16.72
Oceanic and International ATC

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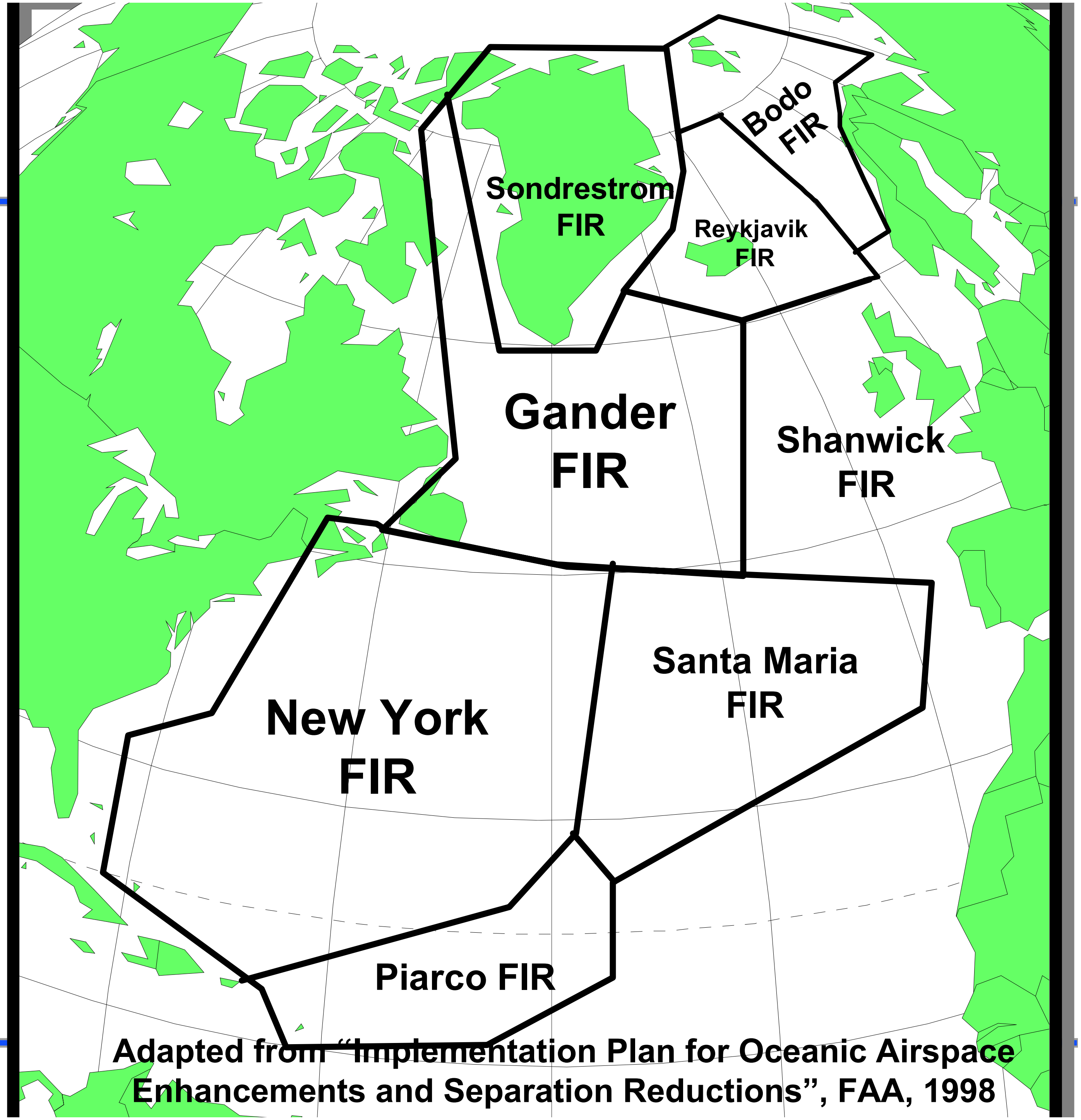
and others

MIT International Center for Air Transportation

Oceanic Attributes

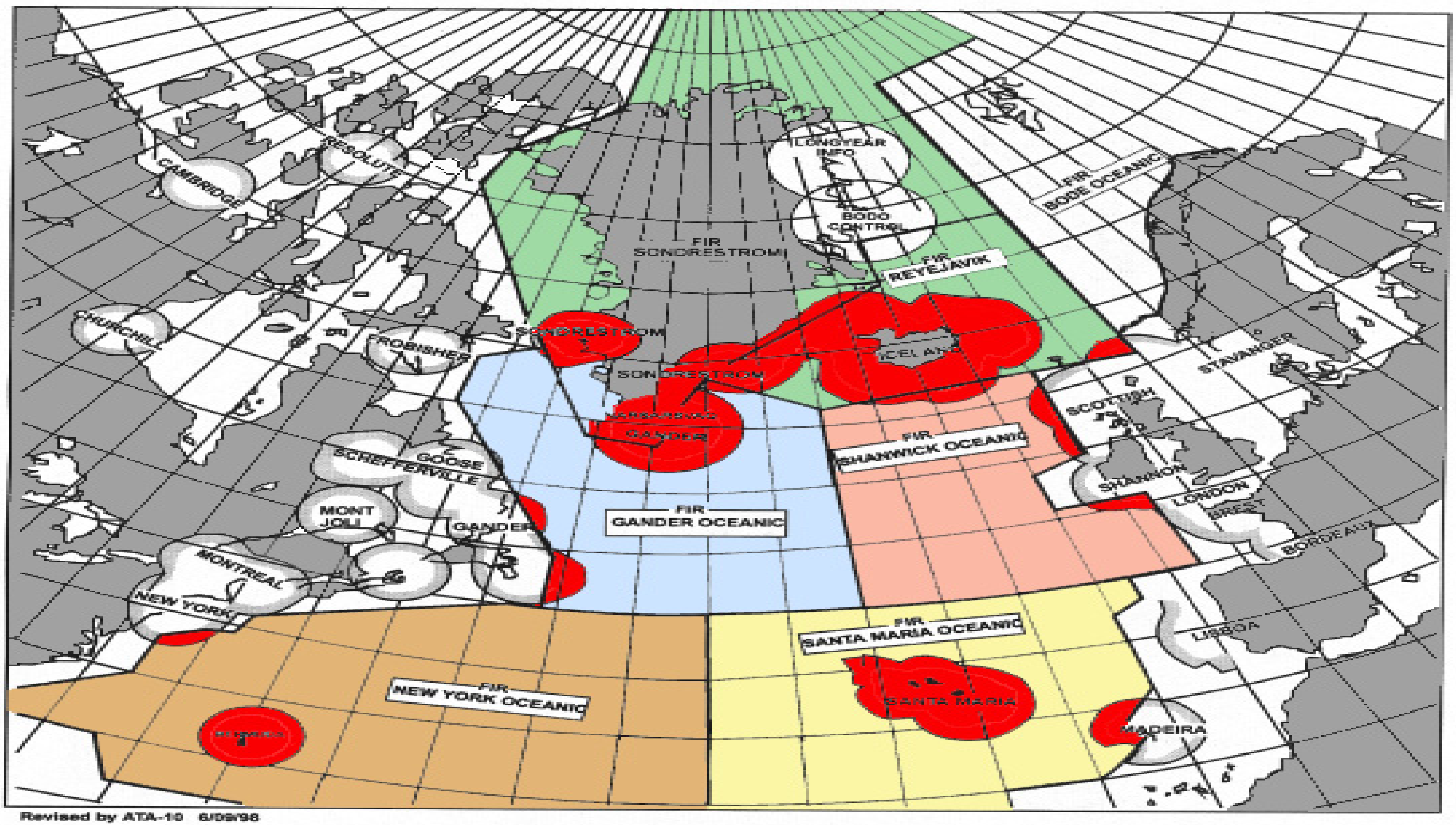
- **International**
  - ICAO Oversight
- **Low CNS Performance**
- **Generally Low Density**
- **Limited Diversion Opportunities**
- **Limited Weather Observations**

ATLANTIC OCEANIC FLIGHT INFORMATION REGIONS (FIR'S)



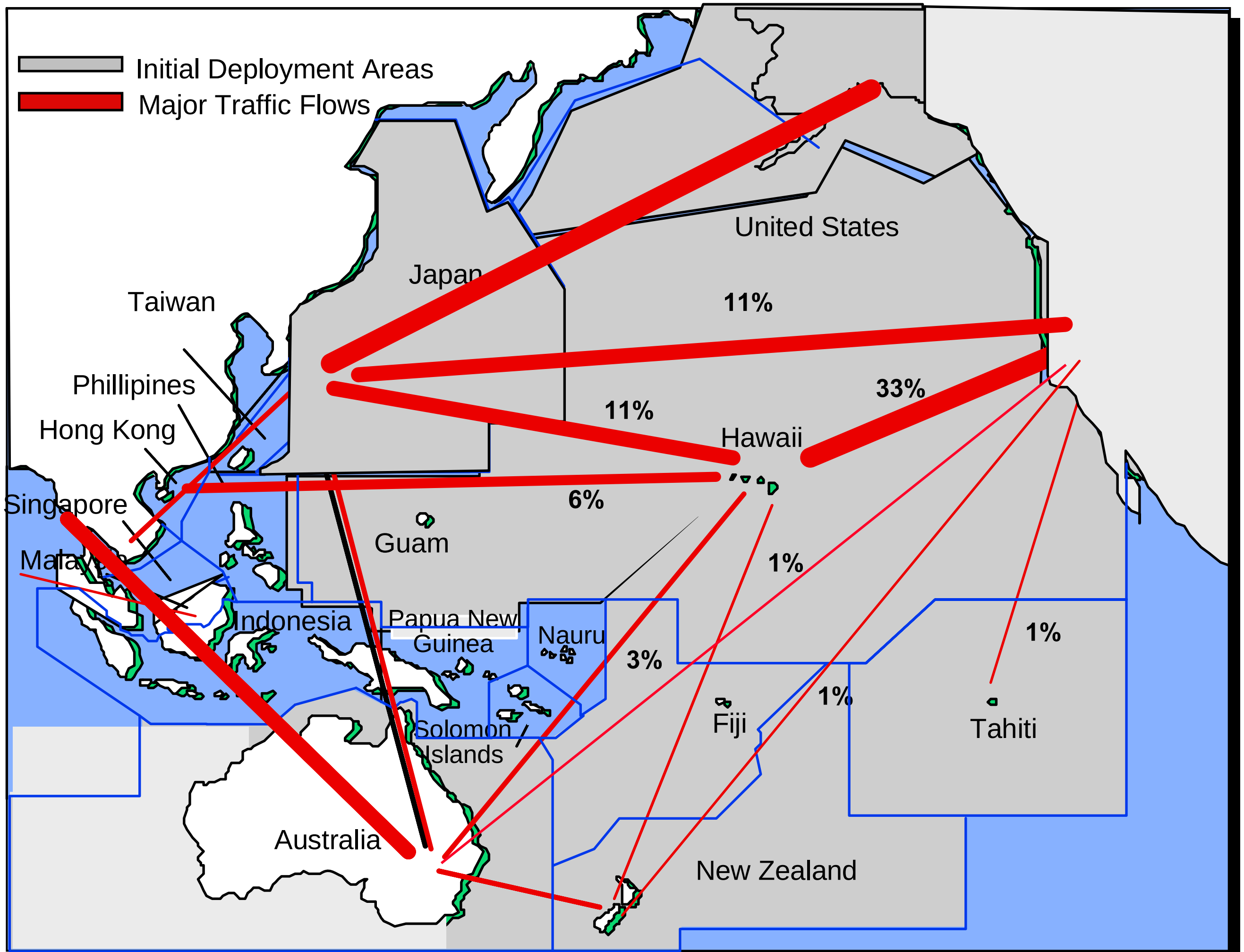
Adapted from "Implementation Plan for Oceanic Airspace Enhancements and Separation Reductions", FAA, 1998

MUCH OF ATLANTIC AIRSPACE OUT OF RANGE OF VHF & RADAR

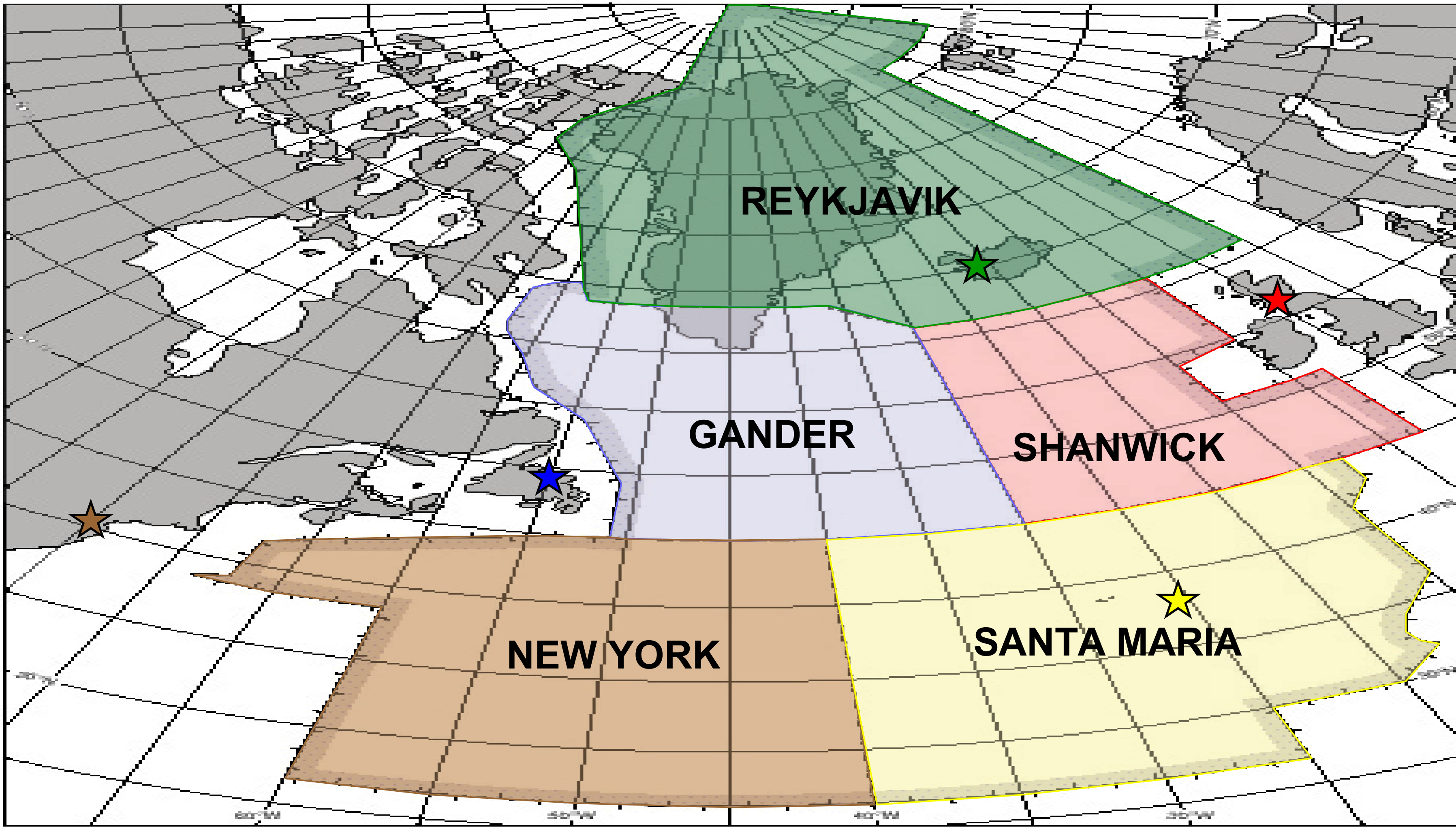


PACIFIC OCEANIC FLIGHT INFORMATION REGIONS (FIR'S)

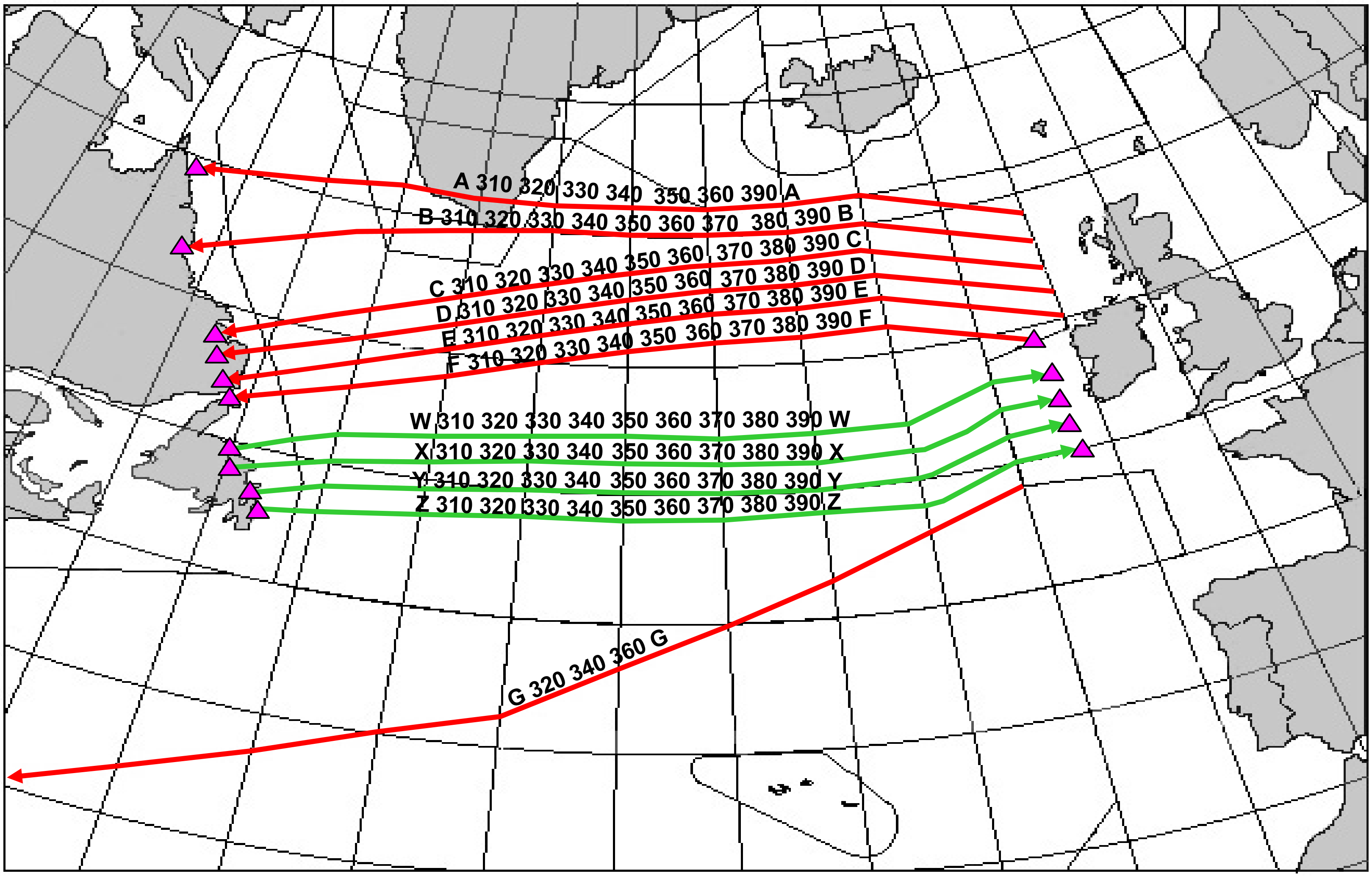
FANS Data Link Deployment Areas in Grey



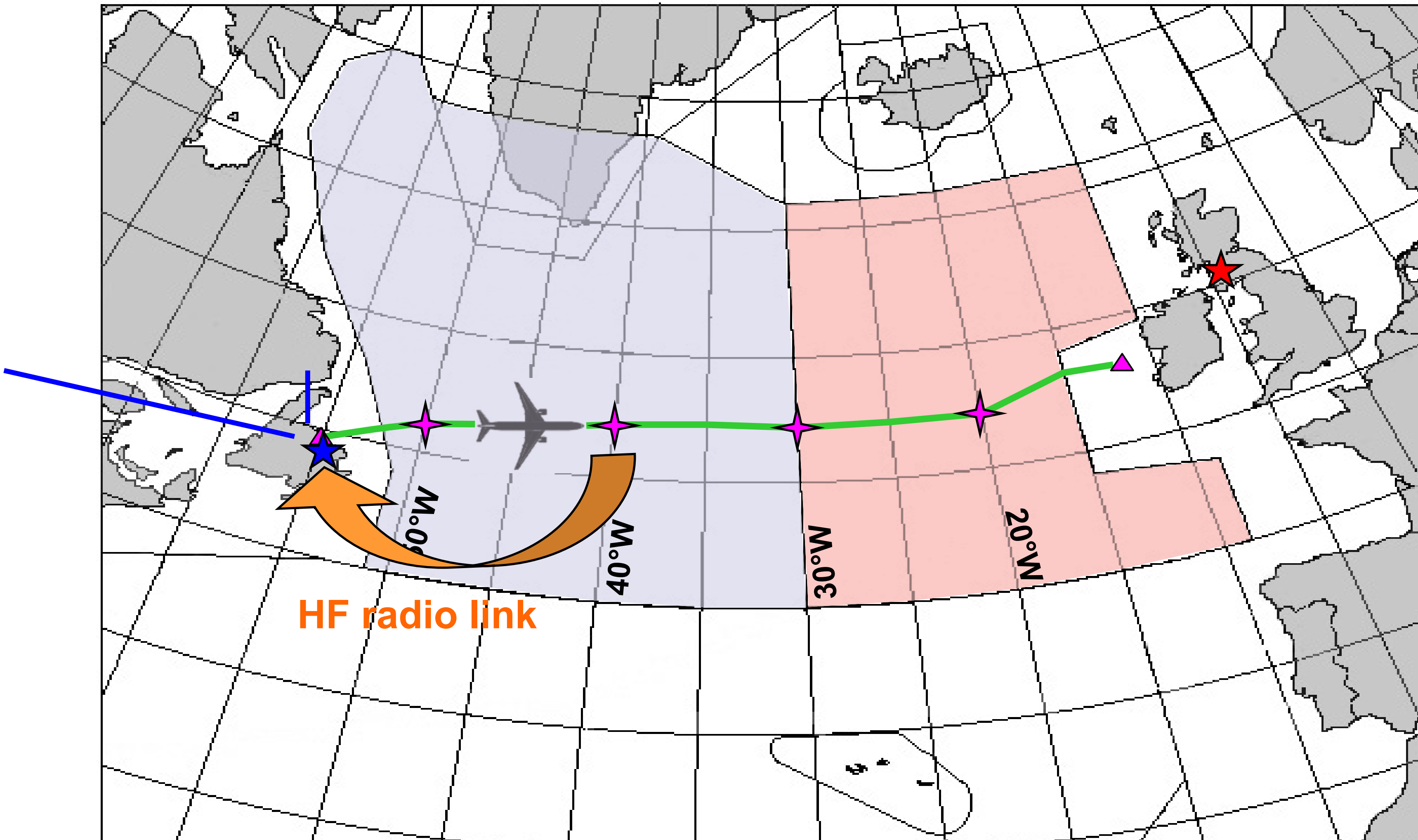
ATLANTIC OCEANIC AREA CONTROL CENTERS (OACCs)



NORTH ATLANTIC TRACKS



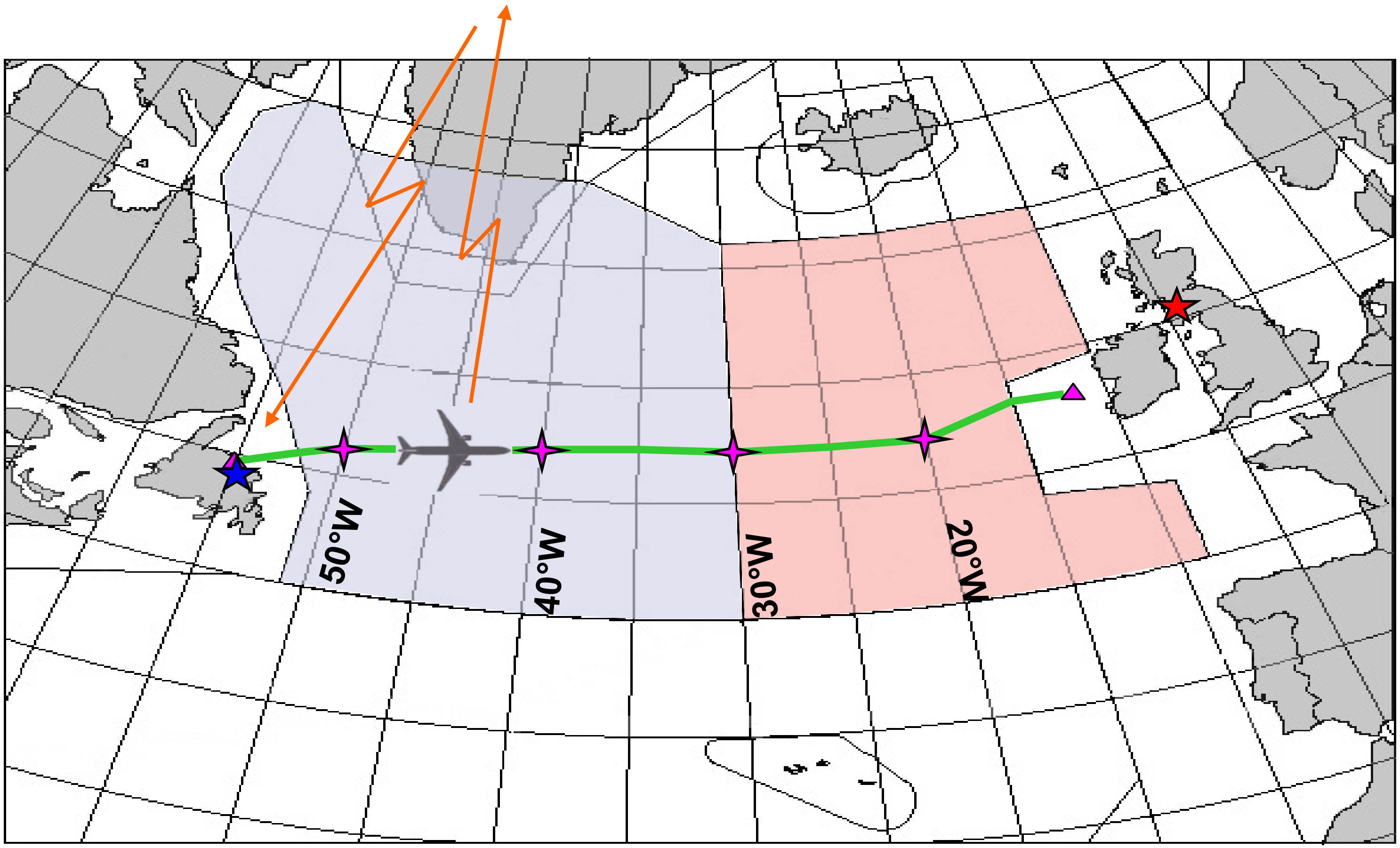
POSITION REPORT TO OACC EVERY 10° VIA HF RADIO



Ground controller receives position update from each aircraft about once per hour

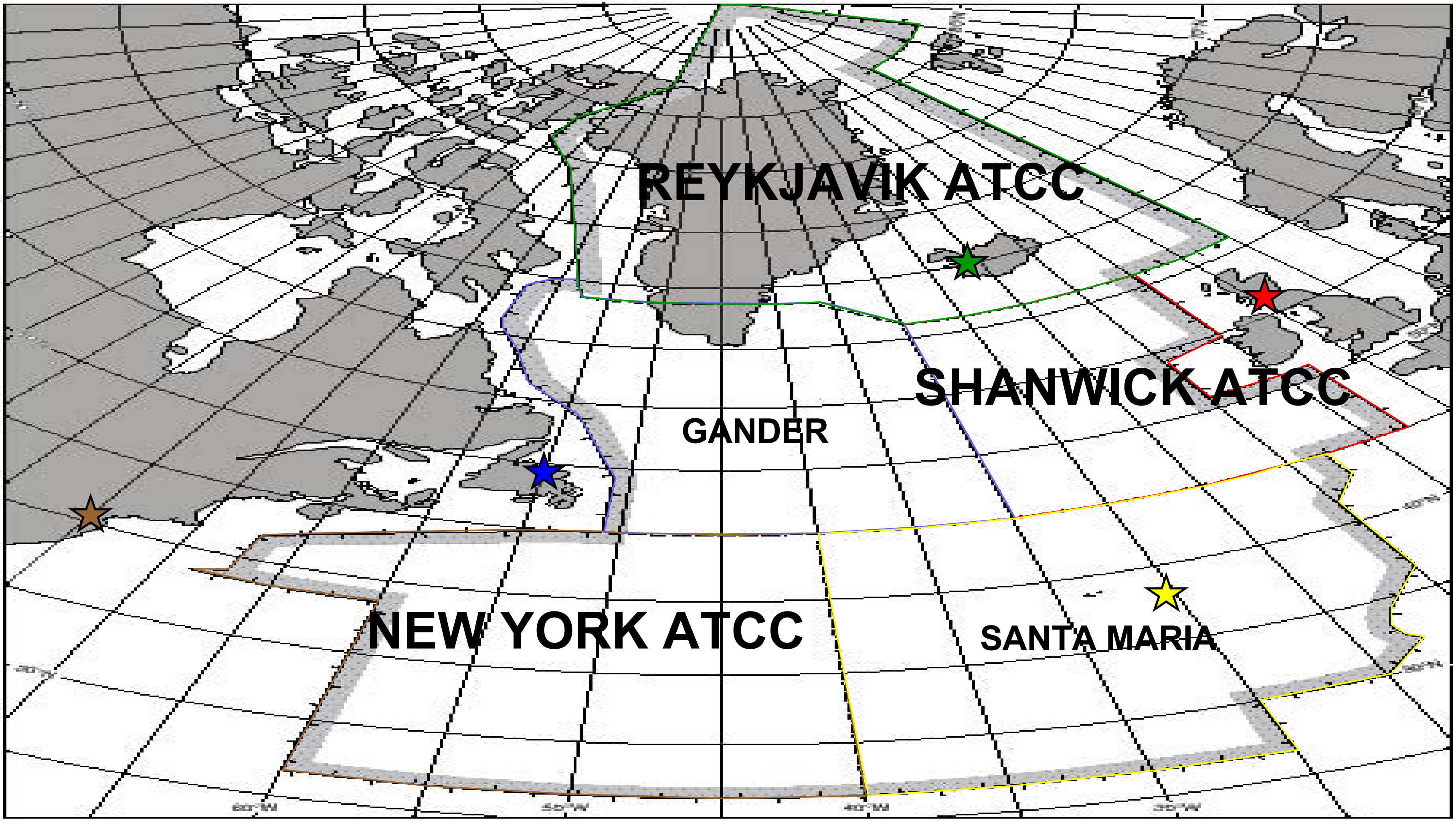
PROPOSED FUTURE OCEANIC: STATUS REPORTING TO OACC EVERY FEW MINUTES VIA SATCOM DATALINK

Communications satellite

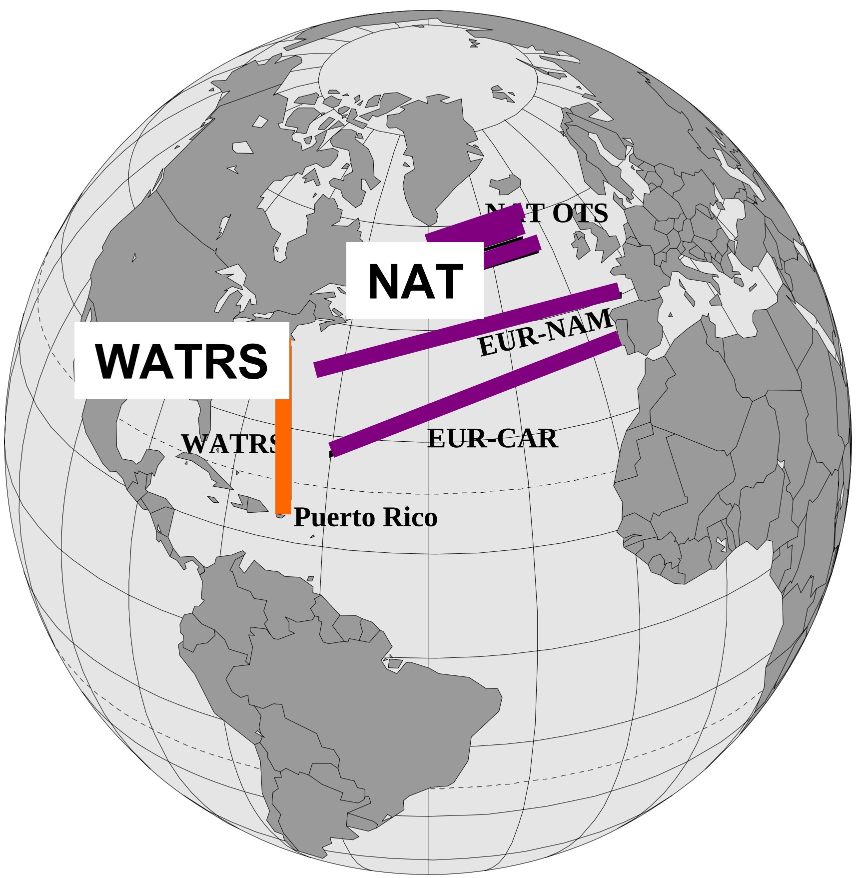


Ground controller receives position update from each aircraft about once per hour

Overview of Facilities



ZNY Airspace



NAT (North Atlantic Traffic):

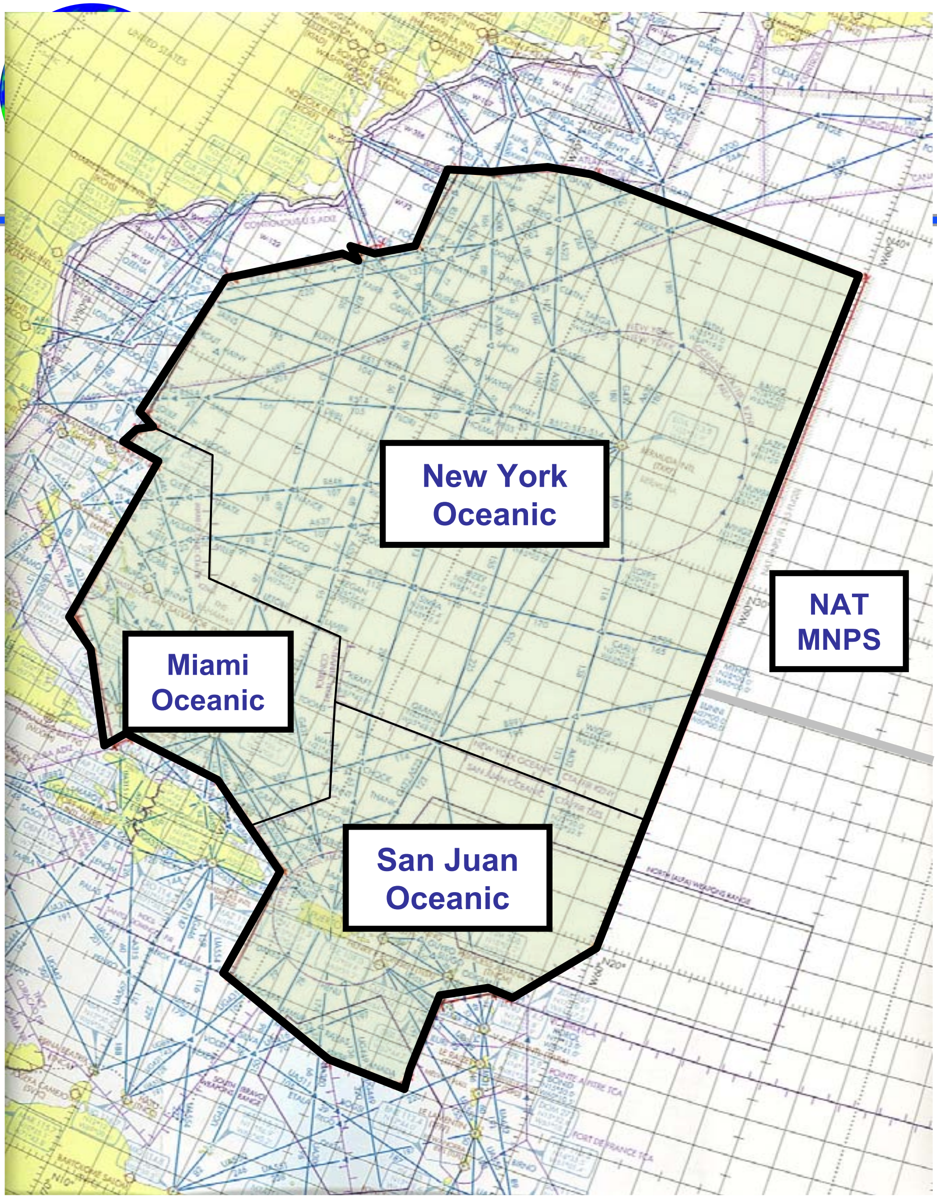
- Organized Track System (OTS)
- Iberian Peninsula to Caribbean/South America
- Random routes between Europe and North America

WATRS (West Atlantic Route System):

- Complex web of crossing fixed routes
- Heaviest major traffic flow - US east coast to Puerto Rico

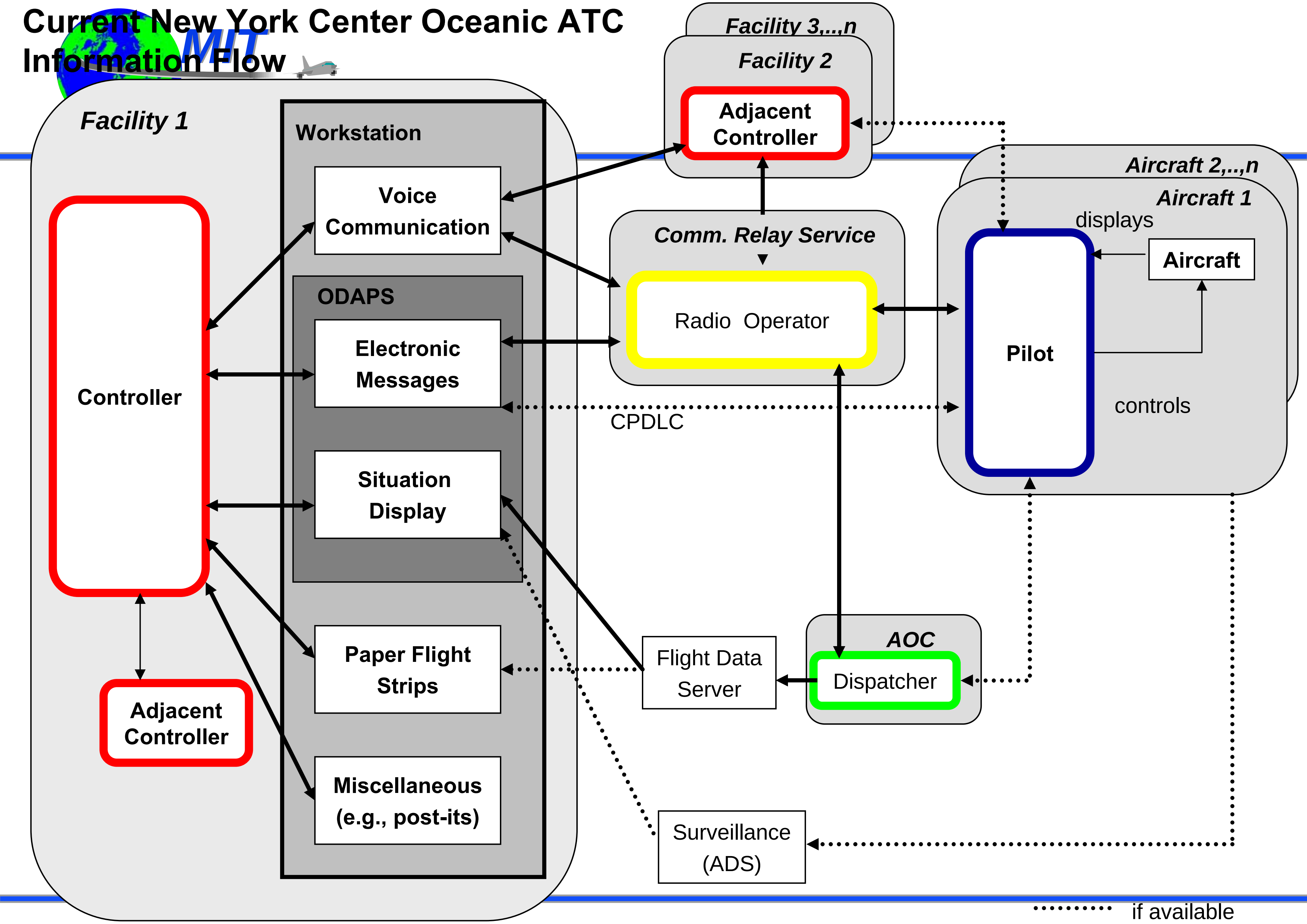
Adapted from “Strategic Plan for Oceanic Airspace Enhancements and Separation Reductions”, FAA, 2000

WATRS Plus Airspace

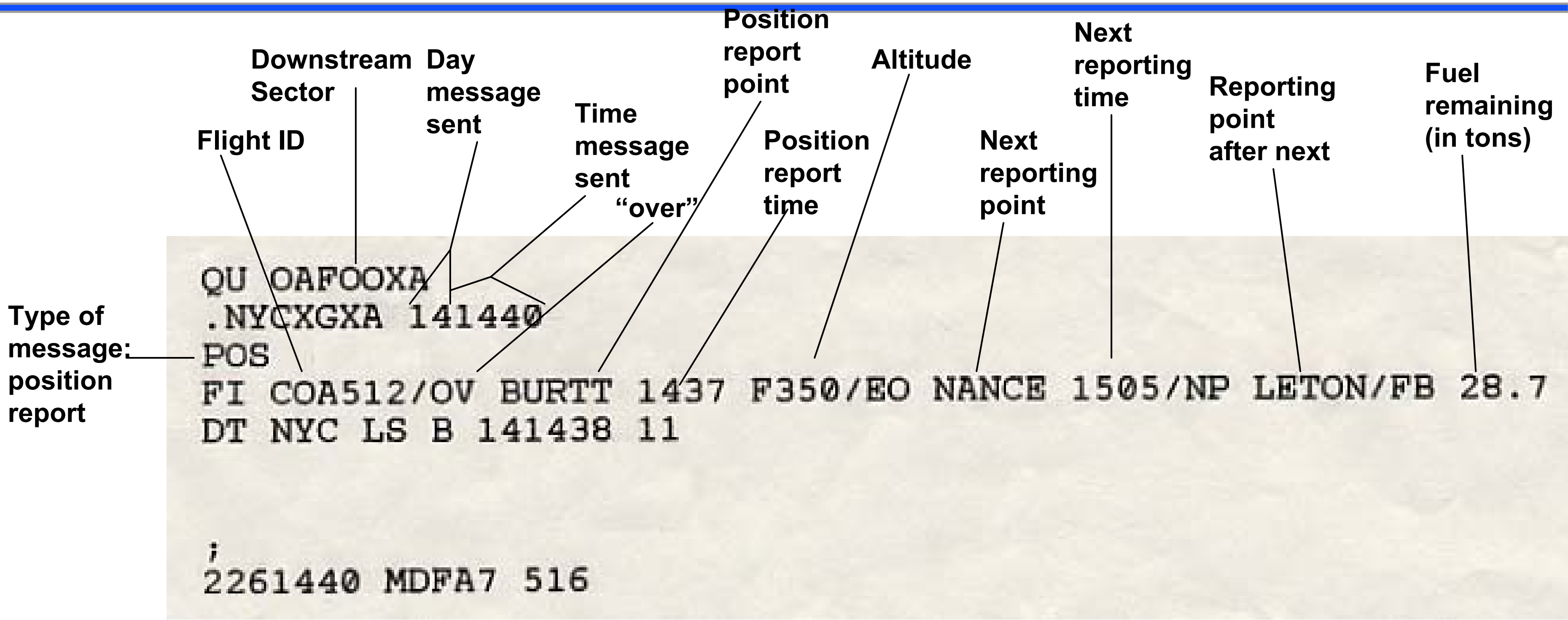


- Airspace being considered for oceanic lateral separation reduction
- Intended to show general location of WATRS Plus airspace
- Full WATRS coordinates posted at www.faa.gov/ats/ato/watrs.htm

Current New York Center Oceanic ATC Information Flow

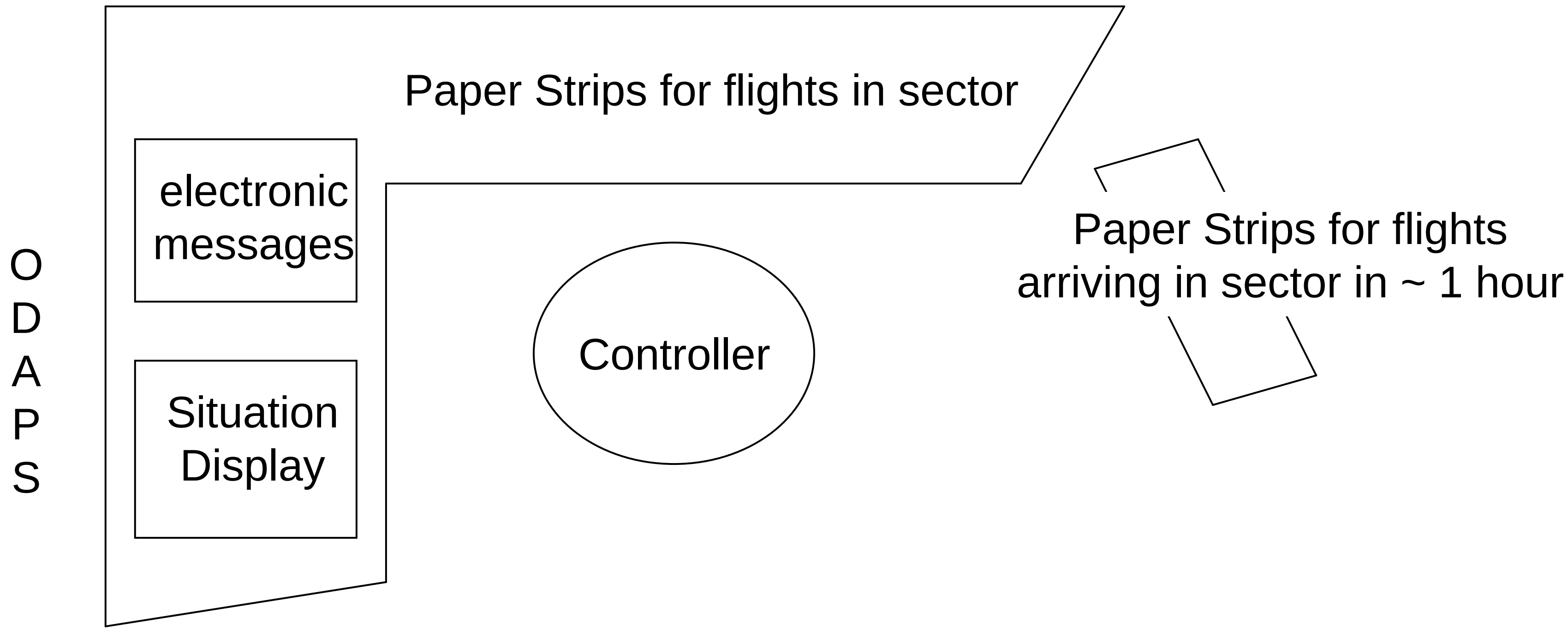


WATRS area ARINC message



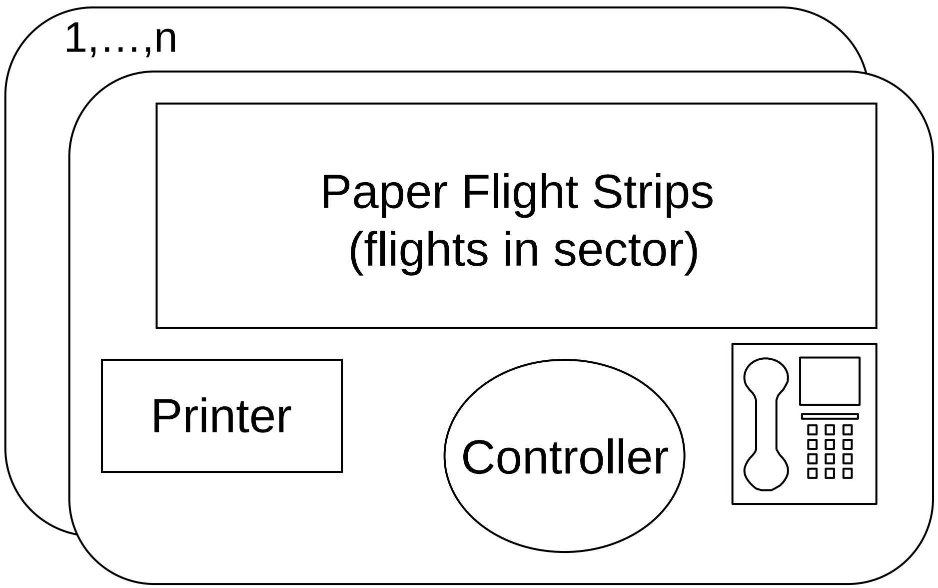
```
QU OAFOOXA
.NYCXGXA 141440
POS
FI COA512/OV BURTT 1437 F350/EO NANCE 1505/NP LETON/FB 28.7
DT NYC LS B 141438 11

;
2261440 MDFA7 516
```

Workstation: North Atlantic



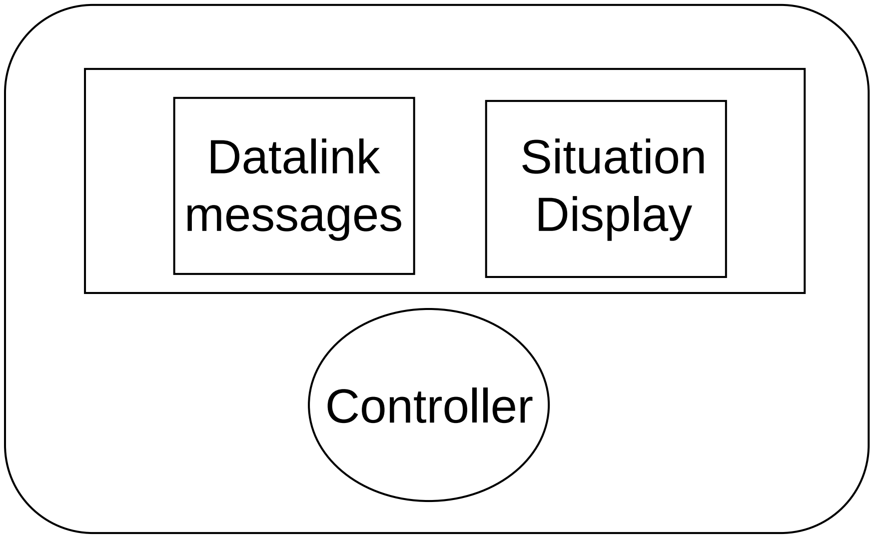
WATRS Workstations

Sector Controllers



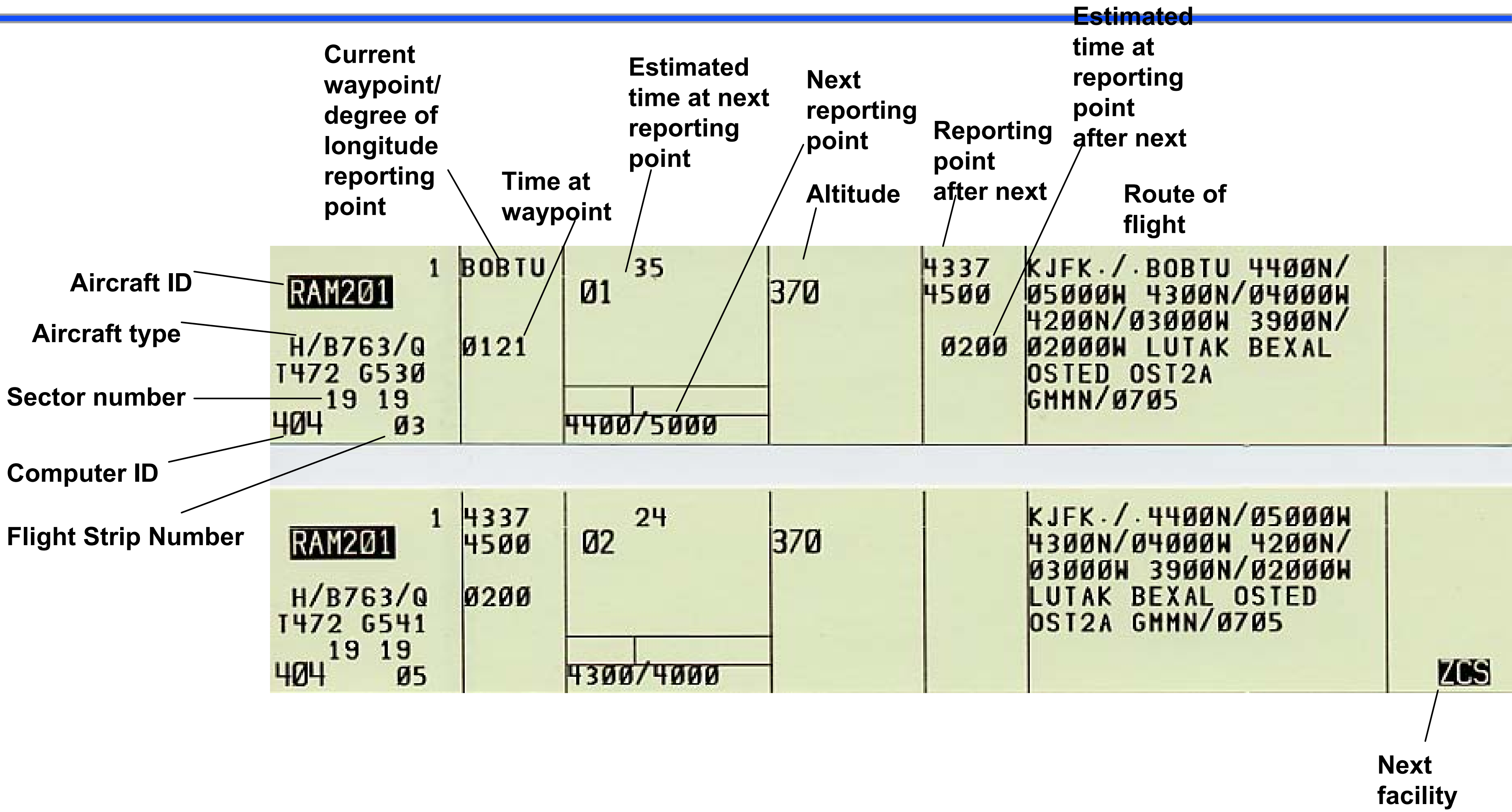
- Responsible for controlling aircraft in sector
- Communicates with pilot, ARINC, other controllers
- Resolves conflicts using grease pencil and map, because do not have access to Situation Display

ODAPS Controller



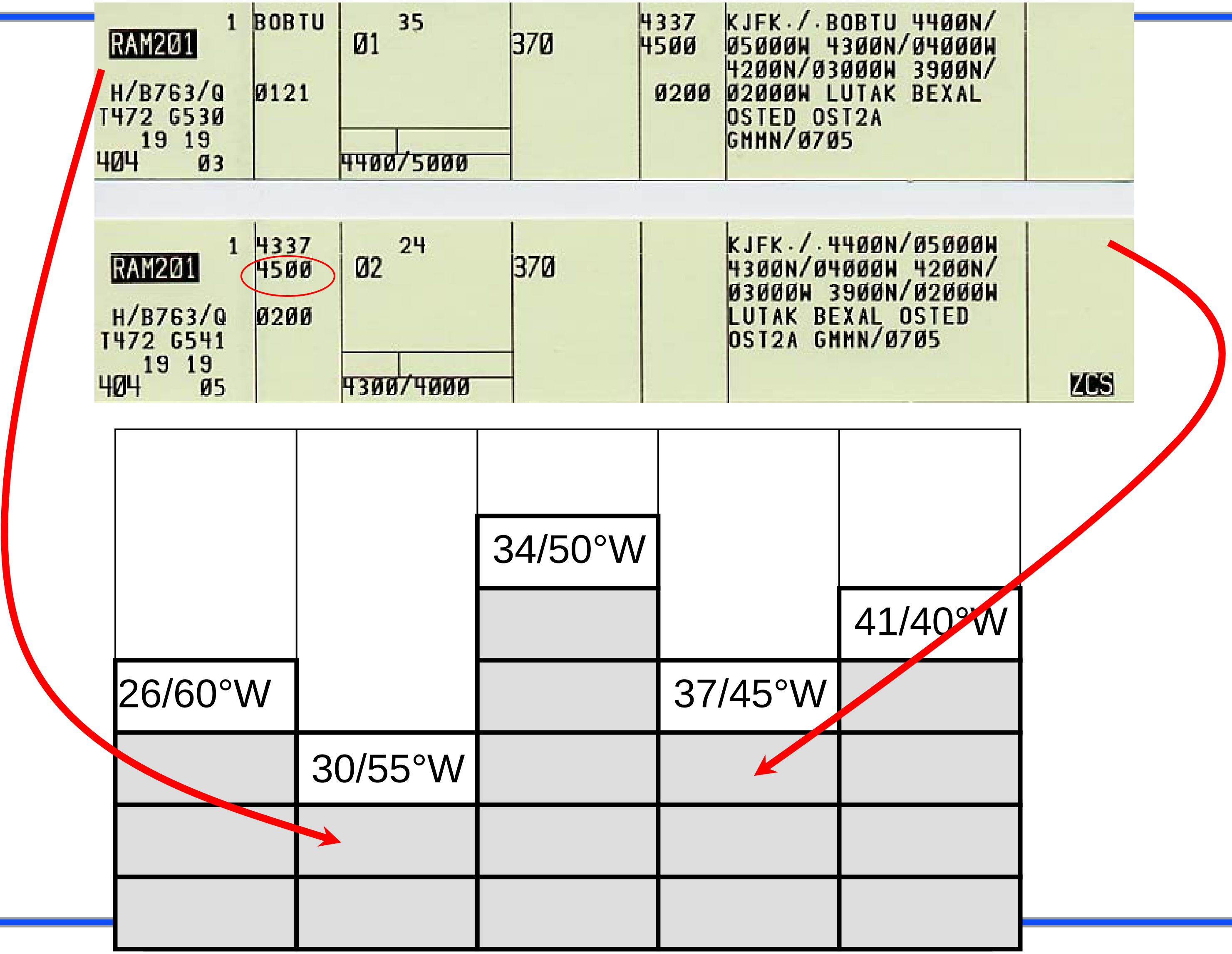
- Serve as a "safety net" to sector controllers
- Ensures conflicts alerts are being handled by sector controllers
- Confirm that all messages are received

NY Oceanic Flight Strip



Flight Strip Organization

- For a single aircraft there will be a flight strip for each longitudinal position on the strip bay that the aircraft traverses (e.g., 4 strips for this aircraft on this strip bay, since it enters at 55°W)



ATOP-Situation Display

Comments by Controllers:

- Controllers will use Situation Display instead of strips for separation
- ADS information will be displayed (and have priority over position reports, if there is a discrepancy), but radar information will not be displayed until Build 2
- Can click on multiple aircraft to view distance between them (cannot view time between them)

MIT ICAT

ATOP Datablock

switched if aircraft is climbing

(Callsign)
(Actual Altitude) ↓(Cleared Altitude)
(Mach Number)

- can add other information to datablock, such as:
  - ground speed
  - sector #
  - …
- Controller will be alerted on datablock when new coordination is received and will be able to click on datablock to receive coordination information
- Datablock will flash when there is a conflict

ATOP Overview

- **Based on New Zealand System (changed for sectorization)**

Schedule:

- ☐ Just beginning training of first controllers
- ☐ Implementation planned for Summer 2004

Changes due to automation:

- ☐ Controllers will use spatial *Situation Display* for separation instead of electronic *flight strips* (Reasoning: ATOP is more accurate than ODAPS and has more tools to assist controllers)
- ☐ Automation determines *when* events will occur, as opposed to *where*
- ☐ Before Clearances are administered, they are automatically probed and alerts the controller of any conflicts

What procedural changes do you anticipate because of this implementation?

- ☐ Controllers will be made aware of conflicts further in the future, which will make their coordination more efficient
- ☐ Moving towards 30nm lateral separation

Coordinating Hand-offs

- **Standard Operating Procedures say that hand-offs must be coordinated before the aircraft reaches the boundary of sector**

- **Letters of Agreement with adjacent facilities more conservatively specify how far in advance hand-offs need to be coordinated with each facility:**
  - ☐ Santa Maria: > 1 hour
  - ☐ Monkton: > 1hour
  - ☐ Gander: > 1 hour
  - ☐ San Juan: <1 hour, > 45 mins
  - ☐ Piarco: >45 mins

Estimate Used for Separation

- Controller is responsible for separating based on CENTER'S ESTIMATE of time at waypoint
- If pilot's estimate is significantly different from center's estimate, controller will ask the pilot for his or her estimate again (if pilot's estimate is > 3 minutes off of center's estimate, controller is required to re-coordinate)
- Controller may adjust center's estimate based on headwind information, however if there is a violation of separation, he will be held responsible based on center's estimate

WATRS Plus Draft Proposal

- Draft route redesign proposal formulated by FAA TF
- 50 – 75% increase in route options
- To be presented at NAT/CAR Working Group Meeting September 19 – 21 in Miami

Taskload

How many aircraft can you handle at a time?

- Radar: 18-20
- Oceanic: ~40
- Most ever handled by controller: 65 (could not honor any requests)

What is the hardest sector?

- radar – reduced separation, not as much time as non-radar
- WATRS (as opposed to North Atlantic) – traffic is more dense with more crossings
- North Atlantic – have to use latitude and longitude coordinates as opposed to the fixes used in WATRS
- south sector in WATRS – traffic is more random

North Atlantic Track Planning

- **Get major airlines routes (for 8 major city pairs) for the next shift from airline flight plan database**
  - write route information into a spreadsheet: degrees of longitude consistent– latitude & altitude for every 10 degree of longitude
- **Get computer estimate of track location, based on routes and jet stream - shown in red**
  - fill into same spreadsheet
- **Get Gander's tracks via phone (or Shanwick's tracks for night)**
  - Negotiate altitude if certain altitudes are needed for crossings
  - Plot Gander's tracks on map with grease pencil
- **Choose tracks based on computer estimate and planned flights, more weight placed on major airline routes' flight plans, try to choose between two options**
- **Tell Gander of planned tracks and negotiate altitudes if Gander requests changes**
- **Plot next shift's tracks on map with grease pencil for the next shift's supervisor**

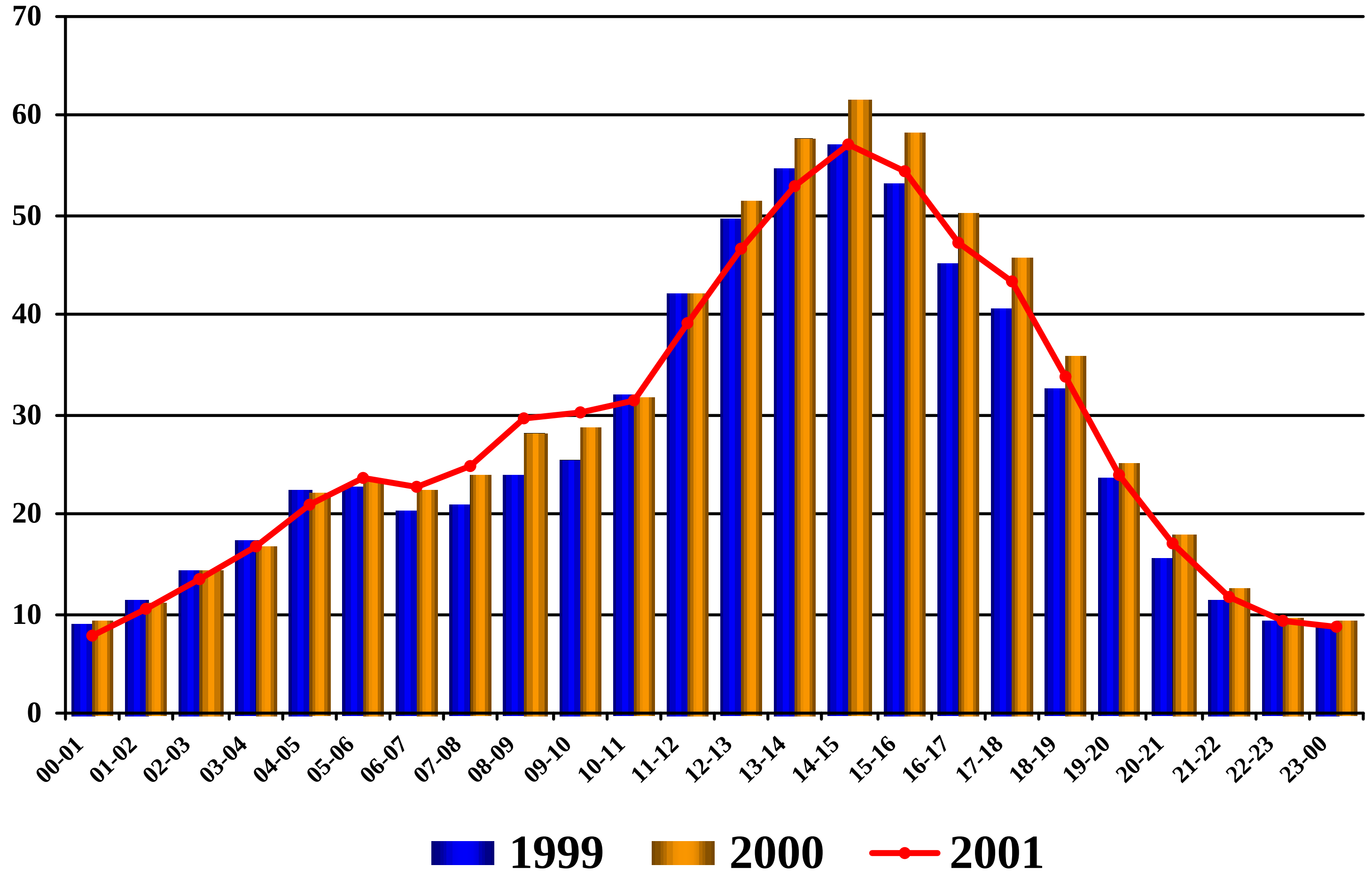
Emergencies

- **occur ~1/week**
  - ☐ on board medical emergencies (most frequent)
  - ☐ mechanical problems
  - ☐ natural occurrences, e.g., volcanoes

Hourly Distribution of Traffic

Daytime traffic flow: WESTBOUND

Nighttime traffic flow: EASTBOUND



Source: Helgi, Chief Controller of Reykjavik ATCC

Flight Data Processing System

Limitations cited by controllers:

- window view**: cannot get a snapshot overview of strips, have to scroll**
- trust:
  - new system
  - electronic information – have to print out paper strips in case of a breakdown
- nuisance warnings: **conflict warnings, coordination warnings, etc**

Electronic Flight Strips

- **Flight strip direction, time, and altitude groupings provide** structure-based abstractions **for controllers:**
  - Strip arrangement (position matrix) mimics traffic structure
  - Color represents direction of flight (westbound are turquoise & eastbound are yellow)

Situation Display

- **Graphically depicts extrapolation of aircraft path based on flight strip assumptions**
- **Not utilized as much as expected**
- **Currently, Iceland's Operating Procedures encourage use of Situation Display to assist in separation, but** require that controllers tactically ensure separation using strips
- **Controllers in mixed environment have to cognitively integrate** nearly continuous information **from radar screen with** discrete information **from Situation Display**

Emergencies

What are the most difficult emergencies? – 4 responses

- emergency decent - 2
- hijack – 2
- malfunction – 1

What do you do with aircraft?

emergency descent – blind transmit all aircraft on the frequency the situation and location of aircraft

hijack – get rid of all traffic in sector and don't accept any new traffic, continue to communicate with aircraft

flight malfunctions – determine location and update it as frequently as possible so that search and rescue can find exact position, or help it to land safely somewhere

What are the most common emergencies? – 5 responses

- medical emergencies - 3
- lose engine (~1/month) – 2
- emergency descent (icing, pressurization) – 2
- small aircraft lost – 1
- run out of fuel – 1
- overdue aircraft – 1

What do you do with aircraft?

medical emergencies – accept pilot requests and control aircraft (may need to drop fuel)

lose engine – pilot deems what he must do (follows rules and recommendations)

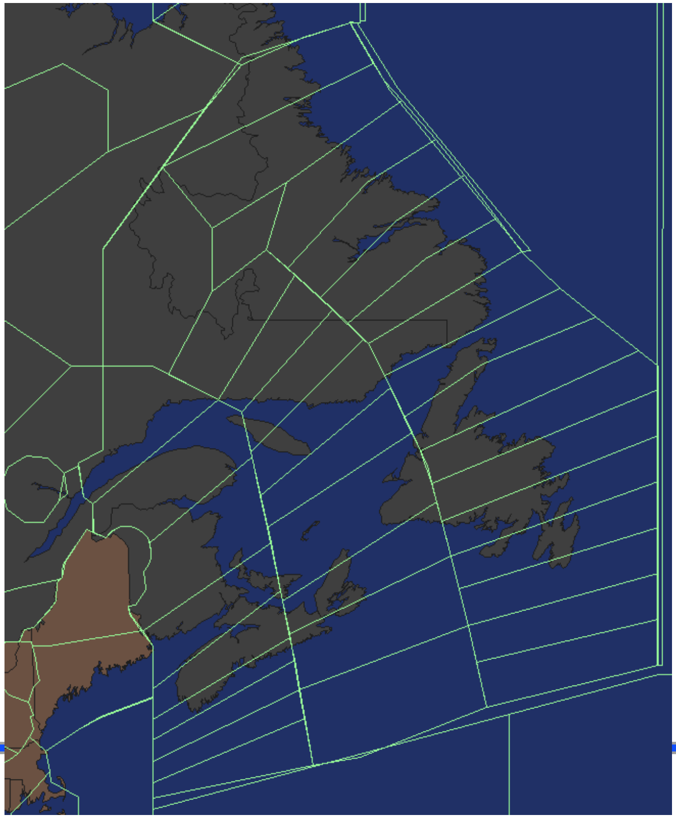
aircraft lost – send CAA plane out to look for them

run out of fuel – determine fuel amount from flight plan, give advice to pilot and pilot makes final decisions

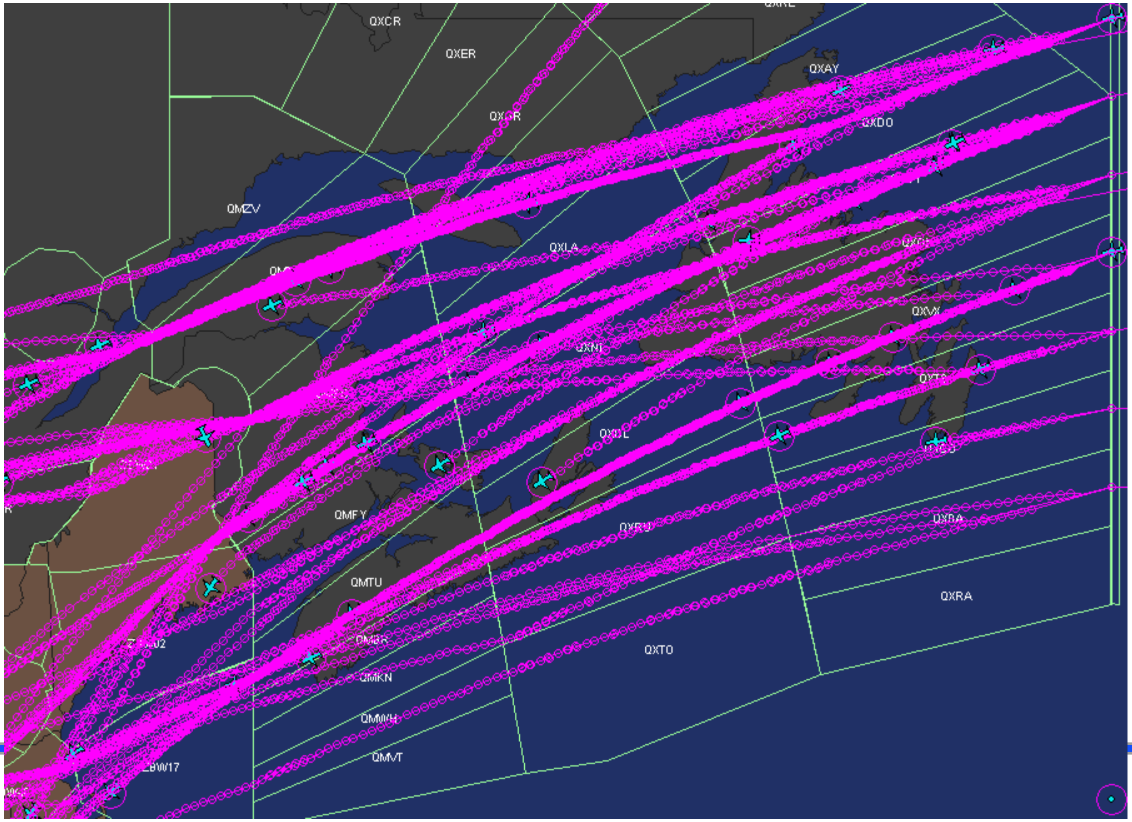
North Atlantic Tracks Transition Area

May 2001 **3:18 p.m.**

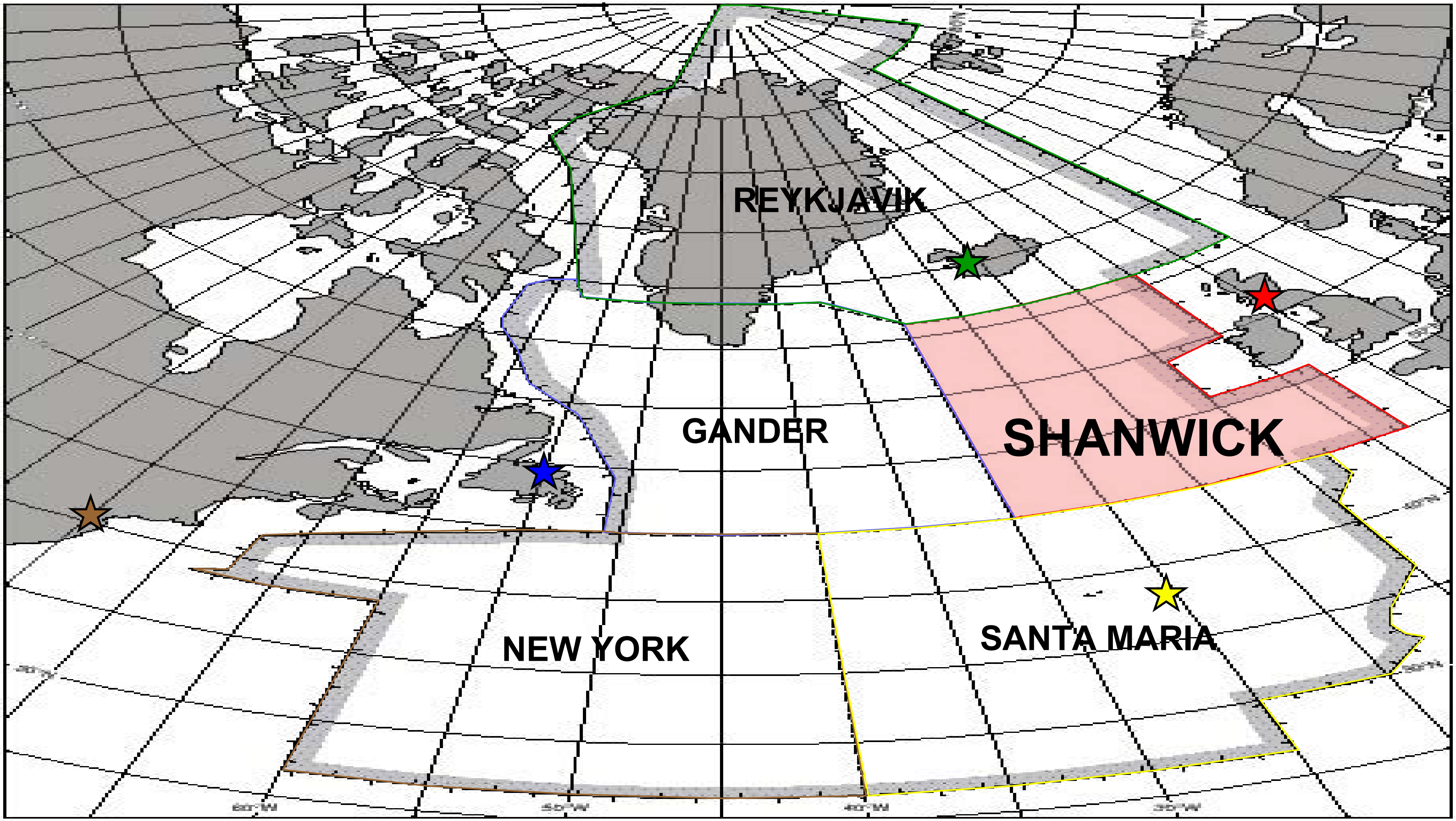
Sector Structure



Observed Flows



Scottish Oceanic Area Control Centre



Preswick Oceanic Area

Supervisor

Tracks Station

Enroute Controllers

Control aircraft once aircraft enter oceanic airspace

Clearance Delivery Operators (CDOs)

Receive position reports/requests through VHF & direct call to appropriate planner/controller

Planners

Give clearances before entering ocean & perform modifications to clearances before aircraft enter ocean

Traffic Dispatch Operators

modify messages rejected by FDPS

CPDLC Station

transcribes datalink requests into FDPS

Observations from Shanwick

Sectorization

- **Unlike other oceanic facilities, Shanwick separates sectors by flight level rather than geographically:**

  360 and higher

  330 and lower

  340-350

- **Approximately 60 aircraft average per sector**

Inter-facility Communication

- **Automated Data Transfer: all hand-off data sent and received automatically to and from other facilities**

Planner Projection

- **Project for conflicts manually, then computer probe clearance**
- **If aircraft routes are perpendicular, check for conflicts with computer *only***
  - Few N/S routings across tracks
  - Do rough position estimates at 50N & 55N, then estimate E/W position
    - If need to draw aircraft positions spatially, just put aircraft at different altitudes or send N/S aircraft under tracks

North/South flight crossing NAT

- On N/S route through tracks flight must be listed for every track crossed for comparison with other flights on that track
- Controllers commented that spatial conflict was very difficult to visualize on these situations

Future Information System

- SAATS- Shanwick Automated Air Traffic System
- Derivative of the GAATS system at Gander in Canada

Today

- Pacific Organized Track System
- Required Navigation Performance
- Reduced Vertical Separation Minima
- User Preferred Routes
- ATS Inter-Facility Data Communications

Source: Dave Maynard, Oakland ARTCC IOAC Briefing

Today

- Implementation of Ocean21 System
- ADS Based 50/50
- UPR Dynamic Airborne Reroute Procedure (DARP)
- 10 minute longitudinal separation without MNT
- ADS Based 30/30 Trials in South Pacific
- AIDC 2.0 Implementation

Source: Dave Maynard, Oakland ARTCC IOAC Briefing

Implementation of Ocean21 System

- Part Time Initial Daily Use began in June 2004
- Full Time Use began in October 2005

Source: Dave Maynard, Oakland ARTCC IOAC Briefing

Distance Based Longitudinal Separation

- D50 Longitudinal first applied on Oct. 27, 2004
- 30/30 implemented on Dec. 22, 2005

Source: Dave Maynard, Oakland ARTCC IOAC Briefing

User Preferred Routes and Reroutes

- User Preferred Routes in South Pacific began December 2000
- DARPS Trials completed
- Daily User Preferred Reroutes between Oakland & Auckland Centers supported in July, 2006

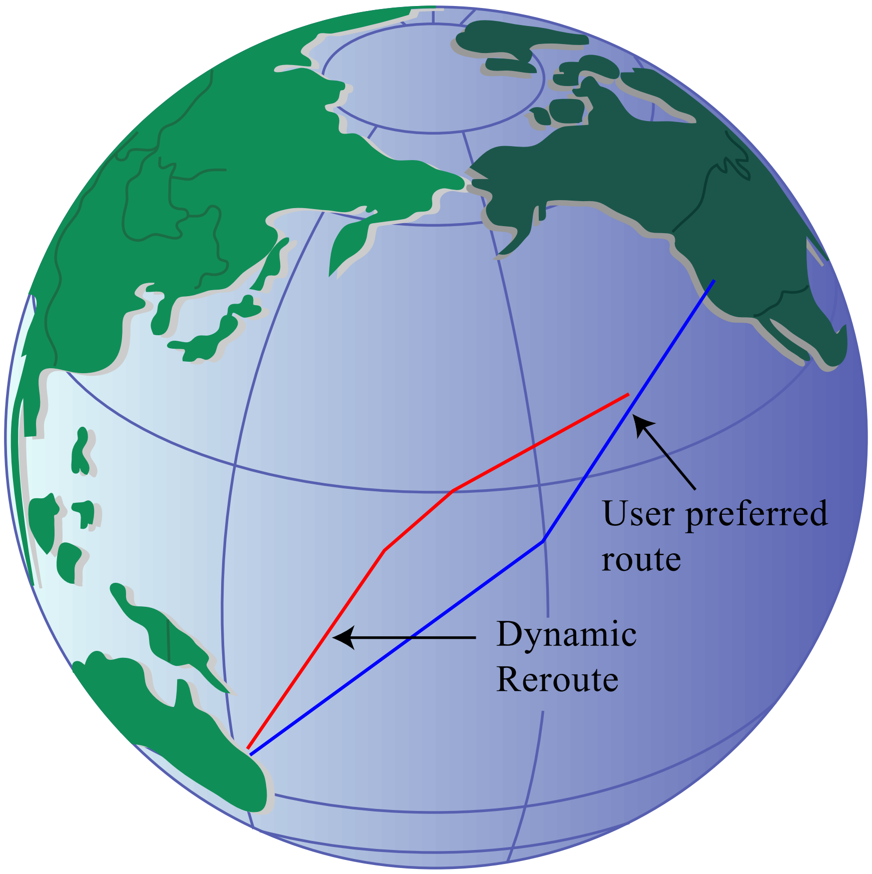
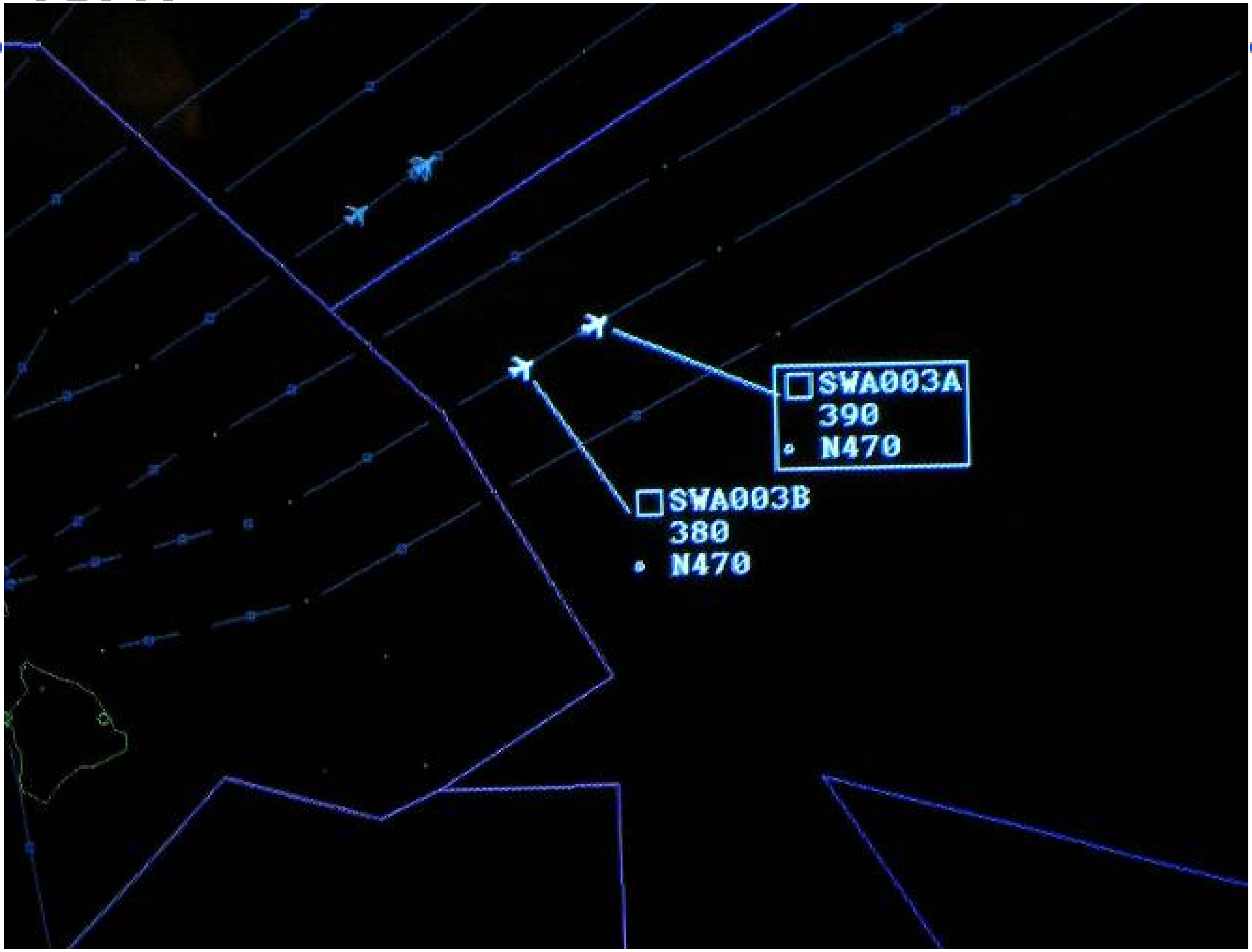


Figure by MIT OCW.

ADS In-Trail Climb



SOUTHERN PACIFIC FANS- INITIAL IMPLEMENTATION

- **Limited operational fleet**
  - ☐ B-747-400
- **Limited FIRs**
  - ☐ Sydney
  - ☐ Auckland oceanic
  - ☐ Oakland oceanic
- **Low density airspace (Order 40 A/C)**
- **Routing flexibility**
- **Significant benefits claimed by airlines**
- **Growth Areas**
  - ☐ Polar Regions
  - ☐ Asia
  - ☐ Africa
  - ☐ South America

South Pacific Weather