

# Historical Perspective

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Spring 2018

# Early Developments

- 1903 - Wright Brothers' first flight in North Carolina
- 1909 - College Park, Maryland is one of the first airports in the US
- 1916 - First air mail service (Army)
- 1918 - US Postal Service takes over the mail system
- 1925 - Kelly Act (Air Mail Act) - allows private operators into the air mail service
- 1926 - President Coolidge signs the first Air Commerce Act
  - Establishes aids to air navigation
  - Provided authority for traffic rules
  - Mandatory registration of aircraft providing air services
  - Certification of airmen

# Sites of Interest to Look at Old Airport Pictures

- <http://forum.skyscraperpage.com/showthread.php?t=152978>
- La Guardia airport pictures at <http://www.panynj.gov/airports/lga-slideshow.html>
- Abandoned and little known airfields at <http://www.airfields-freeman.com>
- Atlanta Hartsfield International Airport History at [http://www.atlanta-airport.com/Airport/ATL/Airport\\_History.aspx](http://www.atlanta-airport.com/Airport/ATL/Airport_History.aspx)

## Early Commercial Aircraft Development (20-30's)

The late twenties and early thirties introduces important advances in aircraft construction methods

Ford Trimotor (called "Tin Goose")  
(great similarity to Fokker F.VII)  
Speed ~ 175 km/hr (94 knots)  
Runway length = 600 m  
10-12 passengers



## Early Developments (II)

- 1930s - U.S., Latin America and Europe airlines flourish
- 1935 - First air traffic control facility (Newark)
- 1936 - The Douglas DC-3 goes into service

Cruise speed = 300 kph  
 21-32 passengers  
 Runway length = 800 m  
 11,000 built  
 Some still fly today



**Douglas DC-3**

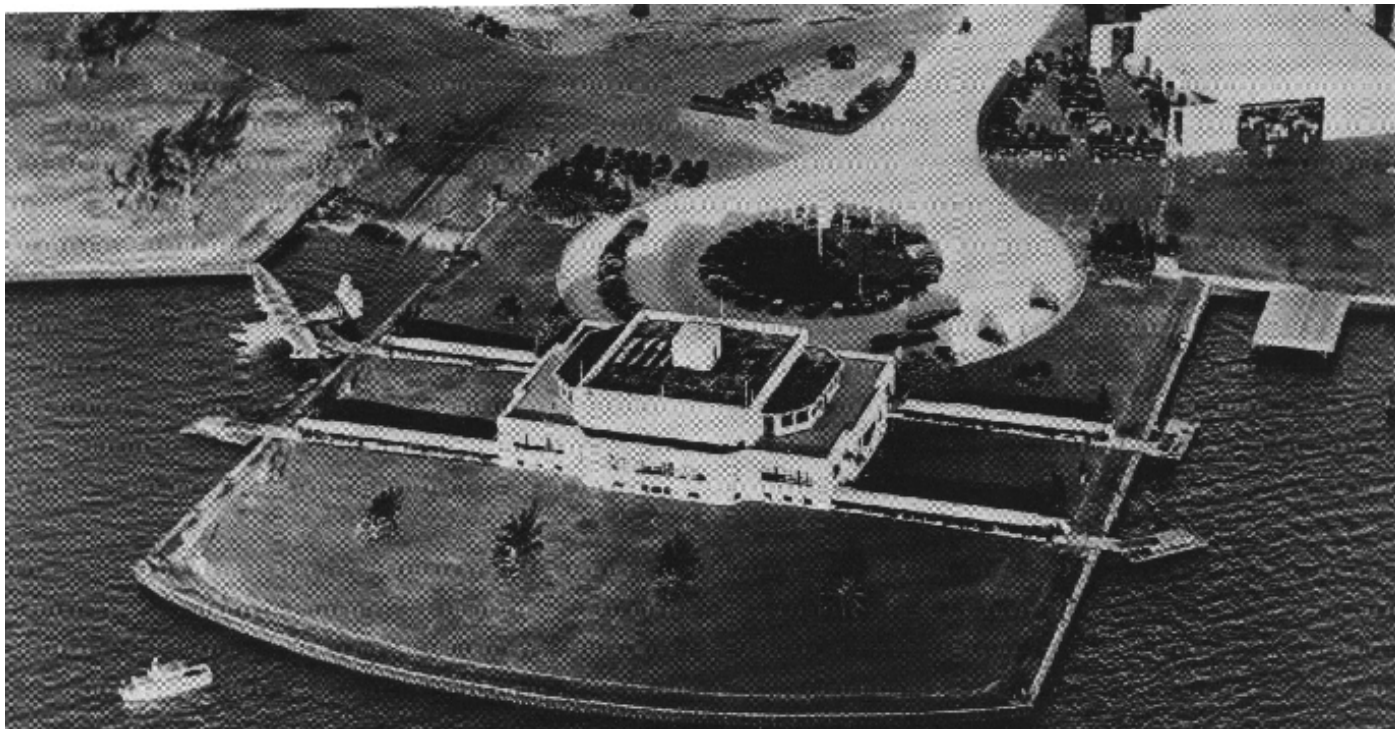
# Many Airlines are Established in the late Twenties and early Thirties

- Pan American World Airways (Pan Am) is founded in 1927
- Many other national airlines are founded in the period as well (United Airlines was founded in 1926 as Varney Air Lines)



# Early Airports (Sea Plane Bases)

- In the 30's airports start adding concrete runways (400-900 m.)



Miami Beach Seaport (circa 1930) (Blankenship, 1967)

# WWII Period

- 1938 - President Roosevelt creates the CAA (Civil Aeronautics Authority) through the Civil Aeronautics Act of 1938
- 1939 - CAA splits into CAA and CAB (Civil Aeronautics Board)
- 1939-1945 Aircraft development during WWII
- 1939-1945 Hundreds of low cost airports are created around the country to train pilots
- 1945-1947 Availability of surplus aircraft (specially many C-47 or DC-3) 500 airports are turned to local and state authorities



# End of WWII Aircraft

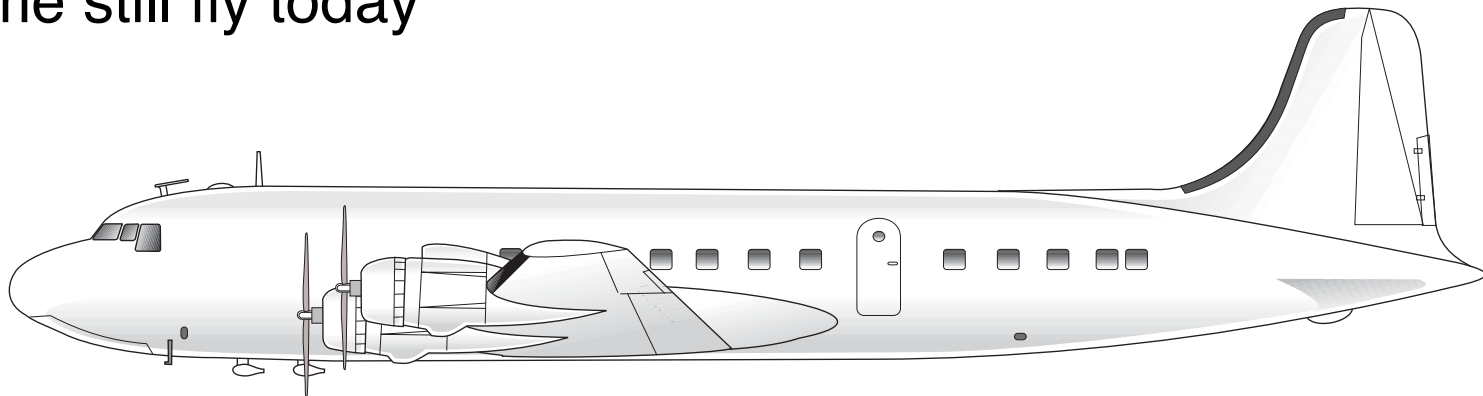
- 1946 - The Douglas DC-6 is introduced
- Several four engine, (piston) powered aircraft become the mainstay of the commercial aircraft fleet

Cruise speed = 550 km/h (310 mph)

45-65 passengers

700 built

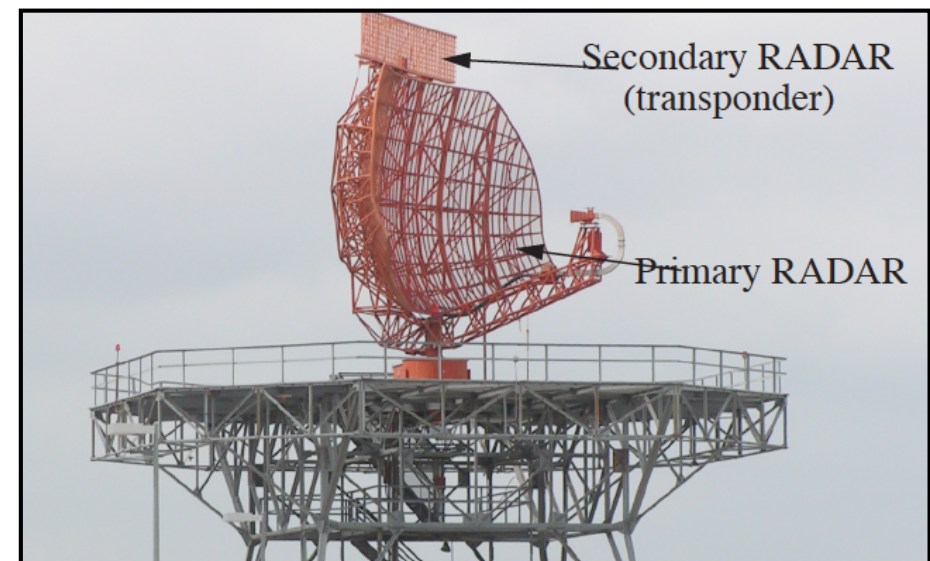
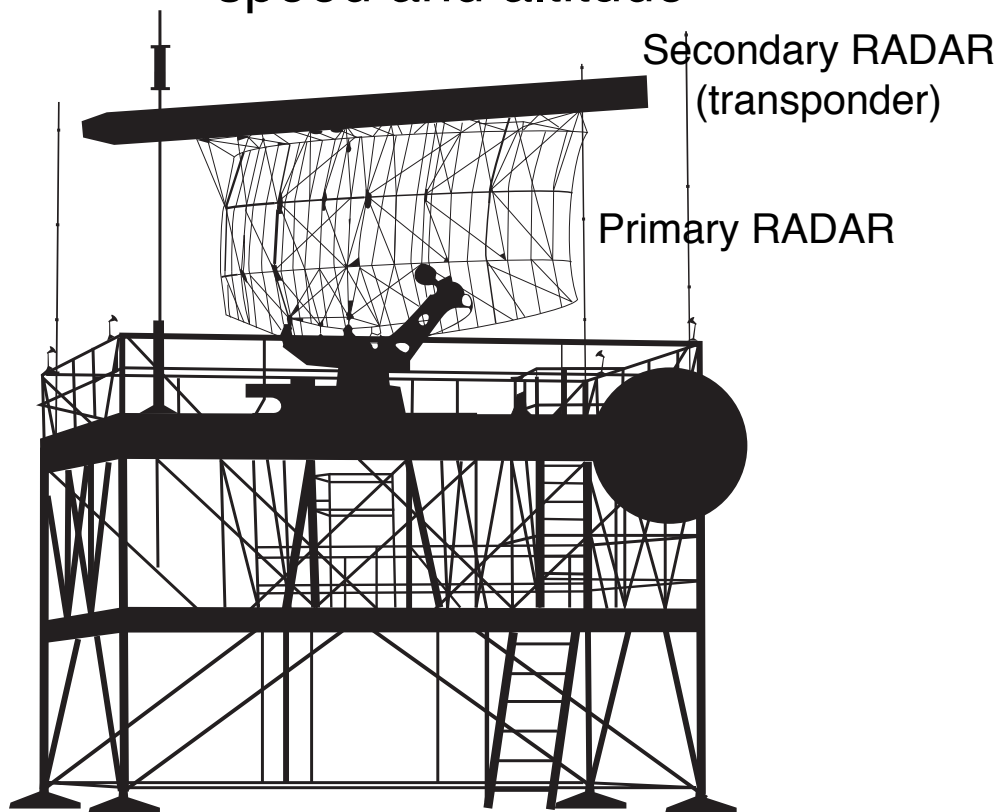
Some still fly today



Douglas DC-6

# Development of the RADAR

- Allows the surveillance of aircraft allowing efficient and safe aircraft operations
- Primary RADAR detects basic metallic objects in space
- Secondary RADAR provides information about aircraft ID, speed and altitude



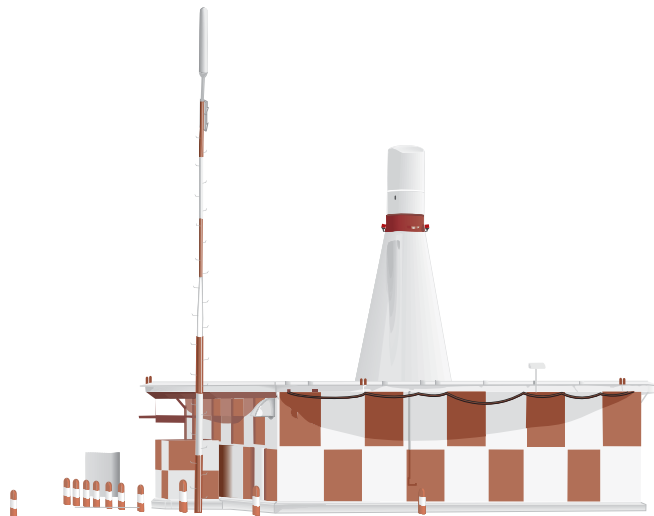
**RADAR = RAdio  
Detection And  
Ranging**

# Post WWII War Period

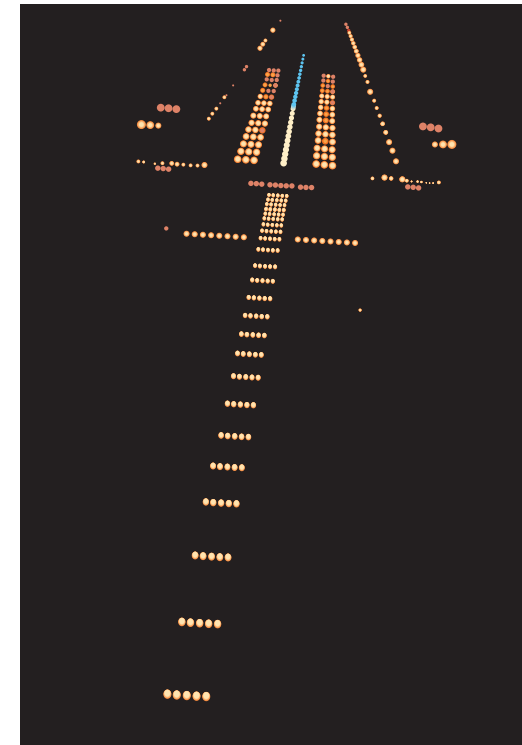
- 1945 - First radar equipped control tower (Indianapolis)
- 1946 - Federal Airport Act of 1946
- 1951 - British launch the first commercial jet (Comet I)
  - Airport runway lengths grow substantially
  - More support equipment is needed
- 1958 - Federal Aviation Act of 1958
  - Creates the Federal Aviation Agency (today's FAA)
  - Retains CAB for regulatory control

# Airport and Airway Technologies (50's)

- Relevant airport/aviation technologies:
  - Very High Frequency Omni-directional Range and Finding (VOR's and later VORTAC's)
  - Instrument Landing System (ILS)
  - Approach lighting systems



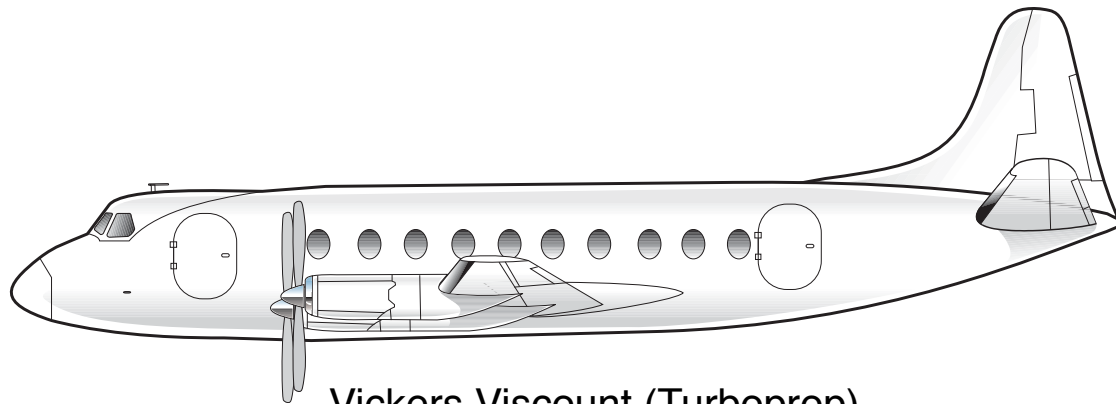
TACAN Station



Approach Lights to Help Pilots Land in Poor Weather and Nighttime Conditions

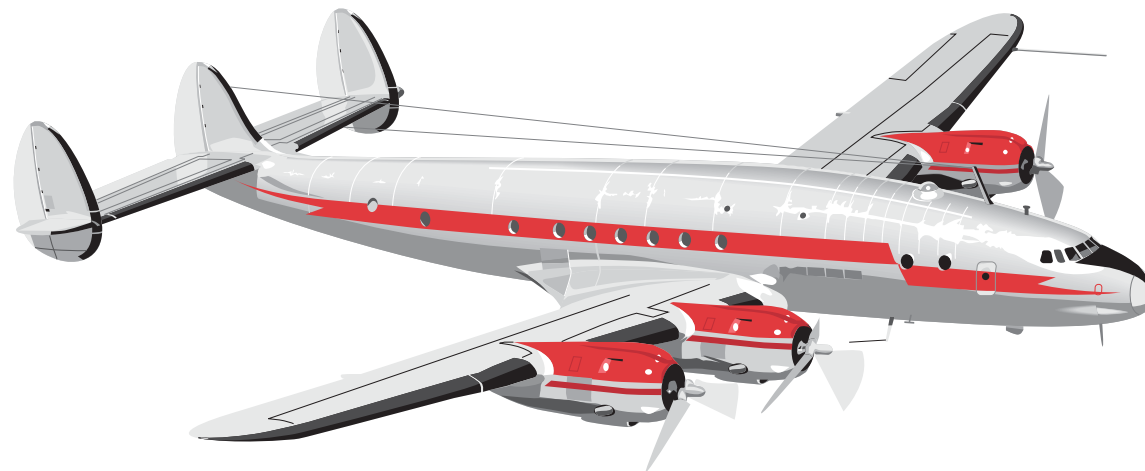
# Representative Aircraft of the Post WWII War Period

Several successful four-engine, piston and turbo-propeller aircraft are developed in this period



Vickers Viscount (Turboprop)

Cruise speed = 600 kph  
90-110 passengers  
Runway length = 2,000 m

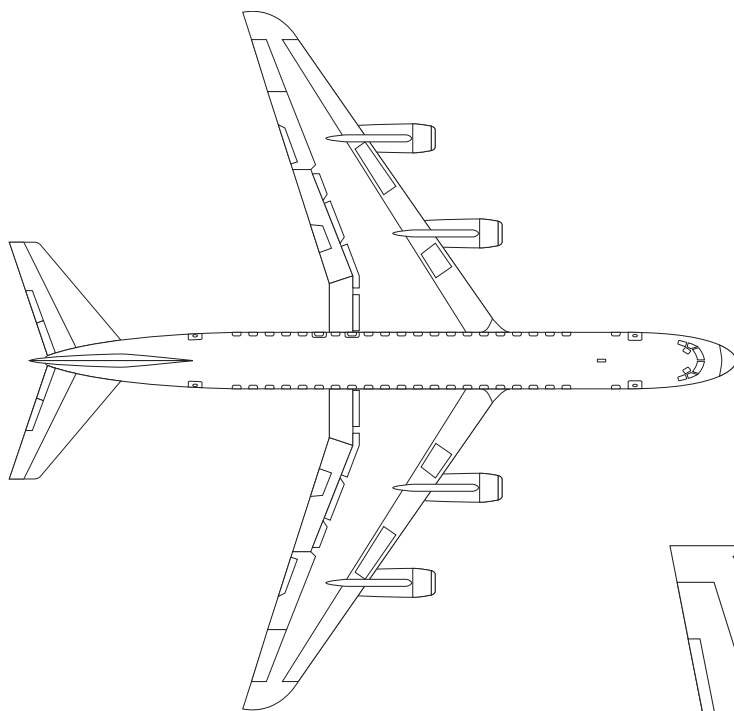


Lockheed Constellation (Piston)

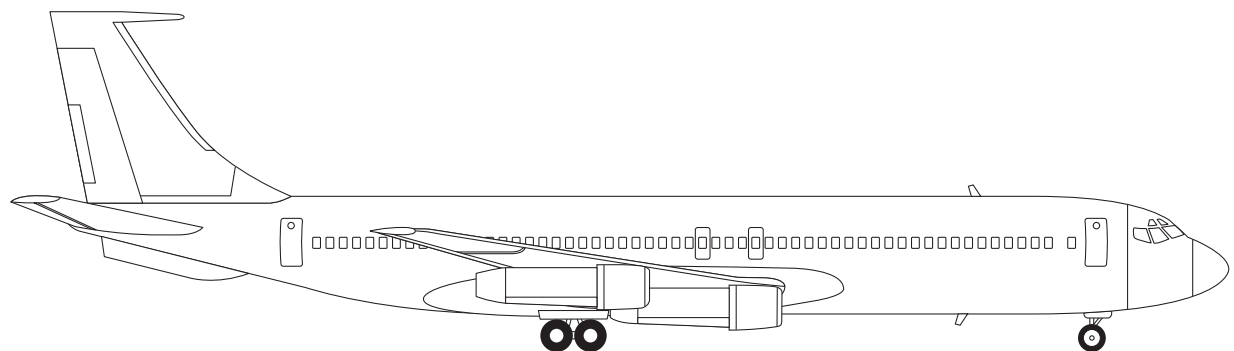
# Long-Range Aircraft Development (50-60's)

The British Comet I is followed by very successful American four-engine turbojet designs from Boeing and Douglas

Cruise speed = 950 kph  
140-165 passengers  
Runway length = 3,000 m



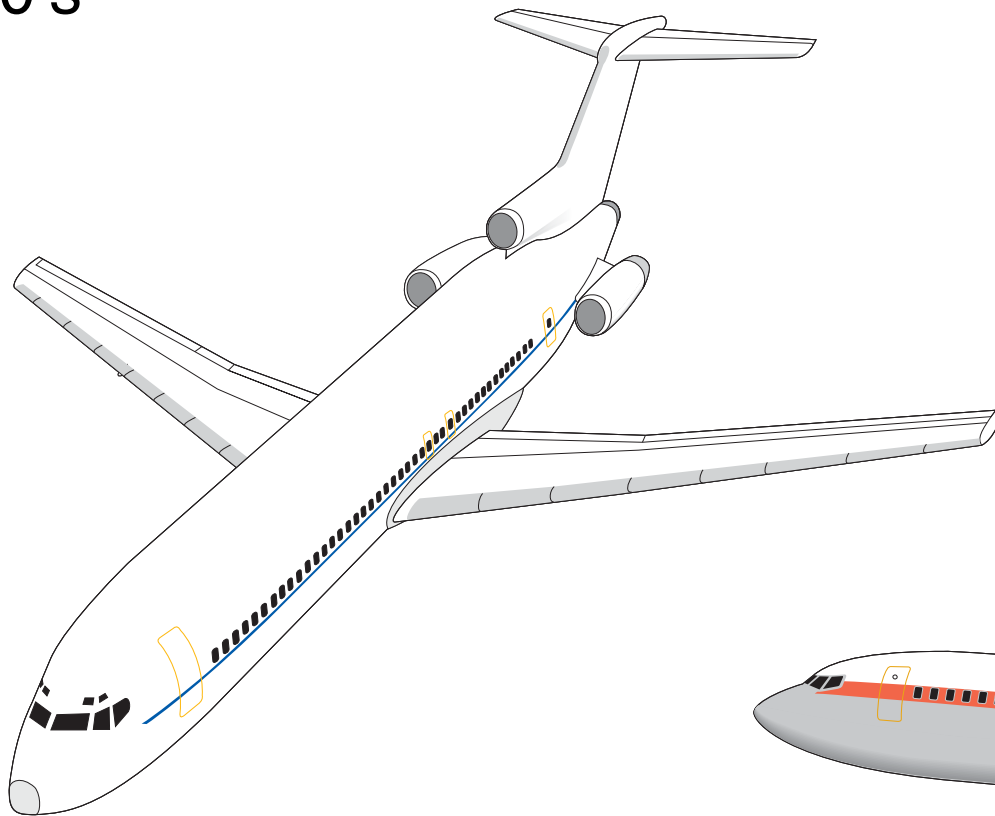
Douglas DC-8-50



Boeing 707-320

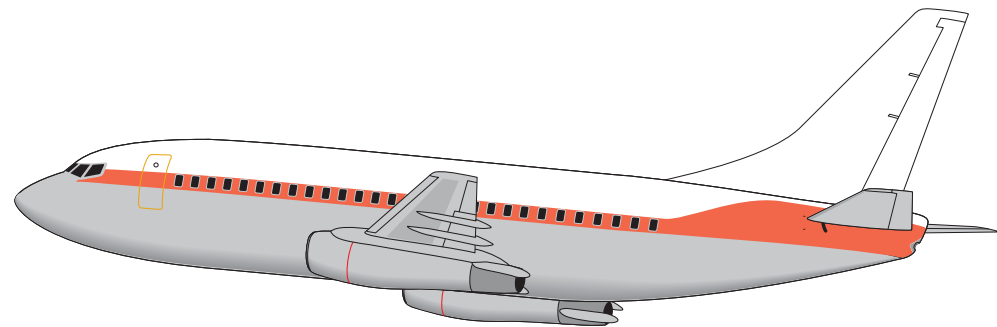
# Short-Range Aircraft Development (60's)

Several short and medium-range aircraft are introduced in the 60's



Boeing 727-200

Cruise speed = 950 kph  
140-165 passengers  
Runway length = 2,200 m



Boeing 737-100

# Airport Development in the 60's

- Many of the most important commercial airports as we know them today are constructed in the late 50's and early 60's
  - Washington Dulles International (1958-1962)
  - Newark International (1967-1973)
  - San Francisco International (1967)
  - Chicago O'hare International (1959-1963)
  - Los Angeles International (1957-1961)
  - Paris Orly-Ouest (1966-1971)
  - Houston Intercontinental (1964-1967)
  - Kansas City (1965-1972)

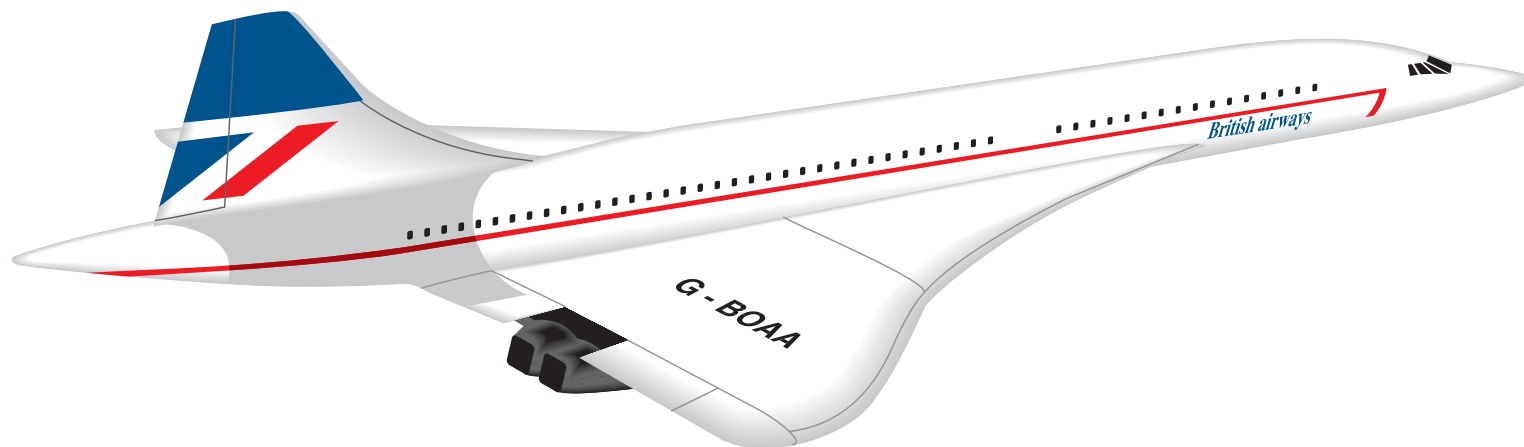


# Supersonic Aircraft (Late 60's)

- 1968 - BAC/Aerospatiale introduce the Concorde

Cruise speed = 2400 kph  
 90-110 passengers  
 7,000 km range  
 150,000 kg  
 Runway length = 3,200 m

Concorde retires in  
 the year 2003

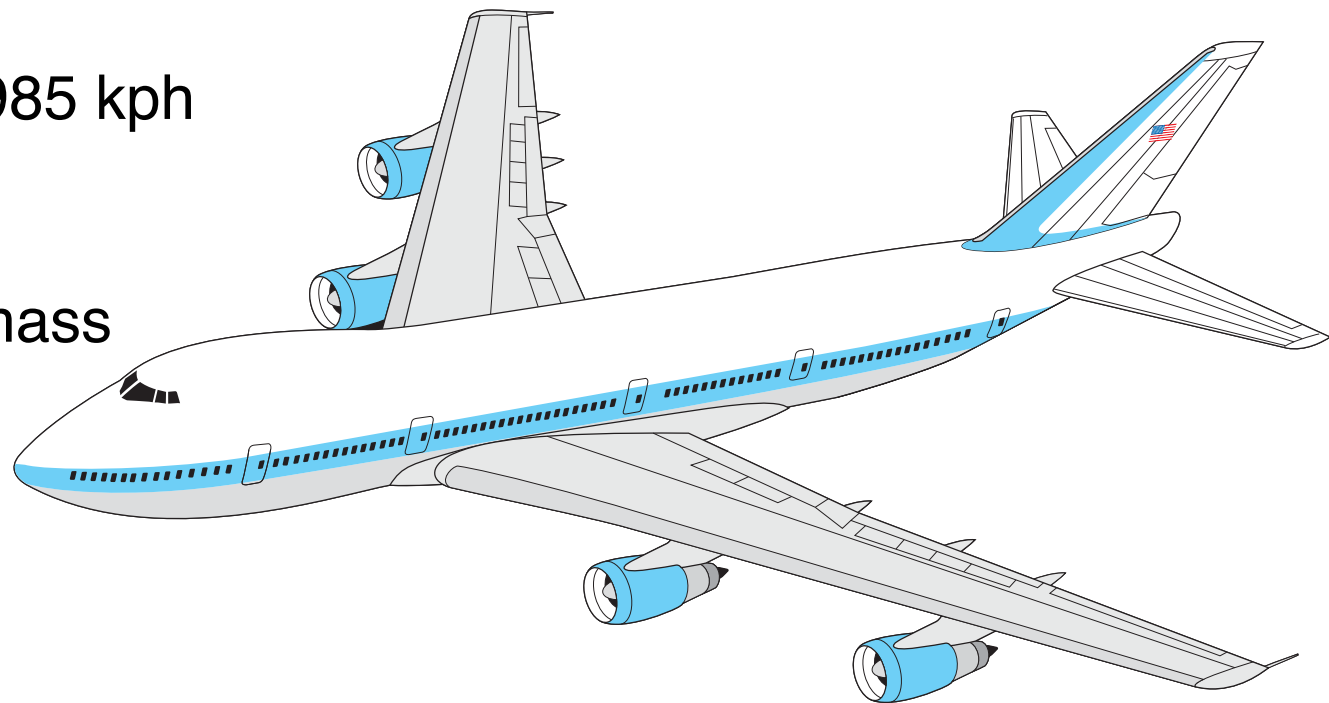


BAC/Aerospatiale Concorde

# Large Capacity Aircraft (1969)

- 1969 - Boeing introduces the Boeing 747-100
- Pan Am is the first airline to place the Boeing 747-100 it into service
- Airports have to adjust to this aircraft (gate size)

Cruise speed = 985 kph  
 400 passengers  
 7,000 km range  
 320,000 kg TO mass  
 Runway length  
 3,100 m



Boeing 747-100

# Airport Innovations (1970s)

In the early seventies new innovations appear at many airports in the U.S. (Automated People Movers -APM, centralized deicing, mobile lounges, moving sidewalks, etc.)



Automated People Movers



Moving Sidewalks

# Important Airport Airway Development

- Airport and Airway development Act of 1970
  - Creates the Aviation Trust Fund
  - Provided assistance to airports for development
  
- Airline Deregulation Act of 1978
  - Eliminates the regulation activities
  - Phases out CAB in 1985
  - Rise and decay of low fare airlines
  - Consolidation of markets
  - Growth in commuter markets

# Last Few Decades

- Airport and Airway Improvement Act of 1982
  - FAA's Brown Book (National Airspace Systems Plan - NASP)
  - Authorizes 11.1 billion dollars for improvements
- 1980s - Few megacarriers dominate the domestic market
- 1980-1990s More consolidations takes place
- 1990s - International megacARRIER arrangements (alliances)
- 1993 - European liberalization starts
- 1990s - Commuter airlines seek alliances with

# Development of Twin Engine Aircraft (70-80-90's)

- Development of large turbofan (fuel efficient) engines
- Boeing and Airbus introduce successful long-range, twin-engine aircraft



Boeing 767-200

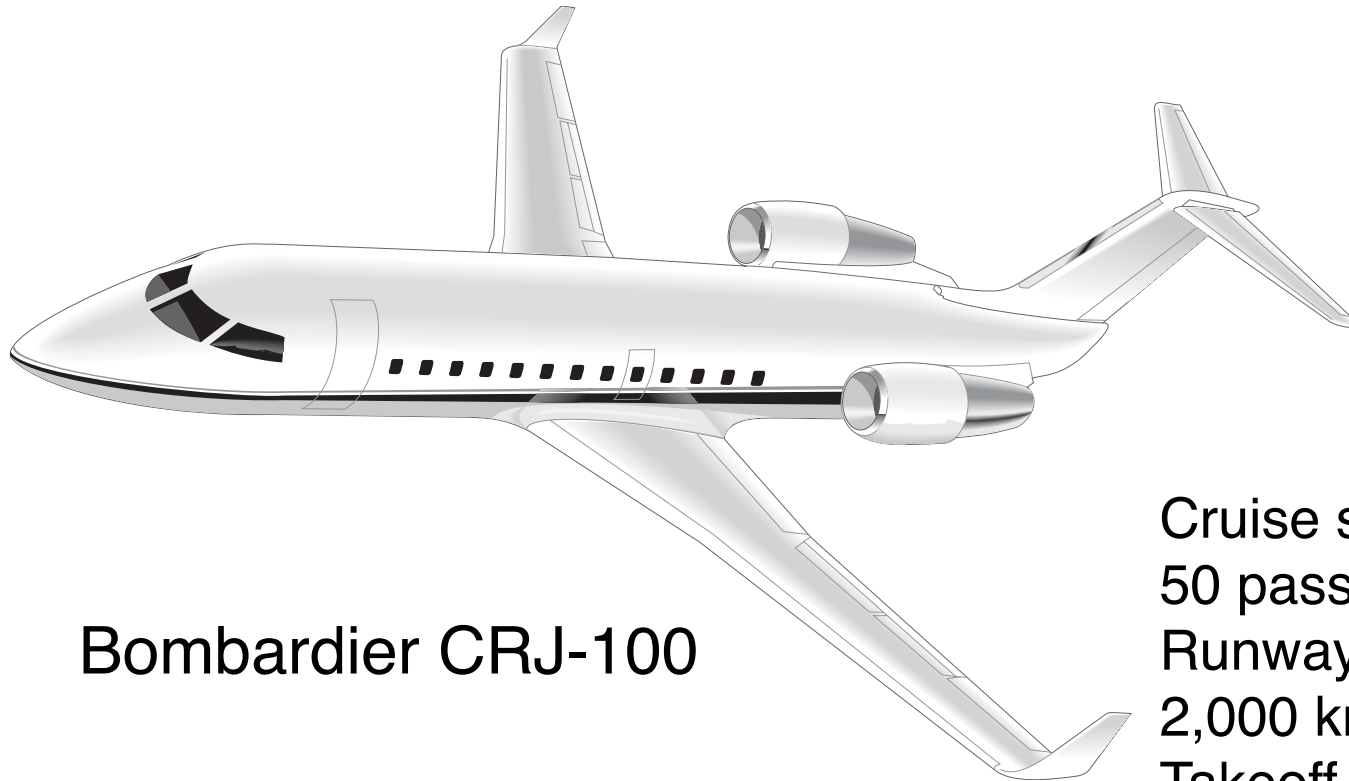
Cruise speed = 985 kph  
 270 passengers  
 Runway length = 2,700 m  
 7,000 km range  
 200,000 kg

# Satellite Revolution

- 1993 - GPS (Global Positioning System) touted as the next ATC revolution
  - SATNAV trials over the Pacific Ocean
  - United predicts 40 million dollars in savings in the Pacific using GPS
- 1994 - Satellite navigation trials start on Trans-Pacific routes
- 1996 - Trials to test DGPS for low visibility landings at airports
- 1998 - ADS-B Automated Dependence Surveillance mode B
- 1999 - DGPS offers near precision approaches

# Development of Regional Aircraft (1992)

- Turbofan-powered regional aircraft are very common in the US system with more than 1660 regional jets flying daily

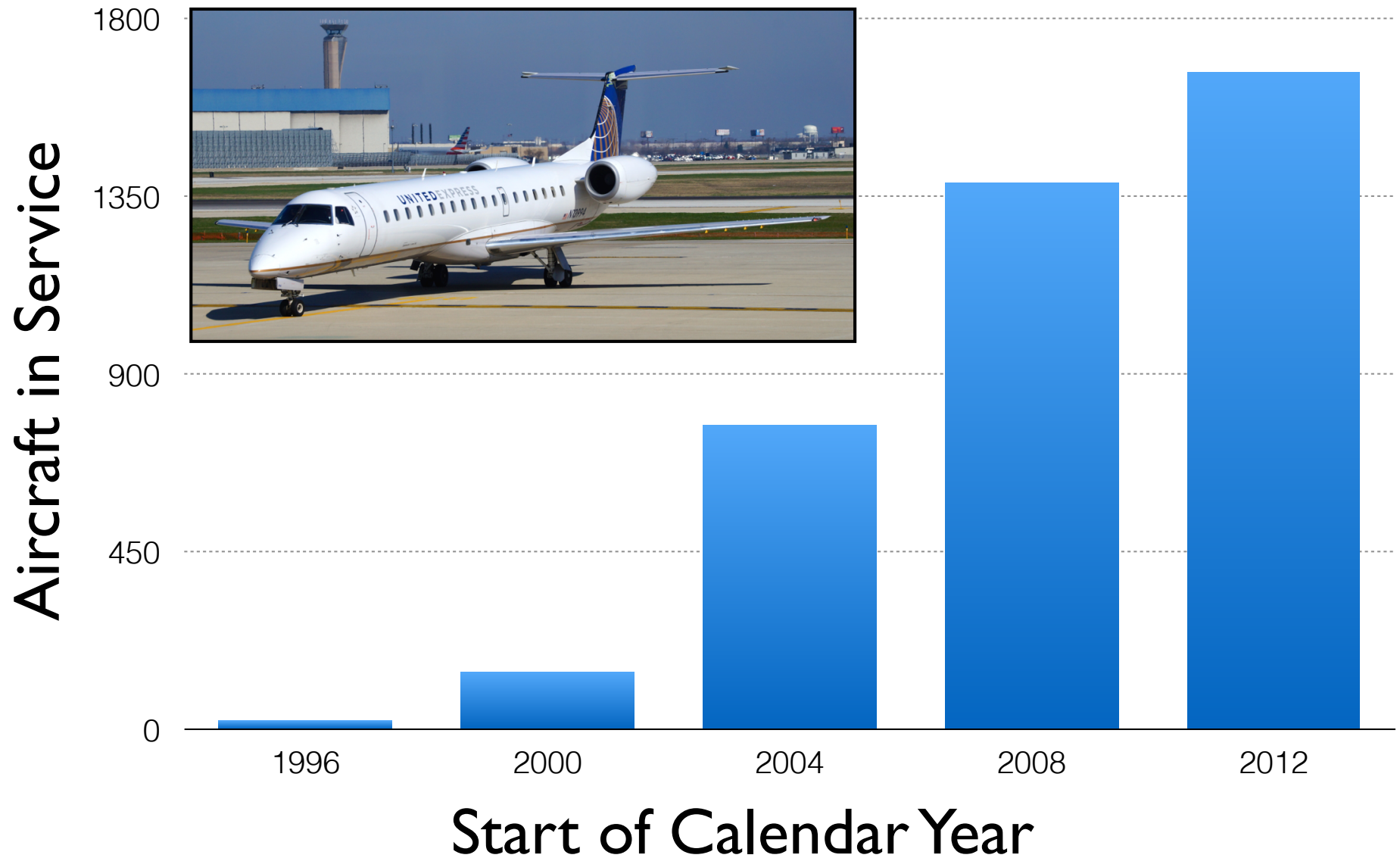


**Bombardier CRJ-100**

Cruise speed = 850 kph  
 50 passengers  
 Runway length = 1,400 m  
 2,000 km range  
 Takeoff weight = 24,000 kg

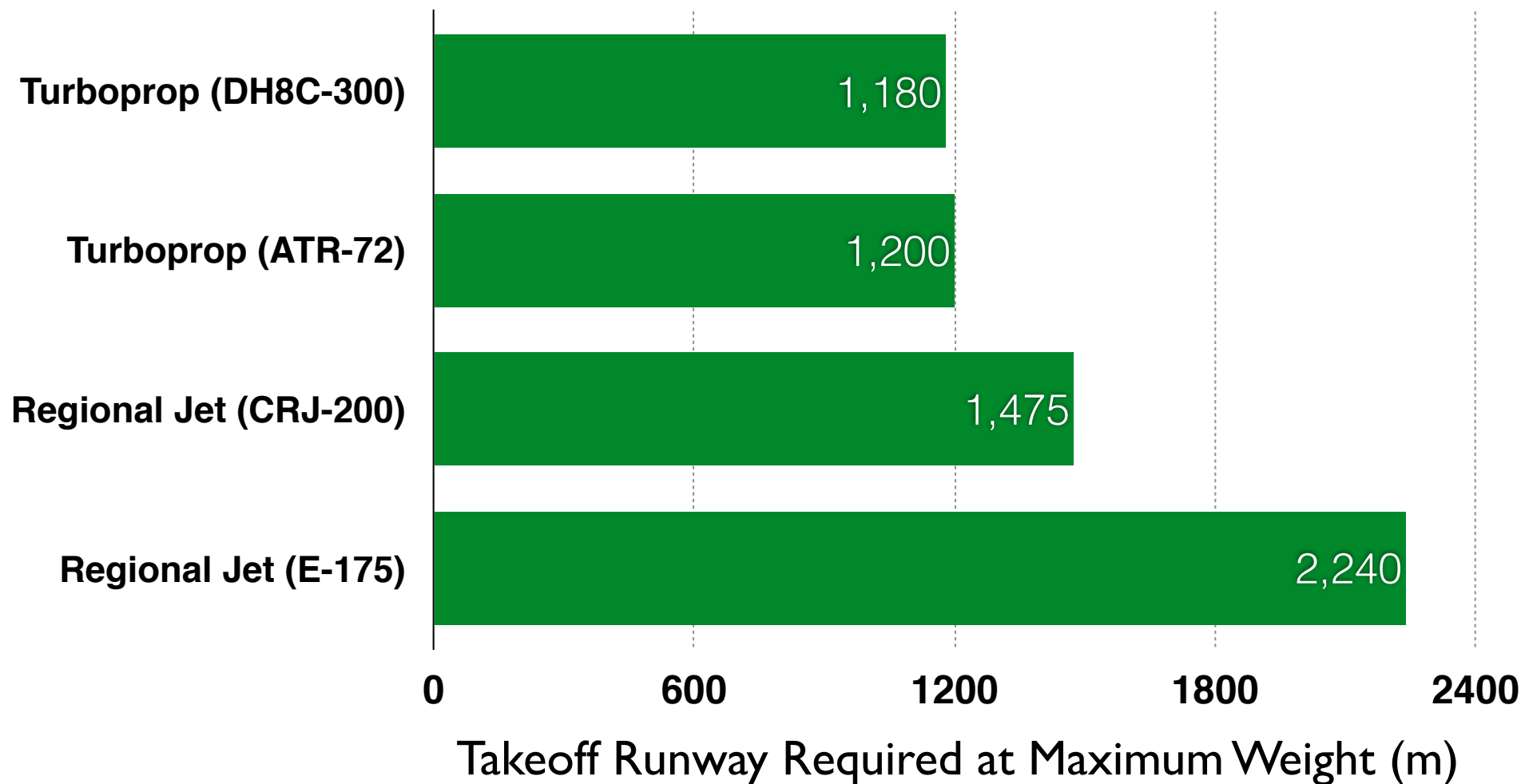


# Regional Jets in the United States



# Regional Jet Runway Characteristics

Regional Jets require more runway to takeoff and land than a typical turboprop commuter aircraft they replace



# New Generation Regional Jets

- The new generation of regional jets are closing on traditional smaller transport aircraft
- The new Embraer 190-195 family and the Bombardier CRJ-900 seat up to 95 and 90 passengers, respectively
- This approaches the 105-110 passengers for the smaller versions of the Airbus A318 and Boeing 737-600



# Airports for General Aviation Use

The Small (or Smart) Air Transportation System (SATS) proposed by NASA Langley attempted to bring personal air transportation to the masses

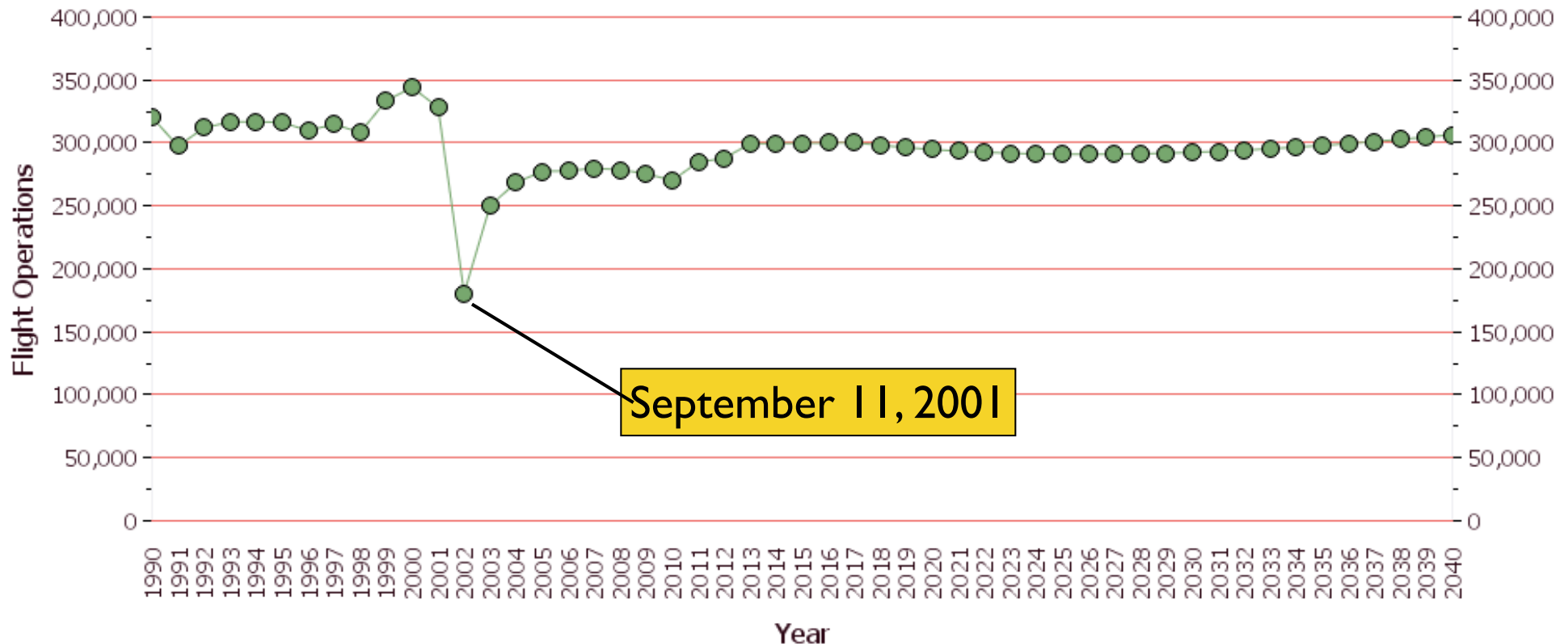


Imaginary Picture of SATS

# September 11, 2001

- One of the darkest days in the history of aviation (four aircraft destroyed and thousands of lives lost)
- More people killed in four senseless acts of terrorism than in all aircraft accidents combined a decade before in the U.S. (this counts all civilian and military casualties in the Pentagon and in New York)
- A turning point for airport security
- A turning point for airport infrastructure
- A turning point for how public views transportation infrastructure and aviation safety/security

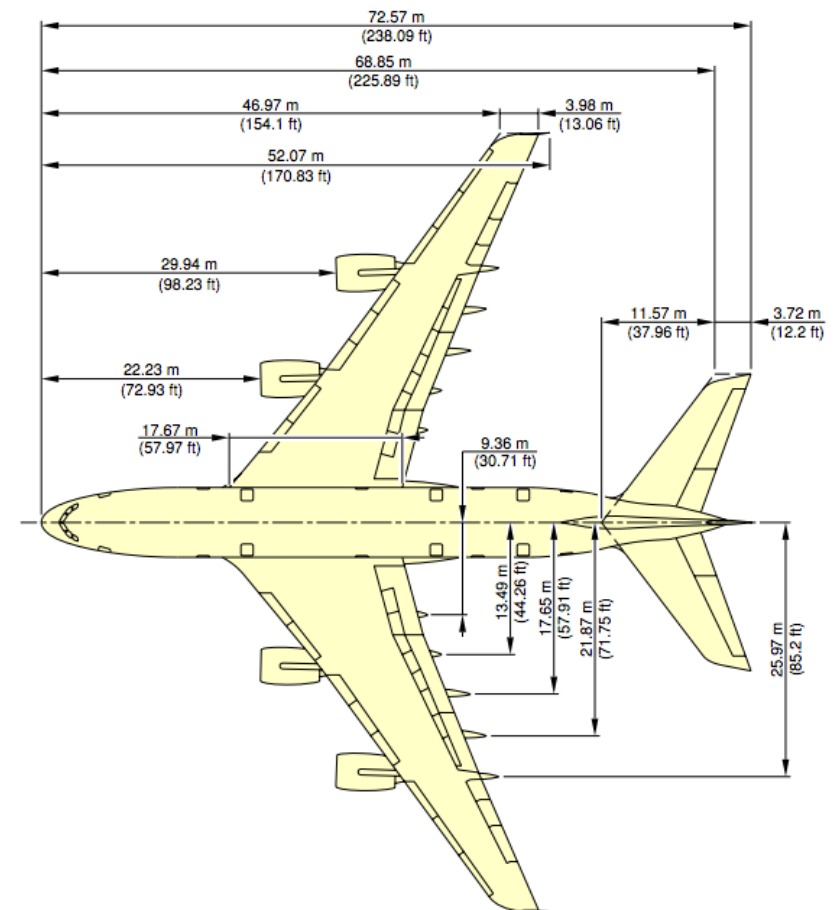
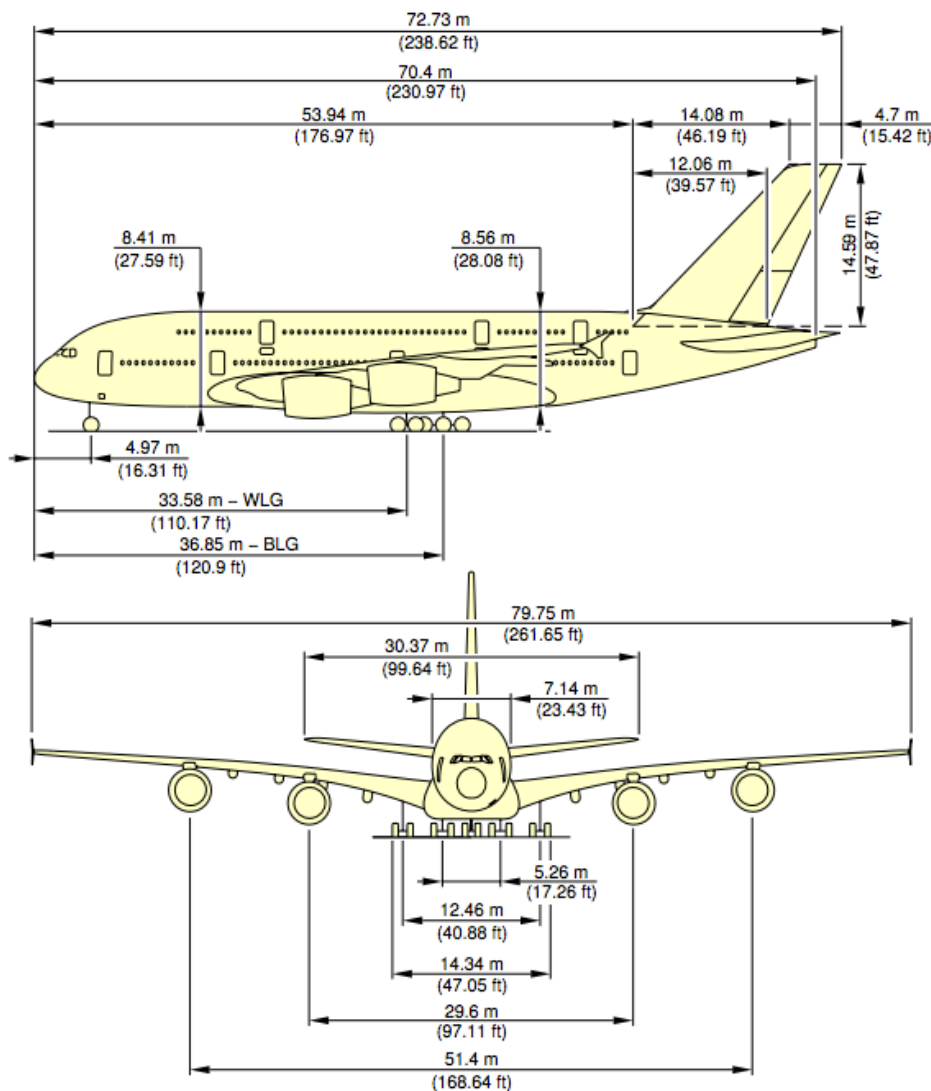
# Flight Operations at Washington National Airport



The number of annual flights dropped at National airport after the September 11, 2001 events

# Large Capacity Aircraft

- Airbus has been producing the Airbus A380 since the year 2006



Dimensions of A380

# Ultra-efficient Subsonic Aircraft (Boeing 787)

- Boeing 787 reduces Direct Operating Cost (DOC) by up to 15-20% per seat compared to existing aircraft (i.e., Boeing 767)
- The key technologies for new generation aircraft are: a) very fuel efficient high-bypass ratio turbofan engines and b) use of composite materials in the wings and fuselage



Boeing 787-8 at Tokyo Narita Airport, Source: A.A. Trani



# Important Agencies to Recognize

- FAA - regulates and promotes aviation in US
- ICAO - International Civil Aviation Organization
  - Based in Montreal, Canada
  - Part of the UN charter
  - Promotes and oversees aviation activities in the world
- State Departments of Aviation
  - Promote development in individual states
  - Part of State DOTs
- Airport Authorities
  - Promote development of airports at the local level

# Federal Aviation Regulations

- Most airport planning and design activities are carried out using Federal Aviation Regulations (FAR)
  - FAR 23 and 25 (Certification of aircraft)
  - FAR 121 (Operation of aircraft by air carriers)
  - FAR 77 (Obstructions to navigation)
- FAA provides designers and planners with Advisory Circulars (AC) to guide airport planning and design activities
  - AC 150/5060-5 (Airport Capacity and Delay)
  - AC 150/5300-13 (Airport Design)
- The regulations are quite strict and enforced. The FAA provides guidelines to even install a light fixture on a

# Reasons to Know More About Air Transportation?

- To plan and design challenging and large-scale airports and air transportation infrastructure
  - Airports are very expensive (25 billion dollars were invested in Kansai airport Phases 1-2 in Japan)
  - Air transportation investment is a 10-15 billion dollar/yr industry in the U.S. alone
- To improve the safety of the system
- To improve the capacity of the system (i.e., to handle more flights or operations without building more airports)