Federal Aviation Administration

Initial En Route Qualification Training

Lesson 16
Vertical Separation

Course 50148001

LESSON PLAN DATA SHEET

COURSE NAME:	INITIAL EN ROUTE QUALIFICATION TRAINING
COURSE NUMBER:	50148001
LESSON TITLE:	VERTICAL SEPARATION
DURATION:	3+30 HOURS
DATE REVISED:	2022-02
VERSION:	V.2022-02
REFERENCE(S):	FAA ORDER JO 7110.65, AIR TRAFFIC CONTROL; GEN04009
HANDOUT(S):	NONE
EXERCISE(S)/ ACTIVITY(S):	ACTIVITY: IDENTIFYING POTENTIAL CONFLICTS EXERCISE: APPLYING VERTICAL SEPARATION
END-OF-LESSON TEST:	YES
PERFORMANCE TEST:	NONE
MATERIALS:	NONE
OTHER PERTINENT INFORMATION:	

INTRODUCTION

Separation of aircraft and issuing safety alerts is your highest priority as an air traffic controller. Vertical separation is the first type of separation that you will be taught here at the Academy and the most commonly applied type of separation. Vertical separation, together with the skills and procedures you have learned to this point, will help you issue control instructions that both ensure safety and maximize the efficiency of the NAS.

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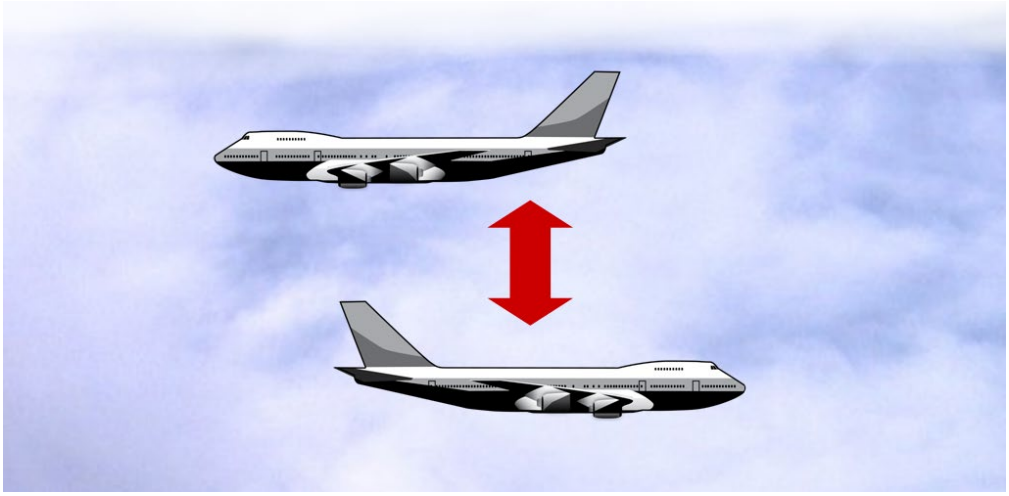
INTRODUCTION *(Continued)*

VERTICAL SEPARATION



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It's critical for safety that aircraft maintain required vertical separation. As a controller, you need to understand the rules that apply to vertical separation so that you can control the aircraft efficiently and effectively.

Purpose

This lesson will cover vertical separation rules and the procedures used to apply them.

Lesson Objectives

LESSON OBJECTIVES

- On an End-of-Lesson Test and in accordance with FAA Order JO 7110.65, you will identify standards, procedures, and phraseology as they apply to vertical separation.

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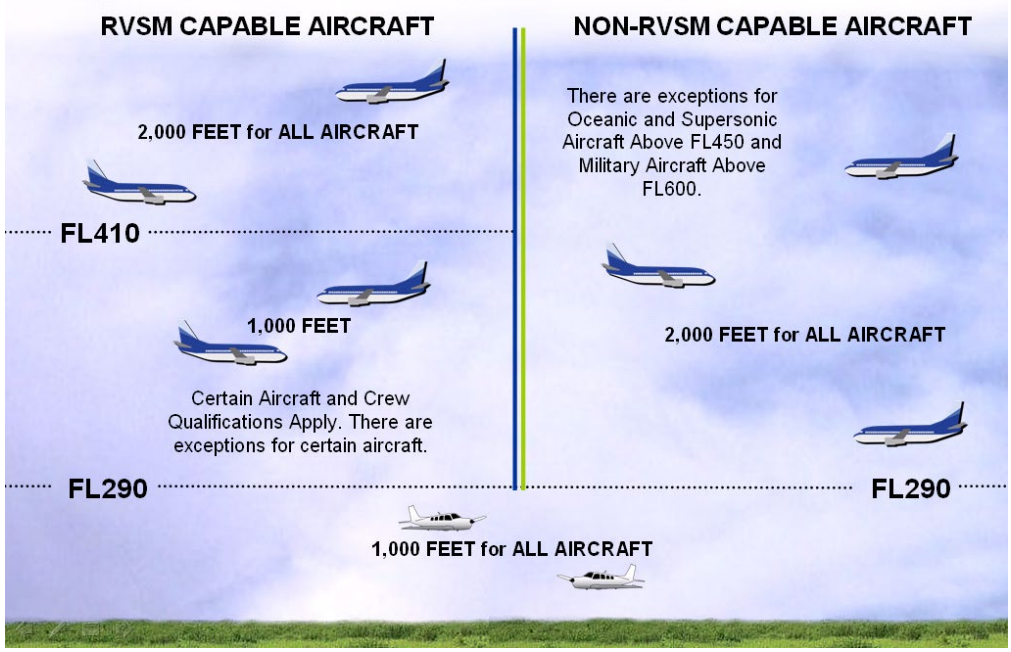
MINIMA BETWEEN ALTITUDES

Minima
JO 7110.65,
par. 4-5-1,
GEN04009



- Separate IFR aircraft by assigning different altitudes using the following minima:

  - Up to and including FL410 - 1,000 feet

    - **Exception:** 2000 feet at or above FL290 between non-RVSM aircraft and all other aircraft at or above FL290

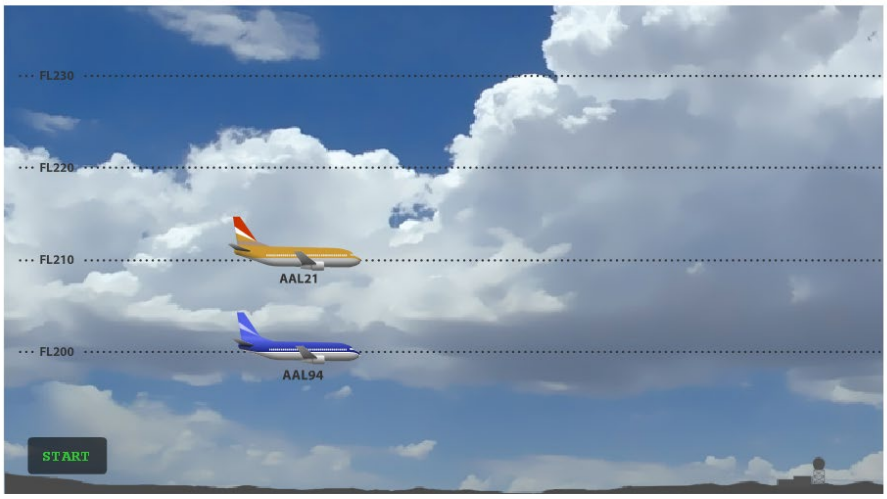
NOTE: RVSM – Reduced Vertical Separation Minimum requires certain aircraft and pilot capabilities which permit the use of 1000 feet of separation for aircraft between FL290 and FL410.

  - Above FL410 - 2,000 feet

ALTITUDE ASSIGNMENT

Application
JO 7110.65,
pars. 4-5-7, 5-5-5

ALTITUDE ASSIGNMENT



ATC: *"American Twenty-One, climb and maintain flight level two three zero."*

AAL21: *"American Twenty-One, leaving flight level two one zero to maintain flight level two three zero."*

ATC: *"American Ninety-Four, climb and maintain flight level two one zero."*

AAL94: *"American Ninety-Four, leaving flight level two zero zero to maintain flight level two one zero."*

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⊙ Assign an altitude to an aircraft after the aircraft previously at that altitude has been issued a climb/descent clearance and is observed (valid Mode C), or reports leaving the altitude.

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ALTITUDE ASSIGNMENT *(Continued)*

Application (Cont'd)
JO 7110.65, pars. 4-5-7, 5-5-5, 6-6-1

✈ **Phraseology**

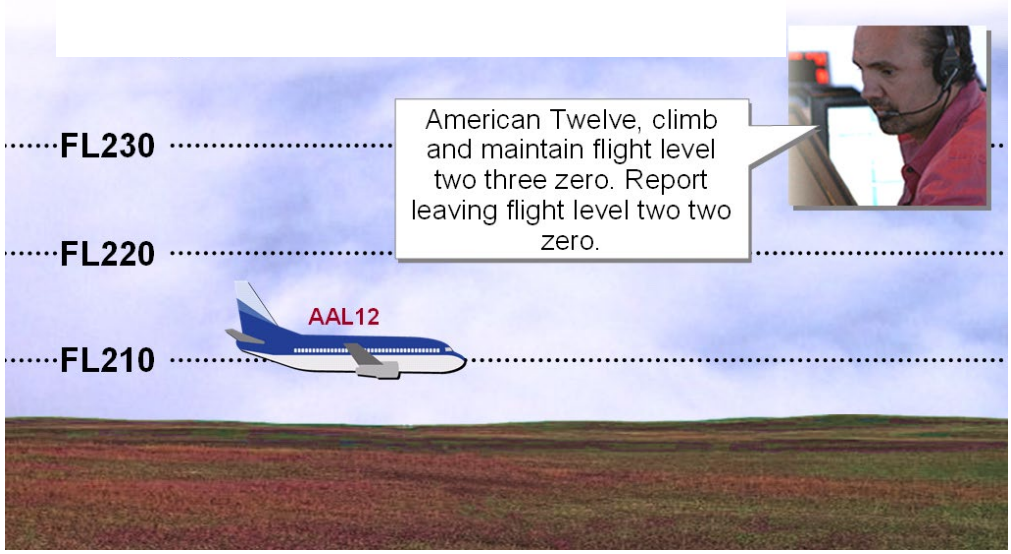
"MAINTAIN/CRUISE (altitude)."

"CLIMB AND MAINTAIN (altitude)."

"DESCEND AND MAINTAIN (altitude)."

NOTE: For more altitude phraseology, see JO 7110.65, par. 4-5-7.

PHRASEOLOGY EXAMPLE – ALTITUDE ASSIGNMENT



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⊙ To obtain an altitude report, use the following phraseology:

✈ **Phraseology**

"REPORT LEAVING/REACHING (altitude/flight level)."

"REPORT LEAVING ODD/EVEN ALTITUDES/FLIGHT LEVELS."

If aircraft is known to be operating below the lowest usable flight level:

"SAY ALTITUDE."

If aircraft is known to be operating at or above the lowest usable flight level:

"SAY FLIGHT LEVEL."

If aircraft's position relative to lowest usable flight level is unknown:

"SAY ALTITUDE OR FLIGHT LEVEL."

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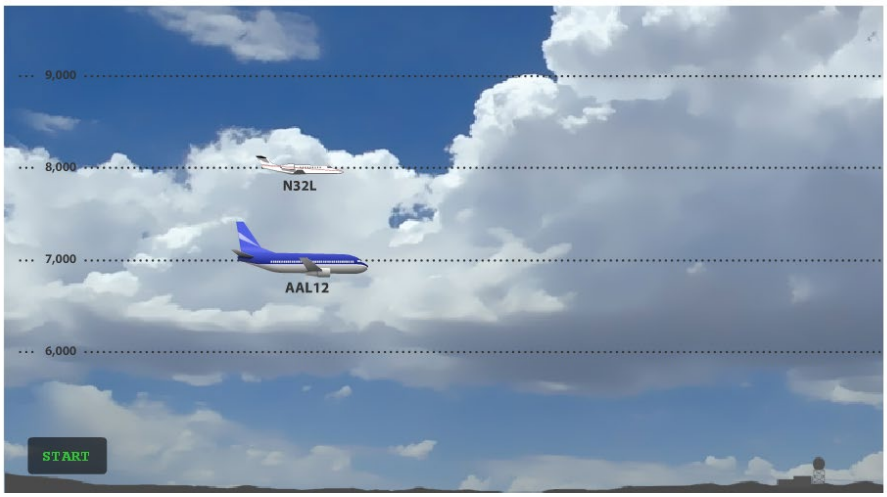
ALTITUDE ASSIGNMENT *(Continued)*

Application (Cont'd)
JO 7110.65, pars. 4-5-7, 6-6-1

PHRASEOLOGY EXAMPLE – ALTITUDE REPORT



ATC: *"Citation Three Two Lima, climb and maintain niner thousand."*

N32L: *"Roger. Citation Three Two Lima, leaving eight thousand for niner thousand."*

AAL12: *"Aero Center, American Twelve, request climb to eight thousand.*

ATC: *"American Twelve climb and maintain eight thousand."*

N32L: *"American Twelve, leaving seven thousand for eight thousand."*

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⊙ When applying vertical separation minima, consider:

- Known aircraft performance characteristics
- Information indicating that climb/descent rates are **not** consistent with rates recommended in the AIM
  - This information may be pilot-furnished or Mode C observed

ALTITUDE ASSIGNMENT *(Continued)*

Knowledge Check

KNOWLEDGE CHECK

QUESTION: How would you ask AAL20 to advise you when it reaches 6,000 feet?

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KNOWLEDGE CHECK

QUESTION: What phraseology would be used to descend N50M and N21P?

N21P PA23/A T140 66 02	STUEE 0640 *0640*	13 07 *13* MHZ	110✓ ↓90	MEI	KSHV V18 KMEI/0748	
N50M BE65/A T160 66 02	STUEE 0643 *0643*	12 07 *12* MHZ	90✓ ↓70	MEI	KSHV V18 KMEI/0746	

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ALTITUDE ASSIGNMENT *(Continued)*

Knowledge Check (Cont'd)

KNOWLEDGE CHECK

QUESTION: What phraseology would be used to clear N50M and N21P to their requested altitudes?

N21P PA23/A T140 66 03	GLH 0658	13 07 13 0713 SQS	110✓ ↑130	IGB	KTXK GLH V278 IGB KUBS/0749	
N50M BE65/A T160 66 03	GLH 0700	12 07 12 0711 SQS	90✓ ↑110	IGB	KTXK GLH V278 IGB KUBS/0749	

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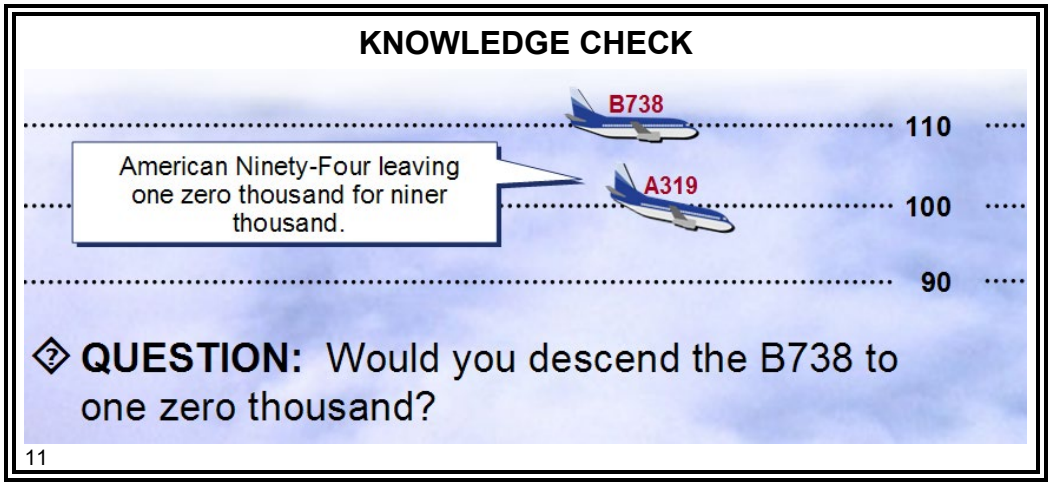
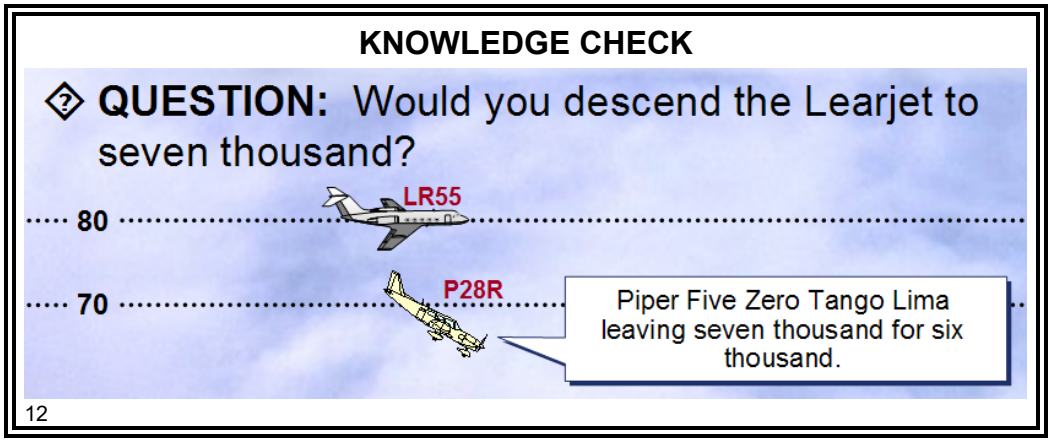
ALTITUDE ASSIGNMENT *(Continued)*

Knowledge Check (Cont'd)

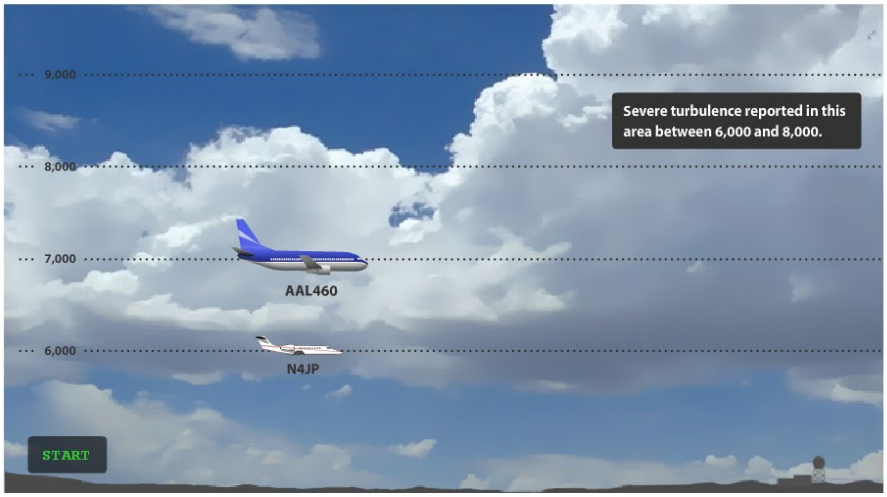




EXCEPTIONS TO ALTITUDE ASSIGNMENT

Exceptions
JO 7110.65,
pars. 4-5-7, 6-6-2

EXCEPTIONS – SEVERE TURBULENCE



ATC: *"American Four Sixty, climb and maintain niner thousand."*

AAL460: *"American Four Sixty, leaving seven thousand to maintain niner thousand."*

N4JP: *"Aero Center. November Four Juliett Papa. Request climb to seven thousand."*

ATC: *"November Four Juliett Papa. Standby."*

ATC: *"American Four Sixty, report leaving eight thousand."*

AAL460: *"Aero Center, American Four Sixty leaving eight thousand to maintain niner thousand."*

ATC: *"November Four Juliett Papa, climb and maintain seven thousand."*

Pilot: *"Roger. November Four Juliett Papa leaving six thousand to maintain seven thousand."*

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EXCEPTIONS TO ALTITUDE ASSIGNMENT *(Continued)*

Exceptions (Cont'd)
JO 7110.65, pars. 4-5-7, 6-6-2

⊙ Assign an altitude to an aircraft **only** after the aircraft previously at that altitude has reported at or passing through another altitude separated from the first by the appropriate minima when:

- Severe turbulence is reported
- Military aircraft are conducting aerial refueling
- The aircraft previously at that altitude has been issued:

  – Climb/descent at pilot's discretion

    → Crossing restriction permits descent at pilot's discretion. The pilot may level off at any altitude, but once an altitude is vacated, the pilot may **not** return to it.

    → Approach clearance also permits descent at pilot's discretion—the aircraft **must** comply with restrictions on approach plate.

  – Cruise clearance

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EXCEPTIONS TO ALTITUDE ASSIGNMENT *(Continued)*

Exceptions (Cont'd)
JO 7110.65, pars. 4-5-7, 6-6-2

EXCEPTIONS – PILOT DISCRETION #1

ATC: *"November Two Five Lima Romeo. Cross one seven miles Northwest of Jackson VORTAC, at and maintain six thousand."*

N25LR: *"November Two Five Lima Romeo, leaving one three thousand to cross one seven miles northwest Jackson VORTAC, at and maintain six thousand."*

N45GB: *"Aero Center November Four Five Golf Bravo, request descent to one two thousand for chop."*

ATC: *"November Four Five Golf Bravo. Standby."*

ATC: *"November Two Five Lima Romeo. Report leaving one one thousand."*

N25LR: *"Aero Center. November Two Five Lima Romeo leaving one one thousand at this time."*

ATC: *"November Two Five Lima Romeo. Roger."*

ATC: *"November Four Five Golf Bravo. Descend and maintain one two thousand."*

N45GB: *"November Four Five Golf Bravo. Leaving one four thousand for one two thousand."*

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EXCEPTIONS TO ALTITUDE ASSIGNMENT *(Continued)*

Exceptions (Cont'd)
JO 7110.65, pars. 4-5-7, 6-6-2

EXCEPTIONS – PILOT DISCRETION #2

ATC: "*November Two Five Lima Romeo. Cleared approach Vicksburg Airport."*

N25LR: *"November Two Five Lima Romeo leaving seven thousand on approach."*

N45GB: *"Aero Center November Four Five Golf Bravo, request descent to seven thousand for chop."*

ATC: *"November Four Five Golf Bravo. Standby."*

ATC: *"November Two Five Lima Romeo. Report leaving six thousand."*

N25LR: *"November Two Five Lima Romeo leaving six thousand at this time."*

ATC: *"November Two Five Lima Romeo. Roger."*

ATC: *"November Four Five Golf Bravo. Descend and maintain seven thousand."*

N45GB: *"November Four Five Golf Bravo. Leaving niner thousand for seven thousand."*

ATC: *"November Four Five Golf Bravo. Roger."*

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NOTE: Most altitude changes in nonradar scenarios at Aero center will be pilot's discretion.

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EXCEPTIONS TO ALTITUDE ASSIGNMENT *(Continued)*

Exceptions (Cont'd)
JO 7110.65, pars. 4-5-7, 6-6-2

⊙ Assignment

- ATC may issue a specified altitude over a specified fix for that portion of a descent clearance where descent at pilot's discretion is permissible

  Example: The clearance is "Cross eight miles northeast Magnolia VORTAC at or below one zero thousand, descend and maintain seven thousand." The crossing restriction at or below one zero thousand is a pilot's discretion descent, but the descent to seven thousand is **not**.

✈ **Phraseology**

"CLIMB/DESCEND AT PILOT'S DISCRETION."

– Issue specific altitude clearance instructions.

✈ **Phraseology**

"CLIMB/DESCEND NOW TO (altitude), THEN CLIMB/DESCEND AT PILOT'S DISCRETION MAINTAIN (altitude)."

⊙ Removal of pilot's discretion

- Issue new clearance

✈ **Phraseology**

"AMEND ALTITUDE."

⊙ Advantages of pilot's discretion:

- Pilot can choose when to start climb or descent
- Pilot may level off at intermediate altitude, but after vacating an altitude, **cannot** return to vacated altitude
- Discretion clearance may conserve fuel for aircraft

⊙ Disadvantages of pilot's discretion:

- Controller **must** protect more altitudes, which may interfere with sequencing and separation of traffic

EXCEPTIONS TO ALTITUDE ASSIGNMENT *(Continued)*

Cruise Clearance
JO 7110.65, Pilot/Controller Glossary

⊙ Pilot is assigned altitude to cruise the airspace from ATC assigned altitude to minimum IFR altitude.

NOTE: Controller **must** protect those altitudes.

⊙ Pilot may climb, descend, or level off at any altitude within block.

- Once pilot reports leaving an altitude, they **cannot** return to that altitude

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EXCEPTION TO ALTITUDE ASSIGNMENT *(Continued)*

Knowledge Check

KNOWLEDGE CHECK

– Severe turbulence exists.

N32WM C421/A T210 G210 66 **123** 02	STUEE 0922	44 09 MHZ	150✓	MEI	KSHV V18 KMEI/1002	1515

– N32WM requests descent to 9,000 feet.

N30PP BE80/A T200 G200 66 **323** 02	STUEE 0917	41 09 MHZ	130✓	MEI	KSHV V18 KMEI/1012	2334

– N30PP requests descent to 7,000 feet.

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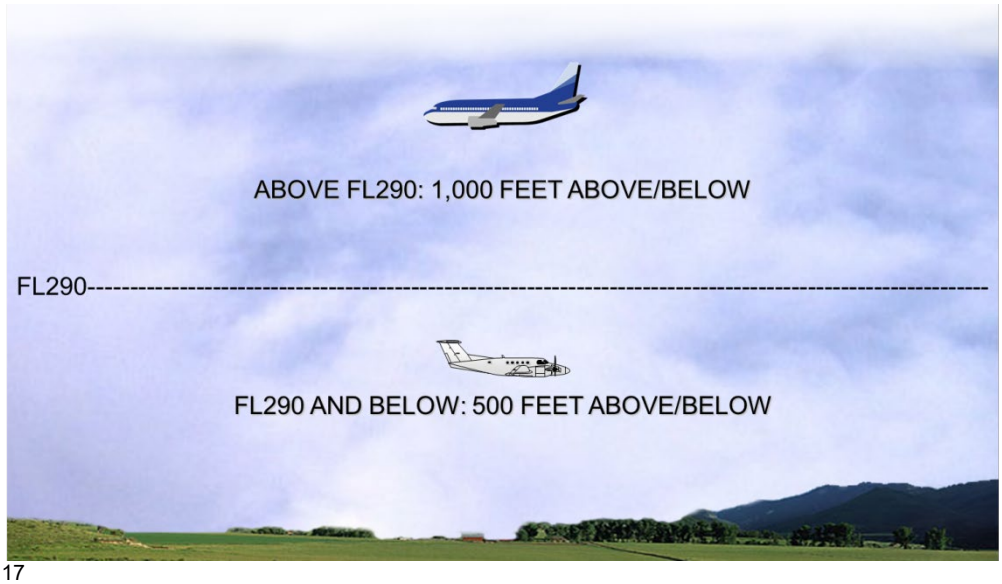
QUESTION: What is the procedure to clear each aircraft above to its requested altitude?

QUESTION: When aircraft are **not** climbing/descending at pilot's discretion, how is vertical separation applied?

SEPARATION FROM SPECIAL USE AND ATC ASSIGNED AIRSPACE (ATCAA)

Minima
JO 7110.65,
par. 9-3-2

MINIMA FROM SUA/ATCAA



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⊙ Separate nonparticipating aircraft from active Special Use or ATC assigned airspace by the following minima:

- FL290 and below - at least 500 feet above/below altitude limits of airspace

NOTE: Altitudes are assigned in 1,000 foot increments.

- Above FL290 - at least 1,000 feet above/below altitude limits of airspace

EXERCISE: APPLYING VERTICAL SEPARATION

Exercise

APPLYING VERTICAL SEPARATION EXERCISE

Purpose: to practice applying the rules of vertical separation

Directions: record the clearance and control information on the flight progress strips and write the appropriate clearances in the spaces provided

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Directions

Using the following flight progress strips, record the clearance and control information for each problem. Write the appropriate clearances in the spaces provided. Keep in mind that there may be more than one solution to each problem.

Continued on next page

EXERCISE: APPLYING VERTICAL SEPARATION

(Continued)

Problem #1

PROBLEM 1

Assign A43661 120 and A44321 140.

TIME: 1258

A44321 C130/A T310 66 02	MEI 1242	56 12 56 1256 MHZ	120✓	STUEE	KMEI V18 KSHV	
A43661 C130/A T310 66 02	MEI 1241	55 12 55 1255 MHZ	100✓	STUEE	KMEI V18 KSHV	

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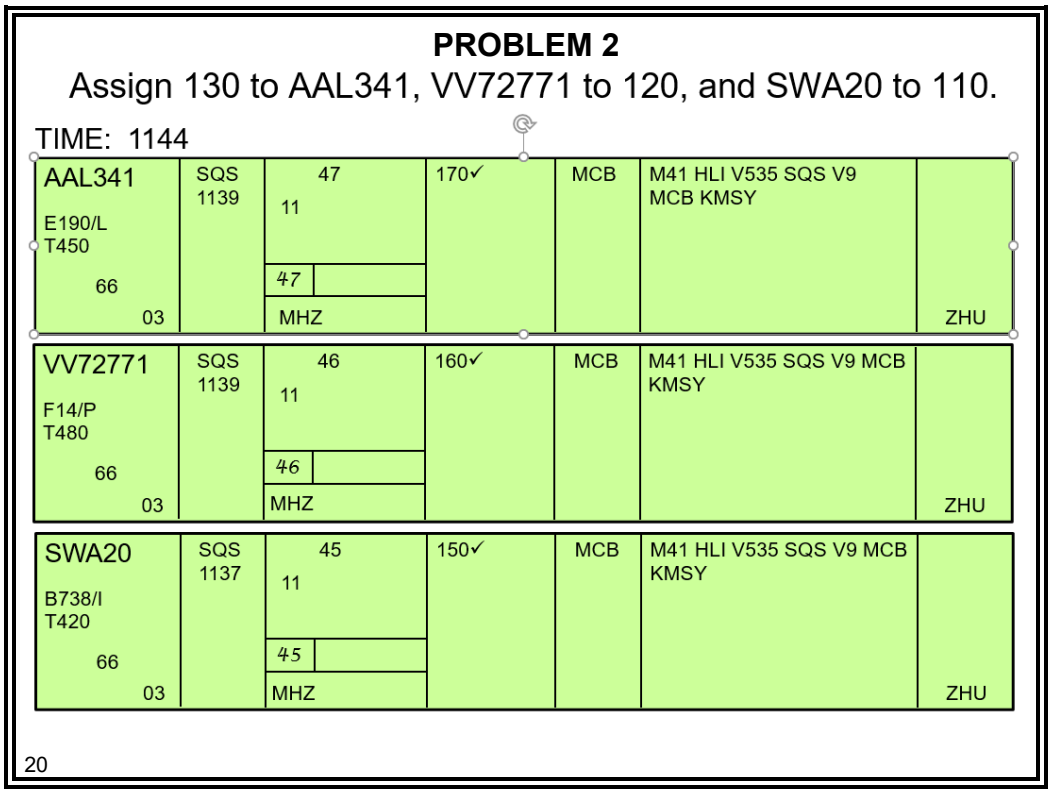
EXERCISE: APPLYING VERTICAL SEPARATION

(Continued)

Problem #2



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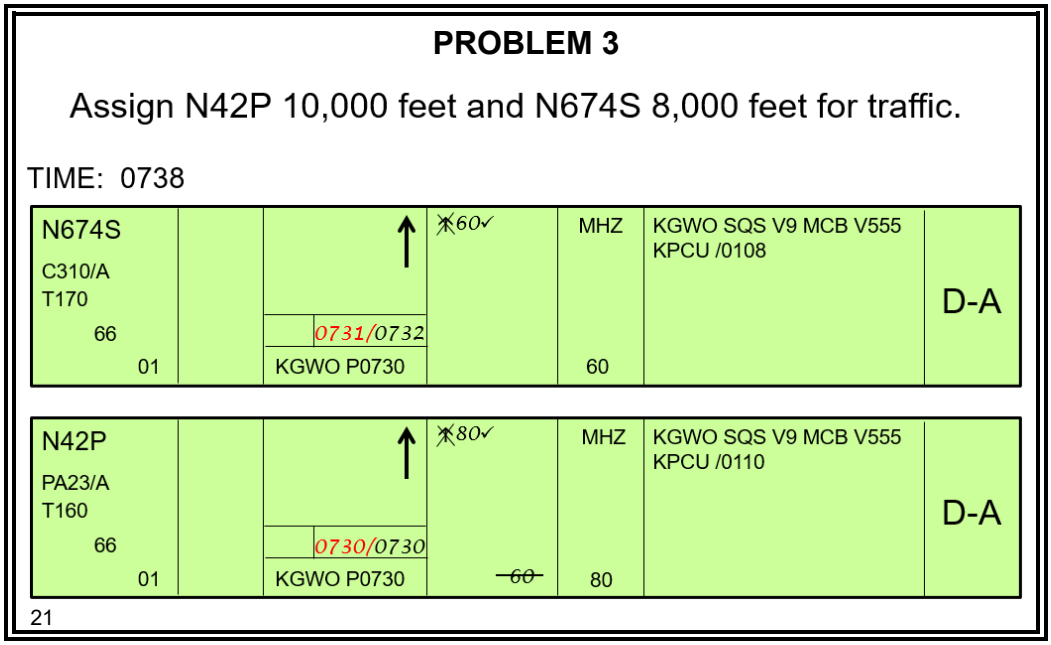
EXERCISE: APPLYING VERTICAL SEPARATION

(Continued)

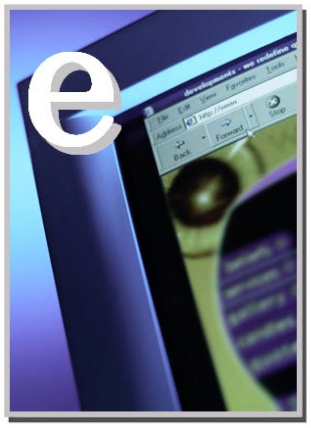
Problem #3



ACTIVITY: IDENTIFYING POTENTIAL CONFLICTS

Activity

IDENTIFYING POTENTIAL CONFLICTS ACTIVITY



Purpose: to practice identifying potential conflicts

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Description In this activity, you will practice identifying potential conflicts on flight progress strips.

Directions Access the IET eLearning menu. Select **Lesson 16 – Vertical Separation**. Click on the title to launch the **Identifying Potential Conflicts** activity.

Time Allotted 30 minutes

IN CONCLUSION

Lesson Review

LESSON REVIEW

The following topics were covered in this lesson:

- Minima between altitudes
- Altitude assignment
- Exceptions to altitude assignment
- Separation from Special Use and ATC Assigned Airspace (ATCAA)

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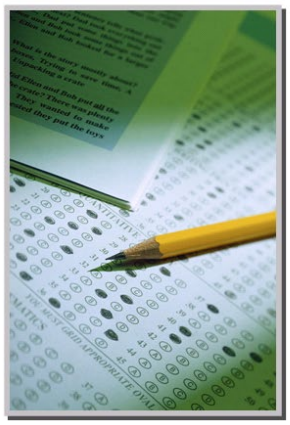
End-of-Lesson Test

END-OF-LESSON TEST

Vertical Separation



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