

# [Terminal Area and Enroute] Radar Separation

Nolan, Chap 9

<http://quest.nasa.gov/challenges/airtrans/>  
<http://virtualskies.arc.nasa.gov/main/matm.html>

# Overview

1. Primary and Secondary Radar
2. Radar Identification
3. Radar Contact
4. Radar Separation Standards
5. Radar Assisted Navigation
6. Traffic Advisories

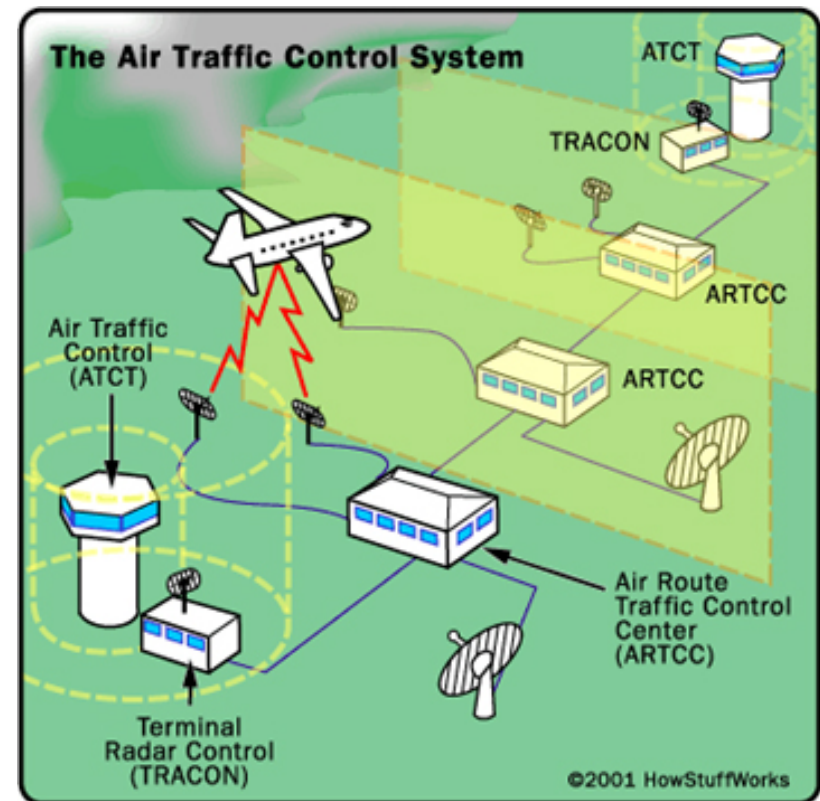


Photo courtesy of HowStuffWorks.com

# Primary & Secondary Radar

- The primary radar *works with passive echoes*.
  - transmitted high-frequency impulses are reflected by the target and then received by this [radar unit](#) again.
- Secondary radar units work *with active answer signals*.
  - The secondary radar unit transmits high-frequency sending impulses = **interrogation**
  - Interrogation received by the target and by means of a [transponder](#) receiver and processed.
  - Target answers with another frequency, the [response telegram](#) produced and transmitted.
- Primary radar is accurate for *direction, height and distance* of the targets
- Secondary surveillance radar provides additional information, like *signal to identification* and also the *altitude* of the targets
- Secondary radar enables in reduction of Primary radar transmission power

# ATCo's



# Primary Radar Identification

- How to identify an aircraft on the radar screen
    - Aircraft not equipped with a transponder (or transponder not working)
1. Observe an aircraft departing from airport
  2. Pilot reports over known location (e.g. intersection)
  3. Request pilot to turn in specific direction

# Secondary Surveillance Radar Identification

- How to identify an aircraft on the radar screen
  - Aircraft not equipped with a transponder (or transponder not working)
- Pilot press IDENT button on transponder
- Pilot switch Transponder from ON to STANDBY
- Pilot squawk specific code
  - United 7-7-2, squawk 2-1-4-5

# “Radar Contact”

- Once aircraft identified, pilot informed by phrase “Radar Contact”
- Radar identification lost “radar contact lost”
  - IFR aircraft separated using non-radar techniques

# Radar Separation

- Radar used to separate aircraft
  - Reduces lateral and longitudinal separation minima
  - Increases throughput
  - Enhances safety
  - Better use of airspace



# Separation Standards

- Vertical Separation
  - Aircraft below FL 290
    - Separated by 1000 ft
  - Aircraft above FL290
    - Separated by 2000 ft

# Separation Standards

- Longitudinal Separation
  - Radar accuracy
    - 3nm within 40 nm radius of radar antenna
    - 5nm beyond 40nm radius of radar antenna
  - Wake Vortex Separation
    - Enroute and Approach (page 367)
    - Landing (page 367)

# Separation Standards

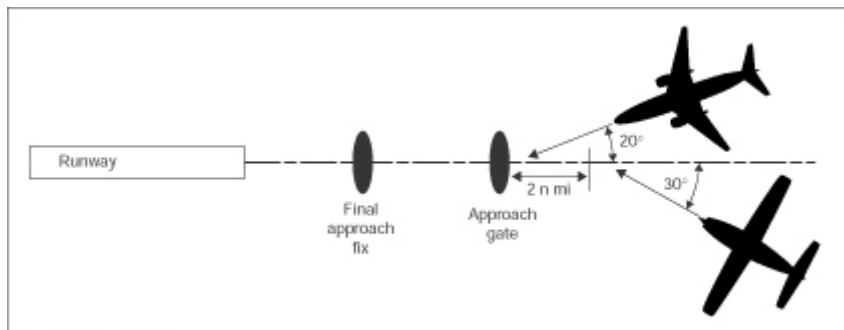
- Lateral Separation
  - Radar accuracy
    - 3nm within 40 nm radius of radar antenna
    - 5nm beyond 40nm radius of radar antenna
  - Separation reduced for diverging paths
    - Page 368
    - Page 369

# Radar Assisted Navigation

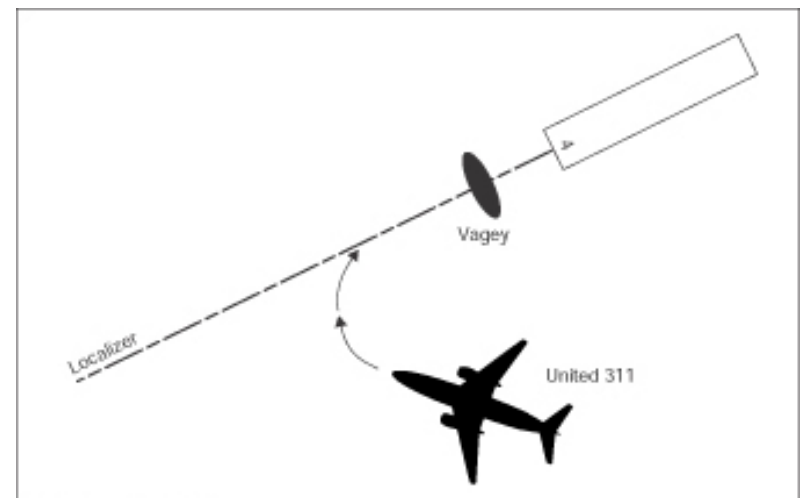
- Instead of pilot using aircraft equipment to identify and navigate to a fix, ATCo provides heading vectors
  - Turn left heading 3-4-0
  - Fly present heading
- Controller heading vector must compensate for wind
  - Radar shows ground track
  - Aircraft ground track (course) = heading + wind
- Pilot must comply with minimum altitudes on charts on published airways/procedures
  - When ATCo vectors off airways/procedures, ATCo's responsibility

# Radar Arrivals and Approaches

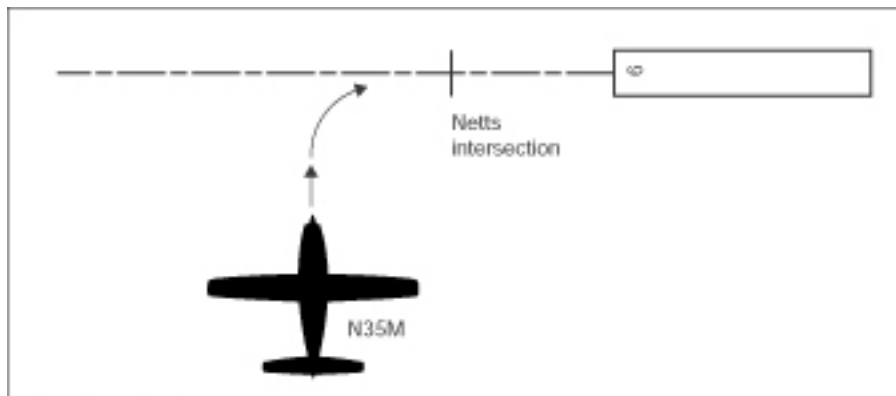
- Increased throughput by sequencing and separation



Aircraft sequence onto final approach course

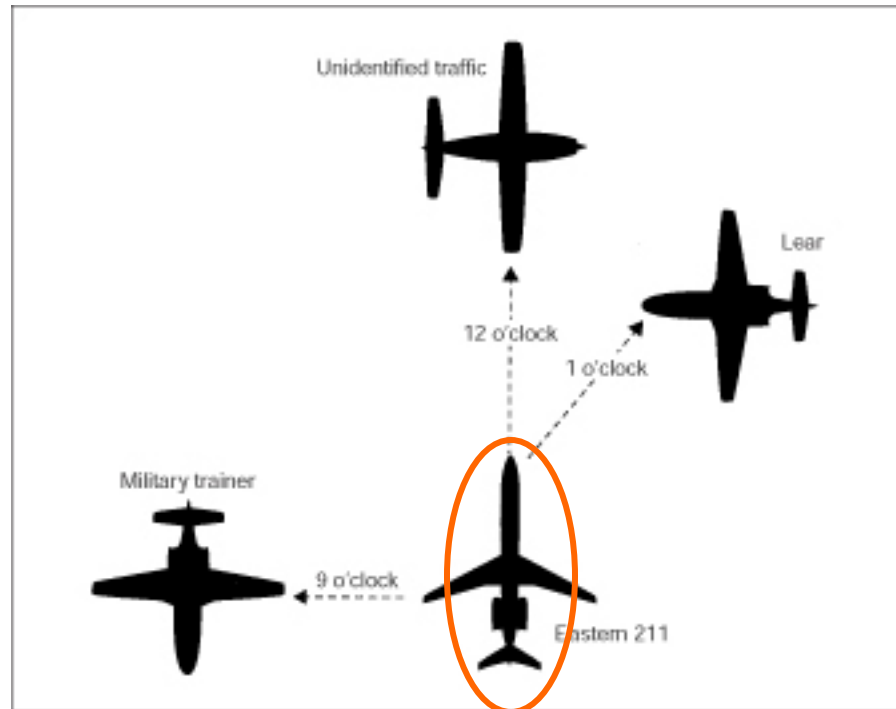


Turn onto final approach course for ILS approach



Turn onto final approach course for RNAV Approach

# Traffic Advisories



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