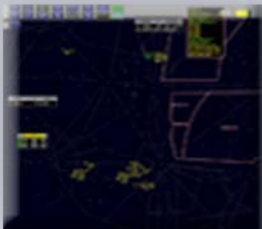




FAA Lesson Plan



En Route Stage 4 Radar Controller Training

H	DEPT	
JFK		
AAL321	60	
SWA123	150	
LGA		
N2234	340	
PHL		
UAL167	50	
N133A	120	
N12A	UFR	
N11A	0TP	

Instructor

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

PRACTICE EXERCISE 1: MACH ASSIGNMENT PRACTICAL APPLICATION, PAGE 26, REFER TO 55055-HO11.PDF

PRACTICE EXERCISE 2: INDICATED AIRSPEED PRACTICAL APPLICATION, PAGE 46, REFER TO 55055-HO11.PDF

END-OF-LESSON TEST: YES (*REFER TO ELT11.PDF*)

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



Objectives

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

1. General procedures for the application of speed adjustments
2. Methods and phraseology for assigning speed adjustments
3. Speed adjustment minima
4. Methods and phraseology for the termination of speed adjustments
5. Procedures for updating speed information in the 4th line of a Full Data Block (FDB)



Speed Adjustment

2

☞ **NOTE:** Review the lesson objectives.

APPLICATION

Excessive Speed Adjustments

JO 7110.65,
par. 5-7-1



*Click 4 times
to animate.*

- ⦿ 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

 **NOTE:** Give examples to clarify.

APPLICATION *(Continued)*

Techniques

JO 7110.65,
par. 5-7-1



Techniques

"FEDEX FIFTY, INCREASE SPEED TO THREE ZERO ZERO."

"AMERICAN TWELVE, MAINTAIN THREE ZERO ZERO KNOTS."

"DELTA TEN, DO NOT EXCEED THREE ZERO ZERO KNOTS."

ARTCC

FEDERAL AVIATION ADMINISTRATION

Speed Adjustment

Click to Play Animation

4

*Click 3 times
to animate.*

- ⦿ 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

👉 **NOTE:** *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.
-

APPLICATION (Continued)

Assignment Restrictions

JO 7110.65,
par. 5-7-1



At or Above FL390

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



ARTCC



Speed Adjustment

5

⊙ Do **not** assign speed adjustment to aircraft:

- At or above FL390, without pilot consent

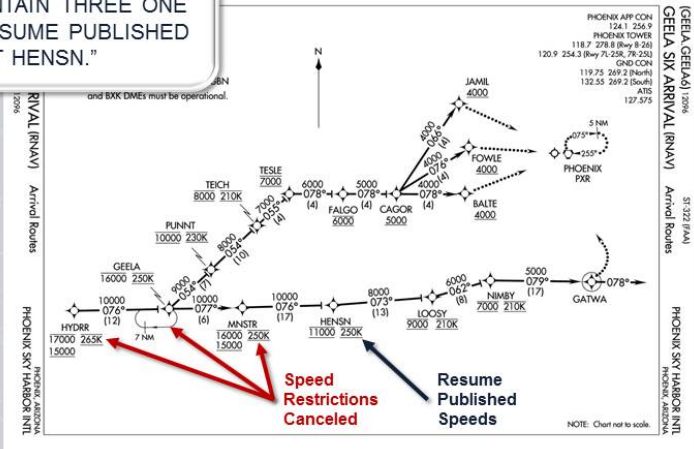
NOTE: Large, heavy and super aircraft at high altitudes have very narrow cruise airspeed margins. Some aircraft's weight/altitude/airspeed combinations are impossible to achieve.

- 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.



Speed Adjustment

6

- 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.

 **NOTE:** Discuss example on slide.

APPLICATION (Continued)

Terms for Issuing Speed Adjustment

JO 7110.65,
par. 5-7-1



Issuing Speed Adjustments

- 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



Speed Adjustment

7

- ⊙ 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



Response Item

Speed adjustments are based on _____.

- A. true airspeed
- B. ground speed
- C. indicated airspeed



Speed Adjustment

Click to Show Answer

8



Response Item

When expressing speed adjustment requests, use units of _____ knots or multiples thereof.

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



Speed Adjustment

Click to Show Answer

9

SLIDE ANSWERS: Slide 8 = C; Slide 9 = B

Continued on next page

APPLICATION *(Continued)*

Review
(Cont'd)



Response Item

When using speed adjustment procedures, controllers can expect pilots to maintain an assigned speed within plus or minus _____ knots.

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

Speed AdjustmentClick to Show Answer10

SLIDE ANSWER: B

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

ANSWER: *Some aircraft have very narrow cruise margins and cannot comply safely.*

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

ANSWER: *It cancels any speed restrictions issued. If the controller needs the restrictions enforced, they must be restated.*

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:** Direct students to the *Speed Adjustment Reference Guide* in handout 55055-HO11. Students will need to refer to this guide during this section of the lesson.

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.
 $TAS \pm \text{wind speed} = GS$.

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 1.0 = Speed of Sound

- Aircraft speeds may be assigned reference their relation to the speed of sound.
 - 80% of the speed of sound = M.80
 - 75% of the speed of sound = M.75



Speed Adjustment

12

- ⦿ 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.

Continued on next page

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.**

Click 1 to show
M.84 at FL370.

Click 2 to show
M.84 at FL290.

AIRSPEED AND MACH (Continued)

Review

❖ **QUESTION:** What does M.80 mean?

ANSWER: That an aircraft's speed is 80% the speed of sound.

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

ANSWER: It remains the same.

Rules of Thumb for Assigning Mach



Rules of Thumb For Mach Assignment

- (+/-) M.01 = (+/-) 6 KTAS
- An aircraft's speed changes by M.01 for every 2,000 feet of altitude
- Used at or above FL290



Speed Adjustment

Click to Play Animation

14

⦿ There are 3 basic rules for Mach number assignment:

Click 1

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

Click 2

- At a constant airspeed, an aircraft's Mach changes by M.01 for every 2000 ft. of altitude.

Click 3

- Mach numbers are primarily used at or above FL290.
-

Continued on next page

AIRSPEED AND MACH (Continued)

Rules of
Thumb for
Assigning
Mach (Cont'd)



*Click to
animate.*

- ⊙ 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.

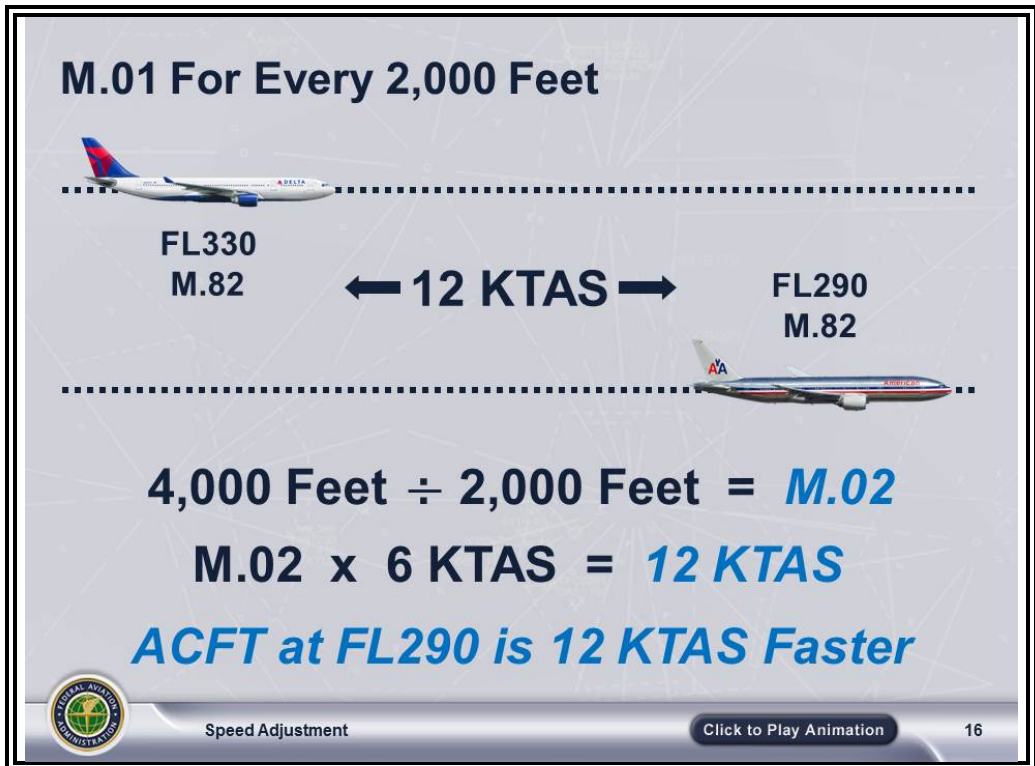
Rule of Thumb

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

Continued on next page

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.

Click 1

- 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.

Click 2

- 6 KTAS for each M.01 = 12 KTAS
- The aircraft at FL290 will be moving 12 KTAS faster than the aircraft at FL330.

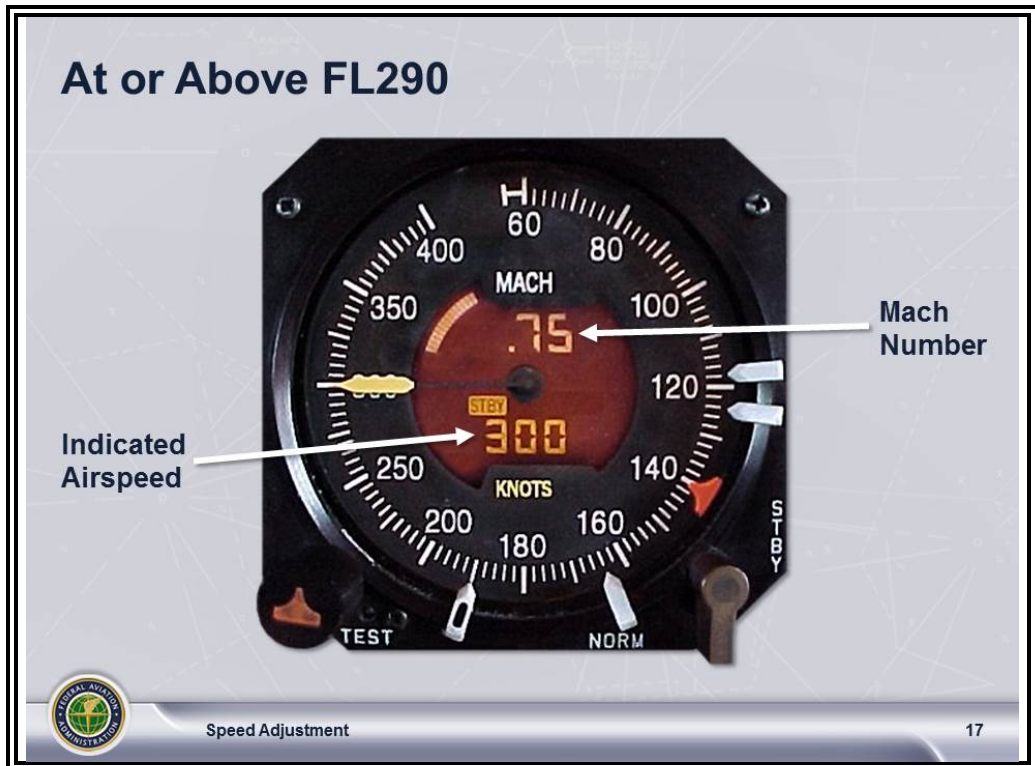
Rule of Thumb

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

Continued on next page

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:
The IAS portion of this lesson contains more detail on this subject.

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.

Continued on next page

AIRSPEED AND MACH (Continued)

Review



Response Item

There is a M.01 difference in speed for every _____ feet below FL360?

- A. 1,000
- B. 2,000
- C. 4,000



Speed Adjustment

[Click to Show Answer](#)

18

SLIDE ANSWER: B

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

ANSWER: 6 KTAS for each M.01 of speed.

MACH APPLICATION SCENARIOS

Scenario 1: Same Altitude Same Mach



Same Mach, Same Altitude = Same TAS

What Mach number should be assigned to DAL210 to maintain the current spacing?

AAL5
FL310
M.83



DAL210
FL310
M.81



Speed AdjustmentClick to Play Animation19

- ⦿ 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?

Click to display answer.

👉 **NOTE:** In the example above: DAL210 is at FL310 operating at M.81 and AAL5 is 10 NM in-trail at FL310 operating at M.83. To maintain the current spacing, DAL210 should be assigned M.83 or greater and AAL5 should be assigned M.83 or less.

Continued on next page

MACH APPLICATION SCENARIOS (Continued)

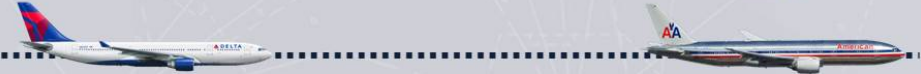
Scenario 2:
Apply
M.01 = 6 KTAS
Rule of Thumb



M.01 = 6 KTAS

**You need DAL660 to be 40 KTAS slower than AAL300.
What Mach number should be assigned?**

DAL660	AAL300
FL350	FL350
M.?	M.83



 Speed Adjustment [Click to Play Animation](#) 20

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

Click 1

☞ Using the Rule of Thumb, $M.07 \text{ times } 6 \text{ KTAS} = 42 \text{ KTAS}$.

☞ DAL660 should be reduced to a speed M.07 slower than AAL300.

Click 2

☞ $M.83 \text{ minus } M.07 = M.76$. DAL660 should be reduced to M.76.

Continued on next page

MACH APPLICATION SCENARIOS (Continued)

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



M.01 = 6 KTAS

What Mach number should DAL25 be assigned to result in the same ground speed as AAL321?

DAL25
FL310
M.83



GS = 450

AAL321
FL370
GS = 410





Speed Adjustment

Click to Play Animation

21

- ⦿ 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?

☞ AAL321's Mach and altitude are irrelevant. Your main concern is reducing DAL25's speed by 40 KTAS.

Click 1

☞ Using the Rule of Thumb, M.07 times 6 KTAS = 42KTAS.

Click 2

☞ M.83 minus M.07 = M.76. Reducing DAL25 to M.76 should result in a ground speed of 410 KTS.

Continued on next page

MACH APPLICATION SCENARIOS (Continued)

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



M.01 Per 2,000 Feet

What is the difference in KTAS?

AAL6
FL360
M.82

EJA42
FL340
M.82

Speed Adjustment [Click to Play Animation](#) 22

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

☞ *EJA42 is faster because “higher is slower.”*

Click 3 times to
display answer.

☞ *Using the Rule of Thumb, M.01 speed difference for every 2000 ft. of altitude.*

☞ *M.01 equates to a 6 KTAS speed difference. EJA42 would be approximately 6 KTAS faster than AAL6.*

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.)

Continued on next page

MACH APPLICATION SCENARIOS (Continued)

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



M.01 Per 2,000 Feet

What Mach number should be assigned to AAL86 to maintain the same TAS?



AAL86
FL310
M.?



EJA22
FL350
M.82



Speed Adjustment

Click to Play Animation

23

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

☞ *Using the Rule of Thumb, an aircraft's TAS will increase the equivalent of M.01 for each 2000 ft. it descends.*

☞ *FL350 minus FL310 = 4000 ft.*

Click 1

☞ *4000 ft. = M.02 speed difference.*

Click 2

☞ *M.82 minus M.02 equals M.80. AAL86 should be assigned M.80.*

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.

Continued on next page

MACH APPLICATION SCENARIOS (Continued)

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



M.01 Per 2,000 Feet

What Mach number would you assign AAL25 to maintain the same true airspeed?

DAL6
FL360
M.84



AAL25
FL380
M. ?



Speed AdjustmentClick to Play Animation24

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

☞ Rule of Thumb: Mach speed (the speed of sound) does not change at or above FL360.

Click to display
answer.

☞ Assign AAL25 M.84 to achieve the same true airspeed.

Practice Exercise 1

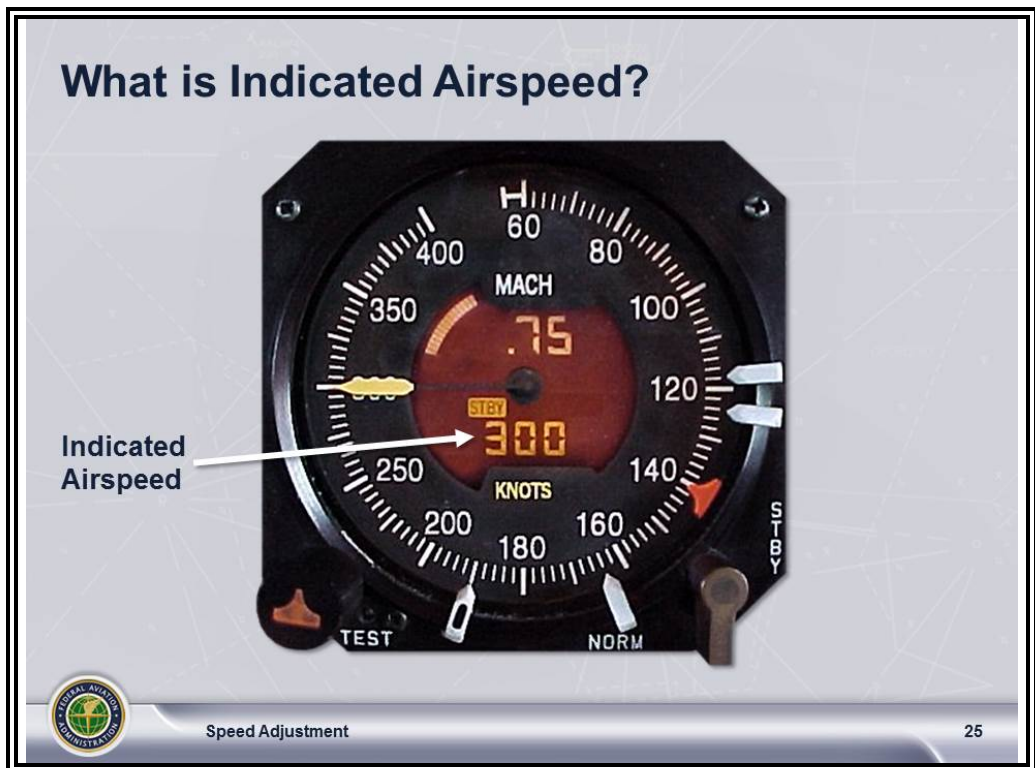
- ⦿ Practice Exercise 1: Mach Assignment Practical Application is located in 55055-HO11.

☞ **NOTE:** Go through the exercise with the students. Discuss items that students did not answer correctly.

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"



*Click twice to
animate.*

- ⦿ 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



*Click to
animate.*

- ⦿ 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



Response Item

The airspeed that is displayed on the aircraft airspeed indicator is _____?

- A. true airspeed (TAS)
- B. indicated airspeed (IAS)
- C. ground speed (GS)

Speed AdjustmentClick to Show Answer28

SLIDE ANSWER: B

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

ANSWER: *It decreases.*

❖ **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?

ANSWER: *The one at FL190.*

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

ANSWER: *FL 290 because the pilot will be transitioning from one to the other at approximately that altitude.*

IAS (Continued)

Rules of Thumb for IAS Use



Rules of Thumb for IAS Use

- 5 - 7 knots TAS for every 1,000 feet
- 10 KIAS = 15 KTAS at or above FL200
- 10 KIAS = 10 KTAS below FL200
- In general, use IAS below FL290



Speed Adjustment

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- ⦿ 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.

Continued on next page

IAS (Continued)

Rules of Thumb for IAS Use (Cont'd)



5 - 7 Knots TAS for Every 1,000 Feet

15,000 Feet

If both aircraft are assigned 250 KIAS, the aircraft at 15,000 Feet will be 30 KTAS faster.

15,000 Feet - 10,000 Feet = 5,000 Feet

6 KTAS for Every 1,000 Feet

6 KTS x 5 = 30 KTAS

10,000 Feet




 Speed Adjustment [Click to Play Animation](#) 30

- ⊙ 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.

Click 1

- 15,000 ft.-10,000 ft. = 5000 ft.

Click 2

- 6 KTAS for every 1000 ft.

Click 3

- 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.

Continued on next page

IAS (Continued)

Rules of Thumb for IAS Use (Cont'd)



10 KIAS = 15 KTAS AOA FL200

AOA FL200, if an aircraft is given a speed reduction of 20 KIAS, expect a 30 KTAS reduction.

2 x 15 KTAS = 30 KTAS

FL200

FAA logo, Speed Adjustment, Click to Play Animation, 31

⊙ 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.

Click to animate.

⊙ **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.

IAS (Continued)

Rules of
Thumb for IAS
Use (Cont'd)



Below FL200 10 KIAS = 10 KTAS

FL200

↓

If you need to reduce Aircraft A 30 KTAS at 17,000 feet, assign a speed reduction of 30 KIAS.

30 KIAS = 30 KTAS

A **17,000 Feet** **B**

 Speed Adjustment [Click to Play Animation](#) 32

*Click to
animate.*

- ⊙ 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.

IAS (Continued)

Review



Response Item

Approximately how many KTAS variation is there for every 1,000 feet of altitude change?

- A. 2 - 4 KTAS (average 3 KTAS)
- B. 5 - 7 KTAS (average 6 KTAS)
- C. 8 - 10 KTAS (average 9 KTAS)



Speed Adjustment

[Click to Show Answer](#)

33

SLIDE ANSWER: B

Continued on next page

IAS (Continued)

Review (Cont'd)



Response Item

If an aircraft at FL290 is assigned 280 KIAS and an aircraft at FL240 is assigned 280 KIAS, which aircraft has a faster TAS?

- A. The aircraft at FL290
- B. The aircraft at FL240
- C. Both aircraft have the same TAS



Speed Adjustment

[Click to Show Answer](#)

34

SLIDE ANSWER: A

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

ANSWER: 30 KTAS (5000 ft difference X 6 KTAS = 30 KTAS)

Continued on next page

IAS (Continued)

Review
(Cont'd)



Response Item

At or above FL200, expect approximately ____ KTAS difference for every 10 KIAS assigned.

- A. 20
- B. 15
- C. 10



Speed Adjustment

Click to Show Answer

35

SLIDE ANSWER: B

Continued on next page

IAS (Continued)

Review (Cont'd)



Response Item

How many KTAS faster will an aircraft at FL200 be than an aircraft at 10,000 feet be, assuming they are assigned the same IAS?

- A. 10 KTAS
- B. 30 KTAS
- C. 60 KTAS



Speed Adjustment

[Click to Show Answer](#)

36

SLIDE ANSWER: C

Continued on next page

IAS (Continued)

Review (Cont'd)



Response Item

Two aircraft in the high altitude environment are descending 10 miles in trail with the following aircraft 4,000 feet higher. If the leading aircraft is maintaining 300 KIAS, what airspeed does the following aircraft need to be assigned to hold the spacing?

- A. 260 KIAS
- B. 280 KIAS
- C. 300 KIAS



Speed Adjustment

[Click to Show Answer](#)

37

SLIDE ANSWER: B

 **NOTE:** Discuss the calculations for the answer. Expect a 24 knot difference in TAS, with the higher aircraft being faster. (6 KTAS for every 1000 ft difference in altitude). AOA FL 200 10 KIAS = 15 KTAS, so an IAS assignment of 280 KIAS should work.

IAS APPLICATION SCENARIOS

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



Scenario 1

Question: How much of a speed reduction in KIAS must be assigned to N169JB to attain the same ground speed as N3608L?

N169JB
120KTS

15,000 Feet

N3608L
100KTS

Speed Adjustment [Click to Play Animation](#) 38

- ⦿ 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?

☞ *Are the aircraft below FL200? In this case they are, so the 1 for 1 TAS/IAS ratio exists.*

Click to display
answer.

☞ *20 KTAS = 20 KIAS. Reduce N169JB by 20 KIAS.*

Continued on next page

IAS APPLICATION SCENARIOS (Continued)

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



Scenario 2

Question: How many KIAS must be assigned to reduce ACFT 2 by 30 KTAS?

ACFT 1
440KTS

FL270

ACFT 2
470KTS

Speed Adjustment

Click to Play Animation

39

- ⦿ 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?

☞ *Are the aircraft above FL200? Yes, so the 15 KTAS for every 10 KIAS assigned rule of thumb applies.*

Click to display answer.

☞ *20 KIAS would equate to 30 KTAS difference. Reduce aircraft 2 by 20 KIAS.*

Continued on next page

IAS APPLICATION SCENARIOS *(Continued)*

Scenario 3: In-trail Spacing



Scenario 3

DUKE33 is maintaining 300 KIAS. You need 6 NM additional spacing. You have 12 minutes to achieve that spacing. What speed should N35YY be assigned?

N35YY

FL250

DUKE33
300 KIAS

Speed Adjustment

Click to Play Animation

40

*Click to
animate.*

*Scenario
continues on
next page.*

- ⦿ 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.

Continued on next page

IAS APPLICATION SCENARIOS (Continued)

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



Scenario 3 (Cont'd)

Step 1: Determine the difference in KTAS needed to achieve the spacing.

Speed AdjustmentClick to Play Animation41

 In the scenario above, you have 12 minutes to increase spacing by 6 miles.

Click 1

 12 minutes divided by 6 minutes = 2.

 $2 \times ? = 6 \text{ miles spacing.}$

 $? = 3$

Click 2

 $3 \times 10 \text{ KTAS} = 30 \text{ KTAS.}$ A speed difference of 30 KTAS needs to be assigned to accomplish the spacing objective.

Scenario
continues on
next page

Continued on next page

IAS APPLICATION SCENARIOS *(Continued)*

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



Scenario 3 (Cont'd)

Step 2: To get a 30 KTAS difference, how many KIAS difference needs to be assigned?

N35YY

FL250

DUKE33
300 KIAS

Speed Adjustment [Click to Play Animation](#) 42

☞ When considering what IAS to assign, you must first consider if the aircraft are at or above FL200. In this case they are.

☞ DUKE33 is at FL250 assigned 300 KIAS.

☞ To get a 30 KTAS difference, how many KIAS difference needs to be assigned?

Click 1

☞ $30 \text{ KTAS} \div 15 \text{ KTAS} = 2$.

Click 2

☞ $2 \times 10 \text{ KIAS} = 20 \text{ KIAS}$. (AOA 200 Rule of Thumb)

Click 3

☞ A 20 KIAS difference in speed needs to be assigned. N35YY should be reduced to 280 KIAS in order to increase spacing 6 miles in 12 minutes.

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

Continued on next page

IAS APPLICATION SCENARIOS (Continued)

Scenario 4: In-trail Spacing



Scenario 4

You need to build in 5 NM extra in 6 minutes.

UAL224
280 KIAS

FL240

N534EB

Question: How many KTAS do we need to build in?

Question: How many KIAS do we need to accomplish this?

Speed AdjustmentClick to Play Animation43

- ⦿ 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.

Click 1

☞ How many KTAS difference do you need to add 5 miles in 6 minutes?

Click 2

☞ Answer: 50 KTAS (10 KTAS = +/- 1 NM every 6 minutes)

Click 3

☞ Since the aircraft are above FL200, how many KIAS difference do you need in order to accomplish this?

Click 4

☞ Answer: Somewhere between 30 KIAS and 40 KIAS. 30 KIAS would equate to 45 KTAS. 40 KIAS would equate to 60 KTAS.

☞ Since IAS is assigned in 10 KT increments, you must pick one or the other. If you use 30 KIAS it may take a little more than 6 minutes to build in the additional 5 miles. If you use 40 KIAS, a little less than 6 minutes. In this case, let's use the 40 KIAS.

☞ **Emphasize** that you should not reduce N534EB below 250 KIAS; therefore, a combination of increasing UAL224 to 290 KIAS and assigning N534EB 250 KIAS should achieve the goal of a 40 KIAS difference.

Continued on next page

IAS APPLICATION SCENARIOS (Continued)

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



Scenario 5

FL300

HOG1
260 KIAS

FL240

RAPTR2
260 KIAS

Question: Which aircraft will have a slower TAS?

Question: Approximately how many KTAS difference can be anticipated?

 Speed Adjustment [Click to Play Animation](#) 44

- ⊙ HOG1 is at FL240 assigned the same IAS as RAPTR2 at FL300.
- ⊙ Which aircraft will have a slower TAS?

Click 1

☞ Answer: HOG1 ("Lower is Slower")

Click 2

- ⊙ Approximately how many KTAS difference can be anticipated?

Click 3

☞ *Approximately 36 KTAS (6 KTAS for every 1,000 ft. of altitude difference)*

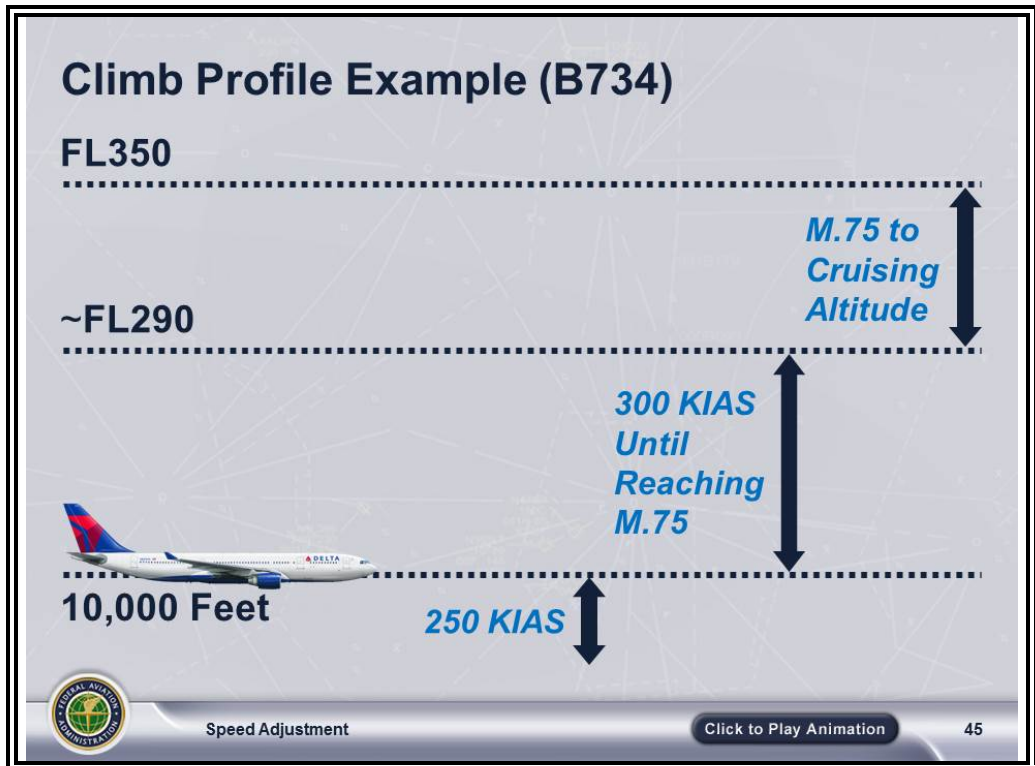
Practice Exercise 2

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

☞ **NOTE:** *Go through the exercise with the students. Discuss items that students did not answer correctly.*

SPEED TRANSITION

Speed Transition – Climb Profile Example



*Click to
animate.*

- ⦿ 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)



What Happens if the Aircraft is Not Allowed to Transition to Mach Speed?

FL350

300 KIAS = 504 KTAS / M.88



Speed Adjustment

Click to Play Animation

46

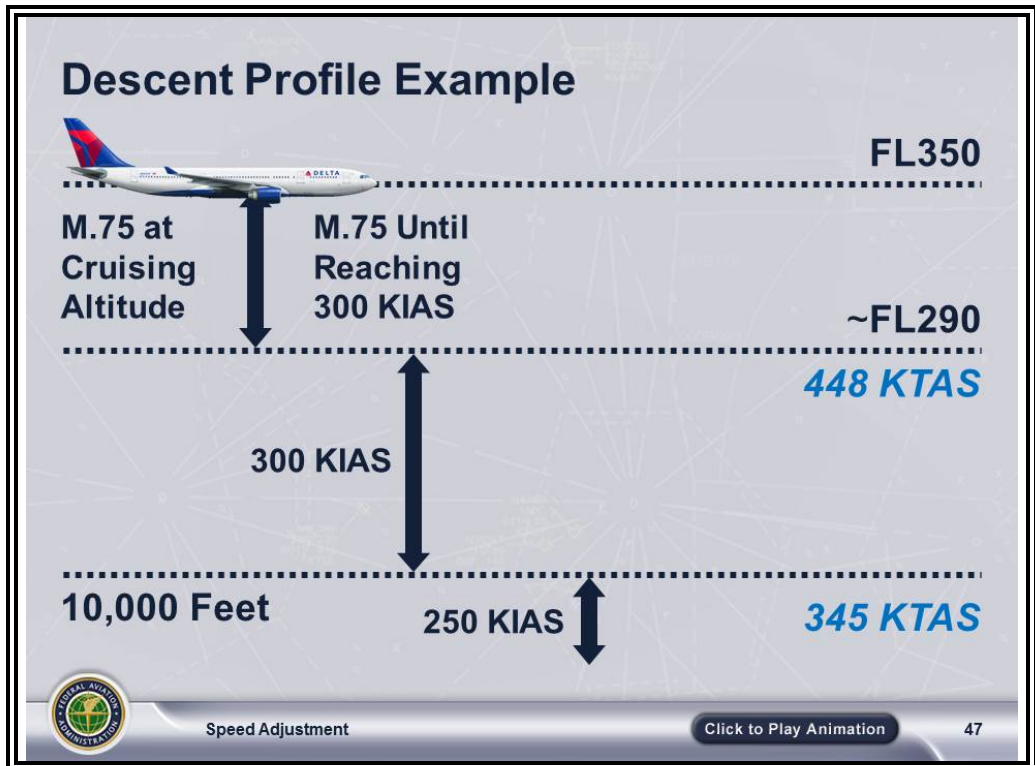
No Transition to Mach?

Click to animate.

- ⦿ 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



Click to animate.

- ⦿ 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.

Continued on next page

SPEED TRANSITION (Continued)

Speed
Transition –
Descent Profile
Example
(Cont'd)



What Happens if the Aircraft is Not Allowed to Transition to IAS?



M.75 = 360 KIAS / 466 KTAS
at FL180

FL180

Speed Adjustment

Click to Play Animation

48

**No Transition
to IAS?**

*Click to
animate.*

- ⊙ 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 stratum, 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



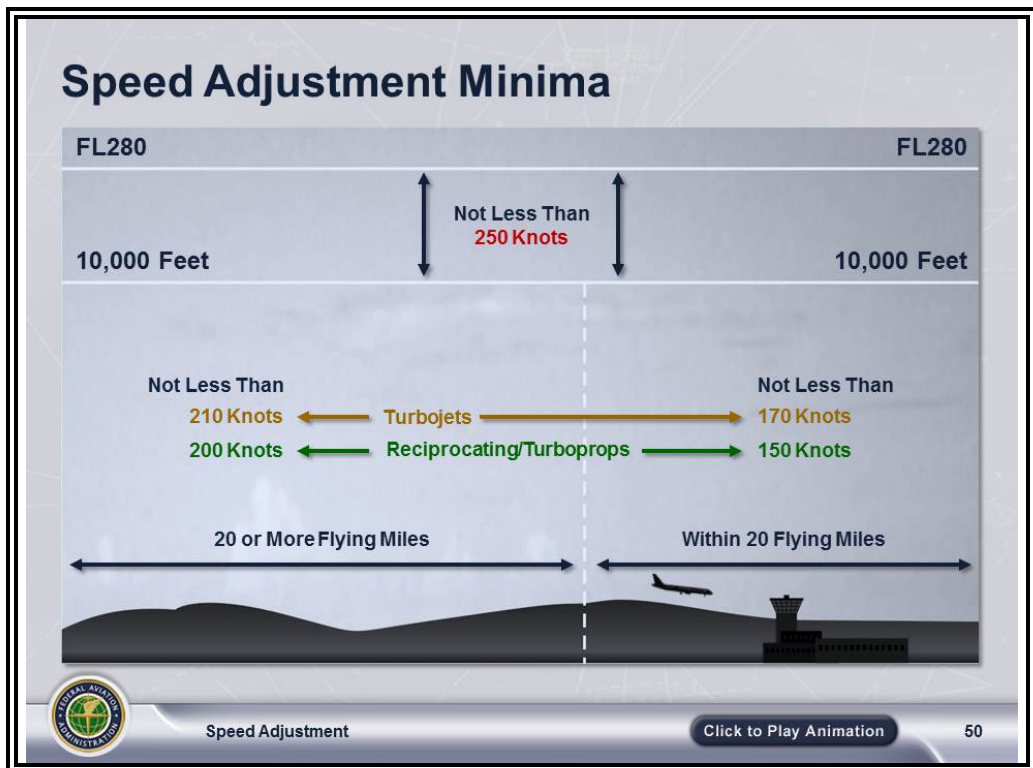
- ⦿ FAR 91.117 prohibits speed in excess of 250 knots below 10,000 feet within domestic airspace.

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:

*Click1 to show
MINIMA
between 10,000
and FL280.*

- 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

*Click 2 to show
MINIMA for
arrivals more
than 20 miles
from airport*

*Click 3 to show
MINIMA for
arrivals within
20 miles from
airport*

- ⊙ 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



Speed Adjustment Minima (Cont'd)

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



Speed Adjustment51

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

MINIMA (Continued)

Review



Response Item

The recommended minimum speed that may be assigned to an aircraft between 10,000 feet and FL280 is _____ knots.

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



Speed Adjustment

[Click to Show Answer](#)

52

SLIDE ANSWER: C

Continued on next page

MINIMA (Continued)

Review
(cont'd)



Response Item

The recommended minimum indicated airspeed (IAS) that may be assigned to a departing turbojet aircraft operating below 10,000 feet is _____ knots.

- A. 150
- B. 230
- C. 250



Speed Adjustment

Click to Show Answer

53

SLIDE ANSWER: B

❖ **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.

ANSWER: 210

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT

**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"

 Speed Adjustment 54

- ⊙ 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



Maintain Present Speed

"KING AIR TWO ONE THREE FOUR, MAINTAIN PRESENT SPEED."



 Speed Adjustment 55

☉ Instruct aircraft to maintain present/specific speed.



Phraseology

"MAINTAIN PRESENT SPEED."

or

"MAINTAIN (specific speed) KNOTS."

Continued on next page

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Methods (Cont'd)

JO 7110.65,
par. 5-7-2



Maintain a Specified Speed

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

"NOVEMBER SIX GOLF ALPHA REDUCING TO TWO FIVE ZERO KNOTS."

Speed Adjustment

[Click to Play Animation](#)

56

Click 4 times
to animate.



Phraseology

- ⦿ Maintain specified speed or greater/less.

"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/Reduce Speed

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





	CRR	
MSP		
A	DAL267	79.8
	DAL263	87.6
ORD		
	UAL437	129.4


Speed Adjustment
Click to Play Animation
57

- ☉ 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."

Click to animate.

At or above FL390



Phraseology

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

"(Speed adjustment), IF UNABLE ADVISE."

Continued on next page

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

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



Combining Speed Reduction and Descent Clearance

"DELTA TWO-SIXTY-THREE, REDUCE SPEED TO TWO FIVE ZERO, THEN DESCEND AND MAINTAIN ONE ZERO THOUSAND."





	CRR	
MSP		
A	DAL267	79.8
	DAL263	87.6
ORD		
	UAL437	129.4


Speed Adjustment
58

- ⊙ 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)."

Continued on next page

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Simultaneous Speed Reduction and Descent **(Cont'd)**

JO 7110.65,
par. 5-7-2



Combining Speed Reduction and Descent Clearance

“DELTA TWO-SIXTY-SEVEN, DESCEND AND MAINTAIN ONE ZERO THOUSAND, THEN REDUCE SPEED TO TWO FIVE ZERO.”





A	CRR	MSP
DAL267	79.8	
DAL263	87.6	
ORD		
UAL437	129.4	


Speed Adjustment
59

☉ 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 Restrictions

"FEDEX SEVEN-NINETEEN,
CROSS PAYNT AT AND
MAINTAIN ONE ONE
THOUSAND, AT TWO FIVE
ZERO KNOTS."



ARTCC



Speed Adjustment

60

☉ 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



Response Item

The phraseology to instruct an aircraft to increase speed from 200 knots to 230 knots is _____

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



Speed Adjustment

[Click to Show Answer](#)

61

SLIDE ANSWER: A

Continued on next page

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

Review
(Cont.)



Response Item

The phraseology to reduce the speed of an aircraft to 250 knots is _____

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



Speed Adjustment

[Click to Show Answer](#)

62

SLIDE ANSWER: B

METHODS AND PHRASEOLOGY FOR SPEED ADJUSTMENT *(Continued)*

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



Published Speed Restrictions

Example 1: Aircraft is inbound to MOXEE and has been cleared to descend pilot's discretion to FL240. Because there are underlying speed restrictions on the route, the aircraft must comply with the published speed restrictions.

Example 2: Aircraft is inbound to MOXEE and has been cleared to descend via the TMBR STAR. Aircraft must comply with published speed and altitude restrictions.

- ⊙ 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)*



Phraseology

⦿ Speed adjustment on route or procedure with published speeds:

“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

"BOEING ZERO FOUR SEVEN, MAINTAIN THREE ZERO ZERO KNOTS UNTIL TMBRS, THEN RESUME PUBLISHED SPEED."



ARTCC



Speed Adjustment

64

- ⦿ "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



Adjusting Published Speeds

"AMERICAN SIXTY-ONE, CROSS ALISAAT TWO TWO ZERO KNOTS, THEN CLIMB VIA THE TIMMY ONE DEPARTURE."



Speed Adjustment

[Click to Play Animation](#)

65

Click to display phraseology.

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



Adjusting Published Speeds

"AMERICAN SIX-TWENTY-SEVEN, DESCEND VIA THE HAWKZ THREE ARRIVAL, LANDING NORTH, EXCEPT AFTER LIINE MAINTAIN TWO THREE ZERO KNOTS."



Speed Adjustment

[Click to Play Animation](#)

66

*Click to display
phraseology.*

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



Response Item

When issuing speed adjustments to aircraft cleared on procedures with published speed restrictions, specify the point at which _____.

- A. the aircraft should resume normal speed
- B. the issued speed changes the published restrictions
- C. the issued restriction begins or ends



Speed Adjustment

[Click to Show Answer](#)

67

SLIDE ANSWER: C

METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT

Termination

JO 7110.65,
par. 5-7-4



Resume Normal Speed

Example: Aircraft is operating on the STAR between BYI and BEARR, and has been issued a speed adjustment. Because there are no published speed restrictions (only “expect” speeds) the phrase “RESUME NORMAL SPEED” may be used when the current speed adjustment is no longer required.

Speed Adjustment

68

☉ 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.

Continued on next page

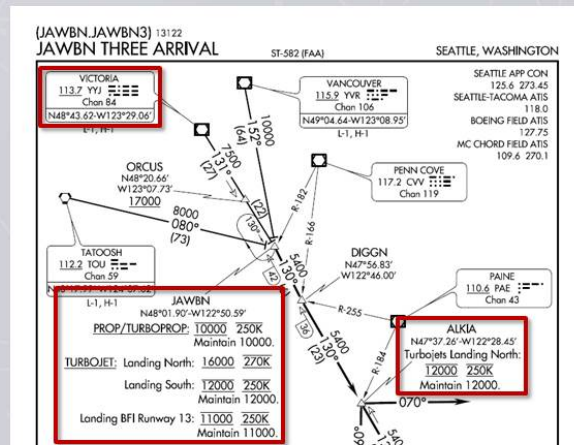
METHODS AND PHRASEOLOGY FOR TERMINATING SPEED ADJUSTMENT *(Continued)*

Termination (Cont'd)

JO 7110.65,
par. 5-7-4



Resume Normal Speed (Cont'd)



Example: Aircraft is operating on the STAR between YYJ and JAWBN, and has been issued a speed adjustment. If used, the phrase “RESUME NORMAL SPEED” does NOT relieve the pilot of speed restrictions on upcoming segments of flight.



Speed Adjustment

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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.”

Continued on next page

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

Termination (Cont'd)

JO 7110.65,
par. 5-7-4



Resume Published Speed

Before:	After:
	
"FEDEX FOUR-TWELVE, DESCEND VIA THE MARNR THREE ARRIVAL, LANDING SOUTH, EXCEPT MAINTAIN TWO NINER ZERO KNOTS"	"FEDEX FOUR-TWELVE, RESUME PUBLISHED SPEED."

Speed AdjustmentClick to Play Animation70

*Click to display
phraseology.*



Phraseology



Phraseology

- ⦿ 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.
 - "RESUME PUBLISHED SPEED."
- ⦿ Advise aircraft when either ATC assigned speed adjustments or published speed restrictions are no longer required.
 - "DELETE SPEED RESTRICTIONS."

Continued on next page

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

Review



Response Item

Which phrase is used to inform an aircraft on a route with speed restrictions that an unpublished speed adjustment is no longer required?

- A. "RESUME NORMAL SPEED."
- B. "DELETE SPEED RESTRICTIONS."
- C. "CANCEL SPEED RESTRICTIONS."
- D. "RESUME PUBLISHED SPEED."



Speed Adjustment

[Click to Show Answer](#)

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SLIDE ANSWER: D

Continued on next page

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

Review
(Cont'd)



Response Item

Use the phrase “RESUME NORMAL SPEED” to terminate a speed adjustment on which types of routes?

- A. A STAR with expected speed restrictions
- B. A STAR with published speed restrictions
- C. A STAR with no speed restrictions
- D. A SID with published speed restrictions



Speed Adjustment

[Click to Show Answer](#)

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SLIDE ANSWERS: A and C

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



Coordinating Speed Adjustments

UAL1254		X
KT	+	-
310+	▲	
300+		
290+		
280+		
270+	▼	
260+		
250+		
DELETE		

UAL1254		X
M	+	-
.86-	▲	
.85-		
.84-		
.83-		
.82-	▼	
.81-		
.80-		
DELETE		

Speed Adjustment73

- ⦿ 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



Speed Value Formats

Formats	
ddd	Mdd
ddd+	Mdd+
ddd-	Mdd-
+d(d)	M.dd
-d(d)	.dd
dd	.dd+
dd+	.dd-
dd-	PS (Present Speed)
+	Sddd
Sddd+	Sddd-
d = digit between 0 - 9	



Speed Adjustment

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- ⦿ 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



4th Line Data Block Coordination

UAL431
280↑225
204 431↓
S280

N707T
360C
321 250↓
M77+

A26942
330C
204 457↓
H090 M75

AAL720
310C
432 380↓
M74-



Speed Adjustment

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- ⊙ 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

 **NOTE:** Review and elaborate briefly on the following:

- ⦿ 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)

 **NOTE:** Ask students if there are any questions.

End-of-Lesson Test

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

 **NOTE:** Distribute and administer the End-of-Lesson Test located in 55055-ELT11.
