

# Air Traffic Management

A thick, horizontal yellow brushstroke with a textured, painterly appearance, extending across the width of the slide below the title.

JM Alliot

Sources : FAA and  
EUROCONTROL documents

# Air Traffic Management



- ⌘ Airspace Management (ASM)
- ⌘ Air Traffic Flow Management
- ⌘ Air Traffic Control

# Airspace



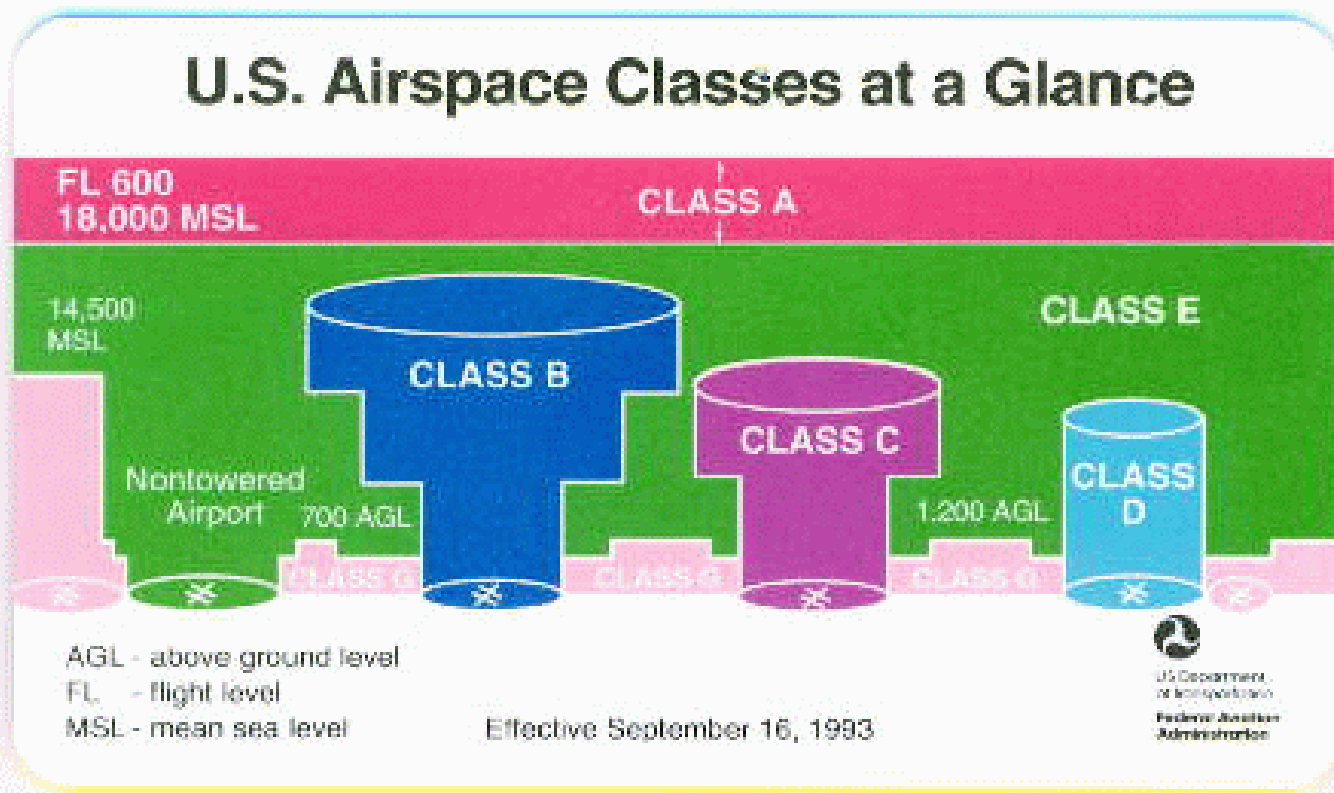
- ⌘ Airspace has been divided by the ICAO (International Civil Aviation Organization) into 7 classifications
- ⌘ There are 2 classifications for aircraft flight :
  - ☑ IFR : Instruments Flying Rules
  - ☑ VFR : Visual Flying Rules

# Airspace classification



- ⌘ A : FL180-600. IFR only.
- ⌘ B/C/D : around airports, VFR+IFR
- ⌘ E : <FL180. VFR+IFR
- ⌘ G : VFR only (uncontrolled)

# Airspace classification



# IFR and VFR



## ⌘ VFR flights :

- ☑ Keep separated from each other by visual means
- ☑ Need radio equipment to enter most airport airspace

## ⌘ IFR flights :

- ☑ Need radionavigation equipment
- ☑ Fill a flight plan before departing
- ☑ Need ATC clearance

# Airspace organisation

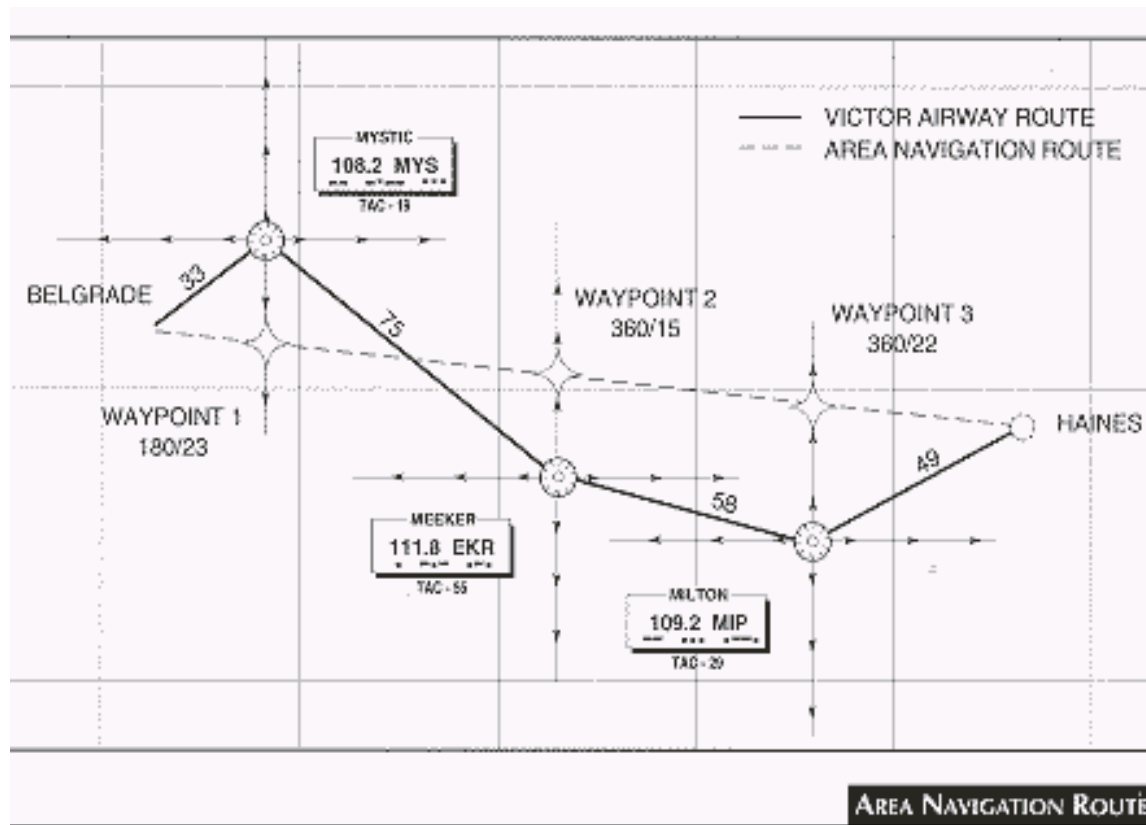


⌘ Waypoints

⌘ Routes

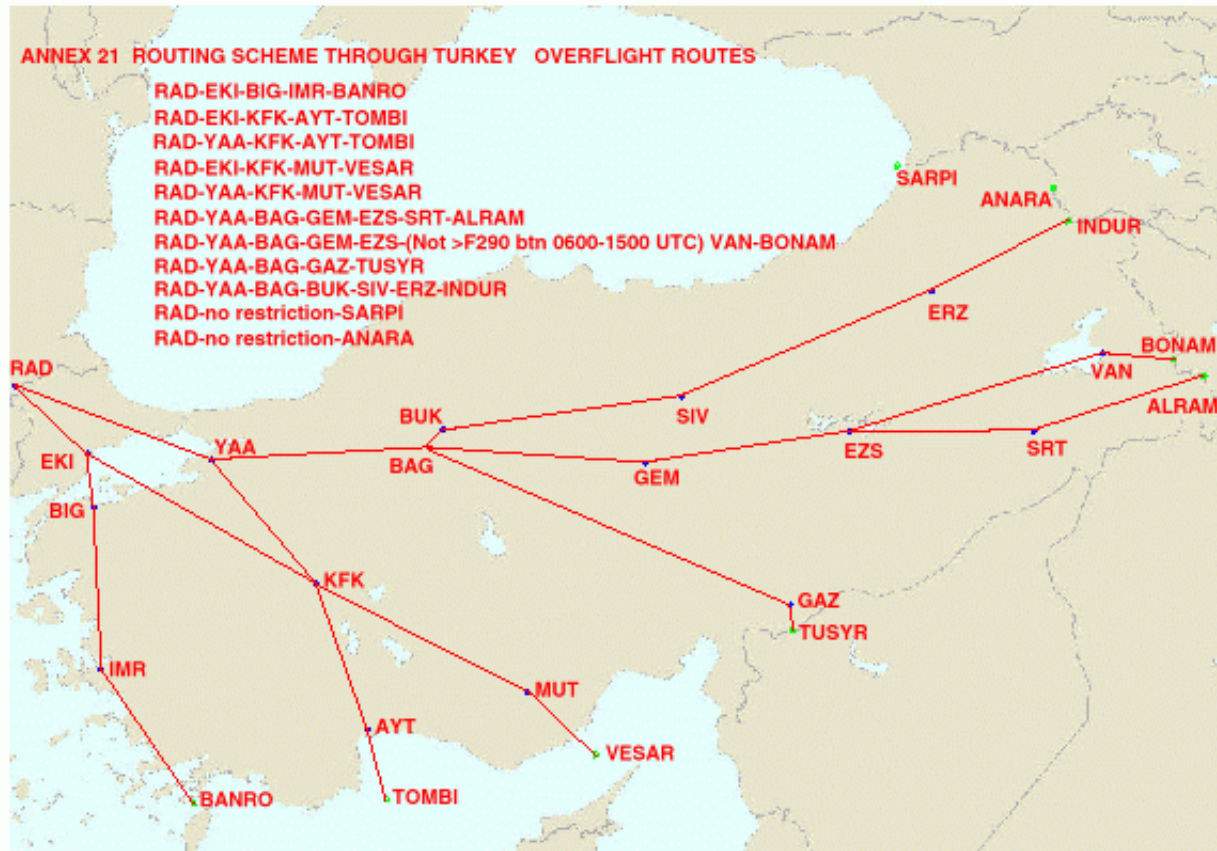
⌘ Sectors

# Waypoints

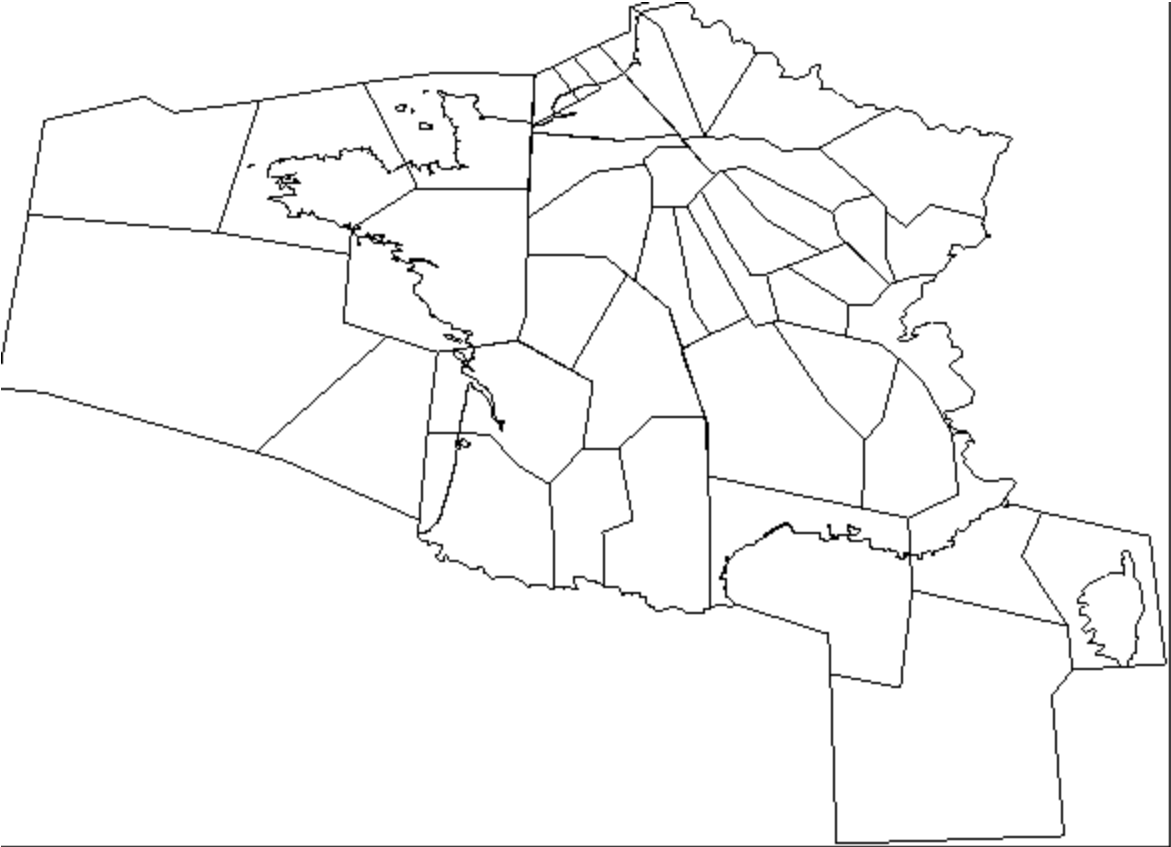




# Routes



# Sectors



# What is Air Traffic Control (ATC)



- ⌘ « The primary purpose of the ATC is to prevent a collision between aircraft operating in the system and to organize and expedite the flow of traffic » (FAA 7110.65K)
- ⌘ First objective : safety
- ⌘ Second objective : efficiency

# Separation standard



## ⌘ Vertical


- ☒ 1000 ft below FL290

- ☒ 2000 ft above FL290

## ⌘ Horizontal : around 5 Nm

⌘ If both are violated, we have a separation violation

# Airprox < > Separation violation



⌘ Airprox : A situation in which, in the **opinion of a pilot or air traffic services personnel**, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised

# Airprox



⌘ System is and remains safe

Year	1995	1996	1997	1998
Traffic	5783	6158	7039	7479
Airprox	388	418	381	367

# Air Traffic Flow Management (ATFM)



- ⌘ Air Traffic sectors have a limited capacity
- ⌘ ATFM matches capacity and demands

# Flight Plans



⌘ Must be filled at least 3 hours before departing



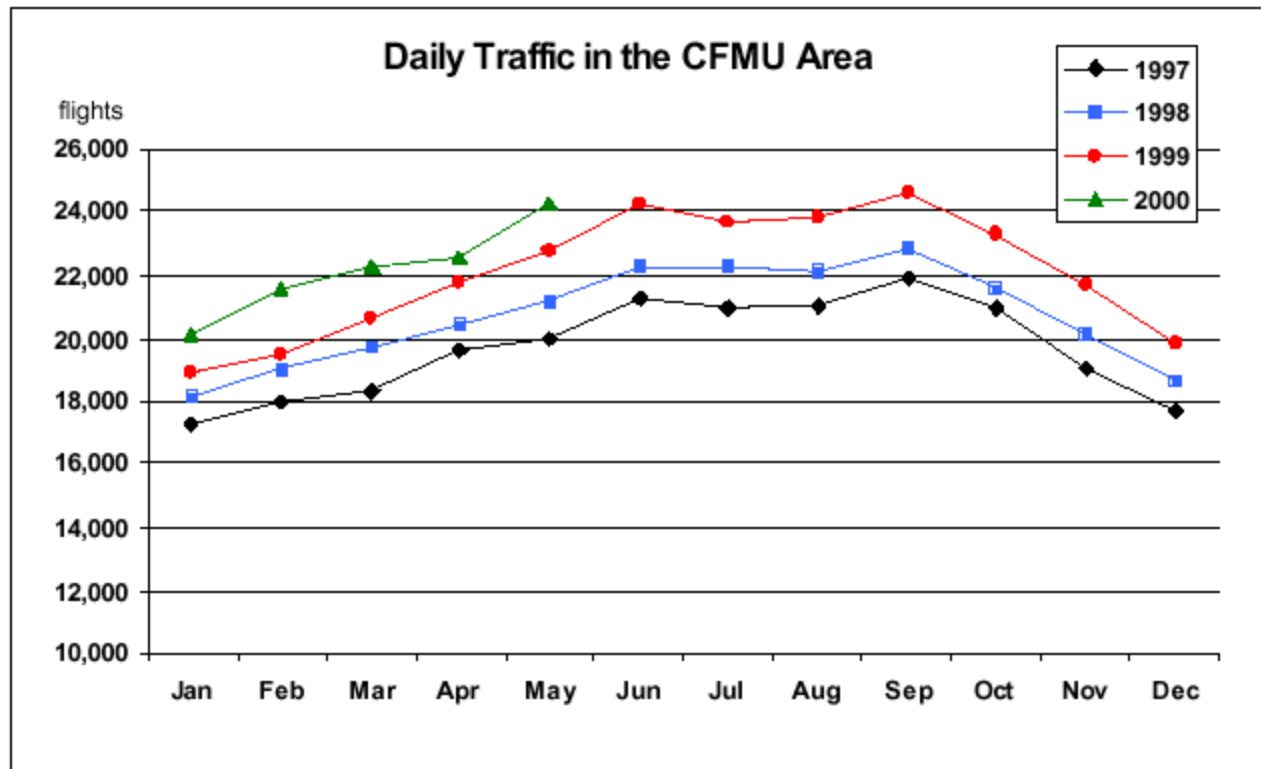
# Slots



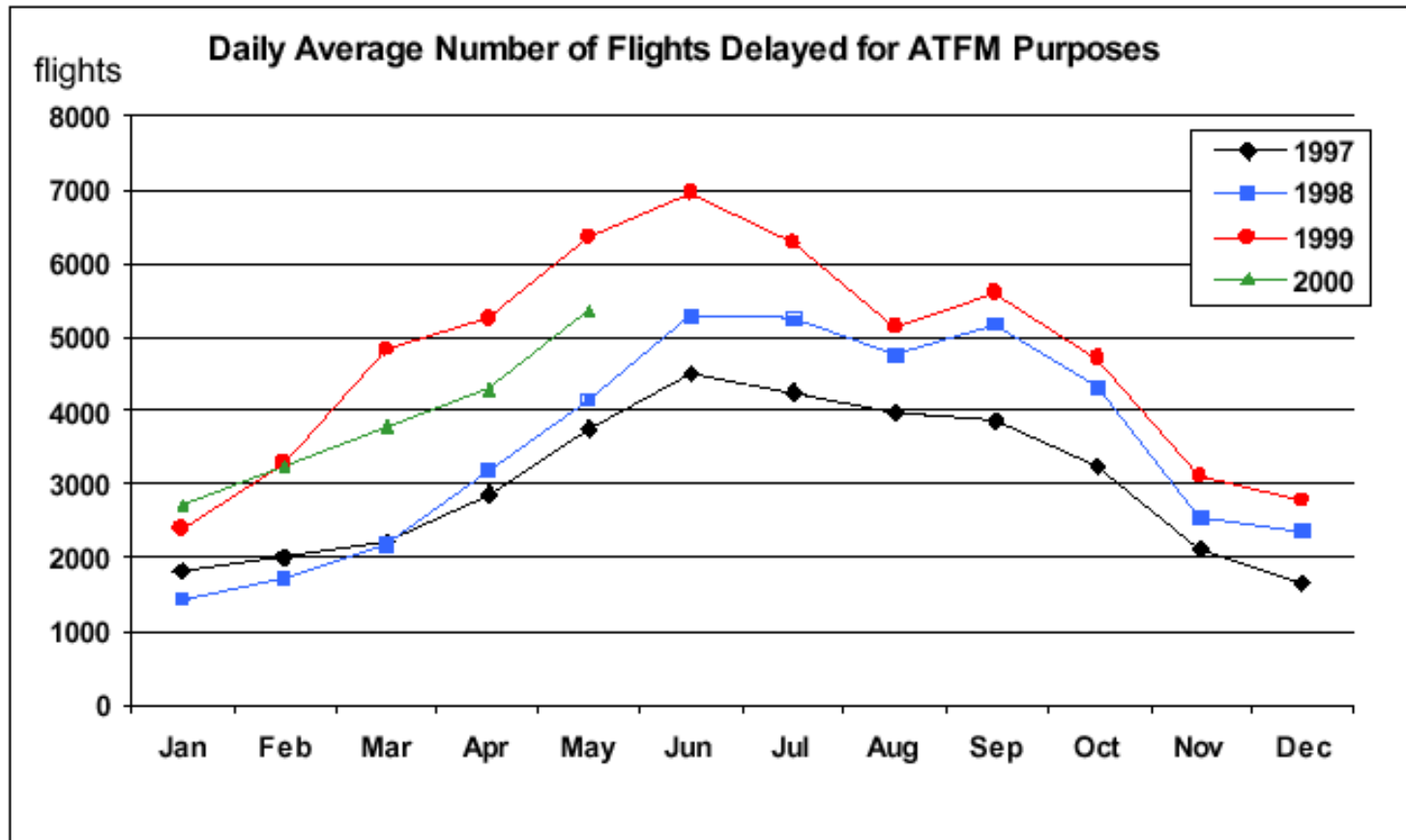
⌘ ATFM slots

⌘ Airport slots

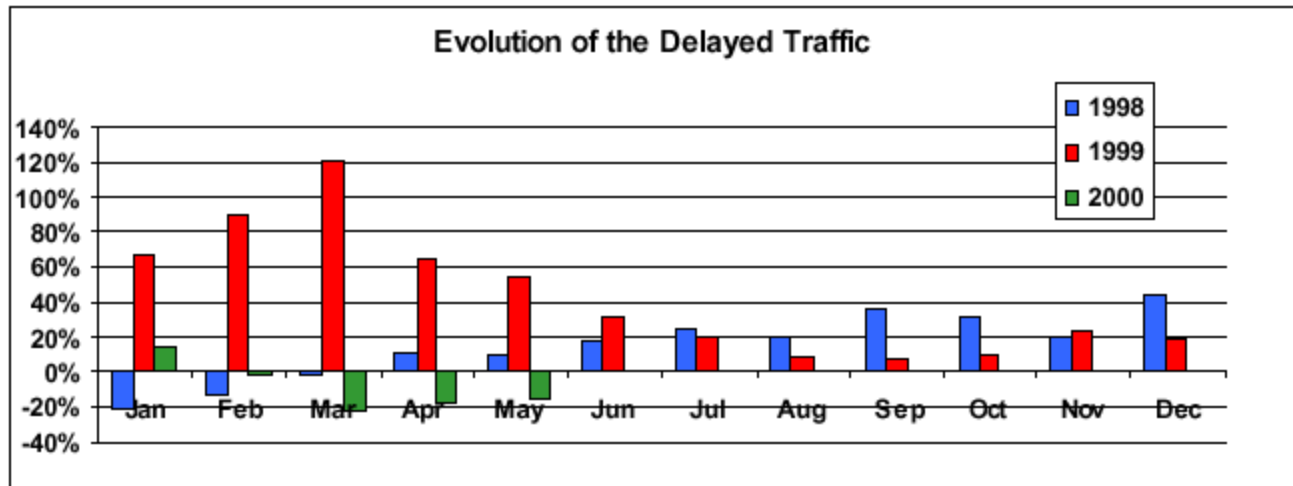
# Daily traffic in the CFMU area



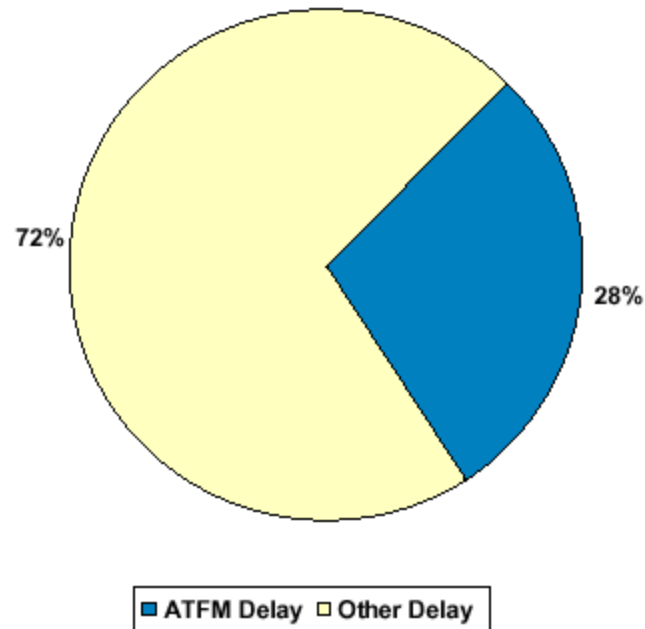
# Daily average delayed flights for ATFM purpose



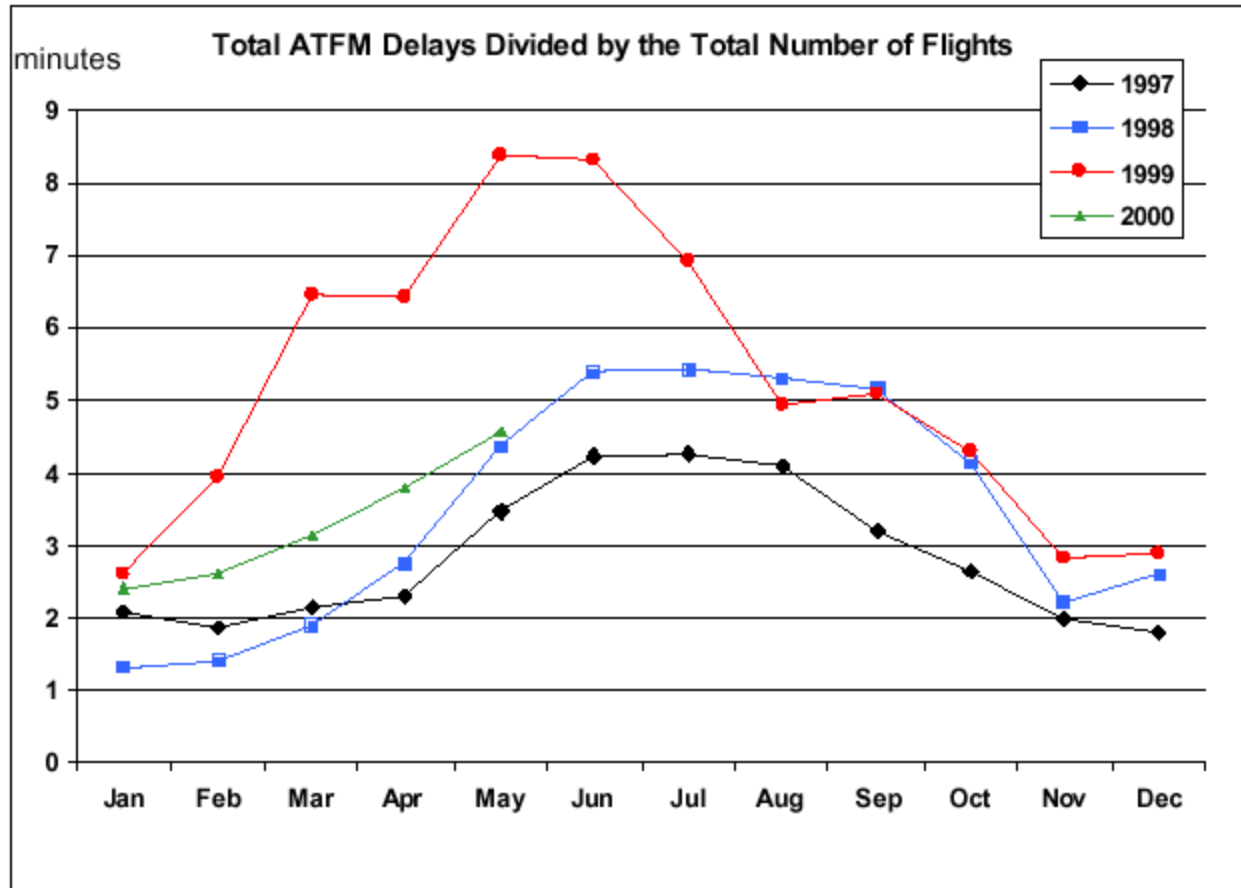
# Evolution for delayed traffic



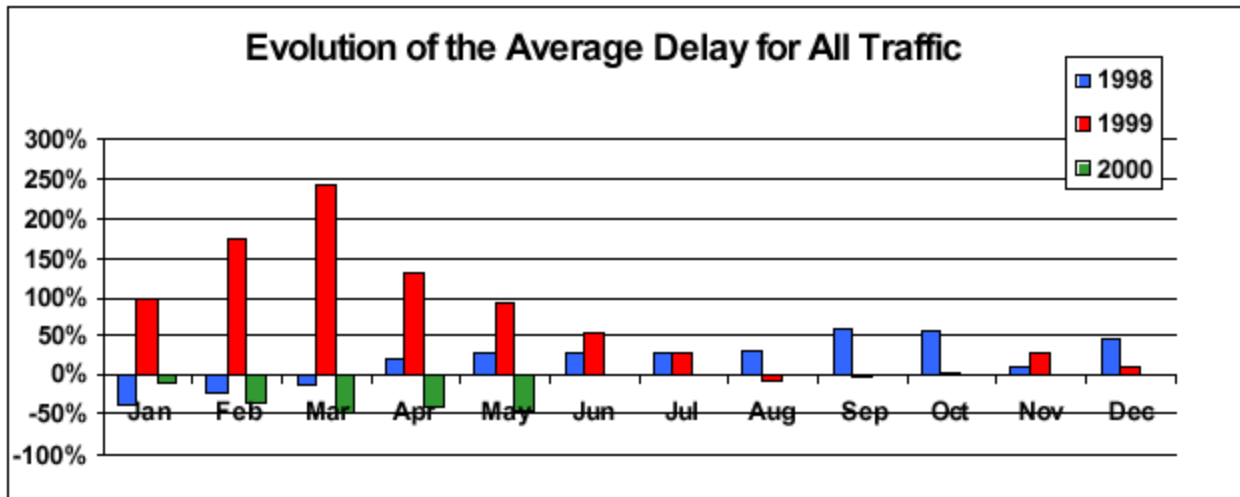
# Delays repartition



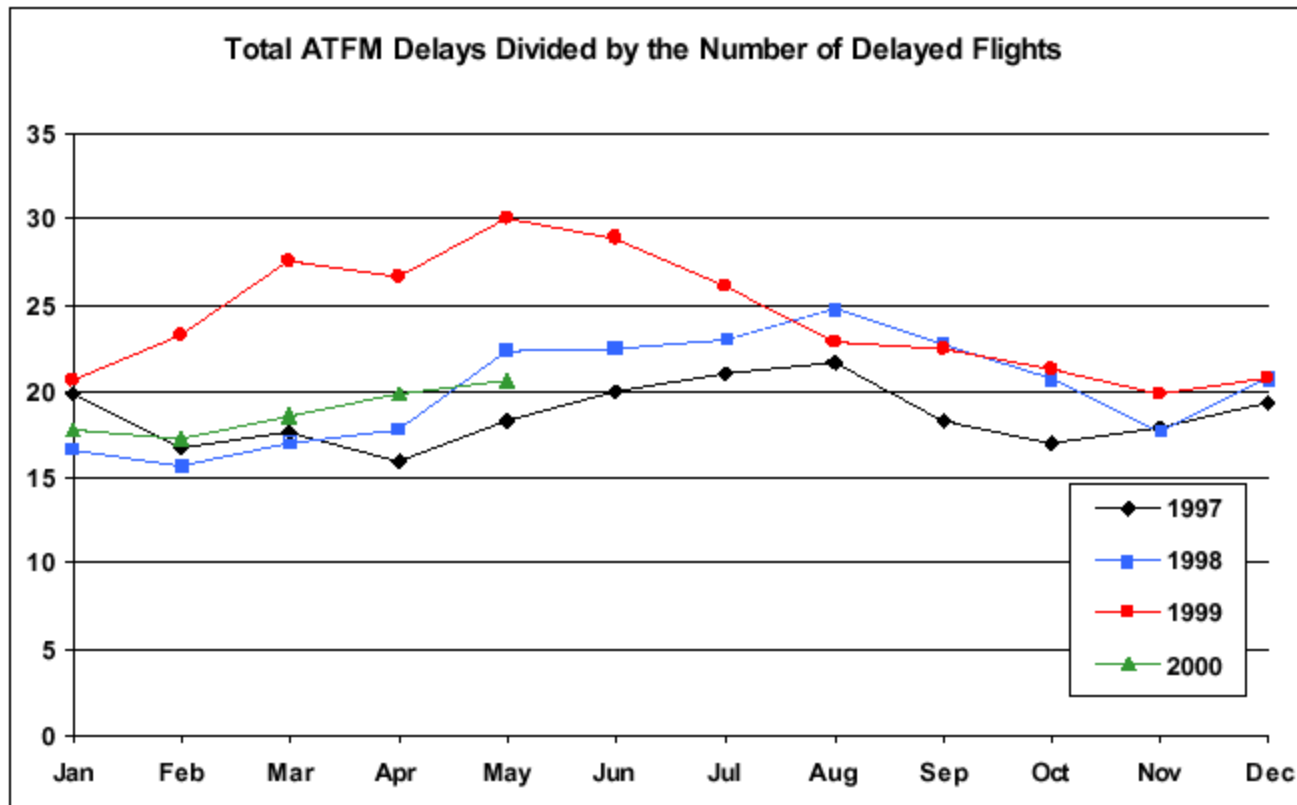
# ATFM delays by total flights



# Average delay for all traffic

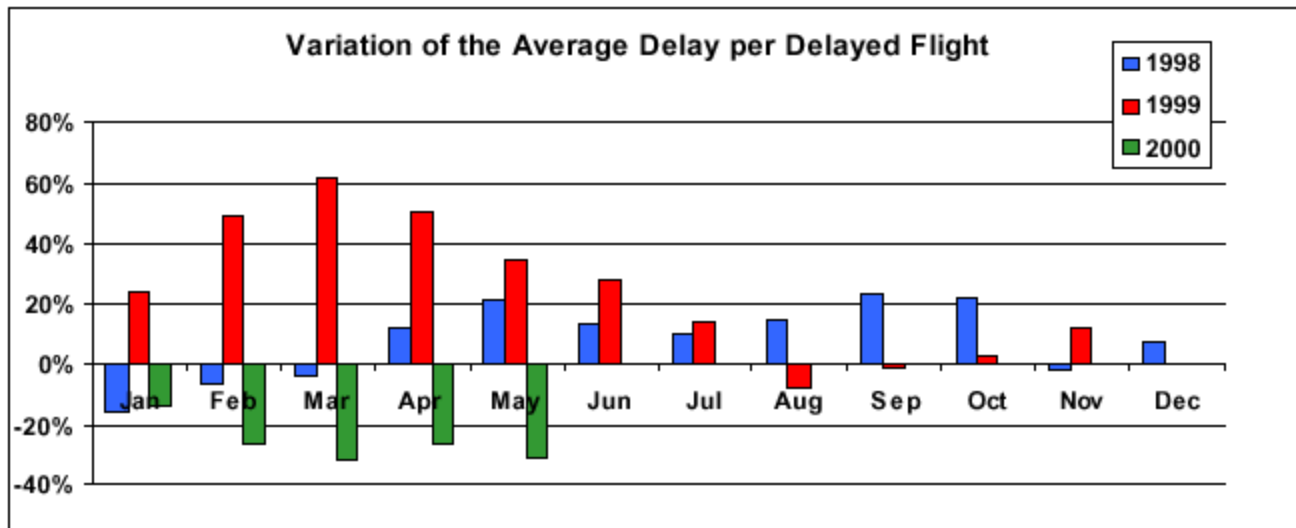


# ATFM delays by delayed flights

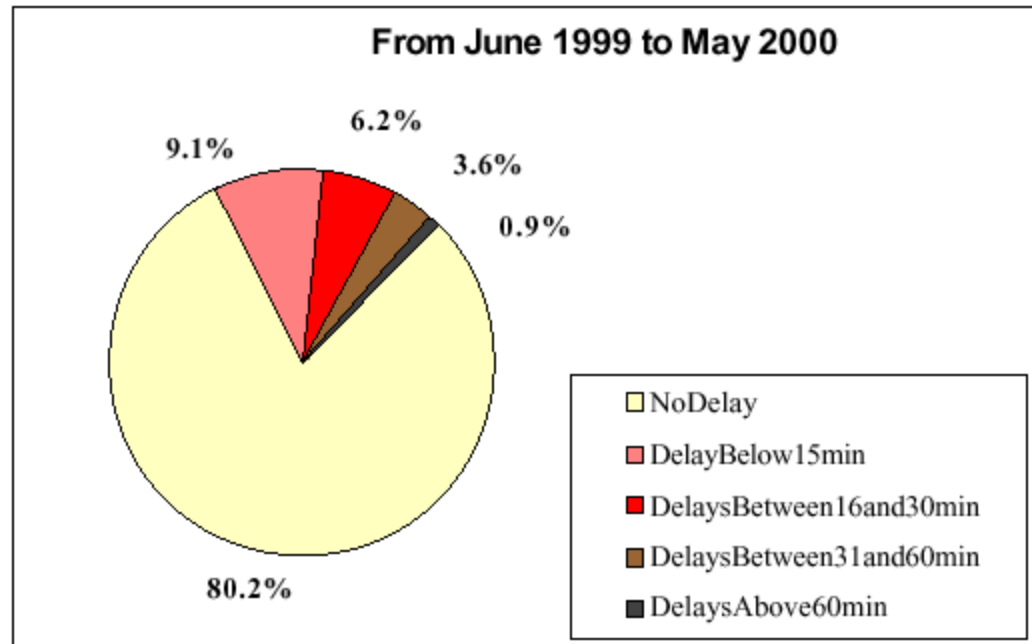




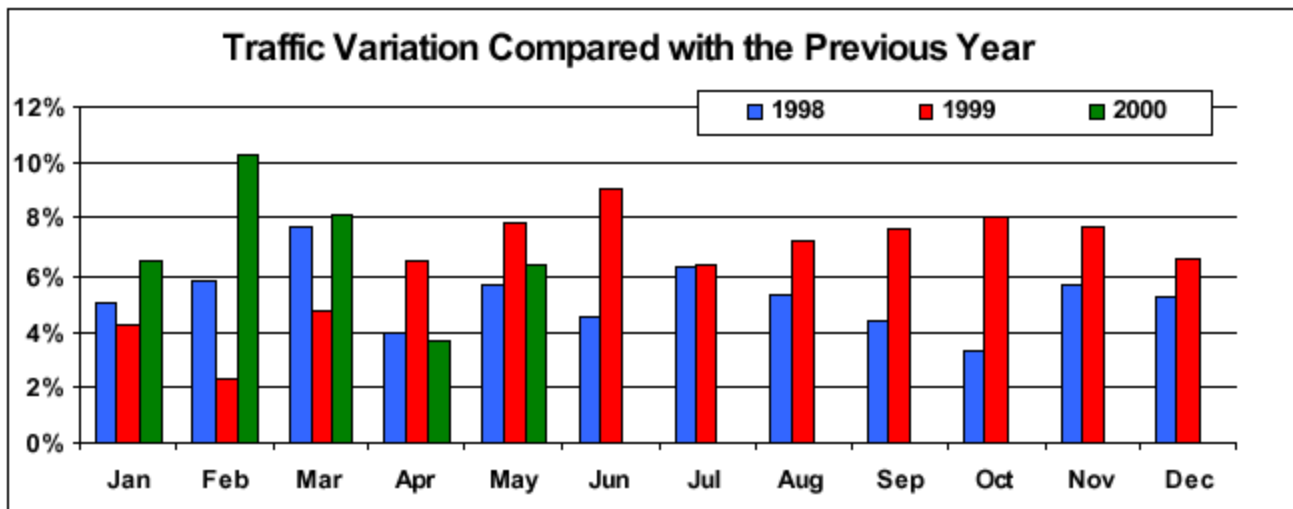
# Average delay by delayed flight



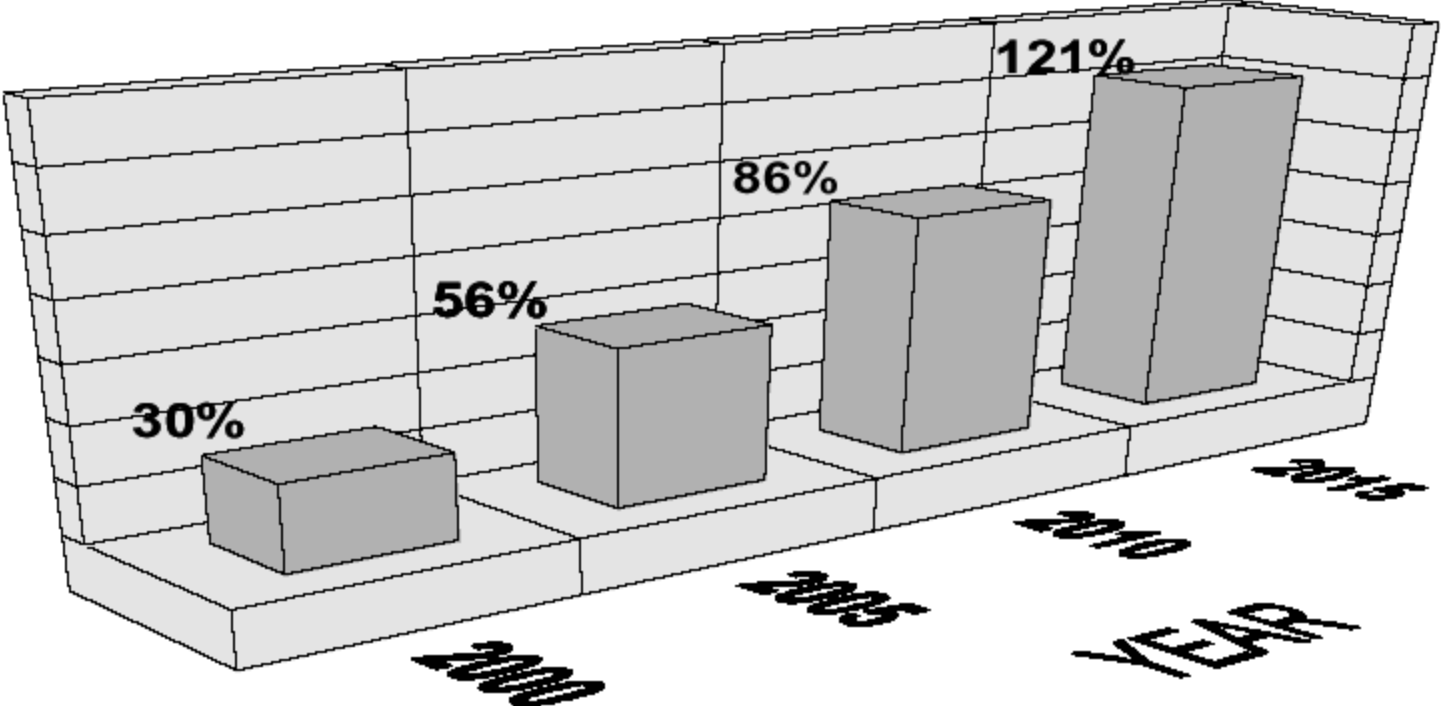
# Delay repartition



# Traffic evolution



# Traffic forecast



# Delays



Year	Sum 97	Sum 98	Sum 99
Traffic	3372	3557 (+5%)	3781 (+6%)
Delayed	623	753 (+21%)	929 (+25%)
%	18%	21%	25%
Delays	20 mns	23 mns	26 mns

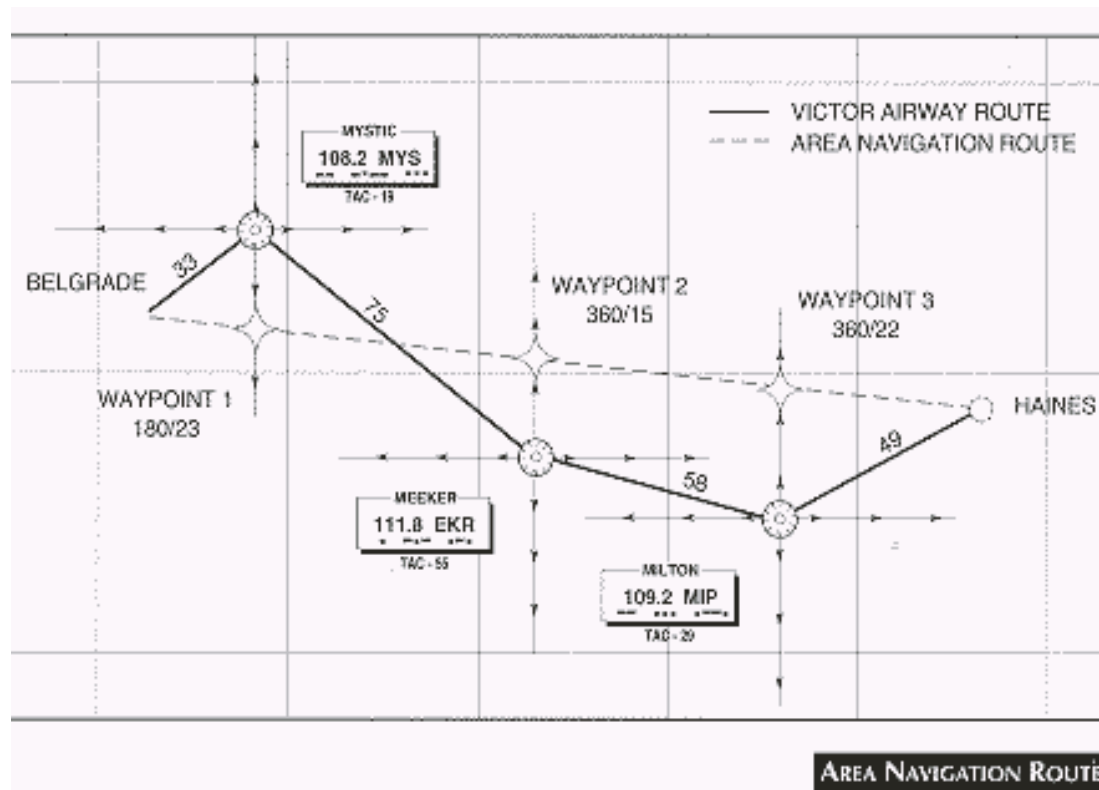
# Improvements



- ⌘ Navigation : Area Navigation (RNAV) and Reduced Vertical Separation Minimum (RVSM)
- ⌘ Flow management (Europe) : Control Flow Management Unit (CFMU)

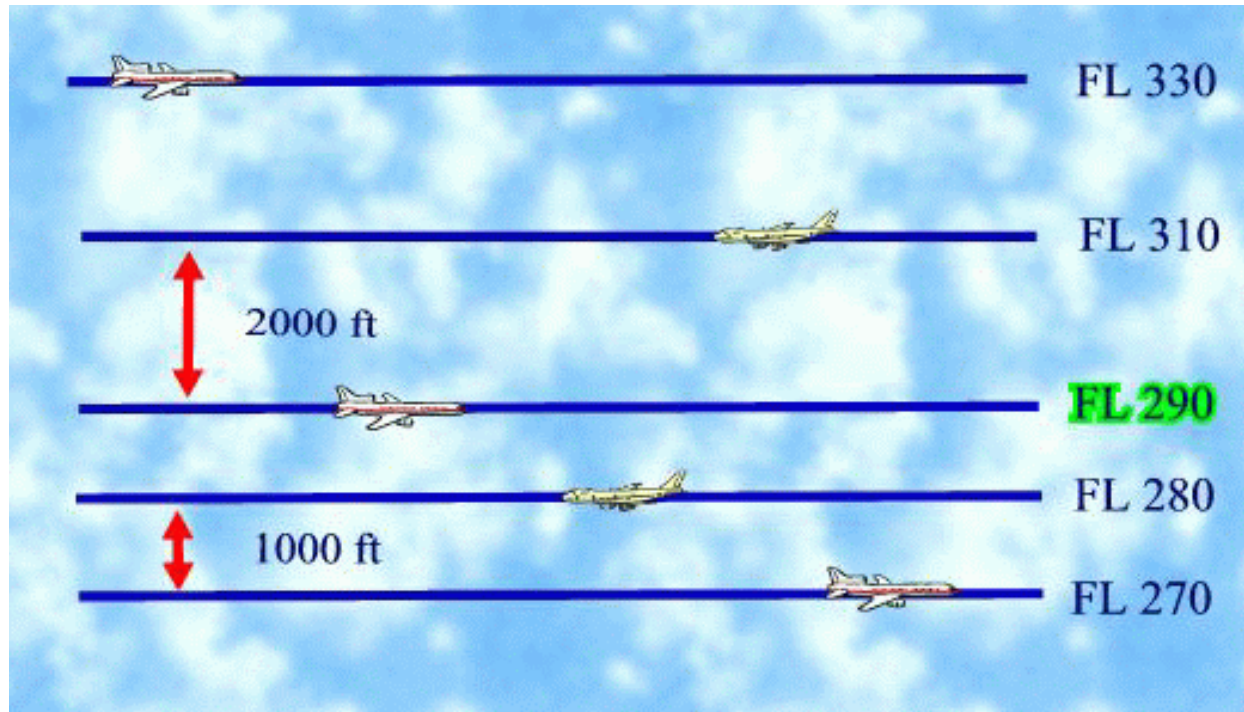
# RNAV

⌘ Permits aircraft operation on any designed course



# RVSM

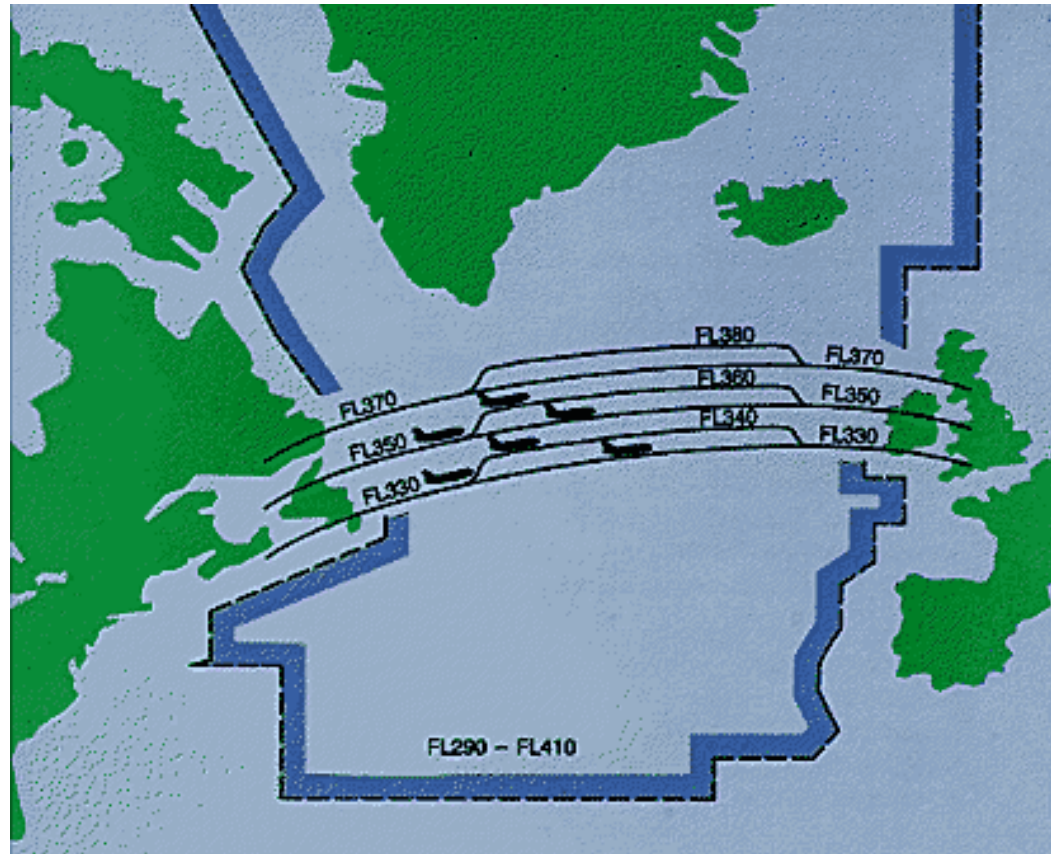
⌘ Reduced separation above FL290





# RVSM and RNAV

## ⌘ Application in the NAT zone

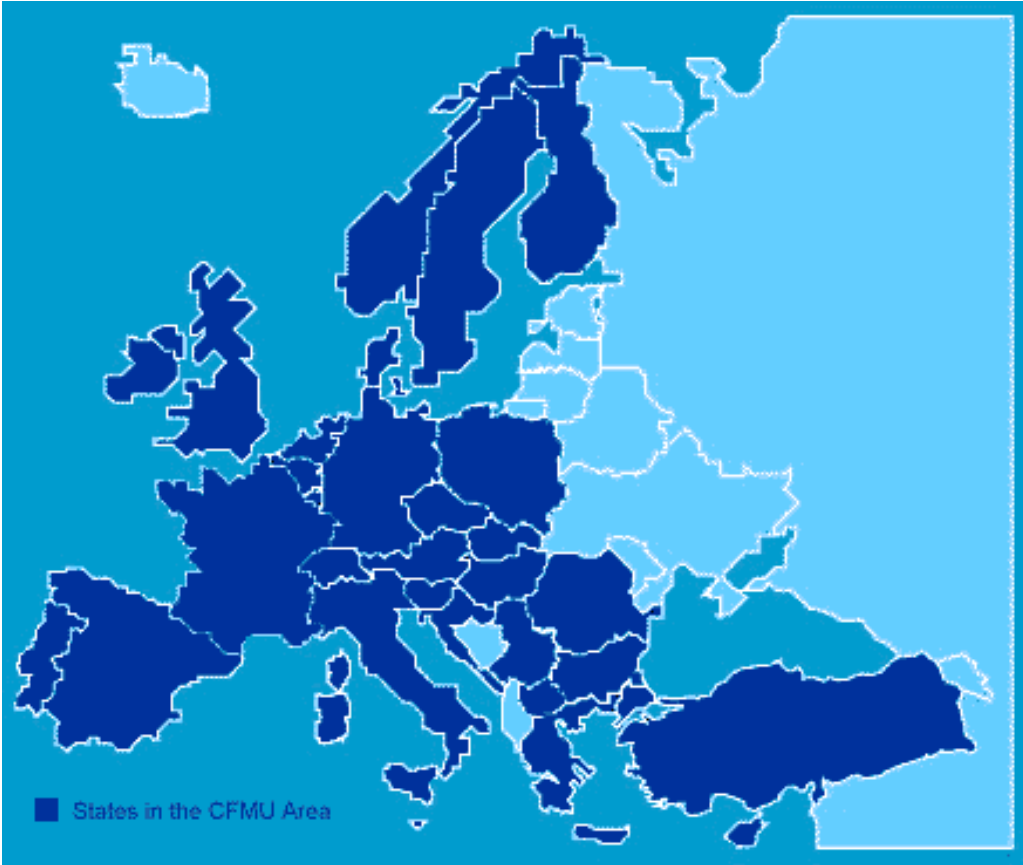


# CFMU basic facts

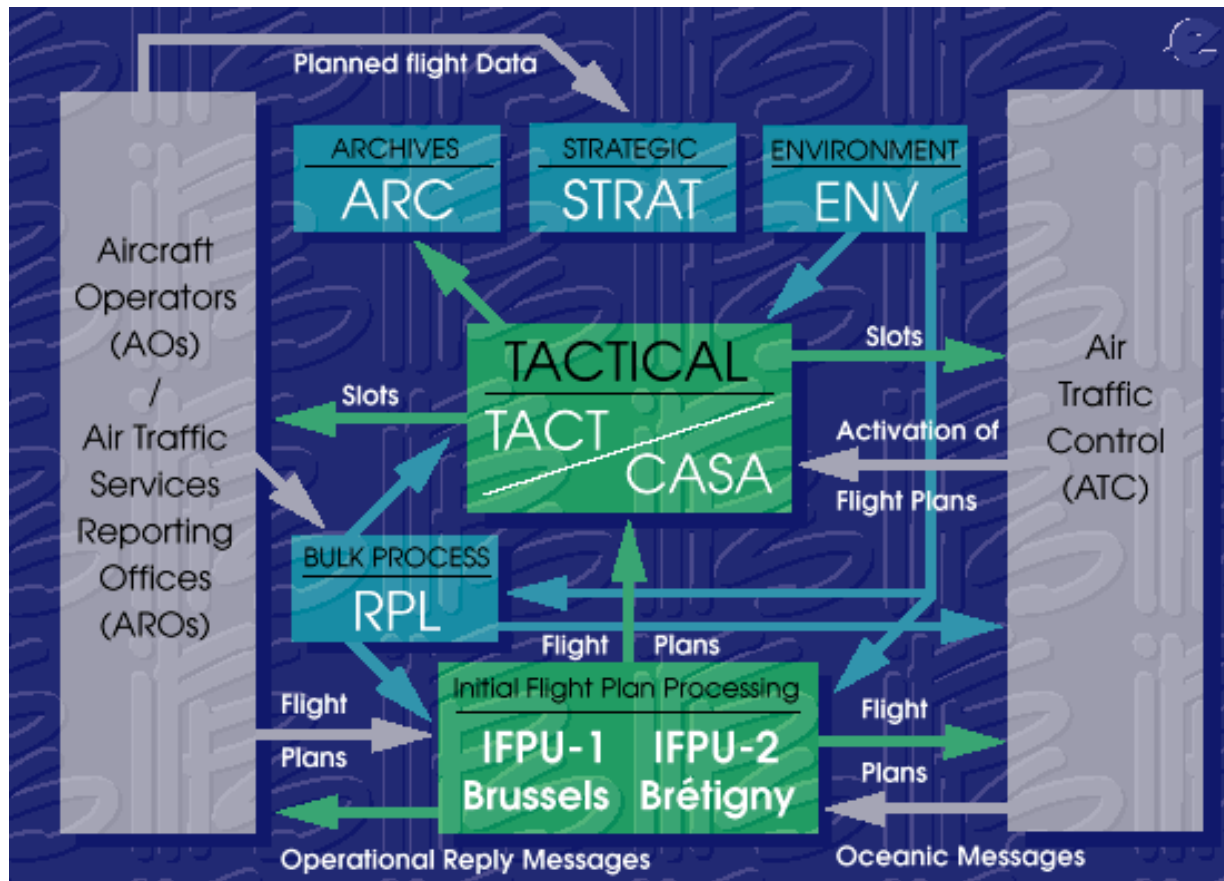


- ⌘ Regulatory and smoothing mechanism to avoid overloads
- ⌘ Try to maximize use of the airspace by dynamic flow managements
- ⌘ Operational around 1996
- ⌘ One Integrated Initial Flight Plan Processing System (IFPS) for all CFMU states

# CFMU Airspace



# CFMU system overview



# The Computer Assisted Slot Allocation (CASA) algorithm



- ⌘ Activated only when a sector is regulated
- ⌘ « Fair » algorithm : flights should arrive above the regulated zone in the same order they would have arrived without ATFM measures
- ⌘ When multiple slots are given, the most penalizing is used