Federal Aviation Administration

55054003 EN ROUTE RADAR ASSOCIATE CONTROLLER TRAINING PART C: ADVANCED CONCEPTS

Lesson 13: Radar Separation and Safety Alerts

Version: 1.0 2022.08

INSTRUCTOR LESSON PLAN

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LESSON PLAN DATA SHEET

Course Name	En Route Radar Associate Controller Training: Advanced Concepts
Course Number	55054003
Lesson Title	Radar Separation and Safety Alerts
Duration	1 hour 45 minutes (includes lesson, ELT, and part-task exercise)
Version	1.0 2022.08
Reference(s)	JO 7110.65, Air Traffic Control; TI 6110.101, Air Traffic Manual (ATM): RA-Position User Manual; TI 6110.108, ERAM Quick Reference Controller Card JO 7210.3, Facility Operation and Administration
Prerequisites	NONE
Handout(s)	⊙ Part-Task Exercise HO01_L13 *(Print prior to class)* ⊙ TI 6110-108, Quick Reference Controller Card
Exercise / Activity	Refer to handout for: ⊙ Part-task Exercise: Radar Separation and Safety Alerts
Scenario	⊙ Run scenario 55054003_L13_S## in TTL
Assessments	⊙ YES - Written (Refer to ELT01_L13, print prior to class)
Materials and Equipment	⊙ Pencil and/or pen
Other Pertinent Information	⊙ **Ensure lesson materials are downloaded to the classroom computer** ⊙ This lesson is based on ERAM EAE410 ⊙ The lesson has been reviewed and reflects current orders and manuals as of April 2022

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

LESSON ICON LEGEND

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

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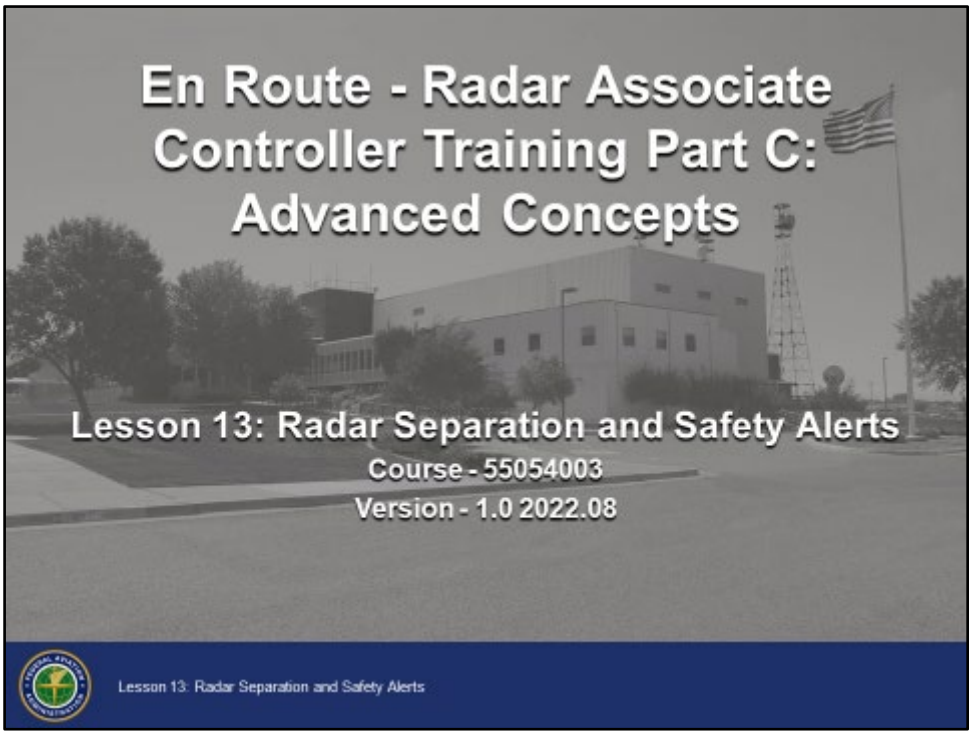
LESSON INTRODUCTION

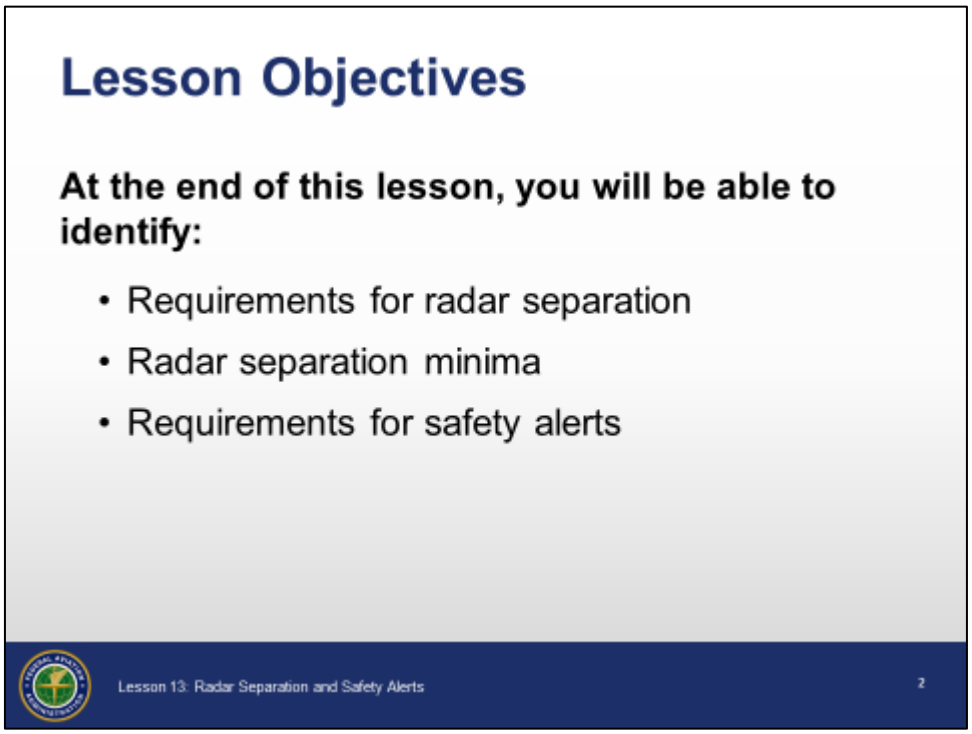
Overview



Basic knowledge of radar separation requirements, minima, and safety alerts is required in order to perform your duties as a Radar Associate Controller.

LESSON INTRODUCTION *(CONT'D)*

Lesson Objectives



Review the lesson objectives.

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

- Requirements for radar separation
- Radar separation minima
- Requirements for safety alerts

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

REQUIREMENTS FOR RADAR SEPARATION

Radar-Identified Aircraft

JO 7110.65, par. 5-5-1

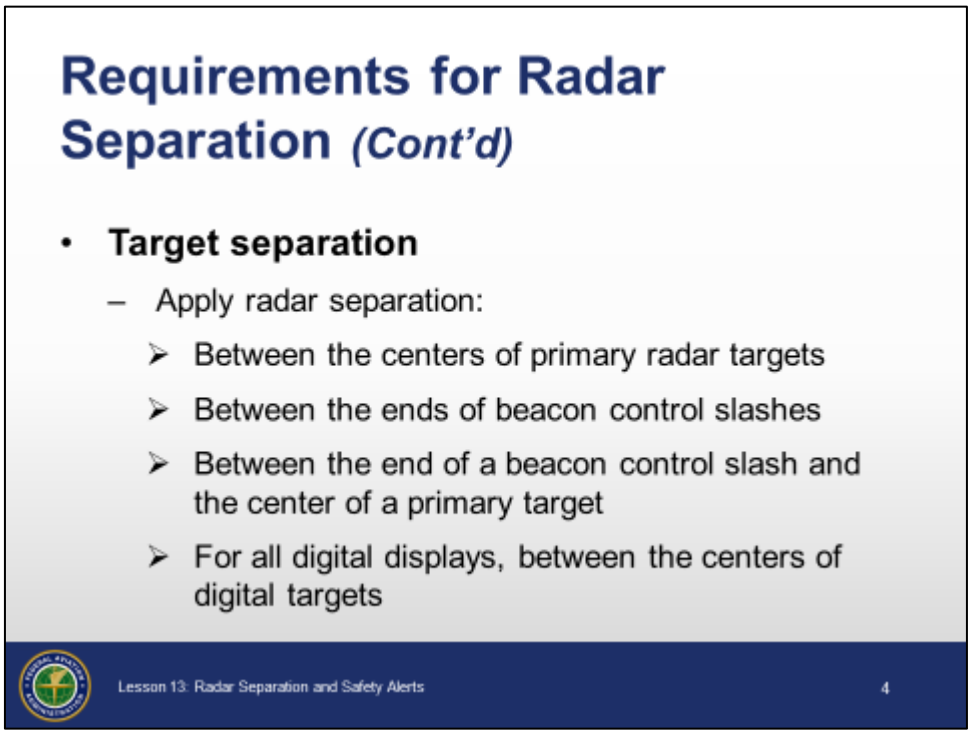
⊙ Radar separation may be applied between:

- Radar-identified aircraft
- An aircraft taking off and another radar-identified aircraft when the aircraft taking off will be identified within 1 mile of the takeoff runway end
- A radar-identified aircraft and one not radar identified when either is cleared to climb or descend through the altitude of the other
- A radar-identified aircraft and one not radar identified that is in transit from oceanic airspace or non-radar offshore airspace into an area of known radar coverage is applied as specified in JO 7110.65 par. 8-5-5, Radar Identification Application, until:
  - The transitioning aircraft is radar identified, or
  - The controller establishes other approved separation in the event of a delay or inability to establish radar identification of the transitioning aircraft

REQUIREMENTS FOR RADAR SEPARATION *(CONT'D)*

Target Separation

JO 7110.65, par. 5-5-2



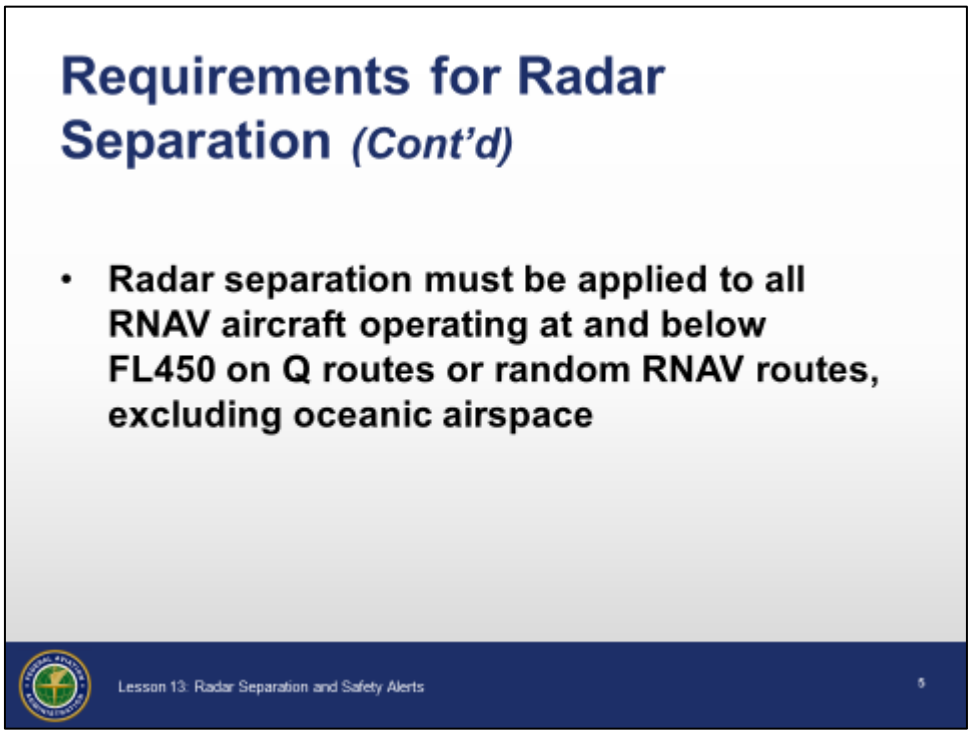
⊙ Apply radar separation:

- Between the centers of primary radar targets
  - Do not allow a primary target to touch another primary target or a beacon control slash
- Between the ends of beacon control slashes
- Between the end of a beacon control slash and the center of a primary target
- For all-digital displays, between the centers of digital targets
  - Do not allow digital targets to touch

REQUIREMENTS FOR RADAR SEPARATION *(CONT'D)*

RNAV Aircraft

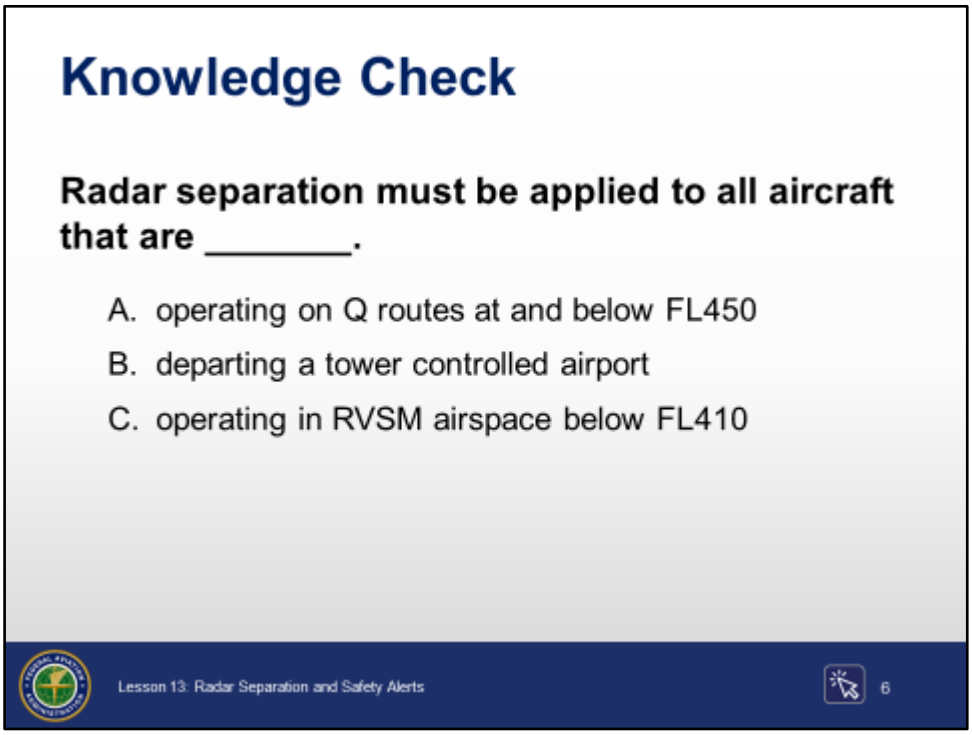
JO 7110.65, par. 5-5-1



- Radar separation must be applied to all Area Navigation (RNAV) aircraft operating at and below FL450 on Q routes or random RNAV routes, excluding oceanic airspace
  - Exception: Global Navigation Satellite System (GNSS) equipped aircraft filed /G, /L, /S, and /V on point-to-point routes, or transitioning between two point-to-point routes via an impromptu route

REQUIREMENTS FOR RADAR SEPARATION *(CONT'D)*

Knowledge Check



Question: Radar separation must be applied to all aircraft that are _____.

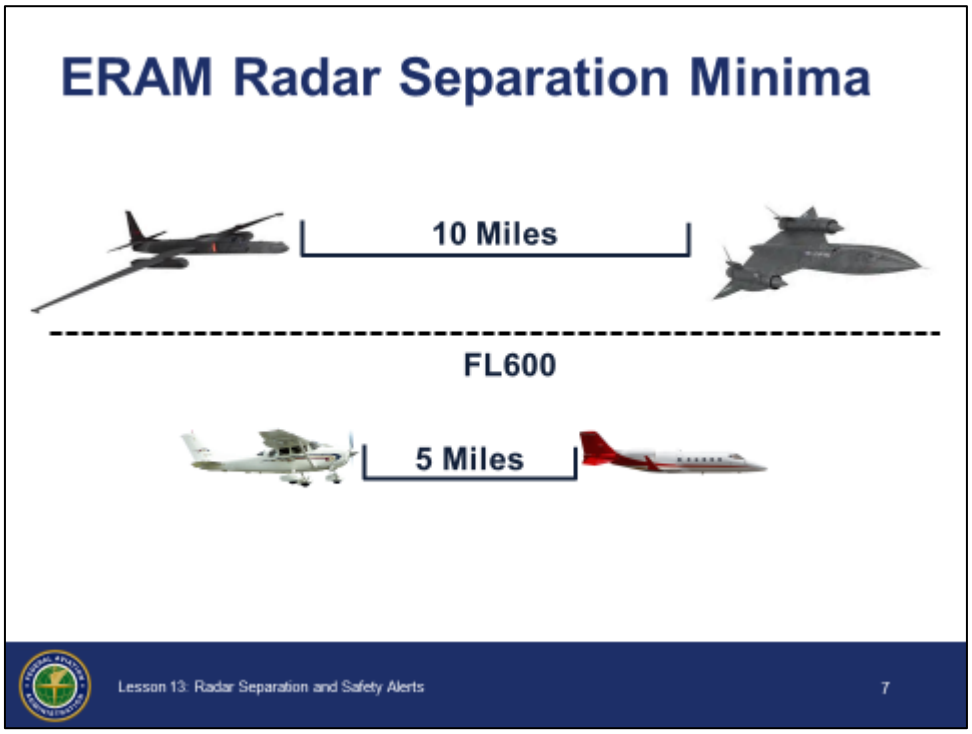
Answer: *A. operating on Q routes at and below FL450*

RADAR SEPARATION MINIMA

ERAM Separation Minima

JO 7110.65, par. 5-5-4

JO 7210.3, par. 8-2-1



- Separate radar identified aircraft from each other using the following minima
  - 10 miles - At or above FL600
  - 5 miles - Below FL600
  - 3 miles - where all the following conditions are met:
    - Up to and including FL230
    - An operational advantage can be obtained
    - Within the 3 mile separation area that is displayable on the video map
    - The preferred sensor and/or ADS-B is providing reliable targets
    - Facility directives specifically define the 3 mile separation area
    - Involved aircraft are displayed using the 3 mile target symbol

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RADAR SEPARATION MINIMA *(CONT'D)*

Separation Minima (Cont'd)

JO 7110.65, par. 5-5-4

JO 7210.3, par. 8-2-1

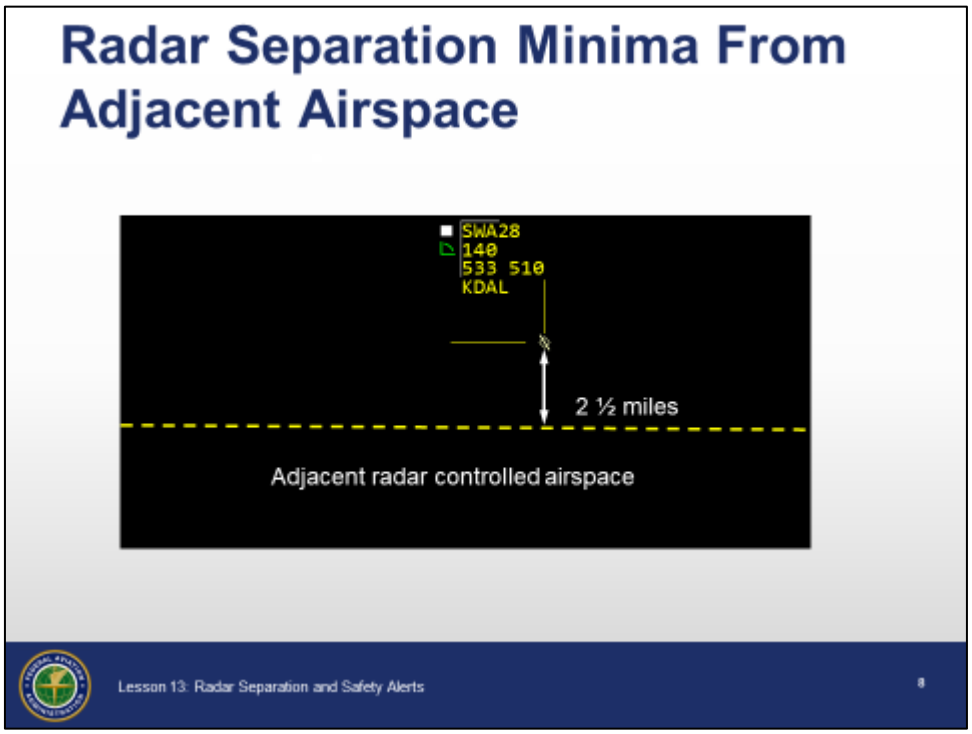
- When transitioning from terminal to en route control, 3 miles increasing to 5 miles or greater, provided:
  - Aircraft are on diverging routes or courses, and/or
  - Leading aircraft is and will remain faster than the following aircraft, and
  - Separation constantly increasing and the first center controller will establish 5 miles or other appropriate form of separation prior to the aircraft departing the first center sector; and
  - The procedure is covered by a letter of agreement (LOA) between the facilities involved and limited to specified routes and/or sectors or positions

NOTE: ADS−B allows the expanded use of 3 mile separation in approved areas. It is not required for, and does not affect the use of radar for 3 mile separation.

RADAR SEPARATION MINIMA *(CONT'D)*

Radar Separation From Adjacent Airspace

JO 7110.65, par. 5-5-10



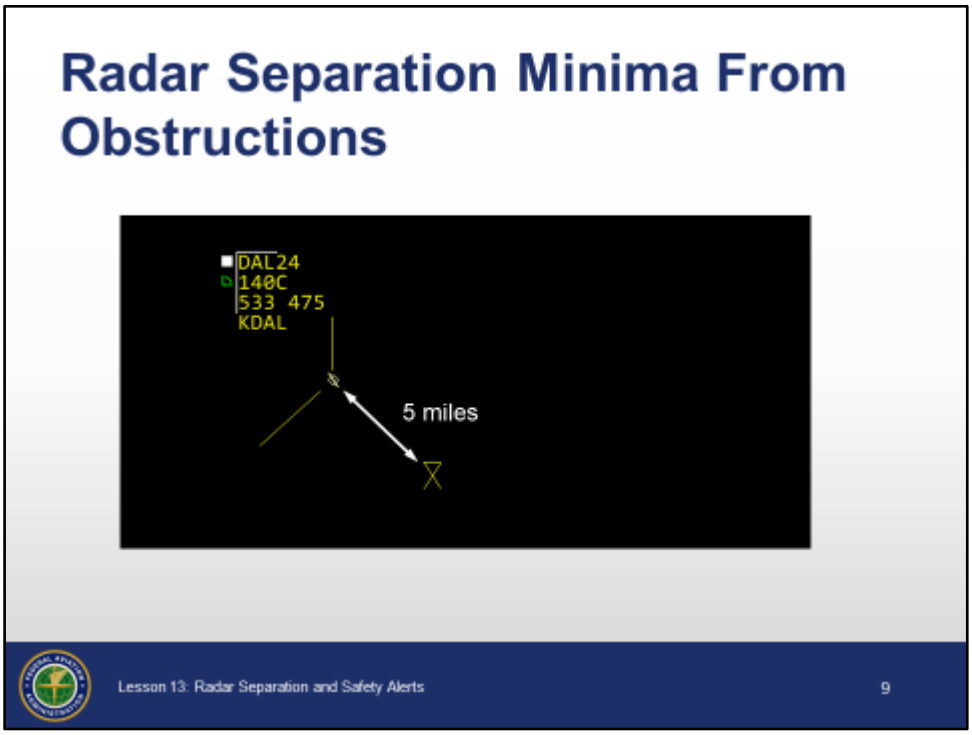
⊙ Radar separation from adjacent airspace

- Radar controlled airspace
  - FL600 and above - 5 miles
  - Below FL600 - 2 ½ miles
- Nonradar controlled airspace
  - FL600 and above - 10 miles
  - Below FL600 - 5 miles

RADAR SEPARATION MINIMA *(CONT'D)*

Radar Separation From Obstructions

JO 7110.65, par. 5-5-4

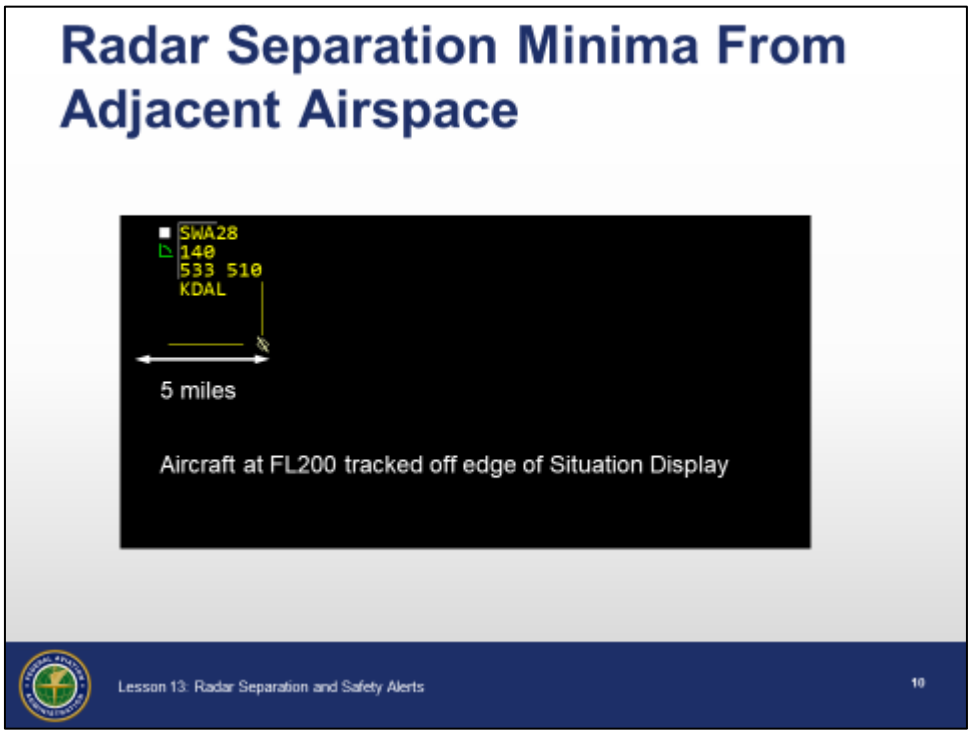


- Separate aircraft from obstructions using standard radar separation minima
  - 5 miles
  - 3 miles if operating in a reduced separation area

RADAR SEPARATION MINIMA *(CONT'D)*

Edge of Scope

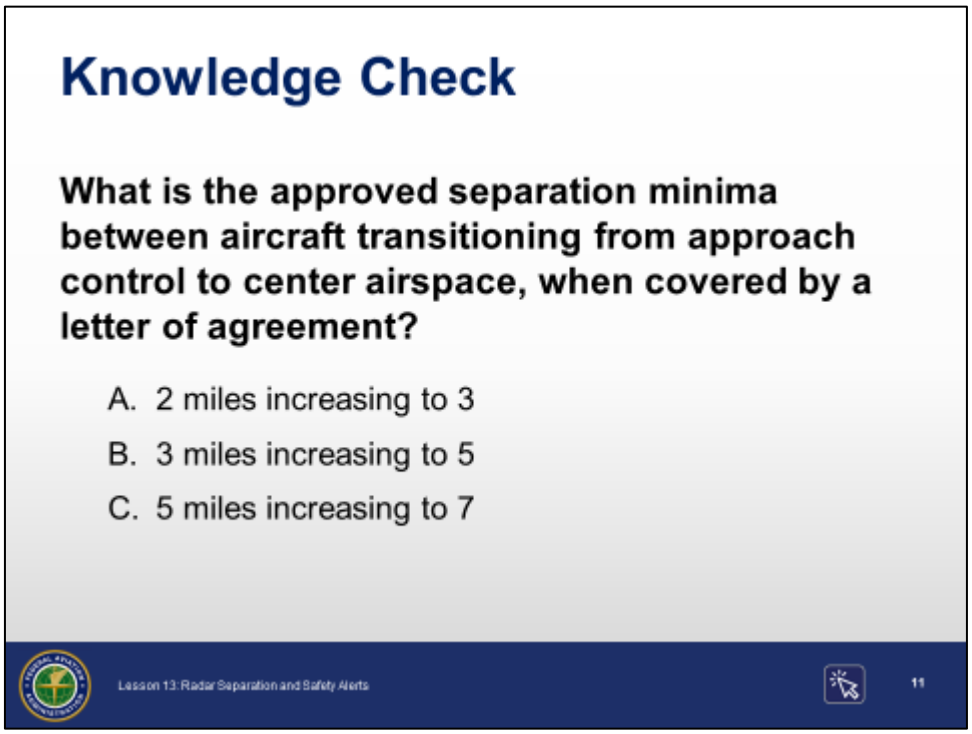
JO 7110.65, par. 5-5-11



- Separate a radar-controlled aircraft climbing or descending through the altitude of an aircraft that has been tracked to the edge of the Situation Display by the following minima until nonradar separation has been established:
  - Below FL600 - 5 miles
  - At or above FL600 - 10 miles

RADAR SEPARATION MINIMA *(CONT'D)*

Knowledge Check



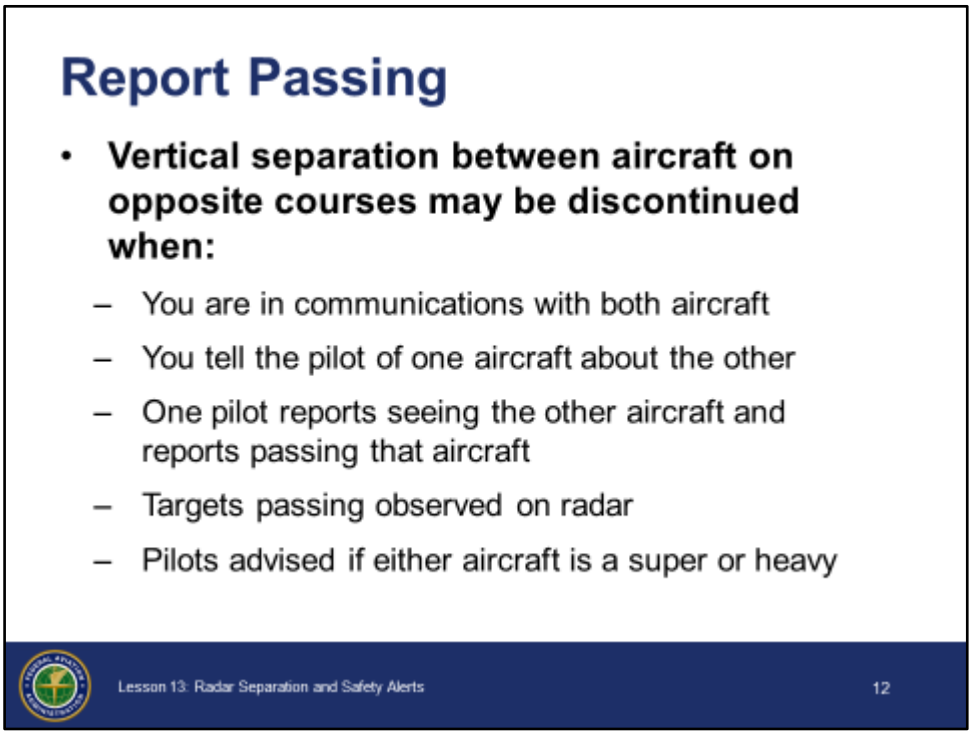
Question: What is the approved separation minima between aircraft transitioning from approach control to center airspace, when covered by a letter of agreement?

Answer: *B. 3 miles increasing to 5*

RADAR SEPARATION MINIMA *(CONT'D)*

Report Passing

JO 7110.65, par. 5-5-7

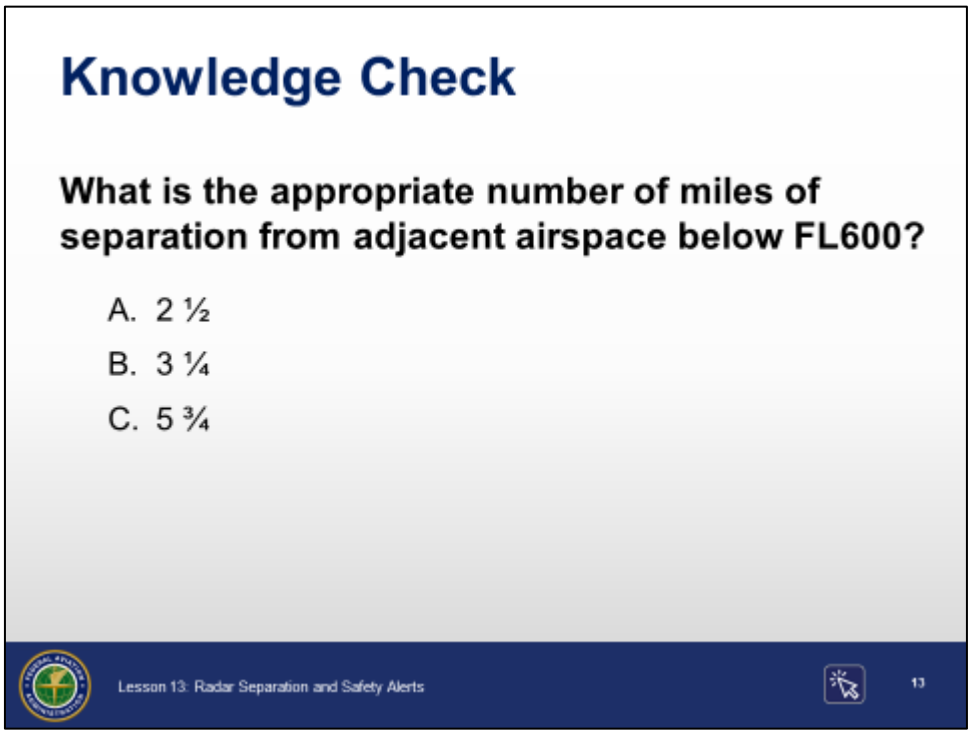


⊙ Vertical separation between aircraft on opposite courses may be discontinued when:

- You are in communications with both aircraft involved; and
- You tell the pilot of one aircraft about the other, including position, direction, type; and
- One pilot reports having seen the other aircraft and that the aircraft have passed each other; and
- You have observed that the radar targets have passed each other; and
- Pilots advised if either aircraft is classified as a super or heavy

NOTE: Although vertical separation may be discontinued, wake turbulence separation minima is required.

Knowledge Check



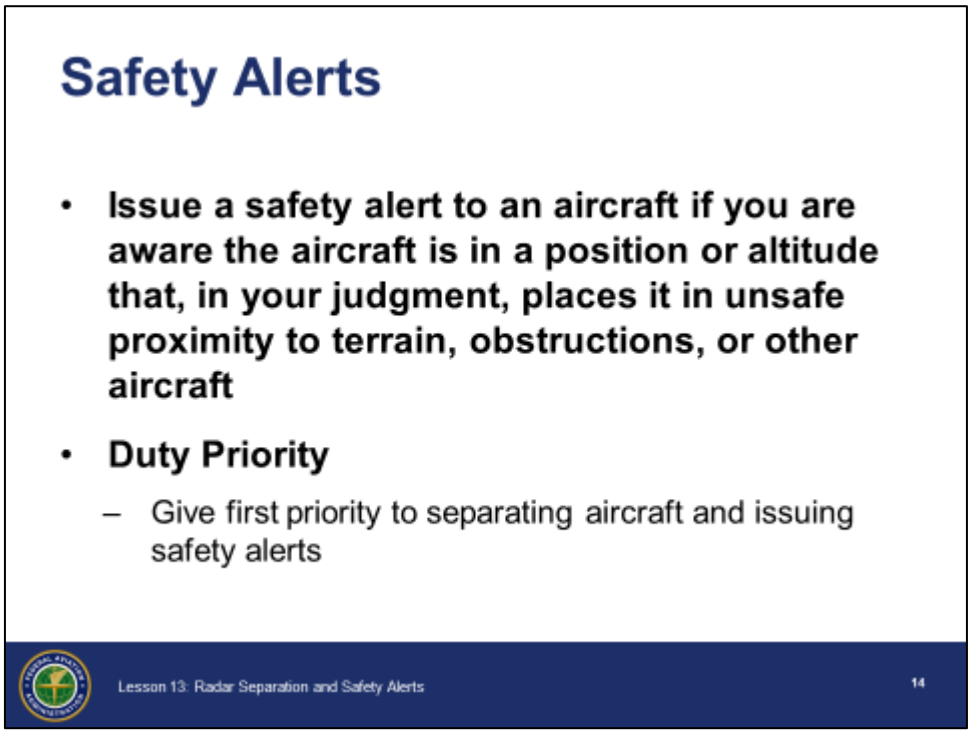
Question: What is the appropriate number of miles of separation from adjacent airspace below FL600?

Answer: *A. 2 ½*

SAFETY ALERTS

Safety Alerts

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



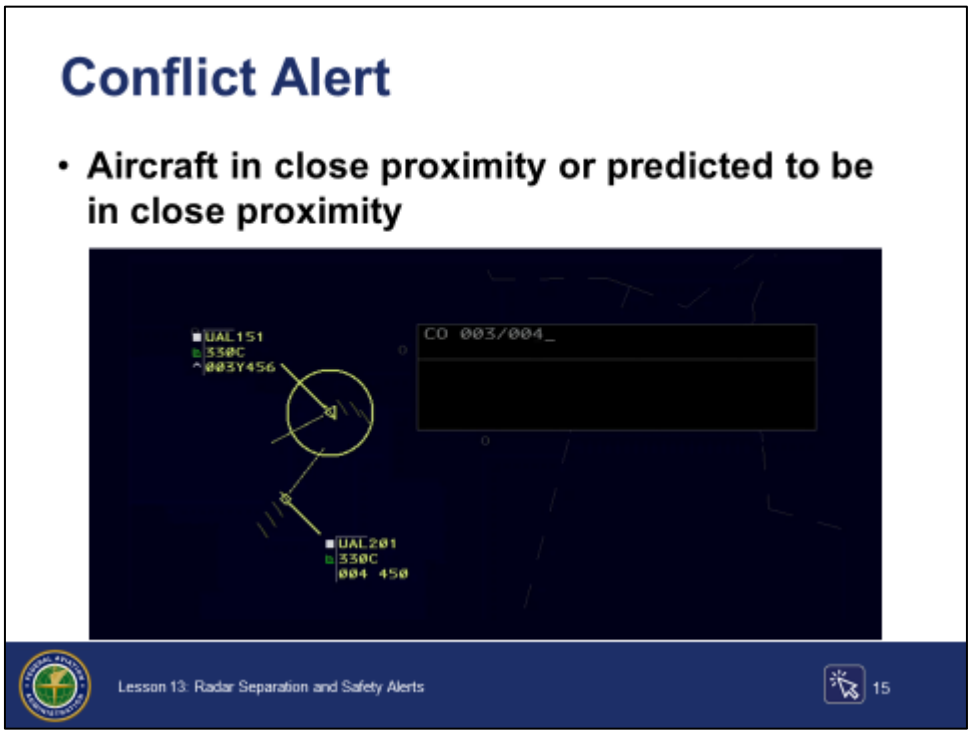
- Issue a safety alert to an aircraft if you are aware the aircraft is in a position or altitude that, in your judgment, places it in unsafe proximity to terrain, obstruction, or other aircraft
- Duty priority
  - Give first priority to separating aircraft and issuing safety alerts

Conflict Alert

TI 6110.101, sec. 1.2.2

TI 6110.108

JO 7110.65, par. 5-14-1; PCG



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

CONFLICT ALERT − A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations between tracked targets that require his/her immediate attention or action.

MODE C INTRUDER ALERT − A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations between a tracked target (known IFR or VFR aircraft) and an untracked target (unknown IFR or VFR aircraft) that requires immediate attention or action.

- Aircraft in close proximity, or predicted to be in close proximity
- Conflict alerts consist of two types of alerts

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SAFETY ALERTS *(CONT'D)*

Conflict Alert (Cont'd)

TI 6110.101, sec. 1.2.2

TI 6110.108

JO 7110.65, par. 5-14-1; PCG

- Predictive
  - Aircraft are predicted to be in close proximity
  - Based on aircraft trajectory and altitude
  - May be suppressed or restored using the CO command and the FLID of each aircraft involved

    Syntax: CO <FLID>/<FLID>

    Examples: `CO 165/156`

    `CO DAL24/SWA28`

 *Click to demonstrate suppression of a conflict alert.*

- Immediate
  - Indicates that both horizontal and vertical alert separation criteria are violated and may not be suppressed

⊙ If the alert involves another controller, initiate appropriate coordination to ensure an effective course of action

⊙ Suppressing an alert constitutes controller acknowledgement and indicates the appropriate action has been, or will be taken

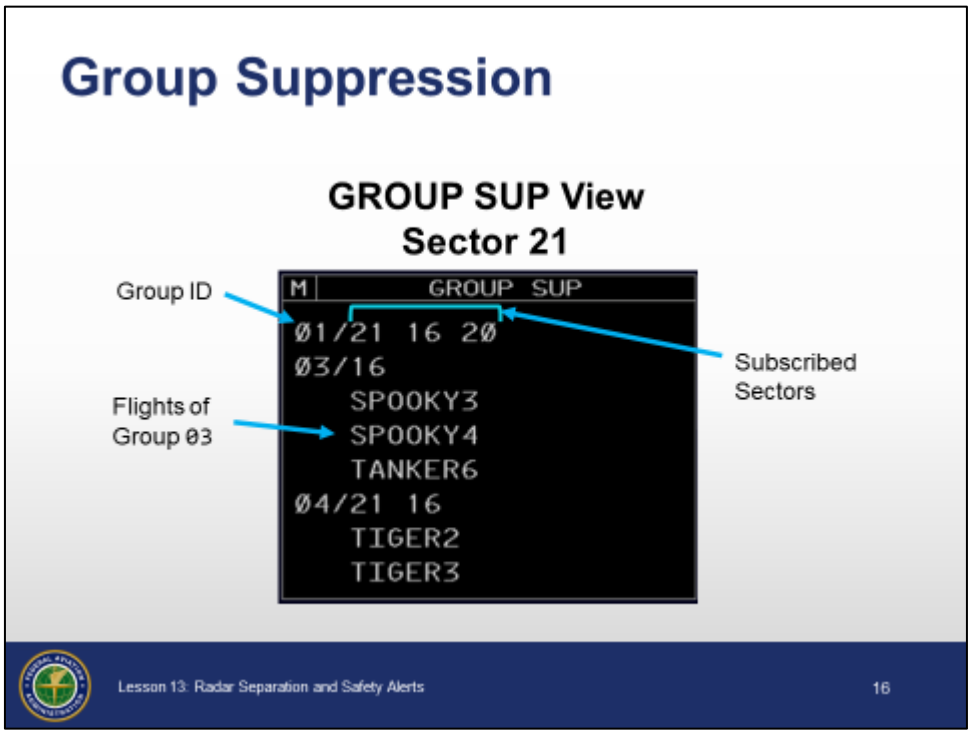
⊙ Conflict alert does not replace good control judgement; it may activate too late to maintain separation, or won't activate unless the altitude is known

Group Suppression

JO 7110.65, par. 5-14-1

TI 6110.100, sec. 4.2.12

TI 6110.108



- Group Suppression (SG) function
  - Must be applied exclusively to inhibit the displaying of alerts among military aircraft engaged in special military operations where en route standard separation criteria does not apply
- Situation Display GROUP SUP View
  - The first column contains the Group Suppression number followed by a "/"
  - The second column contains the sector IDs of all the subscribed sectors
    - The controller's sector is displayed first in the list of sectors, if subscribed to a group
  - The flights of a group may be displayed or suppressed by the Radar Controller
- Create Suppression Group:

  Syntax: SG <FLID>/<FLID>(/<FLID>) (Up to 15 in a single command)

  Example: `SG 103/654/926`

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SAFETY ALERTS *(CONT'D)*

Group Suppression (Cont'd)

JO 7110.65, par. 5-14-1

TI 6110.100, sec. 4.2.12

TI 6110.108

- A two digit Group ID is created when a group of aircraft are initially suppressed

⊙ Add an existing Suppress Group at a sector:

Syntax: SG A <Group ID>

Example: `SG A 02`

⊙ Delete a Suppress Group at a sector:

Syntax: SG D <Group ID>

Example: `SG D 02`

⊙ Add members to Suppressed Group:

Syntax: SG A <Group ID> <FLID>(/FLID) - May be used to add one or more aircraft at a time (Up to 15)

Example: `SG A 03 542/AAL1010/DAL900`

⊙ Delete Members of Suppressed Group:

Syntax: SG D <Group ID> <FLID>(/FLID) - May be used to delete one or more aircraft at a time (Up to 15)

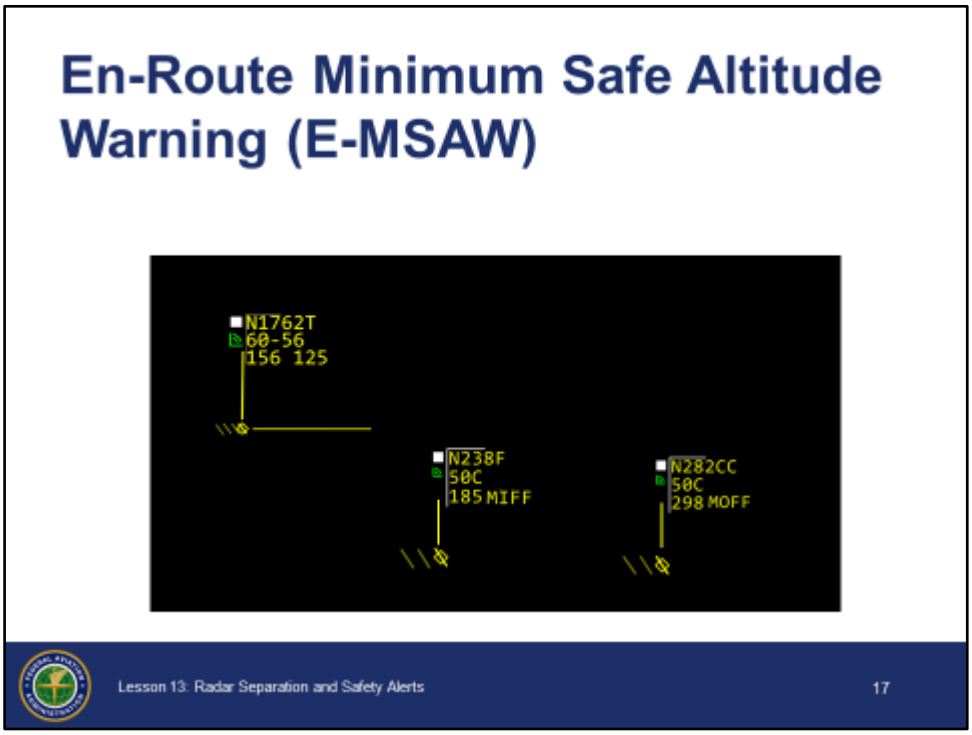
Example: `SG D 03 DAL900`

E-MSAW Alerts

TI 6110.101, sec. 1.2.2

TI 6110.108

JO 7110.65, par. 5-14-2, PCG



⊙ En Route Minimum Safe Altitude Warning (E-MSAW)

- A function of the En Route Automation System (EAS) that aids the controller by providing an alert when a tracked aircraft is below or predicted by the computer to go below a predetermined Minimum IFR Altitude (MIA)
- Provides a visual alert when an aircraft is predicted to enter, or descend into an area of higher terrain
- Can be suppressed in one of two ways
  - Indefinite suppression - This will stop all visual alerts until the aircraft is handed off to another facility

    Syntax: CO ✱I <FLID>

    Examples: `CO ✱I 368`

    `CO ✱I N674P`

    - MIFF will be displayed in field E of the FDB
    - To enable MSAW processing again, re-enter the command

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SAFETY ALERTS *(CONT'D)*

E-MSAW Alerts (Cont'd)

JO 7110.65, pars. 5-2-7, 5-14-2

- Specific suppression - This will stop the visual alert for the current alert, but will allow any future alerts

  Syntax: CO ✱S <FLID>

  Examples: CO ✱S 368

  CO ✱S N674P

  - MOFF will show in field E of the FDB
  - To enable MSAW processing again, re-enter the command

⊙ VFR E-MSAW processing

- Not enabled by default
- Enabled and disabled using the following commands:
  - Enable

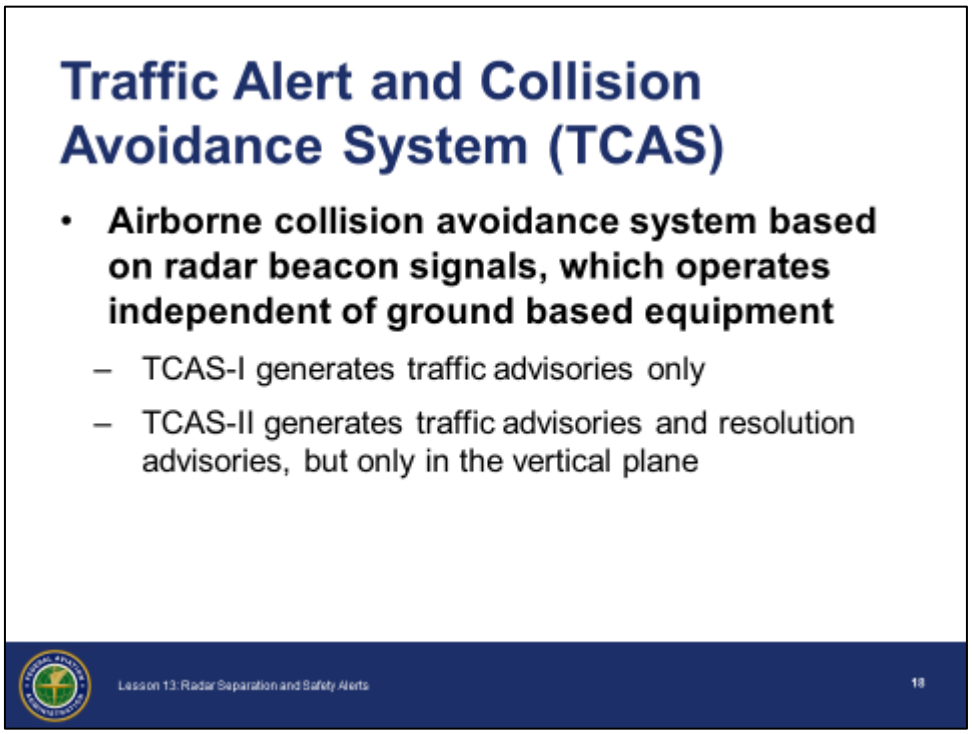
    Syntax: CO ✱VO <FLID>

  - Disable

    Syntax: CO ✱VF <FLID>
- VFR E-MSAW processing must be enabled for VFR aircraft equipped with automatic pressure altitude reporting equipment (e.g., Mode C; ADS-B) that are experiencing an emergency

TCAS

JO 7110.65, par. 2-1-28, PCG



TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) − An airborne collision avoidance system based on radar beacon signals which operates independent of ground-based equipment. TCAS-I generates traffic advisories only. TCAS-II generates traffic advisories, and resolution (collision avoidance) advisories in the vertical plane.

⊙ When an aircraft under your control jurisdiction informs you that it is responding to a TCAS Resolution Advisory:

- Do not issue control instructions that are contrary to the Resolution Advisory procedure the crew is executing
- Do not assume that nearby aircraft are aware of, or involved in the Resolution Advisory maneuver
- Provide safety alerts regarding terrain or obstructions and traffic advisories for the aircraft responding to the Resolution Advisory and all other aircraft as appropriate

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TCAS (Cont'd)

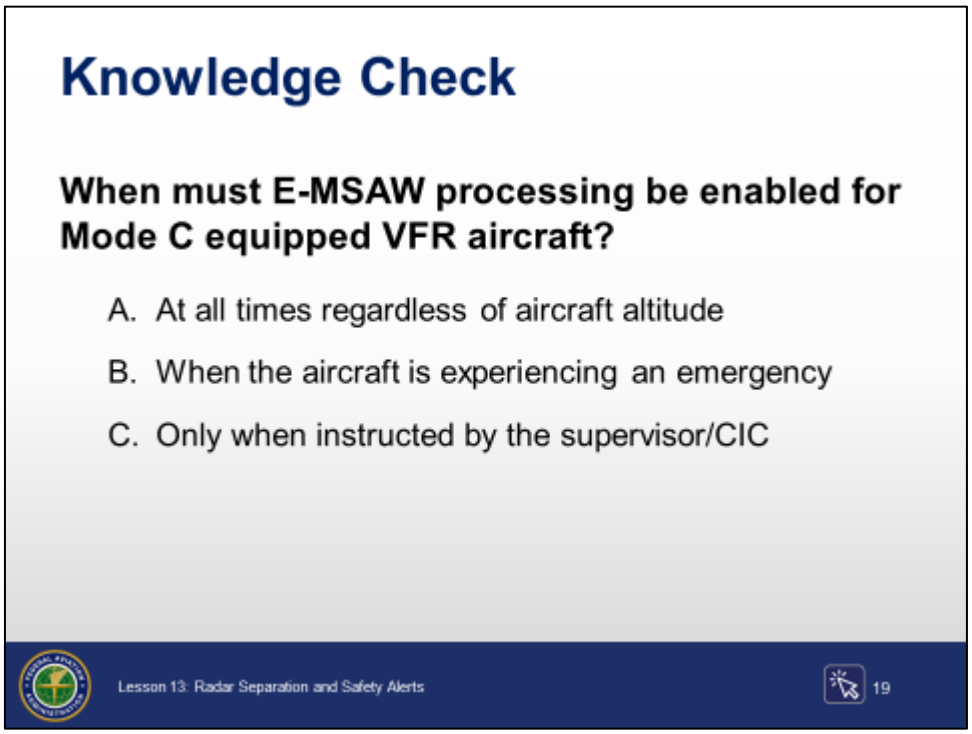
JO 7110.65, par. 2-1-28

- Once an aircraft has begun a maneuver in response to a Resolution Advisory, the controller is not responsible for providing the maneuvering aircraft with approved separation from:
  - Aircraft
  - Airspace
  - Terrain
  - Obstructions
- Controller responsibility for approved separation resumes when one of the following conditions is met:
  - Responding aircraft has returned to its assigned altitude
  - Pilot informs ATC that the TCAS maneuver is completed and the controller observes that approved separation is reestablished
  - Responding aircraft has executed an alternate clearance and the controller observes that approved separation is reestablished

NOTE: When the Resolution Advisory has been resolved, the flight crew should advise ATC they are returning to their previously assigned clearance, or subsequent amended clearance.

NOTE: Local facility directives may require notifying the supervisor/CIC when a TCAS RA occurs.

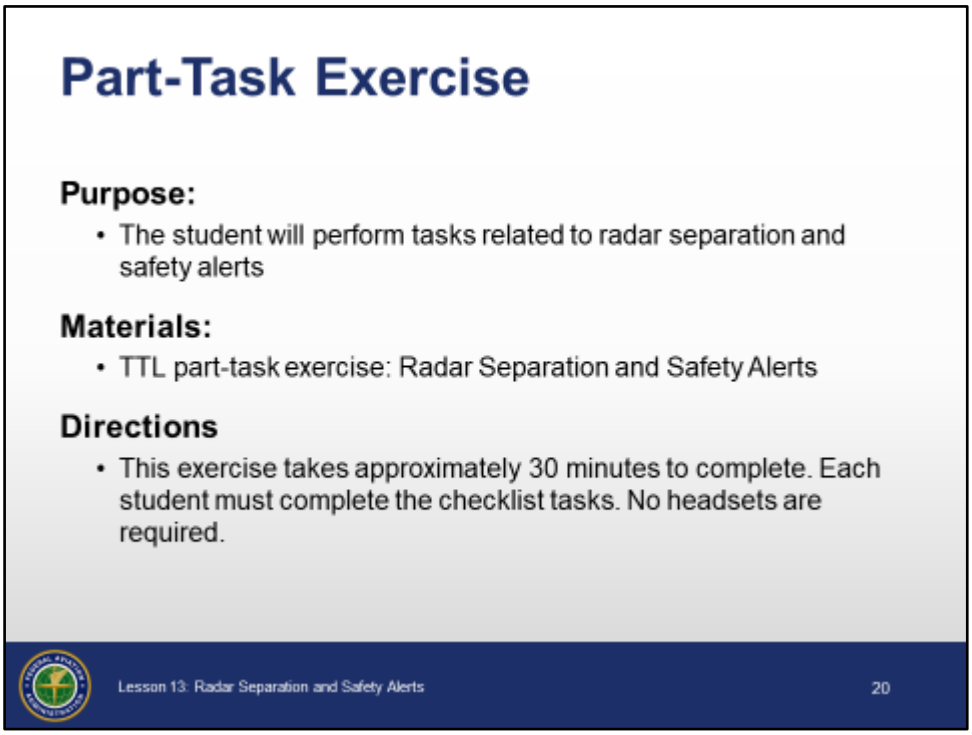
Knowledge Check



Question: When must E-MSAW processing be enabled for Mode C equipped VFR aircraft?

Answer: *B. When the aircraft is experiencing an emergency*

PART-TASK EXERCISE: RADAR SEPARATION AND SAFETY ALERTS



Purpose

The student will perform tasks related to radar separation and safety alerts.

Materials

Handout: HO01_L13

⊙ TTL part-task exercise: Radar Separation and Safety Alerts

TTL Scenario: *55054003_L13_S##*

Directions

This exercise takes approximately 30 minutes to complete. Each student must complete the checklist tasks. No headsets are required.

Provide instruction as required. Check off each task after completion. No ghost pilots are required.

CONCLUSION

Lesson Summary

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

This lesson covered:

- Requirements for radar separation
  - Radar-identified aircraft
  - Target separation
  - RNAV aircraft
- Radar separation minima
  - Separation minima
  - Radar separation from adjacent airspace
  - Radar separation from obstructions
  - Edge of scope
  - Report passing

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CONCLUSION *(CONT"D)*

Lesson Summary (Cont'd)

- Safety alerts
  - Conflict Alert
  - Group suppression
  - E-MSAW
  - TCAS

 *Hand out and administer the end of lesson test. Provide feedback on missed items, including why particular answers are correct, as well as why some responses are incorrect.*