Reduced Vertical Separation Minimum (RVSM)

Program Overview

5 August, 2002

Overview

- Program Objectives
- Background and Operational Experience
- Benefits and Costs
- Implementation Date Factors
- US Rule Schedule

Proposed Program Objectives

- Implement RVSM between FL 290 - 410 in December 2004 timeframe
- Car/Sam plan under discussion
- US plan: lower 48 states, Alaska and Gulf of Mexico airspace---where FAA provides air traffic services

US NAS Operational Evolution Plan

- www.faa.gov/programs/oep
- DRVSM is para ER-4 in NAS OEP
- Principle Office of Delivery (POD): Director, Flight Standards Service

Reduced Vertical Separation Minimum

- 1,000 ft vertical separation applied globally, including domestic US, **up to FL 290** for past 40 years

- RVSM: enables reduction of vertical separation from 2,000 ft to 1,000 ft. between **FL 290 - FL 410 (inclusive)**

DRVSM Program Elements

- Aircraft and operators approved by the appropriate civil aviation operator in accordance with Annex 6
- Aircraft altimetry, auto-pilot, altitude alert systems modified to RVSM standards
- RVSM policy/procedures incorporated into controller, pilot and dispatch programs
- Air Traffic systems and programs revised

Program Elements (cont.)

- Monitoring: aircraft altitude-keeping performance observed to confirm performance standards being met
  - Ground and airborne monitoring systems independently monitor aircraft performance

- Safety Analysis: Collision Risk Modeling used to assess airspace system safety

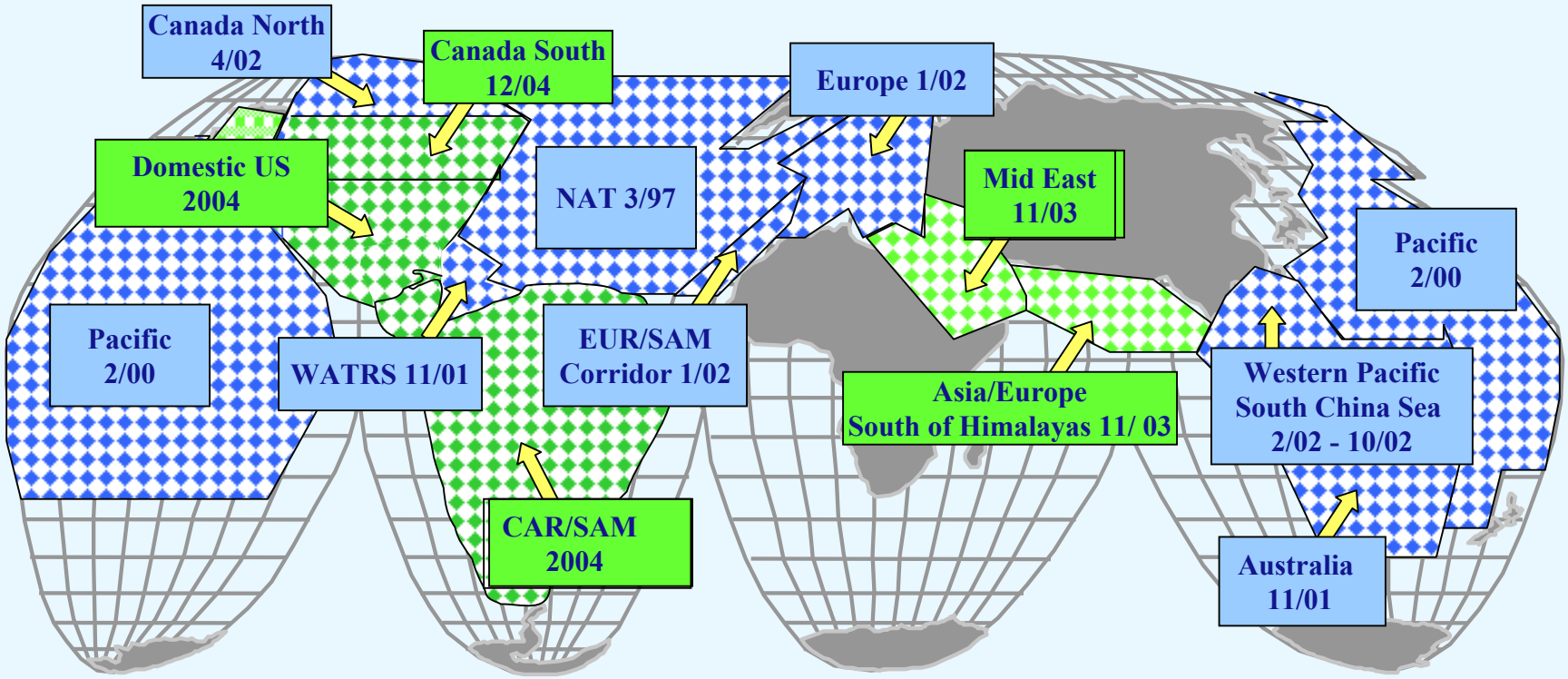
RVSM Mandate

- Exclusionary option: when implemented, **RVSM approval required** for operation in designated airspace, with limited exceptions

- Tactical option used prior to Jan 2002 in UK, Austria and Germany

RVSM Implemented & Planned

As of May 2002



Implemented

Planned

** **Western Pacific/South China Sea**

February 2002 Implementation

Bangkok, Ho Chi Minh, Kota Kinabalu, Kuala Lumpur, Manila, Phnom Penh, Sanya, Singapore, Taipei

October 2002 Implementation

Hanoi, Hong Kong, Jakarta, Ujung Pandang, Vientiane

Benefits in Oceanic Operations

- Enhanced aircraft operating efficiency – reduced fuel burn at more optimum altitudes
- Enhanced Air Traffic Management (ATM) flexibility
- More aircraft on fuel/time efficient routes

Operational Experience

- Air Traffic, Operations, Certification and Safety Analysis specialists have participated in ICAO Panels and Regional Implementation groups
- Approx. 2.0 million RVSM flights
- Approx. 8.0 million RVSM flight hours

Operational Experience (cont.)

- Offset procedure implemented to mitigate wake turbulence for same-direction traffic
- TCAS II (Version 6.04a) produced nuisance traffic alerts
- In non-radar airspace, human errors contributed the most significant risk-bearing errors

RVSM Eligibility

- **Aircraft approved per FAA Interim Guidance 91-RVSM or JAA Temporary Guidance Leaflet #6 are eligible for RVSM operations world-wide**

- Operators remain responsible for complying with operational policies in individual areas of operation (e.g., Europe, Pacific oceanic)

Aircraft Equipage for RVSM Operations

- **!! Aircraft systems listed below must meet tolerances shown on next slide:**

- Two Independent Altimetry Systems
- One SSR Altitude Reporting Transponder
- One Automatic Altitude Control System
- One Altitude Alert System

Equipment Tolerances

•ASE Requirements	Basic Envelope	Full Envelope
Group Aircraft (ACO approved SBs or STCs)	[Mean ASE of the group] ≤80 ft (25m) [Mean ASE + 3SD] ≤200 ft (60m)	≤120 ft (37m) ≤245 ft (75m)
Non-group Aircraft (Individual airframe approval)	[Residual static source error + worst case avionics] ≤160 ft (50m)	≤200 ft (60m)

- **Altitude Alert Threshold:** ±300 ft
  - **Aircraft type certified after January 1, 1997: ±200 ft**

- **Automatic Altitude Control System:** ±65 ft about acquired altitude
  - **Aircraft certified prior to 1/1997: soft altitude hold +/- 130ft allowed**

TCAS Version 7.0

- ICAO Annex 6 Part I (Commercial Air Transport):

  from 1 Jan 2003, all turbine-engine airplanes with take-off weight greater than 15,000 kg or capacity of more than 30 passengers shall be equipped with ACAS II (TCAS II Version 7.0)
- Part II (IGA): from 1 Jan 2003, all aeroplanes equipped with pressure altitude reporting transponder that operates per Annex 10

Example US Benefits 2004 - 2018

- Adds 6 additional FL's between 290 - 410
- Fuel Savings Benefits 2004 – 2018:
  - $5.8 billion ($2.9 billion discounted)
  - 9/1 benefit/cost ratio; 5/1 ratio discounted
  - $371 m. first year savings---1.5% annual increase
- ATS benefits will be covered in ATS program briefing

Example Costs 2002 - 2016

- $634 million costs:
  - Aircraft/operator approval
  - If TCAS II equipped: Version 7.0 upgrade
  - Monitoring
  - Air traffic system modification and controller training costs

Implementation Date
Factors To Consider

- Percentage of aircraft already approved
- New airframes now delivered RVSM ready
- Percentage of flights to be conducted by RVSM approved aircraft by Dec 2004 timeframe
- First year fuel savings and ATM benefits at stake
- Aircraft Engineering Packages available
- Process available for non-group/unique airframe approval

Date Factors (cont).

- Innovative aircraft engineering solutions available
- Options for Unapproved aircraft:
  - Operate at FL 280 and below (fuel burn penalty, but relatively short duration flights)
  - If capable, climb through RVSM FL's to operate at FL 430 and above
  - Potential tactical implementation
- Economic decision for some operators
- Options for unapproved aircraft to be accommodated

US Rule Schedule

- Notice of Proposed Rulemaking is available at:
  http://dms.dot.gov
- Click “Simple Search” and docket number 12261

- May 10….Notice of Proposed Rulemaking published

- August 8….close of comment period

- Jun 2003….publish final rule

Conclusion

- RVSM implementation requires commitment from operators and authorities