Tuesday (01/10/2012)
Briefings

08:30	Intro and MACS Overview
09:40	Break
10:00	MACS/ADRS simulation architecture and integration with ATOS and TMA
11:00	Using MACS to simulate aircraft operations *Simulation Manager and Flight Deck Stations*
12:00	Lunch
1:00	Basic Air Traffic Control Operations.
1:30	Using MACS to simulate near-term air traffic control operations. *Focus ATD-1, Center/TRACON workstations, Scheduling, CMS*
2:45	Break
3:00	Using MACS to simulate far-term automated air traffic control operations. *Focus on Separation Assurance*
3:45	Developing MACS Software
4:30	End of day

Basic ATC Operations

Compiled from material presented at
ATC seminar at NASA Ames in 2007

"Seminar Introduction"
by Bill Preston and Gano Chatterji, NASA Ames Research Center

"Oakland ARTCC Introduction"
by Peter Marcuzzo, Support Specialist, Training Oakland ARTCC

"Current ATC Operations:
Terminal Radar Approach Control"
by: Rick Coté & Patty Daniel Northern California TRACON

Presented by
Tom Prevot

AIRSPACE OPERATIONS LAB

National Airspace System - Airports

5233 Public Use Airports[1]

- IFR Airports
- VFR Airports
- VFR Landing Facilities (including heliports)

[1] FAA Administrator's Fact Book, Apr 2007

# National Airspace System (NAS)

Airports:

- **19,983 Airports in the US (including military and private fields)**
    - Public Use 5,233
    - Private Use: 14,757
- **Certificated airports*: 604 Civil**

Operations (CY05):

- **44,751,000 Airport Operations**
- **45,795,000 Instrument Operations**
- **46,300,000 EnRoute Operations**
- **809 billion Air Carrier Revenue Passenger Miles**

*Certificated airports serve Air Carrier Operations with aircraft seating more than 9 passengers seats. (FAR Part 139).

National Airspace System - Jet Routes
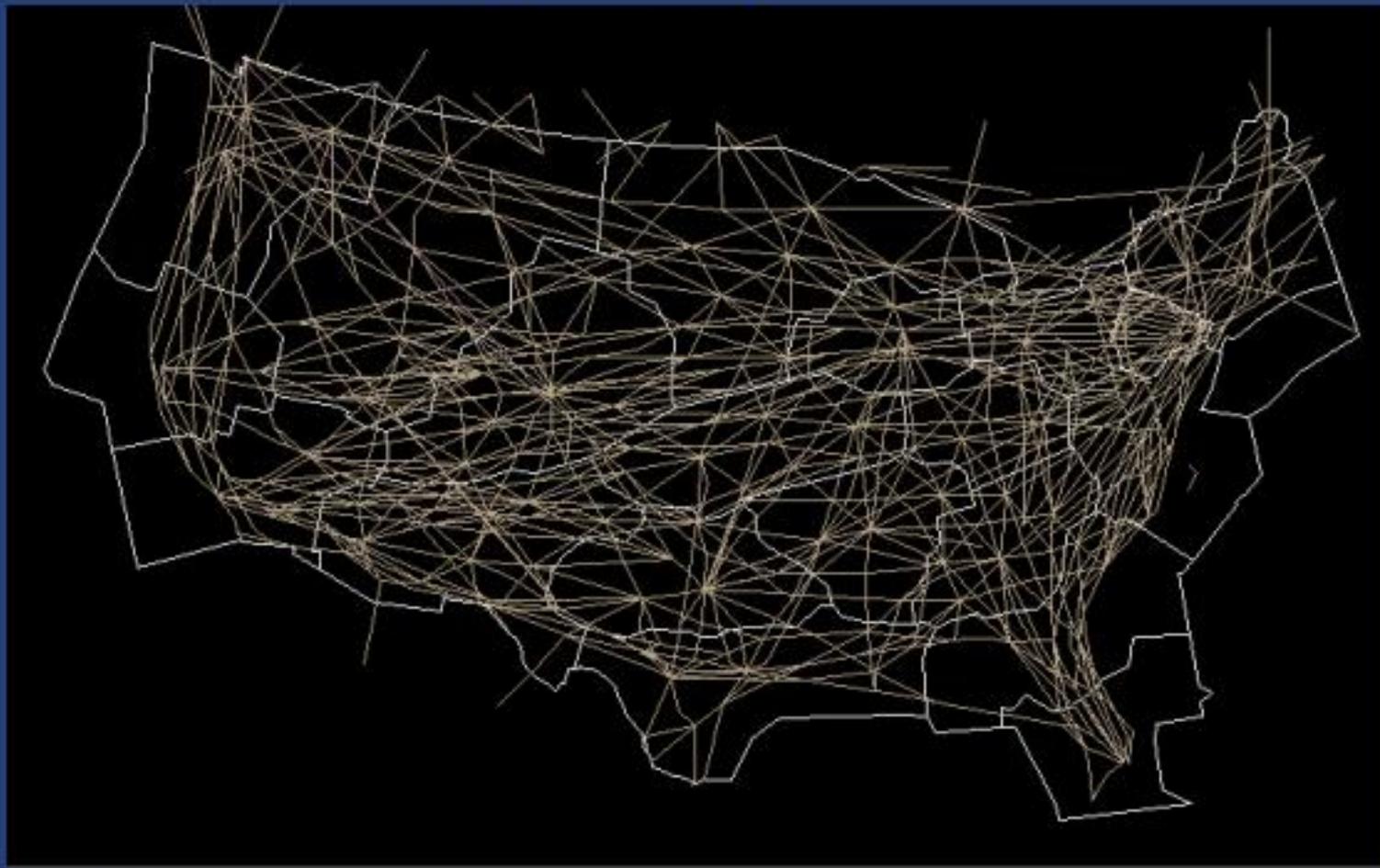
US Air Traffic Control Facilities

Flight Service facilities:

- **76 Flight Service Stations (FSSs)**
  - Under contract w/Lockheed Martin

Terminal facilities:

- **517 Air Traffic Control Towers (ATCTs)**
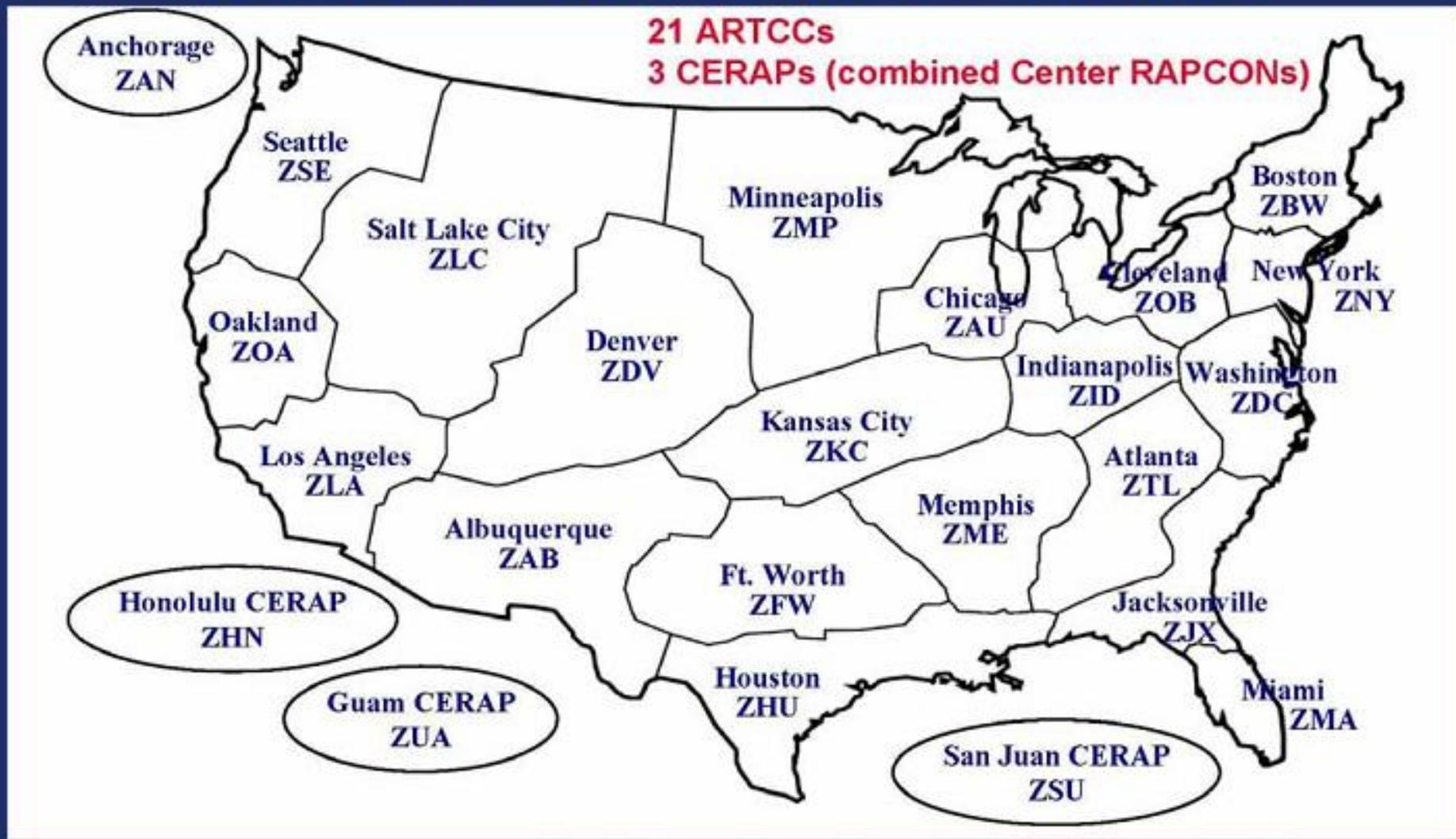- **185 Radar Approach Controls (TRACONs)**

Enroute facilities:

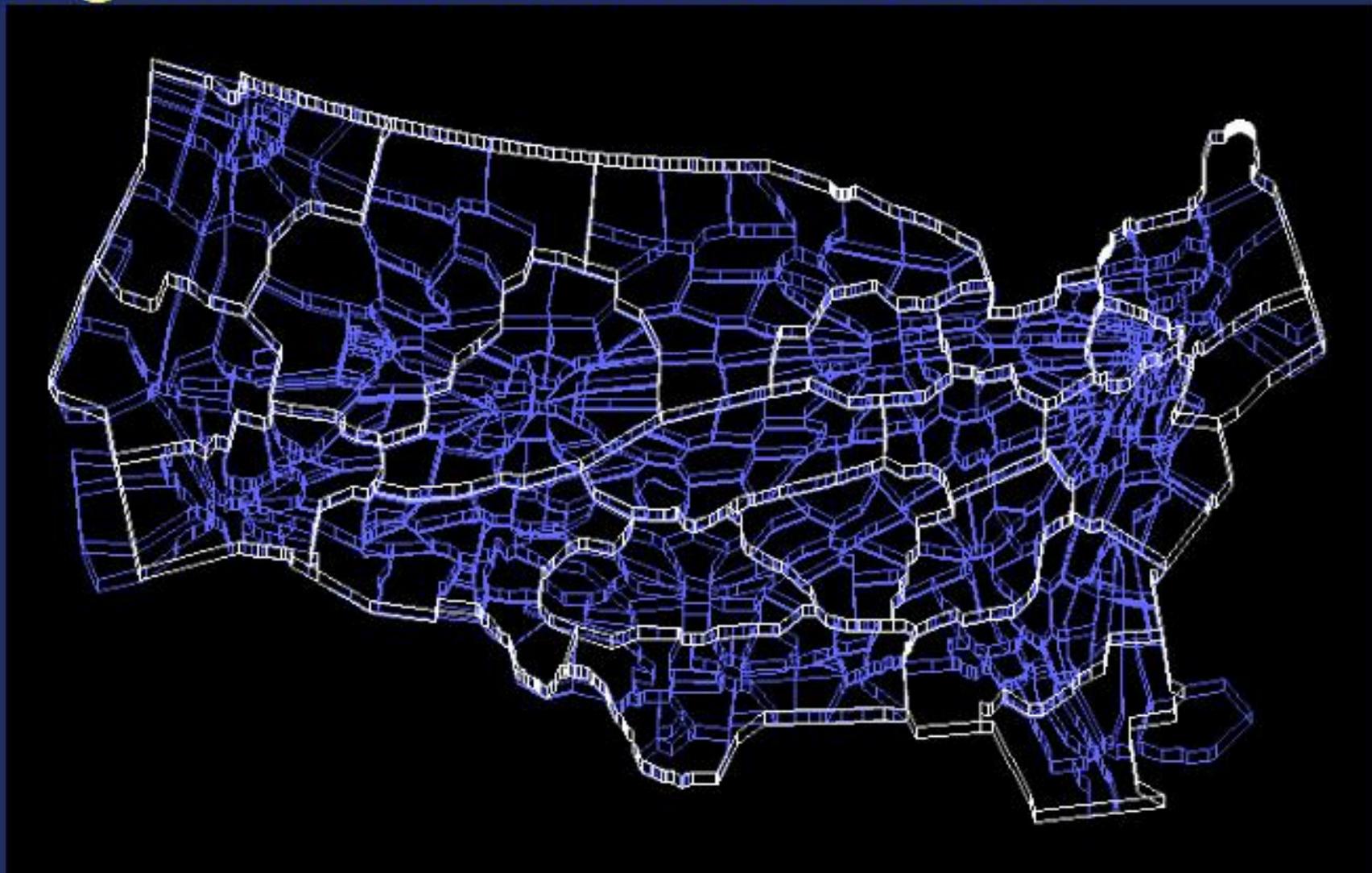- **21 Air Route Traffic Control Centers (ARTCCs)**

Air Traffic Control System Command Center (ATCSCC):

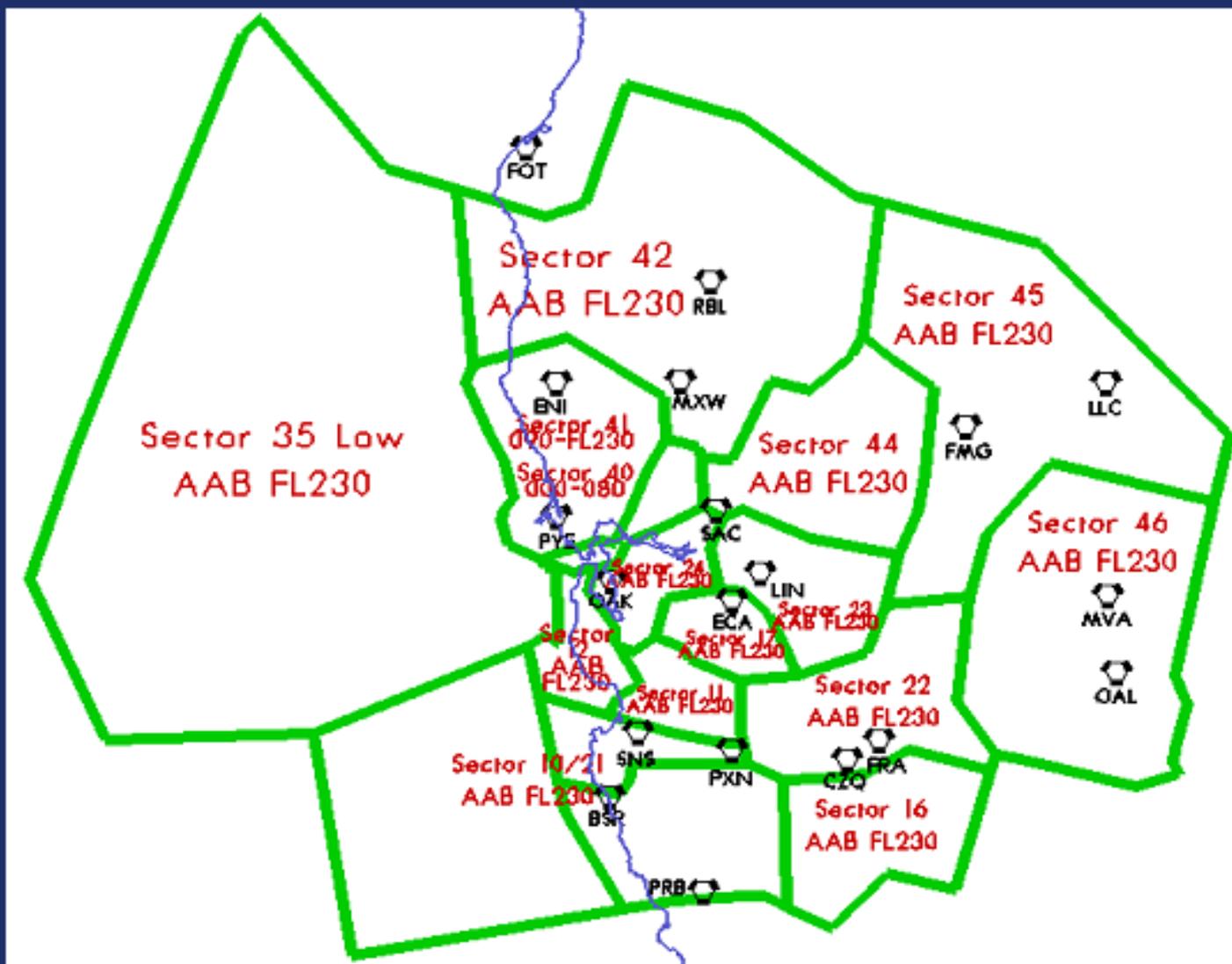 - National air traffic management facility
  - Herndon, VA

Air Route Traffic Control Centers

21 ARTCCs
3 CERAPs (combined Center RAPCONs)

Anchorage ZAN

Seattle ZSE

Salt Lake City ZLC

Minneapolis ZMP

Boston ZBW

Cleveland ZOB

New York ZNY

Oakland ZOA

Denver ZDV

Chicago ZAU

Indianapolis ZID

Washington ZDC

Los Angeles ZLA

Kansas City ZKC

Atlanta ZTL

Albuquerque ZAB

Memphis ZME

Honolulu CERAP ZHN

Ft. Worth ZFW

Jacksonville ZJX

Guam CERAP ZUA

Houston ZHU

Miami ZMA

San Juan CERAP ZSU

High Altitude Enroute Sectors

What does an Air Traffic Controller DO?

Controller Perspective

ARTCC ATC Positions

Radar or "R Side"

Radar Associate (Data) Or "D Side"

Hand-off/ Tracker

Assistant or "ATA"

- Teamwork
- Flexibility
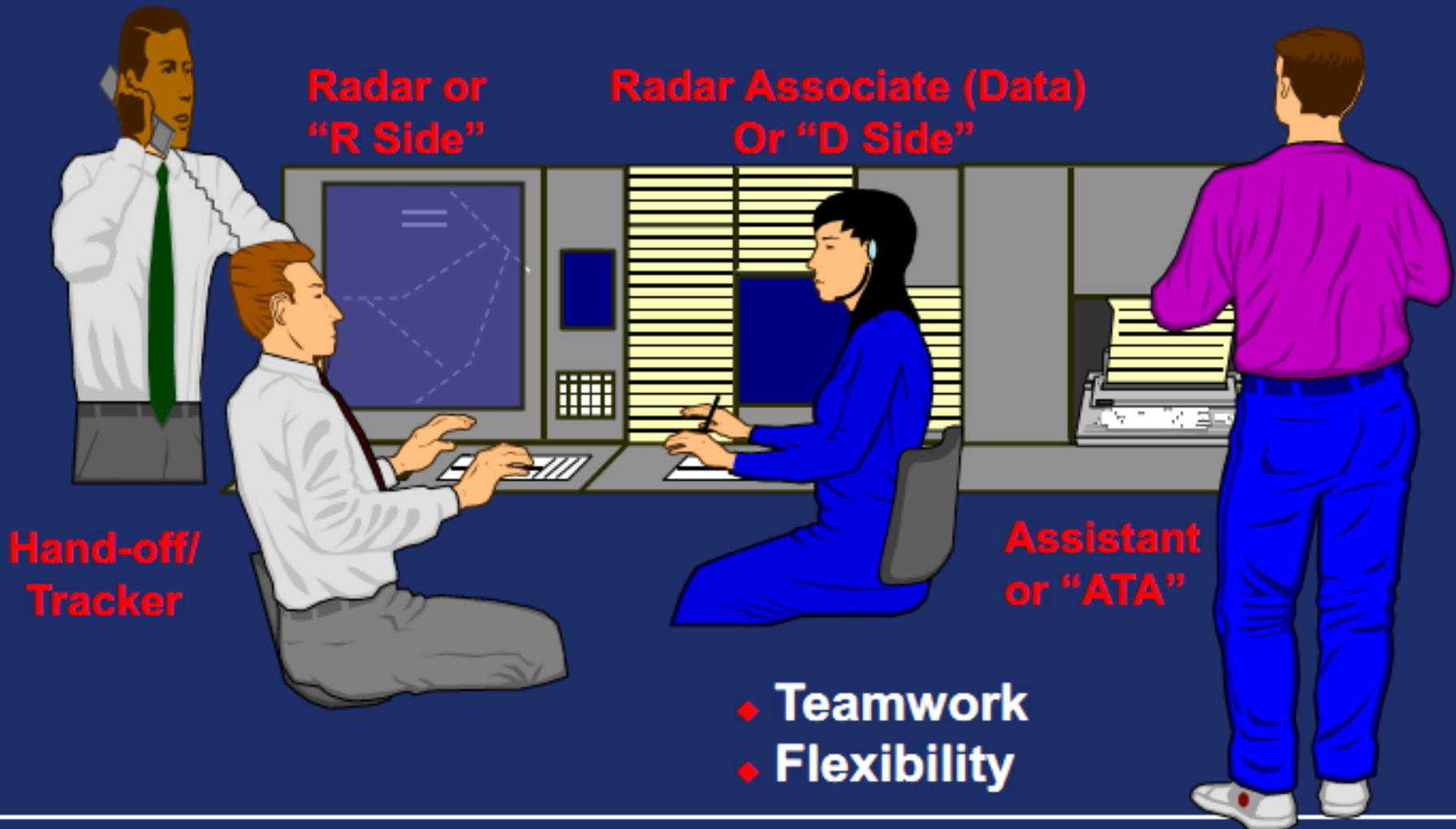
En Route Sector Controller Roles

- **R-side (Radar controller)** - provides separation between all IFR flights in the sector; communicates directly with pilots; during light traffic works the sector alone also performing D-side duties

- **D-side** – (Radar associate controller – data): handles flight strips data and URET; detects potential traffic conflicts; coordinates with other sectors; supports R-side controller

- **ATA** – (Assistant) delivers flight strips to sectors

- **Tracker** – third controller at the sector during heavy traffic periods; detects conflicts; coordinates with other sectors

- **Supervisor** – manages controllers, trainees, equipment and other resources in the area of specialization

Surveillance Systems (En Route)

- The Air Route Surveillance Radar (ARSR) is a long-range radar system designed to provide a display of aircraft over large areas controlled by Air Route Traffic Control Centers.

- Each ARSR site can monitor aircraft flying within a 200-mile radius of the antenna, although some stations can monitor aircraft as far away as 600 miles.

- ARSR antenna rotate at 5rpm providing sweeps at 12 second intervals.

- Data from multiple ARSR sites is presented on controller displays in a mosaic, providing radar coverage over a large geographic area.

- There are approximately 100 ARSR sites in the US.

Display System Replacement (DSR) Console

Radar Target Symbols

(Radar updates every 12 seconds)

+   Primary Target   **#**   Coast Track

Secondary (Beacon) Targets:

/   Uncorrelated Beacon   Flat Track

****   Correlated Beacon   Free Track

En Route Radar Target Display

Position Symbol

Vector Line
1 minute projection

Beacon Target

Leader Line

Histories

Full Data Block

AAL278
330↑294
R068 490
H030 M78

En Route Full Data Block

American 278

Mode C Altitude FL294

Assigned Altitude FL330 →

AAL278

330↑294

068D490

H030 M78

Ground Speed 490kts

Computer ID

'4th Line' (for coordination)

Destination
Airport
Coded

Assigned speed Mach .78

Assigned heading 030⁰
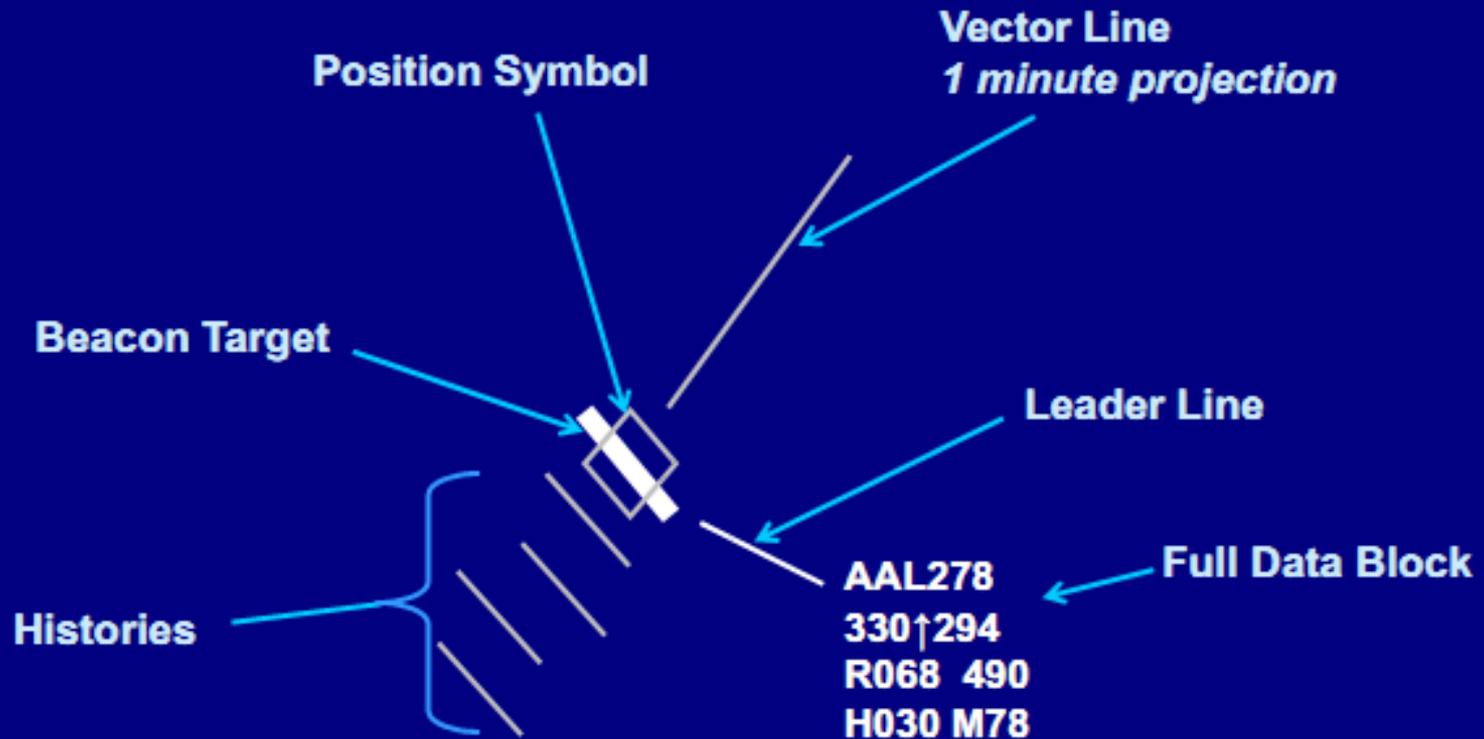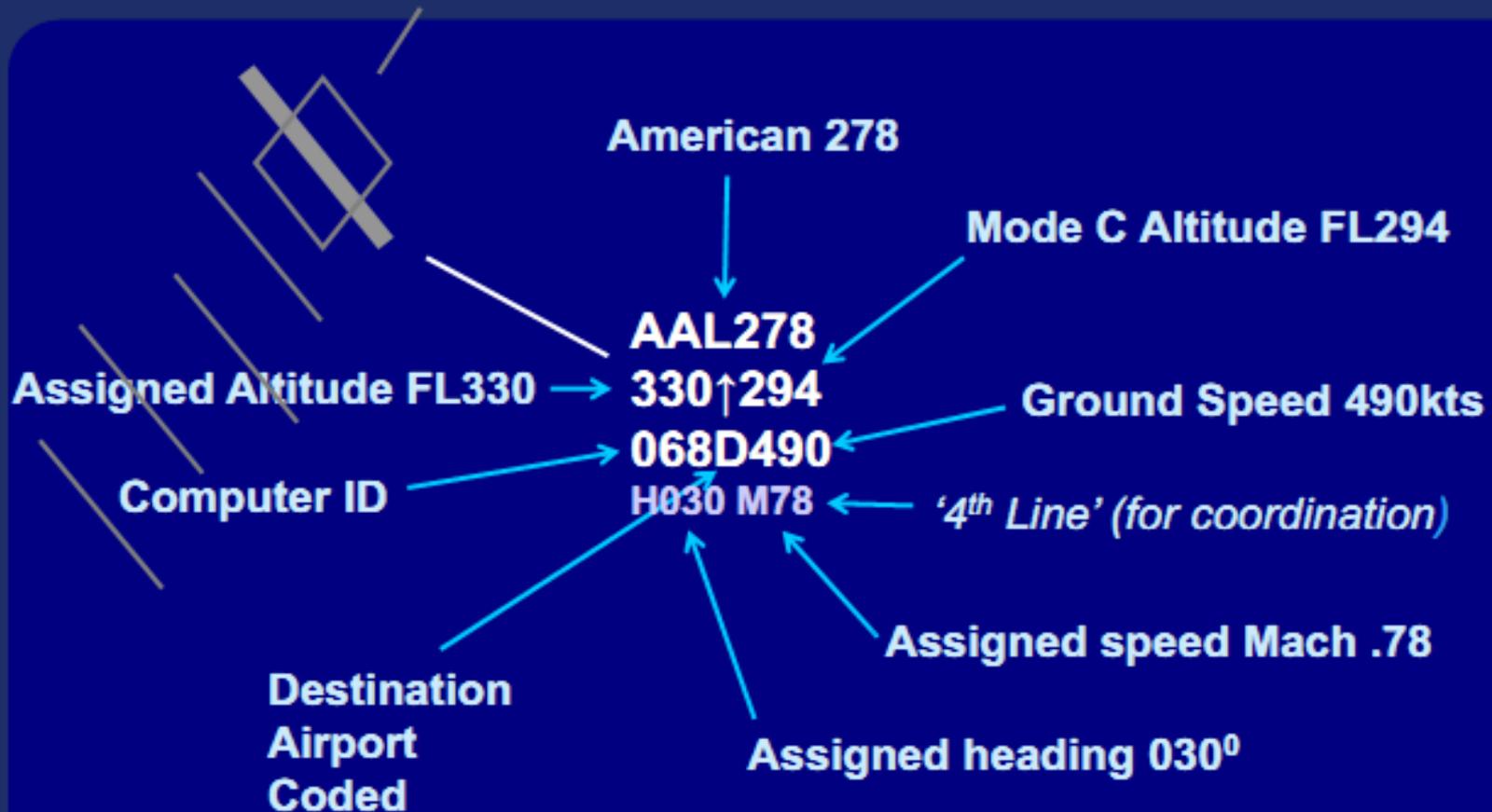
# En Route Radar Separation

1000 feet

5 NM*

1000 feet
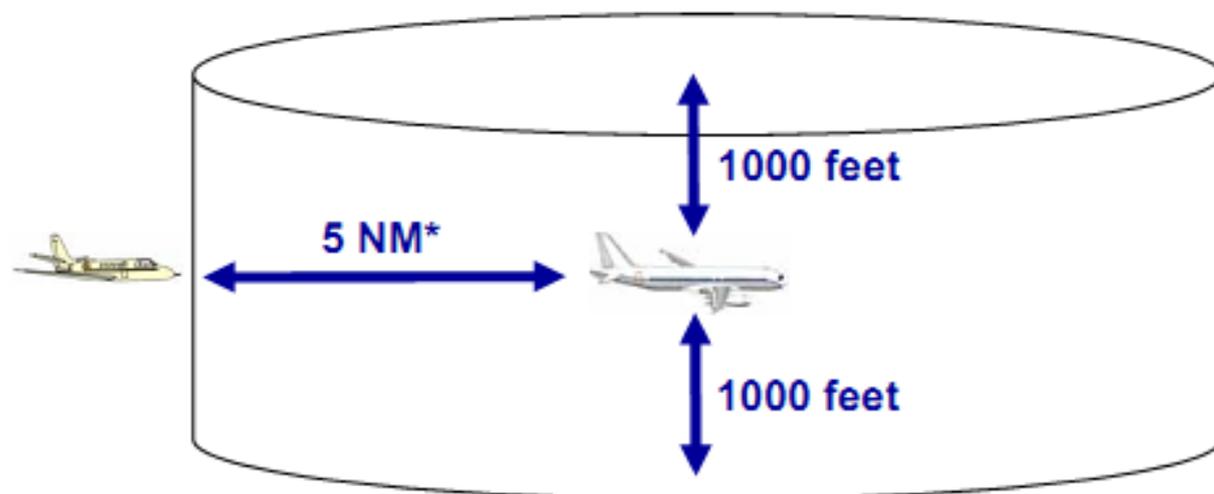
* 3NM when within 40NM or more from antenna or when using single (non-mosaic) radar data source.

Ref: FAAO 7110.65, 5-5-4 Radar Minima

Radar Handoff / Communications Transfer

- **No aircraft can enter another controller's airspace without that controller's permission. That permission being automation or verbal coordination.**
  - **Letters of Agreement**
  - **Automated Information Transfer**
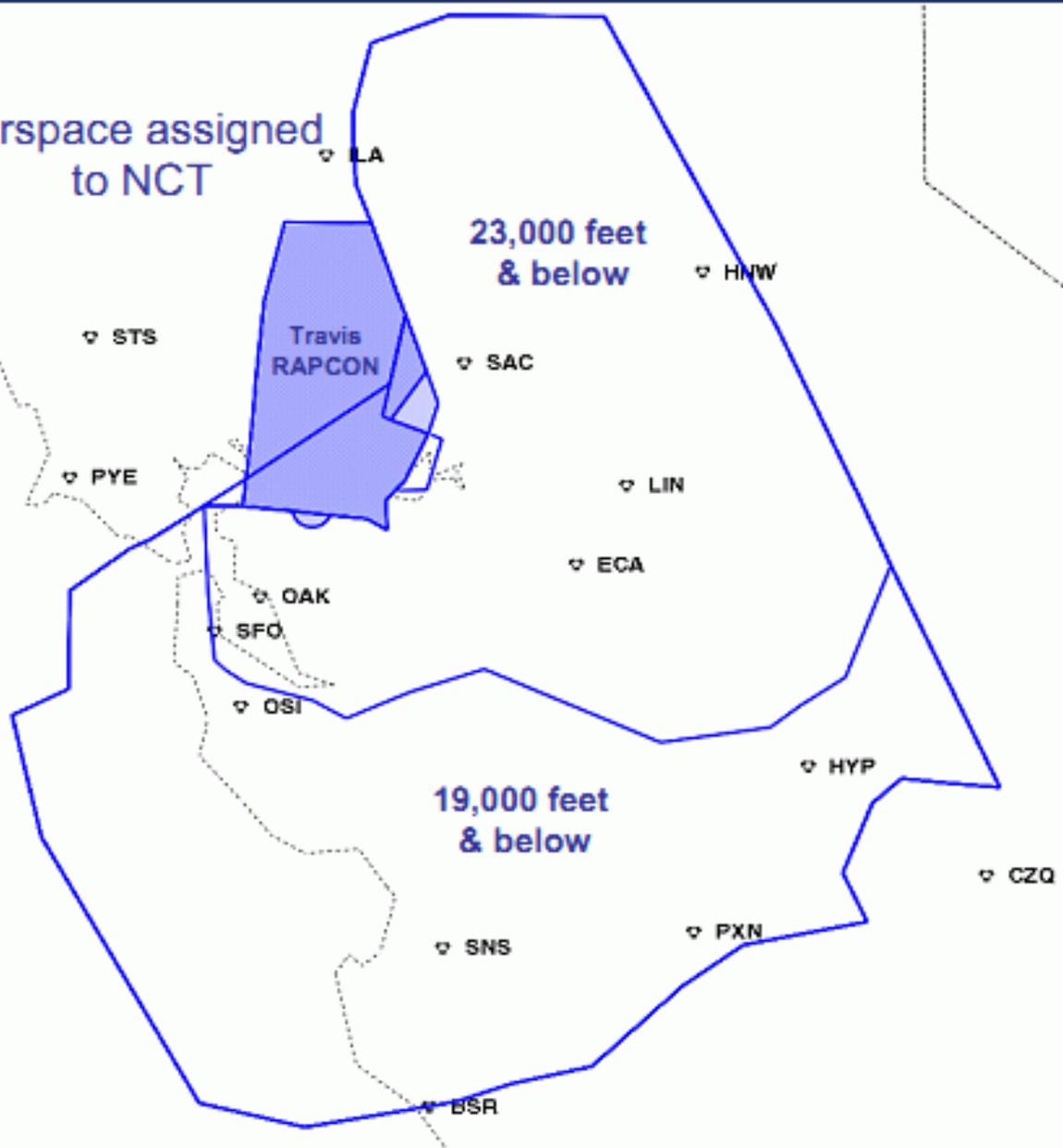
Terminal Radar Approach Control (TRACON)
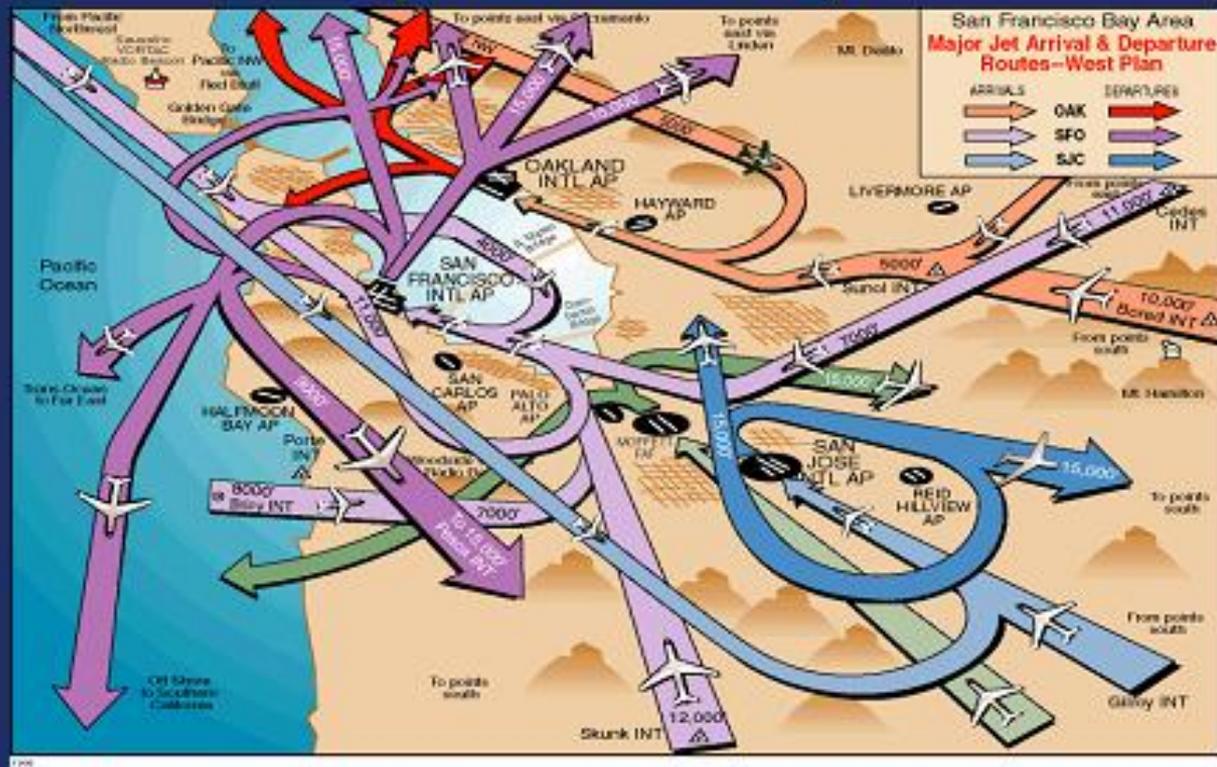
The TRACON's main function is to separate arrivals from departures to and from the underlying airports (towered and non-towered)
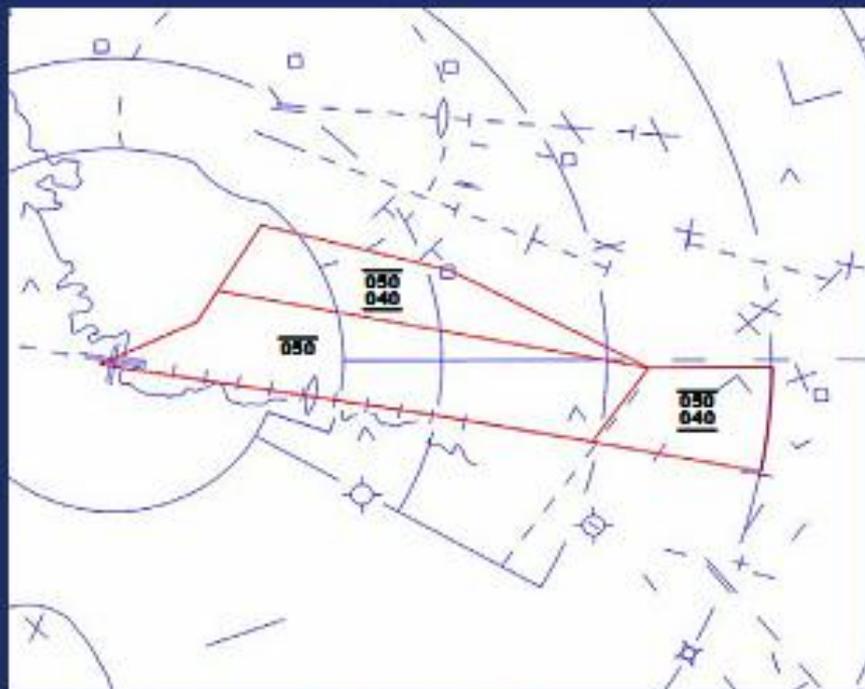
TRACONs

- Most "stand-alone" TRACONs are located on airports (e.g. DFW TRACON), but not all.
- Consolidated TRACONs – cover a larger area than stand-alone TRACONs:
  - Northern California TRACON
  - Southern California TRACON
  - New York TRACON (NYC and Northern NJ airports)
  - Potomac TRACON (Washington DC area airports)

Airspace assigned to NCT

23,000 feet & below

19,000 feet & below

Travis RAPCON

LA · HNW · STS · SAC · PYE · LIN · ECA · OAK · SFO · OSI · HYP · CZQ · SNS · PXN · BSR

Examples of NCT Sectors

Foster - West Plan

Niles – West Plan

FAA Radar Systems

The FAA operates two basic radar systems:

- Airport Surveillance Radar (ASR);
- Air-Route Surveillance Radar (ARSR).

Both of these surveillance systems use primary (raw radar) and secondary (beacon) radar returns to give controllers aircraft position and speed information, plus altitude information from Mode C transponder equipped aircraft. Most ASR's provide 4.8 second sweeps (updates) while ARSR's provide 12 second sweeps.
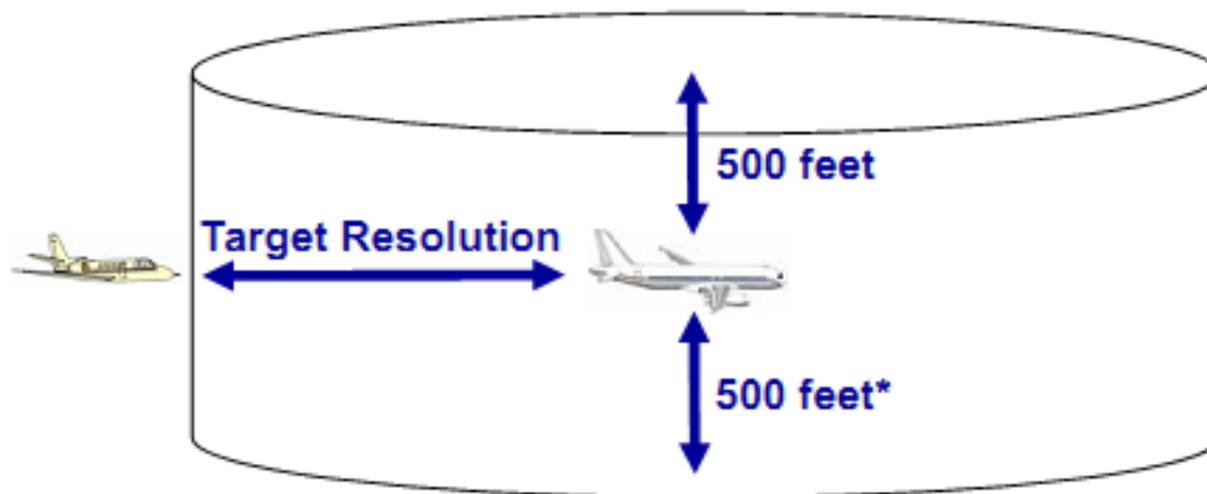
Terminal Radar Separation

- IFR vs IFR regardless of airspace

3 NM*

1000 feet

1000 feet
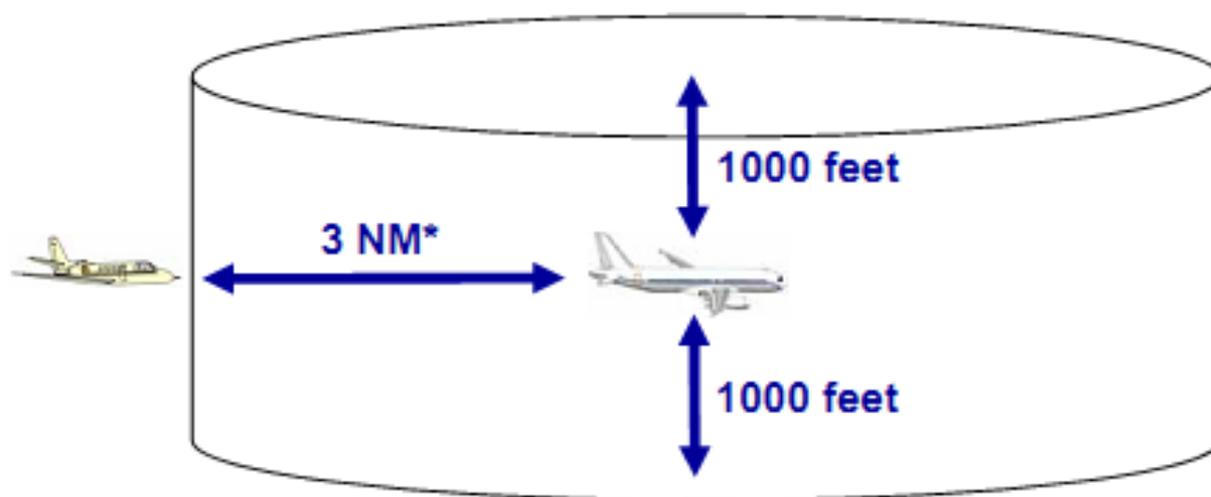
* 5NM when operating behind a "heavy jet" (B747, B767, B777, MD11, A380 for examples), 40NM or more from the radar antenna, or when using multiple (mosaic) radar data sources.

Terminal Radar Separation

- IFR vs VFR in Class B/C airspace

Target Resolution

500 feet

500 feet*

*1,000 when operating below a "heavy jet"
(For example: B747, B767, B777, MD11, A380).

TRACON ATC Position

ARTS Keyboard & Trackball

All SFO Arrivals for January 5, 2007