Terminal Separation Methods and Procedures
Lecture Objectives

Explain basic minimum requirements for

• Vertical Separation
• Radar Separation
• Visual Separation
• Runway Separation

Non-Radar Separation

– Lateral (Miles, Airways, Routes)
– Longitudinal (mile or minutes)

Explain basic holding procedures
ATC – Primary Duty – Separate Aircraft

Prevent Mid-air Collisions
Applied Separation – Positive Control

SEPARATION BETWEEN AIRCRAFT

SEPARATION BETWEEN AIRCRAFT AND PROTECTED AIRSPACE
Separation Minima

LONGITUDINAL - miles/minutes

VERTICAL - feet

LATERAL - miles, airways or routes
“AMERICAN TWO TEN, TURN LEFT HEADING TREE TREE TREE ZERO, VECTOR FOR TRAFFIC.”
Radar Separation

“DELTA TREE TWENTY SIX TRAFFIC TWO O’CLOCK TEN MILES, BOEING SEVEN THIRTY-SEVEN TURNING TO NORTHWEST
Terminal Radar Separation

<< Click to play animation >>
Course Definition

Crossing

Reference Course

Same

Opposite

45° Thru 135°

Less Than 45°

136° Thru 180°

45° Thru 135°

Crossing

Crossing

Less Than 45°
Vertical Separation
Vertical Separation

FL180

10,000

1,000 FT

10,000

1,000 FT

10,000
Block Altitudes

Block Altitude
10,000 - 14,000

9,000

1,000 FEET BELOW BLOCK
Fuel Dumping

- BELOW FL290
- 1000 FT above
- 2000 FT below
Special Use Airspace

UP TO AND INCLUDING FL 290

500 FEET ABOVE

SPECIAL USE AIRSPACE

500 FEET BELOW
Departure Separation

Intersecting Runways

(Lateral Separation)

45°
Same Runway Separation

#3

#1 #2

<< Click to play animation >>
Departure vs. Arrival
Intersecting Runway Separation

10

Runway is safe for aircraft to land

16

Runway is safe for aircraft to depart

Runway is safe for aircraft to depart

28

Aircraft clears intersection

34

Aircraft clears runway

Click to play animation
Nonintersecting Runway Separation
Visual Separation In Conjunction With Visual Approach Procedures
Holding Uses

Why hold?
1. Traffic En Route
2. Arrival Delays
3. Weather at Destination
4. Flow Control
5. Spacing
Basic Principles Using Time

• Depart at a specified time
• Arrive at a fix at a specified time
• Hold at a fix until a specified time
• Change altitude at a specified time or fix
Holding

<< Click to play video >>
Hold At A Fix Until A Specified Time

“DEPART PUEBLO VOR AT OR AFTER ONE THREE ONE EIGHT.”
Typical Holding Pattern

- **ABEAM POSITION**
- **OUTBOUND LEG**
- **LEG LENGTH**
- **INBOUND LEG**
- **HOLDING FIX**
Lateral Separations In Holding Patterns

- Holding pattern airspace must NOT overlap.
- Left-hand pattern airspace does NOT overlap.

Diagram showing airspace boundaries with labels for COYLE, JONES, and BOLEY.
Holding Procedures Using Vertical Separation

CLEARANCE LIMIT

HOLDING FIX

9,000
8,000
7,000
6,000
Question

• The minimum terminal radar separation required for two aircraft 30 NM from the antenna is ______ miles.

A. 1

B. 3

C. 5
Response Item

• For a tower facility to provide visual separation between two arriving IFR aircraft, the following condition must exist:

A. One of the aircraft must be visually observed by the tower.

B. Local Controller in the Tower must be able to see (visually observe) Both aircraft

C. The pilots of both aircraft must see each other.
The End of Terminal Separation for Radar Operations and Holding
Radar vs. Non-Radar Separation

- 75 miles
  - 2 Aircraft w/10 Minutes of Separation at 450 KTS
  - Ground Speed = 75 Miles Airspace

- 80 miles
  - 5 Aircraft w/20 Miles of Separation = 80 Miles of Airspace

- 75 miles
  - 16 Aircraft w/5 Miles of Radar Separation = 75 Miles of Airspace

- 75 miles
  - 26 Aircraft w/3 Miles of Radar Separation = 75 Miles of Airspace
Non-Radar Separation

10 Minutes vs. 20 Miles

2 Aircraft with 10 Minutes of Separation at 450 KTS
Ground Speed = 75 Miles Airspace

5 Aircraft with 20 Miles of Separation = 80 Miles of Airspace
Non-Radar Lateral Separation Example

Minima on diverging radials for DME application (compensates for DME slant range)

Below FL180

Protected Airspace
Longitudinal Separation
Non-Radar Longitudinal Separation

- Same altitude / flight level
- 10 Minutes
- 20 Miles
- Same/converging or crossing courses
Depart At A Specified Time

Departing aircraft must depart at or after one three two zero.

First aircraft crossed LAA at 1310 @ 5,000.

TIME 1310

Departing aircraft will climb to 5,000.
Arrive At A Fix At A Specified Time

November Two must cross LAMAR at or after one three three three zero.
Change Altitude At A Specified Time Or Fix

“CROSS MIAMI VORTAC AT OR AFTER ZERO FOUR TWO ZERO. MAINTAIN SEVEN THOUSAND UNTIL THE MIAMI VORTAC, CLimb AND MAINTAIN NINER THOUSAND”
Basic Principles Using DME

“NOVEMBER ONE, ROGER.”

“NOVEMBER ONE, REPORT PASSING FIVE MILES EAST OF LAMAR.”
DME

Departing aircraft will climb to 5,000

First aircraft is 5 DME from LAA at 5,000

Distance to LAA 15 DME
Using DME

N1 is 3 DME east
LAA @ 5,000

N2 is 17 DME west
LAA @ 5,000
Understanding Separation (Cont’d)

- Same altitude/flight level
- 20 MILES or 10 MINUTES
- Same/converging or crossing courses
LONGITUDINAL SEPARATION
Understanding Separation (Cont’d)

"CROSS MIAMI VORTAC AT OR AFTER TWO TWO FOUR FIVE. MAINTAIN ONE FIVE THOUSAND UNTIL THE MIAMI VORTAC, CLIMB AND MAINTAIN ONE SEVEN THOUSAND"

AIRCRAFT PASSED MIO AT 2235Z
17,000 445 KTS

AIRCRAFT ESTIMATING MIO AT 2240Z REQUESTING 17,000
15,000 400 KTS

Longitudinal

<< Click to show answer >>
Understanding Separation (Cont’d)

1,000 FEET ABOVE

FL310

SPECIAL USE AIRSPACE

FL200

500 FEET BELOW

<< Click to show answer >>
Understanding Separation (Cont’d)

- **Above FL600**: 5,000 FEET
- **Up to FL600**: 2,000 FEET
- **Above FL410**: 2,000 FEET
- **Up to FL410**: 1,000 FEET (RVSM) or 2,000 FEET (Non-RVSM)
- **Above FL290**: 1,000 FEET (RVSM) or 2,000 FEET (Non-RVSM)
- **Up to FL290**: 1,000 FEET
- **Surface**: 1,000 FEET

<< Click to show answer >>
En Route Radar Separation

FL 600

10 NM

5 NM
Separation
Visual Separation
Tower Visual Separation
Runway Separation
The End
Non-Radar Departure Divergence

Headings must diverge by at least 45 degrees.