[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
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
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