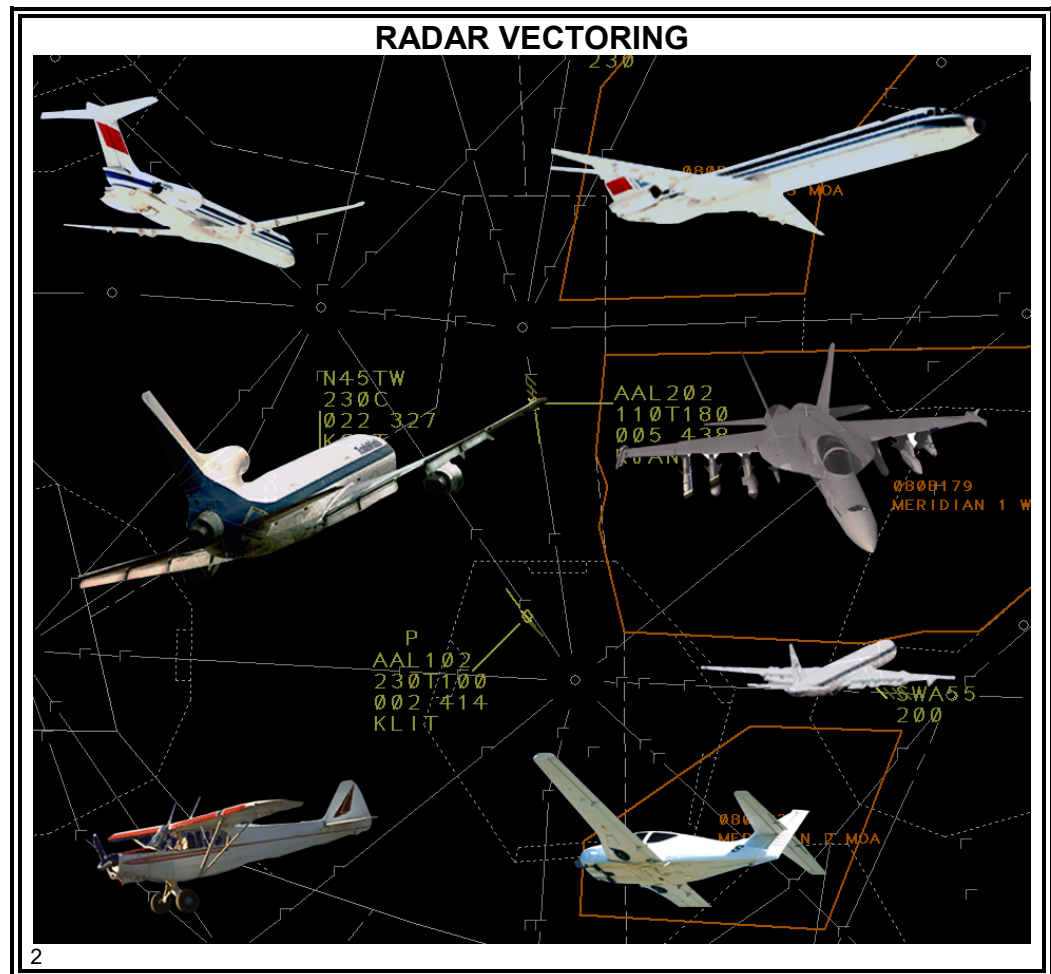
1

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.

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# INTRODUCTION *(Continued)*

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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.

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## **Purpose**

This lesson covers the reasons and methods for issuing vectors.

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# INTRODUCTION *(Continued)*

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## 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

3

# VECTORIZING

## Term

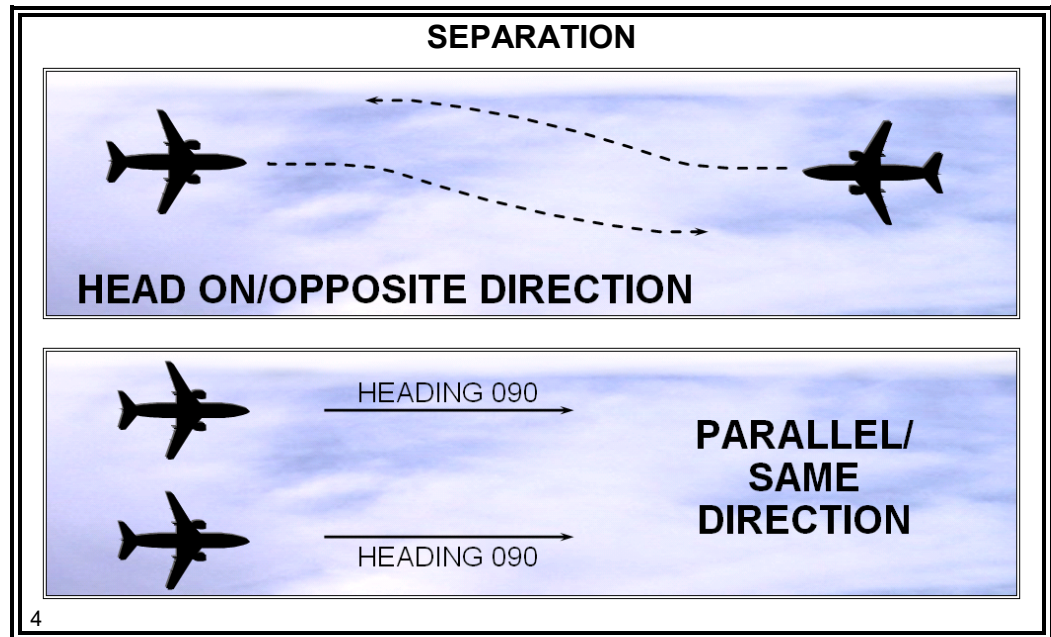
JO 7110.65,  
Pilot/Controller  
Glossary



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

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## 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.

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## Application

JO 7110.65,  
par. 5-6-1

- ⦿ Vector aircraft at or above the MVA or MIA.
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# GENERAL REQUIREMENTS *(Continued)*

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## 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
-



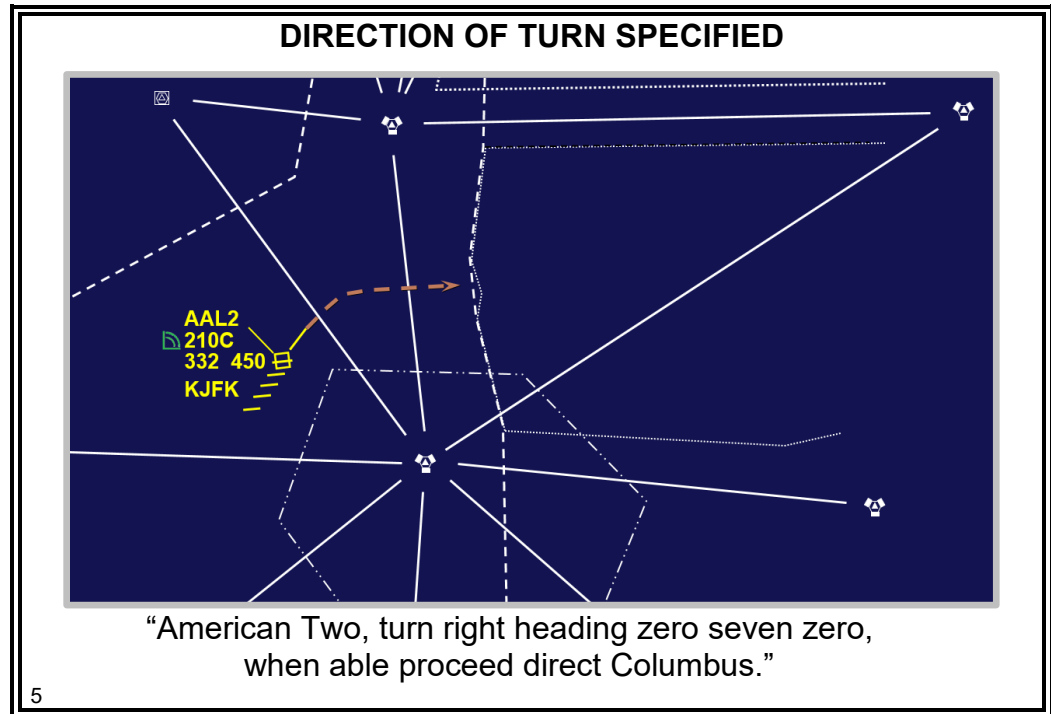
# PROCEDURES

## Items to Specify

JO 7110.65,  
par. 5-6-2



## Phraseology Example



- ⦿ Vector aircraft by specifying:
  - Direction of turn, if appropriate, and magnetic heading to be flown

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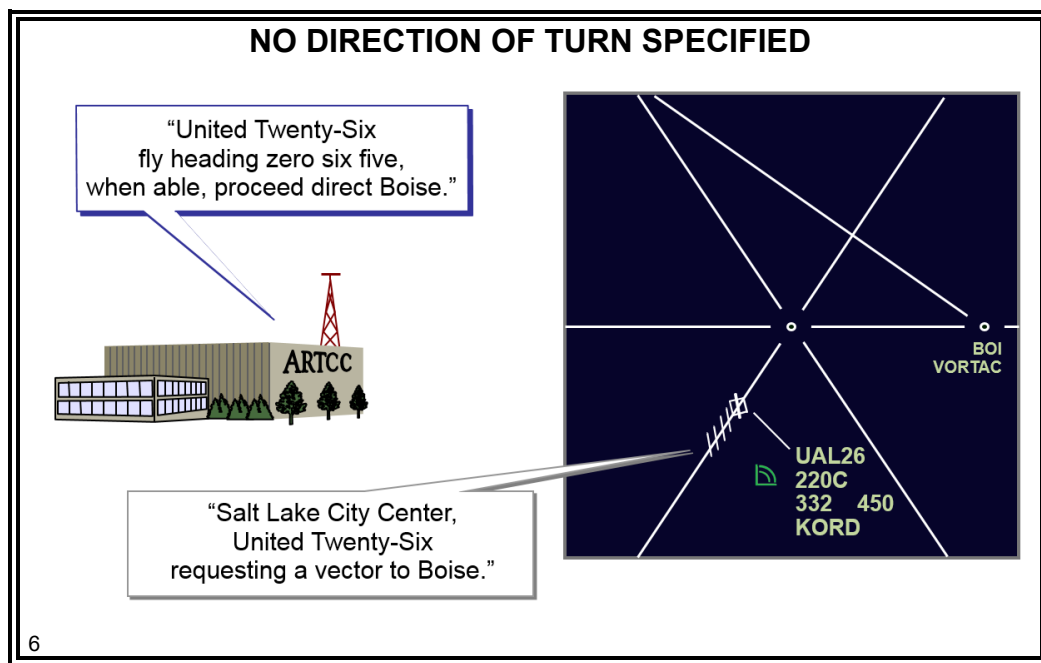
# PROCEDURES *(Continued)*

## Items to Specify (Cont'd)

JO 7110.65,  
par. 5-6-2



## Phraseology Example



*Continued on next page*

# PROCEDURES *(Continued)*

## Items to Specify (Cont'd)

JO 7110.65,  
par. 5-6-2



## Phraseology Examples

**ASSIGNING PRESENT HEADING**

"Chicago Center,  
American Three Twenty-Six  
unable to receive Joliet VORTAC."

ARTCC

"American Three Twenty-Six,  
fly present heading,  
when able proceed direct Joliet."

7



## Phraseology Example

**HEADING TO DEPART FIX**

"Chicago Center,  
this is United  
Twenty-Five,  
request a vector  
to Chicago, over."

ARTCC

"United Twenty-Five,  
depart Ames heading zero five zero,  
when able, proceed direct Chicago."

8

*Continued on next page*

## PROCEDURES *(Continued)*

### Items to Specify (Cont'd)

JO 7110.65,  
par. 5-6-2



### Phraseology Example

**TURNING AN AIRCRAFT A SPECIFIED NUMBER OF DEGREES**

AAL22  
220C  
215 460  
KMIA

DAL642  
220C  
114 450  
KCVG

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

9

- 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.

# VECTORIZING TECHNIQUES

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## 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

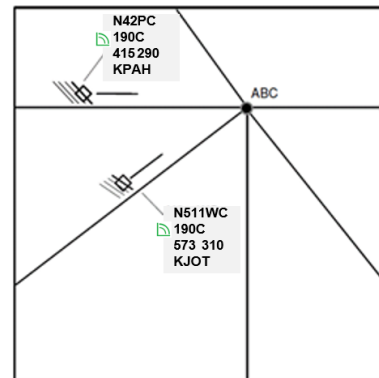
- ⊙ Allow for increased compliance time and distance when aircraft is at:
    - Higher altitude
    - Greater airspeed
  - ⊙ Techniques
    - Utilize minimum heading changes
    - Turn slower aircraft behind faster aircraft if both are similar distances from converging points
  - ⊙ Consider these conditions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

# VECTORIZING 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.



10

# IN CONCLUSION

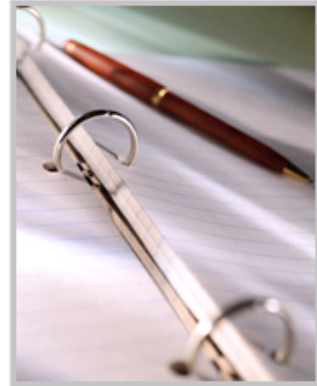
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## Lesson Review

### LESSON REVIEW

**The following topics were covered in this lesson:**

- Vectoring
- General requirements
- Procedures
- Vectoring techniques



11

## End-of- Lesson Test

### END-OF-LESSON TEST

**Radar  
Vectoring**



12