

**DEPARTMENT OF TRANSPORTATION****Federal Aviation Administration****14 CFR Part 91**

[Docket No. 28870; Amdt No. 91-254]

RIN 2120-AE51

**Reduced Vertical Separation Minimum Operations****AGENCY:** Federal Aviation Administration, DOT.**ACTION:** Final rule; request for comments.

**SUMMARY:** The Federal Aviation Administration (FAA) is establishing requirements for operations of U.S.-registered aircraft in airspace designated as Reduced Vertical Separation Minimum (RVSM) airspace. RVSM refers to airspace between flight level (FL) 290 and FL 410, with assigned altitudes separated by a minimum of 1,000 feet rather than the 2,000 foot minimum separation currently required above FL 290. The current requirement is based on navigation equipment with a level of accuracy that necessitated a 2,000 foot buffer. Modern navigation equipment permits more precise navigation, including altitude control. These regulations require operators and their aircraft to be approved in accordance with new requirements, in order to operate in RVSM specified airspace. The regulations ensure that operators and their aircraft are properly qualified and equipped to conduct flight operations while separated by 1,000 feet, and ensure that compliance with the RVSM requirements is maintained. This amendment makes more tracks and altitudes available for air traffic control to assign to operators, thus increasing efficiency of operations and air traffic capacity. This action maintains a level of safety equal to or greater than that provided by the current regulations. RVSM will be applied in designated areas, with the first area being certain flight levels in the North Atlantic (NAT) Minimum Navigation Performance Specifications (MNPS) airspace.

**DATES:** This final rule is effective April 9, 1997. Comments must be submitted on or before June 9, 1997.

**ADDRESSES:** Substantive comments on this action should be delivered or mailed, in triplicate, to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-200), Room 915-G, Docket No. 28870, 800 Independence Avenue, SW., Washington, DC 20591. Comments delivered must be marked Docket No. 28870. Substantive comments also may

be submitted electronically to the following Internet address: 9-NPRM-CMTS@faa.dot.gov. Comments may be examined in Room 915G weekdays between 8:30 a.m. and 5:00 p.m., except on Federal holidays.

**FOR FURTHER INFORMATION CONTACT:**

Mr. Roy Grimes, AFS-400, Technical Programs Division, Flight Standards Service, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591, telephone (202) 267-3734.

**SUPPLEMENTARY INFORMATION:****Substantive Comments Invited**

This action is a product of international agreements under which the international aviation community, including the United States, is prepared to and plans to begin operational testing of the RVSM procedures in certain altitudes on March 27, 1997. Arriving air traffic, having departed Europe and separated at RVSM altitudes, cannot as a practical matter arrive in oceanic airspace controlled by the United States, all needing to be reassigned to a pre-RVSM separation altitude. Unless this rule is implemented by March 27, 1997, there would have to be major delays for westbound NAT traffic in airspace that the FAA does not control, to avoid a significant safety problem.

Because the United States international commitments in this matter cannot otherwise reasonably be met and because of the potential safety problem for aircraft entering U.S.-controlled oceanic airspace without the benefit of this rule, the FAA is publishing this action as a final rule without an opportunity for public comment. It should be noted, however, that this action has been developed through the international committee process, a variety of related program meetings, and a formal public meeting in 1993. No significant adverse comment was received.

If an individual believes that a significant salient issue has been overlooked, that person is invited to comment by submitting such written data, views, or arguments as they may desire. Comments should identify the regulatory docket number and should be submitted in triplicate to the Rules Docket address specified above. Because this rule was developed as a result of an international agreement, comments deemed substantive will be presented for consideration and reviewed by the international community under the auspices of ICAO. If considered salient, the comment will be included for use by all participating member States.

All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons. Commenters wishing the FAA to acknowledge receipt of their comments must include a preaddressed, stamped postcard on which the following statement is made: "Comments to Docket No. 28870." The postcard will be date stamped and returned to the commenter.

**Availability of This Document**

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone 703-321-3339), the **Federal Register's** electronic bulletin board service (telephone: 202-512-1661), or the FAA's Aviation Rulemaking Advisory Committee Bulletin Board Service (telephone: 202-267-5948).

Internet users may reach the FAA's web page at <http://www.faa.gov> or the **Federal Register's** webpage at [http://www.access.gpo/su\\_docs](http://www.access.gpo/su_docs) for access to recently published rulemaking documents.

Any person may obtain a copy of this document by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267-9677. Communications must identify the docket number of this rule.

Persons interested in being placed on the mailing list for future rulemaking actions should request from the above office a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, that describes the application procedure.

**Background***Statement of the Problem*

With air traffic increasing annually worldwide, FAA airspace planners and their international counterparts continually study methods of enhancing the air traffic control (ATC) system's ability to accommodate this traffic in a safe and efficient manner. The traffic problem has become particularly acute in the NAT airspace, where the number of flight operations increased 30 percent from 1988 through 1992, according to the NAT Traffic Forecasting Group. The forecast indicates that traffic will rise 60 percent over the 1992 level of 228,200 operations by 2005. Currently, 27 percent of operations in the NAT airspace receive clearances on tracks and to altitudes other than those

requested by the operators in their filed flight plans because of airspace limitations. These flights are conducted at less than optimum tracks and altitudes for the aircraft, resulting in time and fuel inefficiencies.

One limitation on air traffic management at high altitudes is the required vertical separation. Whereas at lower altitudes air traffic controllers can assign aircraft operating under Instrument Flight Rules (IFR) altitudes a minimum of 1,000 feet apart, above FL 290, required vertical separation is a minimum of 2,000 feet.

**Note:** Flight levels are stated in digits that represent hundreds of feet. The term flight level is used to describe a surface of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Rather than adjusting altimeters for changes in atmospheric pressure, pilots base altitude readings above the transition altitude [in the United States, 18,000 feet] on this standard reference. FL 290 represents 29,000 feet; FL 310 represents 31,000 feet, and so on.)

The 2,000 foot vertical separation minimum applied above FL 290 in U.S. and international airspace dates to the 1950's. At that time, high-altitude flight was possible for only a limited number of military aircraft, and inaccuracies in altitude-keeping systems were evident above FL 290. ("Altitude-keeping" means the accuracy in the vertical plane with which an aircraft adheres to its assigned pressure altitude using the aircraft altitude-keeping and barometric altimeter systems.) However, advances in technology eventually gave transport and general aviation aircraft the ability to operate at higher altitudes, resulting in increased traffic along high-altitude routes.

The 2,000 ft minimum vertical separation restricts the number of flight levels available, even though many more air carrier and general aviation aircraft are capable of high altitude operations now than when the standard was established. Flight levels 310, 330, 350, 370, and 390 are the flight levels at which aircraft crossing between North America and Europe operate most economically, thus causing congestion at peak hours. One solution to air traffic management limitations would be to make available other flight levels, such as 320, 340, 360, and 380. Exhaustive technical studies show that a 1,000 ft minimum vertical separation is feasible and safe. The solution is based on marked improvement in altitude-keeping technology and provides relief from the fuel and time inefficiencies being seen in the NAT MNPS airspace.

## History

Rising traffic volume and fuel costs, which made flight at fuel efficient altitudes a priority for operators, sparked an interest in the early 1970's in implementing RVSM above FL 290. In April 1973, the Air Transport Association of America (ATA) petitioned the FAA for a rule change to reduce the vertical separation minimum to 1,000 feet for aircraft operating above FL 290. The petition was denied in 1977 in part because (1) aircraft altimeters had not been improved sufficiently, (2) improved maintenance and operational standards had not been developed, and (3) altitude correction was not available in all aircraft. In addition, the cost of modifying nonconforming aircraft was prohibitive. The FAA concluded that granting the ATA petition at that time would have adversely affected safety.

Nevertheless, the FAA recognized the potential benefits of RVSM under certain circumstances and continued to review technological developments, committing extensive resources to studying aircraft altitude-keeping performance and necessary criteria for safely reducing vertical separation above FL 290. These benefits and data showing that implementing RVSM is technically feasible have been demonstrated in studies conducted cooperatively in international forums, as well as separately by the FAA.

Because of the high standard of performance and equipment required for RVSM, the FAA foresees initial introduction of RVSM in oceanic airspace where special navigation performance standards already exist. (Special navigation areas require high levels of long-range navigation precision due to the separation standard applied). RVSM implementation in such airspace requires an increased level of precision demanded of operators, aircraft, and vertical navigation systems.

In 1997, RVSM is planned only for one such special navigation area of operation, the NAT MNPS, established in the International Civil Aviation Organization (ICAO) NAT Region. In designated NAT MNPS airspace, tracks are spaced 60 nautical miles (nm) apart. On these tracks, aircraft are separated vertically by 2000 feet. All aircraft operating in this airspace must be appropriately equipped and capable of meeting the MNPS standards. Operators must follow procedures that ensure the standards are met, and flightcrews must be trained and qualified to meet the MNPS standards. Each operator, aircraft, and navigation system combination must receive and maintain authorization to operate in the NAT MNPS. The

NATSPG Central Monitoring Agency for the NAT Systems Planning Group monitors NAT aircraft fleet performance to ensure that a safe operating environment is maintained.

FAA data indicate that the altitude-keeping performance of most aircraft flying in the NAT could meet the standards for RVSM operations. The FAA and ICAO research to determine the feasibility of implementing RVSM in the NAT MNPS included the following four efforts:

1. *FAA Vertical Studies Program.* This program began in mid-1981, with the objectives of collecting and analyzing data on aircraft performance in maintaining assigned altitude, developing program requirements to reduce vertical separation, and providing technical and operational representation on the various working groups studying the issue outside the FAA.

2. *RTCA Special Committee (SC)-150.* RTCA, Inc., (formerly Radio Technical Commission for Aeronautics) is an industry organization in Washington, DC, that addresses aviation technical requirements and concepts and produces recommended standards. When the FAA hosted a public meeting in early 1982 on vertical separation, it was recommended that RTCA be the forum for development of minimum system performance standards for RVSM. RTCA SC-150 was formed in March 1982 to develop minimum system performance requirements, identify required improvements to aircraft equipment and changes to operational procedures, and assess the impact of the requirements on the aviation community. SC-150 served as the focal point for the study and development of RVSM criteria and programs in the United States from 1982 to 1987, including analysis of the results of the FAA Vertical Studies Program.

3. *ICAO Review of the General Concept of Separation Panel (RGCSF).* In 1987, the FAA concentrated its resources for the development of RVSM programs in the ICAO RGCSF. The U.S. delegation to the ICAO RGCSF used the material developed by SC-150 as the foundation for U.S. positions and plans on RVSM criteria and programs. The panel's major conclusions were:

- RVSM is "technically feasible without imposing unreasonably demanding technical requirements on the equipment."
- RVSM provides "significant benefits in terms of economy and en route airspace capacity."
- Implementation of RVSM on either a regional or global basis requires "sound operational judgment supported

by an assessment of system performance based on: Aircraft altitude-keeping capability, operational considerations, system performance monitoring, and risk assessment."

#### 4. NATSPG and the NATSPG Vertical Separation Implementation Group (VSIG).

The NATSPG Task Force was established in 1988 to identify the requirements to be met by the future NAT Region air traffic services system; to design the framework for the NAT airspace system concept; and to prepare a general plan for the phased introduction of the elements of the concept. The objective of this effort was to permit "significant increases in airspace capacity and improvements in flight economy." At the meeting of the NATSPG in June 1991, all of the NAT air traffic service provider States, as well as the International Air Transport Association (IATA) and International Federation of Airline Pilots Association (IFALPA), endorsed the Future NAT Air Traffic Services System Concept Description developed by the NATSPG Task Force. With regard to the implementation of RVSM, the Concept Description concludes that "priority must be given to implementation of this measure as it is believed to be achievable within the early part of the concept timeframe." NATSPG's initial goal was to implement RVSM between 1996 and 1997. To meet this goal, the NATSPG established the VSIG in June 1991 to take the necessary actions to implement RVSM in the NAT. These actions included:

- Programs and documents to approve aircraft and operators to conduct flight in the RVSM environment and to address all issues related to aircraft airworthiness, maintenance, and operations. The group has produced guidance material for aircraft and operator approval, which ICAO has distributed to civil aviation authorities and NAT users. ICAO has planned that the guidance material be incorporated in the approval process established by the States.
  - Developing the system for monitoring aircraft altitude-keeping performance. This system is used to observe aircraft performance in the vertical plane to determine that the approval process is uniformly effective and that the RVSM airspace system is safe.
  - Evaluating and developing ATC procedures for RVSM, conducting simulation studies to assess the effect of RVSM on ATC, and developing documents to address ATC issues.
- The NATSPG RVSM implementation program was endorsed by the ICAO

Limited NAT Regional Air Navigation Meeting held in Portugal in November 1992. At that meeting, it was concluded that RVSM implementation should be pursued. The FAA concurred with the conclusions of the NATSPG on RVSM implementation.

On August 17, 1993, the FAA held a public meeting to obtain input and data that would be considered by the FAA in determining if and how to implement reduced vertical separation in appropriate airspace. The 32 meeting participants included representatives of the aviation industry, including manufacturers and air carriers, and unions, as well as pilots and government officials. Five members of the public made formal statements.

The ATA supported RVSM, indicating that the FAA should proceed as quickly as possible with implementation because of direct economic benefit for airlines. A member of the ATA supported the concept and indicated that Traffic Alert and Collision Avoidance Systems (TCAS) should be included in the system specifications. The speaker indicated that, in his analysis, no changes to the TCAS system would be needed to implement the reduced vertical separation.

The Airline Pilots Association (ALPA) supported RVSM, but expressed concern that the engineering requirements were so complex that continuing compliance could be difficult. Therefore, ALPA emphasized that there must be an ongoing effort to collect data on altitude keeping performance through monitoring to prevent those not meeting the requirements from entering or using RVSM airspace.

The National Air-Traffic Controllers' Association (NATCA) opposed RVSM at that time because of the potential increase in traffic volume in RVSM airspace without a corresponding increase in the number of controllers. However, the NATCA speaker said the increase in oceanic capacity through RVSM implementation should be pursued when the FAA fully staffs the air traffic control system and provides adequate automation to aid the controllers.

(In the interim since the August, 1993 public meeting, the FAA conducted a series of real time simulations at the FAA Technical Center's National Simulation Capability (NSC). Simulations were conducted to assist the FAA's Air Traffic organizations in defining geographical areas for RVSM transitioning and establishing procedures to effect that transition. Controllers, and controllers representing NATCA, from New York, Boston and

Miami Air Route Traffic Control Centers, participated in the simulations. As indicated in the National Simulation Capability RVSM Phase I Result Report, August 1995, the simulation results indicated that, while interval increases in controller workload occurred under RVSM traffic conditions when compared with conventional vertical separation minima (2000 feet) conditions, the overall controller workload did not increase. High interval workload did not interfere with a controller's ability to provide service to the aircraft. Based upon the Phase I RVSM simulation results, the introduction of RVSM in the New York Oceanic Airspace is feasible provided that certain procedures are well defined and agreed upon prior to implementation.)

The National Business Aircraft Association (NBAA) supported the reduced vertical separation concept. However, NBAA expressed concern over the cost of equipping aircraft to enter RVSM airspace. Also, NBAA was concerned that if the RVSM concept was to be considered for the Pacific area and domestic airspace, significant expense to operators could result from the requirement for all airplanes to be equipped, validated, and maintained to RVSM standards. NBAA viewed this as a significant long-range cost impact.

#### Reference Material

The FAA and other entities studying the issue of RVSM requirements have produced a number of studies and reports. The FAA used the following documents in the development of this amendment.

- Summary Report of United States Studies on 1,000-Foot Vertical Separation Above Flight Level 290 (FAA, July 1988).
- Initial Report on Minimum System Performance Standards for 1,000-Foot Vertical Separation Above Flight Level 290 (RTCA SC-150, November 1984); the report provides information on the methodology for evaluating safety, factors influencing vertical separation, and strawman system performance standards.
- Minimum System Performance Standards for 1,000-Foot Vertical Separation Above Flight Level 290 (Draft 7, RTCA, August 1990); the FAA concurred with the material developed by RTCA SC-150.
- The Report of RGCSF/6 (ICAO, Montreal, 28 November–15 December 1988) published in two volumes. Volume 1 summarizes the major conclusions reached by the panel and the individual States. Volume 2 presents the complete RVSM study reports of the individual States:
- European Studies of Vertical Separation Above FL 290—Summary Report (prepared by the Eurocontrol Vertical Studies Subgroup).

- Summary Report of United States Studies on 1,000-Foot Vertical Separation Above Flight Level 290 (prepared by the FAA Technical Center and ARINC Research Corporation).

- The Japanese Study on Vertical Separation.

- The Report of the Canadian Mode C Data Collection.

- The Results of Studies on the Reduction of Vertical Separation Intervals for USSR Aircraft at Altitudes Above 8,100 m (prepared by the USSR).

- Report of RGCSP/7 (Montreal, 30 October–20 November 1990) containing a draft Manual on Implementation of a 300 M (1,000 Ft) Vertical Separation Minimum (VSM) Between FL 290 and 410 Inclusive, approved by the ICAO Air Navigation Commission in February 1991 and published as ICAO Document 9574.

- Interim Guidance Material 91–RVSM, “Approval of Aircraft and Operators for Flight in Airspace Above FL 290 Where a 1,000 Foot Vertical Separation is Applied” (March 14, 1994). (The interim guidance continues to provide recommended procedural steps for obtaining FAA approval.)

- AC No. 91–70, “Oceanic Operations” (September 6, 1994).

- Flight Standards Handbook Bulletin for Air Transportation (HBAT) “Approval of Aircraft and Operators for Flight in Airspace Above Flight Level 290 Where a 1,000 Foot Vertical Separation Minimum is Applied” (HBAT 97–02).

## Related Activity

The FAA plans to implement RVSM starting in the NAT MNPS airspace because of the data and operational controls available for this airspace, and because of the operational efficiency problems in that airspace. The FAA’s groundwork for determining the feasibility of RVSM and developing this rule has been carried out in conjunction with the NATSPG’s plans to implement RVSM in the NAT MNPS Airspace.

Implementation is occurring in two phases:

### 1. Verification Phase

During the verification phase, aircraft have continued to be vertically separated by 2,000 feet, and operators and aircraft have begun to receive RVSM approval in accordance with the FAA’s “Interim Guidance Material” (91–RVSM).

The overall objectives of the verification phase are to:

1. Confirm that the NAT target level of safety (TLS) will continue to be met.

2. Confirm that aircraft approved for RVSM operation demonstrate altitude-keeping performance that meets RVSM standards. This will be achieved by:

- Identifying and eliminating any causes of out-of-tolerance altitude-keeping performance, in general or for specific aircraft groups; and

- Monitoring a sample of RVSM-approved aircraft and operators that is representative of the total NAT MNPS population.

3. Verify that operational procedures adopted for RVSM are effective and appropriate.

4. Confirm that the altitude-monitoring program is effective.

The principal purpose of this phase has been to gain confidence that the operational trial phase can begin.

### 2. Operational Trial Phase

As the objectives of the system verification phase have been met, NATSPG plans to implement RVSM at designated flight levels with separation of 1,000 feet on an operational trial basis starting March 27, 1997 for approximately one year. In the initial phase of implementation, the NATSPG plans to implement RVSM only at certain flight levels (FL 330 to FL 370). The objectives of the operational trial phase are to:

1. Continue to collect altitude-keeping performance data.

2. Increase the level of confidence that safety goals are being met.

3. Demonstrate operationally that there are no difficulties with RVSM implementation.

Starting March 27, 1997, aircraft that do not meet the RVSM requirements will be excluded from operations at flight levels where RVSM is applied. Provided that all requirements continue to be met, at the end of the operational trial period, RVSM will be declared fully operational.

To help operators prepare to comply with the requirements of this rule, the FAA has prepared two documents, which are available in the docket. The first of these documents, distributed at the ICAO meetings since April, 1994, is Interim Guidance Material on the Approval of Operators/Aircraft for RVSM Operations (91–RVSM). This document contains guidance for the approval of aircraft and operators to conduct RVSM operations. It is based on the ICAO manual on RVSM. It was developed in the NATSPG forum by technical and operational experts from the FAA, the European Joint Airworthiness Authorities (JAA), the aircraft manufacturers, and pilot associations. The FAA is taking steps to publish it as an advisory circular (AC). In the interim, a copy of 91–RVSM may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT**.

The second document is a Flight Standards Handbook Bulletin (HBAT) 97–02 entitled Approval of Aircraft and Operators for Flight in Airspace Above

Flight Level 290 Where 1,000 Foot Vertical Separation Minimum Is Applied, and has been distributed through Flight Standards offices.

The interim guidance material describes methods of complying with the airworthiness approval, maintenance program approval, and operations approval requirements in the rule. It discusses timing, process, and maintenance and operations material that the operator should submit for FAA review and evaluation normally at least 60 days before the planned operation in RVSM airspace. Operators under Title 14, Code of Federal Regulations (14 CFR) part 91 receive FAA approval in the form of a letter of authorization, and operators under 14 CFR parts 121, 125, and 135 receive operations specifications approval.

The HBAT contains background information on RVSM, directs inspectors to use the Interim Guidance 91–RVSM for operator approval, and contains specific direction on issuing operating authority.

### Altitude-Keeping Performance

The FAA, in conjunction with the NATSPG, also has been monitoring aircraft altitude-keeping performance. The NATSPG, with industry participation, determined that the overall (i.e., accounting for equipment and human error) criterion for safety in the NAT region is the target level of safety (TLS) of no more than five fatal accidents in 1 billion flying hours. The FAA has determined that the appropriate method of assessing collision risk is the Reich collision risk model (CRM). As noted in AC No. 91–70, “Oceanic Operations,” collision risk refers to the number of midair accidents likely to occur due to loss of separation in a prescribed volume of airspace for a specific number of flight hours.

To ensure that the TLS considered acceptable in the NAT is met, the FAA and the NATSPG are monitoring the total vertical error (TVE) and the remaining CRM parameters that are critical for safety assessment (probability of lateral and longitudinal overlap). TVE is defined as the geometric difference between aircraft and flight level altitude. To monitor TVE, the FAA and the NATSPG have deployed measurement systems that will produce estimates of aircraft and flight level geometric altitude. The overall goal of monitoring is to ensure that airworthiness, maintenance, and operational approval requirements result in required system performance (and level of safety) in the flight environment on a continuing basis. Currently, two altitude-monitoring

systems are operating: a Global Positioning System (GPS)-based monitoring system and a Height monitoring unit (HMU) that uses a Mode C multilateration system. Data are currently being collected on both systems to determine technical and operational feasibility.

Collision Risk Methodology (CRM) (including an acceptable level of safety) was used to develop the requirements for safe implementation of a 1,000 foot vertical separation standard. The level of safety was developed using historical data on safety from global sources. One precedence used was a period of 100 to 150 years between midair collisions. When the NATSPG TLS of 5 accidents in a billion flying hours is projected in terms of a calendar year interval between accidents, it yields a theoretical interval of approximately 390 years between midair collisions. The accepted level of safety is consistent with the acceptable level for aircraft hull loss and is based on the precedence of extremely improbable events as they relate to system safety, the basis for certain requirements in certification regulations such as 14 CFR 25.1309. The United States supported the methodology used to derive the accepted level of safety for RVSM implementation.

Following the development of the accepted level of safety, the corresponding limits for TVE and altimetry system errors were developed. A detailed discussion of the mathematical rationale leading to the requirements for safe implementation of RVSM is available in the docket.

### Current Requirements

In the Federal Aviation Regulations, 14 CFR 91.179(b)(3) establishes the 2,000 ft minimum separation in domestic airspace by requiring that flights in uncontrolled airspace at and above FL 290 on easterly magnetic courses (zero degrees through 179 degrees) be conducted at 4,000 ft intervals, starting at FL 290, (e.g., FL 290, 330, or 370). West-bound flights (magnetic courses of 180 degrees through 359 degrees) must be conducted at 4,000 ft intervals beginning at FL 310 (e.g., FL 310, 350, or 390). Flights in controlled airspace must be conducted at an altitude assigned by ATC.

For operations within a foreign country, 14 CFR 91.703 requires compliance with that country's regulations. For operations over the high seas outside the United States, 14 CFR 91.703 requires that aircraft of U.S. registry comply with Annex 2 (Rules of the Air) to the Convention on International Civil Aviation. Annex 2, amendment 32, effective February 19,

1996, reflects the planned change from 2,000 feet to 1,000 feet vertical separation for Instrument Flight Rules (IFR) traffic between FL 290 and FL 410, based on appropriate airspace designation, international agreements, and conformance with specified conditions. By this amendment, Annex 2, through amendment 32, is incorporated by reference in § 91.703(b).

Regulatory requirements for operations within the NAT MNPS by U.S.-registered aircraft are contained in 14 CFR 91.705. The regulation states that the aircraft must have approved navigation performance capability that meets specified requirements, and that the operator have authorization from the Administrator for operations in the NAT MNPS.

The NAT MNPS is addressed in greater detail in appendix C to Part 91, Operations in the North Atlantic (NAT) Minimum Navigation Performance Specifications (MNPS) Airspace. The appendix defines the airspace geographically and sets minimum navigation performance capability requirements.

### General Discussion of the Amendment

This rule allows operations of civil aircraft of U.S. registration outside the U.S. in airspace where a 1,000 foot vertical separation is applied, based on improvements in altitude-keeping technology. These improvements include:

- Introduction of the air data computer (ADC), which provides an automatic means of correcting the known static source error of aircraft to improve aircraft altitude measurement capability.

- Development of altimeters with enhanced transducers or double aneroids for computing altitude.

Under this amendment, airspace or routes in which RVSM is applied are considered special qualification airspace. Both the operator and the specific types of aircraft that the operator intends to use in RVSM airspace would have to be approved by the appropriate FAA office before the operator conducts flights in RVSM airspace.

Implementation of a 1,000 foot vertical separation standard above FL 290 offers substantial operational benefits to operators, including:

- Greater availability of the most fuel-efficient altitudes. In the RVSM environment, aircraft are able to fly closer to their optimum altitude at initial level off and through step climbing to the optimum altitude during the enroute phase.

- Greater availability of the most time- and fuel-efficient tracks and routes (and an increased probability of obtaining these tracks and routes). Operators often are not cleared on the track or route that was filed due to demand for the optimum routes, and resultant traffic congestion on those routes. RVSM allows ATC to accommodate a greater number of aircraft on a given track or route. More time- and fuel-efficient tracks or routes would therefore be available to more aircraft.

- Increased controller flexibility. RVSM gives ATC greater flexibility to manage traffic by increasing the number of flight levels on each track or route.

- Enhanced safety in the lateral dimension. Studies indicate that RVSM produces a wider distribution of aircraft among different tracks and altitudes, resulting in less exposure to aircraft at adjacent separation standards. RVSM reduces the number of occasions when two aircraft pass each other separated by a single separation standard (e.g., 60 nm laterally). The benefit to safety is that, should an aircraft enter, as a result of gross navigation error, onto an adjacent track, and another aircraft is on that track, there is an increased probability that the two aircraft would be flying at different flight levels.

This rule amends § 91.703(a)(4) and continues to require that operations conducted within airspace designated as MNPS airspace be conducted in accordance with § 91.705. The rule also requires that operations conducted within airspace designated as Reduced Vertical Separation Airspace be conducted in accordance with a new § 91.706.

Section 91.705 has been edited to delete references to the North Atlantic. The revised section also corrects format errors.

Section 91.706 is added to prescribe the requirements for operations conducted in airspace designated as Reduced Vertical Separation Minimum Airspace. That section is similar in form to § 91.705. It requires that each operator obtain authorization from the FAA to operate in airspace designated as RVSM, and requires each operator to obtain RVSM approval for their aircraft in accordance with appendix G.

The new appendix G specifies essential aircraft equipment and capabilities, including altitude measurement systems; altitude control systems; and an altitude alert system. RVSM aircraft are required to meet requirements for altimetry system error containment, equipment installation, and equipment tolerances. The control systems are required to automatically

control aircraft altitude to within specified limits (in non-turbulent, non-gust conditions). The associated alert systems are required to alert flightcrews to deviations of more than 300 feet from selected altitudes, or 200 feet for aircraft for which application for type certification occurs after April 8, 1997.

Altitude system error (ASE) requirements are prescribed in part 91, appendix G, section 2, paragraph (e). The ASE that aircraft groups are required to exhibit in service for acceptable aircraft altitude-keeping performance to be achieved in the full RVSM flight envelope is:

The mean ASE of an aircraft group must not exceed 120 feet and the sum of mean ASE plus three standard deviations of ASE must not exceed 245 feet.

On the basis of studies documented in ICAO Document 9536, Volume 2, a margin was established between the ASE to be exhibited in service and the ASE criteria used for initial approval to allow for some degradation with increasing aircraft age. Thus, for initial aircraft approval, the following ASE requirements are established in the basic envelope (as defined below):

The mean ASE of the group must not exceed 80 feet, and the sum of ASE for the aircraft group plus three standard deviations must not exceed 200 feet.

For the purpose of approving in-service aircraft, the FAA divides the flight envelope into two parts to provide a reasonable method for applying the above criteria to currently type-certificated aircraft. The Basic RVSM flight envelope (see part 91, appendix G, section 1) represents the aircraft speeds, altitudes and weights at which the majority of aircraft operations are conducted. The Full RVSM flight envelope also includes portions of the operating flight envelope in which aircraft operate less frequently. The values of 80 feet for mean ASE and 200 feet for mean ASE plus three standard deviations of ASE must be met in the Basic RVSM flight envelope. The values of 120 feet for mean ASE and 245 feet for mean ASE plus three standard deviations must be met in the Full RVSM flight envelope.

For RVSM approval of aircraft for which a type certificate is requested after April 9, 1997, however, the FAA has determined that it is not necessary to continue designating two flight envelopes (i.e., Basic and Full flight envelopes). With values of 80 feet for mean ASE and 200 feet for mean ASE plus three standard deviations for ASE established during the design phase, the FAA has determined that those values

can also be achieved throughout the Full RVSM flight envelope.

The ASE criteria for group aircraft will not be applied to non-group aircraft, because with non-group aircraft there is no data with which to measure airframe to airframe variability. Therefore, a single ASE value would be established to control the simple sum of altimetry errors. To control the overall population distribution, this limit would be set at a value less than that for group aircraft.

The new appendix G also provides for limited deviations to the operator and aircraft approval requirements. To accomplish this, the appendix states that an operator's request should normally be submitted at least 48 hours in advance of the proposed flight except under mitigating circumstances, so that ATC could then determine if proper separation could be provided without interference with normal RVSM operations. As with current appendix C to part 91, such deviations are considered as exceptions, not normal operations. For example, the operations envisioned that could be conducted in deviation from the RVSM requirements are the occasional part 91 flight in a business jet, or a maintenance ferry flight of a part 121 certificate holder's aircraft for the purpose of performing maintenance and returning the aircraft to RVSM-approved status.

Under this amendment, the new appendix G designates, in Section 8, those areas in which RVSM may be applied. Initially, as previously stated, RVSM will be applied only at designated flight levels in NAT MNPS airspace (e.g., FL 330 to FL 370). However, the appendix is otherwise structured in a generic format so that other airspace could be added to the designation when RVSM is expanded. By reviewing Section 8, operators are provided notification of areas where RVSM may be applied. (Operations still have the Annex 2 requirements to determine route requirements during preflight.)

NATSPG has agreed to change the floor and ceiling of MNPS airspace to FL 285 and FL 420. This change will enable the application of RVSM between FL 290 and FL 410, inclusive. The FAA does not consider this to be a substantive change.

The new appendix generally defines RVSM airspace as any airspace between FL 290 and FL 410 (inclusive) where aircraft are to be separated by a minimum of 1,000 feet vertically. The appendix also specifies that operators receive approval for RVSM operations either through operations specifications or a Letter of Authorization, as

appropriate. Applicants for operation in RVSM airspace are required to submit supporting material for aircraft approval, including information on compliance with the performance and hardware requirements and on the operator's maintenance program, in connection with meeting RVSM minimum performance requirements. Operators are also required to implement policies and procedures related to RVSM operations and to show that their pilots have necessary knowledge of those policies and procedures.

Specific guidance on how to meet the requirements is available in Interim Guidance Material 91-RVSM, which addresses various aspects of RVSM requirements, including maintenance and operations programs. Operators can obtain authorization for RVSM from their local Flight Standards District Office (FSDO) or Certificate Management Office. Approval of aircraft may be given for aircraft groups or for individual aircraft. In the former case, the FAA expects that operators would need to enlist the assistance of the aircraft manufacturers to develop the necessary data on the aircraft group. In the latter case, the operator would work with the FAA to determine the accuracy of the altitude-keeping equipment on the individual aircraft.

This amendment results in more stringent vertical navigation standards in oceanic airspace; the standards will be applied in other airspace above FL 290 as they are designated as RVSM airspace in the future. In NAT MNPS airspace, aircraft and operators that do not meet the vertical navigation requirements of RVSM will be accommodated in 4 ways—First, RVSM will be implemented in stages. In Stage 1, RVSM approval will be required when operating between FL 33 to FL 370 inclusive. Unapproved operators will have the option of flying at FL 310 and below or FL 390 and above. The staged implementation plan was adopted to give operators more time and flexibility in their planning to gain RVSM approval (Note: NATSPG will evaluate user needs before implementing a second stage that applies RVSM requirements to other flight levels.). Second, unapproved operators will be allowed to climb or descend in MNPS airspace through flight levels where RVSM is applied to operate at FL's where RVSM is *not* applied. Third, the operator may be authorized to deviate from RVSM requirements in accordance with the provisions of Appendix G, Section 5. Though it is not intended to be the routine mode of operation, this section

does enable an operator that has not been RVSM approved (or an aircraft with an RVSM required system temporarily inoperative) to fly in MNPS airspace where RVSM is applied provided request is made in advance and ATC determines that appropriate separation can be applied without imposing a burden on other operators. And fourth, when RVSM is applied to all flight levels in MNPS airspace (FL 290 to 410 inclusive), the operator not wishing to gain RVSM approval will retain the option of crossing the North Atlantic at FL's above or below airspace where RVSM requirements apply. Such an operator will be able to fly at FL 280 and below or FL 430 and above. The FAA has determined that these are reasonable and adequate means to accommodate the transition to RVSM requirements, particularly for general aviation operators.

The Interim Guidance is intended to be applicable for RVSM aircraft and operator approval in continental, oceanic, and remote airspace. The FAA expects that RVSM eventually will be applied in other airspace, including the Pacific region, Europe, and eventually even U.S. airspace. The rule establishes requirements for operation of U.S. registered aircraft outside the U.S. in any airspace designated for RVSM; it specifically establishes that the NAT MNPS airspace is an area where RVSM may be applied.

#### **Need for Immediate Adoption**

This action is a product of international agreements. It is the implementation of a joint, ongoing action started in 1988 with the member States of ICAO. The international aviation community is prepared to and will begin operational testing of the RVSM procedures in certain altitudes on March 27, 1997.

The United States, as a member of ICAO, has an international commitment to participate in this action. Arriving air traffic, having departed Europe and separated at RVSM altitudes, as a practical matter, cannot arrive in oceanic airspace controlled by the United States, all needing to be reassigned to a pre-RVSM separation altitude. Unless this rule is implemented by March 27, 1997, to avoid a significant safety problem, there would have to be major delays for westbound NAT traffic in airspace the FAA does not control.

Additionally, U.S. operators will incur an economic disadvantage compared to their European competitors, if they are unable to utilize the benefits gained from operating at

RVSM altitudes beginning on March 27, 1997.

Because of the imminent beginning of operational testing by all countries involved, good cause exists for making this final rule effective immediately.

#### **Regulatory Evaluation Summary**

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effect of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) generates benefits that justify its costs and is not "a significant regulatory action" as defined in the Executive Order; (2) is significant as defined in Department of Transportation's Regulatory Policies and Procedures; (3) does not have a significant impact on a substantial number of small entities; and (4) does not constitute a barrier to international trade. These analyses, available in the docket are summarized below.

This rule establishes a new Federal Aviation Regulations (FAR) section that allows the vertical separation minimum from 2,000 feet to 1,000 feet between FL 290 and FL 410 to be reduced in certain designated airspace. This action is intended to increase the number of available flight levels, enhance airspace capacity, permit operators to fly more fuel/time efficient tracks and altitudes, and enhance air traffic controller flexibility by increasing the number of available flight levels, while maintaining an equivalent level of safety.

Assuming that operators with the capability of operating above FL 410 would do so in lieu of obtaining RVSM approval, the FAA estimates that this rule costs U.S. operators \$28.1 million in constant 1995 dollars for the fifteen-year time period 1996–2010 or \$20.4 million discounted. Benefits begin accruing in 1997. Benefits, based on fuel savings for the commercial aircraft fleet over the years 1997 to 2010, are estimated to be \$35.8 million undiscounted in constant 1995 dollars or discounted at \$24.0 million. The other benefits of implementing RVSM are: (1) availability of added tracks; (2) increased controller flexibility to clear aircraft for efficient step (enroute)

climbs; and (3) increased controller flexibility to route aircraft to appropriate tracks. Therefore, based on a quantitative and qualitative evaluation of this action, the FAA believes that the amendment is cost-beneficial.

#### **Regulatory Flexibility Act**

The FAA has determined that these amendments do not significantly affect a substantial number of small entities.

#### **International Trade Impact Analysis**

This amendment does not affect the importation of foreign products or services into the United States or the exportation of U.S. products or services to foreign countries.

#### **Federalism Implications**

This rule will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this amendment does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

#### **Paperwork Reduction Act of 1995**

The reporting and recordkeeping requirements associated with this rule remain the same as under the current rules and have previously been approved by the Office of Management and Budget under the provisions of the Paperwork Reduction Act of 1980 (Pub. L. 96–511) and have been assigned OMB Control Numbers 2120–0026. The FAA believes that this rule does not impose any additional recordkeeping or reporting requirements.

#### **Unfunded Mandates Reform Act of 1995**

The FAA has determined that the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply to this rulemaking.

#### **International Civil Aviation Organization and Joint Aviation Regulations**

In keeping with U.S. obligations under the Convention on International Civil Aviation Organization (ICAO), it is FAA policy to comply with ICAO Standards and Recommended Practices (SARPs) to maximum extent practicable. The operator and aircraft approval process was developed jointly by the FAA and the JAA under the auspices of NATSPG. The FAA has determined that this amendment does not present any difference.



## Conclusion

For the reasons discussed in the Preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this rule is not a "significant regulatory action" under Executive Order 12866. In addition, the FAA certifies that this regulation does not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act of 1990. This amendment is considered significant under Order DOT 2100.5, Policies and Procedures for Simplification, Analysis, and Review of Regulations due to the significant international ramifications of this rule. A regulatory evaluation of the regulation, including a Regulatory Flexibility Determination and International Trade Impact Analysis, are available in the docket. A copy may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT**.

## List of Subjects in 14 CFR Part 91

Air-traffic control, Aircraft, Airmen, Airports, Aviation safety, Reporting and recordkeeping requirements.

## The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends part 91 of Title 14 of the Code of Federal Regulations (14 CFR part 91) as follows:

## PART 91—GENERAL OPERATING AND FLIGHT RULES

1. The authority citation for Part 91 continues to read as follows:

**Authority:** 49 U.S.C. 106(g), 40103, 40113, 40120, 44101, 44111, 44701, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 46306, 46315, 46316, 46502, 46504, 46506–46507, 47122, 47508, 47528–47531.

2. Section 91.703 is amended by revising paragraphs (a)(4) and (b) to read as follows:

### § 91.703 Operations of civil aircraft of U.S. registry outside of the United States.

(a) \* \* \*

(4) When operating within airspace designated as Minimum Navigation Performance Specifications (MNPS) airspace, comply with § 91.705. When operating within airspace designated as Reduced Vertical Separation Minimum (RVSM) airspace, comply with § 91.706.

(b) Annex 2 to the Convention on International Civil Aviation, Ninth Edition—July 1990, with Amendments through Amendment 32 effective February 19, 1996, to which reference is

made in this part, is incorporated into this part and made a part hereof as provided in 5 U.S.C. § 552 and pursuant to 1 CFR part 51. Annex 2 (including a complete historic file of changes thereto) is available for public inspection at the Rules Docket, AGC–200, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; or at the Office of the Federal Register, 800 North Capitol Street, NW., Suite 700, Washington, DC. In addition, Annex 2 may be purchased from the International Civil Aviation Organization (Attention: Distribution Officer), P.O. Box 400, Succursale, Place de L'Aviation Internationale, 1000 Sherbrooke Street West, Montreal, Quebec, Canada H3A 2R2.

3. Section 91.705 is revised to read as follows:

### § 91.705 Operations within airspace designated as Minimum Navigation Performance Specification Airspace.

(a) Except as provided in paragraph (b) of this section, no person may operate a civil aircraft of U.S. registry in airspace designated as Minimum Navigation Performance Specifications airspace unless—

(1) The aircraft has approved navigation performance capability that complies with the requirements of appendix C of this part; and

(2) The operator is authorized by the Administrator to perform such operations.

(b) The Administrator may authorize a deviation from the requirements of this section in accordance with Section 3 of appendix C to this part.

4. New § 91.706 is added to read as follows:

### § 91.706 Operations within airspace designated as Reduced Vertical Separation Minimum Airspace.

(a) Except as provided in paragraph (b) of this section, no person may operate a civil aircraft of U.S. registry in airspace designated as Reduced Vertical Separation Minimum (RVSM) airspace unless:

(1) The operator and the operator's aircraft comply with the requirements of appendix G of this part; and

(2) The operator is authorized by the Administrator to conduct such operations.

(b) The Administrator may authorize a deviation from the requirements of this section in accordance with Section 5 of appendix G to this part.

5. Section 1 of Appendix C to Part 91 is amended by removing the flight levels "FL 275" and "FL 400" cited in the first sentence and replacing them with "FL 285" "FL 420" respectively.

6. A new appendix G is added to read as follows:

## Appendix G to Part 91—Operations in Reduced Vertical Separation Minimum (RVSM) Airspace

### Section 1. Definitions

**Reduced Vertical Separation Minimum (RVSM) Airspace.** Within RVSM airspace, air traffic control (ATC) separates aircraft by a minimum of 1,000 feet vertically between flight level (FL) 290 and FL 410 inclusive. RVSM airspace is special qualification airspace; the operator and the aircraft used by the operator must be approved by the Administrator. Air-traffic control notifies operators of RVSM by providing route planning information. Section 8 of this appendix identifies airspace where RVSM may be applied.

**RVSM Group Aircraft.** Aircraft within a group of aircraft, approved as a group by the Administrator, in which each of the aircraft satisfy each of the following:

(a) The aircraft have been manufactured to the same design, and have been approved under the same type certificate, amended type certificate, or supplemental type certificate.

(b) The static system of each aircraft is installed in a manner and position that is the same as those of the other aircraft in the group. The same static source error correction is incorporated in each aircraft of the group.

(c) The avionics units installed in each aircraft to meet the minimum RVSM equipment requirements of this appendix are:

(1) Manufactured to the same manufacturer specification and have the same part number; or

(2) Of a different manufacturer or part number, if the applicant demonstrates that the equipment provides equivalent system performance.

**RVSM Nongroup Aircraft.** An aircraft that is approved for RVSM operations as an individual aircraft.

**RVSM Flight envelope.** An RVSM flight envelope includes the range of Mach number, weight divided by atmospheric pressure ratio, and altitudes over which an aircraft is approved to be operated in cruising flight within RVSM airspace. RVSM flight envelopes are defined as follows:

(a) The *full RVSM flight envelope* is bounded as follows:

(1) The altitude flight envelope extends from FL 290 upward to the lowest altitude of the following:

(i) FL 410 (the RVSM altitude limit);

(ii) The maximum certificated altitude for the aircraft; or

(iii) The altitude limited by cruise thrust, buffet, or other flight limitations.

(2) The airspeed flight envelope extends:

(i) From the airspeed of the slats/flaps-up maximum endurance (holding) airspeed, or the maneuvering airspeed, whichever is lower;

(ii) To the maximum operating airspeed ( $V_{mo}/M_{mo}$ ), or airspeed limited by cruise thrust buffet, or other flight limitations, whichever is lower.



(3) All permissible gross weights within the flight envelopes defined in paragraphs (1) and (2) of this definition.

(b) The *basic RVSM flight envelope* is the same as the full RVSM flight envelope except that the airspeed flight envelope extends:

(1) From the airspeed of the slats/flaps-up maximum endurance (holding) airspeed, or the maneuver airspeed, whichever is lower;

(2) To the upper Mach/airspeed boundary defined for the full RVSM flight envelope, or a specified lower value not less than the long-range cruise Mach number plus .04 Mach, unless further limited by available cruise thrust, buffet, or other flight limitations.

#### Section 2. Aircraft Approval

(a) An operator may be authorized to conduct RVSM operations if the Administrator finds that its aircraft comply with this section.

(b) The applicant for authorization shall submit the appropriate data package for aircraft approval. The package must consist of at least the following:

(1) An identification of the RVSM aircraft group or the nongroup aircraft;

(2) A definition of the RVSM flight envelopes applicable to the subject aircraft;

(3) Documentation that establishes compliance with the applicable RVSM aircraft requirements of this section; and

(4) The conformity tests used to ensure that aircraft approved with the data package meet the RVSM aircraft requirements.

(c) *Altitude-keeping equipment: All aircraft.* To approve an aircraft group or a nongroup aircraft, the Administrator must find that the aircraft meets the following requirements:

(1) The aircraft must be equipped with two operational independent altitude measurement systems.

(2) The aircraft must be equipped with at least one automatic altitude control system that controls the aircraft altitude—

(i) Within a tolerance band of  $\pm 65$  feet about an acquired altitude when the aircraft is operated in straight and level flight under nonturbulent, nongust conditions; or

(ii) Within a tolerance band of  $\pm 130$  feet under nonturbulent, nongust conditions for aircraft for which application for type certification occurred on or before April 9, 1997 that are equipped with an automatic altitude control system with flight management/performance system inputs.

(3) The aircraft must be equipped with an altitude alert system that signals an alert when the altitude displayed to the flight crew deviates from the selected altitude by more than:

(i)  $\pm 300$  feet for aircraft for which application for type certification was made on or before April 9, 1997; or

(ii)  $\pm 200$  feet for aircraft for which application for type certification is made after April 9, 1997.

(d) *Altitude system error containment: Group aircraft for which application for type certification was made on or before April 9, 1997.* To approve group aircraft for which application for type certification was made on or before April 9, 1997, the Administrator must find that the altimetry system error (ASE) is contained as follows:

(1) At the point in the basic RVSM flight envelope where mean ASE reaches its largest absolute value, the absolute value may not exceed 80 feet.

(2) At the point in the basic RVSM flight envelope where mean ASE plus three standard deviations reaches its largest absolute value, the absolute value may not exceed 200 feet.

(3) At the point in the full RVSM flight envelope where mean ASE reaches its largest absolute value, the absolute value may not exceed 120 feet.

(4) At the point in the full RVSM flight envelope where mean ASE plus three standard deviations reaches its largest absolute value, the absolute value may not exceed 245 feet.

(5) *Necessary operating restrictions.* If the applicant demonstrates that its aircraft otherwise comply with the ASE containment requirements, the Administrator may establish an operating restriction on that applicant's aircraft to restrict the aircraft from operating in areas of the basic RVSM flight envelope where the absolute value of mean ASE exceeds 80 feet, and/or the absolute value of mean ASE plus three standard deviations exceeds 200 feet; or from operating in areas of the full RVSM flight envelope where the absolute value of the mean ASE exceeds 120 feet and/or the absolute value of the mean ASE plus three standard deviations exceeds 245 feet.

(e) *Altitude system error containment: Group aircraft for which application for type certification is made after April 9, 1997.* To approve group aircraft for which application for type certification is made after April 9, 1997, the Administrator must find that the altimetry system error (ASE) is contained as follows:

(1) At the point in the full RVSM flight envelope where mean ASE reaches its largest absolute value, the absolute value may not exceed 80 feet.

(2) At the point in the full RVSM flight envelope where mean ASE plus three standard deviations reaches its largest absolute value, the absolute value may not exceed 200 feet.

(f) *Altitude system error containment: Nongroup aircraft.* To approve a nongroup aircraft, the Administrator must find that the altimetry system error (ASE) is contained as follows:

(1) For each condition in the basic RVSM flight envelope, the largest combined absolute value for residual static source error plus the avionics error may not exceed 160 feet.

(2) For each condition in the full RVSM flight envelope, the largest combined absolute value for residual static source error plus the avionics error may not exceed 200 feet.

(g) If the Administrator finds that the applicant's aircraft comply with this section, the Administrator notifies the applicant in writing.

#### Section 3. Operator Authorization

(a) Authority for an operator to conduct flight in airspace where RVSM is applied is issued in operations specifications or a Letter of Authorization, as appropriate. To issue an

RVSM authorization, the Administrator must find that the operator's aircraft have been approved in accordance with Section 2 of this appendix and that the operator complies with this section.

(b) An applicant for authorization to operate within RVSM airspace shall apply in a form and manner prescribed by the Administrator. The application must include the following:

(1) An approved RVSM maintenance program outlining procedures to maintain RVSM aircraft in accordance with the requirements of this appendix. Each program must contain the following:

(i) Periodic inspections, functional flight tests, and maintenance and inspection procedures, with acceptable maintenance practices, for ensuring continued compliance with the RVSM aircraft requirements.

(ii) A quality assurance program for ensuring continuing accuracy and reliability of test equipment used for testing aircraft to determine compliance with the RVSM aircraft requirements.

(iii) Procedures for returning noncompliant aircraft to service.

(2) For an applicant who operates under part 121 or 135, initial and recurring pilot training requirements.

(3) Policies and Procedures. An applicant who operates under part 121 or 135 shall submit RVSM policies and procedures that will enable it to conduct RVSM operations safely.

(c) Validation and Demonstration. In a manner prescribed by the Administrator, the operator must provide evidence that:

(1) It is capable to operate and maintain each aircraft or aircraft group for which it applies for approval to operate in RVSM airspace; and

(2) Each pilot has an adequate knowledge of RVSM requirements, policies, and procedures.

#### Section 4. RVSM Operations

(a) Each person requesting a clearance to operate within RVSM airspace shall correctly annotate the flight plan filed with air traffic control with the status of the operator and aircraft with regard to RVSM approval. Each operator shall verify RVSM applicability for the flight planned route through the appropriate flight planning information sources.

(b) No person may show, on the flight plan filed with air traffic control, an operator or aircraft as approved for RVSM operations, or operate on a route or in an area where RVSM approval is required, unless:

(1) The operator is authorized by the Administrator to perform such operations; and

(2) The aircraft has been approved and complies with the requirements of Section 2 of this appendix.

#### Section 5. Deviation Authority Approval

The Administrator may authorize an aircraft operator to deviate from the requirements of § 91.706 for a specific flight in RVSM airspace if that operator has not been approved in accordance with Section 3 of this appendix, and if:

(2) The operator submits an appropriate request with the air traffic control center

controlling the airspace, (request should be made at least 48 hours in advance of the operation unless prevented by exceptional circumstances); and

(b) At the time of filing the flight plan for that flight, ATC determines that the aircraft may be provided appropriate separation and that the flight will not interfere with, or impose a burden on, the operations of operators who have been approved for RVSM operations in accordance with Section 3 of this appendix.

#### *Section 6. Reporting Altitude-Keeping Errors*

Each operator shall report to the Administrator each event in which the operator's aircraft has exhibited the following altitude-keeping performance:

- (a) Total vertical error of 300 feet or more;
- (b) Altimetry system error of 245 feet or more; or
- (c) Assigned altitude deviation of 300 feet or more.

#### *Section 7. Removal or Amendment of Authority*

The Administrator may amend operations specifications to revoke or restrict an RVSM authorization, or may revoke or restrict an RVSM letter of authorization, if the Administrator determines that the operator is not complying, or is unable to comply, with this appendix or subpart H of this part. Examples of reasons for amendment, revocation, or restriction include, but are not limited to, an operator's:

- (a) Committing one or more altitude-keeping errors in RVSM airspace;
- (b) Failing to make an effective and timely response to identify and correct an altitude-keeping error; or
- (c) Failing to report an altitude-keeping error.

#### *Section 8. Airspace Designation*

RVSM may be applied in the following ICAO Flight Information Regions (FIR's): New York Oceanic, Gander Oceanic,

Sondrestrom FIR, Reykjavik Oceanic, Shanwick Oceanic, and Santa Maria Oceanic.

RVSM may be effective in the Minimum Navigation Performance Specification (MNPS) airspace with the NAT. The MNPS airspace within the NAT is defined by the volume of airspace FL 285 and FL 420 extending between latitude 27 degrees north and the North Pole, bounded in the east by the eastern boundaries of control areas Santa Maria Oceanic, Shanwick Oceanic, and Reykjavik Oceanic and in the west by the western boundaries of control areas Reykjavik Oceanic, Gander Oceanic, and New York Oceanic, excluding the areas west of 60 degrees west and south of 38 degrees 30 minutes north.

Issued in Washington, DC, on March 27, 1997.

**Barry L. Valentine,**

*Acting Administrator.*

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