



**Federal Aviation
Administration**

55054003

EN ROUTE

RADAR ASSOCIATE

***CONTROLLER TRAINING PART C:
ADVANCED CONCEPTS***

Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

Version: 1.0 2022.08

INSTRUCTOR LESSON PLAN

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LESSON PLAN DATA SHEET

Course Name	En Route Radar Associate Controller Training Part C: Advanced Concepts
Course Number	55054003
Lesson Title	Radar Vectoring, Speed Adjustment, and Scanning for Radar-Associate Position
Duration	2 hours 45 minutes (includes lesson, , practice exercise, and ELT)
Version	1.0 2022.08
Reference(s)	JO 7110.65, Air Traffic Control; TI 6110.101, En Route Automation Modernization RA-Position User Manual; TI 6110.100, En Route Automation Modernization R-Position User Manual; JO 7210.3, Facility Operation and Administration; FAA-H-8083-25B, Pilot's Handbook of Aeronautical Knowledge; ERAM ATCHI MISC 230.05, ERAM Air Traffic Computer-Human Interface; 14 CFR 91.117, Aircraft speed; AC 61-107B, Aircraft Operations at Altitudes Above 25,000 Feet Mean Sea Level
Prerequisites	NONE
Handout(s)	☉ Practice Exercise: <i>HO01_L14 (Print prior to class)</i>
Exercise / Activity	☉ Practice Exercise: Scanning
Scenario	NONE
Assessments	☉ YES - Written (Refer to ELT01_L14, print prior to class)
Materials and Equipment	☉ Pencil and/or pen
Other Pertinent Information	☉ Ensure lesson materials are downloaded to the classroom computer ☉ This lesson is based on ERAM EAE410 ☉ The lesson has been reviewed and reflects current orders and manuals as of April 2022.



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

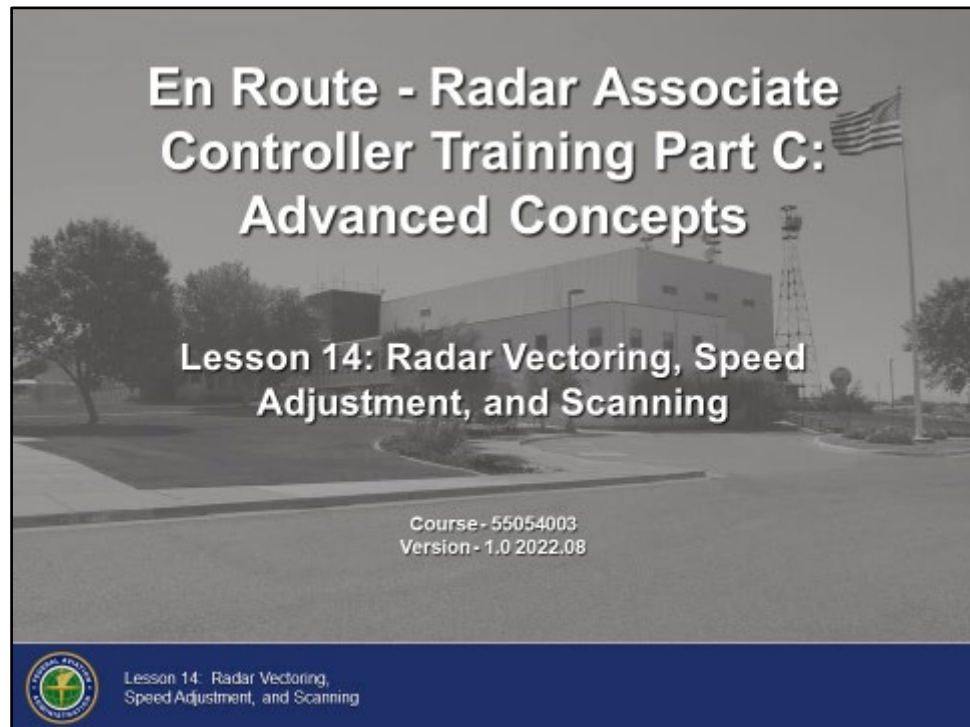
LESSON ICON LEGEND

	Description
	The Activity icon indicates an exercise, lab, or hands-on activity.
	The Discussion Question icon signals a discussion question to be asked to the students.
	The Handout icon indicates a handout is to be distributed to the students.
	The Instructor Note icon is in hidden text and indicates text that is for the instructor only.
	The Multimedia icon indicates a video or audio clip is in the presentation.
	The Phraseology icon indicates that phraseology is in the content.
	The WBT icon indicates a component of web-based training.
	The Click icon indicates a PPT slide with click-based functionality to present additional information.
	The Definition icon indicates a published definition.

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LESSON INTRODUCTION

Overview



As a Radar Associate Controller, you will be required to make control decisions to accomplish your duties. Vectoring, speed adjustment, and scanning are skills that benefit both the pilot and the sector team, resulting in a safe, orderly, and expeditious flow of air traffic.

In this lesson, you will learn the reasons, methods, and phraseology for issuing vectors and speed adjustments. You will also learn techniques for scanning the Situation Display and EDST.


LESSON INTRODUCTION (CONT'D)

Lesson Objectives

Lesson Objectives

At the end of this lesson, you will be able to identify procedures for:

- Vectoring
- Speed adjustment
- Scanning



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Review the lesson objectives.

☉ At the end of this lesson, you will be able to identify procedures for:

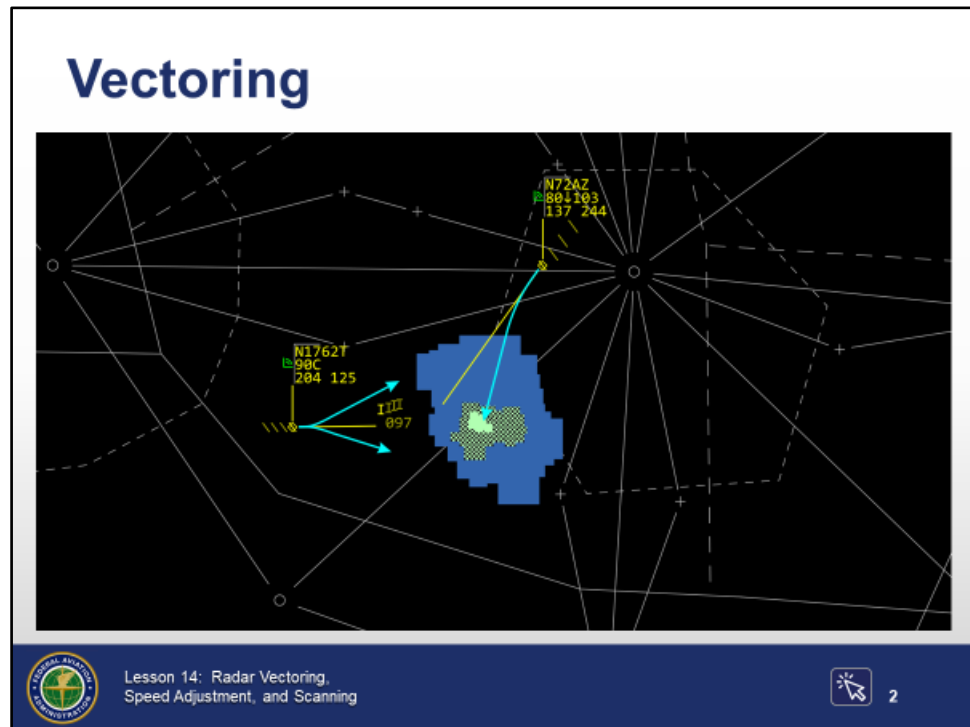
- Vectoring
- Speed adjustment
- Scanning

NOTE: There will be a graded end-of-lesson test upon completion of the lesson. The passing score is 70%. If you do not achieve a score of 70%, you will be provided study time and one retake of an alternate end-of-lesson test.

VECTORIZING

Vectoring

JO 7110.65,
pars. 5-6-1, 5-6-
2, PCG



Slide is animated, 3 clicks. Click where indicated by click icons.



VECTOR - A heading issued to an aircraft to provide navigational guidance by radar.



STANDARD RATE TURN - A turn of 3 degrees per second.

NOTE: Rate of turn at higher altitudes may be lower.

⦿ Vectors may be initiated by ATC or requested by the pilot for:

- Separation



Click to show left turn for N72AZ.

Example: Conflicting traffic

Continued on next page

VECTORIZING (CONT'D)

Vectoring (Cont'd)

JO 7110.65,
pars. 4-4-4, 5-6-
1, 5-6-2, PCG

JO 7210.3, par.
2-1-2

- Safety



Click to show right turn for N1762T away from MCI traffic.

Examples: Uncontrolled traffic



Click to show left turn for N1762T around WX.

Weather

Terrain

- Noise abatement
 - Guidance is contained in Standard Operating Procedures (SOP) or other facility directives
- Operational advantage
 - Maneuvers that benefit sector traffic
 - Comply with Traffic Management Initiatives (TMI)
- Navigation
 - When any part of an airway or route is unusable because of NAVAID status, clear aircraft that are not RNAV capable via radar vectors
- Confidence maneuver



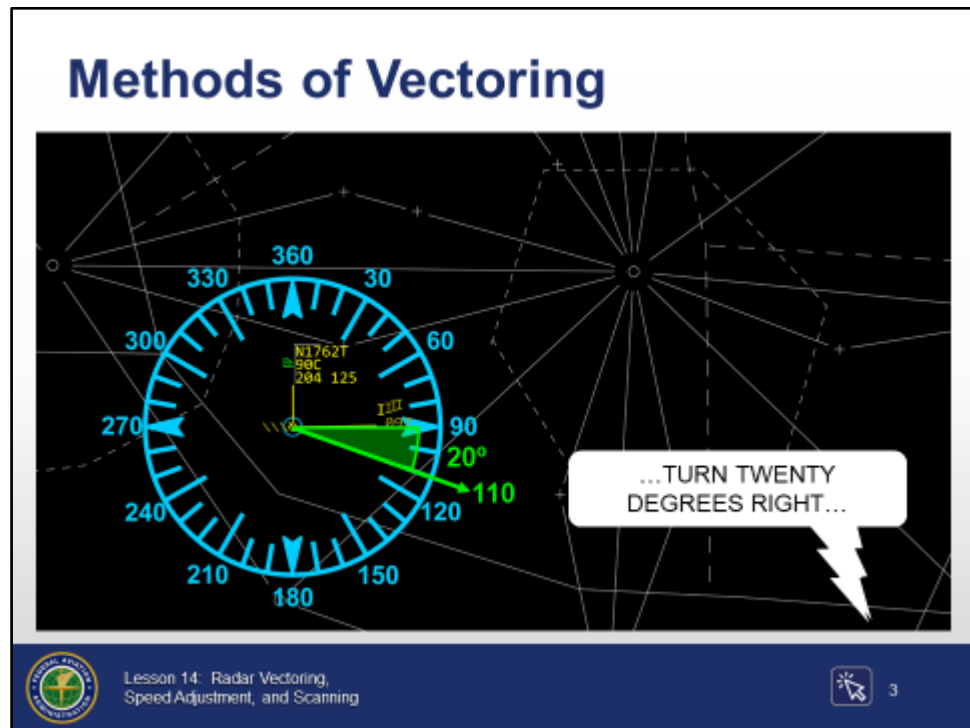
CONFIDENCE MANEUVER - One or more turns, a climb or descent, or other maneuver to determine if the pilot in command is able to receive and comply with ATC instructions.

- Pilot request
-

VECTORIZING (CONT'D)

Methods for Vectoring

JO 7110.65, par.
5-6-2



Slide is animated, 2 clicks. Click where indicated by click icons.

⦿ Vector aircraft by specifying one of the following:



Click to show heading 110.



Discuss how radar displays are oriented to true north and aircraft will fly a magnetic heading.

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



TURN LEFT/RIGHT HEADING (degrees)

FLY HEADING (degrees)

FLY PRESENT HEADING

DEPART (fix) HEADING (degrees)

Example: "...TURN RIGHT, HEADING ONE ONE ZERO..."



Click to show 20 degree turn to the right.

Continued on next page

VECTERING (CONT'D)

Methods for Vectoring (Cont'd)

JO 7110.65,
pars. 5-6-2, 5-
10-3, PCG

FAA-H-8083-
25B, p. G-14

- Number of degrees, in group form, to turn and the direction of turn



TURN (number of degrees) DEGREES LEFT/RIGHT

Example: "... TURN TWENTY DEGREES RIGHT..."

NOTE: When you issue a specific heading like ZERO EIGHT ZERO, the direction comes first. When issuing a number of degrees like THIRTY DEGREES, the direction of turn comes after the number of degrees.

- For NO-GYRO procedures, the type of vector, direction of turn, and when to stop turn
 - NO-GYRO vector is given to a pilot who has lost their directional gyro



DIRECTIONAL GYRO (DG) - A mechanical instrument that displays heading based on a 360° azimuth. The heading indicator is not affected by the forces that make the magnetic compass difficult to interpret.

- When issued a NO-GYRO vector, the pilot will make a standard rate turn
 - Optionally, the pilot may be instructed to make a half standard rate turn to allow finer adjustments
- ⊙ When initiating a vector, advise the pilot of:
- The purpose
 - If appropriate, what to expect when radar navigational guidance is terminated
- ⊙ Provide radar navigational guidance until the aircraft is:
- Established within the airspace to be protected for the route to be flown, or
 - On a heading that will, within a reasonable distance, intercept the route to be flown, and informed of its position unless the aircraft is RNAV, FMS, or DME equipped and being vectored toward a VORTAC/TACAN or waypoint and within the service volume of the NAVAID

Continued on next page

VECTORING (CONT'D)

Methods for Vectoring (Cont'd)

JO 7110.65, par.
5-6-2

- ⦿ Aircraft may not be vectored off an Obstacle Departure Procedure (ODP), or issued an altitude lower than published altitude on an ODP, until at or above the MVA/MIA, at which time the ODP is canceled and may not be resumed
 - ⦿ Aircraft vectored off an RNAV route must be recleared to the next waypoint or as requested by the pilot
 - ⦿ Update the route of flight in the computer unless an operational advantage is gained and coordination is accomplished
 - ⦿ Inform the pilot when a vector will take the aircraft across a previously assigned nonradar route
-

VECTERING (CONT'D)

Knowledge Check

Knowledge Check

What is a standard rate turn?

- A. 2 degrees per second
- B. 3 degrees per second
- C. 5 degrees per second



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning



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Question: What is a standard rate turn?



Answer: B. 3 degrees per second


VECTORIZING (CONT'D)

Knowledge Check


Knowledge Check

What information should be included when issuing a vector?

- A. Purpose
- B. Duration of the vector
- C. Altimeter



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Question: What information should be included when issuing a vector?



Answer: A. Purpose

VECTURING (CONT'D)


Knowledge Check

Knowledge Check


Can you vector for noise abatement?

A. Yes

B. No



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning

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Question: Can you vector for noise abatement?

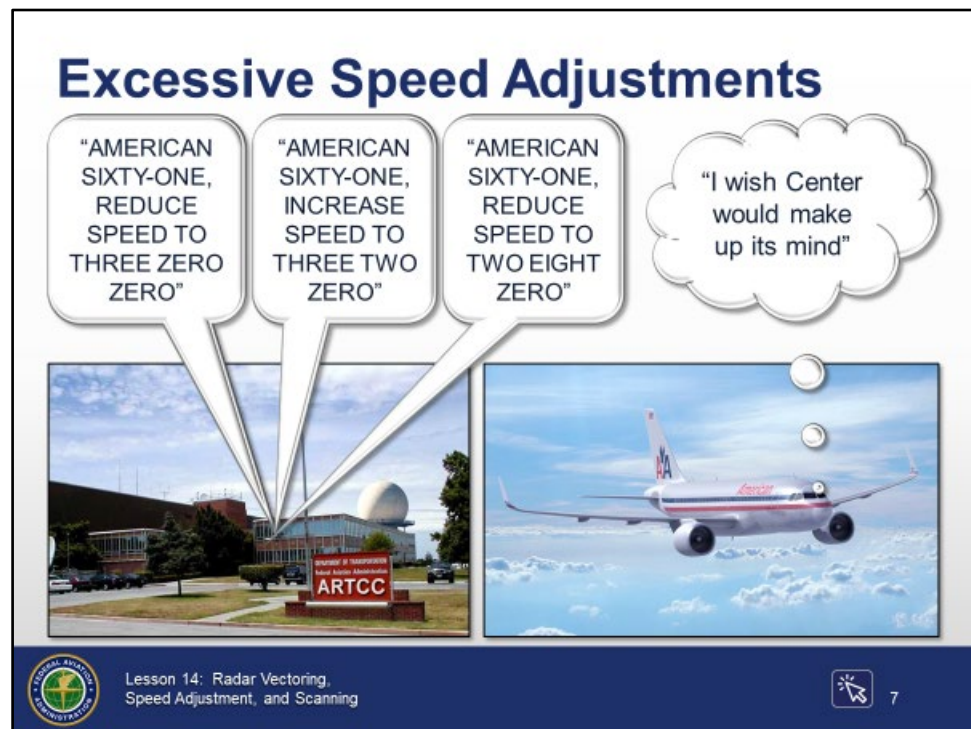


Answer: A. Yes

SPEED ADJUSTMENT PROCEDURES

Excessive Speed Adjustments

JO 7110.65, par. 5-7-1



Slide is animated, 2 clicks. Click where indicated by click icons.

Examples:

"AMERICAN SIXTY-ONE, REDUCE SPEED TO THREE ZERO ZERO"



Click to show 2nd speed clearance.

"AMERICAN SIXTY-ONE, INCREASE SPEED TO THREE TWO ZERO"



Click to show 3rd speed clearance.

"AMERICAN SIXTY-ONE, REDUCE SPEED TO TWO EIGHT ZERO"



Emphasize that pilot confusion can result from multiple, conflicting speed assignments.

- ⦿ Keep speed adjustments to the minimum necessary to achieve or maintain:
 - Required spacing
 - Desired spacing
- ⦿ Avoid adjustments requiring alternate increases and decreases

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SPEED ADJUSTMENT PROCEDURES (CONT'D)

Excessive Speed Adjustments (Cont'd)

JO 7110.65,
par. 5-7-1

- ⦿ Terminate speed adjustments when no longer needed

NOTE: It is the pilot's responsibility and prerogative to refuse speed adjustment that he/she considers to be excessive or contrary to aircraft operating specifications.

- ⦿ Determine the number of miles needed for spacing and the point at which spacing needs to be accomplished
 - ⦿ Implement speed adjustment based on the following principles:
 - Priority of speed adjustment instructions is determined by:
 - Relative speed and position of aircraft involved
 - Spacing requirement
 - Time and distance required to accomplish speed adjustment is determined by aircraft:
 - Configuration
 - Altitude
 - Speed
-

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Techniques

JO 7110.65, par.
5-7-1

The slide is titled "Techniques" in large blue font. On the left, there is a photograph of the ARTCC (Air Traffic Control Center) building with a sign that reads "ARTCC". Three white callout boxes with black text point from the building to the right. The first box says "FEDEX FIFTY, INCREASE SPEED TO THREE ZERO ZERO". The second box says "AMERICAN TWELVE, MAINTAIN THREE ZERO ZERO KNOTS". The third box says "DELTA TEN, DO NOT EXCEED THREE ZERO ZERO KNOTS". To the right of each callout box is a corresponding image of an aircraft: a FedEx plane, an American Airlines plane, and a Delta plane. At the bottom left is the Federal Aviation Administration logo. At the bottom center, it says "Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning". At the bottom right is a small icon of a hand pointing to a screen and the number 8.



Slide is animated, 2 clicks. Click where indicated by click icons.

- ⦿ Compensate for compression by using one of the following techniques:

- Increase leading aircraft first

Example: "FEDEX FIFTY, INCREASE SPEED TO THREE ZERO ZERO"

- Reduce trailing aircraft first



Click to show 2nd speed clearance.

Example: "DELTA TEN, DO NOT EXCEED THREE ZERO ZERO KNOTS"

- ⦿ Assign a specific airspeed if required to maintain spacing



Click to show 3rd speed clearance.

Example: "AMERICAN TWELVE, MAINTAIN THREE ZERO ZERO KNOTS"

- ⦿ Speed adjustments are not achieved instantaneously

Continued on next page

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Techniques (Cont'd)

JO 7110.65, par.
5-7-1

- ⦿ Allow increased time and distance to achieve speed adjustments in the following situations:

- Higher altitudes



Explain that at higher altitudes, the air is thinner and provides less friction.

- Greater speed
- Clean configuration

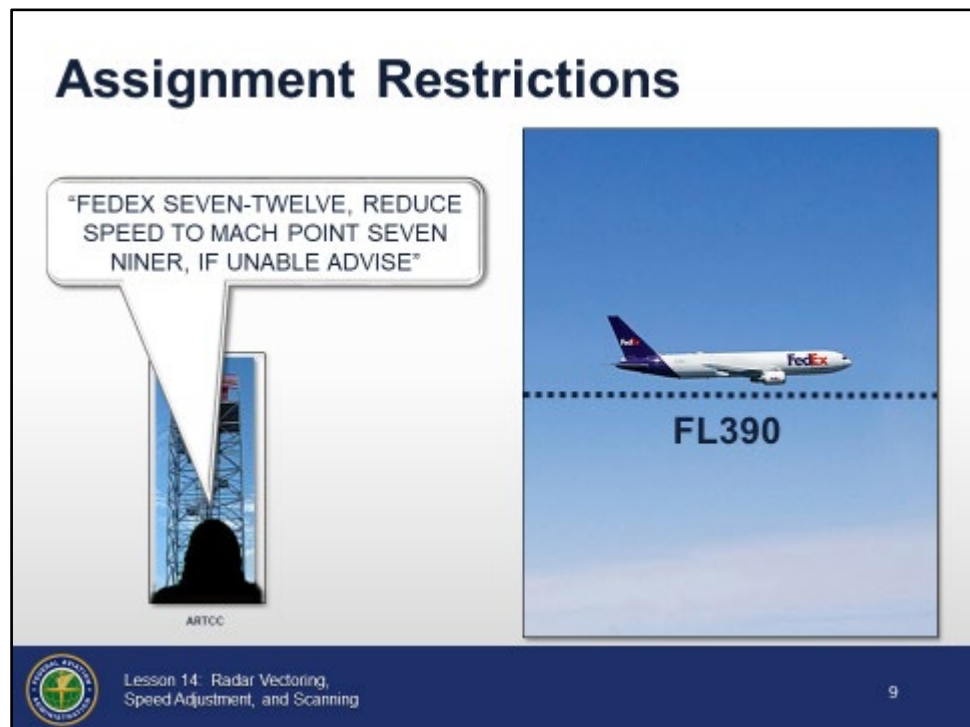
NOTE: A clean configuration is flaps and landing gear up.

- ⦿ Allow aircraft to operate in clean configuration as long as circumstances permit
 - ⦿ Keep number of speed adjustments per aircraft to the minimum required to achieve and maintain spacing
-

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Assignment Restrictions

JO 7110.65, par. 5-7-1



⦿ Do not assign speed adjustment to aircraft:

- At or above FL390, without pilot consent

Example: "FEDEX SEVEN-TWELVE, REDUCE SPEED TO MACH POINT SEVEN NINER, IF UNABLE ADVISE"

- Executing a published high altitude instrument approach procedure
- In a holding pattern
- Inside the final approach fix on final, or a point 5 miles from the runway, whichever is closer to the runway

NOTE: Large, heavy and super aircraft at high altitudes have very narrow cruise or airspeed margins. Some weight/altitude/airspeed combinations are impossible to achieve.


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Issuing Speed Adjustment - Terms

JO 7110.65, par. 5-7-1

Issuing Speed Adjustments - Terms

- **Knots**
 - Based on indicated airspeed (IAS)
 - Expressed in increments of 5
- **Mach numbers**
 - May be used at or above FL240
 - For turbojet aircraft with Mach meters
 - Expressed in increments of .01



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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- ⊙ Knots
 - Based on indicated airspeed (IAS)
 - Expressed in increments of 5
 - CPDLC increments are 10 for crossing restrictions
- ⊙ Mach numbers
 - May be used at or above FL240
 - For turbojet aircraft with Mach meters
 - Expressed in increments of .01
 - Examples:** Mach .69, .71, .75, .82, etc.
 - NOTE:** Although Mach numbers may be used at or above FL240, they are typically used at or above FL290.
- ⊙ Pilot must maintain speed within plus or minus 10 knots or .02 Mach number of the specified speed
- ⊙ Consider that ground speed may vary with altitude when assigning speeds to achieve spacing between aircraft at different altitudes
 - Further adjustments may be necessary to achieve desired spacing


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

Speed adjustments are based on what value?

- A. True airspeed
- B. Ground speed
- C. Indicated airspeed



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Question: Speed adjustments are based on what value?



Answer: C. Indicated airspeed


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

What increments, in knots, are speed adjustments expressed?

- A. 5
- B. 10
- C. 15



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Question: What increments, in knots, are speed adjustments expressed?



Answer: A. 5

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check

Knowledge Check

What is the range in knots (+/-) that pilots must maintain when complying with speed adjustments?

- A. 5
- B. 10
- C. 25



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Question: What is the range in knots (+/-) that pilots must maintain when complying with speed adjustments?



Answer: B. 10

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Airspeed and Mach



- ⦿ Every aircraft in flight has a true airspeed (TAS), an indicated airspeed (IAS), and a Mach number (M)
 - The relationship between the three is not always obvious
 - It is important that you gain an understanding of how they differ and when they are to be used


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Definitions

JO 7110.65 par.
5-7-1, PCG

Definitions

- **Airspeed**
- **Indicated Airspeed (IAS)**
- **True Airspeed (TAS)**
- **Mach Number**
- **Ground Speed (GS)**



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AIRSPEED - The speed of an aircraft relative to its surrounding air mass. The unqualified term airspeed means one of the following: true airspeed (TAS) or indicated airspeed (IAS).



INDICATED AIRSPEED (IAS) - Speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term airspeed.



TRUE AIRSPEED (TAS) - Speed of an aircraft relative to undisturbed air. Used primarily in flight planning and in the en route portion of flight. When used in pilot/controller communications, it is referred to as true airspeed and not shortened to airspeed. TAS is IAS corrected for air density and instrument and position errors (Calibrated Airspeed).



MACH NUMBER - The ratio of true airspeed to the speed of sound, e.g., MACH .82, MACH 1.6.

NOTE: At or above FL240, speeds may be expressed in terms of Mach numbers.



GROUND SPEED (GS) - Speed of an aircraft relative to the surface of the earth. It is the result of true airspeed affected by winds. $TAS \pm \text{wind speed} = GS$.


SPEED ADJUSTMENT PROCEDURES (CONT'D)

What is Mach?

FAA-H-8083-25B, pp. 5-44, 5-45

Mach 1.0 = Speed of Sound

- **Mach is the speed an aircraft moves in relation to the speed of sound**
 - The speed of sound is M1.0
 - Aircraft traveling at 80% of the speed of sound are maintaining M.80
 - Aircraft traveling at 75% of the speed of sound are maintaining M.75



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⊙ Mach is the speed an aircraft moves in relation to the speed of sound

- The speed of sound is M1.0

Examples: Aircraft traveling at 80% of the speed of sound are maintaining M.80.

Aircraft traveling at 75% of the speed of sound are maintaining M.75.

- The speed of sound is a complex formula taking into account:
 - Density of the atmosphere
 - Temperature
 - Other factors

SPEED ADJUSTMENT PROCEDURES (CONT'D)

What is Mach? (Cont'd)

FAA-H-8083-25B, pp. 5-44, 5-45

AC 61-107B, par. 3-2

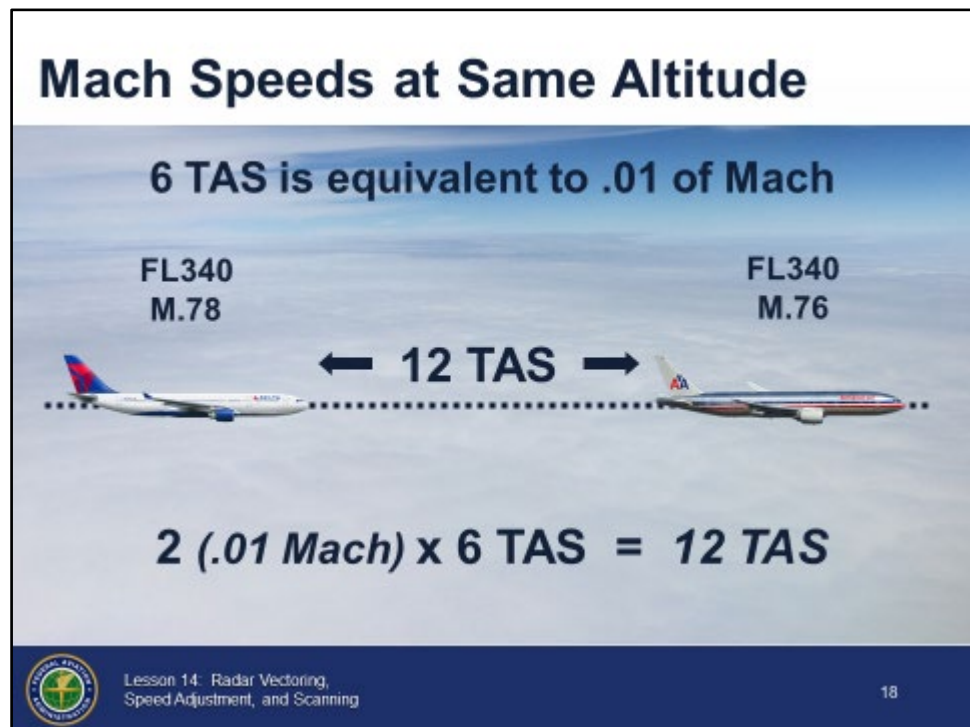


- ⦿ For ATC purposes, you can think of the speed of sound as a function of temperature, with colder temperatures equating to slower speeds
- ⦿ At sea level, the standard temperature is 59 degrees Fahrenheit while at FL360, the standard temperature is -69.7 degrees Fahrenheit
- ⦿ Therefore, at a constant Mach number, the higher an aircraft climbs, the slower its TAS
- ⦿ Conversely, at a constant Mach number, the lower an aircraft descends, the faster its TAS
- ⦿ At and above FL360, the temperature remains virtually the same, so the speed of sound does not vary above FL360
 - Therefore, at FL360 or above, aircraft at different altitudes but assigned the same Mach number will have the same true airspeed

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Guidance for Assigning Mach

FAA-H-8083-25B, pp. 5-44, 5-45



- ⊙ 6 TAS is equivalent to .01 of Mach

Example: If an aircraft at FL340 is maintaining M.78 and another aircraft at FL340 is maintaining M.76, there will be a 12 TAS difference between the two aircraft. A difference of M.02, 6 TAS per M.01, results in 12 TAS difference.

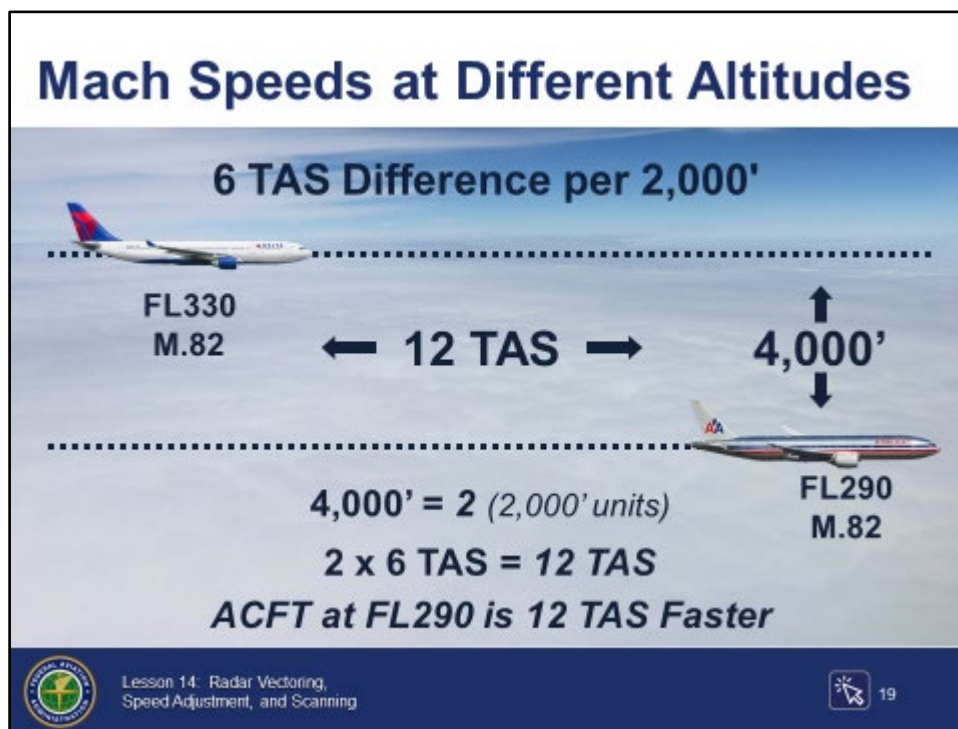
$$2 (.01 \text{ Mach}) \times 6 \text{ TAS} = 12 \text{ TAS}$$

NOTE: All examples assume a no wind situation; therefore, a difference of 12 TAS will equate to a 12 knot difference in ground speed.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Guidance for Assigning Mach (Cont'd)

FAA-H-8083-25B, pp. 5-44, 5-45



Slide is animated, 1 click. Click where indicated by click icon.

- 6 TAS difference for every 2,000' of altitude

Example: An aircraft is at FL330 is assigned M.82 while another aircraft is at FL290 is assigned M.82

Since higher is slower, and the aircraft at FL330 is 4,000' higher than the aircraft at FL290, there will be an equivalent of M.02 in speed difference, or 12 TAS



Click to show speed calculation.

$$4,000' = 2 (2,000' \text{ units})$$

$$2 \times 6 \text{ TAS} = 12 \text{ TAS}$$

The aircraft at FL290 will be moving 12 TAS faster than the aircraft at FL330

NOTE: In the above example increasing the higher aircraft by M.02, or reducing the lower aircraft M.02 will match true airspeeds.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Guidance for Assigning Mach (Cont'd)

FAA-H-8083-25B, p. 5-45



Slide is animated, 1 click. Click where indicated by click icon.

- ⦿ Assigning Mach at or above FL240 stems from pilot instrumentation and aircraft operating envelopes
- ⦿ At lower altitudes, speed limitations are expressed in IAS
- ⦿ The pilot will transition from measuring the aircraft's speed in IAS to Mach number at some point
 - Does not imply that IAS cannot be used at higher altitudes, but that aircraft instrumentation favors the use of Mach numbers at higher altitudes



Click to enlarge airspeed/Mach limit.

NOTE: Aircraft have an upper Mach limit. As altitude increases and the speed of sound decreases, the Mach limit approaches the stall speed of the airframe. This means that the aircraft cannot fly faster because of the Mach limit or fly slower because of the stall speed. The Mach limit is indicated to the pilots by a red-and-white indicator referred to as the barber pole.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check

Knowledge Check

What does M.80 mean?

- A. Minimum speed of 80 knots
- B. Aircraft speed is 8 times the speed of sound
- C. Aircraft speed is 80% the speed of sound



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning



Question: What does M.80 mean?



Answer: C. Aircraft speed is 80% the speed of sound


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

At or above FL360 at a given Mach number, what happens to TAS?

- A. Remains the same
- B. Increases
- C. Decreases



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Question: At or above FL360 at a given Mach number, what happens to TAS?



Answer: A. Remains the same


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

Mach numbers are adjusted in increments of ____.

- A. M.01
- B. M.10
- C. M1.0



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Question: Mach numbers are adjusted in increments of ____.



Answer: A. M.01

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check

Knowledge Check

Given a no wind situation, if an aircraft at FL350 is maintaining M.79, what Mach number would be assigned to an aircraft at FL330 to maintain the same TAS?

- A. M.78
- B. M.79
- C. M.81



Lesson 14: Radar Vectoring,
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Question: Given a no wind situation, if an aircraft at FL350 is maintaining M.79, what Mach number would be assigned to an aircraft at FL330 to maintain the same TAS?



Answer: A. M.78

SPEED ADJUSTMENT PROCEDURES (CONT'D)

What is IAS?

JO 7110.65,
PCG



- ⦿ Indicated airspeed is the airspeed shown on the aircraft airspeed indicator
 - This is the speed used in pilot/controller communications under the general term “airspeed”
 - Airspeed is the speed of an aircraft relative to its surrounding air mass



The Mach limit on this airspeed indicator is the segmented arc to the left of “.75” on the display.

SPEED ADJUSTMENT PROCEDURES (CONT'D)


Relationship of IAS to TAS

AC 61-107B,
par. 2-10

Relationship of IAS to TAS

- With constant indicated airspeed, true airspeed increases about 2% per 1,000' of increase in altitude

Altitude	Knots IAS	Approximate Knots TAS
FL300	10	16
FL250	10	15
FL200	10	14
15,000'	10	13
10,000'	10	12
5,000'	10	11
1,000'	10	10
0'	10	10



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- ⦿ With constant indicated airspeed, true airspeed increases about 2% per 1,000' of increase in altitude
- ⦿ Due to low air density at higher altitudes, the airspeed indicator reads less than the actual speed of the aircraft
- ⦿ At sea level, there is virtually no difference between IAS and TAS
- ⦿ If an aircraft in a descent is assigned a constant IAS, the TAS of the aircraft will decrease as altitude is lost

Examples: At FL300, a 10 IAS adjustment results in a 16 TAS change.

At 1,000', the same 10 IAS results in a 10 TAS change.

NOTE: TAS without a wind speed component = ground speed.

NOTE: Aircraft in trail assigned the same airspeed and in a descent, i.e., an arrival stream, will slow as they descend, causing compression.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Guidance for IAS Use

AC 61-107B,
par. 2-10

5 - 7 Knots TAS for Every 1,000'

FL240

If both aircraft are assigned 250 IAS, the aircraft at FL240 will be 24 TAS faster.

$24,000' - 20,000' = 4,000'$

6 TAS for Every 1,000'

6 KTS \times 4 = 24 TAS

FL200

Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Slide is animated, 1 click. Click where indicated by click icon.

- ⦿ For IAS assignment, assume 5-7 knots TAS variance for every 1,000' of altitude change above FL200

NOTE: For the calculations in this lesson, 6 TAS will be used.

Example: Aircraft at FL240 assigned 250 IAS will be traveling 24 TAS faster than aircraft assigned 250 IAS at FL200.



Click to show altitude formula.

$$24,000' - 20,000' = 4,000'$$

$$6 \text{ TAS for every } 1,000'$$

$$6 \text{ TAS} \times 4 = 24 \text{ TAS}$$

NOTE: As an aircraft gets closer to mean sea level (MSL), less variance in TAS will be seen for every thousand feet of altitude difference. Below 10,000' the variance is so slight that you can typically expect no change.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check

Knowledge Check

If aircraft at FL190 and 15,000' are assigned 250 IAS, which will have a faster TAS?

- A. Both aircraft will have similar TAS
- B. Aircraft at 15,000'
- C. Aircraft at FL190



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Question: If aircraft at FL190 and 15,000' are assigned 250 IAS, which will have a faster TAS?



Answer: C. Aircraft at FL190


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

What happens to the TAS of an aircraft that descends at a constant IAS?

- A. Increases
- B. Decreases
- C. Remains the same



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Question: What happens to the TAS of an aircraft that descends at a constant IAS?



Answer: B. Decreases

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Minima Below 10,000'

JO 7110.65,
pars. 3-1-11,
Note, 5-7-2,
Note

14 CFR 91.117



- ⦿ Speed in excess of 250 knots below 10,000' within domestic airspace is prohibited, unless otherwise authorized by the FAA administrator

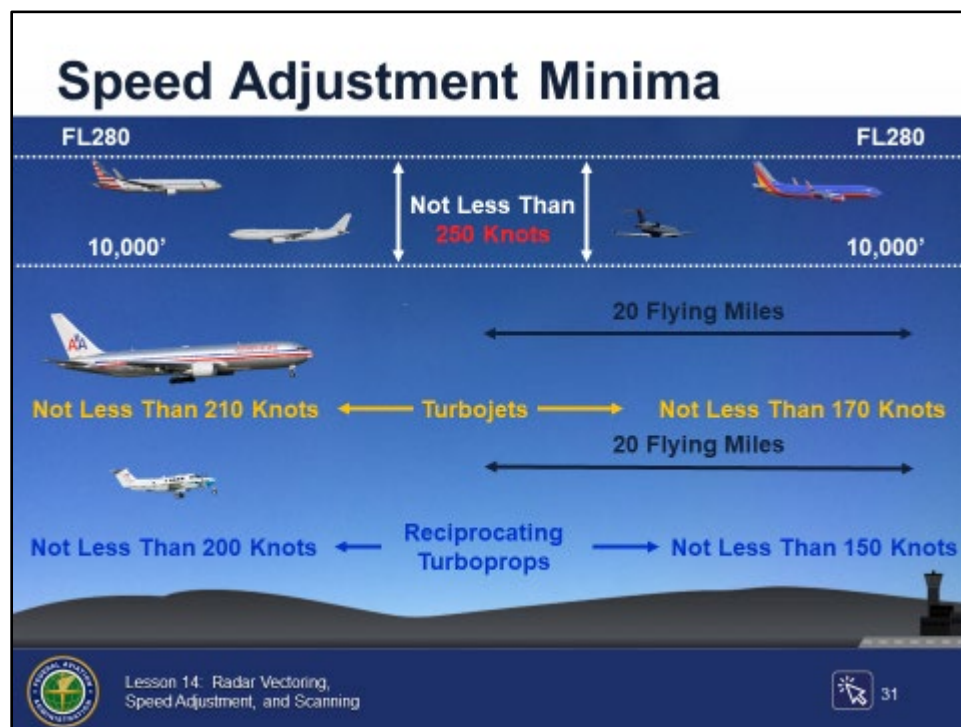
NOTE: Speed in excess of 250 knots is allowed when required or recommended in the airplane flight manual or when required by military operating procedures.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Speed Adjustment Minima

JO 7110.65, par. 5-7-3

14 CFR Part 1



Slide is animated, 4 clicks. Click where indicated by click icons.

- ⦿ When assigning airspeeds, use the following minima:
 - To aircraft operating between FL280 and 10,000', a speed not less than 250 knots or the equivalent Mach number
 - A pilot will advise if unable to comply with the speed assignment
- NOTE:** On a standard day, the Mach numbers equivalent to 250 knots calibrated airspeed (subject to minor variations) are:
- FL240 - 0.6
 - FL250 - 0.61
 - FL260 - 0.62
 - FL270 - 0.64
 - FL280 - 0.65
 - FL290 - 0.66

Continued on next page

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Speed Adjustment Minima (Cont'd)

JO 7110.65, par. 5-7-3

- ⦿ When an operational advantage will be realized, speeds lower than the recommended minima may be applied



Click to show turbojet speed more than 20 miles.

- ⦿ Turbojet arrival aircraft operating below 10,000':
 - More than 20 flying miles from the runway threshold
 - Not less than 210 knots



Click to show turbojet speed within 20 miles.

- Within 20 flying miles of the runway threshold
 - Not less than 170 knots



Click to show reciprocating/turboprop speed more than 20 miles.

- ⦿ Reciprocating and turboprop arrival aircraft below 10,000':
 - More than 20 flying miles from the runway threshold
 - Not less than 200 knots



Click to show reciprocating/turboprop speed within 20 miles.

- Within 20 flying miles of runway threshold
 - Not less than 150 knots
-

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Speed Minima, Departures

JO 7110.65, par. 5-7-3

Speed Minima, Departures

Departing:	Not Less Than:
Turbojet aircraft	230 Knots
Reciprocating and turboprop aircraft	150 Knots
Helicopter	60 Knots

Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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- ⦿ Minima for departures
 - Turbojet aircraft:
 - Not less than 230 knots
 - Reciprocating and turboprop aircraft:
 - Not less than 150 knots
 - Helicopters:
 - Not less than 60 knots


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

What is the minimum speed, in knots, that may be assigned to a departing turbojet aircraft?

- A. 210
- B. 230
- C. 250



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Question: What is the minimum speed, in knots, that may be assigned to a departing turbojet aircraft?



Answer: B. 230


SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check


Knowledge Check

What is the minimum speed, in knots, that may be assigned to an aircraft between 10,000' and FL280?

- A. 200
- B. 230
- C. 250



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Question: What is the minimum speed in knots that may be assigned to an aircraft between 10,000' and FL280?



Answer: C. 250

SPEED ADJUSTMENT PROCEDURES (CONT'D)


Knowledge Check

Knowledge Check


Can you assign an aircraft 270 knots below 10,000'?

A. Yes

B. No



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Question: Can you assign an aircraft 270 knots below 10,000'?




Answer: B. No

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Speed Phraseology

JO 7110.65, par.
2-4-17

Speed Phraseology	
Speed	Phraseology Example
250 Knots	"TWO FIVE ZERO KNOTS"
180 Knots	"ONE EIGHT ZERO KNOTS"
150 Knots	"ONE FIVE ZERO KNOTS"
Mach	Phraseology Example
1.5	"MACH ONE POINT FIVE"
0.64	"MACH POINT SIX FOUR"
0.82	"MACH POINT EIGHT TWO"

 Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning 36

☉ State speeds as follows:

- The separate digits of the speed, followed by the word KNOTS, where applicable, or
- The separate digits of the Mach number preceded by Mach

Examples: 250 Knots - "TWO FIVE ZERO KNOTS"

180 Knots - "ONE EIGHT ZERO KNOTS"

150 Knots - "ONE FIVE ZERO KNOTS"

Mach 1.5 - "MACH ONE POINT FIVE"

Mach 0.64 - "MACH POINT SIX FOUR"

Mach 0.82 - "MACH POINT EIGHT TWO"

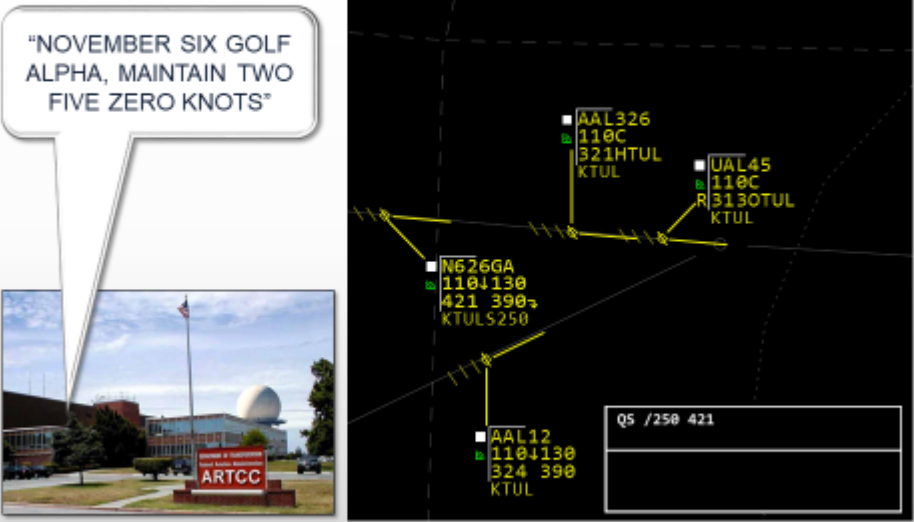
SPEED ADJUSTMENT PROCEDURES (CONT'D)

Maintain Specified Speed

JO 7110.65, par. 5-7-2

Maintain a Specified Speed

"NOVEMBER SIX GOLF ALPHA, MAINTAIN TWO FIVE ZERO KNOTS"



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Slide is animated, 2 clicks. Click where indicated by click icons.

⦿ Instruct aircraft to maintain present or specific speed



MAINTAIN PRESENT SPEED



MAINTAIN (specific speed) KNOTS

Example: "NOVEMBER SIX GOLF ALPHA, MAINTAIN TWO FIVE ZERO KNOTS"



Click to show 4th line entry in command line.

Continued on next page

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Maintain Specified Speed (Cont'd)

JO 7110.65, par. 5-7-2



Click to show data block with speed in 4th line.

- ⦿ Maintain specified speed or greater/less



MAINTAIN (specific speed) KNOTS OR GREATER/LESS

or



DO NOT EXCEED (speed) KNOTS

- ⦿ Maintain the highest or lowest practical speed (used primarily for sequencing)



MAINTAIN MAXIMUM FORWARD SPEED

or



MAINTAIN SLOWEST PRACTICAL SPEED

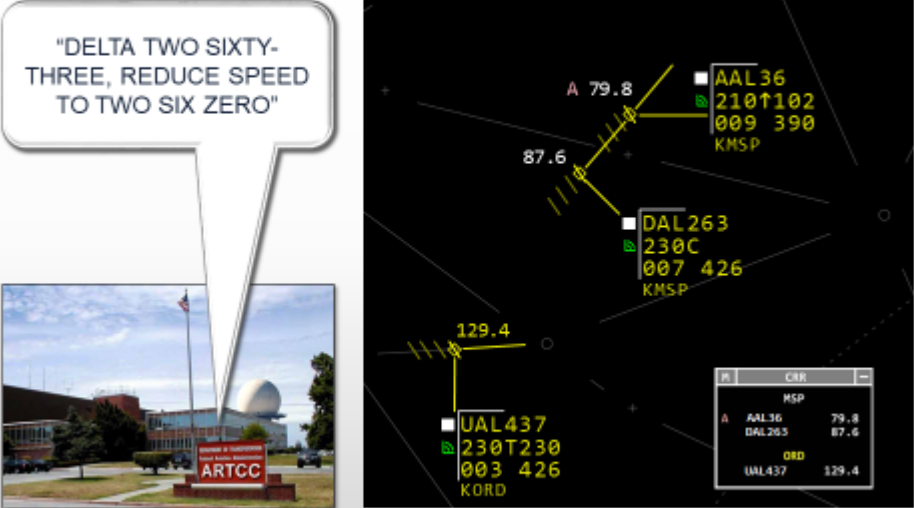
SPEED ADJUSTMENT PROCEDURES (CONT'D)

Increase/Reduce Speed

JO 7110.65, par.
5-7-2

Increase/Reduce Speed

"DELTA TWO SIXTY-THREE, REDUCE SPEED TO TWO SIX ZERO"



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Slide is animated, 1 click. Click where indicated by click icon.

- ⦿ Increase or reduce to a specified speed or by a specified number of knots (spoken in group form)



INCREASE/REDUCE SPEED TO (specified speed in knots)

Examples: "AMERICAN THIRTY-SIX, INCREASE SPEED TO THREE ONE ZERO"



Click to show DAL263 clearance to reduce speed to 260 knots.

"DELTA TWO SIXTY-THREE, REDUCE SPEED TO TWO SIX ZERO"

or

Continued on next page

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Increase/Reduce Speed (Cont'd)

JO 7110.65, par.
5-7-2



INCREASE/REDUCE SPEED TO MACH (Mach number)

or



INCREASE/REDUCE SPEED (number of knots) KNOTS

☉ At or above FL390

- Obtain pilot concurrence for a speed adjustment at or above FL390



(Speed adjustment), IF UNABLE ADVISE

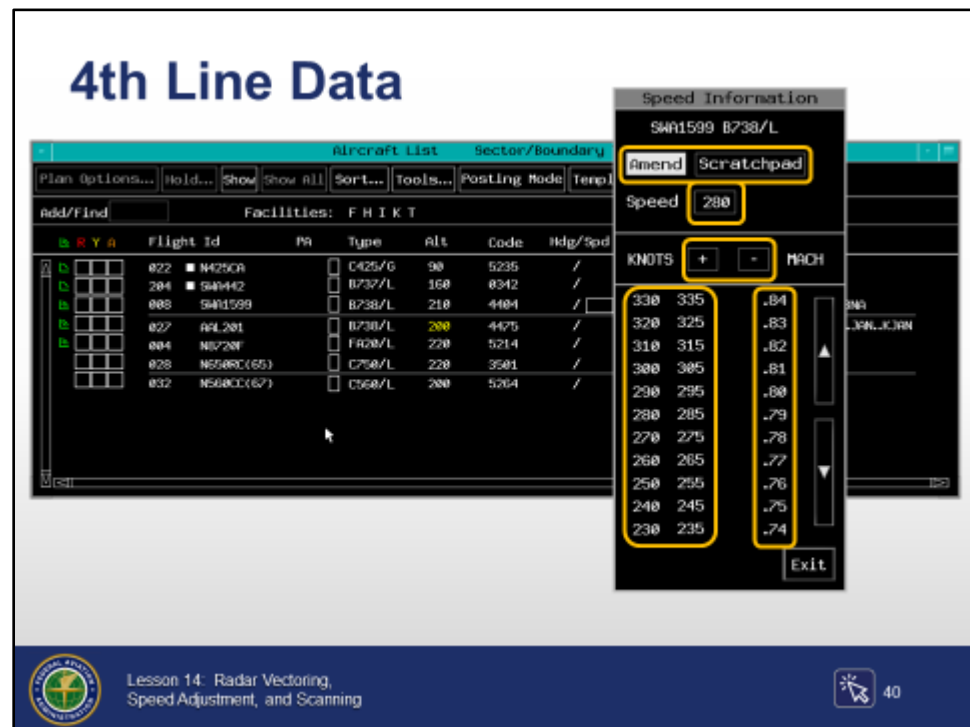
SPEED ADJUSTMENT PROCEDURES (CONT'D)

4th Line Data

JO 7110.65,
pars. 5-4-8, 5-4-
10, 5-7-1, 13-1-8

TI 6110.101,
sec. 5.2.11

ERAM ATCHI
MISC 230.05,
par. 3.8.55



Slide is animated, 5 clicks. Click where indicated by click icons.

- ⦿ The 4th line of the FDB is used to non-verbally coordinate speed control information
 - Coordination format for assigned airspeeds is an “S”, followed by a three-digit number
 - Coordination format for assigned a Mach number is an “M”, followed by the two-digit assigned value
 - A plus “+” notation may be added to denote an assigned speed at or greater than the displayed value
 - A minus “-” notation may be added to denote an assigned speed at or less than the displayed value
- ⦿ The EDST may also be used to enter 4th line data:



Click to move cursor and open Speed Information menu.

- TBP an entry's speed field to open the Speed Information menu

Continued on next page

SPEED ADJUSTMENT PROCEDURES (CONT'D)

4th Line Data (Cont'd)

TI 6110.101,
sec. 5.2.11



Click to highlight Amend/Scratchpad.

- Select Amend or Scratchpad

NOTE: Scratchpad speeds displayed on EDST are not coordinated.



Click to highlight text entry box.

- Type a speed in the text box



Click to highlight +/- selection boxes.

- Increment/decrement the default speed with +/-



Click to highlight knots/Mach menu values.

- Select a speed in knots or Mach number from the menu
-

SPEED ADJUSTMENT PROCEDURES (CONT'D)


4th Line Speed Formats

JO 7110.65,
pars. 5-4-8, 5-4-10

TI 6110.101,
sec. 13.2.2.1
and Table B-1

TI 6110.108

4th Line Speed Value Formats	
Formats	
ddd	Mdd
ddd+	Mdd+
ddd-	Mdd-
+d(d)	M.dd
-d(d)	.dd
dd	.dd+
dd+	.dd-
dd-	Sddd
+	-
PS	
GIM-S accepted speed formats:	
∟(d)dd	∟Mdd

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- ⦿ The table lists 4th line speed formats that are allowed by automation
- ⦿ Speed entry 4th Line:
Syntax: QS /ddd <FLID> KBE
- ⦿ Delete 4th Line Speed Info:
Syntax: QS /* <FLID> KBE
- ⦿ Hide or unhide 4th Line Info:
Syntax: QS <FLID> KBE
NOTE: When 4th line is hidden, it is indicated by the Heading/Speed/Free Form Text Indicator “↵” after speed in the FDB.

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check

Knowledge Check

What is the phraseology to reduce the speed of an aircraft to 250 knots?

- A. REDUCE SPEED TO TWO FIVE ZERO
- B. REDUCE TO TWO FIVE ZERO KNOTS
- C. SLOW TO TWO FIVE ZERO KNOTS



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning



Question: What is the phraseology to reduce the speed of an aircraft to 250 knots?



Answer: A. REDUCE SPEED TO TWO FIVE ZERO

SPEED ADJUSTMENT PROCEDURES (CONT'D)

Knowledge Check

Knowledge Check

What is the phraseology to instruct an aircraft to increase speed from 200 knots to 230 knots?

- A. ADJUST INDICATED AIRSPEED TO TWO THREE ZERO KNOTS
- B. INCREASE TO TWO THREE ZERO KNOTS
- C. INCREASE SPEED TO TWO THREE ZERO



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning



Question: What is the phraseology to instruct an aircraft to increase speed from 200 knots to 230 knots?




Answer: C. INCREASE SPEED TO TWO THREE ZERO

ACTIVITY: AIRSPEED FLOWCHART REVIEW

Activity: Airspeed Flowchart Review

Activity: Airspeed Flowchart Review

- **Purpose**
 - Review Airspeed Flowchart
- **Materials**
 - Airspeed Flowchart
- **Directions**
 - Steps to use the flowchart on the next page:
 - Begin at the top START oval, follow the paths
 - Answer questions in decision boxes (diamonds)
 - Note the answer in the last step of the chart (oval)

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Purpose Review Airspeed Flowchart

Materials ☉ Airspeed Flowchart

Directions The flowchart on the next page represents a step-by-step process to determine the changes to true airspeed that occur as aircraft change altitude.



Tell the students to refer to the flowchart on page 57.

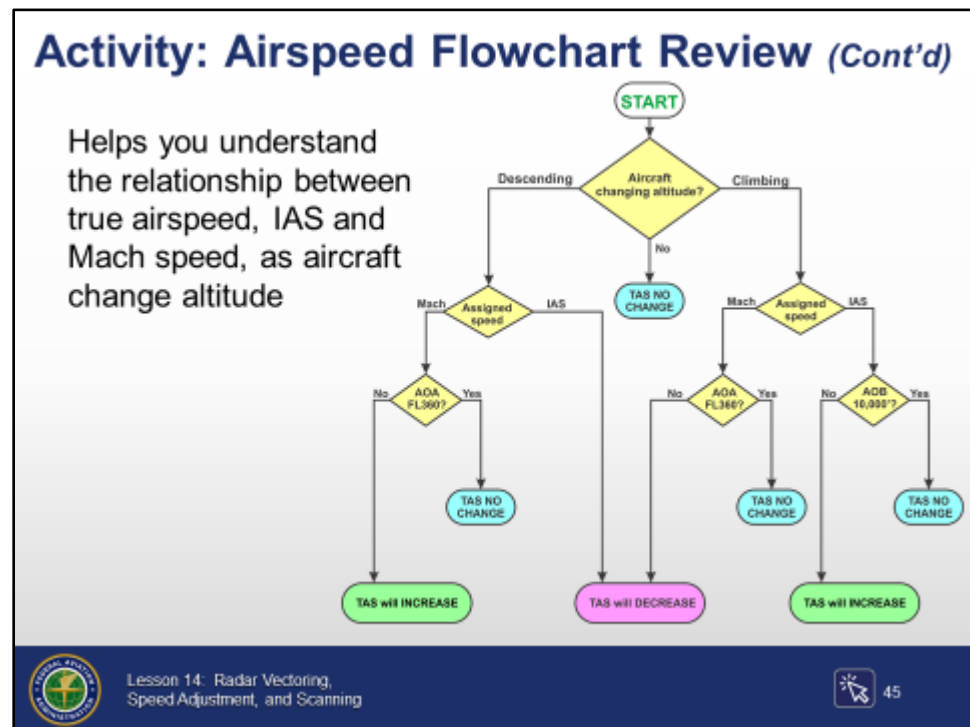
- ☉ Steps to use the flowchart on the next page:
 - Begin at the top START oval, follow the paths
 - Answer questions in decision boxes (diamonds)
 - Note the answer in the last step of the chart (oval)
- ☉ Use the flowchart to help answer the situations on the following pages



Situations using the flowchart are on the next two pages.

ACTIVITY: AIRSPEED FLOWCHART REVIEW (CONT'D)

Activity: Airspeed Flowchart Review (Cont'd)



Slide is animated, 4 clicks. Click where indicated by click icons.

☉ True airspeed flowchart

- Helps you understand the relationship between true airspeed, IAS, and Mach number as aircraft change altitude



Click to show Situation #1.

Situation #1: A flight at FL290 is descending with an assigned Mach number speed restriction.

Question: Will true airspeed and ground speed change? If so, will it increase or decrease?



Answer: True airspeed and ground speed will increase.

Continued on next page

ACTIVITY: AIRSPEED FLOWCHART REVIEW (CONT'D)

Activity: Airspeed Flowchart Review (Cont'd)



Click to show Situation #2.

Situation #2: A flight at FL370 is climbing with an assigned Mach number speed restriction.

Question: Will true airspeed and ground speed change? If so, will it increase or decrease



Answer: No change in true airspeed and ground speed.



Click to show Situation #3.

Situation #3: A flight at 15,000' is climbing with an assigned IAS restriction.

Question: Will true airspeed and ground speed change? If so, will it increase or decrease?



Answer: True airspeed and ground speed will increase.



Click to show Situation #4.

Situation #4: A flight at FL220 is descending with an assigned IAS restriction.

Question: Will true airspeed and ground speed change? If so, will it increase or decrease?



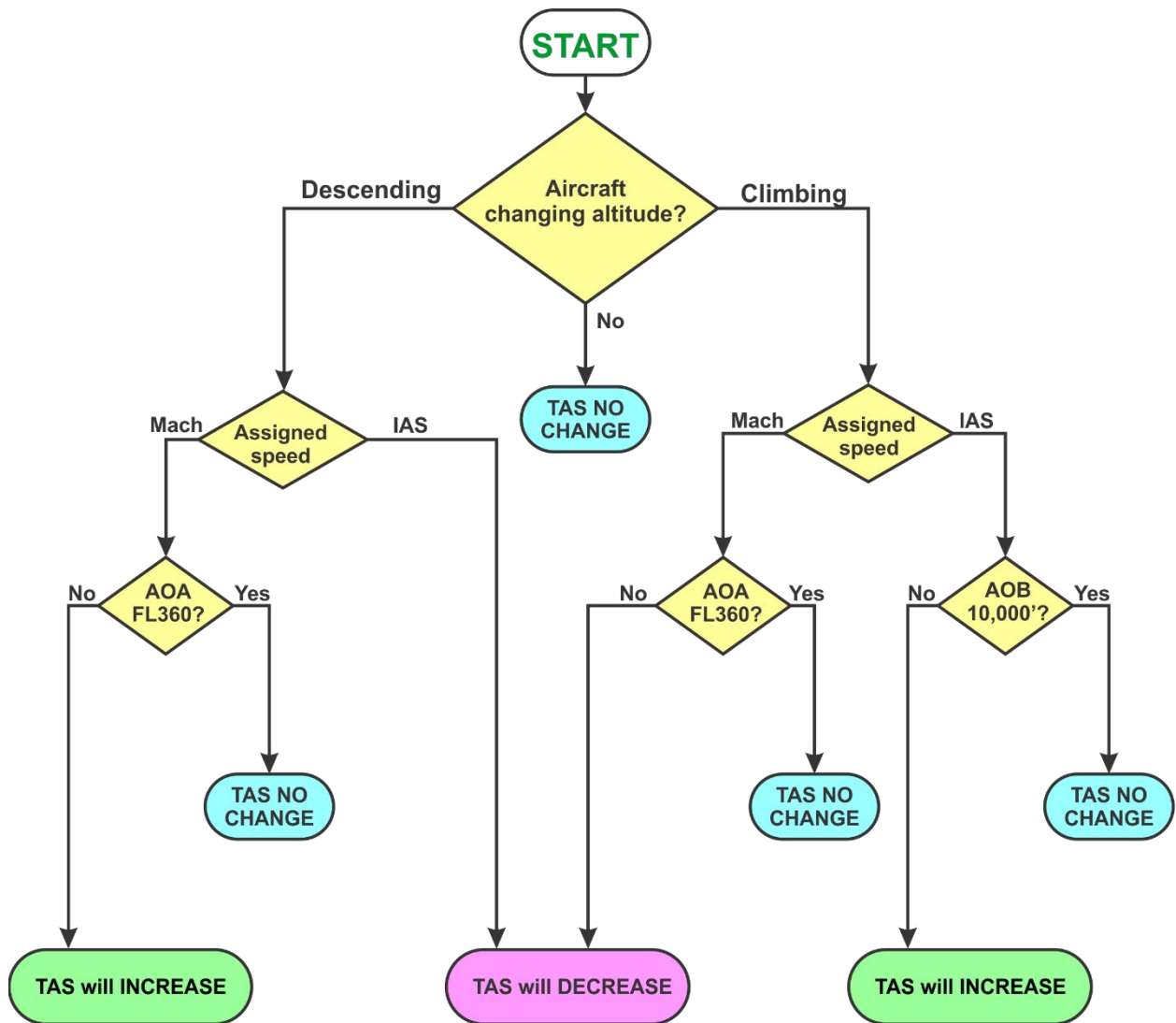
Answer: True airspeed and ground speed will decrease.



Add local examples. Use the flowchart to trace the path to the answer.

TRUE AIRSPEED FLOWCHART

This flowchart helps you understand the relationship between true airspeed, IAS and Mach number as aircraft change altitude.




SCANNING PROCEDURES

Introduction

Scanning

Flight Id	PA	Type	Alt	Code	Hdg/Bpd	Route
008 N525PS		C525/I	170	0024	/	KORD..KOR..TEKN..THO..DEPHE..KPIIT
027 VFP009		P8/L	120	0103	/	KNUO../CATHE../PWN../CHRL../KNLC
004 N4830E		C310/G	90	0112	/	KUSH../CHRLA../V35..DIB../KCKB
028 N44434		CRJ2/L	200	0123	/	T KCHO..V38..TEKN../THO../DEPHE..KPIIT
*032 N4110a		C152/G	40	4406	/	KSP../PNO..V27../FREES../KSTS
010 RNDERS1		F18/F	350	0125	/	KNLC../CHRL../KIGHT../CORSE../NADDE../KNLC
029 N6513G		PMY2/G	100	3415	/	KSDA../PNO30455../DSK../SHOEY../OST../KSFO
005 DAL2697(27)		B739/L	300	5521	/	T KATL../KATTS../INVOE../DYAMOS../KSFO
030 N9325K(UNK)		C182/G	0TP	5543	/	KSJC../MOONY../ROM../KCHA



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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- ⦿ An efficient method of scanning allows effective correlation of data from multiple sources
- ⦿ Develop a method of scanning that will allow you to make sound control decisions in a timely manner that will assist the radar controller

NOTE: The method outlined in this lesson is only one possible technique for developing a scan, and is by no means the only way to accomplish this task. Each individual must find the process that works for him/her, and continually strive for increased awareness of all aspects of the events which take place at their sector.

NOTE: Appendix B gives examples of the scanning process.

SCANNING PROCEDURES (CONT'D)

Sector Team Responsibilities

JO 7110.65, par.
2-10-1



SCANNING - To examine systematically in order to obtain data. Scanning allows you to determine if the sector is free of conflict and meets the objectives of a safe, orderly, and expeditious flow of traffic.



SECTOR - The area of control responsibility (delegated airspace) of the en route sector team and the team as a whole.

☉ Team members

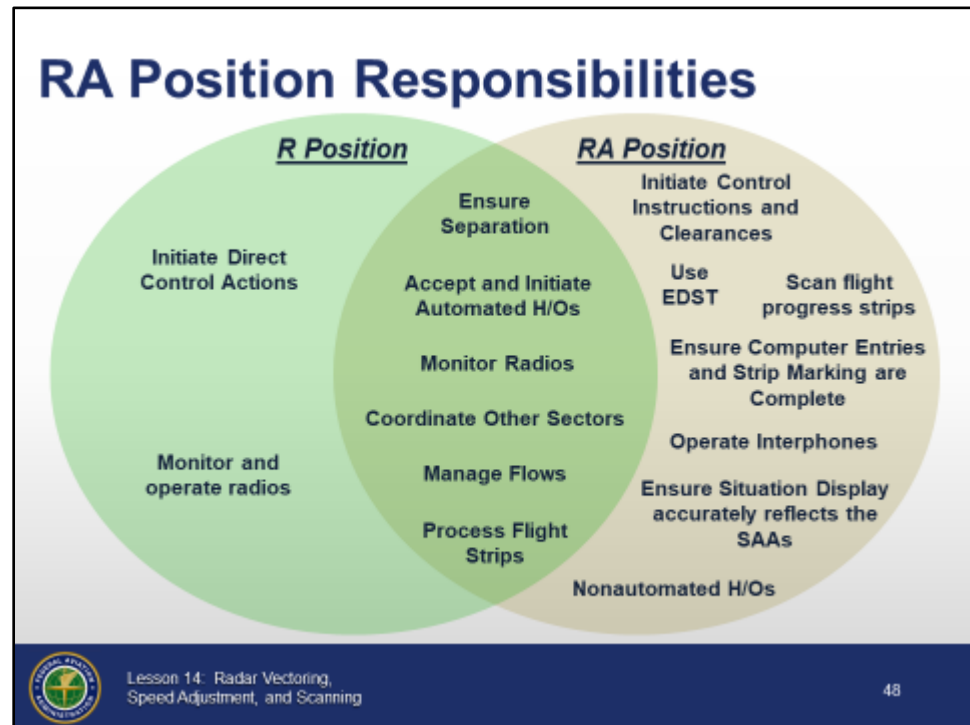
- Radar (R) Position
- Radar Associate (RA) Position
- Radar Coordinator (RC) Position
- Radar Flight Data (FD) Position
- Nonradar Position (NR)

NOTE: The RC Position, FD Position, and NR Position responsibilities are not covered in this lesson.

SCANNING PROCEDURES (CONT'D)

Radar Associate (RA) Position Responsibilities

JO 7110.65, par. 2-10-1



⊙ RA responsibilities:

- Ensure separation
- Use EDST to plan, organize, and expedite the flow of traffic
- Initiate control instructions and clearances
- Operate interphones
- Accept and initiate nonautomated handoffs
 - Ensure R Position is made aware of the actions
- Assist the R Position by accepting or initiating automated handoffs, which are necessary for the continued smooth operation of the sector
 - Ensure that the R Position is made immediately aware of any action taken
- Coordinate
 - Including point outs

Continued on next page

SCANNING PROCEDURES (CONT'D)

Radar Associate (RA) Position Responsibilities (Cont'd)

JO 7110.65, par. 2-10-1

- Monitor radios
 - When not performing higher priority duties
 - Scan flight progress strips and/or EDST data
 - Correlate with radar data
 - Manage flight progress strips and/or electronic flight data
 - Ensure computer entries are completed on instructions issued or received
 - Enter instructions issued or received by the R Position when aware of those instructions
 - Ensure strip marking and/or EDST data entries are completed on instructions issued or received
 - Record instructions issued or received by the R Position when aware of them
 - Adjust equipment at RA Position to be usable by all members of the team
 - Where authorized, perform EDST data entries to keep the activation status of designated EDST Airspace Configuration Elements current
 - Ensure the Situation Display accurately reflects the status of all Special Activities Airspaces (SAAs)
 - Scan your display for electronically distributed information, evaluate the information, and take action as appropriate
-

SCANNING PROCEDURES (CONT'D)

Scanning the EDST

JO 7110.65,
pars. 2-10-1, 13-
1-2 to 13-1-5,
13-1-9

TI 6110.101,
sec. 2.1, 2.2

Scanning

Color coding gets your attention

Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning



Slide is animated, 5 clicks. Click where indicated by click icons.

- Actively scan the EDST



Click to highlight SIGMETs, GIs, Status, Outage and Message Waiting.

- EDST displays information pertaining to the system and specific flights
- Status colors emphasize new or amended information
- Evaluate and take action as appropriate on all ACL alerts and other indications
- Prioritize the evaluation and resolution of alerts to ensure the safe, expeditious, and efficient flow of air traffic



Click to highlight alerts.

- Scan for aircraft-to-aircraft and aircraft-to-airspace alerts
- When a conflict probe alert is displayed, evaluate the alert and take appropriate action as early as practical, in accordance with duty priorities

Continued on next page

SCANNING PROCEDURES (CONT'D)

Scanning the EDST (Cont'd)

JO 7110.65,
pars. 2-10-1, 13-
1-2 to 13-1-5,
13-1-9

TI 6110.101,
secs. 2.1, 2.2

- When sector priorities permit, consider the following in determining a solution:
 - Solutions that involve direct routing, altitude changes, inappropriate altitude for direction of flight, and/or removal of restrictions
 - Impact on surrounding sector traffic and complexity levels, flight efficiencies, and user preferences



Click to highlight remarks indicator.

- ⦿ When an ACL or DL entry has a Remarks indication, the Remarks field of the flight plan must be viewed
 - Changes to the Remarks field must also be viewed



Click to highlight IAFDOF altitude.

- ⦿ Inappropriate Altitude for Direction of Flight (IAFDOF) coding
 - Must be acknowledged only after the appropriate action has been completed



Click to highlight a Route field.

- ⦿ Scan for route notifications
 - Embedded Route Text (ERT) coding
 - Issue and send or acknowledge the route prior to initiating a handoff
 - Route Action Notifications (RAN)
 - ATC preferred routes must be amended at the first control position that displays the RAN, unless verbally coordinated or as specified in appropriate facility directives

SCANNING PROCEDURES (CONT'D)


Scanning Data Blocks

TI 6110.100,
secs. 1.2.2, 4.3,
5-3-8

JO 7110.65, par.
2-10-1

Scanning Data Blocks

- **Actively scan the Situation Display**
 - Ensure all FDBs can be seen
 - Avoid data block overlap
 - Potential conflicts
 - Aircraft-to-aircraft
 - Aircraft-to-airspace
 - Unusual situations
 - Weather
 - Sector boundaries



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning

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- ⊙ Actively scan the Situation Display
 - Ensure all FDBs can be seen
 - Avoid data block overlap
 - Potential conflicts
 - Aircraft-to-aircraft
 - Aircraft-to-airspace
 - Unusual situations
 - Weather
 - Sector boundaries

CONCLUSION

Lesson Summary

Lesson Summary

This lesson covered:

- Vectoring
- Speed adjustment
- Scanning



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Review and elaborate briefly on the following topics. Ask students if they have questions about any of the concepts covered in the lesson.

- ⦿ Vectoring
 - Reasons for vectoring
 - Methods for vectoring
- ⦿ Speed adjustment
 - Excessive speed adjustments
 - Techniques
 - Assignment restrictions
 - Issuing speed adjustment
 - Airspeed and Mach
 - Guidance for assigning Mach
 - Guidance for IAS use
 - Speed adjustment minima

Continued on next page

CONCLUSION (CONT'D)

Lesson Summary (Cont'd)

-
- Speed phraseology
 - 4th line data
 - 4th line Speed formats
- ⊙ Scanning
 - Sector team responsibilities
 - ⊙ End-of-Lesson Test

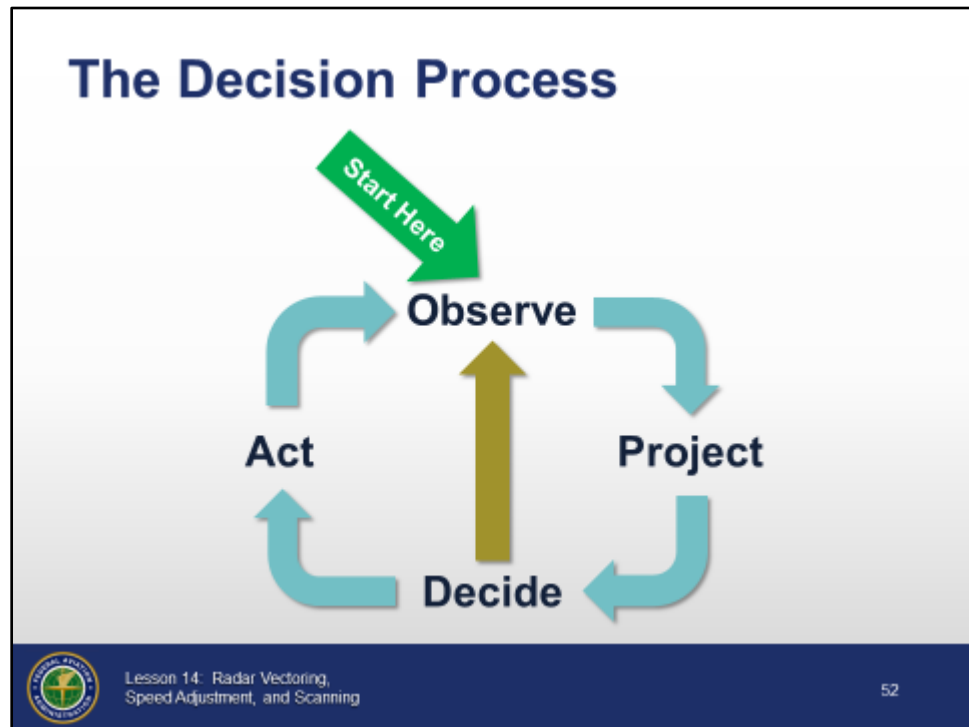


Hand out and administer the End-of-Lesson Test. Provide feedback on missed items, including why particular answers are correct, as well as why some responses are incorrect. Then conduct the scanning activity.

- ⊙ Scanning activity
-

SCANNING PROCEDURES

The Decision Process



NOTE: This appendix provides examples of how scanning process works.

- ⦿ A decision process air traffic controllers can utilize:
 - Observe
 - Area of responsibility
 - Project
 - The future position and analyze data to form a current mental picture
 - Decide
 - What actions, if any, are necessary
 - Act
 - Intervene, issue a new or amended clearance
- ⦿ Occasionally you will decide no action is necessary and the observation cycle begins again



Emphasize that the process returns continually to observe.

- ⦿ It may be necessary to amend a planned action in order to incorporate the new information noted during the observation phase

Continued on next page

SCANNING PROCEDURES (CONT'D)

Scanning the EDST

- ⊙ The decision cycle is a loop
 - Use the current information to maintain awareness of the current and future situation
 - ⊙ For new entries mentally ask the following questions:
 - Who?
 - Flight call sign and type may require special handling
 - Air Force One
 - MEDEVAC
 - Where?
 - Route of flight
 - Is this the preferred route?
 - Incomplete route indicators: XXX, ???
 - Destination
 - Any traffic management programs?
 - What?
 - Any LOA/SOP requirements to be met?
 - ⊙ Flights can be mentally grouped into four categories:
 - Overflights
 - Aircraft passing through your sector that will not change altitude or route, unless requested by the pilot
 - Departures
 - Aircraft not yet at requested altitude
 - Consider any traffic that may impede a climb
 - Does the flight have a later restriction that makes the requested altitude impracticable?
 - Arrivals
 - Descend to meet LOA/SOP restrictions
 - Approach control services, if provided
 - Weather at destination
 - NAVAID status
 - Current NOTAMs
 - Special flights such as:
 - Air refueling
 - Photo or air sampling missions
 - Military training routes
-

SCANNING PROCEDURES (CONT'D)

Observing Alerts

JO 7110.65, par. 13-1-2

TI 6110.101, sec. 5.2.2

Observing Alerts

Flight Id	PR	Type	Alt	Code	Hdg/Spd	Route
167 UAL712		B735/L	220	0024	/	KOKK./SOS,KOKC
168 FOX222		B752/L	350T220	0100	/	KOKK./SOS,UMM,KHEM
009 AAL2435		A319/L	200	0112	/	KSAV./MEM.,MLU.,TYUTUN,WHITM4,TRON
011 H4750		BE30/G	150	0123	/	KMLU.,KSDP
007 N355LT		C210/G	110T50	4400	/	KWKS.,JIN.,KHEI
002 N851FQ(28)		C550/L	230	0125	/	KMDU,STRAY7,OPRTY.,KOH
012 UPS6059(28)		B752/L	320T230	3415	/	KMSY.,MOB.,MEVEE,KOBK3,KHEM
003 POL039(47)		H/C17/L	220	5521	/	KSEA.,JENMO,GP,JAGAR.,BURGL,IRRMNO,KLAK
030 N9975K(UNK)		C182/G	0TP	5543	/	KREX.,KGRD



Slide is animated, 1 click. Click where indicated by click icon.

⦿ When an alert is observed, investigate and evaluate



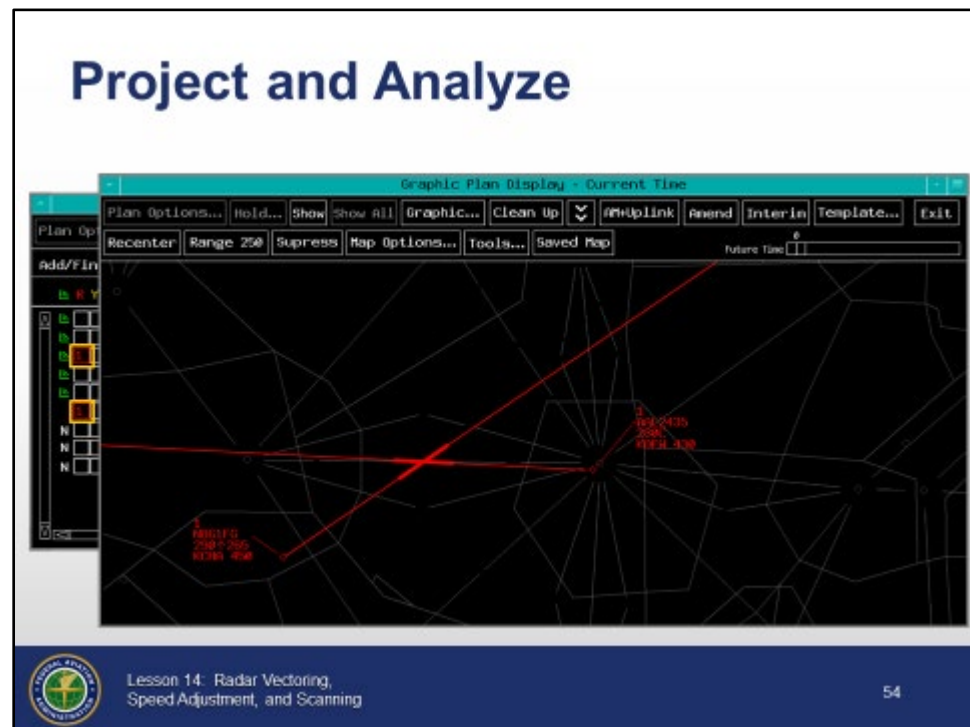
Click to highlight the red alerts.

- TBE on an alert box to Show All alerts of that type for the entry on the GPD

SCANNING PROCEDURES (CONT'D)

Project and Analyze

JO 7110.65,
pars. 2-4-2, 2-
10-1



⦿ Project - Future Positions and Analyze

- Alert planning
 - Meeting the objective of a safe, orderly, and expeditious flow of traffic
 - Will planned maneuvers make the alert invalid?



Explain how we see the projected path and the conflict area on the slide.

- Potential conflict
 - What maneuvers are available to resolve conflict?
 - EDST Conflict Probe can be a helpful tool
 - Correlate EDST information with Situation Display and other resources



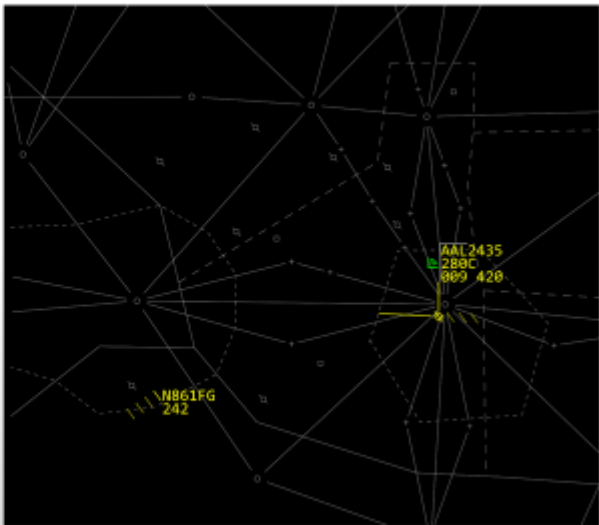
Discuss the following with the students; Is the alert valid? Will planned maneuvers change the situation? Does it meet LOA & SOP requirements?


SCANNING PROCEDURES (CONT'D)

Decide if
Action is
Necessary


Decide if Action is Necessary

- EDST alerts are projections
- Display the data block on the situation display





Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning



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Slide is animated, 1 click. Click where indicated by click icon.

- ⦿ Decide - What actions, if any, are necessary?



Click to display FDB for N861FG.

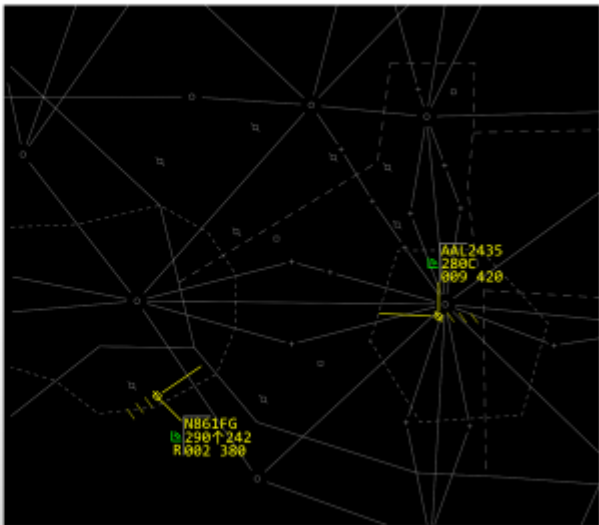
- ⦿ EDST alerts are projections
- ⦿ For dynamic traffic situations display the data block to check the targets actual position and altitude on the situation display
 - Ideal clearance solves both:
 - Separation problem - meeting established minima
 - Control problem - complying with LOA, SOP and TM initiatives

SCANNING PROCEDURES (CONT'D)

Act - Intervene

Act - Intervene

- Coordinate a new or amended clearance to:
 - Eliminate conflicts
 - Meet objectives
 - Avoid weather



Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning

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Slide is animated, 1 click. Click where indicated by click icon.

⦿ Act - Intervene



Click to show an interim attitude of FL270 coordinated with the transferring sector that resolves the conflict.


- Where necessary, coordinate a new or amended clearance to:
 - Eliminate conflicts
 - Meet objectives
 - Avoid weather

SCANNING PROCEDURES (CONT'D)

Necessity of Constant Scanning

Necessity of Constant Scanning

- **Continuous scanning and attention to detail is necessary to prevent:**
 - Complacency
 - Laxness
- **Do not allow your attention to be diverted by:**
 - Conversations not related to the job,
 - Distractions from facility tours, or
 - Other personnel in the area



Lesson 14: Radar Vectoring,
Speed Adjustment, and Scanning

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- ⊙ Continuous scanning and attention to detail is necessary to prevent:
 - Complacency
 - Lack of activity
 - Laxness
 - Treat each situation as unique
 - Traffic may be similar but it's up to you to determine what is different or unusual
- ⊙ Do not allow your attention to be diverted by:
 - Conversations not related to the job
 - Distractions from facility tours
 - Other personnel in the area
- ⊙ Be aware of situations that can cause your scan to break down:
 - Tunnel vision
 - Keep your scan moving
 - Make time to observe low activity areas

Continued on next page

SCANNING PROCEDURES (CONT'D)


Necessity of Constant Scanning (Cont'd)

- ⊙ Shift focus from the Situation Display to the EDST
 - Inaccurate data
 - Address and correct any deficiencies
 - Update the EDST and flight strips promptly
 - Complete coordination in a timely manner
-

SCANNING ACTIVITY

Scanning Activity

- **Purpose**
 - Scan scenarios of EDST and data blocks to observe various system notifications
- **Materials**
 - Practice exercise from Lesson 14 handout
- **Directions**
 - Change your position in class as necessary to read the screen
 - Exercise will depict five EDST and five situation display examples
 - Scan for alerts and any other indications
 - Write down what you see

 Lesson 14: Radar Vectoring, Speed Adjustment, and Scanning 58

Purpose

Scan slides of EDST and data blocks to observe various system notifications

Materials



Handout: *HO01_L14*

- ⦿ Practice exercise from Lesson 14 handout



Practice exercise starts on slide #60.

Directions

This exercise takes approximately 45 minutes to complete.



This exercise requires students to see details of ACL flight entries and situation display data blocks. Allow students to change seating if necessary.

- ⦿ Change your position in class as necessary to read the screen
-

Continued on next page

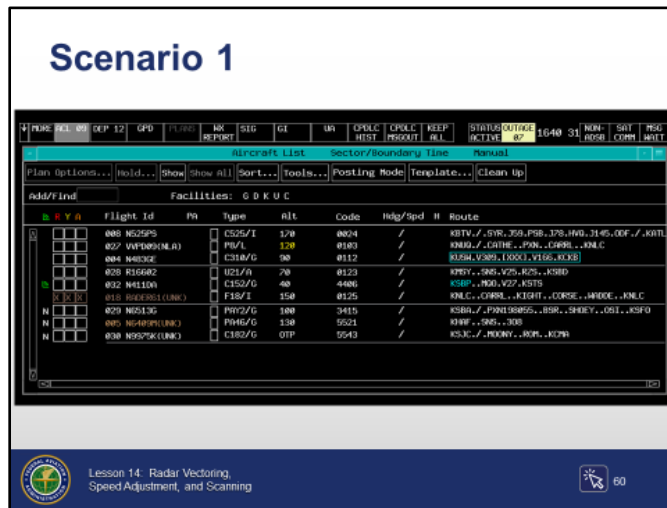
SCANNING ACTIVITY (CONT'D)

Directions (Cont'd)

-
- ⦿ The exercise slides will depict five EDST and five situation display examples
 - Scan for alerts and any other indications that signify action may be necessary
 - Write down what you see, such as:
 - Alerts
 - New entry coding
 - Climb and descent
 - VCI status
 - IAFDOF
 - Route field indicators
 - Data block altitude and field E indicators
 - Position symbol status, etc.
 - Each slide has time limit
 - The first EDST scenario has a 2 minute, 30 second time limit
 - Situation display scenarios have a 1 minute, 30 second time limit
 - A countdown timer will appear when 20 seconds remains in each scenario
 - Record your observations before the timer expires
-

SCANNING ACTIVITY (CONT'D)

Scenario 1



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:30.

FLID	✓	Event
N411DA		VCI manual
		Route, APR (cyan dep fix)
N483GE		Route, XXX
N6409M		APD unreliable (tan)
		New entry
N6513G		New entry
N9975K		New entry
RADER61		Not probed XXX (brown)
Toolbar		Outage yellow
VVPD09		IAFDOF

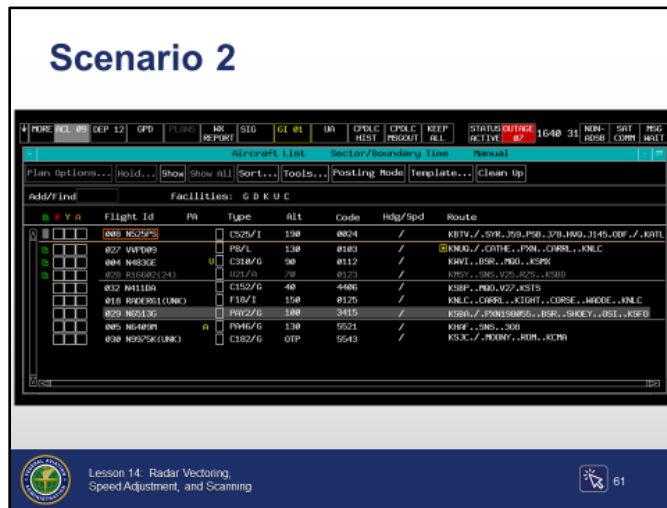


Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 2



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:15.

FLID	✓	Event
N483GE		UTM
		VCI manual
N525PS		Entry in SPA
		Kept individual entry
		Overdue (Orange box SPA)
N6409M		Yellow coordination "A"
N6513G		Angulation highlight
R16602		Gray entry
		VCI manual
Toolbar		Outage red
		Unviewed GI
VVPD09		Unviewed remarks
		VCI manual

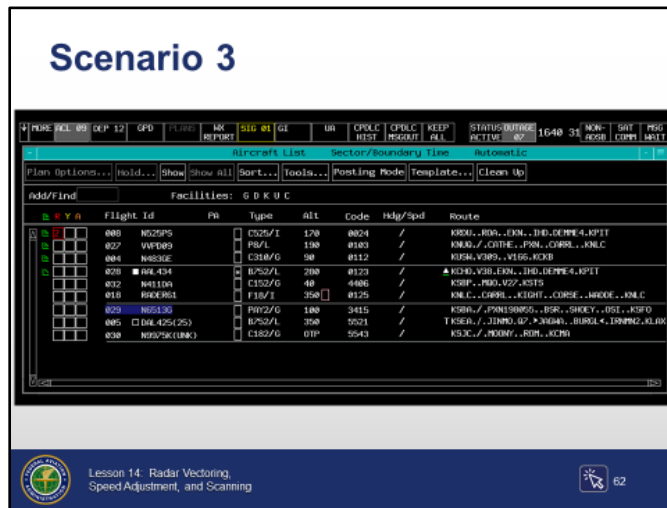


Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 3



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:15.

FLID	✓	Event
AAL434		Hidden free form text “*”
		CDA with eligibility
		Route uplink
		VCI auto
DAL425		Route, TFM-Protected Segment (white “T”)
		CDA without eligibility
N483GE		VCI manual
N525PS		VCI manual
		Red alerts
N6513G		Gray Flight ID on dark blue background
RADER61		Non-RVSM
Toolbar		Unviewed SIGMET
		Outage gray
VVPD09		VCI manual

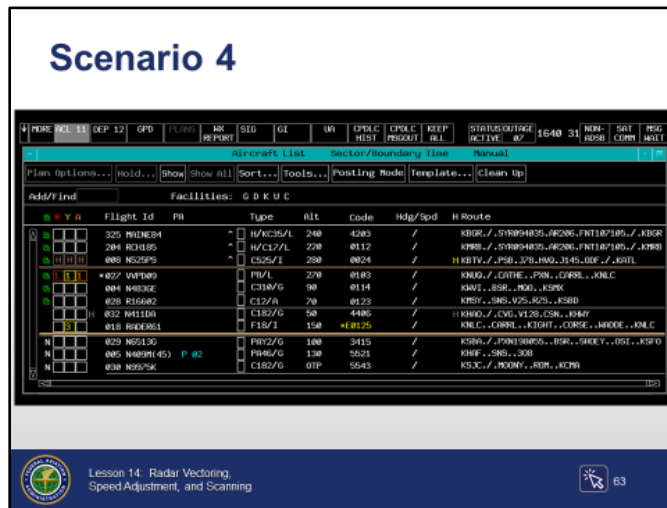


Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 4



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:45.

FLID	✓	Event
MAINE84		Entry in SPA
		VCI manual
N409M		New entry
		Point out - initiating sector; unacknowledged
N411DA		Brown "H": future hold, 2 places
N525PS		Entry in SPA
		VCI manual
		Yellow "H": EFC expiration
N6513G		New entry
N9975K		New entry
R16602		VCI manual
RADER61		Yellow alert
		External beacon code
RCH185		Entry in SPA
		VCI manual

☉ Use the space below for notes

Continued on next page

SCANNING ACTIVITY (CONT'D)

Scenario 4 (Cont'd)

FLID	✓	Event
N483GE		VCI manual
VVPD09		Entry with multiple alerts
		Multiple FPs “*”
		VCI manual

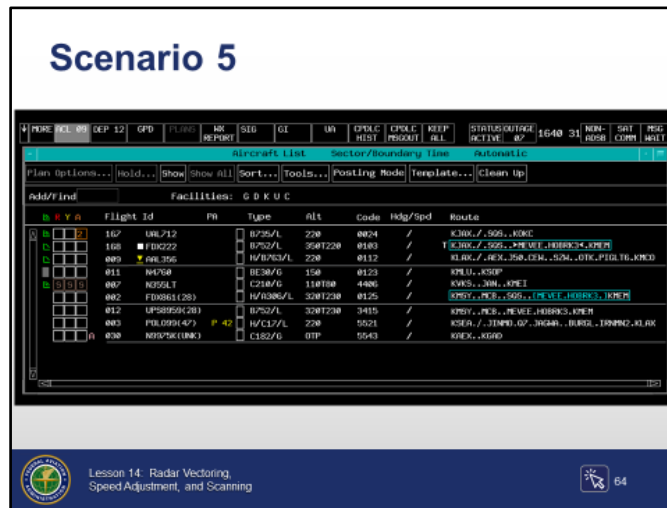


Click to review slide.

⦿ If needed, use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 5



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:00.

FLID	✓	Event
AAL356		CDA with eligibility
		VCI auto
		PID normal
FDX222		CDA with eligibility
		Route, TFM-Protected Segment (white "T", cyan boxed route)
		Interim altitude
FDX861		VCI auto
		Route, ERT
		Interim altitude
N355LT		Stop probe SSS
		Interim altitude
		VCI manual
N4760		Kept individual entry

Use the space below for notes

Continued on next page

SCANNING ACTIVITY (CONT'D)

Scenario 5 (Cont'd)

FLID	✓	Event
N9975K		Non-ADS-B "A"
		OTP altitude
POL099		Point out - receiving sector; unacknowledged
UAL712		SAA alert
		VCI manual
UPS8959		Interim altitude

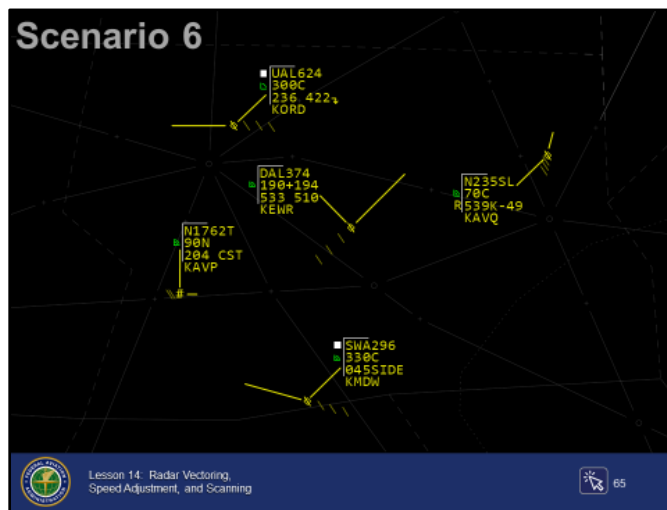


Click to review slide.

- ⦿ Use the space below for notes
-

SCANNING ACTIVITY (CONT'D)

Scenario 6



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:25.

FLID	✓	Event
DAL374		B4: "+"
		VCI manual
N1762T		B4: "N"
		Coast CST
		VCI manual
N235SL		/OK by sector 49
		VCI manual
SWA296		CDA with eligibility
		VCI manual
		Field E: SIDE
UAL624		CDA with eligibility
		Field E: Heading/Speed/Free Form Text Display/Suppress Indicator
		VCI auto

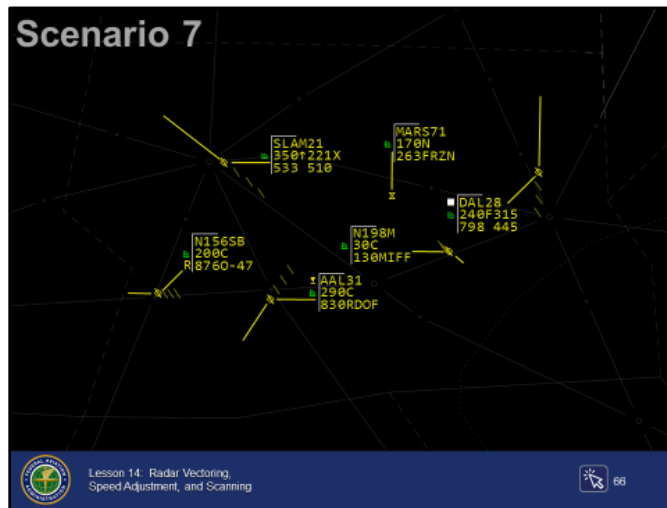


Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 7



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:30.

FLID	✓	Event
AAL31		CDA with eligibility
		Field E: RDOF
		VCI manual
		PID normal
DAL28		B4: "F"
		VCI manual
		CDA with eligibility
MARS71		Field E: FRZN
		VCI manual
N156SB		Handoff complete
		VCI manual
N198M		Field E: MIFF
		VCI manual
SLAM21		Exceptional Vertical Rate Indicator
		VCI manual

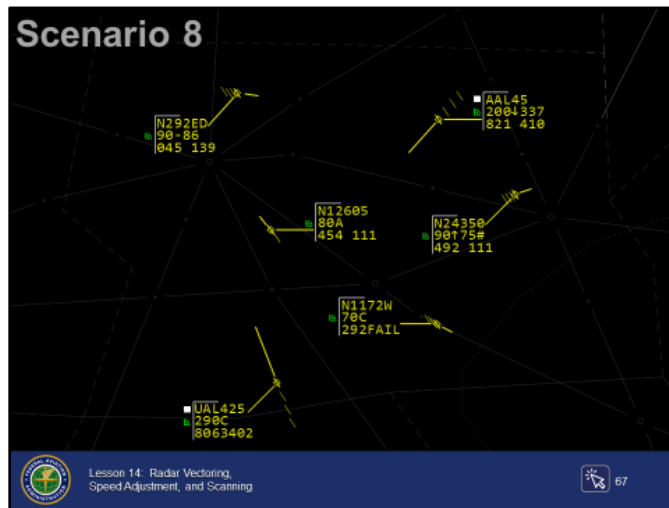


Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 8



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. Time limit 2:10.

FLID	✓	Event
AAL45		CDA with eligibility
		Descending to FL200
		VCI manual
N1172W		Field E: FAIL
		VCI manual
N21605		B4: "A"
		VCI manual
N24350		Controller entered reported altitude - "#" character
		Climbing to 90
		VCI manual
N292ED		B4: "-"
		VCI manual
UAL425		CDA with eligibility
		VCI manual
		Squawking wrong code



Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 9



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. . Time limit 2:10.

FLID	✓	Event
JAWS11		Lost Mode C XXX
		VCI manual
JBU400		ALT uplink timeout
		Descending to FL350
		CDA with eligibility
		VCI auto
N4577		Non-ADS-B "A"
		VCI manual
N468MT		IDENT
		VCI manual
SWA1198		Field E: EFC
		VCI manual
UAL169		Field E: EMRG
		VCI manual

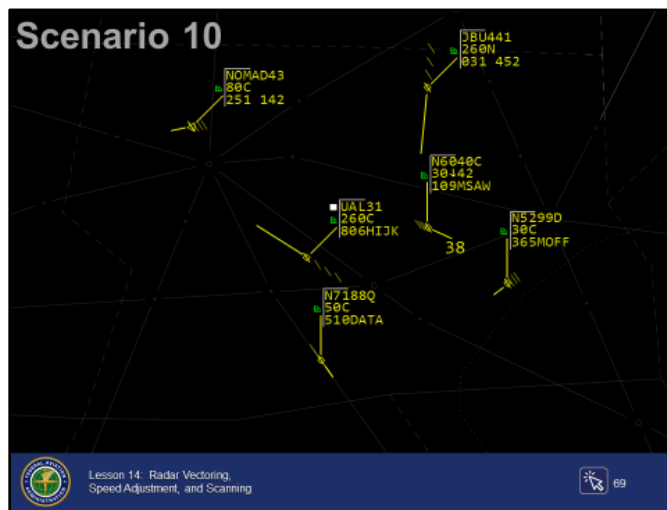


Click to review slide.

Use the space below for notes

SCANNING ACTIVITY (CONT'D)

Scenario 10



Slide is animated, 2 clicks. Click where indicated by click icons. The chart below shows items students should identify. Check them off as students name them in the review.



Click when student is ready. . Time limit 2:10.

FLID	✓	Event
JBU441		B4: "N"
		VCI manual
N5299D		Field E: MOFF
		VCI manual
N6040C		Field E: MSAW
		Descending to 30
		VCI manual
N7188Q		Field E: DATA
		VCI manual
NOMAD43		Free track
		VCI manual
UAL31		CDA with eligibility
		VCI manual
		Field E: HIJK



Click to review slide.

Use the space below for notes