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ICAO: UNITING AVIATION ON CLIMATE CHANGE

ICAO Colloquium on Aviation and Climate Change

ICAO Colloquium on Aviation and Climate Change 11 to 14 May 2010

ATM Improvements and Global and Regional Planning Processes

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Outline

- Challenges we face in our evolution toward a safe, efficient and environmentally sustainable air transport system
- Solutions and the means to get there
 - Global and seamless air navigation system
 - Global ATM Operational Concept
 - Global Air Navigation Plan
 - Most promising technologies and capabilities
 - Tactical measures
- Summary



Challenges

- Disparate systems
- Rigid structures
- Limited information exchange
- Advanced avionics capabilities underutilized
- Long lead times for system improvement

0032	12:10	13:40	DELAYED
0115	12:12	13:50	DELAYED
5312	12:15	14:00	DELAYED
8714	12:15	-----	CANCELLED
0002	12:17	12:17	ON TIME
0452	12:18	15:20	DELAYED
0322	12:20	-----	CANCELLED

Address airline delays, group urges

*High-Global Warming Debate
Aviation Enters Cooling Airfares*



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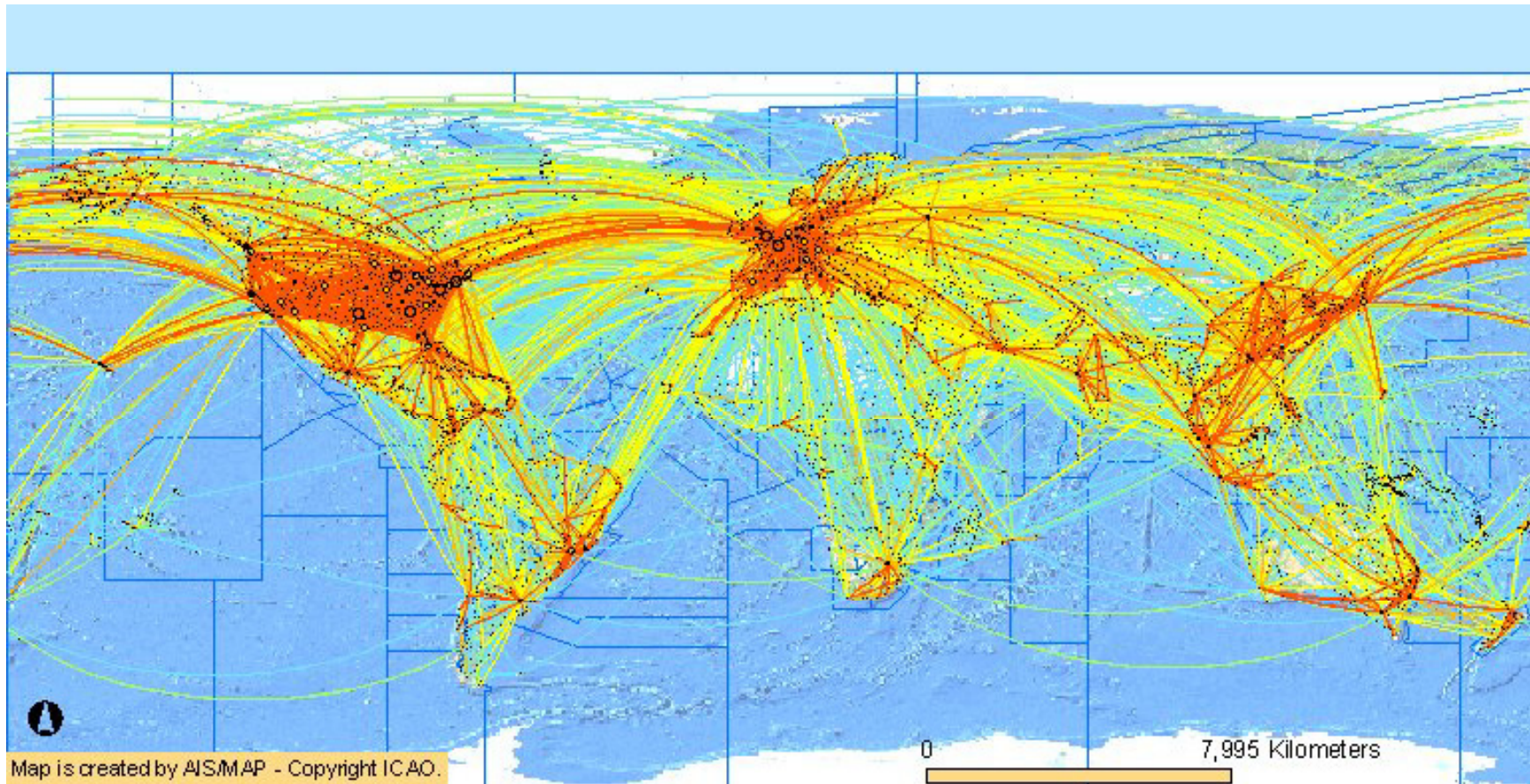
Solution: A More Global and Seamless Air Navigation System

- What is a Global Air Navigation System?
- How do we get there?
- Planning structure
- Expectations
 - ICAO
 - States



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What is a Global Air Navigation System? Physical Connectedness





What is a Global Air Navigation System?

- A seamless, interoperable, worldwide system based on:
 - Seamless safety across all regions
 - For all users during all phases of flight
 - Physical connectedness
 - Homogeneous ATM areas and Major Traffic flows
 - Common requirements, Standards and procedures
 - Integration (Enroute, TMAs, Aerodromes)
 - Meets environmental objectives



What is a Global Air Navigation System?

- Wider planning perspectives
- Far-reaching cooperation
- A global vision
- Implementation of facilities and services over larger geographical areas
- A global framework for performance measurement



Today's Global System

- At the highest level, the System attempts to meet the vision of the **Global ATM Operational Concept**:
- “ To achieve an interoperable global air traffic management system, for all users during all phases of flight, that meets agreed levels of safety, provides for optimum economic operations, **is environmentally sustainable** and meets national security requirements”



The Operational Concept and environmental issues

- ➔ Ensure that **environmental issues** are considered in the design, development, and operation of all aspects of the ATM system
- ➔ Establish and monitor agreed environmental performance targets to ensure that the expectations of society for the aviation industry contribute to the reduction of impacts on the environment
- ➔ Facilitate collaborative decision-making between the appropriate community members and appropriate environmental authorities to ensure that an appropriate balance exists between the need to mitigate the effects of the ATM system on the environment and the economic benefit to States derived from operation of the ATM system



How Does this Fit with NextGen

- NextGen (in their own words)
 - Many of the concepts build on ICAO's Global ATM Operational Concept which represents a globally harmonized set of concepts for the future
 - We recommend that ICAO assess NextGen and other future systems to advance harmonization efforts and to ensure global collaboration in the development and acceleration of standards for required future systems



How Does this Fit with SESAR

- **SESAR** (in their own words)
 - Planning should be In accordance with the Global Plan
 - Planning should be based on specific performance objectives supported by Global Plan Initiatives
 - The terminology and methodology used in the Master Plan are consistent with ICAO



The Global Air Navigation Plan

- Flexible use of airspace
- Reduced vertical separation minima
- Harmonization of level systems
- Alignment of upper airspace classifications
- RNAV and RNP (Performance-based navigation)
- Air Traffic Flow Management
- Dynamic and flexible ATS route management
- Collaborative airspace design and management
- Situational awareness
- Terminal area design and management
- RNP and RNAV SIDs and STARs
- Functional integration of airborne systems and ground systems
- Aerodrome design and management
- Runway operations
- Match IMC and VMC operating capacity
- Decision support and alerting systems
- Data link applications
- Aeronautical information
- Meteorological systems
- Navigation systems
- Communications infrastructure



Global Plans Become Regional Plans

- The Global Air Navigation Plan implements the Global ATM Operational Concept
 - It's the Transition Roadmap which outlines the tools for improving the ATM system
 - Drives Regional and National Planning
 - Contains Options for ATM improvements
 - Results in the Regional Air Navigation Plan, which
 - Results in Direct Performance Enhancements



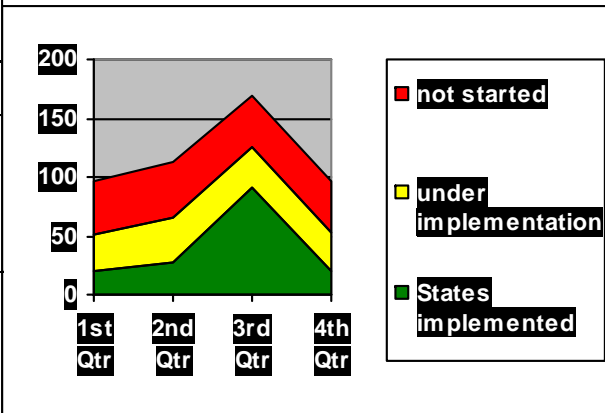
Programme 2 \$
Increase airspace capacity, improve flight profiles, reduce fuel consumption and emissions through reductions in aircraft to aircraft separation minima

REGIONAL PERFORMANCE OBJECTIVES / NATIONAL PERFORMANCE OBJECTIVES — OPTIMIZE THE ATS ROUTE STRUCTURE IN EN-ROUTE AIRSPACE

Benefits

- Environment:**
- reductions in fuel consumption;
 - ability of aircraft to conduct flight more closely to preferred trajectories;
 - increase in airspace capacity;
 - facilitate utilization of advanced technologies (e.g., FMS based arrivals) and ATC decision support tools (e.g., metering and sequencing), thereby increasing efficiency.

Strategy
Short term (2010)
Medium term (2011 - 2015)



STATUS OF MLAT & ADS-B ACTION

Harmonized use & exchange of RVSM monitoring data among RMAs		
2009:	Publication of RMA manual [SASP]	SASP
5 NM in-trail separation on final up to 20 miles from runway end		
2010:	Amendment to PANS-ATM [SASP]	SASP
MLAT & ADS-B for 3 NM separation minima in use		
2009:	SARPs [ASP]	ASP
2009:	Aeronautical Surveillance manual [ASP]	SASP
2011:	GM on Safety assessment [SASP]	
2011:	GM on flight testing [ASP]	
2011:	Evolution of ground surveillance timeline [ASP]	

ATM OC COMPONENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
AOM	<p>En-route airspace</p> <ul style="list-style-type: none"> • analyze the en-route ATS route structure and implement all identifiable improvements; • implement all remaining regional requirements (e.g. RNP 10 routes); and • finalize implementation of WGS-84 • monitor implementation progress • develop a strategy and work programme to design and implement a trunk route network, connecting major city pairs in the upper airspace and for transit to/from aerodromes, on the basis of PBN and, in particular, RNAV/5, taking into account interregional harmonization; • monitor implementation progress 	2005-2008		
linkage to GPs	<p>GPI/5: performance-based navigation, GPI/7: dynamic and flexible ATS route management, GPI/8: collaborative airspace design and management, GPI/11: RNP and RNAV SIDs and STARs and GPI/12: FMS-based arrival procedures.</p>			

Project 7: GNSS (DME 10) separation in oceanic airspace		
2011-2012	2011: Amendment to PAN-ATM [SASP]	SASP



Most promising technologies and procedures

- Let's look at how technology and procedures can improve safety and the environment
 - Reduced vertical separation minimum (RVSM)
 - Performance based Navigation (PBN)
 - Continuous Descent Operations (CDO)
 - Data link
 - Automatic Dependent Surveillance-Broadcast (ADS-B)

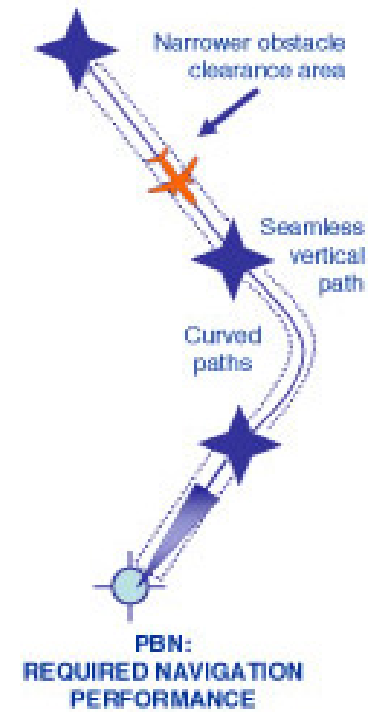
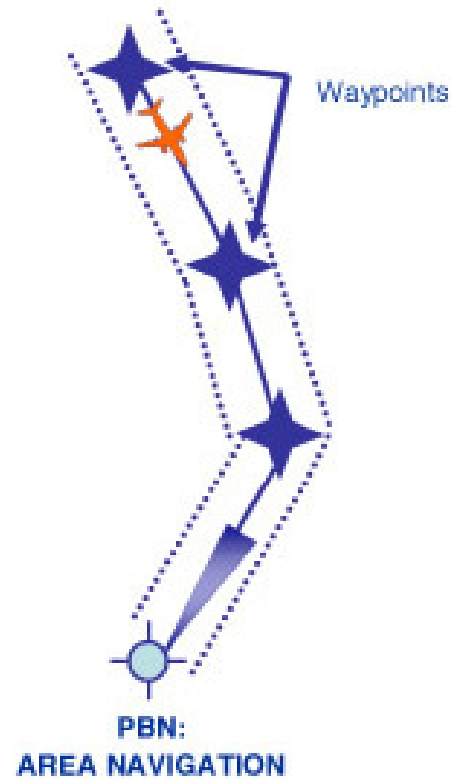
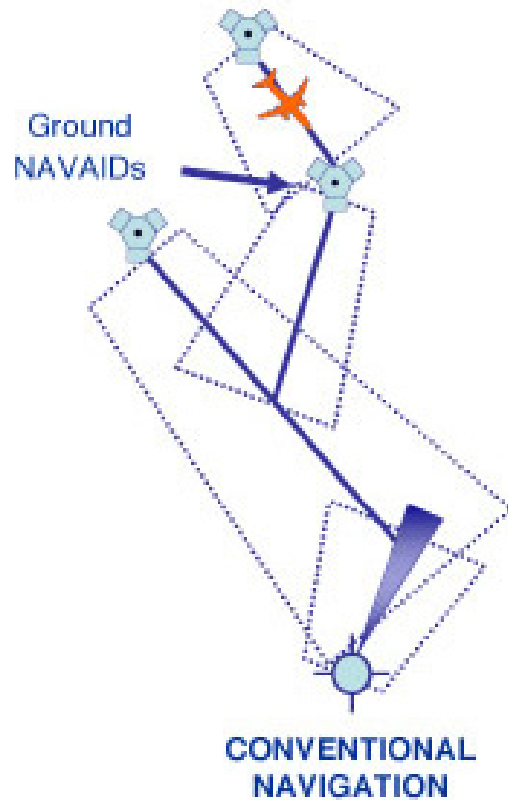


Benefits of RVSM in Numbers

- Taking advantage of operating more often, more close to optimum levels
- Conservative estimate: average 80kg fuel saving per flight in RVSM airspace
- In one ICAO region: 10,000 flight daily
 - ⇒ yearly saving 290,000 tons
 - ⇒ yearly 913,500 tons less CO₂
 - ⇒ yearly 4,350 tons less NO_x



Performance Based Navigation (PBN)





Benefits of PBN

- Western Atlantic Route System (WATRS) USA
 - A daily CO₂ fuel emission reduction of 489 tons was calculated.
 - The estimated annual reduction in CO₂ fuel emission reductions is 178,400 tons.
- New East Coast Oceanic Routes (USA) - expected savings:
 - 3.9 million tons of CO₂ emission
 - \$400-700 million in fuel costs over a 15-year period.



Advantages of Data link

- Enhances Safety
 - Through clear unambiguous communication.
 - No human handling of complex clearances.
- Increased Capacity
 - One channel support many aircraft and controllers.
- Increased Efficiency
 - “Say Again” becomes redundant.



Supported Concepts

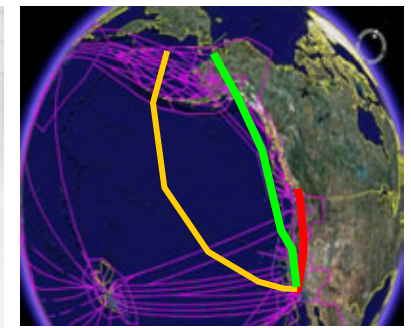
- **User-Preferred Routes**
 - Dynamically optimised for latest wind data using individual aircraft characteristics.
- **Controlled Descent Operations**
 - Method of delivery for Continuous Climb and Approach Clearances
- **Horizontal Separation Reductions**



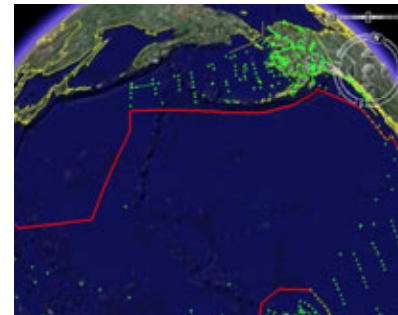
Practical Examples

**In 2008 saved 21.9 million kilograms (kg) of fuel
Reduced CO₂ emissions by 69.2 million kg**

Projects	Mil kg
Hawaii ATS route changes	1.2
Central East Pacific (CEP) flex routes	6.8
Route entry point UPRs	1.09
Guam ATS route changes	2.4
Japan – Hawaii UPRs	2.27
San Francisco tailored arrival trials	0.3
California – Singapore UPRs	0.27
“WIDEN” oceanic gateway	3.6
Narita – Sydney/Brisbane UPRs	1.89
Asia – New Zealand/Caledonia UPRs	2.09



Saved 37,000 trees



Automatic Dependent Surveillance - Broadcast (ADS-B)

- Automatic—Periodically transmits information with no pilot or operator input required
- Dependent—Position and velocity vector are derived from the Global Positioning System (GPS)
- Surveillance —A method of determining position of aircraft, vehicles, or other asset
- Broadcast—Transmitted information available to anyone with the appropriate receiving equipment





ATC Separation Services - Current Conditions





ATC Separation Services - ADS-B Enabled





Merging and Spacing





Tactical actions

- Allow departures in direction of flight
- Allow early arriving flights to slow down to prevent gate holds and ramp congestion
- Provide opportunities for rolling take offs
- Allow cruise climbs or step climbs in oceanic and remote airspace
- Allow flexible flight planning so that airlines can plan routes and entry/exit points based on the best operational conditions
- Educate controllers on the operational requirements and impact of optimum cruising levels
- Provide options to pilots, such as offering a small departure delay or alternate routing as an alternative to a penalising en route altitude provides significant savings, especially to long haul flights that may be retained for hours at an inefficient cruising altitude.



Proposed Next Steps

- ICAO will develop a common way to Measure Benefits (by end of 2010)
- ICAO will develop joint Training Programme to support environmental improvements under the Performance Framework (beginning of 2011)
- Establish a Measurements Subgroup of the PIRGS to Measure Benefits (target a Lead Region by early 2011)



Collaboration Delivers the Best Overall Outcome

