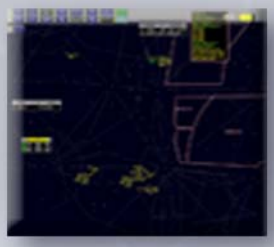
FAA Lesson Plan



En Route Stage 4
Radar Controller Training

Student

Speed Adjustment
Lesson 11

55055
V.1.07

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LESSON PLAN DATA SHEET

COURSE NAME:	RADAR CONTROLLER TRAINING
COURSE NUMBER:	55055
LESSON TITLE:	SPEED ADJUSTMENT
DATE REVISED:	2014-04
VERSION:	V.1.07
REFERENCES:	JO 7110.65V, Air Traffic Control; Federal Aviation Regulations (FARS) 14 CFR Section 91.117, Aircraft Speed; TI 6110.100, En Route Automation Modernization Air Traffic Manual: R-Position User Manual.
HANDOUTS:	55055-HO11, REFERENCE GUIDE AND PRACTICE EXERCISES
EXERCISES:	YES
END-OF-LESSON TEST:	YES
PERFORMANCE TEST:	NONE
MATERIALS:	
OTHER PERTINENT INFORMATION:	THIS LESSON IS BASED ON ERAM BUILD EAC1500. THE LESSON HAS BEEN REVIEWED AND REFLECTS CURRENT ORDERS AND MANUALS AS OF APRIL 2014.

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INTRODUCTION

Speed adjustment, when properly used, is an effective method of achieving separation and sequencing. It can make your job as a controller much easier and can be advantageous to pilots and aircraft operators.

Purpose

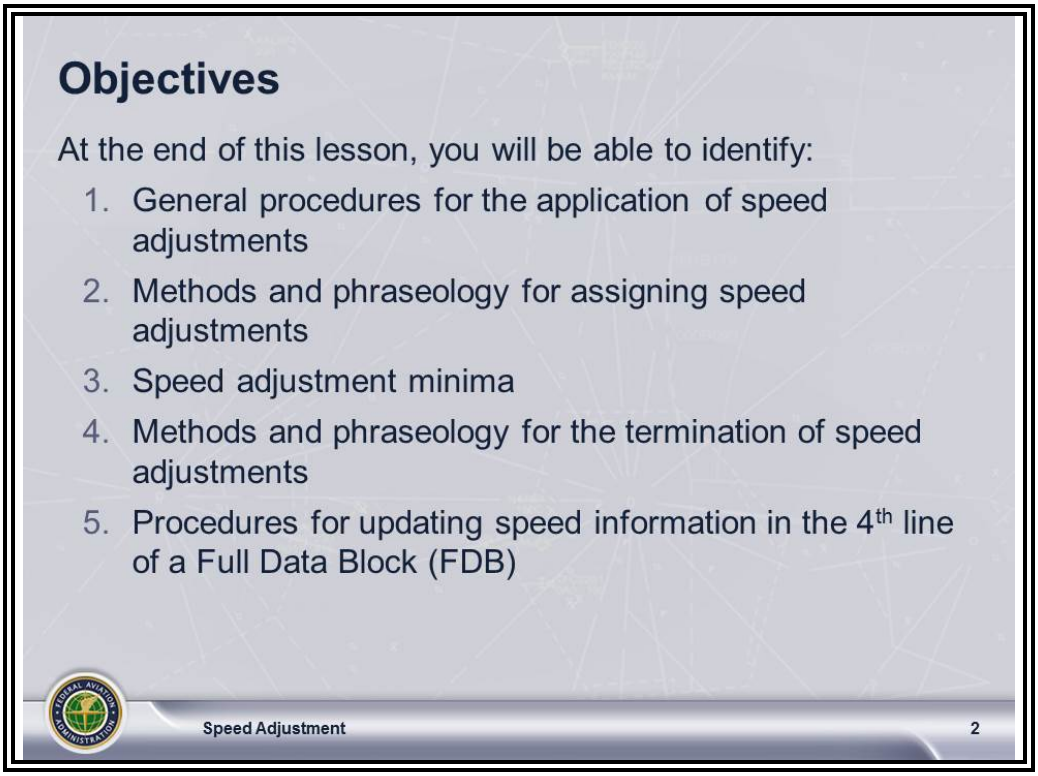
In this lesson, you will learn procedures, methods, minima, and phraseology for applying and terminating speed adjustments.

Motivation

Without an understanding of the mechanics of speed control, how altitude affects speed and how to manage speed adjustments, the controller can find that what appears to be a simple sequencing problem can quickly become a nightmare. Conversely, a thorough understanding of speed control and how to use it can make what appears to be a complex situation easily manageable.

INTRODUCTION *(Continued)*

Objectives



APPLICATION

Excessive Speed Adjustments
JO 7110.65, par. 5-7-1

- Keep speed adjustments to the minimum necessary to achieve or maintain:
  - Required spacing
  - Desired spacing
- Avoid adjustments requiring alternate increases and decreases.
- Terminate speed adjustments when no longer needed.

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

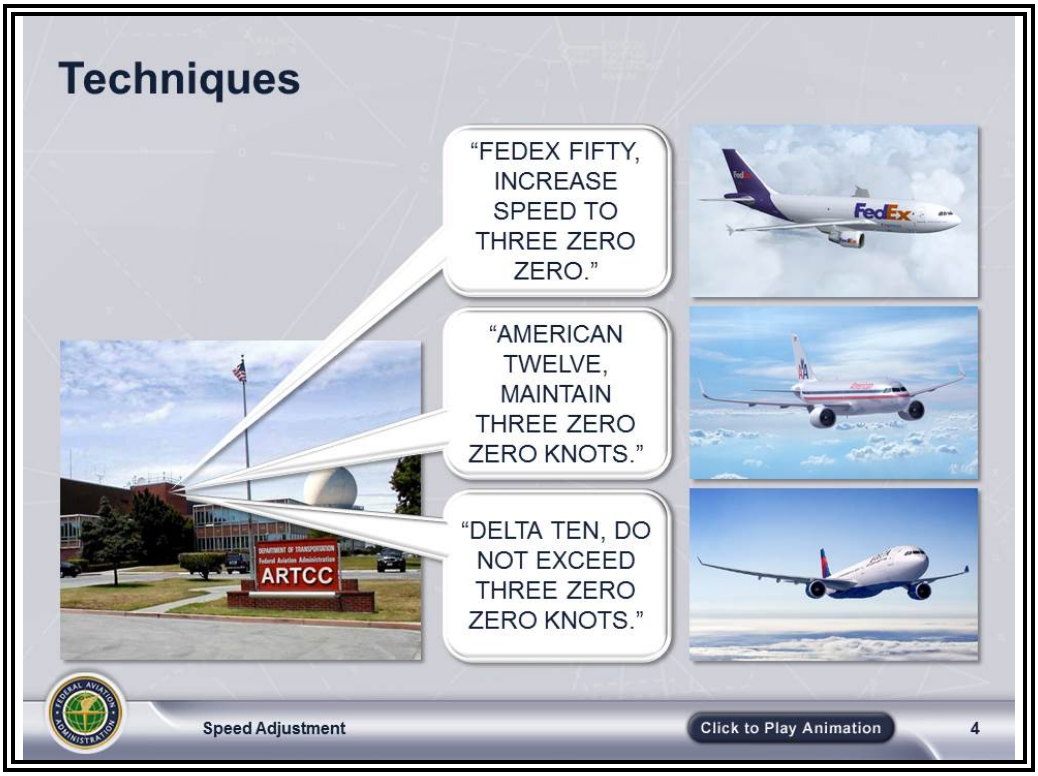
APPLICATION *(Continued)*

Considerations
JO 7110.65, par. 5-7-1

- 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 positions of aircraft involved
    - Spacing requirements
  - Time and distance required to accomplish speed adjustment is determined by aircraft:
    - Configuration
    - Altitudes
    - Speed

APPLICATION *(Continued)*

Techniques
JO 7110.65,
par. 5-7-1



- Compensate for compression by using one of the following techniques:
  - Increase leading aircraft first.
  - Reduce trailing aircraft first.
- Assign a specific airspeed if required to maintain spacing.
- Speed adjustments are not achieved instantaneously.

Continued on next page

APPLICATION *(Continued)*

Techniques (Cont'd)
JO 7110.65, par. 5-7-1

⊙ Allow increased time and distance to achieve speed adjustment in the following situations:

- Higher altitudes
- 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.

APPLICATION *(Continued)*

Assignment Restrictions
JO 7110.65,
par. 5-7-1

- Do **not** assign speed adjustment to aircraft:
  - At or above FL390, without pilot consent

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

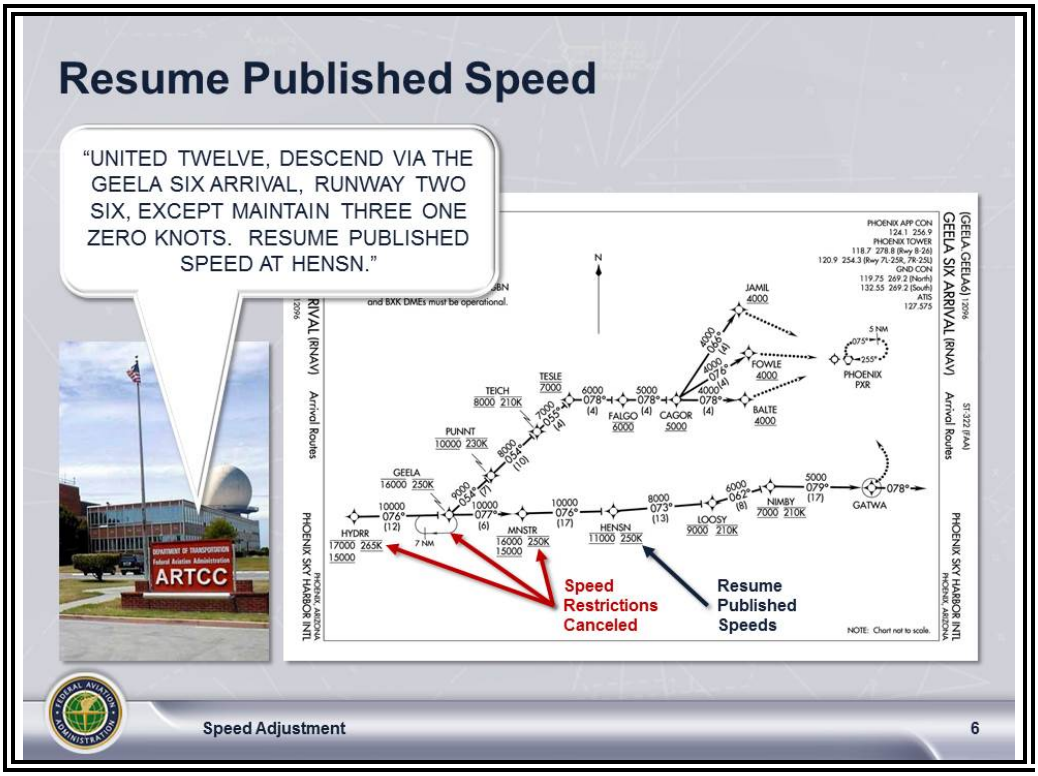
  - Executing a published high altitude instrument approach procedure
  - In a holding pattern
  - Inside the final approach fix on final, or a point 5 miles from the runway, whichever is closer to the runway

Restating Previously Issued Speed Adjustment
JO 7110.65,
par. 5-7-1

- If required, restate previously issued speed adjustments at the time the approach clearance is issued.
  - An approach clearance cancels any previously issued speed adjustment.
    - Pilots are expected to make their own speed adjustment to complete the approach unless adjustments are restated.

APPLICATION *(Continued)*

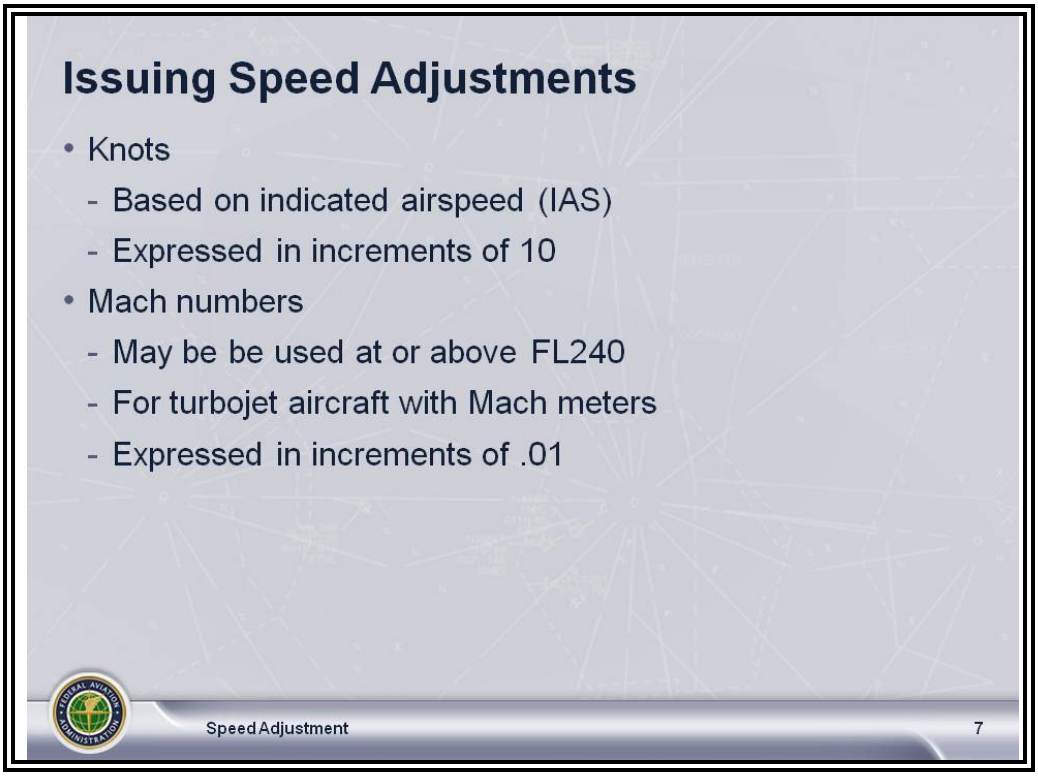
Published Speed Restrictions
JO 7110.65,
par. 5-7-1



- If feasible, when issuing speed adjustments to aircraft cleared along a route or procedure that has published speed restrictions, advise the aircraft where to resume published speed.

APPLICATION *(Continued)*

Terms for Issuing Speed Adjustment
JO 7110.65, par. 5-7-1



- Knots
  - Based on indicated airspeed (IAS)
  - Expressed in increments of 10
- Mach numbers
  - May be used at or above FL240
  - For turbojet aircraft with Mach meters
  - Expressed in increments of .01

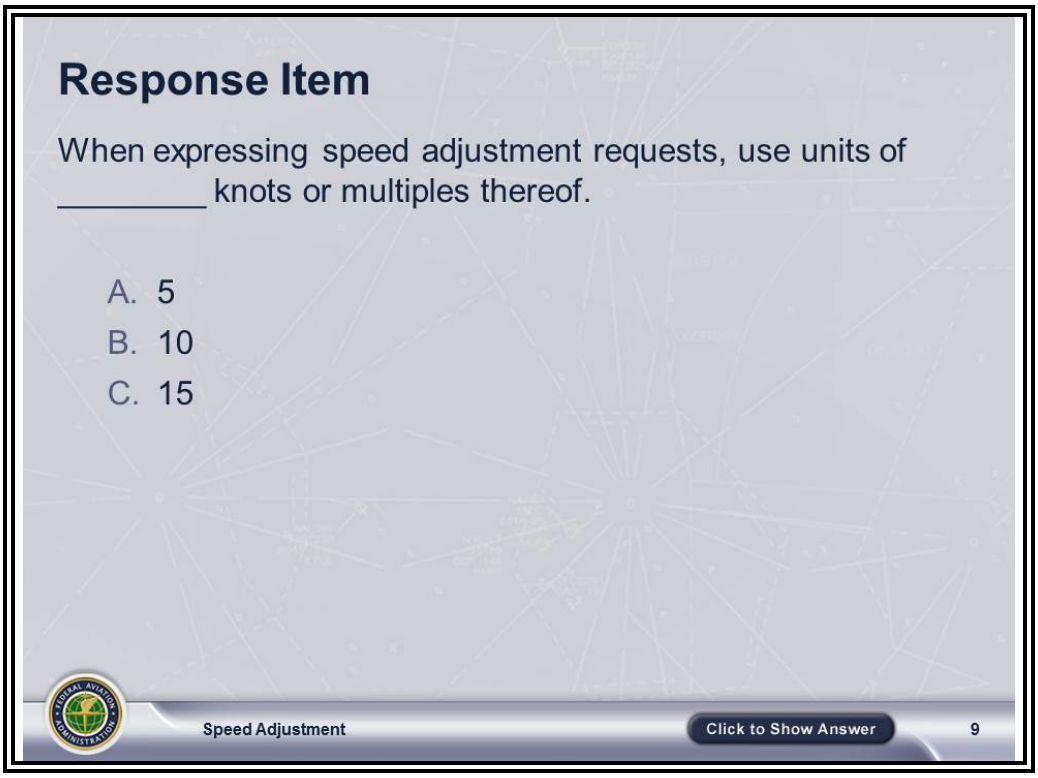
    Examples: .69, .71, .75, .82, etc.

NOTE: Although Mach numbers ***may*** be used at or above FL240, they are ***typically*** used at or above FL290. The reasons for this will be discussed in more detail later in the lesson.

- 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.

APPLICATION *(Continued)*

Review



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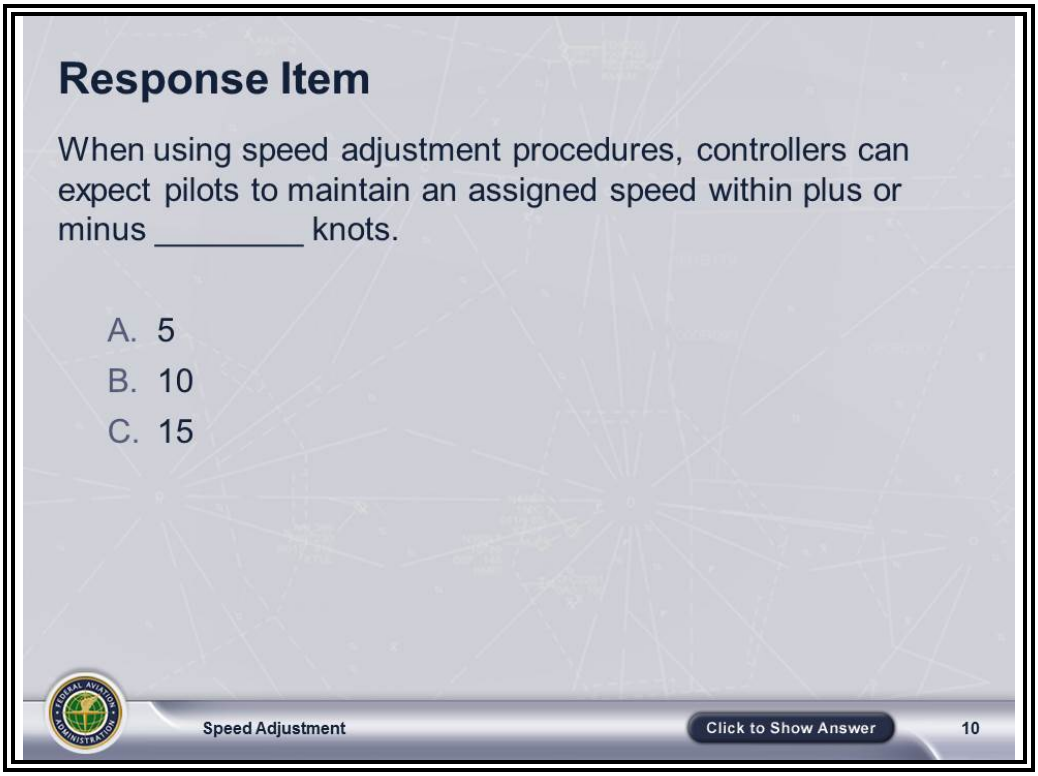
APPLICATION *(Continued)*

Review (Cont'd)



QUESTION: Why should speed adjustment **not** be assigned at/above FL390 without the pilot's consent?

QUESTION: What effect does an approach clearance have on previously issued speed restrictions?

AIRSPEED AND MACH

Airspeed and Mach Introduction

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

NOTE: For purposes of this lesson, scenarios are applied in “no wind” situations. Also, the speeds on the reference charts are based on standard temperature and pressure. As temperature and pressure vary, the speeds will vary as well. You will always need to take the winds into consideration when applying speed control.

AIRSPEED AND MACH *(Continued)*

Definitions
JO 7110.65
Pilot Controller
Glossary

📖 **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).

📖 **True airspeed in knots (KTAS):** True Airspeed is the airspeed 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.”

📖 **Indicated airspeed in knots (KIAS):** The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term “airspeed.” *Used primarily in speed assignments below FL290.*

📖 **Mach:** The speed an aircraft is moving in relation to the speed of sound, e.g. MACH.82, MACH.76. *Used primarily at FL290 and above*.

📖 **Ground speed (GS):** The speed of an aircraft relative to the surface of the earth. It is the result of true airspeed affected by winds.
TAS +/- wind speed = GS.

Mach Number Overview

⊙ Effective speed control requires a working knowledge of the differences between:

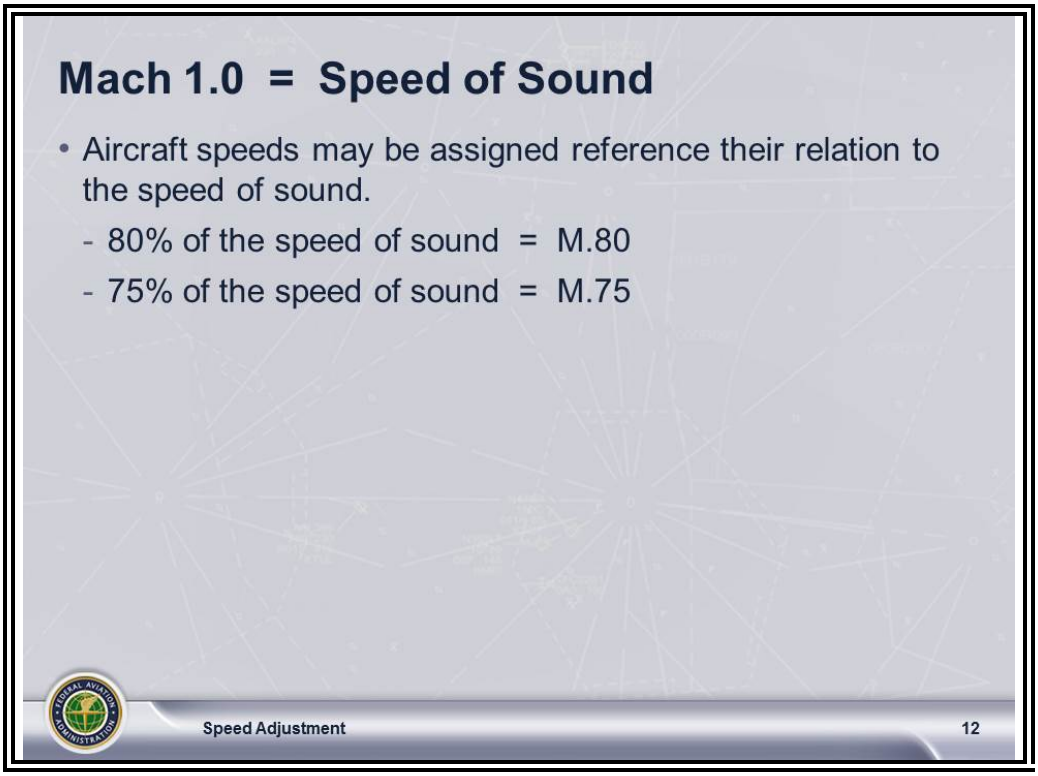
- Mach number
- Indicated airspeed

⊙ In this section we will discuss:

- Definition of Mach
- Relationship between altitude, temperature, TAS and Mach
- Basic rules of thumb for using Mach numbers in speed control situations

AIRSPEED AND MACH *(Continued)*

What is Mach?



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

- The speed of sound is M1.0, so an aircraft traveling at 80% of the speed of sound would be maintaining M.80.
- An aircraft traveling at 75% of the speed of sound would be maintaining M.75.

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AIRSPEED AND MACH *(Continued)*

What is Mach? (Cont'd)

- The speed of sound is a complex formula taking into account:
  - Density of the atmosphere
  - Temperature
  - Other factors
- For ATC purposes, you can think of the speed of sound as a function of temperature with "colder" equaling "slower."
- At sea level the standard temperature is 59 degrees F while at FL360 the standard temperature is -69.7 degrees F.
- Therefore, at a constant Mach number, the **higher** an aircraft climbs, the **slower** its KTAS.
- Conversely, at a constant Mach number, the **lower** an aircraft descends, the **faster** its KTAS.
- At and above FL360, the temperature remains virtually the same, so **Mach speed does not vary above FL360.**

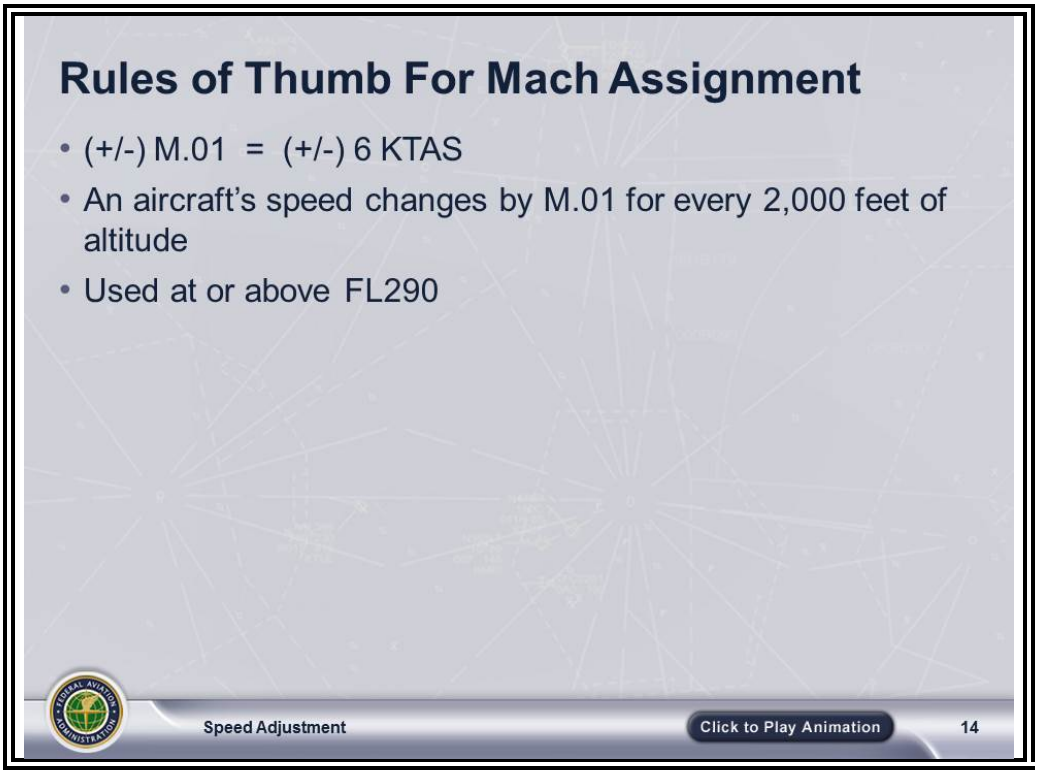
AIRSPEED AND MACH *(Continued)*

Review

QUESTION: What does M.80 mean?

QUESTION: What happens to the speed of sound at FL360 and above?

Rules of Thumb for Assigning Mach



- There are 3 basic rules for Mach number assignment:
  - For every M.01 adjustment, there is a 6 KTAS difference in speed.
  - At a constant airspeed, an aircraft's Mach changes by M.01 for every 2000 ft. of altitude.
  - Mach numbers are primarily used at or above FL290.

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AIRSPEED AND MACH *(Continued)*

Rules of Thumb for Assigning Mach (Cont'd)

- Speed Adjustments of M.01 will affect the TAS of an aircraft by 6 knots.
- **Example:** If an aircraft at FL340 is maintaining M.78 and another aircraft at FL340 is maintaining M.76, there will be a 12 KTAS difference between the two aircraft.
  - There is a difference of M.02 between them.
  - 6 KTAS per M.01 results in 12 KTAS difference.

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

Rule of Thumb

For every M.01 adjustment, there is a 6 KTAS difference in speed.

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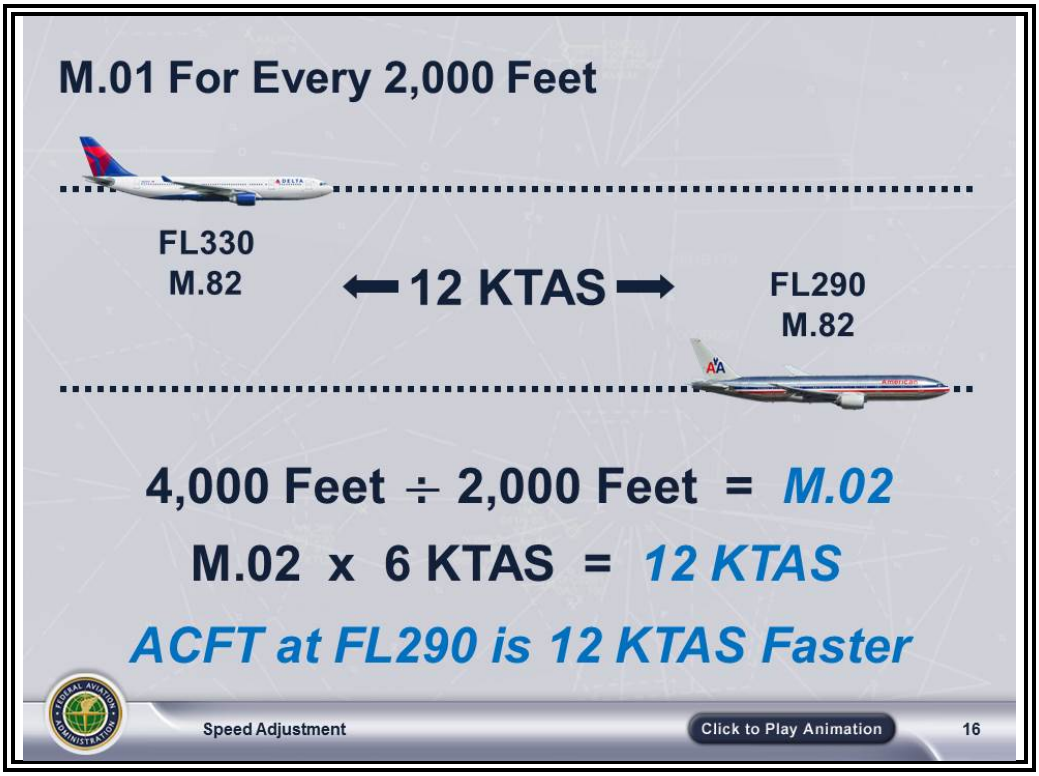
AIRSPEED AND MACH *(Continued)*

Rules of Thumb for Assigning Mach (Cont'd)



- M.01 change in speed for every 2000 ft. of altitude.
- **Example:** An aircraft is at FL330 assigned M.82 while another aircraft is at FL290 assigned M.82.
  - Since **higher is slower**, and the aircraft at FL330 is 4000 ft. higher than the aircraft at FL290, there will be an equivalent of M.02 in speed difference, or 12 KTAS.
  - 6 KTAS for each M.01 = 12 KTAS
  - The aircraft at FL290 will be moving 12 KTAS faster than the aircraft at FL330.

Rule of Thumb

Mach changes by M.01 for every 2000 ft. of altitude.

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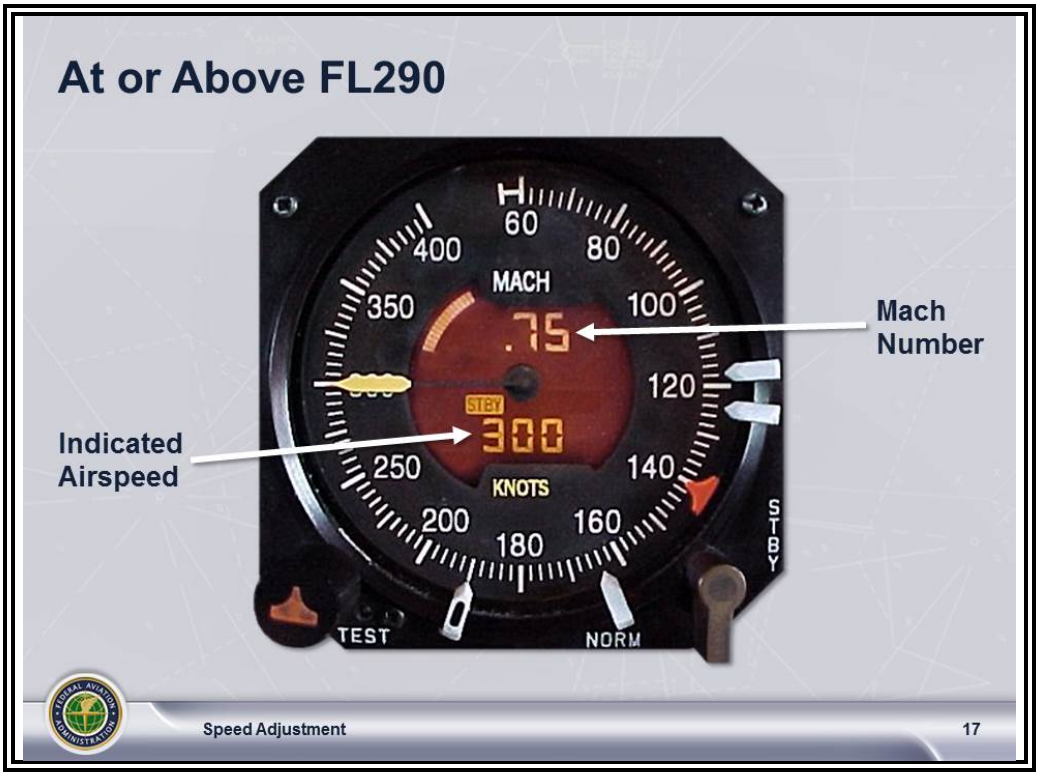
AIRSPEED AND MACH *(Continued)*

Rules of Thumb for Assigning Mach (Cont'd)



- The "At or above FL290" rule of thumb stems from pilot instrumentation and aircraft operating envelopes.
- At lower altitudes, speed limitations are expressed in IAS.
- At some point, the pilot will transition from measuring the aircraft's speed in IAS to Mach number.
- This usually occurs around FL290, so controllers also typically use this as a natural transition point.
- This by no means implies that IAS cannot be used above FL290, but rather that aircraft instrumentation favors the use of Mach numbers at these higher altitudes.

NOTE: Take note of the operating envelope of different aircraft models and aircraft operators as you work.

Rule of Thumb

Mach numbers are primarily used at or above FL290.

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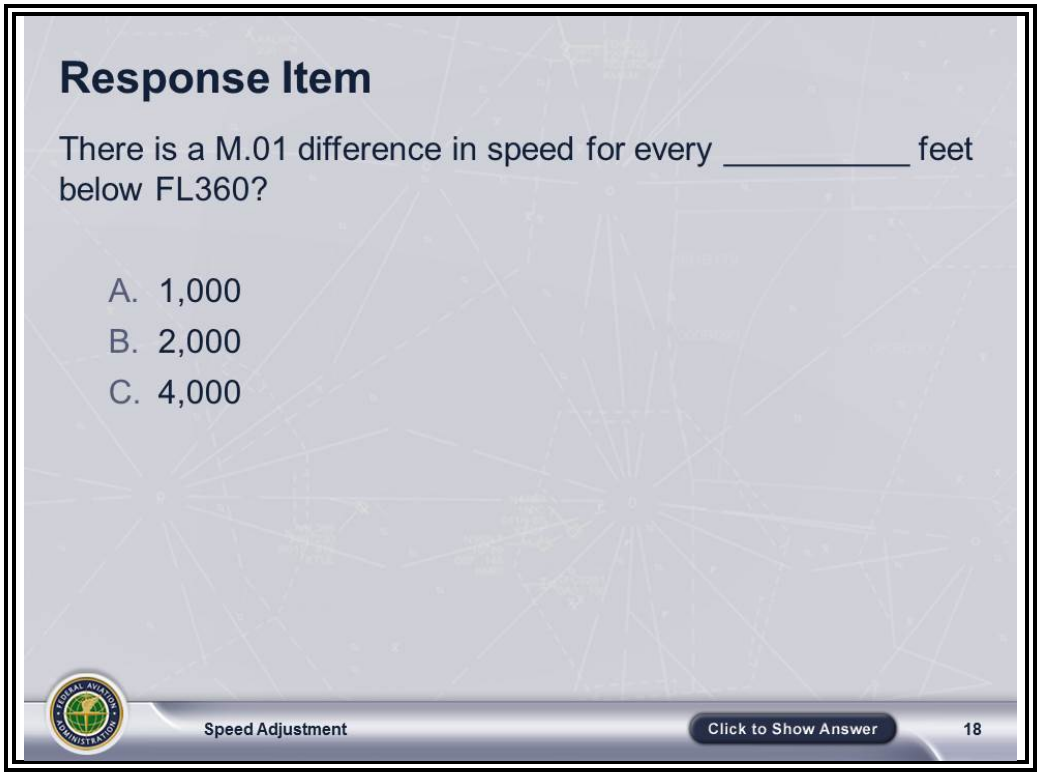
AIRSPEED AND MACH *(Continued)*

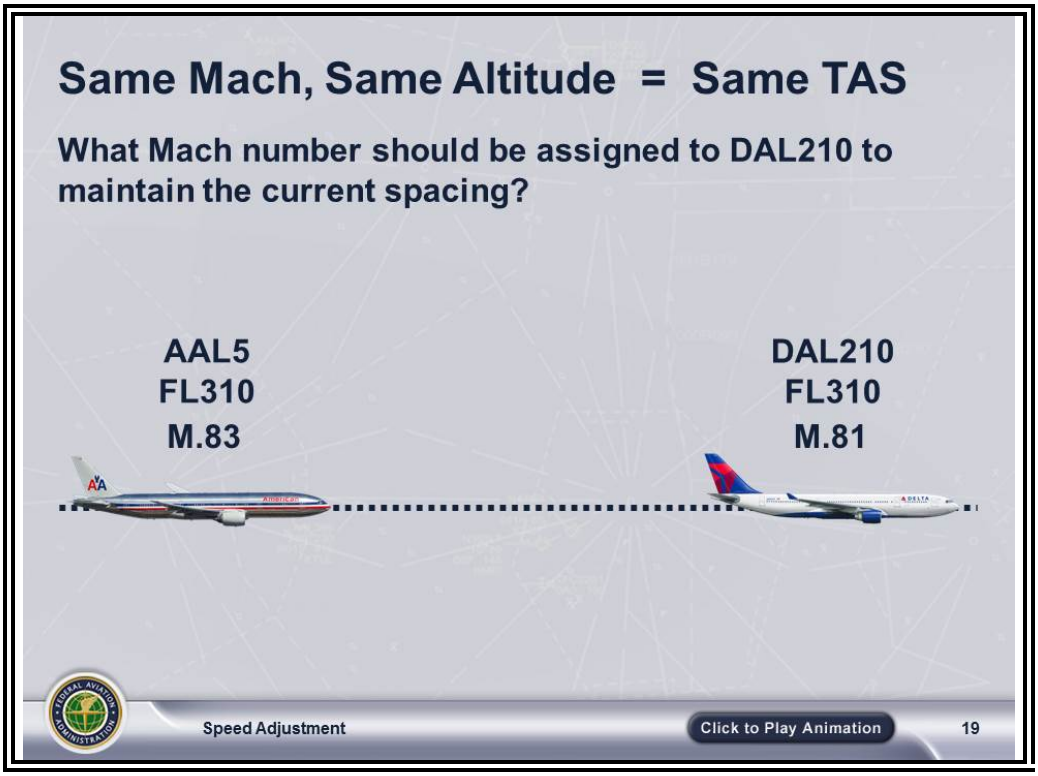
Review



QUESTION: What is the difference in KTAS for each M.01 of assigned speed?

MACH APPLICATION SCENARIOS

Scenario 1:
Same Altitude
Same Mach



- The simplest speed control situation occurs when two aircraft are operating at the same altitude, on the same heading, in level flight.
- Assignment of the same Mach will produce the same TAS.
  - There may be a slight variation in that a pilot has the authority to vary by M.02 from an assigned speed.
- What Mach number should be assigned to DAL210 to maintain the current spacing?

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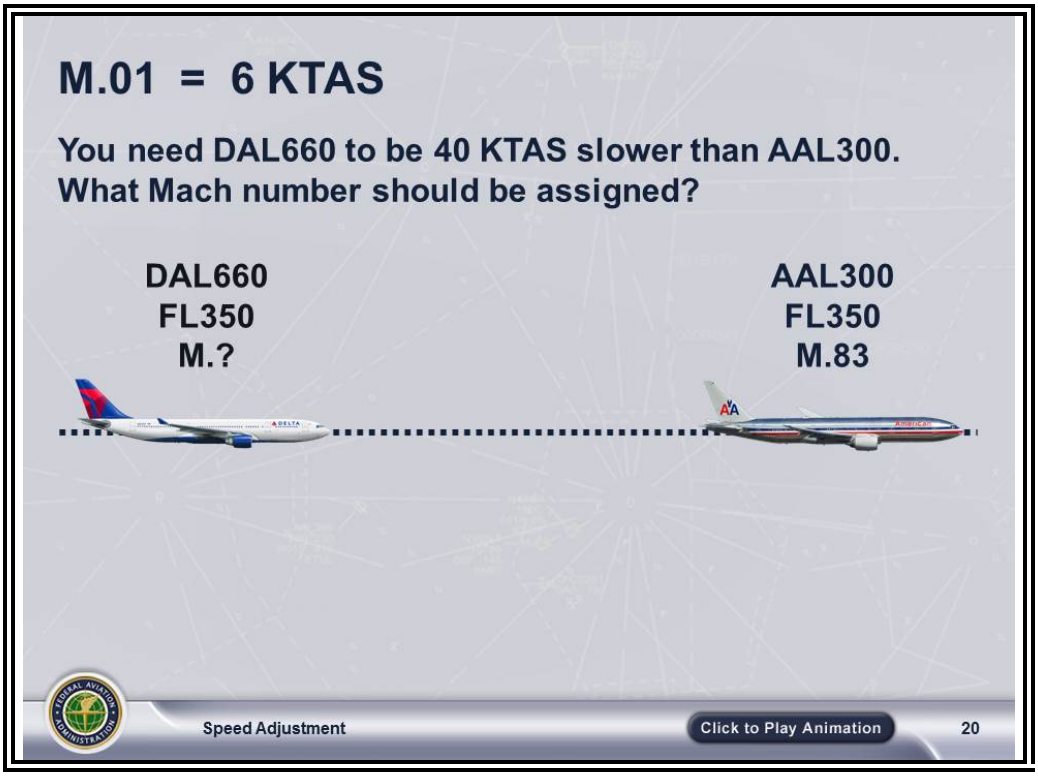
MACH APPLICATION SCENARIOS *(Continued)*

Scenario 2:
Apply
M.01 = 6 KTAS
Rule of Thumb



- AAL300 is at FL350 maintaining Mach .83. You need DAL660 to be 40 knots slower.
- What Mach number would you assign DAL660?

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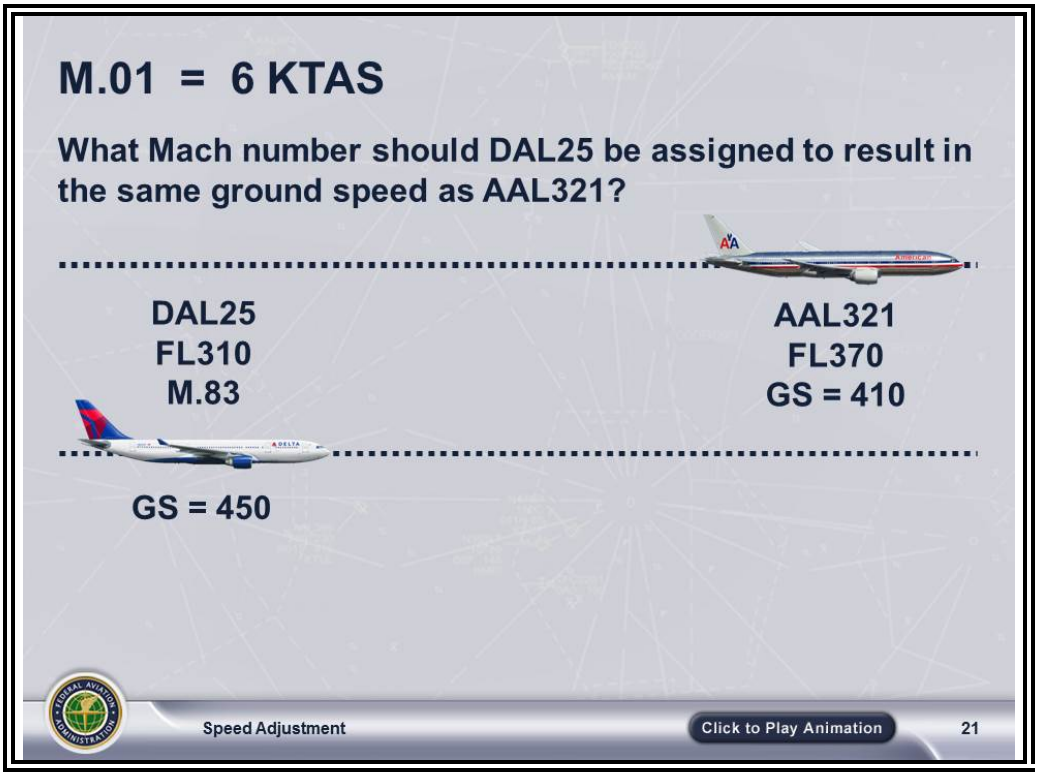
MACH APPLICATION SCENARIOS *(Continued)*

Scenario 3:
Apply
M.01 = 6 KTAS
Rule of Thumb



- DAL25 at FL300 is following AAL321 at FL360. AAL321's ground speed is 410 knots and DAL25's is 450 knots. DAL25 is maintaining M.83.
- What Mach should you assign DAL25 to get the same ground speed as AAL321?

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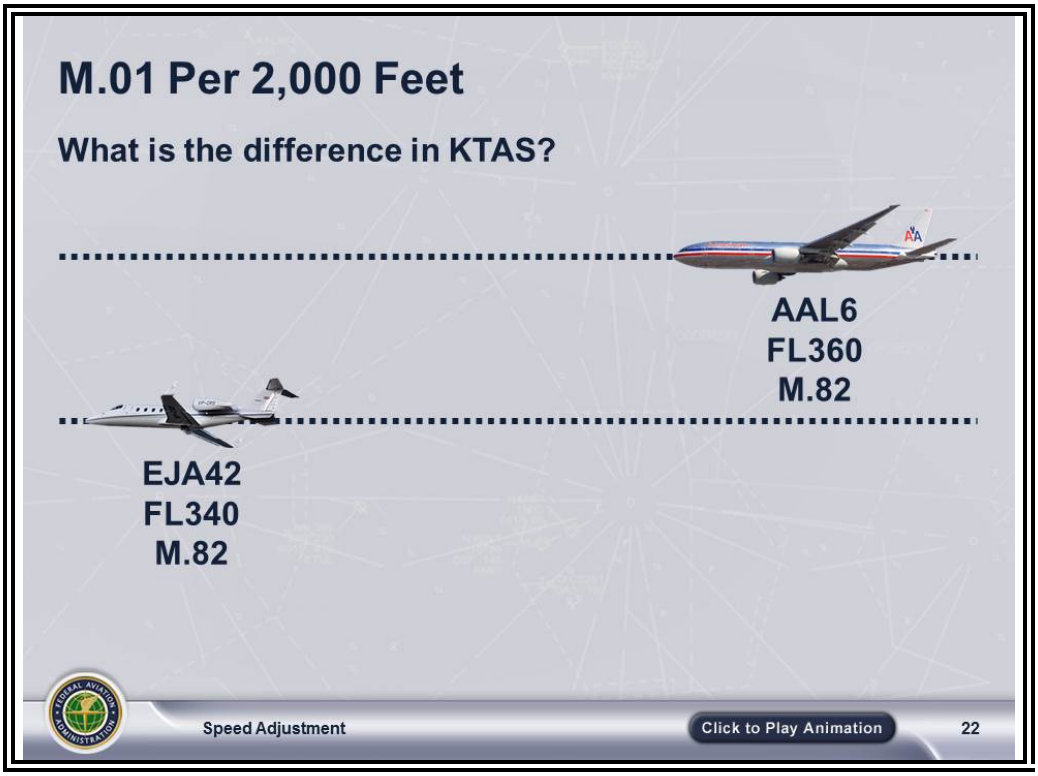
MACH APPLICATION SCENARIOS *(Continued)*

Scenario 4: Apply M.01/2000ft. Rule of Thumb



- AAL6 at FL360 and EJA42 at FL340 are both maintaining M.82.
- Which aircraft is faster? By how many knots?

NOTE: If you need an aircraft to go faster and the aircraft is already at its maximum airspeed, descending the aircraft may accomplish this goal. (Winds at different altitudes also need to be taken into account.)

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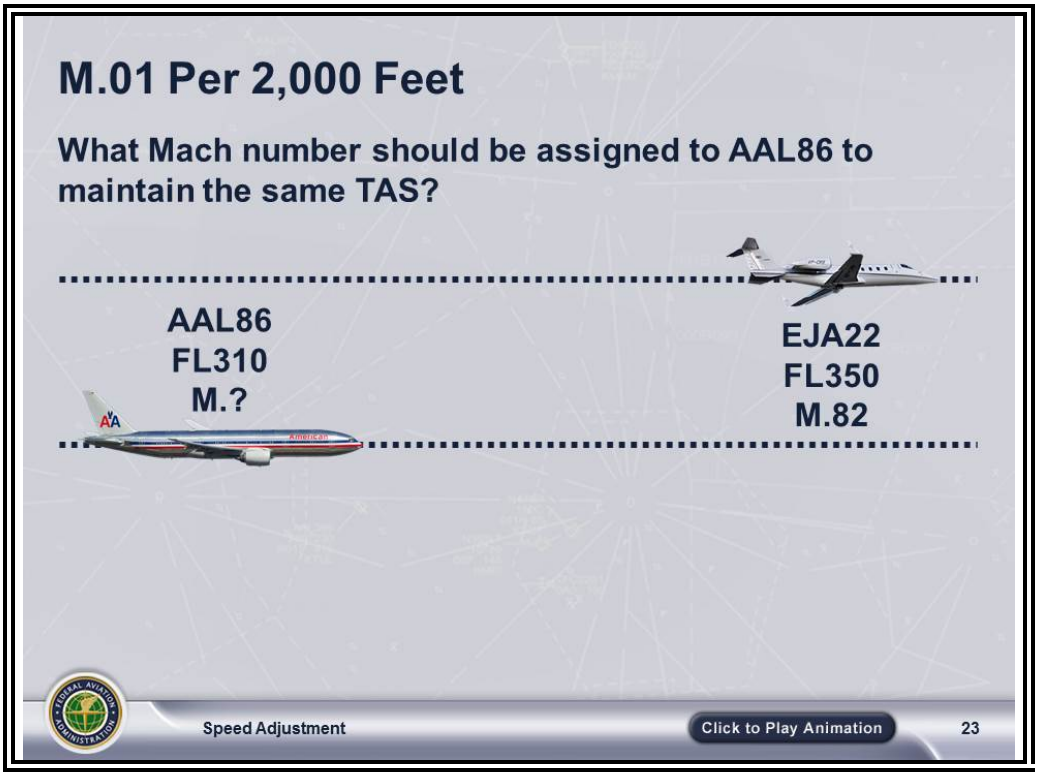
MACH APPLICATION SCENARIOS *(Continued)*

Scenario 5: Apply M.01/2000ft. Rule of Thumb



- EJA22 is at FL350 maintaining M.82.
- What Mach number should be assigned to AAL86 at FL310 to maintain the same TAS?

NOTE: Generally, an aircraft at a lower altitude needs to be assigned a lower Mach number to maintain the same true airspeed as an aircraft at a higher altitude.

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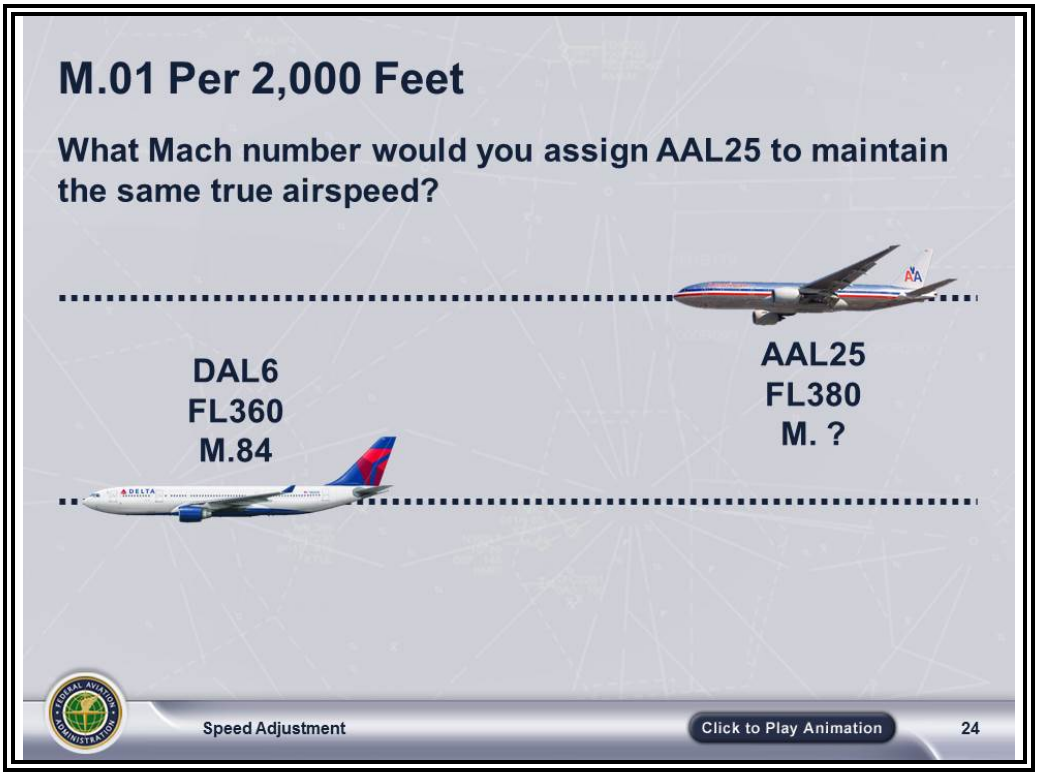
MACH APPLICATION SCENARIOS *(Continued)*

Scenario 6: Apply M.01/2000ft. Rule of Thumb



- DAL6 is at FL360 maintaining M.84 and AAL25 is at FL380.
- What Mach would you assign AAL25 to maintain the same true airspeed?

Practice Exercise 1

- Practice Exercise 1: Mach Assignment Practical Application is located in 55055-HO11.

IAS

What is IAS?
JO 7110.65
Pilot Controller Glossary

- In this section we will discuss:
  - What is indicated airspeed
  - The relationship between altitude, TAS and IAS
  - Basic rules of thumb for using IAS in speed control situations
  - Why pilots use both Mach and IAS
- 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.

NOTE: KIAS and IAS are used interchangeably in this lesson, with IAS assuming airspeed in knots.

IAS *(Continued)*

"Lower" is "Slower"

- 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 error.
- At FL430, 250 KIAS is equal to 502 KTAS, while at MSL, 250 KIAS equals 250 KTAS.
- If indicated airspeed is constant, "**LOWER" IS "SLOWER**."

IAS *(Continued)*

Indicated Airspeed in Descent

- If an aircraft in a descent is assigned a constant IAS, the TAS of the aircraft will decrease as altitude is lost.

IAS *(Continued)*

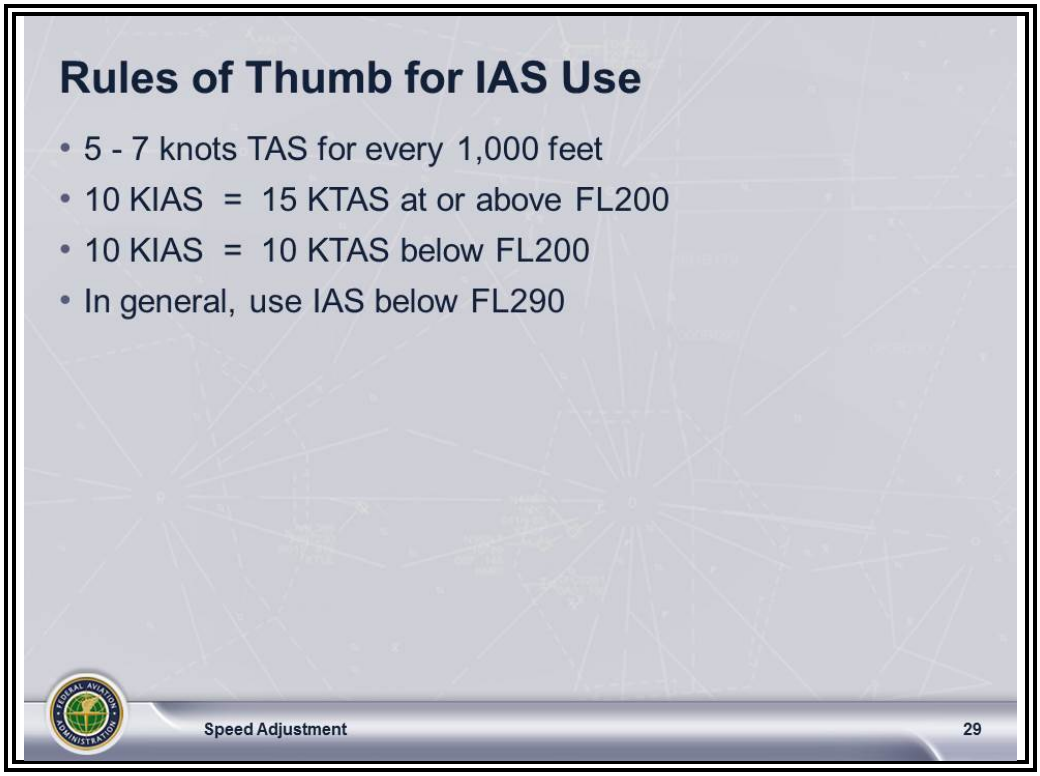
Review

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

QUESTION: If one aircraft is at FL190 assigned 250 KIAS and another is at 15,000 ft. assigned 250 KIAS, which will have a faster TAS?

QUESTION: What altitude is a good general point to switch from IAS to Mach numbers, or vice versa, and why?

Rules of Thumb for IAS Use



⊙ The basic rules for IAS assignment are as follows:

- Assume 5-7 knots TAS variance for every 1000 ft. of altitude change.
- Expect 15 KTAS difference for every 10 KIAS assigned at an altitude at or above FL200.
  - 10 KIAS = 15 KTAS at or above (AOA) FL200
- Below FL200, assume basically a 1 for 1 ratio. 10 KIAS will equate to approximately 10 KTAS.
- In general, use indicated airspeeds below FL290.

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Rules of Thumb for IAS Use (Cont'd)

- Assume 5-7 knots TAS variance for every 1,000 ft. of altitude change.
  - For the calculations in this lesson, 6 KTAS will be used.
- **Example:** an aircraft at 15,000 ft. assigned 250 KIAS will be traveling 30 KTAS faster than an aircraft assigned 250 KIAS at 10,000.
  - 15,000 ft.-10,000 ft. = 5000 ft.
  - 6 KTAS for every 1000 ft.
  - 6 KTAS X 5 = 30 KTAS

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 ft. the variance is so slight that you can typically expect no change.

Rule of Thumb

Assume 5-7 knots TAS variance for every 1000 ft. of altitude change.

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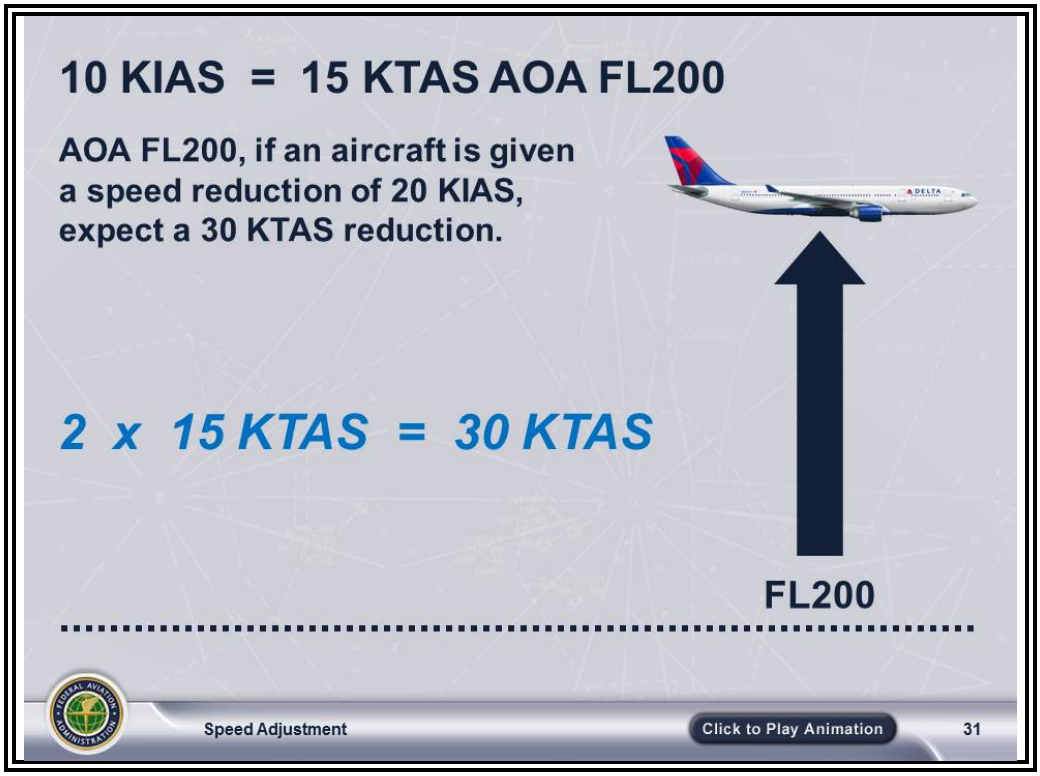
Rules of Thumb for IAS Use (Cont'd)



- 10 KIAS = 15 KTAS AOA FL200
  - The disparity between IAS and TAS increases with altitude.
  - At mean sea level there is no variance, but at FL290 there is a 15 KTAS difference.
  - For general purposes, assuming *15 KTAS difference for every 10 KIAS assigned at an altitude at or above FL200* works well.
- **Example:** At or above FL200, if an aircraft is reduced by 20 KIAS, expect a difference of approximately 30 KTAS.
  - 2 X 15 KTAS = 30 KTAS

NOTE: FL200 is used as a cutoff point based on airspeed conversion charts. In reality, it averages about 13 KTAS for every 10 KIAS at FL200.

Rule of Thumb

Expect 15 KTAS difference for every 10 KIAS assigned at an altitude at or above FL200.

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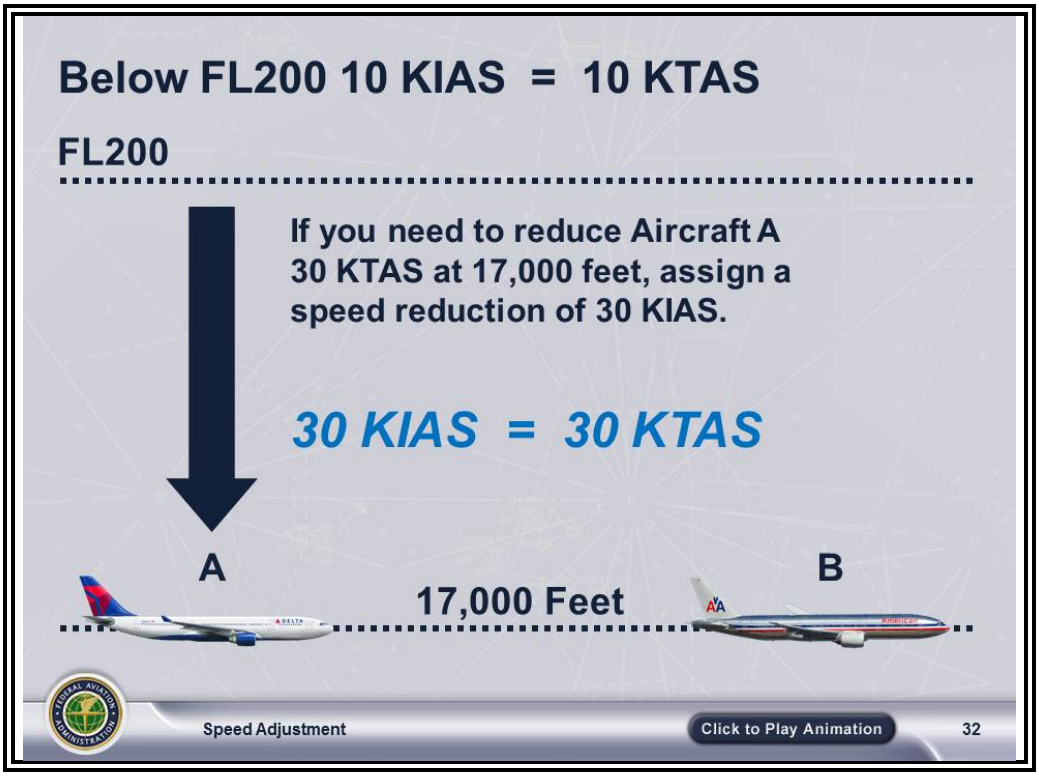
IAS *(Continued)*

Rules of Thumb for IAS Use (Cont'd)

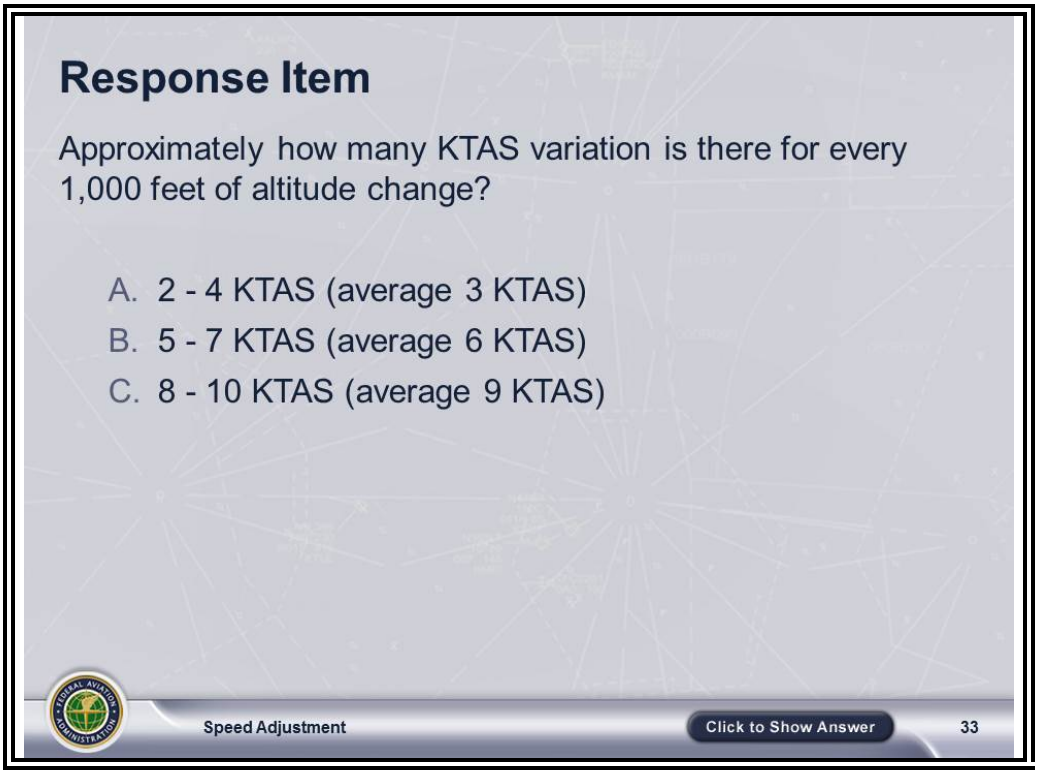


- Below FL200, assume basically a 1 for 1 ratio. 10 KIAS will equate to approximately 10 KTAS.
- **Example:** If there are 2 aircraft at 17,000 and you want the back aircraft to reduce speed by 30 KTAS, reduce that aircraft by 30 KIAS.
  - 30 KIAS = 30 KTAS

Rule of Thumb

Below FL200, 10 KIAS will equate to approximately 10 KTAS.

Review



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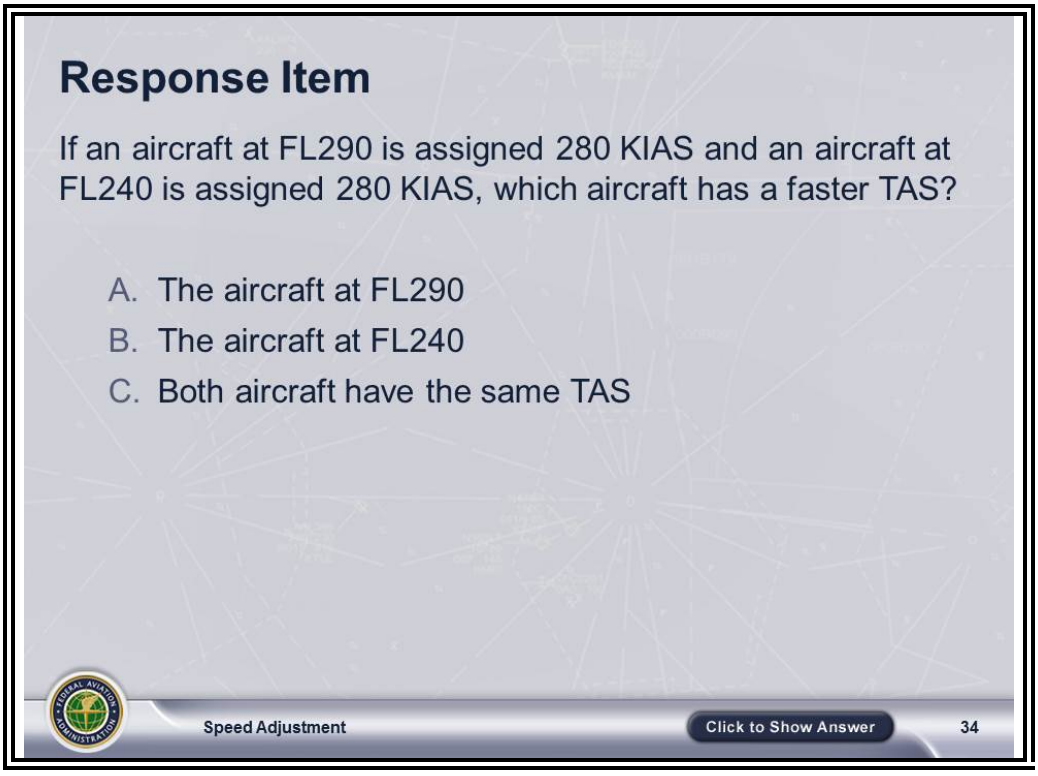
Review (Cont'd)



QUESTION: In the previous scenario, approximately how many KTAS faster is the aircraft at FL290 than the aircraft at FL240?

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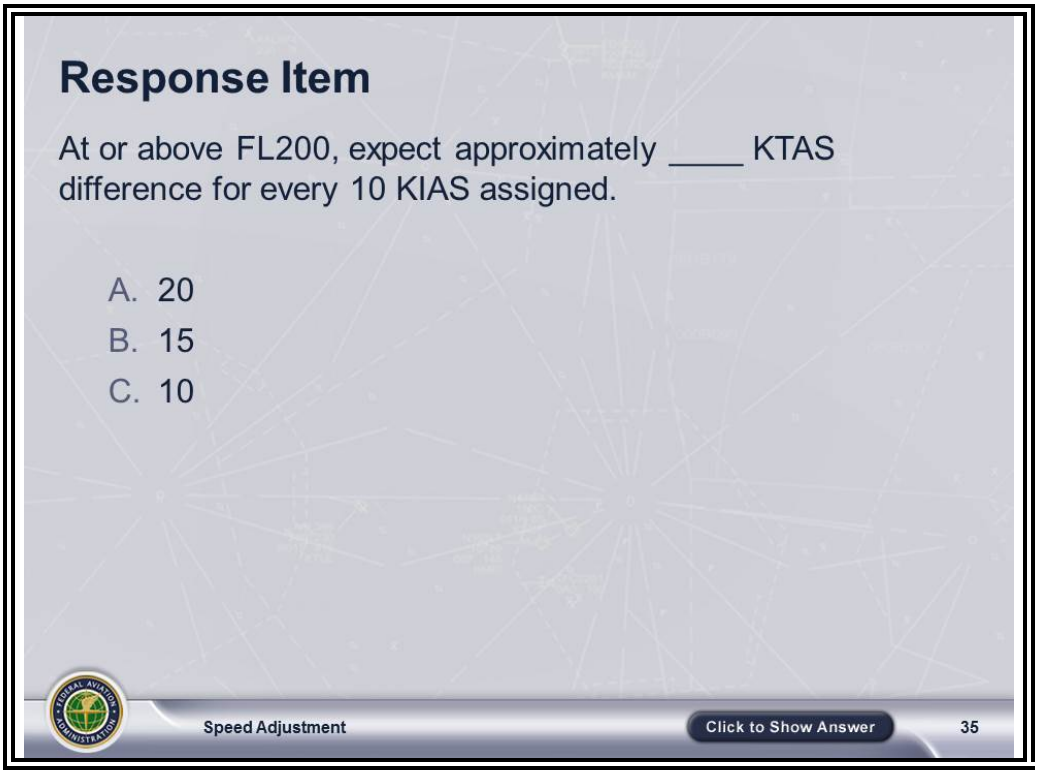
Review (Cont'd)



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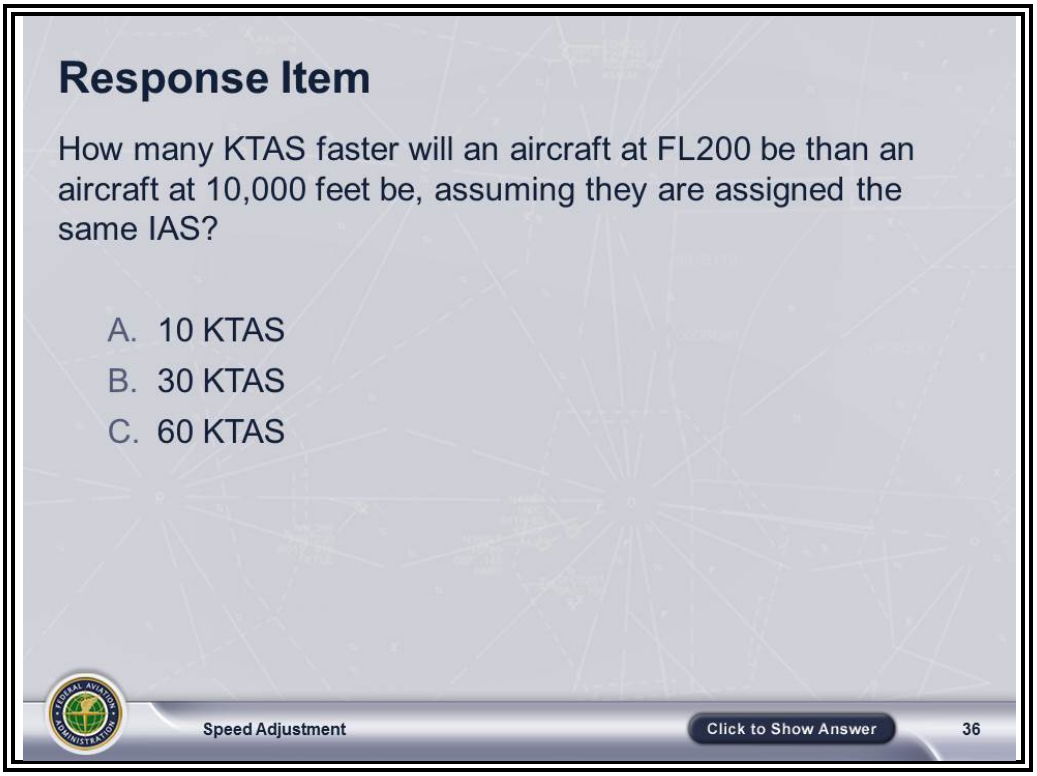
Review (Cont'd)



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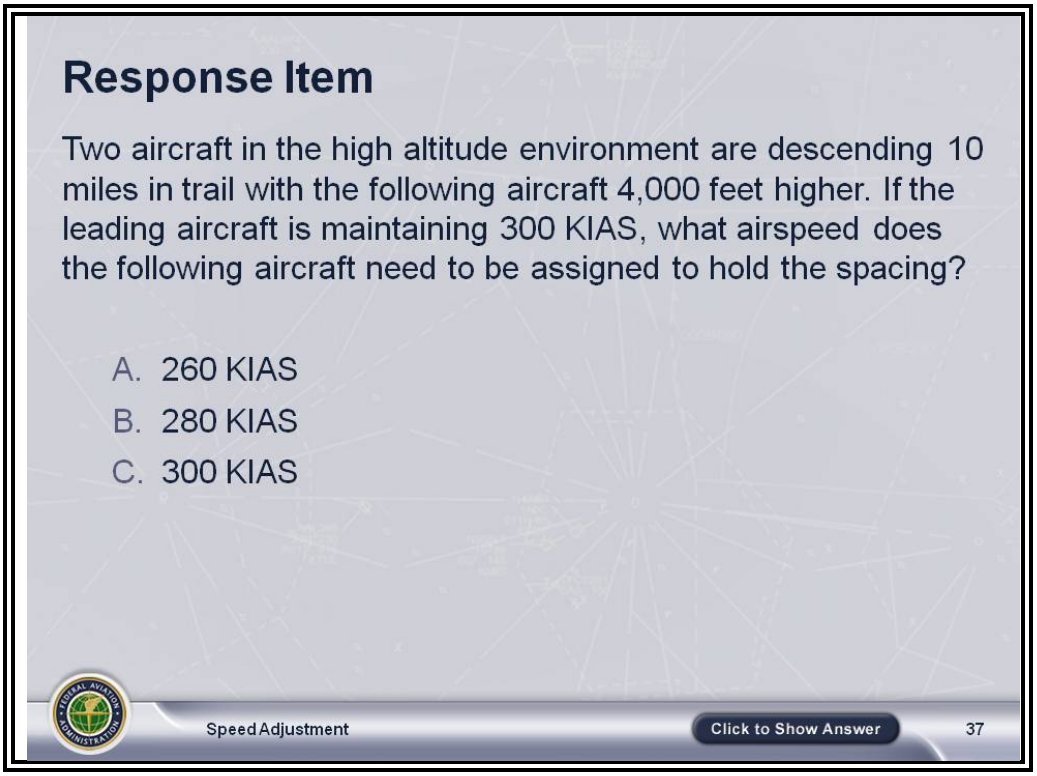
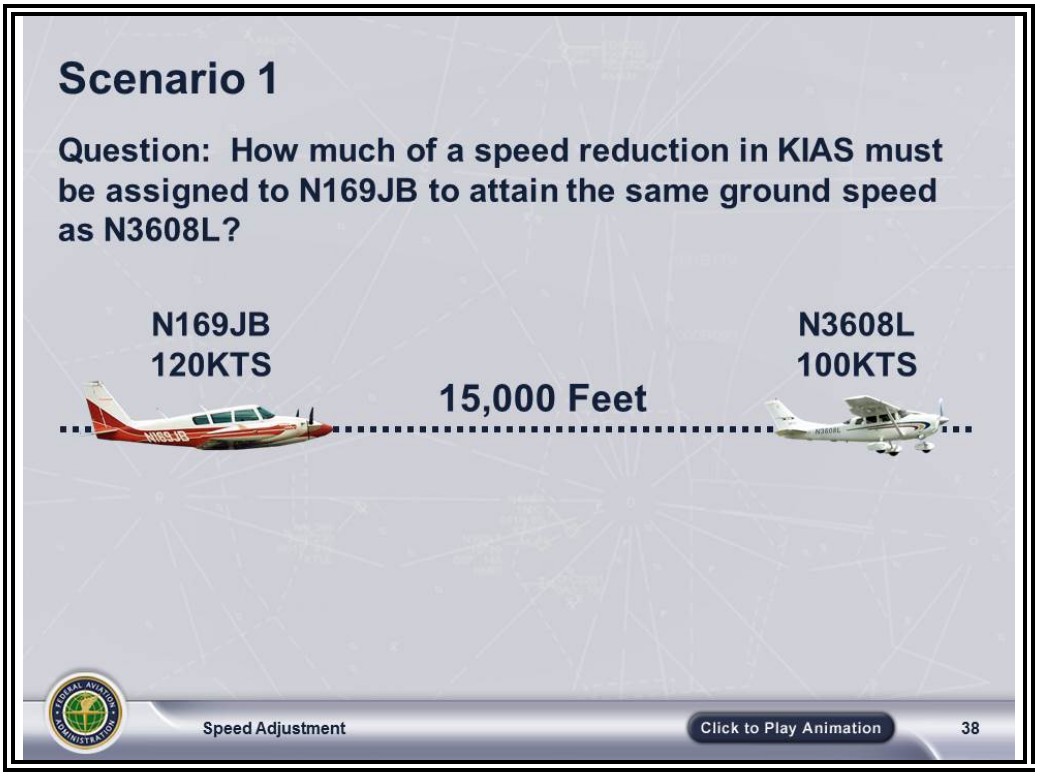
Review (Cont'd)



IAS APPLICATION SCENARIOS

Scenario 1: Apply 10 KIAS = 10 KTAS Below FL200 Rule of Thumb



- N3608L is at 15,000 ft. showing a ground speed of 100 knots. N169JB, also at 15,000 ft. is faster, with a ground speed of 120 knots.
- How much of a speed reduction in KIAS must be assigned to N169JB to attain the same ground speed as N3608L?

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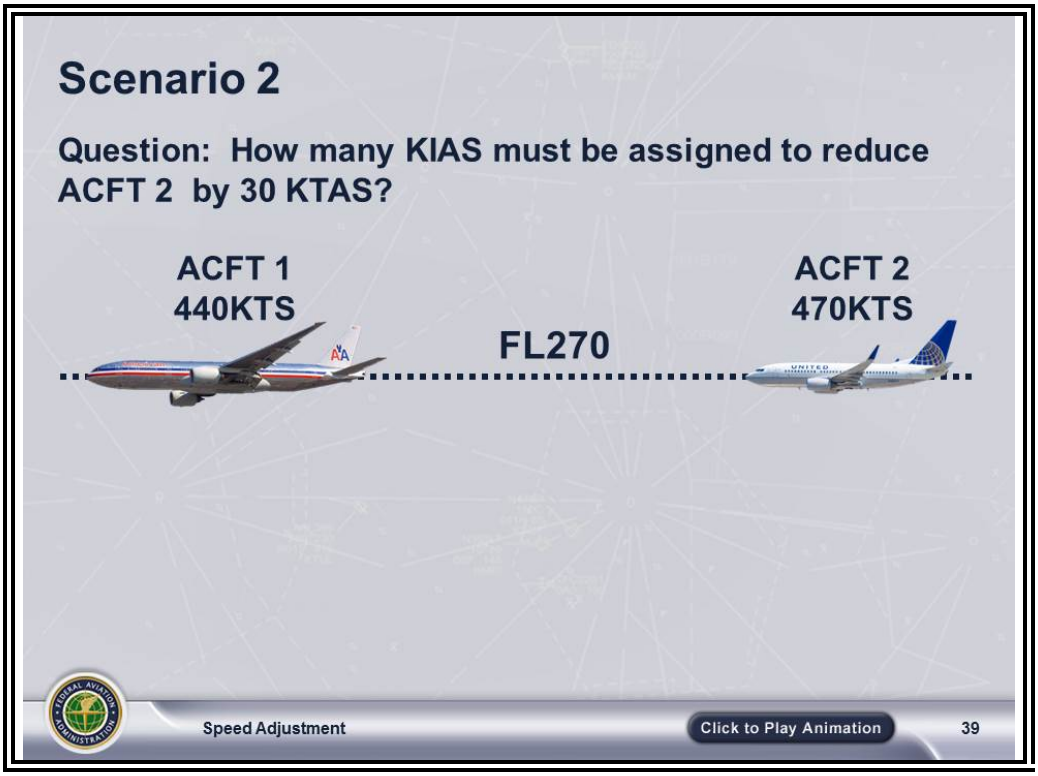
IAS APPLICATION SCENARIOS *(Continued)*

Scenario 2: Apply 10 KIAS = 15 KTAS AOA FL200 Rule of Thumb



- Aircraft 1 is at FL270 with a ground speed of 440 knots. Aircraft 2 is at FL270 with a ground speed of 470 knots.
- How many KIAS must be assigned to reduce Aircraft 2 by 30 KTAS?

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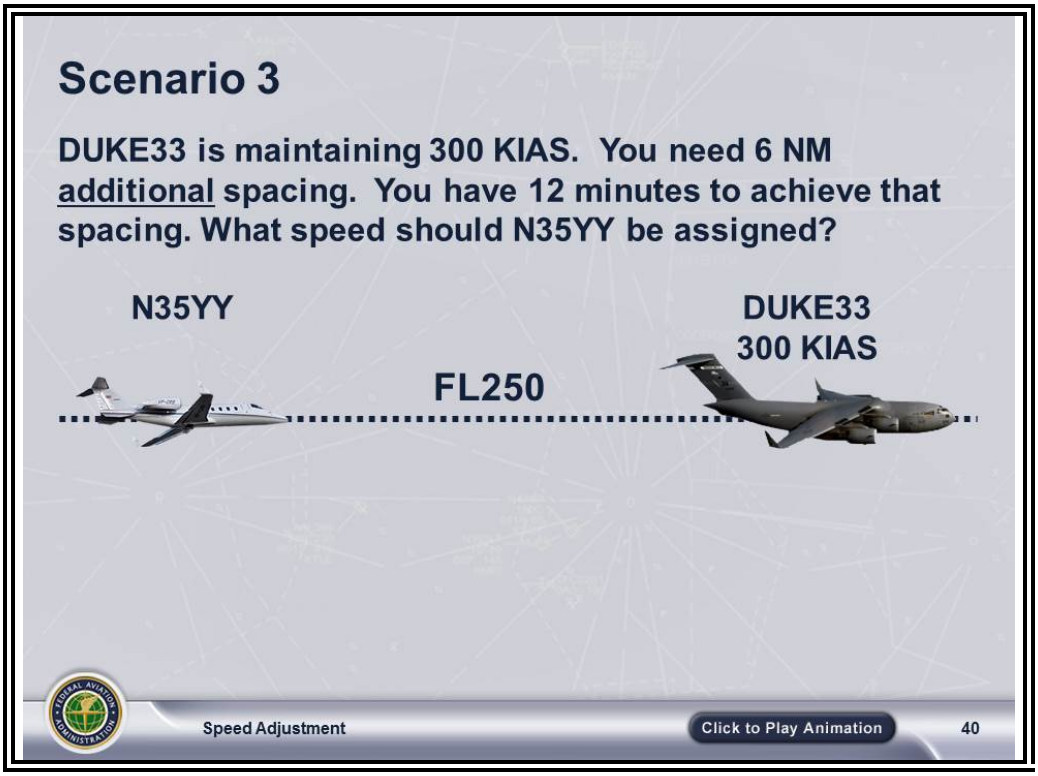
IAS APPLICATION SCENARIOS *(Continued)*

Scenario 3:
In-trail Spacing



- When presented with a speed control situation where spacing needs to be increased, think first about how many miles in trail you need to build.
- A 10 KTAS difference in speed is equal to +/- 1 mile of space every 6 minutes.
  - 40 KTAS difference will result in a 4NM every 6 minutes; 30 KTAS difference equals 3 NM every 6 minutes; etc.

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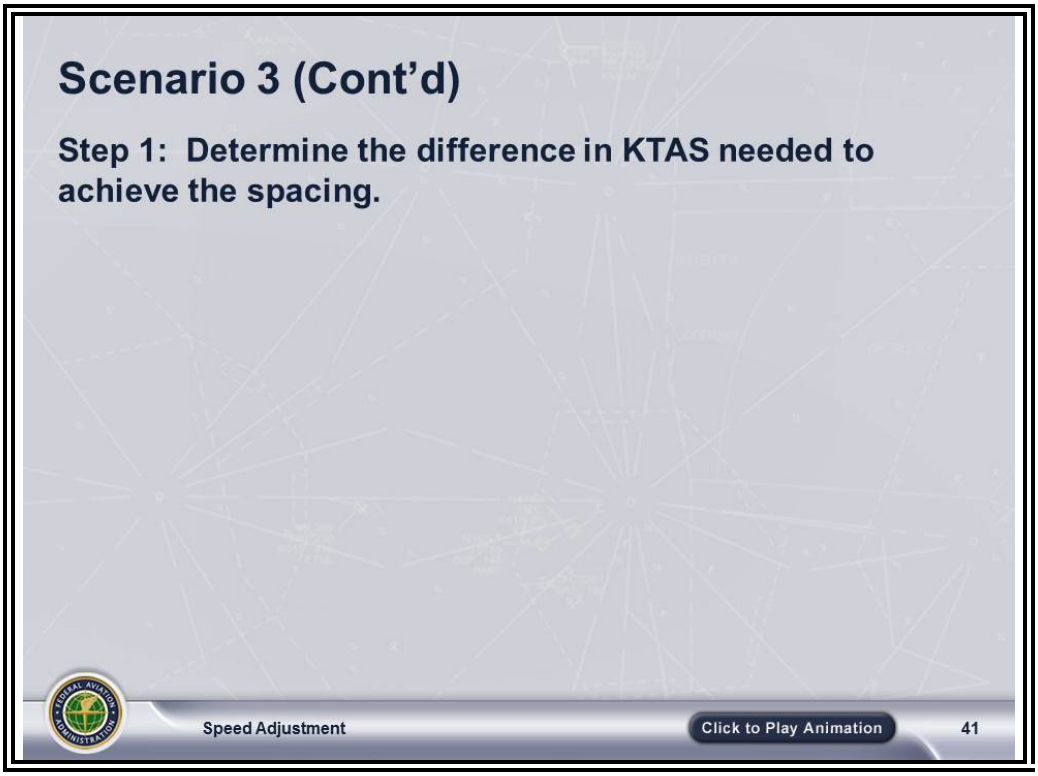
IAS APPLICATION SCENARIOS *(Continued)*

Scenario 3: In-trail Spacing (Cont'd)



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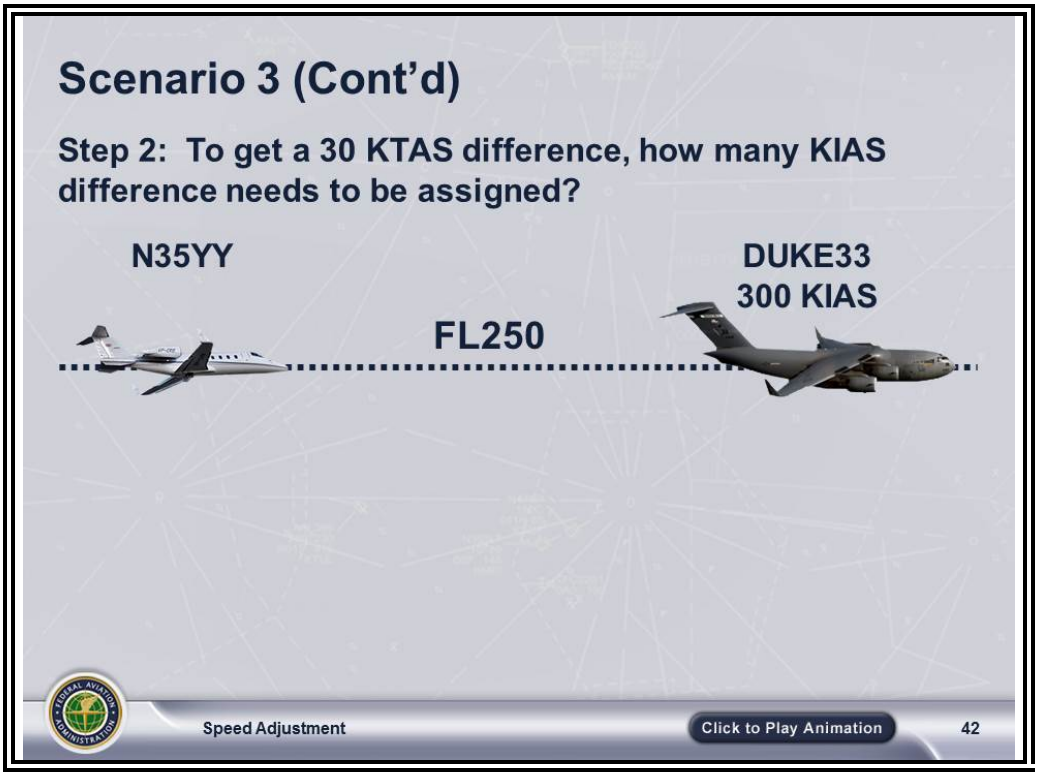
IAS APPLICATION SCENARIOS *(Continued)*

Scenario 3: In-trail Spacing (Cont'd)



NOTE: Once the spacing has been accomplished, the aircraft will typically be assigned the same airspeed to maintain spacing.

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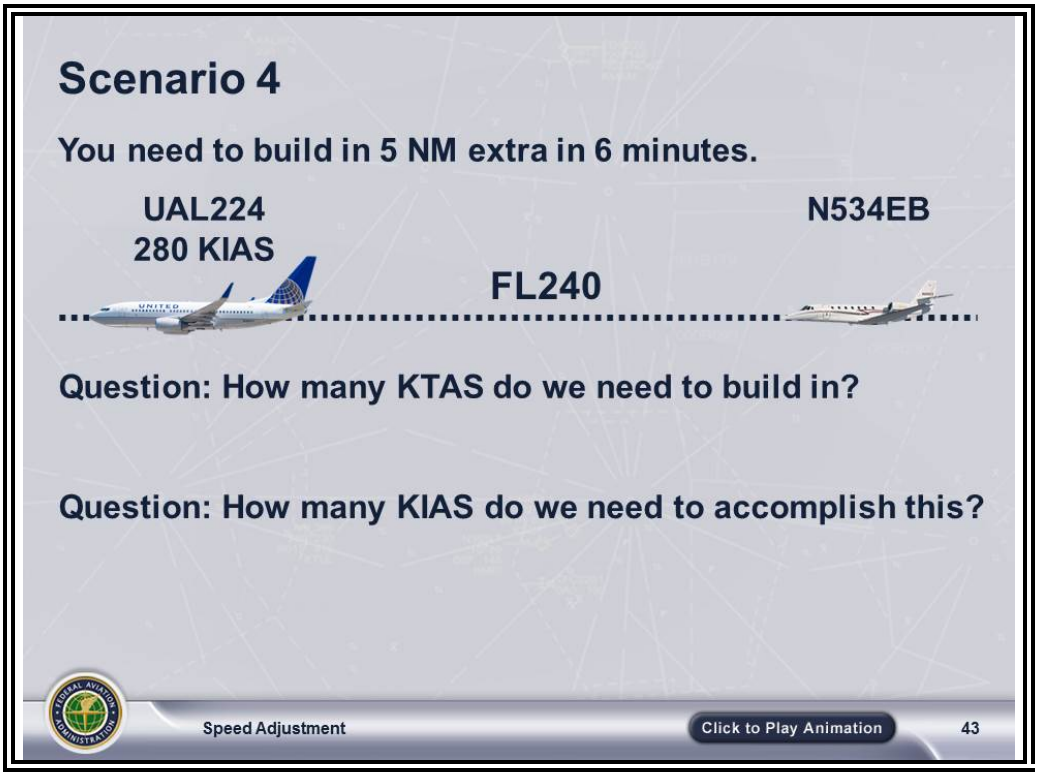
IAS APPLICATION SCENARIOS *(Continued)*

Scenario 4:
In-trail Spacing



- UAL224 is assigned 280 KIAS at FL240. N534EB, also at FL240, has no speed assignment. In 6 minutes you need to build in 5 NM extra.

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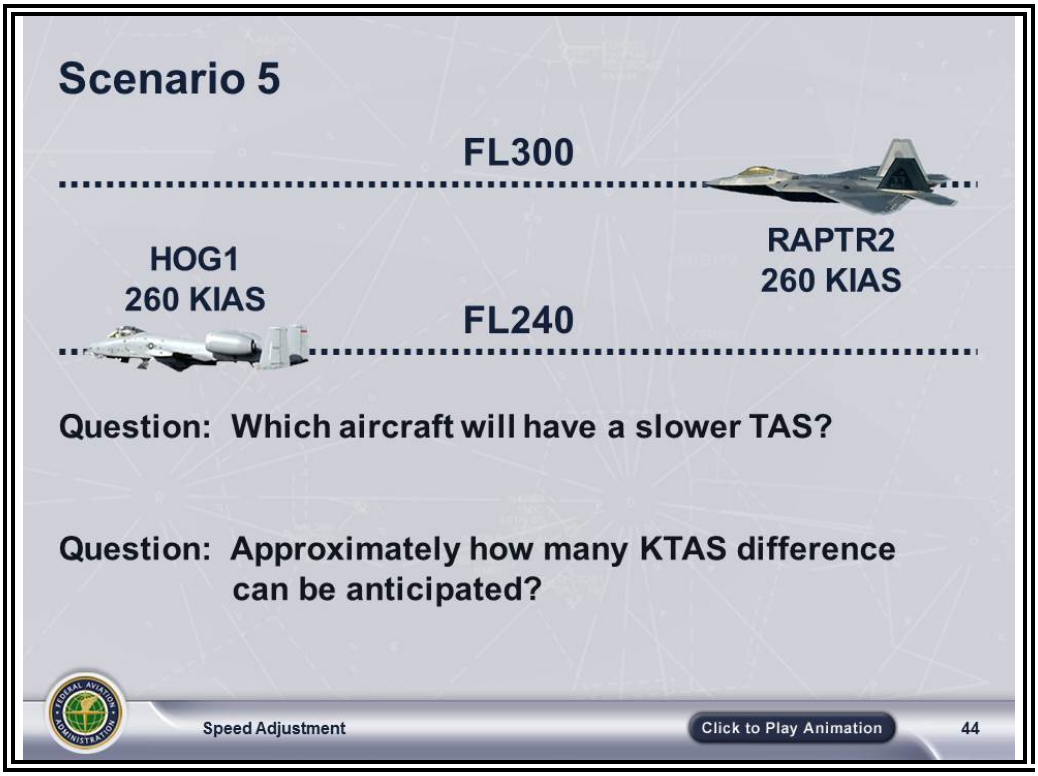
IAS APPLICATION SCENARIOS *(Continued)*

Scenario 5: Apply 5-7 KTAS per 1000 ft. Rule of Thumb



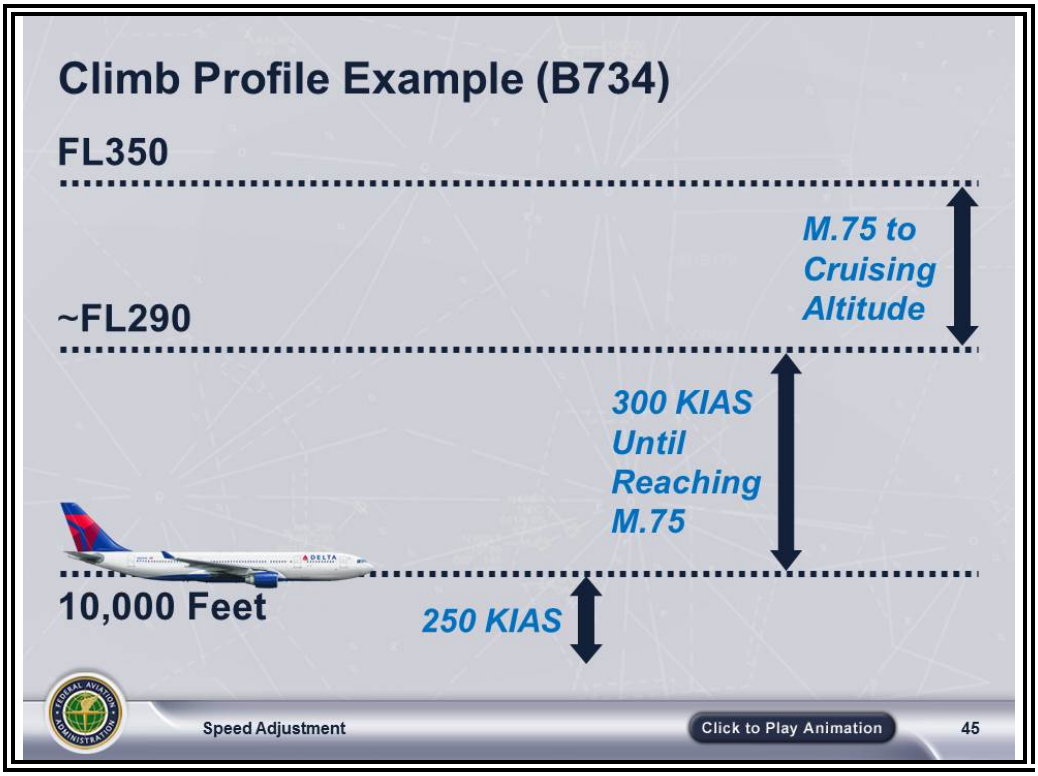
- HOG1 is at FL240 assigned the same IAS as RAPTR2 at FL300.
- Which aircraft will have a slower TAS?
- Approximately how many KTAS difference can be anticipated?

Practice Exercise 2

- Practice Exercise, Indicated Airspeed Practical Application, is located in 55055-HO11.

SPEED TRANSITION

Speed Transition – Climb Profile Example



- Initial climb will be 250 KIAS until reaching 10,000 ft. (289 KTAS, M.45)
- At 10,000 ft. the aircraft will accelerate to 300 KIAS.
  - As the aircraft climbs at a constant IAS, the TAS and Mach number will be increasing.
- When the instrumentation indicates that the aircraft is now at M.75, the pilot will maintain M.75 in the climb.
  - At this point the pilot will not be using IAS unless asked to do so by the controller.
- When reaching cruise altitude the pilot will level off and maintain M.75.

Continued on next page

SPEED TRANSITION *(Continued)*

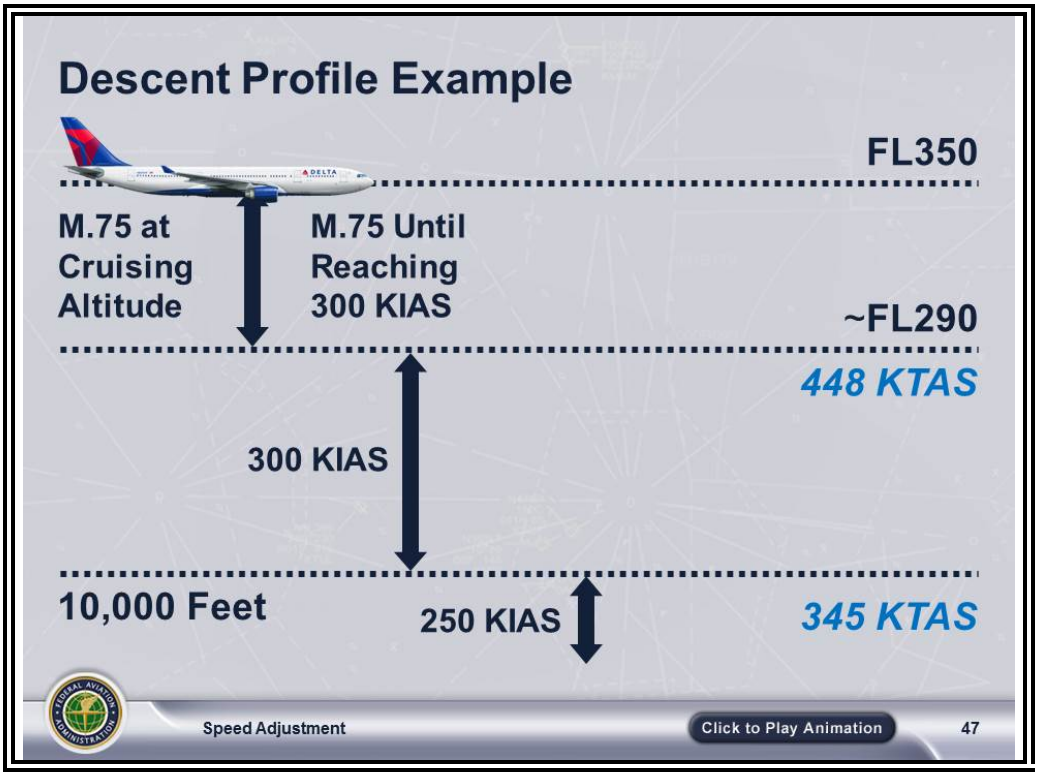
Speed Transition – Climb Profile Example (Cont'd)

No Transition to Mach?

- If the controller had assigned a speed of 300 KIAS without allowing a transition to a Mach number; at FL350 the aircraft would have had a TAS of 504 and a corresponding Mach number of M.88.
  - This would exceed the operating envelope of the aircraft at that altitude.

SPEED TRANSITION *(Continued)*

Speed Transition – Descent Profile Example



- The same concept holds true for descent.
- The aircraft will maintain M.75 in cruise and M.75 in the descent until reaching 300 KIAS.
- When the instrumentation shows 300 KIAS, the pilot will switch over to IAS and hold 300 KIAS until reaching 10,000.

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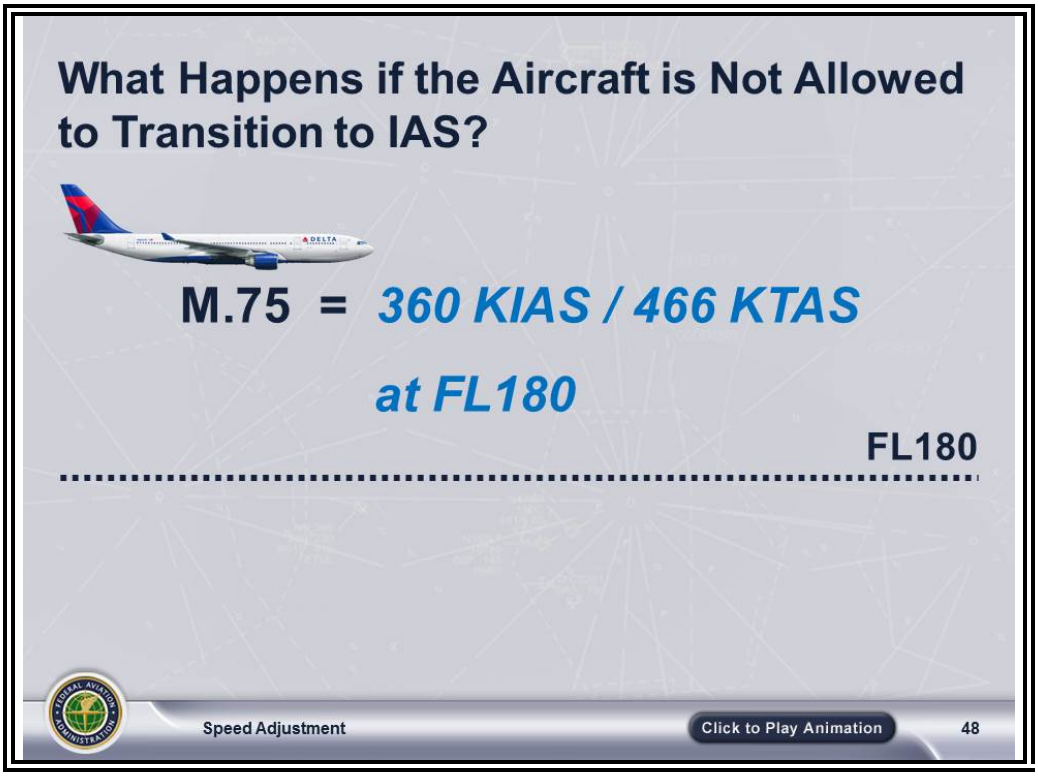
SPEED TRANSITION *(Continued)*

Speed Transition – Descent Profile Example (Cont'd)



No Transition to IAS?

- If the controller had assigned M.75 to the aircraft without allowing a change to KIAS in the descent, the indicated airspeed of the aircraft leaving FL180 would have exceeded 360 KIAS (466 KTAS), again exceeding the operating limitations of the aircraft.
- When assigning airspeeds to aircraft transitioning altitude stratums, be cognizant of the effect of that speed assignment as the aircraft transitions between Mach and IAS or vice-versa.
- All turbojets will have similar profiles, but the exact climb and cruise speeds will vary depending on the aircraft model and company.

MINIMA

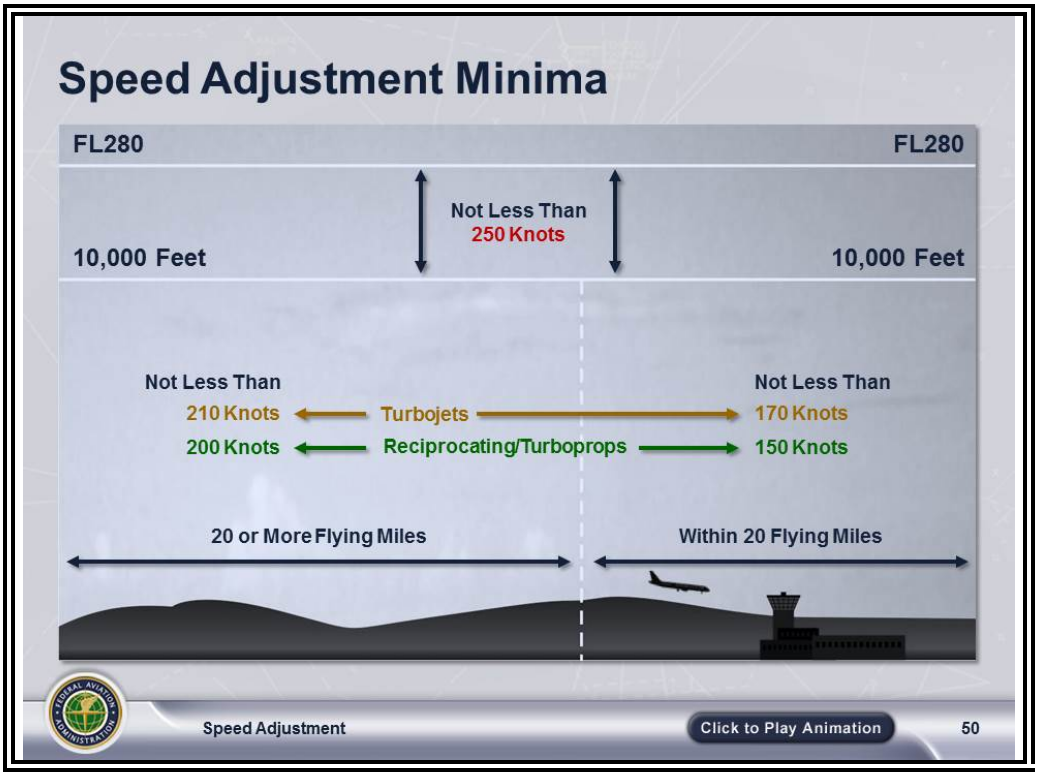
Below 10,000 Feet
JO 7110.65, pars. 3-1-11, note, 5-7-2, note

- FAR 91.117 prohibits speed in excess of 250 knots below 10,000 feet within domestic airspace.

NOTE: FAR 91.117 permits speeds in excess of 250 knots (288 mph) when required or recommended in the airplane flight manual or when required by normal military operating procedures. The pilot will inform you if a higher minimum speed is required.

MINIMA *(Continued)*

Minima - Between 10,000 Feet and FL280
JO 7110.65, par. 5-7-3



- When assigning airspeeds, use the following minima:
  - To aircraft operating between FL280 and 10,000 feet, a speed not less than 250 knots or the equivalent Mach number.
  - On a standard day, the Mach number equivalents to 250 knots (subject to minor variations) are:
    - FL240 - 0.6
    - FL250 - 0.61
    - FL260 - 0.62
    - FL270 - 0.64
    - FL280 - 0.65
    - FL290 - 0.66
- If a pilot is unable to comply with a speed adjustment, the pilot will advise.
- When an operational advantage will be realized, speeds lower than the recommended minima may be applied.

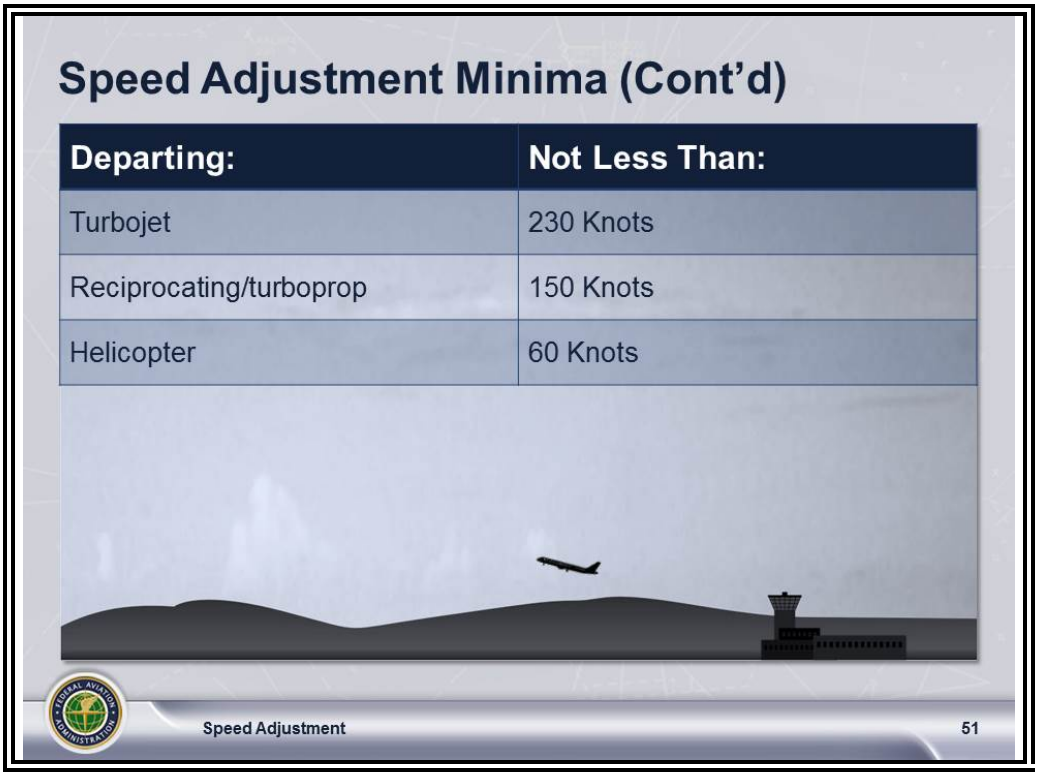
MINIMA *(Continued)*

Recommended Minima for Arrivals Below 10,000 Feet
JO 7110.65, par. 5-7-3;
FAR 91.117

- Turbojet arrivals operating below 10,000 feet:
  - More than 20 flying miles from the runway threshold
    - **Not** less than 210 knots
  - Within 20 flying miles of runway threshold
    - **Not** less than 170 knots
- Reciprocating/turboprop arrivals below 10,000 feet:
  - More than 20 flying miles from the runway threshold
    - **Not** less than 200 knots
  - Within 20 flying miles of runway threshold
    - **Not** less than 150 knots

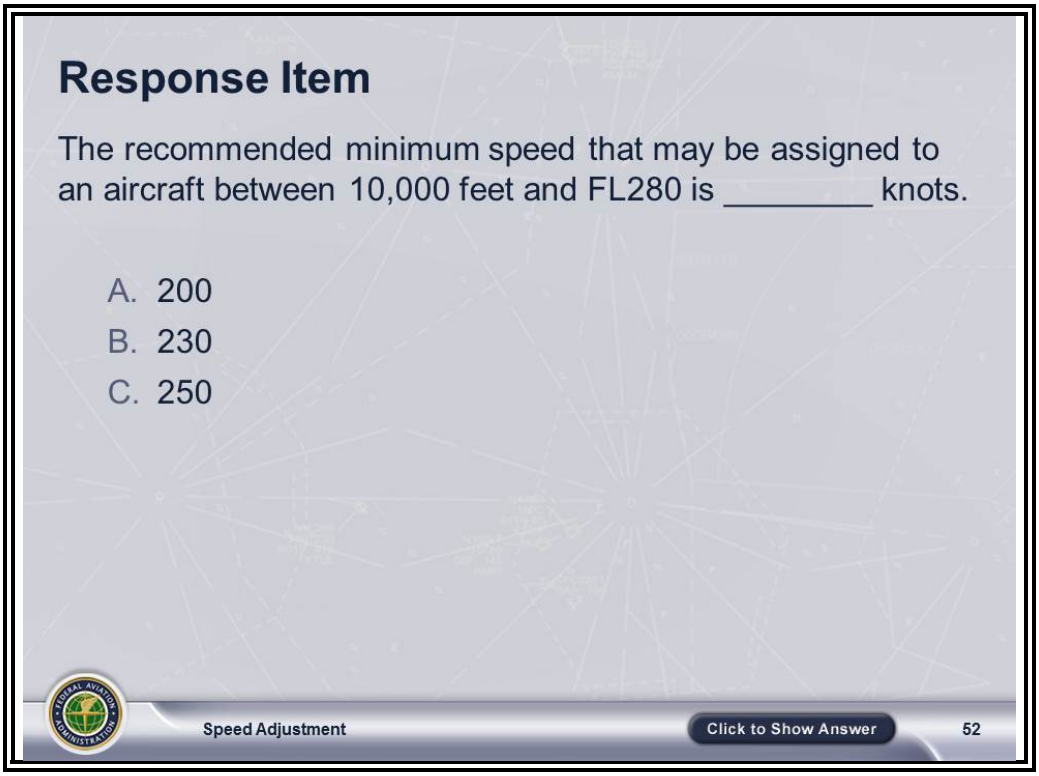
MINIMA *(Continued)*

Recommended Minima for Departures
JO 7110.65, par. 5-7-3



- Minima for departures.
  - Turbojet:
    - **Not** less than 230 knots
  - Reciprocating/turboprop:
    - **Not** less than 150 knots
  - Helicopters:
    - **Not** less than 60 knots

Review



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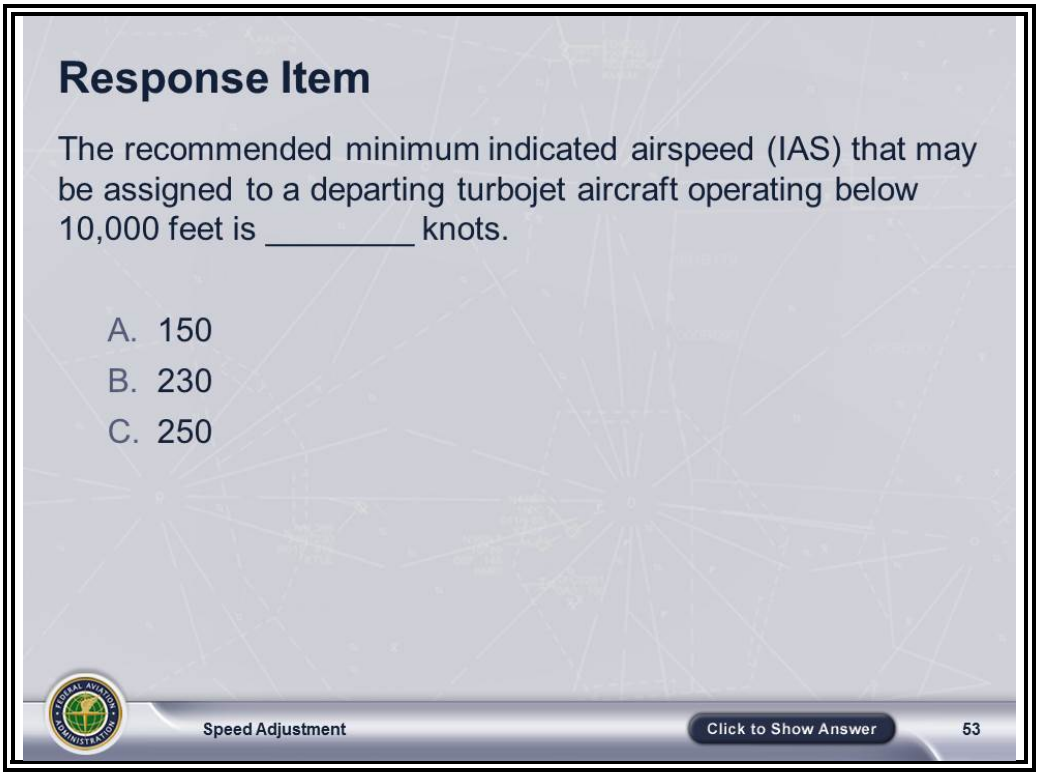
MINIMA *(Continued)*

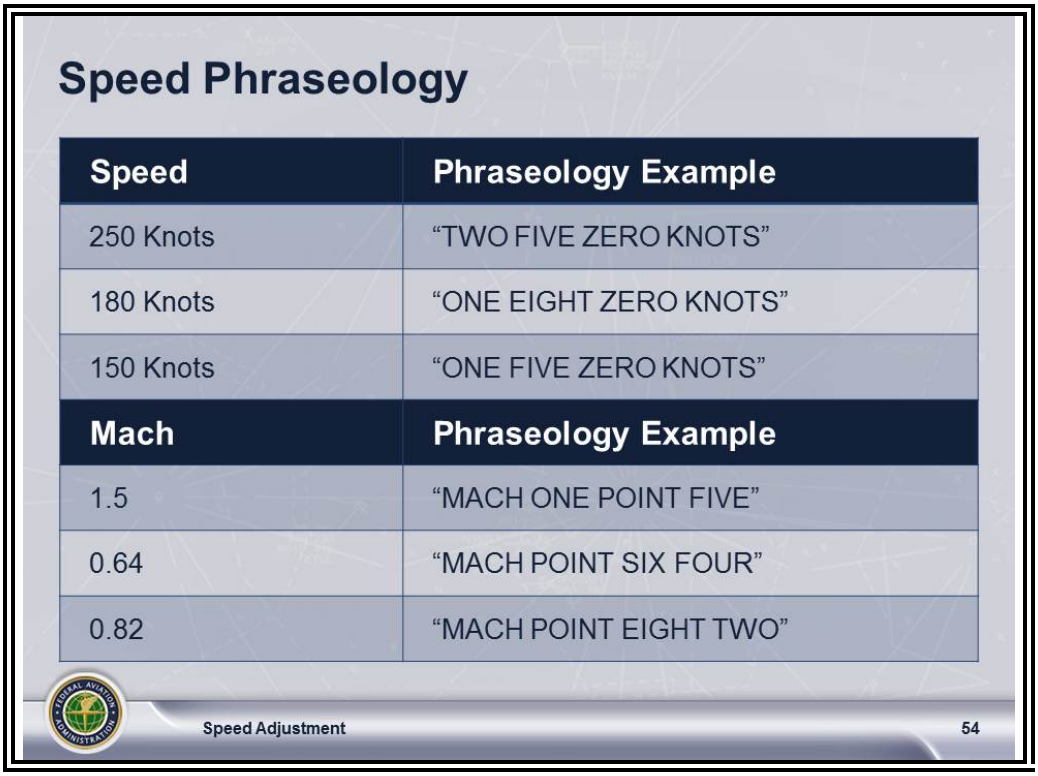
Review (cont'd)



QUESTION: AAL210 is a B767 at 8,000 feet and 30 miles from the destination airport. The recommended minimum speed you may assign is _____ knots.

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT

Speed Phraseology
JO 7110.65,
par. 2-4-17



⊙ To state the desired speed adjustment:

- State the separate digits of the speed, followed by the word "KNOTS," where applicable, or
- State the word "MACH" followed by "POINT" and the separate digits of the Mach number.

Determining Aircraft Speed
JO 7110.65,
par. 5-7-2

✈
Phraseology

⊙ To determine an aircraft's speed prior to applying speed adjustment procedures:

"SAY AIRSPEED."

- Pilot response will be in indicated airspeed (IAS).

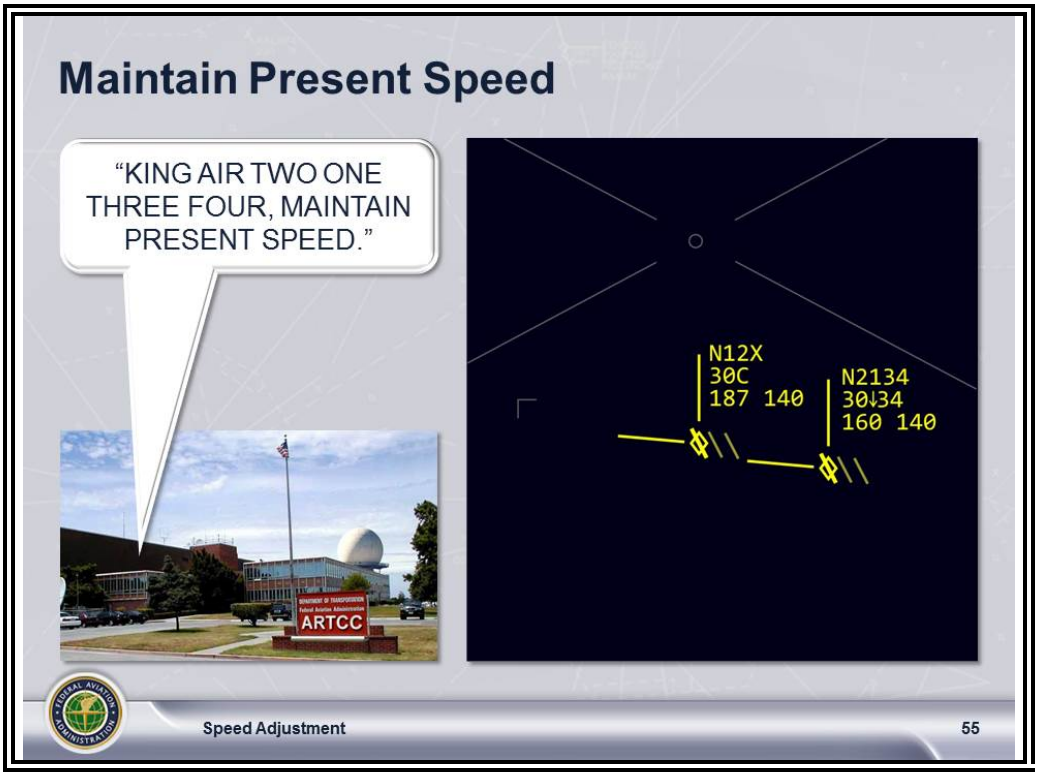
Or if appropriate,

"SAY MACH NUMBER."

- Pilot response will be a Mach number.

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Methods
JO 7110.65,
par. 5-7-2



⊙ Instruct aircraft to maintain present/specific speed.

✈ **Phraseology**

"MAINTAIN PRESENT SPEED."

or

"MAINTAIN (specific speed) KNOTS."

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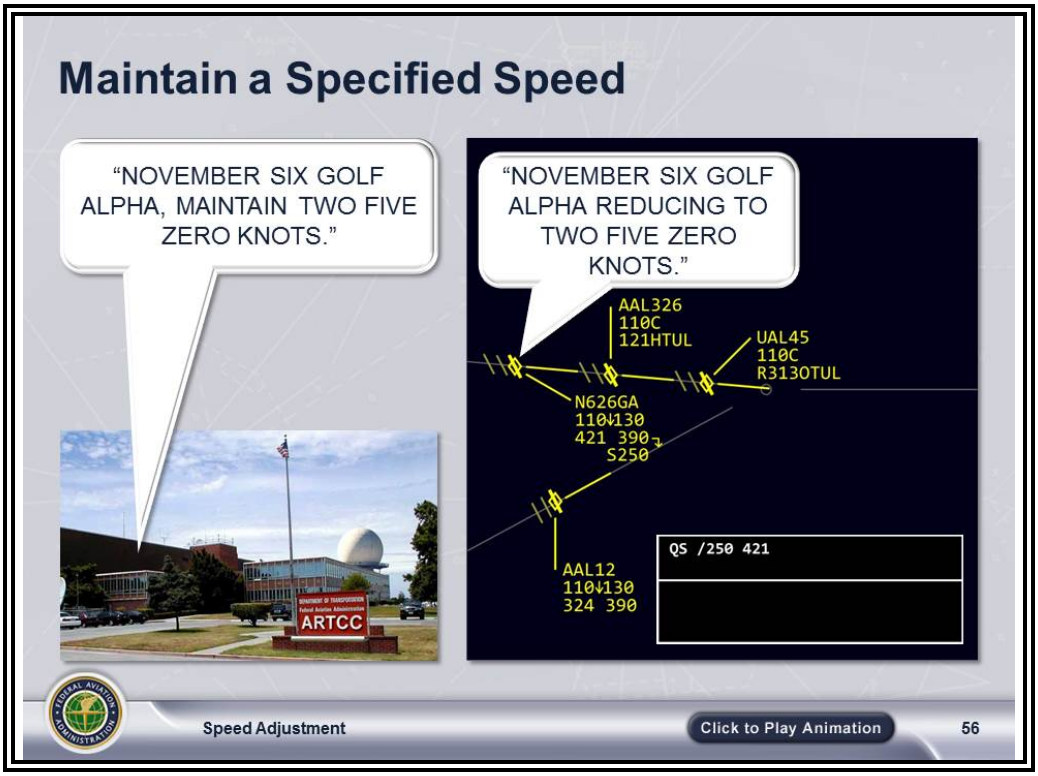
METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Methods (Cont'd)
JO 7110.65, par. 5-7-2



⊙ Maintain specified speed or greater/less.

✈ **Phraseology**

"MAINTAIN (specific speed) KNOTS OR GREATER."

or

"DO NOT EXCEED (speed) KNOTS."

⊙ Maintain the highest/lowest practical speed (used primarily for sequencing).

✈ **Phraseology**

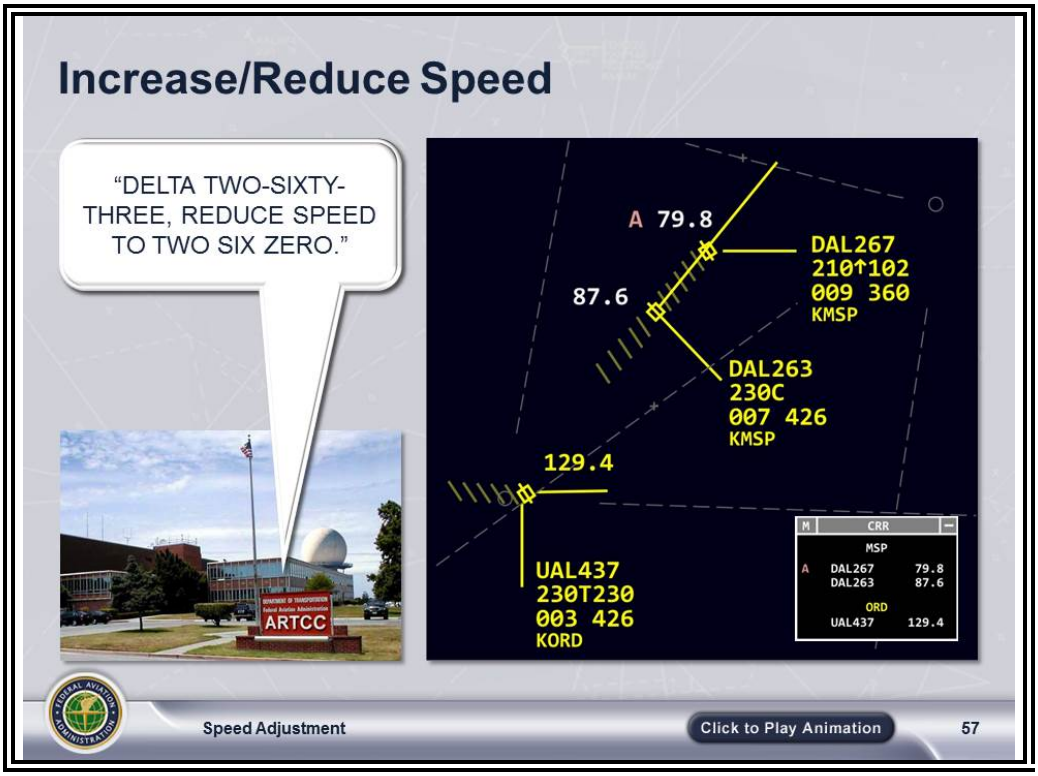
"MAINTAIN MAXIMUM FORWARD SPEED."

or

"MAINTAIN SLOWEST PRACTICAL SPEED."

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Methods (Cont'd)
JO 7110.65, par. 5-7-2



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

✈ **Phraseology**

"INCREASE/REDUCE SPEED TO (specified speed in knots)."

or

"INCREASE/REDUCE SPEED TO MACH (Mach number)."

or

"INCREASE/REDUCE SPEED (number of knots) KNOTS."

At or above FL390

⊙ To obtain pilot concurrence for a speed adjustment at or above FL390:

✈ **Phraseology**

"(Speed adjustment), IF UNABLE ADVISE."

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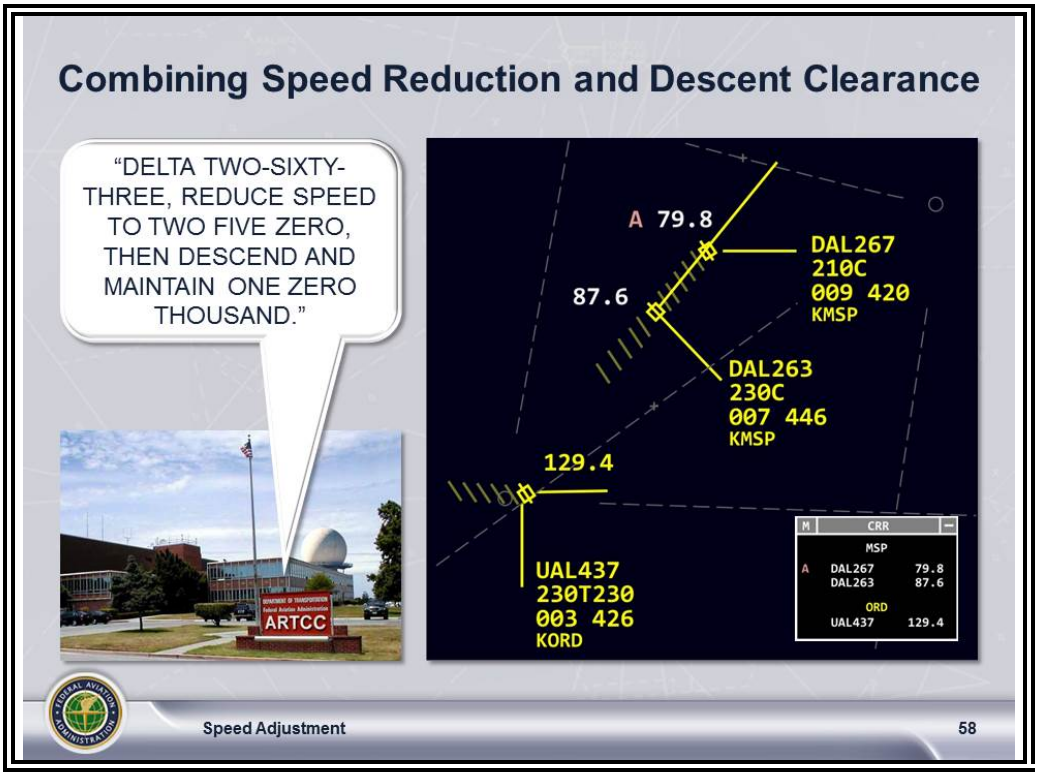
METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Simultaneous Speed Reduction and Descent
JO 7110.65, par. 5-7-2



- Reducing speed and descending at the same time can be extremely difficult, particularly for turbojet aircraft.
- Specify which action is to be accomplished first.
  - This removes any doubt the pilot may have as to controller intent.
- Issuing **SPEED first**, then descent:

✈ **Phraseology**

"REDUCE SPEED TO (specified speed), THEN DESCEND AND MAINTAIN (altitude)."

or

"REDUCE SPEED (number of knots), THEN DESCEND AND MAINTAIN (altitude)."

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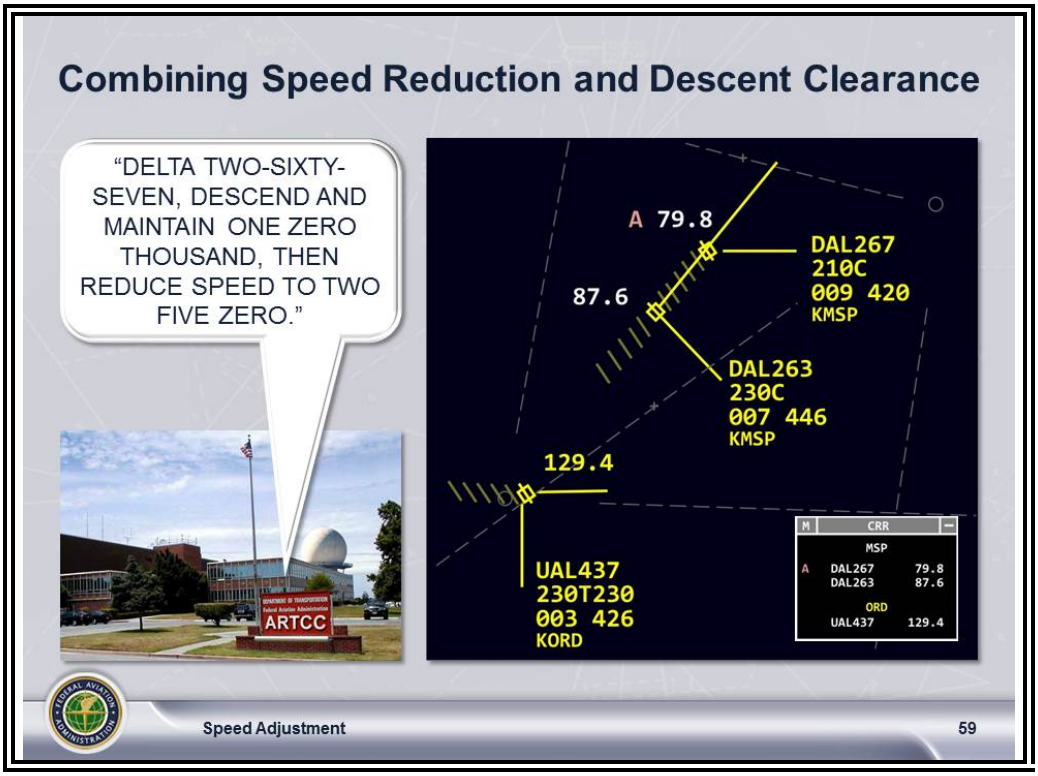
METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Simultaneous Speed Reduction and Descent (Cont'd)
JO 7110.65, par. 5-7-2



⊙ Issuing **ALTITUDE first**, then speed:

✈ **Phraseology**

"DESCEND AND MAINTAIN (altitude), THEN REDUCE SPEED TO (specified speed in knots)."

or

"DESCEND AND MAINTAIN (altitude), THEN REDUCE SPEED TO MACH (Mach number)."

or

"DESCEND AND MAINTAIN (altitude), THEN REDUCE SPEED (number of knots) KNOTS."

- Consider maximum speed requirements specified in FAR 91.117.
- In domestic airspace, aircraft may need to level off temporarily to reduce speed prior to descent below 10,000 feet **without** notifying ATC.

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Speed/Fix Crossing Restrictions
JO 7110.65, par. 5-7-2

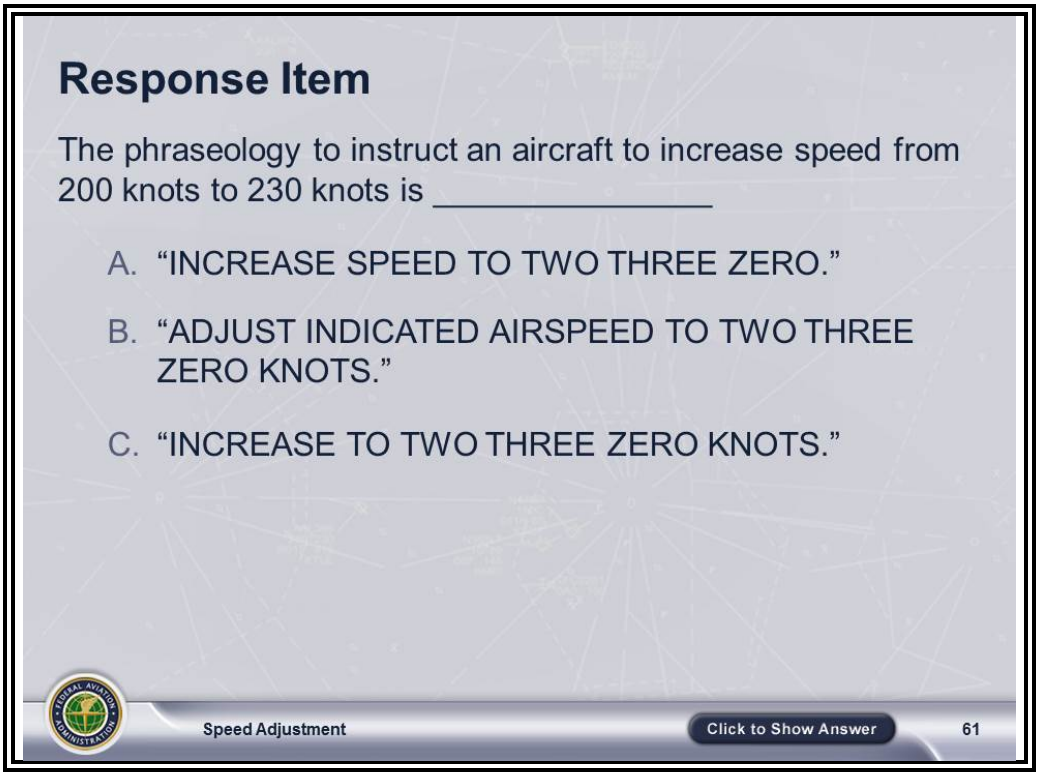
- Combining speed/altitude fix crossing restrictions:
  - Issue information in the following order:
    - Crossing fix
    - Altitude
    - Speed

✈ **Phraseology**

"CROSS (fix) AT AND MAINTAIN (altitude) AT (specified speed) KNOTS."

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Review



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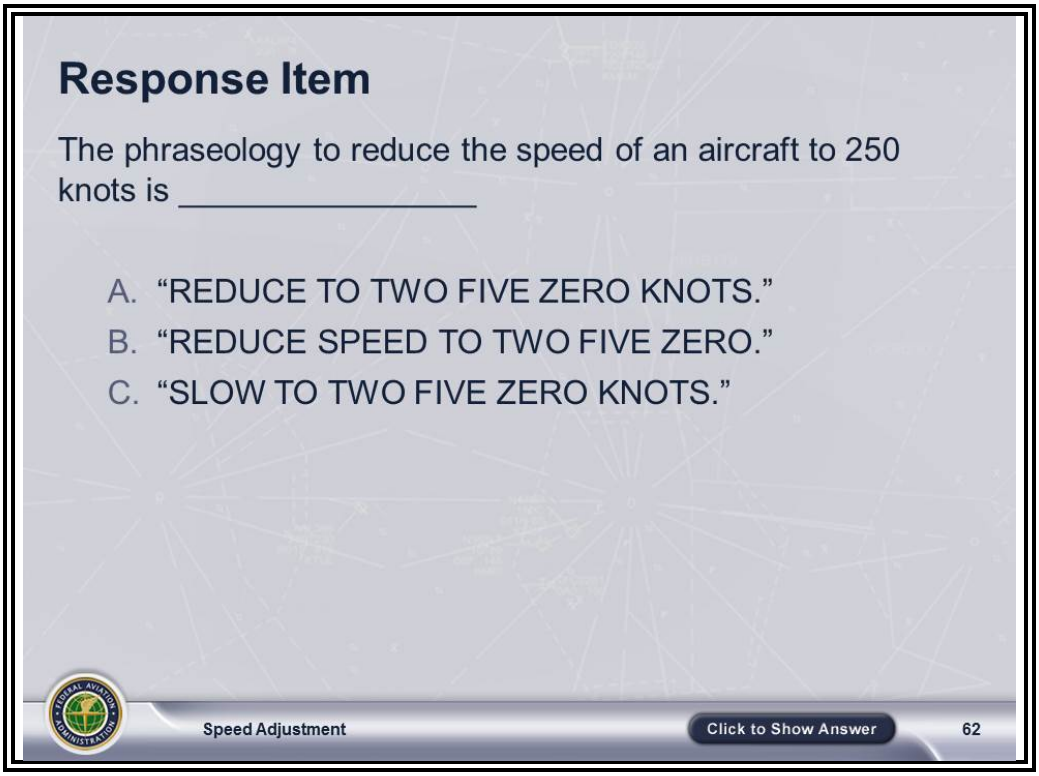
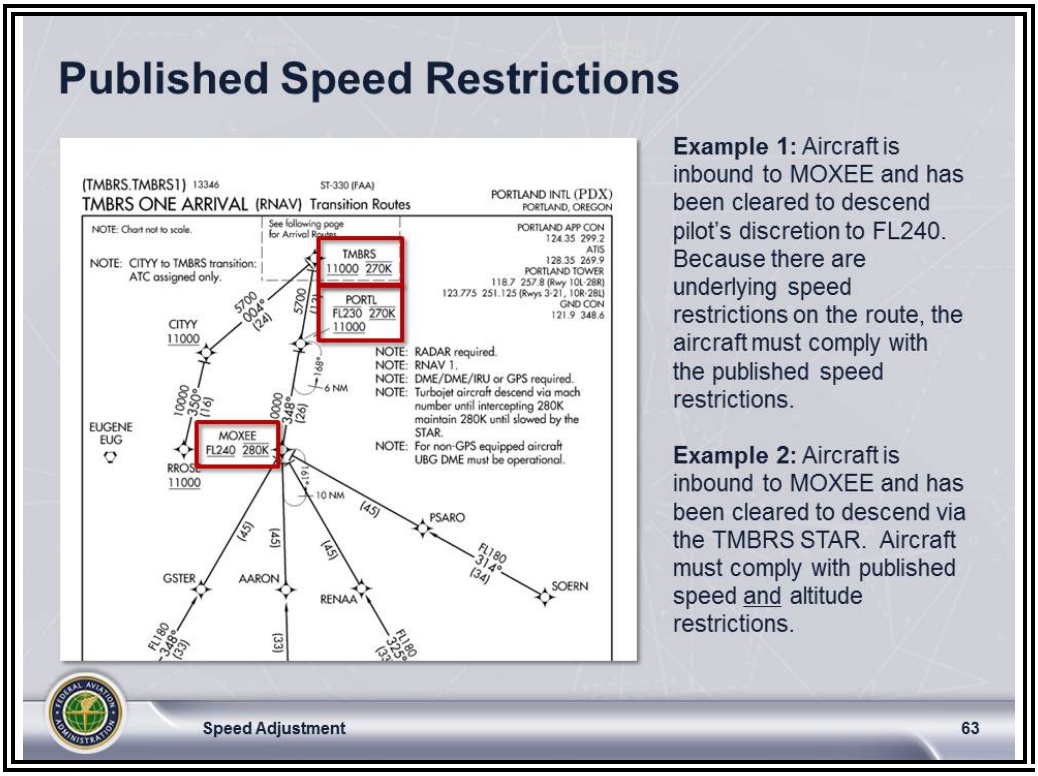
METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Review (Cont.)



METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Procedures with Published Speed Restrictions
JO 7110.65,
pars. 4-5-7, 5-7-2



- When cleared along a route or procedure that contains published speed restrictions, the pilot must comply with those speed restrictions independent of a climb via or descend via clearance.

  - Due to variations of aircraft types, Flight Management Systems, and environmental conditions, ATC should anticipate that aircraft will begin speed adjustments at varying locations along cleared routes or procedures that contain published speed restrictions.

  - Issuing speed adjustments to aircraft flying procedures with published speed restrictions may impact the pilot's ability to fly the intended flight profile of the procedure.

- Pilots must comply with speed restrictions on the SID or STAR unless canceled by ATC using the phraseology:

  "DELETE SPEED RESTRICTIONS."

- When issuing speed adjustments to aircraft cleared on procedures with published speed restrictions, specify the point at which the issued speed assignment begins, ends, or changes the published restrictions.

Continued on next page

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

⊙ Speed adjustment on route or procedure with published speeds:

✈ **Phraseology**

“MAINTAIN (speed) UNTIL (fix/waypoint), THEN (additional instructions).”

⊙ Additional instructions may include:

“RESUME PUBLISHED SPEED.”

or

“COMPLY WITH SPEED RESTRICTIONS.”

or

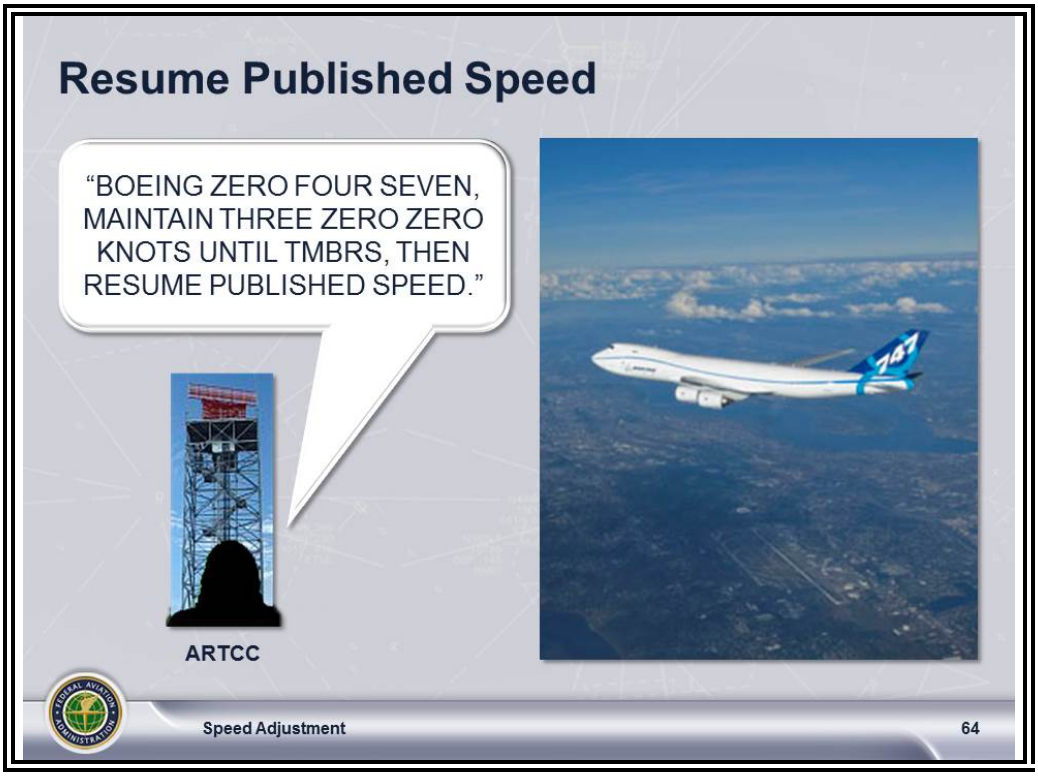
“CLIMB/DESCEND VIA (SID/STAR name and number) (transition if required).”

or

“CLIMB/DESCEND VIA (SID/STAR name and number) (transition if required), EXCEPT (modified clearance, if required).”

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Resume Published Speed
JO 7110.65, par. 5-7-2



- "RESUME PUBLISHED SPEED" is used by ATC to advise aircraft that have been assigned an unpublished speed adjustment that the aircraft should meet all subsequent published speed restrictions on the route or procedure.

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Adjusting Published Speeds
JO 7110.65,
pars. 4-5-7, 5-7-2

NOTE: The aircraft will maintain the ATC assigned speed until ALISA waypoint and will then comply with the speed (and altitude) restrictions on the TIMMY One departure.

Continued on next page

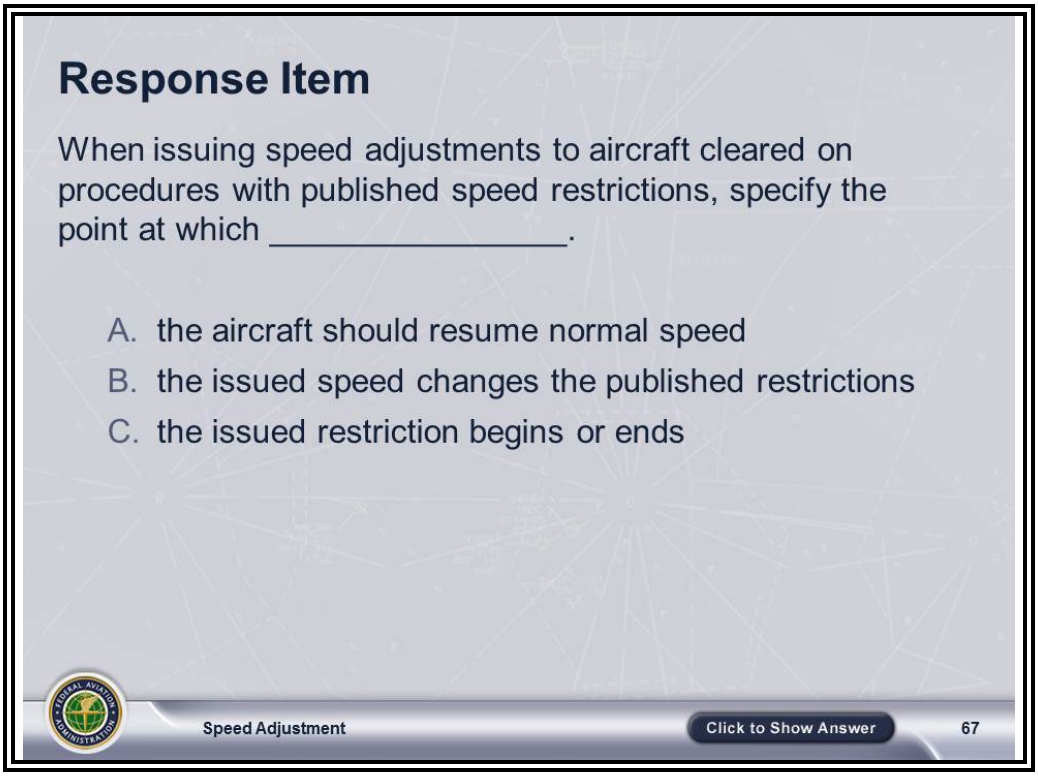
METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Adjusting Published Speeds (Cont'd)
JO 7110.65, pars. 4-5-7, 5-7-2

NOTE: The aircraft will comply with all published restrictions. After LIINE, the aircraft will continue to comply with altitude restrictions, but will comply with the ATC assigned speed adjustment.

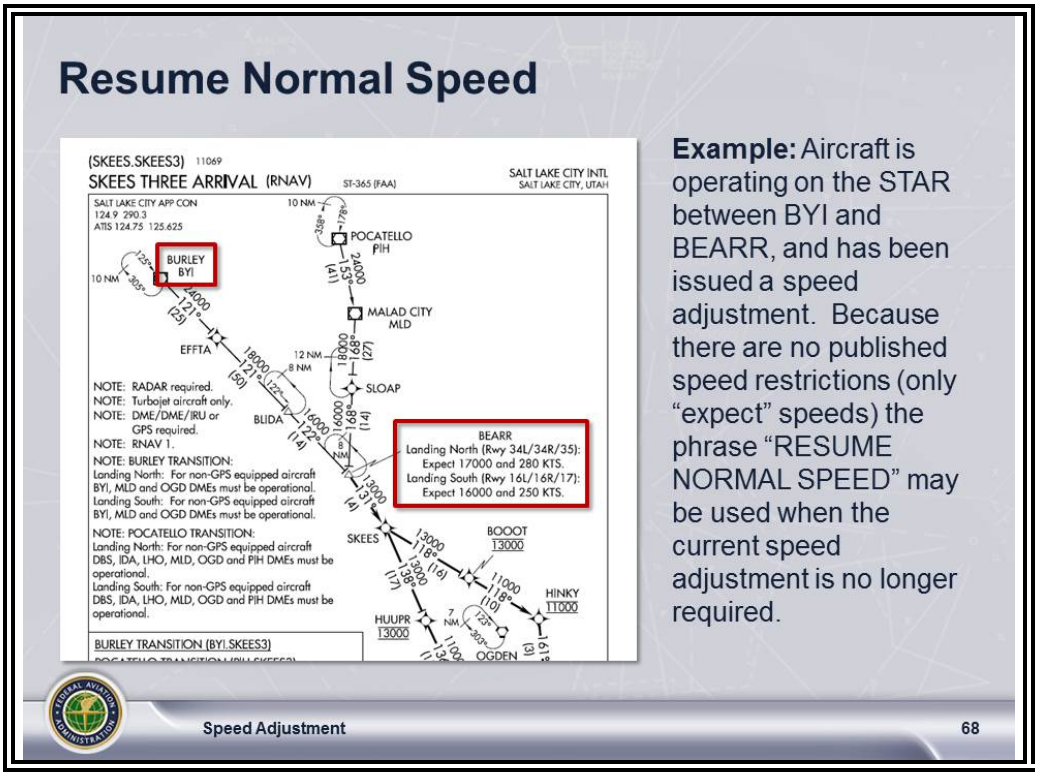
METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Review



METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT

Termination
JO 7110.65,
par. 5-7-4



- ⊙ Advise aircraft when speed adjustments are no longer needed.
  - Advise aircraft to "resume normal speed" when ATC-assigned speed adjustments are no longer needed and no published speed restrictions apply.

✈
Phraseology

"RESUME NORMAL SPEED."

NOTE: "Resume normal speed" is only used where there are *no* underlying published speed restrictions.

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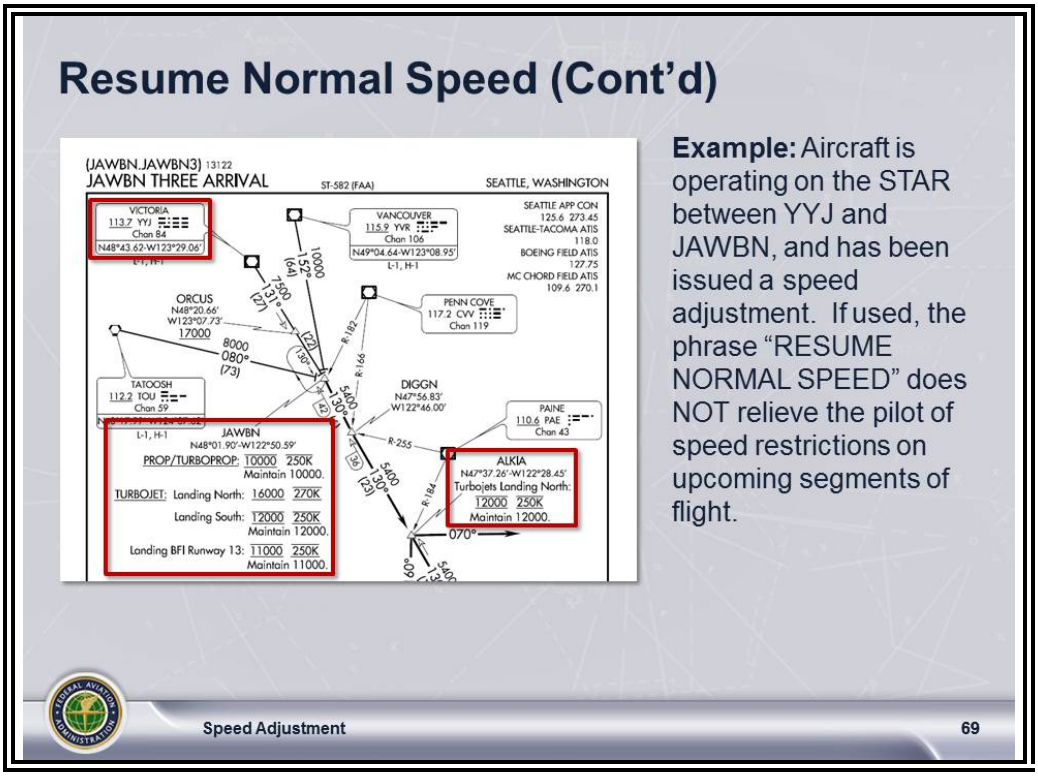
METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT *(Continued)*

Termination (Cont'd)
JO 7110.65, par. 5-7-4



NOTE: "Resume normal speed" does not delete speed restrictions on upcoming segments of flight and does not relieve the pilot of those speed restrictions which are applicable to 14 CFR Section 91.117.

- When speed adjustment is no longer needed, aircraft may be Instructed to comply with restrictions applicable to the charted procedure or route being flown.

✈ **Phraseology**

"COMPLY WITH SPEED RESTRICTIONS."

or

"COMPLY WITH RESTRICTIONS."

NOTE: The phraseology "comply with restrictions" requires compliance with ***ALL*** altitude and speed restrictions depicted on the procedure."

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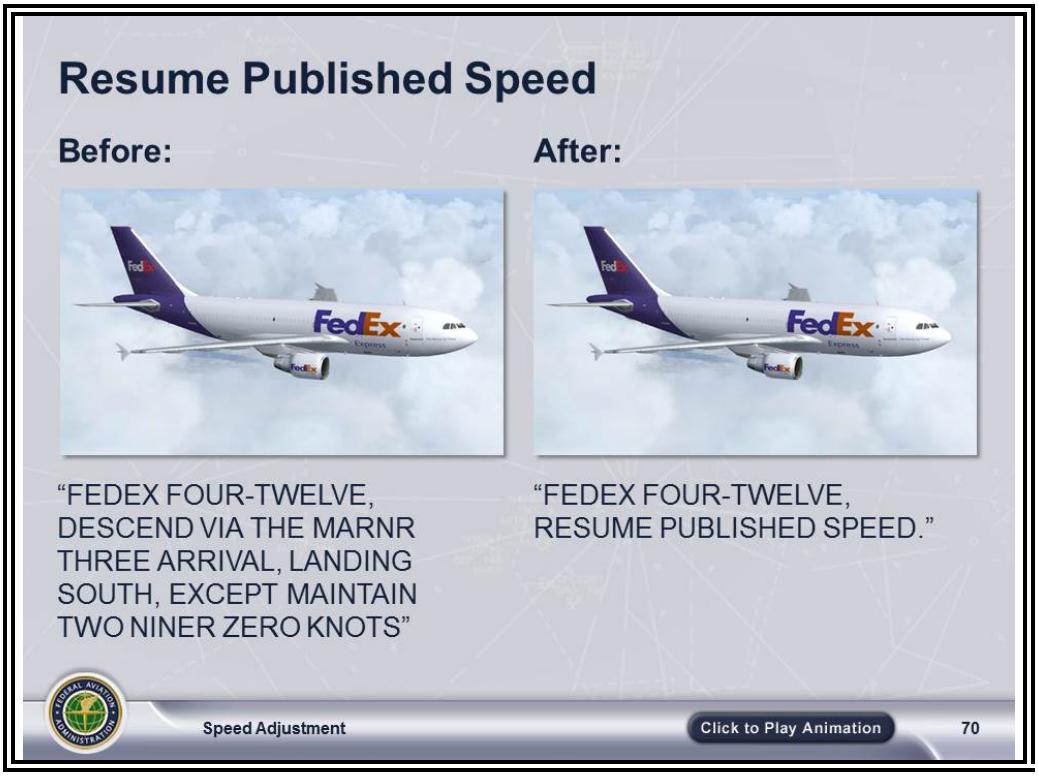
METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT *(Continued)*

Termination (Cont'd)
JO 7110.65, par. 5-7-4



- Advise aircraft to "resume published speed" when aircraft have been assigned an unpublished speed adjustment and ATC wants aircraft to meet subsequent published speed restrictions on the route or procedure.

✈ **Phraseology**

  - "RESUME PUBLISHED SPEED."

- Advise aircraft when either ATC assigned speed adjustments or published speed restrictions are no longer required.

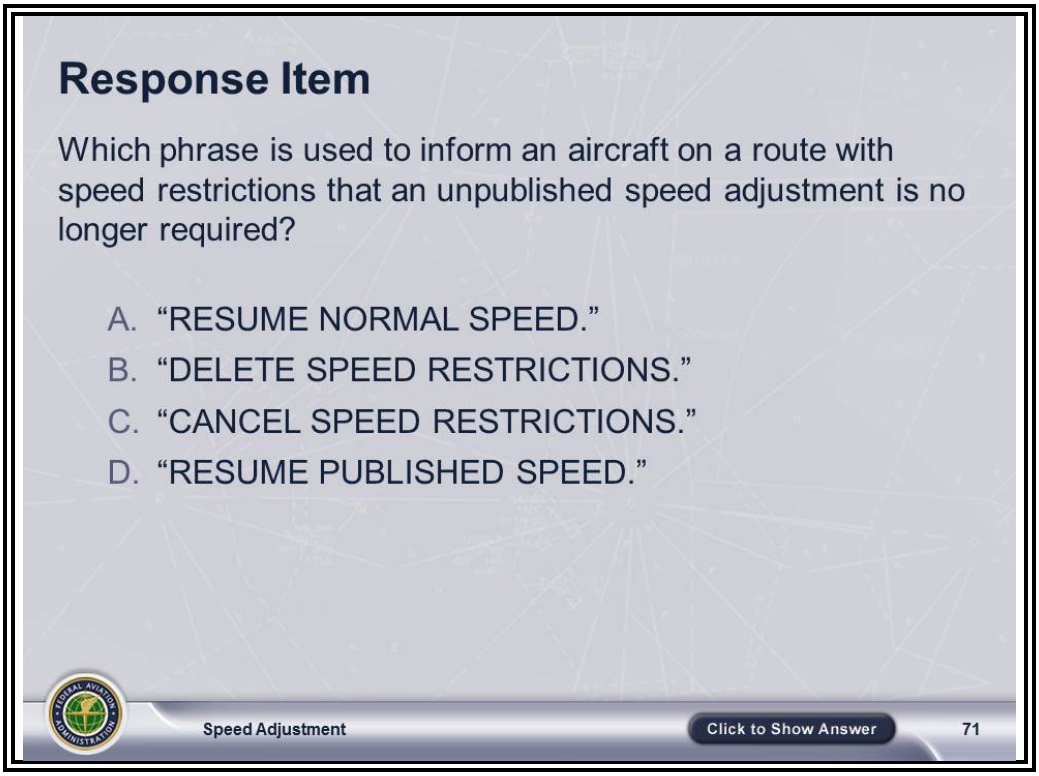
✈ **Phraseology**

  - "DELETE SPEED RESTRICTIONS."

Continued on next page

METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT *(Continued)*

Review



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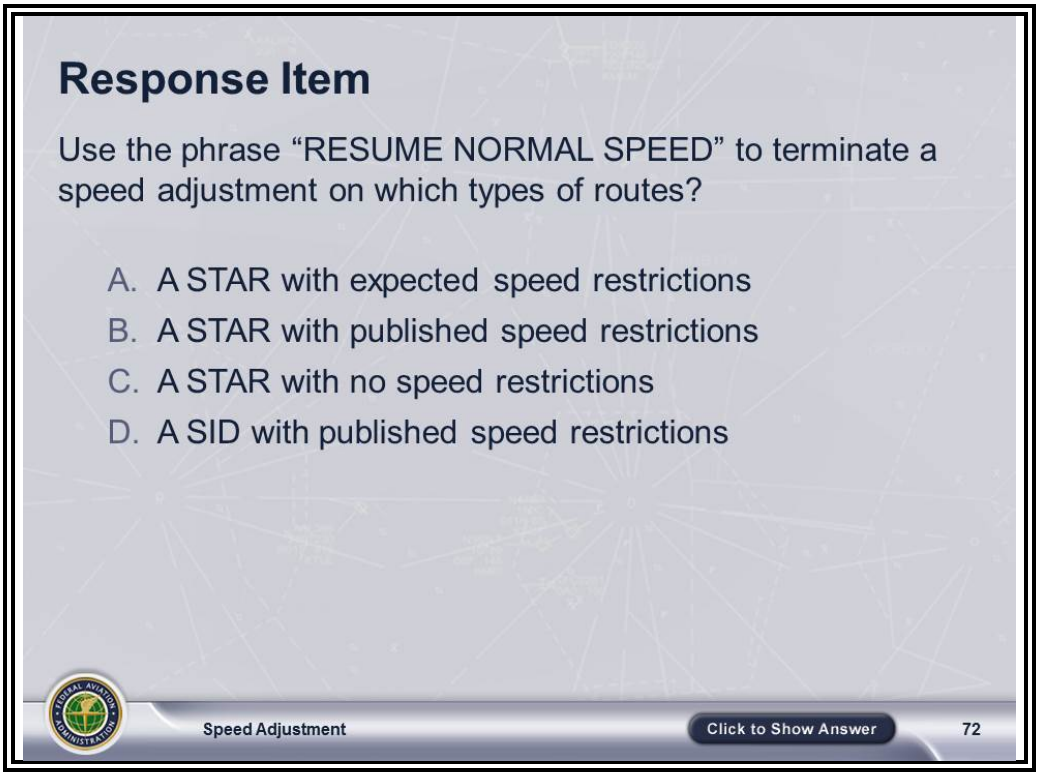
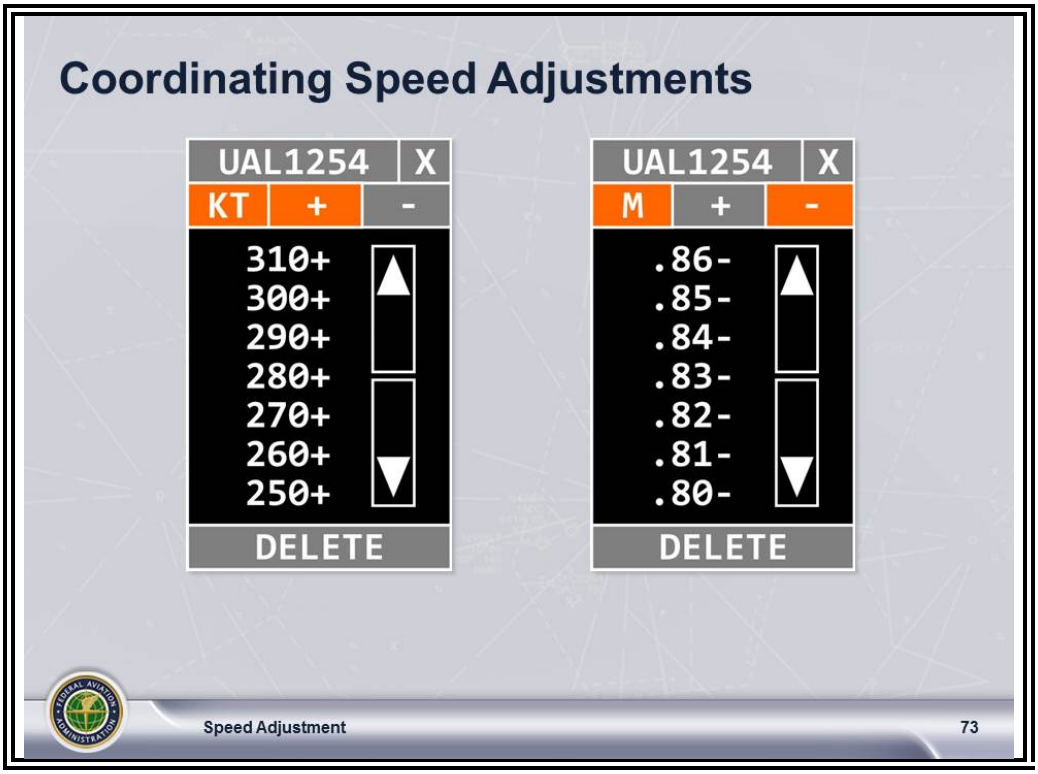
METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT *(Continued)*

Review (Cont'd)



COORDINATING SPEED CONTROL INFORMATION VIA THE 4TH LINE OF A FULL DATA BLOCK (FDB)

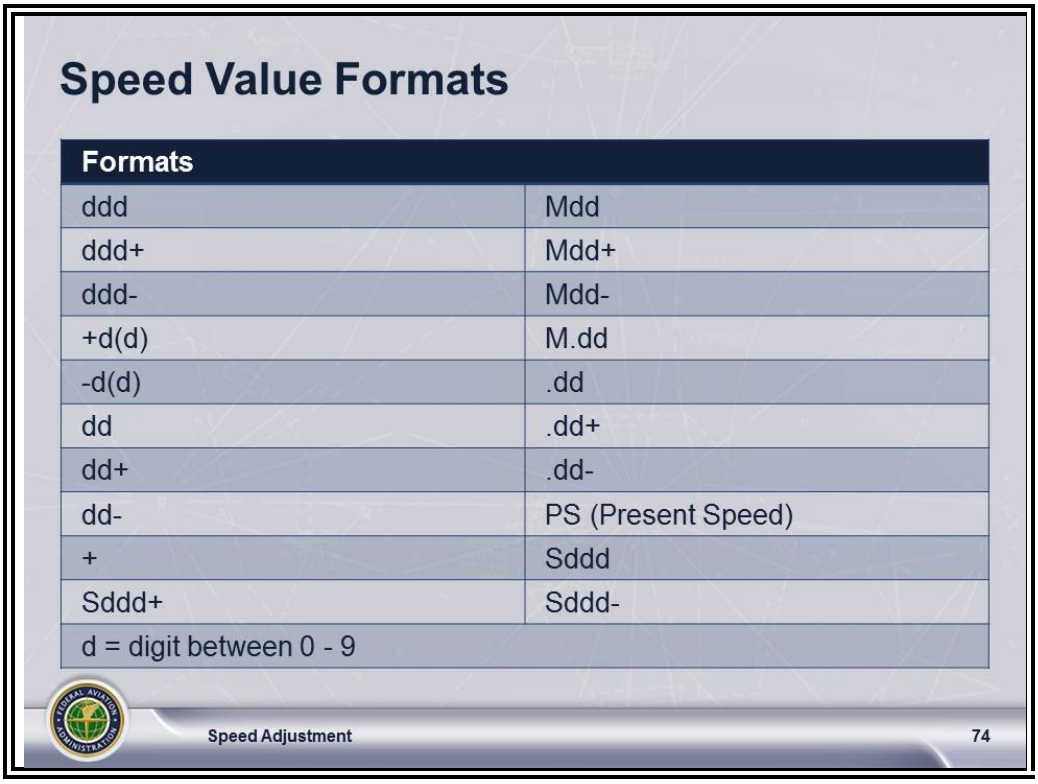
4th Line Data
JO 7110.65,
pars. 5-4-8, 5-4-11



- The fourth line of the full data block (FDB) is used to non-verbally coordinate speed control information.
  - Coordination format for assigned airspeeds must use the designation character S preceding a three-digit number.
  - Aircraft assigned a Mach number must use the designation M preceding 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.

COORDINATING SPEED CONTROL INFORMATION VIA THE 4TH LINE OF A FULL DATA BLOCK (FDB) *(Cont'd)*

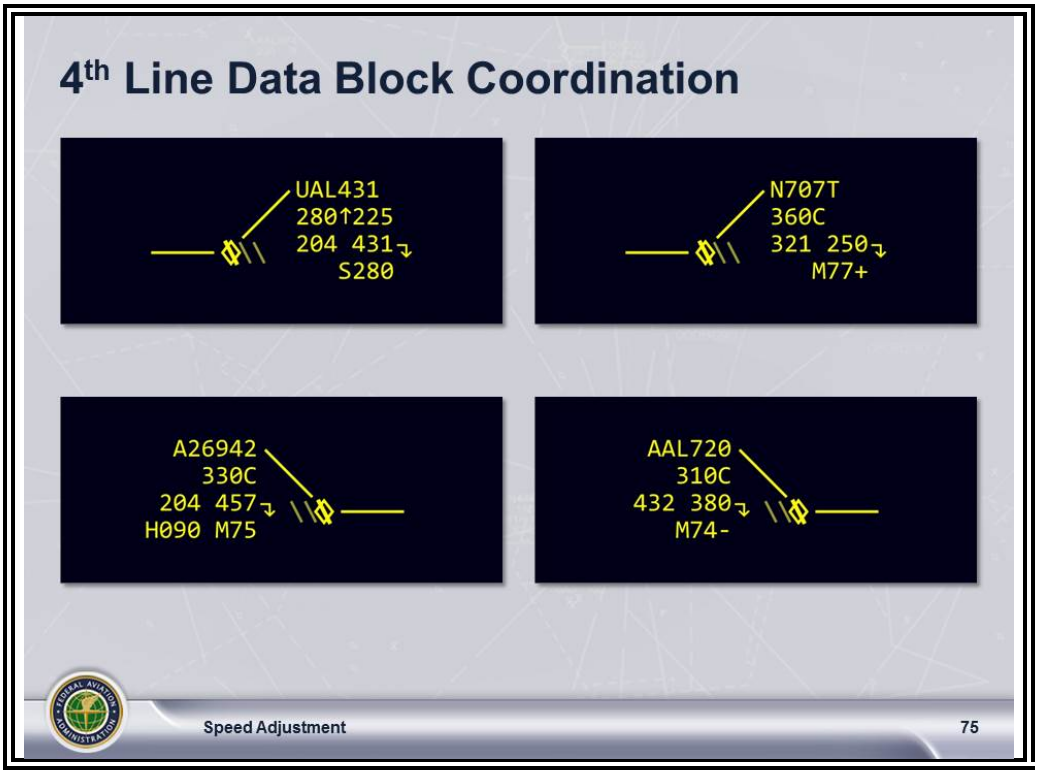
Speed Formats
JO 7110.65,
pars. 5-4-8, 5-4-1;
TI 6110.100,
par. 4-26-1



- The table lists 4th line speed formats that are allowed by automation. Keep in mind that not all of these formats are permissible for non-verbal coordination.

COORDINATING SPEED CONTROL INFORMATION VIA THE 4TH LINE OF A FULL DATA BLOCK (FDB) *(Cont'd)*

Entering 4th Line Speeds
TI 6110.100, pars. 4.25, 4.25.1



- The Speed Menu allows controllers to enter, update or remove speed assignments in the fourth line of a FDB. Speed values (knots or Mach) can be selected from a list or typed in with the keyboard.
  - To invoke the speed menu left/middle-click the ground speed in the third line of the FDB (Field E).

    or

  - Position the trackball cursor on the speed field (previously entered) in the fourth line of an FDB and press the trackball PICK or ENTER button.
- Other entry methods include: the QS command typed on the keyboard and the SPD column in the aircraft list (ACL) on the EDST.

NOTE: These methods have been discussed in previous lessons.

CONCLUSION

Summary

- General procedures for the application of speed adjustments
- Methods and phraseology for assigning speed adjustments
- Speed adjustment minima
- Methods and phraseology for the termination of speed adjustments
- Procedures for updating speed information in the 4th line of a Full Data block (FDB)

End-of-Lesson Test

- Your instructor will now administer the End-of-Lesson Test.