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

** 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

<table>
<thead>
<tr>
<th>ASE Requirements</th>
<th>Basic Envelope</th>
<th>Full Envelope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Aircraft (ACO approved SBs or STCs)</td>
<td>[Mean ASE of the group] (\leq 80) ft (25m)</td>
<td>(\leq 120) ft (37m)</td>
</tr>
<tr>
<td></td>
<td>[Mean ASE + 3SD] (\leq 200) ft (60m)</td>
<td>(&lt; 245) ft (75m)</td>
</tr>
<tr>
<td>Non-group Aircraft (Individual airframe approval)</td>
<td>[Residual static source error + worst case avionics] (\leq 160) ft (50m)</td>
<td>(\leq 200) ft (60m)</td>
</tr>
</tbody>
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- **Altitude Alert Threshold:** \(\pm 300\) ft
  - **Aircraft type certified after January 1, 1997:** \(\pm 200\) ft

- **Automatic Altitude Control System:** \(\pm 65\) 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

- 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
RVSM implementation requires commitment from operators and authorities